Complete documents for the following Action Items:

- Proposal to create a new Ph.D. in Chemical and Life Sciences Engineering
- Proposal to create a new Ph.D. in Pharmaceutical Engineering
Proposal to create a new Ph.D. in Chemical and Life Sciences Engineering
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<td>2. Academic Program (Check one):</td>
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<tr>
<td>Virginia Commonwealth University</td>
<td>New program proposal X</td>
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<td>Spin-off proposal</td>
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<td>Certificate document</td>
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<td>3. Name/title of proposed program</td>
<td>4. CIP code</td>
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<tr>
<td>Chemical and Life Science Engineering</td>
<td>14.0702</td>
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<td>5. Degree/certificate designation</td>
<td>6. Term and year of initiation</td>
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<td>Ph.D.</td>
<td>Fall 2018</td>
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<td>7a. For a proposed spin-off, title and degree designation of existing degree program</td>
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<td>7b. CIP code (existing program)</td>
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<td>8. Term and year of first graduates</td>
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<td>Spring 2021</td>
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<td>10. For community colleges:</td>
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<td>date approved by local board</td>
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<td>date approved by State Board for Community Colleges</td>
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<td>11. If collaborative or joint program, identify collaborating institution(s) and attach letter(s) of intent/support from corresponding chief academic officers(s)</td>
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<td>12. Location of program within institution (complete for every level, as appropriate and specify the unit from the choices).</td>
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<td>School(s) or college(s) of</td>
<td>School of Engineering</td>
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<td>Campus(es) or off-campus site(s)</td>
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<td>hybrid (both face-to-face and distance)</td>
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<td>13. Name, title, telephone number, and e-mail address of person(s) other than the institution's chief academic officer who may be contacted by or may be expected to contact Council staff regarding this program proposal.</td>
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</tr>
<tr>
<td>Deborah S. Noble-Triplett, Ph.D., Senior Vice Provost for Academic Affairs.</td>
<td></td>
</tr>
<tr>
<td>(804) 828-8833, <a href="mailto:nobletriplett@vcu.edu">nobletriplett@vcu.edu</a></td>
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Description of the Proposed Program

Program Background

Virginia Commonwealth University (VCU) requests approval to establish a Doctor of Philosophy (Ph.D.) program in Chemical and Life Science Engineering (CIP Code 14.07) with an initiation date of August 2018. The program will be offered by the Chemical and Life Science Engineering (CLSE) Department of the VCU School of Engineering.

The VCU School of Engineering (SoE) began operation on July 1, 1995 with its first undergraduate class graduating in May 2000. For the past twenty years, the SoE, an innovation frontrunner in academics and research, has brought real-world education to Central Virginia. Our multidisciplinary partnerships prepare undergraduate, masters and doctoral students for leadership. Part of a premier research university, the SoE has enhanced regional and global prosperity with cutting-edge research and partnering with industry and the community. Key research areas in the SoE include sustainability and energy engineering; micro and nano-electronic systems; pharmaceutical engineering, mechanobiology, and regenerative medicine; mining of big data, materials science and device design. Our facilities are hubs of discovery, powered by students and faculty committed to excellence.

At the graduate level, the SoE currently awards the M.S. and Ph.D. in Engineering (ENGR), with concentrations in Chemical and Life Science Engineering (M.S and Ph.D.), Electrical Engineering (M.S. and Ph.D.) and Computer Science (Ph.D.). The SoE also awards Ph.D. and M.S. degrees in Biomedical Engineering, Mechanical and Nuclear Engineering, and an M.S. degree in Computer Science.

The concentration in chemical engineering in the graduate program was started in 2001 and is currently in place. The department has grown from 8 faculty and 5 graduate students (2001) to 12 faculty and 30 graduate students (2016). As detailed in Appendix D, CLSE faculty have a robust research and teaching portfolio. Educational and research program successes in CLSE have earned publicity in both the academic and industry communities. To our credit, these successes have led to enhancements in academic stature, which attract students from the State of Virginia and the world. With a proposed stand-alone CLSE Ph.D. program, we expect research successes to expand with diverse and talented students and professional researchers to complement our growing academic programs within the School of Engineering. Importantly, the proposed program will allow VCU to serve student demand stemming from the outgrowth of the Engineering Ph.D. - Chemical and Life Science Engineering concentration, as well as address the regional and national demand for researchers and products in emergent and unique areas such as drug synthesis, nanomaterials and life science engineering. This ties in with VCU's strategic goals to significantly enhance, broaden, and formalize interactions of engineering, life and health sciences, materials science, and physical sciences across the university.

The proposed Ph.D. program is designed to address the need for researchers and scientists with training, and to satisfy labor market demand with knowledge and skills to bring about technical breakthroughs in areas such as energy storage, biofuels, drug delivery, environmental remediation, stem cell engineering, materials for regenerative medicine and other chemically
engineered applications to living organisms. A stand-alone Ph.D. will be distinctive and timely
given the projected jobs outlook and the engineering talent pool needs facing the Commonwealth
of Virginia.

As detailed below, the proposed program is unique in the areas of doctoral training and faculty
research. Chemical engineers work on the development and production of chemicals for
semiconductors, pharmaceuticals, nanostructured materials, cosmetics, petrochemicals and
plastics, wood products and papers. They manufacture products varying from metals to food and
pharmaceuticals, and develop processes used to separate and purify chemical products. Life
science engineers, sharing core knowledge of chemical engineering processes, focus on
biological systems engineering, biomolecular engineering, and cellular engineering. Each of
these areas of research and invention strive to understand life at the cellular and molecular level
towards the end of producing breakthrough applications of chemical and biological knowledge to
human, plant, and animal biological systems.

The purpose of this proposed degree program is to:

1. Meet Virginia’s growing private-sector demand for engineers and scientists with doctoral-
   level training in chemical and life science engineering, and allied fields such as
   pharmaceutical and chemical processes, materials science and engineering, cellular
   engineering, and chemical engineering applied to biological systems and biomolecular
   processes.

2. Meet the national need for engineers and scientists with doctoral-level training in chemical
   and life science engineering for employment in the academic (future faculty), industrial, and
   federal government sectors. The discipline-specific degree is expected to enhance the
   marketability of graduates and will address a current and future need for chemical and life
   science engineers.

Mission

The proposed Chemical and Life Science Engineering Ph.D. program is consistent with VCU’s
mission and strategic plan as Virginia’s premier urban, public research university. The proposed
program will notably advance VCU’s mission to be “an engaged, learner-centered environment
that fosters inquiry, discovery and innovation in a global setting,” to promote “research that
expands the boundaries of new knowledge and creative expression and promotes translational
applications to improve human health,” and to foster “interdisciplinary collaborations that bring
new perspectives to complex problems and mobilize creative energies that advance innovation
and solve global challenges.” \(^1\) Additionally, the proposed Chemical and Life Science
Engineering Ph.D. program advances two of the themes from VCU’s strategic plan, Quest for
Distinction\(^2\):

- **Theme II:** Attain preeminence as an urban, public research university by making
  contributions in research, scholarship, creative expression and clinical practice to advance
  knowledge and enhance the quality of life.

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\(^1\) [http://bulletin.vcu.edu/about/mission-vision-core-values/](http://bulletin.vcu.edu/about/mission-vision-core-values/)

\(^2\) [http://www.quest.vcu.edu/](http://www.quest.vcu.edu/)
Theme III: Achieve national recognition as a fully integrated research university with a commitment to human health.

The proposed Ph.D. in Chemical and Life Science Engineering program is consistent with the mission of the university by providing graduate students with learning opportunities for acquiring a broad foundation of engineering knowledge; an in-depth original research experience at the frontiers of the chemical and life sciences; and life-long learning and professional development skills. Through teaching and research, the CLSE department creates knowledge and transforms ideas that provide benefits in medicine, pharmaceutics, environmental management, and defense technologies, in addition to others. A few highlighted examples show that the CLSE faculty are aligned with VCU’s mission and poised to move forward to produce the next generation of knowledge and researchers:

- An engaged, learner-centered environment that fosters inquiry, discovery and innovation in a global setting: CLSE students graduating with a Ph.D. in 2015-16 published an average of 5 peer-reviewed publications each. A discipline specific program will accelerate the pace of discovery and the translation of research into economic activity via startups or intellectual property generation.

- Research that expands the boundaries of new knowledge and creative expression and promotes translational applications to improve human health: CLSE faculty have active research portfolios with funding from the National Science Foundation (NSF), National Institutes of Health, and Department of Defense among others (See Appendix D).

- Interdisciplinary collaborations that bring new perspectives to complex problems and mobilize creative energies that advance innovation and solve global challenges: CLSE faculty collaborate with colleagues in VCU’s Schools of Medicine, Pharmacy, College of Humanities and Sciences, the Center for Environmental Studies and the other departments within the School of Engineering to address some of the most pressing challenges today such as the manufacture of drugs at low cost, the creation of organ replacements, and water purification. The CLSE faculty have established collaborations with major institutions. The NSF Industry/University Collaborative Research Center for Rational Catalysis Synthesis was established in 2015 as a multi-institutional center between CLSE faculty and the University of South Carolina. The Defense Advanced Research Projects Agency (DARPA) funded Pharmacy on Demand project is a collaboration between CLSE faculty and the Massachusetts Institute of Technology (MIT).

- Health care that strives to preserve and restore health for all people, to seek the cause and cure of diseases through groundbreaking research, and to educate those who serve humanity: Research funded by the Bill and Melinda Gates foundation as part of the “Medicines for All” initiative and an NIH-sponsored project to study the human microbiome. (See Appendix D.)
Admissions Criteria

All applicants to graduate programs will be required to meet the admissions requirements of the VCU Graduate School. Applicants will be required to submit the following materials to the Graduate School Admissions Office:

- Application form
- Application fee
- Three letters of recommendation, professional and/or academic
- Official undergraduate transcripts from all schools attended
- Graduate Record Examination (GRE) scores obtained within the last five years
- A statement of purpose outlining career goals
- A resume stating relevant work experience

International students will submit an official transcript evaluation from a recognized foreign educational credentials evaluation service accredited by the National Association of Credential Evaluation Services (NACES), or the American Association of Collegiate Registrars and Admissions Officers (AACRAO). International students must also provide proof that they can support themselves financially for the duration of the program.

Non-native English speakers will provide evidence of proficiency in English by one of the following:

- A test of English as a Foreign Language (TOEFL) minimum composite score of 80 for the Internet Based Test (IBT) or 550 for the paper-based score; or
- An International English Language Testing System (IELTS) score minimum of 6.5 on the academic exam

Admission to the Chemical and Life Science Engineering Ph.D. program requires that applicants demonstrate the following specific requirements:

- Proof of graduation from an accredited college or university or its equivalent with a degree in chemical engineering or a related discipline, such as petroleum engineering, biochemical engineering or materials science and engineering.
- A minimum undergraduate GPA of 3.0 on a 4.0 scale in chemical engineering or a related discipline for at least the last two years of undergraduate work.
- A written statement of intent for pursuing graduate studies in chemical and life science engineering.

Admission (acceptance to the program) will be based upon review of all applicants by the CLSE Graduate Admissions Committee. The Graduate Admissions Committee is composed of the CLSE Graduate Committee, chaired by the Graduate Program Director. The admission recommendation is based on an overall assessment of the applicant’s potential for success in the program. The recommendations will be approved by the CLSE Graduate Program Director and the Associate Dean for Graduate Studies of the SoE.
The program may admit students provisionally. Provisional admission may be granted when small deficiencies are identified for otherwise strong candidates; these deficiencies should be remedied in time specified by the Admissions Committee. At the end of the provisional period, the student's progress is evaluated. Undergraduate remedial courses designed to remove deficiencies are not accepted for credit towards the fulfillment of course requirements for the Ph.D. degree. A student admitted to the program may need to take undergraduate Chemical Engineering courses in order to prepare for the required graduate-level courses. These will be specified as provisions at the time of admission. Credit hours from undergraduate courses do not count towards the doctoral degree.

**Target Population**

The target population for the Chemical and Life Science Engineering Ph.D. program is students with a B.S. or M.S. degree in chemical engineering or an allied field such as materials science, petroleum engineering, biochemical engineering and engineering physics. According to the United States Department of Labor, a considerable amount of work-related skill (for example, manufacturing processes, equipment design, analytical equipment), knowledge (principles of chemistry, biology, physics, and mathematics), and experience are needed in chemical engineering and allied fields. Sixteen percent (16%) of chemical engineers reported that a master's degree was required for their positions, with 20% of respondents reporting that a doctoral degree was required for their positions.

**Curriculum**

The proposed Chemical and Life Science Engineering Ph.D. program requires a minimum of 68 credit hours for students entering with a B.S. and a minimum of 45 credit hours for students entering with a M.S. degree. The proposed program will be delivered in a traditional, face-to-face modality.

In engineering programs, doctoral students are expected to complete coursework in two categories: **core** and **elective**. Research is the other significant component of the degree. The core courses represent knowledge needed by all students in the degree program. Elective courses in the proposed program represent cutting-edge knowledge targeted to specific research and academic needs of students. This program creates specific areas of focus such as chemical kinetics and process engineering, materials science and engineering, and life science engineering; these are growth areas in fundamental and applied research and development for the 21st century (employment statistics provided on page 20). Note that both the core courses and preparatory work, play a key role in elevating the concentration courses to a level necessary for interdisciplinary doctoral level research and future professional careers in chemical and life science engineering.

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3 https://www.onetonline.org/link/summary/17-2041.00 (O*NET OnLine is sponsored by the U.S. Department of Labor)

Students can earn the Ph.D. in CLSE through two routes: post-baccalaureate study (B.S. to Ph.D.) and post-master’s study (M.S. to Ph.D.). Post-baccalaureate students undergo a course- and research-intensive program with 41 didactic credit hours and at least 27 research credit hours. The post-M.S. route requires 18 didactic credit hours and at least 27 research credit hours. At least half of the minimum required coursework credit hours must be at the 600-level. While interdisciplinarity is conferred by both the core and the elective courses, note that M.S. to Ph.D. students typically take additional courses (beyond the one required elective) to acquire skills and the breadth of knowledge required for their thesis research.

Typically, a student entering with a B.S. degree requires around four years of study to complete all requirements for the Ph.D. degree. A student entering with an M.S. degree requires around three years to complete the requirements for the Ph.D. Owing to its research intensive nature, the program does not propose to have part-time Ph.D. students. A period of residence of at least three consecutive semesters is required. Residency is defined as registration for at least nine credit hours per semester. A time limit of seven calendar years, beginning at the time of the first registration, is placed on work to be credited towards the Ph.D., although the CLSE Graduate Committee may extend the time limit by one year, not to exceed eight years. Sample plans of study for the B.S. to Ph.D. and the M.S. to Ph.D. paths are shown in Appendix A. Specific course descriptions are in Appendix B.

**B.S. to Ph.D. Program**

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<td>24 credits technical elective coursework</td>
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<td>Seminar</td>
<td>8 credits CLSE 690</td>
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<td>Directed Research</td>
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**M.S. to Ph.D. Program**

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<td>6 credits CLSE 690</td>
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<td>Directed Research</td>
<td>27 credits CLSE 697</td>
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**Curriculum Components**

**Core Component:** All students will complete 9 credits of core studies. Core courses provide foundational material for advanced courses and research, while providing the fundamental concepts critical to chemical engineering for all graduate students. Note that the core courses themselves provide an interdisciplinary foundation in life science and engineering with concepts in mathematics, physics, chemistry and biology being used to convey analytical, problem-solving and deductive reasoning skills. All courses are three credit hours:

**CLSE 654:** Equilibrium Analysis in Chemical and Biological Systems  
**CLSE 655:** Non-Equilibrium Analysis in Chemical and Life Science Engineering  
**CLSE 656:** Advanced Chemical Reaction Engineering
Electives: Students will select courses in specialized areas of engineering and sciences in consultation with their advisor and dissertation committee. Students can select technical elective courses across disciplines such as engineering, chemistry, biology, medicine, mathematics, or computing to help tailor their educational backgrounds to their specific research topics and future professional scientific interests.

Examples of Electives within Areas of Research Focus

**Life Science Engineering Focus:**
- CLSE 560: Protein Engineering
- CLSE 561: Stem Cell Engineering
- CLSE 563: Metabolic Engineering
- CLSE 570: Molecular Physiology and Microanatomy for Biomolecular and Life Science Engineering
- CLSE 660: Biomolecular and Computational Engineering

**Chemical Kinetics and Process Engineering Focus:**
- ENGR 692: Chemical Process Development
- CLSE 549: Process Biotechnology
- CLSE 543: Advanced Reaction Engineering
- BNFO 530: Bioinformatics and Genomics in Drug Research
- MEDC 630 Theoretical Methods in Drug Design

**Materials Science and Engineering Focus:**
- ENGR 591: Introduction to Materials Science and Engineering
- CLSE 575: Nanotechnology in Life Science and Engineering
- CLSE 650: Quantitative Analysis in Chemical and Life Science Engineering
- CLSE 675: Polymers in Medicine
- CLSE 645: Biosensors and Bioelectronic Devices

**Environmental Sciences and Engineering Focus:**
- CI SE 544: Applied Transport Phenomena
- CLSE 562: Advanced Systems Biology Engineering
- ENVS 591: Environmental Chemistry
- ENVS 602: Environmental Technology

Seminar: All students will register for the 1 credit seminar course of CLSE 690. This component will expose students to cutting edge research from invited speakers and researchers from academia and industry each semester.

Directed research: All students will complete at least 27 credit hours of CLSE 697 Directed Research. This component emphasizes research directed toward solving an open, challenging problem, under the guidance of the Research Advisor and Dissertation Committee.

Transfer Policy: No more than 50 percent of the required minimum of didactic, non-research credit hours in graduate-level courses can be fulfilled by graduate didactic courses taken at VCU or another accredited institution before admission to the Ph.D. program.
Requirements and Procedures

Degree Requirements: To graduate, degree applicants must achieve an overall minimum grade point average of 3.0 on a 4.0 scale. Grades below a B will require remediation of the course as instructed by the course instructor. The GPA for graduation will be based on all graduate courses attempted after acceptance into the program. Graduates must also achieve a passing performance on their qualifying and comprehensive examination.

Ph.D. Qualifying Examination: To advance to doctoral candidacy, the student must pass the Ph.D. qualifying examination for the Ph.D. by the end of their first year of graduate study. The qualifying examination is in two parts.

Part I of the Qualifying Examination comprises the following topics: Thermodynamics, Non-Equilibrium Analysis, Reaction Engineering, and Quantitative Analysis. The examination is designed to assess knowledge and problem-solving skills fundamental to chemical and life science engineering. The core coursework discussed above will prepare the students for this part of the Qualifying Examination. Students may not take the qualifying exam if their overall GPA is less than 3.0. Students entering the Ph.D. program with a B.S. degree will be required to answer questions covering 4 topic areas. Students entering the Ph.D. program with an M.S. degree will choose 2 out of the 4 topic areas.

Part II of the qualifying examination has the same requirements for all students: an open ended research question aimed at assessing critical thinking, research skills, and technical writing. This will require submission of a written research proposal within a specified time period. The report will be graded by members of the program faculty who will be appointed in a rotating fashion each year.

The qualifying examination will be organized by the Graduate Program Director who, with the CLSE Graduate Committee, will review all results and issue recommendations.

Dissertation Committee: Following the qualifying examination, the research advisor will work with the student to select members of the dissertation committee. The dissertation committee should be formed within 12 months of selecting the research advisor, and no later than within 24 months of enrollment. This committee will consist, at a minimum, of five members. Three members must be from the CLSE program faculty and two members must be from outside the program. The primary advisor will serve as the committee chair. The outside members may be from VCU, another university, or from industry. All outside committee members must be members of the VCU graduate faculty. Those not already graduate faculty members must apply for membership via the Dean of the VCU Graduate School. The selection of the research advisor and the dissertation committee is to be approved by the CLSE Graduate Program Director.

Ph.D. Proposal Defense: A dissertation proposal must be presented for defense within 36 months from enrollment. The proposal defense will present progress in the chosen research area, and demonstrate problem-solving capabilities related to dissertation research.
The proposal defense has two parts: an oral and written examination. The student is required to prepare a written dissertation proposal and to defend it in front of the dissertation committee. The proposal will include a research plan, initial results, and a thorough literature review to judge the feasibility, scope, and potential impact of the research. At the proposal defense, an oral presentation is first presented followed by questions from the dissertation committee. A favorable decision with no more than one negative vote from the committee is required to pass.

Admission to Candidacy: The admission to doctoral degree candidacy is a formal statement by the graduate student's faculty regarding the student's academic achievements and readiness to proceed to the final research phase of the doctoral program.\textsuperscript{5} Before admission to candidacy for the doctorate, a student in good standing must have:

- Completed required course work.
- Successfully passed the qualifying examination and the oral comprehensive examination.

Dissertation Research and Review: The student must complete at least 27 research credit hours conducting an original investigation under the guidance of the advisor. The student's dissertation committee will conduct a yearly review of progress based on a report prepared by the student. The student's report, along with written minutes of the dissertation committee recommendations, signed by all committee members will be submitted to the Graduate Program Director.

Final Dissertation Defense: At the completion of the research, the student will prepare a dissertation reporting the results of this research. There should be a dissertation committee meeting no later than six months prior to dissertation defense to certify student readiness to write the dissertation. When the dissertation has been written, copies in the required form and style are submitted to the members of the dissertation committee. If the committee accepts the dissertation for defense, the candidate appears before them for a final oral examination.

The oral defense of the dissertation is open to all members of the community. There will be an announcement of the candidate's name, department and title of dissertation, specifying day, place and time of the final oral examination at least 14 days in advance. Following the presentation and questions, the candidate is excused and committee members vote. A favorable decision by the dissertation committee with no more than one negative vote is required for passing the examination. The committee can approve the final oral examination conditionally, subject to the corrections, to the satisfaction of either the advisor or the entire committee.

Publication Requirement: To encourage research at the highest level and foster a spirit of innovation and discovery, it is important that the graduate students have conducted high quality original research. Peer-reviewed evidence of the quality of work, in terms of at least one accepted journal paper or published high-quality conference paper in a student's research area and a second manuscript submitted for review to a journal or a high-quality conference must be approved by the dissertation committee and the CLSE Graduate Committee prior to the Ph.D. defense.

\textbf{Student Retention and Continuation Plan}

\textsuperscript{5} http://www.graduate.vcu.edu/student/candidacy.html
Informed by assessment, program review, and planning discussions, VCU’s School of Engineering realize some important lessons about student retention, and degree completion:

- A concerted effort helps students acclimate to advanced studies.
- Without intensive mentor engagement student progress will stall.
- Retention is a programmatic problem, not a student problem.
- Graduate programs have to be attractive in order to attract students of the highest caliber.

These lessons have been transformed into programmatic cornerstones - acclimation, mentoring, retention, and professional development. To accomplish tasks, the School of Engineering custom designs an experience to address the unique educational needs of engineering students. This will ensure that teaching, mentoring, and retention strategies are consistent, appropriate, and culturally relevant. Below are examples of efforts that have been implemented, and continue to be strengthened as part of the School of Engineering’s goals for the Chemical and Life Science Engineering Ph.D. program.

Department and Discipline Nuances: Recognizing distinctive climates across disciplines, it is incumbent upon faculty mentors to guarantee that every student learns about departmental nuances, protocol, communication, explicit rules, and implicit expectations. Students will be trained in research ethics and ethical issues surrounding collaborative research. Transparency, not secrecy, will be the key to graduate students achieving a sense of comfort and confidence.

Intensive Engagement by Mentors: The student-mentor relationship has been shown to positively correlate with student retention. Specific strategies include ongoing communications, timely and consistent mentor feedback, formal regular meetings, and use of e-progress reporting systems. CLSE faculty mentors will attend sessions with students at conferences, and debrief them on session content to enhance their critical thinking skills. Faculty mentors will also introduce students to faculty researchers from institutions outside of VCU, and encourage them to seek opportunities to publish and/or present with mentors across institutions. The School of Engineering’s Graduate Office will facilitate informal socializing and recognition of student achievements, with two planned campus events for additional mentor-trainee interaction.

Ph.D. Completion Team: To move beyond the rote functions of an advisory committee, the Ph.D. Completion Team will oversee transition points, process evaluation, and recruitment, mentoring, and retention activities. This team, comprising administration and faculty, will make objective programmatic suggestions on: (a) how to improve Ph.D. production and (b) competencies needed by new faculty. An underlying strength of this team will be its composition, drawn from other public, private, and nonprofit institutions including but not limited to public schools, research centers, universities, and the several national institutes.

Assessment of Progress and Attrition Intervention: Faculty mentors are responsible for the

ongoing monitoring and assessment of student progress. At a minimum, faculty mentors will conduct quarterly meetings with students to provide timely and explicit feedback on progress toward degree completion. The semiannual review will examine academic and research progress, active participation in career development workshops, and scholarly work. After year two, faculty mentors will also monitor: (a) readiness for the comprehensive examination, (b) proposal development, and (c) approval of dissertation research. The Ph.D. Completion Team will annually review mentors' reports. If a student might be at risk of attrition, members will verify mentor engagement and ascertain the causal factors (e.g., familial, mentor relationship, departmental climate) leading to the student's situation. The mentor will meet with the student (or a Ph.D. Completion Team member, if the student-mentor relationship is strained) to develop an action plan with performance expectations for the following semester. The purpose is to provide early intervention for doctoral students at risk of attrition.

Networking Opportunities: Finally, the School of Engineering firmly believe that ongoing contact with other researchers and multiple mentors will help reinforce our students' motivation to enter and continue graduate school. This offers steady engagement and helps students (a) develop career skills, (b) attach to a profession, and (c) achieve success in their respective doctoral programs. When this includes conference travel, it will also enable our students to get out of the confines of the laboratory and gain greater insight into the dedication and motivation of other successful professionals.

Faculty

The Chemical and Life Science Engineering department currently has 12 full time “core” faculty members (7 Full Professors, 3 Associate Professors and 2 Assistant Professors). All core faculty are tenured or tenure-track. One emeritus professor and 1 non-tenure track professor are involved in research and/or teaching in the department. Given the interdisciplinary nature of the program, several affiliate faculty are also part of this effort. For instance, in the last 2 years, 2 faculty members from across the SoE have advised CLSE graduate students as the primary Ph.D. advisor. Abbreviated CVs of core and affiliated faculty members are provided in Appendix C. All core faculty teach courses at the graduate level, including core and elective courses. Driven by a robust research program, the faculty strength is sufficient to deliver the program, including the projected growth in student enrollments.

All faculty are engaged in research, which is crucial for a successful graduate program. The research program is diverse in the department focusing on energy, materials science, tissue engineering and regenerative medicine, nanoscience, and pharmaceutical engineering. As of Fall 2016, there are 3 faculty members focused on research and teaching in pharmaceutical engineering, 5 faculty members focused on materials science and engineering and 4 faculty members focused on life science and engineering. The research is funded through a number of research grant awards from government (e.g. National Science Foundation, National Institutes of Health, Department of Defense), foundation (e.g. Bill and Melinda Gates Foundation, Dreyfus Foundation) and industrial sources (e.g. Honeywell, Canon). Faculty funding information is provided in Appendix D.
Program Administration

The program will be administered by the CLSE Graduate Program Director (GPD) who is appointed by the Chair of the CLSE department and reports to the Chair.

Duties of Graduate Program Director: The GPD is responsible for directing and guiding the graduate program overall, and chairing the departmental Graduate Committee. The Graduate Committee consists of a minimum of three full time program faculty members including the Graduate Program Director, appointed by the Chair. The GPD works with the department chair and faculty in assigning teaching assistantships. The GPD also represents the department at the SoE Graduate Advisory Committee meetings and at the University Programs & Courses Committee.

Duties of Graduate Committee: This Committee is responsible for graduate admissions decisions, qualifying exam oversight, deciding on student petitions, appeals, and credit transfer requests, graduate student advising, and processing of graduation applications. The program will have logistical support from an administrative assistant. The assistant will help in compiling data and building reports and graphs for departmental purposes including NSF, ASEE and other surveys/assessment activities.

Industrial Advisory Board: The Department of Chemical and Life Science Engineering has an industrial advisory board that meets twice a year and is convened by the Department Chair. Members are appointed for 2 year terms, which can be renewed by the Department Chair. The board which includes members from global Fortune 500 corporations will provide feedback and guidance on how best to prepare our graduates for suitable employment opportunities. (Appendix G includes the name, position title, credentials and company names for the current board members).

Student Assessment

At Virginia Commonwealth University, all degree programs are mandated by university policy to maintain a plan for assessing student learning outcomes annually. This plan includes the identification of program level student learning outcomes; direct and indirect methods for assessing the degree to which students are achieving the expected outcomes, procedural and logistical plans for administering the assessments, analyzing the findings, and using this information to assess the efficacy of the program in terms of expected student learning. All degree programs report assessment findings and plans for using the findings annually in a centralized assessment data management system.

Goals for VCU School of Engineering Graduates: Graduate students from the VCU School of Engineering will possess the technical and business skills to provide a significant impact to Virginia's and the nation's industries and businesses and for extending the boundaries of knowledge through critical thinking, problem solving, research and scholarship. The VCU School of Engineering’s graduate programs will prepare students to aid in the advancement and application of engineering knowledge by providing instruction and experiential learning in three categories: core competency areas, topical areas of specialization, and interdisciplinary research.
Goals for Chemical Life Science Engineering Ph.D. Graduates: The goal of the Chemical and Life Science Engineering Ph.D. program is to train students for careers as independent researchers with the tools and awareness to be able to function in an interdisciplinary environment. Students pursuing the doctorate will think critically, communicate effectively, design complex systems, and solve complex problems. These goals include preparing CLSE graduates in the following broad areas of intellectual skills:

- Comprehend complex problems, theoretical and applied concepts, and engineering principles demonstrated by the ability to describe and discuss the problem, identify critical components of the problem/concept/principle, and restate or reformulate the problem/concept.
- Analyze problems, data, and systems demonstrated by an ability to appraise, compare and contrast the problem/data/system and critique, examine, and differentiate the problem/data/system.
- Synthesize data, information, and solutions demonstrated by his/her ability to assemble, collect, and or measure the required data/information and create design and develop solutions or formulate, prepare and propose solutions, based upon measure and synthesis.
- Evaluate problems, solutions, data, and systems, demonstrated by his/her ability to assess, compare, and judge the problem/solution/data/system and present, rate, defend and/or critique problem/solution/data/system.

Learning Outcomes for Chemical and Life Science Engineering Ph.D. Graduates: Upon program completion, graduates will demonstrate the following knowledge and skills:

1. Demonstrate broad-based understanding of life-science and engineering.
2. Demonstrate in-depth comprehension of the current literature.
3. Identify meaningful problems/areas of inquiry.
4. Demonstrate design and implementation of problem solving methodologies.
5. Demonstrate the ability to formulate experimental protocols.
6. Demonstrate the ability to analyze research findings.
7. Demonstrate effective oral, written, and visual communication and presentations.

Assessments: To determine the degree to which students are achieving the expected learning outcomes, and to determine the degree to which the learning program is effective, program level assessment data will be collected at the following degree requirement events:

- Qualifying examination
- Dissertation proposal defense
- Final dissertation defense
- Peer reviewed manuscript accepted for publication
- Conference presentations

Using degree requirements for student evaluation and program assessment ensures the alignment of program level learning outcomes, student learning, and the design of the curriculum. Rubrics will be deployed for assessing effective communication, research design, problem posing/solving, and depth and scope of science and engineering knowledge and literature. Table 1 illustrates the alignment of goals, learning outcomes, courses, program level assessments, and
targets. Table 2 presents the performance targets for each assessment.

<table>
<thead>
<tr>
<th>Program Goals for Learning</th>
<th>Expected Outcomes</th>
<th>Courses Aligned to Learning Outcome</th>
<th>Program Level Assessment Methods</th>
</tr>
</thead>
</table>
| Comprehend complex problems, theories, concepts, principles | 1. Demonstrate broad-based understanding of life-sciences and engineering.  
2. Demonstrate in-depth comprehension of the current literature. | Core curriculum |  
- Qualifying exam  
- GPA. in core courses |
| Assess and evaluate problems, solutions, and systems | 3. Identify meaningful problems/areas of inquiry  
4. Demonstrate design and implementation of problem solving methodologies. | Directed research |  
- Proposal defense  
- Dissertation defense |
| Synthesize and integrate data and information to formulate solutions | 5. Demonstrate the ability to formulate experimental protocols.  
6. Demonstrate the ability to analyze research findings. | Directed research |  
- Dissertation  
- Peer-reviewed publications |
| Communicate effectively | 7. Demonstrate effective oral, written, and visual communication and presentations. | Directed research |  
- Dissertation  
- Proposal defense  
- Dissertation defense;  
- Peer-reviewed publications  
- Conference presentations |

**Table 1.** Aligned Goals, Expected Learning Outcomes, Curriculum, and Assessment Methods for the proposed Chemical and Life Science Engineering Ph.D.
<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessments</th>
<th>Performance Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Demonstrate broad-based understanding of life-science and engineering.</td>
<td>Qualifying exam (direct)</td>
<td>80% of students will meet or exceed criteria for broad-based life science and engineering knowledge on the qualifying examination.</td>
</tr>
<tr>
<td></td>
<td>Core curriculum G.P.A. (indirect)</td>
<td>90% of students will obtain a G.P.A of at least 3.5 in core courses</td>
</tr>
<tr>
<td>2. Demonstrate in-depth comprehension of the current literature.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Identify meaningful problems/areas of inquiry</td>
<td>Proposal defense (direct)</td>
<td>90% of students will meet or exceed criteria for identifying problems for inquiry and the criteria for demonstrating design and problem solving methodologies.</td>
</tr>
<tr>
<td>4. Demonstrate design and implementation of problem solving methodologies.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Demonstrate the ability to formulate experimental protocols</td>
<td>Dissertation (direct)</td>
<td>100% of Ph.D. candidates will meet or exceed the criteria for formulating experimental protocols and the criteria for analyzing research findings.</td>
</tr>
<tr>
<td></td>
<td>Peer-reviewed publications (indirect)</td>
<td>100% of the candidates will have one peer reviewed manuscript accepted for publication at the time of the dissertation defense.</td>
</tr>
<tr>
<td>6. Demonstrate the ability to analyze research findings.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Demonstrate effective oral, written, and visual communication and presentations.</td>
<td>Proposal defense (direct)</td>
<td>100% of students who submitted an acceptable proposal/dissertation will pass the proposal/final defense.</td>
</tr>
<tr>
<td></td>
<td>Dissertation defense (direct)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Peer-reviewed publication (indirect)</td>
<td>100% of the students will have one accepted peer reviewed manuscript at the time of the final dissertation defense.</td>
</tr>
<tr>
<td></td>
<td>Conference presentations (indirect)</td>
<td></td>
</tr>
</tbody>
</table>

Table 2. Learning Outcomes, Assessments, and Performance Targets

**Program Assessment**

All programs at VCU participate in the six-year cycle for program review, the Academic Program Review (APR). At VCU, the APR is an evidence based review of academic and fiscal viability regarding alignment with the university's mission and strategic aims. APR is administered by the Office of Academic Affairs.

In addition to the APR cycle, the proposed Ph.D. in Chemical and Life Science Engineering
program will annually monitor progress toward the following benchmarks of success. The annual collection of these data will be used to prepare and implement action plans.

**Benchmarks of Success**

The proposed Chemical and Life Science Engineering Ph.D. will use the following criteria to gauge the success of the program:

- Average annual enrollments of at least 12 graduate students after five years.
- Average annual graduation rate of at least 8 students after five years.
- Average performance on the assessment rubrics of 3.5/5.0.
- Average graduating student grade point average of at least 3.1 after three years.
- Average incoming student GRE scores of at least 300 (combined quantitative and verbal reasoning) after three years.
- Average annual number of applicants to program – at least 50 after three years.
- Number of graduates who accept jobs – at least 75% (of those who do not continue for post-graduate studies) within six months of graduating.

Values for each measure will be calculated and compared to the benchmark on an annual basis. Benchmarks will also be used as flagging indicators to trigger a review of statistically significant measures below target. Corrective action will follow within two months of the end academic years.

Other benchmarks will include numbers of job placements and starting salaries of engineering graduates which can be compared to national engineering averages. The national average data is available from the American Society for Engineering Education and various engineering professional societies including AIChE (American Institute of Chemical Engineers) and ACS (American Chemical Society). Additional data will include subjective information such as the satisfaction level of both graduates and prospective employers. Graduating students will be asked to describe their experiences in the program to assess areas that they felt were weak and strong. Each graduating student will have an exit interview with the program chair and the Associate Dean for Graduate Affairs to provide additional feedback on that student's specific program of study.

The following employment indicators will be used to evaluate the program:

- Jobs offered to each student and starting salaries of each student.
- Type of job and area/focus of company job title and responsibilities.
- Job reviews and advancement review - conducted at 6 months, 1 year, and 2 years.

Other relevant information to assess student outcomes include the number of patents issued to the graduate (either individually or through a company), the number of technical and professional publications in scientific and engineering journals and periodicals, and the number of presentations at scientific and engineering conferences and workshops.
Workplace Competencies and Employment Skills

The proposed Ph.D. program will train graduates for careers in industry, technical administration, and academia. It will address the growing demand for researchers trained in interdisciplinary science and engineering, who recognize the need for cross-disciplinary approaches to solving complex problems in energy, healthcare, and sustainable manufacturing.

Graduates entering the workforce will be able to:
- Apply knowledge of engineering principles to design and conduct experiments, as well as to analyze and interpret data.
- Design systems, components, or processes to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- Understand how chemical and life science engineering connect with other major disciplines in order to function on interdisciplinary teams to produce the goods and services needed by society.
- Appreciate professional, and moral responsibilities within their careers in engineering and through service in their communities.
- Understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- Communicate clearly and effectively to the general public the contributions that chemistry and chemical engineering make to society.
- Attract the best and the brightest young students into the chemical sciences, instruct the next generation of engineers, and assist in the development of curricula.

Expansion of Existing Programs

This is an expansion of an existing concentration within the Engineering Ph.D. program in VCU’s School of Engineering.

Relationship to Existing Degree Programs

The Chemical and Life Science Engineering Department (CLSE) operates the Bachelor of Science program and administers the CLSE track in the Engineering M.S. and Ph.D. programs. The establishment of the doctoral program in CLSE will strengthen the existing programs. No other doctoral program at VCU has similar or related content to the proposed program.

Collaboration or Standalone

This is a stand-alone program. No other organization is involved in its development, and no other organization will collaborate in its operation.
JUSTIFICATION FOR THE PROPOSED PROGRAM

Response to Current Needs

Chemical and life science engineers translate processes developed in the lab into practical applications for the commercial production of chemicals, fuels, foods, pharmaceuticals, and biologics, and then work to maintain and improve those processes. They are most often employed by large-scale manufacturing plants to maximize productivity and product quality while minimizing costs. The aerospace, automotive, biomedical, electronic, environmental, medical, and military industries seek the skills of chemical engineers in order to help develop and improve their technical products, such as:

- Biocompatible materials for implants, prosthetics, and organs
- Low-cost pharmaceuticals
- Clean drinking water
- Biofuels and alternative energy sources

Chemical and life science engineers work in almost every industry and affect the production of almost every article manufactured on an industrial scale. The United States Department of Labor’s 2016 analysis estimates that the ability of engineers in the chemical engineering, biochemical engineering and biomedical engineering fields “to stay on the forefront of emerging technologies will sustain employment growth.” Chemical engineering is migrating into new fields, such as nanotechnology, alternative energy, and biotechnology, helping to sustain demand for engineering services in many manufacturing industries. Sixteen percent (16%) of chemical engineers reported that a master's degree was required for their positions; with 20% of respondents reporting that a doctoral degree was required; (for the allied field of bioengineering, 35% reported a master’s degree was required, while 20% of respondents reported that a doctoral degree was required for their positions). In a recent report, the Bureau of Labor Statistics noted: “In the government and government-related job sector, certain STEM disciplines have a shortage of positions at the Ph.D. level (e.g., materials science engineering, nuclear engineering, petroleum engineering, process engineering)” The discipline-specific Ph.D. degree in Chemical and Life Science Engineering therefore addresses a current need, with an eye to the future of the ever-broadening interface between engineering and life sciences.

According to the latest projections by Bureau of Labor Statistics (data last modified April 18, 2016, accessed December 2016), employment needs in chemical engineers, industrial engineers, and health and safety engineers are expected to be 4.5% or higher. Across the US, there is projected to be much faster than average growth (14% or higher growth) for chemical

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7 https://www.acs.org/content/acs/en/careers/college-to-career/chemistry-careers/chemical-engineering.html
8 Ibid
10 https://www.onetonline.org/link/details/17-2041.00#ToolsTechnology (O*NET OnLine is sponsored by the U.S. Department of Labor)
13 http://www.bls.gov/emp/ep_table_102.htm
and biochemical engineers through 2024. Labeled by the U.S. Department of Labor as “Bright Outlook” occupations, both bioengineering and biochemical engineering are expected to grow rapidly in the next several years with large numbers of job openings or new and emerging occupations. Chemical engineering and biochemical engineering are considered “green occupations”, and are expected to see a change in employment demand or work or worker requirements including tasks, skills, knowledge and credentials with the green economy.\(^{14}\)

Combined, there were nearly 193,000 workers in these occupations across the U.S. in 2014, with 53,900 openings projected through 2024. In 2014, there were 1,200 chemical engineers and 370 biomedical engineers and related titles employed throughout Virginia; biochemical engineers were not listed separately. A 1% increase in job openings in chemical engineering is expected, with a projected 30 openings annually through 2024 across the state resulting from turnover and new job creation; 20 job openings in biomedical engineering are projected annually, representing a 25% change between 2014 and 2024. Despite a flat employment growth projected for 2012-2022, job openings for materials engineers are still significant due to replacement needs.\(^{15}\)

**Rationale for a stand-alone program:** A stand-alone Ph.D. program in CLSE as proposed will enhance efforts to build an internationally recognized graduate program and bridge faculty across different disciplines. A distinctive degree program will enhance student placement for careers in industrial sectors, including but not limited to energy, materials, performance chemicals, pharmaceuticals, biotechnology and biosciences, and environmental life sciences. The areas of research focus identified in our program position us to provide graduates with unique cross-disciplinary expertise to solve challenges in areas ranging from manufacture of low-cost lifesaving medicines and clean drinking water, to efficient energy storage and bioprinting of replacement organs in regenerative medicine. For example, VCU CLSE recently established an NSF-supported Center for Rational Catalyst Synthesis (CeRCaS) to leverage research opportunities with industry. This Industry/University Cooperative Research Center (I/UCRC) utilizes core chemical engineering tenets of chemical kinetics and materials design to form new catalysts for industrial processes. By applying principles and technology of biology in engineering, Ph.D. graduates will address problems related to materials, systems, or processes that interact with humans, plants, animals, microorganisms, or biological materials. Several recent awards to CLSE faculty from NSF, NIH, and Department of Defense (see Appendix C) involve the nexus of engineering and global health.

**Improving intake of the highest quality of graduate students:** VCU has an established national reputation in the health and life sciences, and, along with its comprehensive medical center, School of Pharmacy and the School of Engineering; given this interdisciplinary context, a unique opportunity exists to develop contemporary, forward-looking programs of the highest level of significance and societal impact. The Ph.D. program in CLSE will ensure growth of the program in terms of student intake and quality, research productivity, and conforming to the highest international academic standards. Discipline-specific graduate programs are an absolute requirement today for recruitment of the highest quality graduate students and faculty. The top chemical engineering programs in the country, as assessed by the National Research Council

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\(^{14}\) [https://www.dol.gov/wb/green_jobs_guide/GreenJobs%20Ch%203.pdf](https://www.dol.gov/wb/green_jobs_guide/GreenJobs%20Ch%203.pdf)

(NRC) in a 2010 report, in terms of research have their own discipline-specific graduate
degrees.¹⁶ (Note that the NRC produces a report once every 10 years).

A Chemical and Life Science Engineering Ph.D. program will attract the highest caliber students
and faculty, which will benefit the Commonwealth in terms of providing a highly skilled
workforce, generation of world-class, cutting edge research, generation of intellectual property,
and provide a vibrant hub of discovery in Virginia. Strong graduate students will further improve
training efforts at the undergraduate level since these students are expected to participate as
teaching assistants, tutors, and mentors for undergraduate courses.

Note that the National Science Foundation’s IGERT grants (Integrative Graduate Education and
Research Traineeship) and the National Institute for Health’s T30 training grants to support
graduate students require discipline-specific graduate degree programs in order to compete with
other institutions across the U.S. Such grants are critically needed and have been used effectively
to significantly increase both the quantity and quality of graduate students in discipline specific
degree programs.

Synergies with the proposed Pharmaceutical Engineering Ph.D. program: In addition to the
uniqueness of chemical and life science engineering discussed above, this stand-alone Ph.D.
program will be synergistic in its interaction with the proposed Pharmaceutical Engineering
Ph.D. program. Specifically, areas of chemical reaction kinetics, process engineering and design
represent core chemical engineering competencies critical to the success broader goals of low
cost drugs. Graduates with training in these areas will enable translation from the laboratory
(bench scale) to the marketplace (large scale manufacture). This will allow a seamless transition
of the resources currently at VCU as well as anticipated (e.g. "Medicines-for-All" initiative of
the Bill and Melinda Gates Foundation).¹⁷

**Employment Demand**

The Commonwealth of Virginia and surrounding states will need a workforce prepared to face
the challenges presented by the biotechnology industry. In a recent speech, Governor McAuliffe
emphasized this point – “Biotech innovation is key to building a new Virginia economy, and we
have made it a top priority to encourage growth in this exciting sector. This emerging industry
has tremendous potential to make our Commonwealth stronger, healthier, and more competitive
in the 21st century economy.”¹⁸ Over the last decade or more, major corporations have
established engineering divisions in Virginia, many with a focus on life science engineering.
These include DuPont, Honeywell, WestRock, Ampac, Pfizer and Merck. The Virginia
Biotechnology Association (VABio) estimates that the biopharmaceutical sector accounts for
11,000 direct jobs, and a payroll of approximately $1 billion per year.¹⁹ It creates another 25,000
jobs in Virginia indirectly in the companies and professionals in service and support of the
sector. The average pay more than 50% greater than the average for all industries.²⁰ Graduates

¹⁶ National Research Council (NRC) - [http://chronicle.com/article/NRC-Rankings-Overview/-124712/]
¹⁷ [http://www.gatesfoundation.org/What-We-Do/Global-Health/HIV]
¹⁸ [https://governor.virginia.gov/newsroom/newsarticle?articleId=15579]
¹⁹ [https://www.vabio.org/?page=overview]
²⁰ Ibid.
with backgrounds in life science and engineering form a key pipeline for this sector. The biotechnology industry is growing faster than others, as well. From 2001 to 2008, life science employment in the state grew by 23%, compared to 6% total growth statewide and 3.5% across all sectors in the U.S. Virginia’s biotech sector generated products and services valued at more than $13 billion in 2008. In the tougher economic times of the last several years, Virginia bioscience job growth and company formation outpaced state and national averages. Clusters of bioscience industry have been identified in Northern Virginia (34%), Richmond (30%), Charlottesville (15%), Western Virginia/Blacksburg (14%), and Hampton Roads (7%).

An advanced demand report through Labor Insight™ reveals that Virginia is #7 among the Top 15 Hiring Regions in the U.S. in the last 12 months for chemical engineers, biochemical engineers, biomedical engineers, and related job titles. Labor Insight™ pulled 3,109 job postings in the last 12 months across the state of Virginia for chemical, biochemical, and biomedical engineering and related job titles. There is a strong concentration of these jobs in the state, with a much higher demand than average. There were 75,681 job openings nationwide during this time period, with the Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) being the sixth largest hiring region in the country with 3,584 postings requiring such expertise.

Studies conducted by both the American Society for Engineering Education and the National Science Foundation reported a shortage of graduate level engineers in the United States. The unemployment rate for graduate level engineers is among the nation's lowest. There are excellent job opportunities in engineering throughout the nation with corresponding demands for increased graduate school enrollments in engineering disciplines. The distribution of minimum education requirements (as specified) across the United States and across Virginia for graduate level engineers is shown in the figures 1 and 2 below.

**Figure 1:** Education and Experience Desired (US numbers, Snapshot reporting last 12 months,

https://www.vabio.org/?page=overview

The percentages represent the concentration of biotech and biotech-related industry in a given region.

21 Labor Insight™ | Burning Glass Technologies, October 2016
23 Labor Insight™ | Burning Glass Technologies, October 2016
25 Labor Insight™ | Burning Glass Technologies, October 2016
taken October 2016).

![Graph showing education and experience desired](image)

**Figure 2:** Education and Experience Desired (Virginia, Snapshot reporting last 12 months, taken October 2016).

Thus, the regional and nation-wide demand for engineers with advanced degrees is strong and is anticipated to remain strong in the coming years. The Commonwealth has a long-standing interest in growing high tech industries. The graduate engineering programs at VCU take advantage of proximity to the industries in Central Virginia and are able to form strong ties and will play a significant role in promoting the high tech industrial in the Commonwealth. The proposed program is poised to provide manpower and aids in growth spurt of economic development in Virginia. **Whether in academic research or industry, the discipline-specific degree is expected to enhance the marketability of our graduates and will address a current and future need for chemical and life science engineers.**

**Student Demand**

Given the rising demand for graduate level engineers nationwide, coupled with the strong interconnection with Virginia industries, there is every expectation that the job market for Ph.D. level engineers will remain quite strong. With such growing demand, the prediction for graduate engineering enrollments at VCU will echo, if not exceed, those at other universities. The existence of the CLSE track within the umbrella Engineering Ph.D. at VCU has allowed us to develop the curriculum and evaluate student and employer demand for the proposed Chemical and Life Science Engineering Ph.D. program. Enrollment data for the last five years of the graduates in Engineering - CLSE track, shown in Table 3, indicate a stable demand from students.

<table>
<thead>
<tr>
<th>Number of graduate students</th>
<th>2010-2011</th>
<th>2011-2012</th>
<th>2012-2013</th>
<th>2013-2014</th>
<th>2014-2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>32</td>
<td>26</td>
<td>25</td>
<td>25</td>
<td>26</td>
</tr>
</tbody>
</table>

**Table 3.** Graduate enrollment data for the CLSE track.

**Table 6.** Enrollment data for VCU’s Ph.D. in Engineering, Computer Science track.

VCU surveyed 742 students including enrolled seniors in Biology B.S., Bioinformatics, B.S., Chemical and Life Science Engineering B.S., Chemistry B.S., and Physics B.S. Additionally.
graduate students in Bioinformatics, Chemistry, Engineering, and Physics and Applied Sciences were surveyed between March 17 and March 29, 2017. (Sec Appendix F.) The students were asked: “If VCU offered the Chemical and Life Science Ph.D., would you enroll?” Of the 47 students who responded, 35 expressed a level of interest in enrolling: 7 (15%) said “Definitely;” 8 (17%) said “Very Likely;” 12 (26%) said “Likely;” 8 (17%) said “Somewhat Likely.” Thirty-five (35) students indicated that between 2018 and 2020 they would enroll in this proposed program. VCU expects to attract qualified applicants from outside of VCU as well, nationally and internationally, who are interested in a program emphasizing data science and cybersecurity. The number of potential applicants from VCU seeking admission to this proposed program will exceed the number of available acceptance slots (8).

**STATE COUNCIL OF HIGHER EDUCATION FOR VIRGINIA**

**SUMMARY OF PROJECTED ENROLLMENTS IN PROPOSED PROGRAM**

Projected enrollment:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5 Target Year (4-year institutions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HDCT 8</td>
<td>FTES 8</td>
<td>HDCT 16</td>
<td>FTES 16</td>
<td>HDCT 24</td>
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<td>FTES 24</td>
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<td>HDCT 32</td>
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<td>FTES 32</td>
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<td>GRAD 8</td>
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<td>FTES 32</td>
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<td></td>
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<td></td>
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<td>GRAD 8</td>
</tr>
</tbody>
</table>

Planning assumptions:

- Cohort size: – 8 per fall admission cycle
- Retention percentage: __90%__
- Full-time students: __100%__
- Full-time students average credit hours per semester: __9__
- Full-time students graduate in __4 years__

**NOTE:** While this Ph.D. program is an option for working students, the impact of any part-time participation in the degree program is assumed to be minimal and thus ignored for budget planning purposes.

**Duplication**

The State Council for Higher Education degree inventory website only 2 doctoral chemical engineering programs in the Commonwealth of Virginia. There are currently no graduate programs in chemical and life science engineering in the state. The greater Richmond

28 [http://research.schev.edu/DegreeInventory/default.asp](http://research.schev.edu/DegreeInventory/default.asp)
metropolitan area, with a population of over one million, with large private and public sectors, has no institution offering the Chemical and Life Science Engineering Ph.D. program.

The primary motivation for the Ph.D. in CLSE program is the high demand from employers and students for graduate training opportunities. This unique, forward-looking program does not duplicate any other graduate program in Virginia. In particular, emphasis areas on interdisciplinary pathways such as life science engineering, chemical kinetics and process engineering, materials science engineering coupled with a core training in chemical engineering fundamentals is a truly unique program of its kind, not just in the Commonwealth but nationwide. This degree is therefore distinctive and timely given the projected jobs outlook for the future and the engineering talent pool needs facing the Commonwealth.

The unique nature of the proposed program capitalizes on the ability to leverage the fundamental elements of chemical engineering in research areas that address unmet needs both locally as well as nationally. The Medicines for All Initiative,29 which has been funded by the Bill and Melinda Gates Foundation since 2014 is centered in CLSE with the mission to increase access to global health care by employing fundamental engineering principles of process intensification. Likewise, the NSF I/UCRC Center for Rational Catalysis Synthesis is the only center of its kind, focusing on the development of new and commercially scalable processes for the production of nanocatalysts with previously unachievable control. We anticipate that these two CLSE initiatives will become a hub for economic development in the Commonwealth in the near term.

In addition to the School of Engineering, VCU has a comprehensive health system (VCU Health) — formerly known as the Medical College of Virginia (MCV) — and an integrated life sciences program. The proposed discipline-specific graduate degree program will be able to take full advantage of the possibilities for interdisciplinary study and collaboration present at VCU.

There is no duplication between the existing Chemical Engineering doctoral programs listed in Table 4 and the proposed Ph.D. in CLSE at VCU. The proposed program aims to train leaders for the economy by providing a unique curriculum that combines an engineering core with training in various multi- and inter-disciplinary tracks in the life sciences, energy, materials or chemical kinetics and process engineering.

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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Virginia Tech</td>
<td>45</td>
<td>46</td>
<td>42</td>
<td>33</td>
<td>44</td>
</tr>
<tr>
<td>University of Virginia</td>
<td>47</td>
<td>46</td>
<td>45</td>
<td>43</td>
<td>35</td>
</tr>
<tr>
<td>Virginia Tech</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>University of Virginia</td>
<td>13</td>
<td>5</td>
<td>7</td>
<td>9</td>
<td>8</td>
</tr>
</tbody>
</table>

(Available data for last 5 years is presented)

29 http://news.vcu.edu/article/VCU_engineering_professor_receives_5_million_grant_to_drive_down
**Table 4.** Enrollments and Degrees Awarded at Comparable Ph.D. Programs (Chemical Engineering, General, CIP: 14.0701) in the Commonwealth, obtained from State Council of Higher Education for Virginia.
PROJECTED RESOURCE NEEDS

All program resources currently used to support the Chemical and Life Science Engineering track within the umbrella Ph.D. degree in Engineering (ENGR) will be transitioned to the new graduate program. The resources include:

Full-time Faculty

There are no faculty with 100% effort devoted to the Ph.D. program. All department faculty have responsibilities for both graduate and undergraduate academic programs, and all department faculty spend portions of their time conducting research and performing service to the school, university and their respective professions. For purposes of the budget planning, we set the number of full-time faculty to 0.

Part-time Faculty

Program faculty will be shared with the undergraduate program in CLSE and will also be expected to conduct research and perform service. For purposes of the planning, code all program faculty as part-time faculty.

For planning purposes, we assumed an upper bound of 9 month faculty salary of $150,000. Fringe is estimated at 37.2%. We did not escalate costs over time. For instruction of the program, we assume a 1-month effort per course and a faculty capacity of 4 courses per year (this is similar to what exists currently). To meet the anticipated curricular needs of the program, we estimate a need of 3 equivalent full time (EFT) faculty to cover the instructional needs of the program. We therefore do not anticipate the need to hire additional faculty for this program.

Adjunct Faculty

No adjunct faculty will be involved with the program.

Graduate Assistants

We assume a cohort of 8 doctoral students per year will enter the program. We expect that all of these student will be fully funded with tuition, stipend and fees. We expect to allocate 5 graduate student lines provided by the Graduate School to this program. The remaining 3 graduate student lines will be funded through sponsored program activities (Please see the robust external funding to CLSE faculty in Appendix D that justify this assumption). For budgeting purposes, we assume in-state tuition of $4,494 per semester, out of state tuition of $9,579 per semester, in-state fees of $1,223 per semester, out of state fees at $1,535 per semester and graduate student stipends of $28,000 per year (12-months). There is no fringe benefit rate charged for graduate assistants.

Classified Positions

One administrative staff person will devote approximately 33% effort to the graduate program. All support will be steadily transitioned from the existing engineering graduate program to the
new program. The resources described are sufficient to initiate and operate the program.

Targeted Financial Aid

Beyond providing opportunities to work on sponsored projects, no financial aid is required.

Equipment

A full detail of equipment and resources is listed in Appendix H. The resources described are sufficient to initiate and operate the program.

Library

A full detail of library resources is listed in Appendix I. The resources described are sufficient to initiate and operate the program.

Space

All facilities currently used to support the Engineering Ph.D. – Chemical and Life Science Engineering track will be transitioned and used to support the proposed new graduate programs. These include the research and teaching laboratories and classrooms located in the School of Engineering buildings on the Monroe Park Campus and the Biotech Center. The resources described are sufficient to initiate and operate the program.

Other Resources

The Department has allocated $20,000 for other program expenses. We estimate $8,000 related to graduate student recruiting including travel and the publication of brochures, $2,000 for telecommunications costs and $10,000 for materials and supplies to support administrative and instructional needs. The resources described are sufficient to initiate and operate the program.

Current funding from external sources such as the National Science Foundation, the National Institutes of Health, the Department of Defense, the Department of Energy and the Bill & Melinda Gates Foundation has allowed offering support to Ph.D. students beyond these GTA positions (see Appendix D), and this trend is expected to continue.
Projected Resource Needs for Proposed Program

Part A: Answer the following questions about general budget information.

- Has or will the institution submit an addendum budget request to cover one-time costs?  
  Yes _____ No X

- Has or will the institution submit an addendum budget request to cover operating costs?  
  Yes _____ No X

- Will there be any operating budget requests for this program that would exceed normal operating budget guidelines (for example, unusual faculty mix, faculty salaries, or resources)?  
  Yes _____ No X

- Will each type of space for the proposed program be within projected guidelines?  
  Yes X No

- Will a capital outlay request in support of this program be forthcoming?  
  Yes _____ No X

Part B: Fill in the number of FTE positions needed for the program

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year 2017 – 2018</th>
<th>Expected by Target Enrollment Year 2021 – 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>On-going and reallocated</td>
<td>Added (New)</td>
</tr>
<tr>
<td>------------------------------------</td>
<td>---------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Full-time FTE*</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Part-time FTE **</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Adjunct faculty</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Graduate assistants</td>
<td>32</td>
<td>0</td>
</tr>
<tr>
<td>Classified positions</td>
<td>0.33</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>35.33</td>
<td>0</td>
</tr>
</tbody>
</table>

* Faculty dedicated to the program. **Faculty effort can be in the department or split with another unit.  
*** Added after initiation year.
Part C: Estimated resources to initiate and operate the program

Please see section PROJECTED RESOURCES NEEDED in text for details and assumptions. Program Initiation Year data is the same as Target enrollment data – students in the pipeline will be transitioned from old program to new, keeping enrollments generally steady.

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year</th>
<th>Expected by Target Enrollment Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018 – 2019</td>
<td>2021 – 2022</td>
</tr>
<tr>
<td>Full-time faculty</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td></td>
<td></td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Part-time faculty</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Salaries</td>
<td>$450,000</td>
<td>$450,000</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$167,400</td>
<td>$167,400</td>
</tr>
<tr>
<td>Adjunct faculty</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>fringe benefits</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Graduate assistants</td>
<td>32</td>
<td>32</td>
</tr>
<tr>
<td>Salaries (stipend/tuition/fees)</td>
<td>$1,488,248</td>
<td>$1,488,248</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Classified Positions</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Salaries</td>
<td>$16,500</td>
<td>$16,500</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$6,138</td>
<td>$6,138</td>
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<tr>
<td><strong>Total personnel cost</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salaries</td>
<td>$1,954,748</td>
<td>$1,954,748</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$173,538</td>
<td>$173,538</td>
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<tr>
<td><strong>Total personnel cost</strong></td>
<td>$2,128,286</td>
<td>$2,128,286</td>
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<tr>
<td>Equipment</td>
<td>-</td>
<td>-</td>
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<td>Library</td>
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<td>-</td>
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<tr>
<td>Telecommunication costs</td>
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<td>-</td>
</tr>
<tr>
<td>Other costs (specify)</td>
<td>$20,000</td>
<td>$20,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$2,148,286</td>
<td>$2,148,286</td>
</tr>
</tbody>
</table>
Part D: Certification Statement(s)

The institution will require additional state funding to initiate and sustain this program.

Yes

Signature of Chief Academic Officer

X  No

Signature of Chief Academic Officer

If “no,” please complete items 1, 2, and 3 below.

1. Estimated $$$ and funding source to initiate and operate the program.

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Program initiation year 2018-2019</th>
<th>Target enrollment year 2021-2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reallocation within the department (Note below the impact this will have within the department.)</td>
<td>$1,122,405</td>
<td>$1,122,405</td>
</tr>
<tr>
<td>Reallocation within the school or college (Note below the impact this will have within the school or college.)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Reallocation within the institution (Note below the impact this will have within the institution.)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other funding sources (Please specify, to include extramural funding and philanthropy, and note if these are currently available or anticipated.)</td>
<td>$1,025,881</td>
<td>$1,025,881</td>
</tr>
</tbody>
</table>

2. Statement of Impact/Other Funding Sources.

Reallocation within the department

This action is effectively an expansion of the existing CLSE track within the Engineering Ph.D. program. Resources are already dedicated to delivery of the existing program. Internal resources will therefore be simply reallocated to the new program. Additional resources are not required.

Reallocation within the school or college

Within the School of Engineering MBU, instructional resources are budgeted to the departments. This action has no impact on the overall School of Engineering budget.
Reallocation within the institution

This action is expected to have no impact on the university budget.

Other funding sources

Sponsored projects fund the stipends, tuition and fees of graduate students. It is expected that all students in this program will be supported by sponsored projects and/or graduate student lines from the Graduate School. We are not requesting additional lines from the graduate school, we are reallocating existing lines already allocated to CLSE.

If resources are reallocated from another unit to support this proposal, the institution will not subsequently request additional state funding to restore those resources for their original purpose.

         Agree

____________________________
Signature of Chief Academic Officer

         Disagree

____________________________
Signature of Chief Academic Officer
APPENDICES
Appendix A - Sample Plan of Full time Graduate Study

Example Program of study – Engineering B.S. to Ph.D. in CLSE

**FALL ADMISSION**

| Year 1 Fall | STAT 641 - Statistics for Engineering  
|            | CLSE 650 - Quantitative Analysis in Chemical and Life Science Engineering  
|            | CLSE 654 - Equilibrium Analysis in Chemical and Biological Systems |
| Year 1 Spring | CLSE 655 - Nonequilibrium Analysis in Chemical and Life Science Engineering  
|              | CLSE 656 - Advanced Chemical Reaction Engineering  
|              | Grad Elective (500/600 level)  
|              | (Research Topic Selection) |
| End of Year 1 | Ph.D. qualifying exam |
| Year 2 Fall | Grad Elective (500/600 level)  
|             | Grad Elective (500/600 level)  
|             | Research Seminar (CLSE 690)  
|             | Thesis Work (CLSE 697) |
| Year 2 Spring | Grad Elective (500/600 level)  
|               | Grad Elective (500/600 level)  
|               | Research Seminar (CLSE 690)  
|               | Thesis Work (CLSE 697) |
| Year 3 Fall | Grad Elective (500/600 level)  
|             | Research Seminar (CLSE 690)  
|             | Thesis Work (CLSE 697) |
| Year 3 Spring | Thesis Work (CLSE 697)  
|               | Research Seminar (CLSE 690) |
| Year 4 Fall | Thesis Work (CLSE 697)  
|             | Research Seminar (CLSE 690) |
| Year 4 Spring | Thesis Work (CLSE 697)  
|               | Research Seminar (CLSE 690) |

Courses in **bold** represent CLSE core curriculum
## Example Program of study – Engineering M.S. to Ph.D. in CLSE

### FALL ADMISSION

| Year 1 Fall                  | CLSE 654 - Equilibrium Analysis in Chemical and Biological Systems  
Grad Elective (500/600 level)  
Thesis Work (CLSE 697)  
Research Seminar (CLSE 690)  
(Research Topic Selection) |
|------------------------------|--------------------------------------------------------------------|
| Year 1 Spring                | CLSE 655 - Nonequilibrium Analysis in Chemical and Life Science Engineering  
CLSE 656 - Advanced Chemical Reaction Engineering  
Research Seminar (CLSE 690)  
Thesis Work (CLSE 697)        |
| End of Year 1                | Ph.D. qualifying exam                                              |
| Year 2 Fall                  | Grad Elective (500/600 level)  
Thesis Work (CLSE 697)  
Research Seminar (CLSE 690)  |
| Year 2 Spring                | Thesis Work (CLSE 697)  
Research Seminar (CLSE 690)  |
| Year 3 Fall                  | Thesis Work (CLSE 697)  
Research Seminar (CLSE 690)  |
| Year 3 Spring                | Thesis Work (CLSE 697)  
Research Seminar (CLSE 690)  |

*Courses in **bold** represent CLSE core curriculum*
Appendix B - Course Descriptions

CLSE 650 Quantitative Analysis in Chemical and Life Science Engineering
Semester course; 3 lecture hours. 3 credits. Prerequisites: MATH 301 and 302 or equivalent. An understanding of the quantitative descriptions of chemical and biological processes is required for engineering analysis, including prediction and design. Analytical approaches are necessary to simplify and provide limits of complex behavior. These approaches include perturbation theory and scaling, density functional formulations, control theory, and stability theory. This course represents the applied mathematical foundations in the analysis of chemical and biological systems.

CLSE 654 Equilibrium Analysis in Chemical and Biological Systems
Semester course; 3 lecture hours. 3 credits. Prerequisite: CLSE 305 or equivalent. Provides a molecular based, thermodynamic framework for the quantitative equilibrium analysis of a broad range of biological and chemical processes. Contemporary equations of state, liquid solution models and elementary statistical mechanics are used to predict the behavior of molecules. Important issues addressed include the estimation of solvation and partitioning of molecules between phases or media, the calculation of free energy changes associated with cellular events and prediction of order/disorder phenomena.

CLSE 655 Nonequilibrium Analysis in Chemical and Life Science Engineering
Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 654 and the equivalent of the undergraduate courses CLSE 301 and 302 and MATH 301. An understanding of the spatial and temporal dynamics of biological systems is key to many cellular events including cell signaling processes, second messenger systems, positive and negative feedback control, transcription, translation, and many more. This course introduces nonequilibrium (dynamic) analysis as applied to biological and chemical systems.

CLSE 656 Advanced Chemical Reaction Engineering
Semester course; 3 lecture hours. 3 credits. Prerequisites: CLSE 312 or equivalent undergraduate course. This course considers the design of systems and processes for the manufacture of chemicals and pharmaceutical ingredients. This further addresses growing needs identified by industrial employers to have graduates with strong, detailed backgrounds in analysis and design of chemical reaction kinetics and mechanisms.
Example Elective Courses offered in the CLSE department

CLSE 560 Protein Engineering
Semester course; 3 lecture hours. 3 credits. This course focuses on the structure-function characterization of proteins and the quantification of protein-protein interactions for the design of novel protein and peptide therapeutics. Additional topics include biochemistry of proteins for engineers, large scale, batch production and manufacturing techniques for biologics.

CLSE 561 Stem Cell Engineering
Semester course; 3 lecture hours. 3 credits. The production and behavior of adult and embryonic stem cells are studied and potential applications for the treatment of disease are surveyed. The importance of the extracellular matrix in cell differentiation and proliferation is established. Stem cell engineering techniques including parthenogenesis, nuclear transfer stem cells and embryonic carcinoma cells are introduced. The use of stem and germ cells for cloning, stem cells and tissue rejection, and ethical considerations in the use of embryonic human stem cells are discussed.

CLSE 562 Advanced Systems Biology Engineering
Semester course; 3 lecture hours. 3 credits. The system-level properties of biology will be surveyed to understand how DNA leads to cellular behavior through complex molecular interactions. Theoretical and experimental concepts associated with high-throughput data (genomics, transcriptomics, metabolomics, fluxomics, proteomics), cellular regulation and computational modeling will be introduced. Bioinformatic analysis, integration of data and current challenges are discussed.

CLSE 563 Metabolic Engineering
Semester course; 3 lecture hours. 3 credits. The principles and methods used in metabolic engineering of microbes will be covered. Theoretical and experimental concepts associated with metabolite production, strain design, strain construction and strain characterization will be introduced. Design, metabolic engineering challenges, metabolic engineering applications and ethical considerations of genomic alterations are discussed.

CLSE 570 Molecular Physiology and Microanatomy for Chemical and Life Science Engineering
Semester course; 3 lecture and 2 laboratory hours. Understanding physiology from the molecular perspective of cellular biochemical mass action kinetics, molecular diffusion and transport, biomolecular separation processes, and dynamic biochemical control theory is key to the engineering and design strategies for medical intervention in disease and human health. This course explores these biomolecular dynamic events in human physiology with an emphasis on the application of the fundamental biochemical transport phenomena, kinetics and separation processes, and dynamic control theory.

CLSE 575 Nanotechnology in Life Science and Engineering
Semester course; 3 lecture hours, 3 credits, Nanobiotechnology is the application of nano- and micro-fabrication methods to build tools for exploring the world of biological systems. This upper-level undergraduate and graduate level course will introduce the
principles and practice of microfabrication techniques and perspectives in the field of nanobiotechnology. Lectures will cover interdisciplinary topics such as biomolecules at interfaces, biosensors, micro and nano-fabrication strategies, self-assembly, nanoparticles, micro- and nano-devices and microfluidics.

CLSE 660 Biomolecular and Computational Engineering
Semester course; 3 lecture hours. 3 credits. Dynamic analysis of interacting cellular events, including cell signal pathways, clock reactions, etc., often requires large-scale computational approaches. Furthermore, these techniques are necessarily time dependent requiring unique methodologies, such as multi-time scale methods. This course introduces the subject of real-time biomolecular simulations.

CLSE 675 Polymers in Medicine
Semester course; 3 lecture hours. 3 credits. This course is based on the need for integration of engineering and materials science of polymers with applications in life science engineering. Basic principles of polymer science including structural concepts at the molecular-, nano-, micro- and macro-scales are emphasized so that the student can understand structure/function correlation. The use of polymers in drug delivery applications is explored, including osmotic-pressure-driven drug delivery. Concepts surrounding polymeric surface modifiers are developed, including applications such as enhanced biodurability and biocidal function.

CLSE 690 Research Seminar in Chemical and Life Science Engineering
Semester course; 1 lecture hour. 1 credit. Presentations and discussions of current problems and developments in life science engineering by faculty and visiting lecturers.

CLSE 691 Special Topics in Chemical and Life Science Engineering
Semester course; 1-4 lecture hours. 1-4 credits. Prerequisites: At least one graduate-level engineering course and permission of the instructor. Lectures, tutorial studies, library assignments in selected areas of advanced study or specialized laboratory procedures not available in other course offerings or as part of research training.

CLSE 692 Independent Study in Chemical and Life Science Engineering
Semester course; 1-3 lecture and/or 0-4 laboratory hours. 1-5 credits. Prerequisites: graduate standing or permission of instructor. The student must submit a prospectus to the graduate committee for approval and identify a faculty member willing to supervise the course. Investigation of specialized engineering problems through literature search, mathematical analysis, computer simulation and/or experimentation. Written and oral reports, final report and examination required.

CLSE 697 Directed Research in Chemical and Life Science Engineering
Semester course; variable hours. 1-9 credits. Prerequisite: graduate standing or permission of instructor. Research directed toward completion of the requirements for the Ph.D. in engineering, with concentration in chemical and life science engineering, under the direction of an engineering faculty member and dissertation committee. Graded S/U/F.
Appendix C - Abbreviated CVs for Core Faculty in Chemical and Life Science Engineering

Dr. Stephen S. Fong, Ph.D., 2004, Bioengineering, University of California, San Diego, Associate Professor. Research specialization in metabolic engineering, computational metabolic modeling and biorefineries.

Dr. Ram B. Gupta, Ph.D., 1993, Chemical Engineering, University of Texas, Austin, Professor and Associate Dean for Research. Research specialization in supercritical carbon dioxide technology, hydrogen fuel, renewable fuels, batteries, bioenergy, nanoparticles and smart medicine.

Dr. B. Frank Gupton, Ph.D., Chemistry, Virginia Commonwealth University, Professor and Chair. Research specialization in cross-coupling catalysis, flow chemistry/continuous chemical processing, organic synthesis in pharmaceutical applications.

Dr. Nastassja A. Lewinski, Ph.D., 2011, Bioengineering, Rice University, Assistant Professor. Research specialization in biological effects of nanoparticles, advanced in vitro exposure systems, nanomedicine.

Dr. Mark A. McHugh, Ph.D., 1981, Chemical Engineering, University of Delaware, Emeritus Professor. Research specialization in high-pressure phase equilibria, polymer solution behavior at high pressures, scattering phenomena in polymer solutions, and supercritical fluid solvent technology.

Dr. Michael H. Peters, Ph.D., 1981, Chemical Engineering, Ohio State University, Professor. Research specialization in protein engineering, peptide biomimetics, protein misfolding, time force autocorrelation, and multiple time scale perturbation theory.

Dr. Thomas D. Roper Ph.D., 1992, Organic Chemistry, University of Virginia, Director of Pharmaceutical Engineering. Research specialization in metabolic engineering and biocatalysis, 3D printing of dose units, long acting therapy development, nanomaterials and particle sciences, Continuous chemical reaction engineering, Cost effective therapeutic treatments for the developing world.

Dr. Christina Tang, Ph.D., 2012, Chemical Engineering, North Carolina State University, Assistant Professor. Research specialization in multifunctional polymer nanomaterials, self-assembly of metal-polymer nanoparticles, rheology of polymers/biopolymers.

Dr. Xuejun Wen, Ph.D., 2003, Bioengineering, University of Utah, Salt Lake City, M.D., Medicine, 1994, Henan Medical University, Zhengzhou, China, William H. Goodwin Professor. Research specialization in biomaterials – natural, pure synthetic and hybrid, stem cell biology and engineering, cell/tissue engineering and regenerative medicine.

Dr. Kenneth J. Wynne, Ph.D., 1965, Inorganic Chemistry, University of Massachusetts, Commonwealth Professor. Research specialization in surface polymer science, kinetics of
nanoscale and mesoscale diffusion, antimicrobial and cytocompatible coatings.

Dr. Vamsi K. Yadavalli, Ph.D., 2004, Chemical Engineering, Pennsylvania State University, Associate Professor. Research specialization in functional biomaterials, nanoscale surface characterization, microfabricated biosensors.

Dr. Hu Yang, Ph.D., 2004, Chemical engineering, University of Akron, Qimonda Associate Professor. Research specialization in clickable polymers for drug delivery, brain cancer therapy, drug delivery for glaucoma.

Abbreviated CVs for Affiliate Faculty in Chemical and Life Science Engineering

Dr. Barbara D. Boyan, Ph.D., 1975, Comparative Biochemistry and Physiology, Rice University, Dean School of Engineering. Research specialization in cell and tissue engineering, mechanisms of action of hormones and growth factors in cartilage and bone, stem cell delivery technologies.

Dr. Everett Carpenter, Ph.D. 1999, Inorganic Chemistry, University of New Orleans, Professor. Research specialization in nanomagnetic materials, power generation, catalysis, renewable energy applications.

Dr. Russell D. Jamison, Ph.D., 1982, Materials Engineering Science, Virginia Tech, Alice T. and William H. Goodwin, Jr. Chair, Engineering Education; Professor, Biomedical Engineering and Chemical and Life Science Engineering; Dean Emeritus. Research specialization in bioregeneration, tissue engineering, innovation and entrepreneurship, K-12 STEM education.

Dr. Sandro Da Rocha, Ph.D., Chemical Engineering, University of Texas – Austin, Associate Professor. Research specialization in nanomedicine, non-invasive gene and drug delivery, biomaterials, cancer nanotechnology and aerosol formulations.

Dr. Gregory E. Triplett, Ph.D., Electrical and Computer Engineering, Georgia Tech, Professor. Research specialization in optoelectronics and photonics, electronic materials, Semiconductor manufacturing.
Appendix D - Research Interests for Core Faculty in Chemical and Life Science Engineering

Dr. Stephen S. Fong, Associate Professor

Jeffress Memorial Trust, “Genomic and transcriptomic analysis of an unculturable marine bacterial symbiont”, $100,000, 2013-2015, co-PI


Gates Foundation, “The Medicines for All Initiative: Tenofovir, TDF, TAF, and Darunavir”, 2015-2016, $150,000, co-PI

VCU Presidential Research Quest Fund, “A Greener Route to Blockbuster Statin Drugs”, 2015-2016, $50,000, co-PI

VCU Presidential Research Quest Fund, “D2-Tex Next Generation Smart Fabric for Detection and Detoxification of Chemical Warfare”, 2015-2016, $50,000, co-PI

Dr. Ram B. Gupta, Professor

Alabama Center for Paper and Bioresource Research & Education, “Conversion of bio-butanol to jet fuel”, $25,000, 2011-2012, PI

British Petroleum - Gulf of Mexico Research Initiative, “A smart dispersant formulation with reduced environmental impact and amount needed”, $180,000, 2011-2015, PI


The Sweet Living Group, “Testing of the ECO UV Ultraviolet Protection within the Textiles and Detergents”, $6,300, 2014-2014, PI

Dr. B. Frank Gupton, Professor and Department Chair

Bill & Melinda Gates Foundation (OPP1151406), Medicines for All: Dolutegravir, $4,900,000, 2016-17, PI

Defense Advanced Research Projects Agency, Make-It, $1,245,000 Co-PI

Bill & Melinda Gates Foundation (OPP1134441), Medicines for All Planning Grant, $875,000, 2015-16, PI

Virginia Biosciences Health Research Corporation, Three Wave Mixing Technique for Chiral Analysis in Continuous Process Manufacturing, $400,000, 2015-2017, Co-PI

Bill & Melinda Gates Foundation (OPP1128257), Medicines for All: Tenofovir, $4,999,542,
2015-16, PI
NSF, I/UCRC Center for Rational Catalyst Synthesis, $325,000, 2015-2020, Co-PI
Bill & Melinda Gates Foundation (OPP1108573), Medicines for All: Nevirapine, $4,390,944, 2014-15, PI
NSF, Collaborative Research Planning Grant, $11,500, 2014-15, Co-PI
Boehringer Ingelheim Pharmaceuticals, Inc., Development of Asymmetric Heterogeneous Hydrogenation Catalysts, $50,000, 2013-14, PI
Clinton Health Access Initiative, Development of Reaction Conditions for Conversion of Artemisinic Acid to Dihydroartemisinic Acid, $24,000, 2013-14, PI
Clinton Health Access Initiative, Third Generation Nevirapine Process, $62,500, 2012-13, PI

Dr. Nastassja A. Lewinski, Assistant Professor
Honeywell International Inc., "Nanotechnology-enabled thermal stabilization of nylon", $85,000, 2016-2017, PI
Commonwealth Center for Advanced Manufacturing, "Synthesis and characterization of gold nanoparticles", $90,000, 2016-2017, PI
Canon Virginia Inc., "Characterization of gold recovery process", $100,000, 2016-2017, co-PI
Commonwealth Center for Advanced Manufacturing, "Characterization of gold precursor solution", $5,000, 2016, PI

Dr. Mark A. McHugh, Emeritus Professor
Afton Chemical Corporation, "The use of star polymers and dendrimers as viscosity modifiers, dispersants, antioxidants, and detergents," $196,000, 4/15 - 4/17, co-PI
Afton Chemical Corporation, "The use of star polymers and dendrimers as viscosity modifiers, dispersants, antioxidants, and detergents," $465,000, 4/09 - 12/14, PI
Department of Energy (DOE), "Thermodynamic studies in support of geological and environmental processes at extreme conditions," $720,000, 3/10 - 11/14, PI
Department of Defense, ONR, "Novel acute rescue strategies using nonpulmonary oxygenation," $500,000, 11/10-11/14, PI

Dr. Thomas D. Roper, Professor
Defense Advanced Research Projects Agency, DARPA-BAA-15-39; Pharmacy on Demand; $800,000, 2016-2018, PI

Dr. Christina Tang, Assistant Professor
VCU Presidential Research Quest Fund, "D2-Tex Next Generation Smart Fabric for Detection
and Detoxification of Chemical Warfare”, $50,000, 2015-2017, PI
Canon Virginia Inc., “Characterization of Gold Recovery Processes”, $100,000, 2016, PI
Commonwealth Center for Advanced Manufacturing, “Synthesis and Characterization of Gold Nanoparticles”, $90,000, 2016, co-PI

Dr. Xuejun Wen, Professor, Alice T. and William H. Goodwin Jr. Endowed Chair
NIH/NINDS, 1R01NS093985, “Combination of HIPSCS and Bioengineering to Repair Injured Pediatric Brain”, $381,416, 2016-2021, co-I
NSF, CBET 1346387, “CAREER: A novel space-creation concept to enhance the survival and functionality of transplanted human stem cells”, $242,691, 2013-2014, PI

Dr. Kenneth J. Wynne, Commonwealth Professor
NSF, DMR 1608022, “Nanostructured surface modification for antimicrobial effectiveness and cytocompatibility”, $390,000, 2016-2019, PI
VCU Center for Clinical and Translational Research, “Toward eliminating catheter associated urinary tract infections (CAUTI)”, $50,000, 2016-2017, PI
SAFT Batteries, “Polymer hermeticity”, $82,000; 2013 – 2014, PI

Dr. Vamsi K. Yadavalli, Associate Professor
VCU Presidential Research Quest Fund: “Chemical Signatures of Environmental Pathogens for Microbial Forensics”, $50,000, 2015-2016, PI
National Science Foundation (CBET-1144611), “EAGER: Microfabricated non-linear fractal
architectures for propagation and differentiation of human neural progenitors”, $110,558, 2012 – 2015, PI

SAFT Batteries, “Polymer hermeticity”, $82,000; 2013 – 2014, co-PI

**Dr. Hu Yang, Associate Professor**


National Institutes of Health (R01EY024072), “Hybrid nanoparticles for glaucoma”, $1,293,612, 9/30/2014–6/30/2017, PI.


National Science Foundation, REU, supplement to CAREER Award CBET0954957, $22,813, 5/1/2012–7/31/2016 (NCE), PI.

National Science Foundation (CBET0954957), Faculty Early Career Development (CAREER) Award, “CAREER: Surface-engineering of monocytes for anticancer drug delivery”, $450,000, 8/1/2010–7/31/2016 (NCE), PI.

National Institutes of Health/National Center for Advancing Translational Sciences (CTSA Award UL1TR000058), CCTR Endoweeht Fund Multi-School Research Award, “Nanoparticle mediated delivery to increase CEH and regress atherosclerotic plagues”, $130,000, 7/1/2014–12/31/2015, Co-PI.

Massey Cancer Center, Multi-Investigator Award (2013-MIP-01), “Synthetically lethal TopoI-ATM inhibitor nanoparticles for glioma therapy”, $100,000, 10/1/2013–4/15/2015, PI.


Massey Cancer Center, Pilot Project Award, “Development ot vectors for targeted airway-mediated anti-cancer drug delivery”, $30,000, 7/1/2011–6/30/2012, PI.
Appendix E - Employment Demand
Engineer Scientist R&D III

Job Number 279
Colonial Heights, Virginia

Are you searching for a rewarding career with a great team of talented people who are leaders in their fields – from research, engineering and agronomy to information technology, supply chain and marketing? Do you believe in driving results in a friendly environment that is open to creative ideas and diverse perspectives?

If so, you’ve come to the right place: AdvanSix, a company that is built on a rich history of teamwork, innovation and customer focus, and that has a fun, entrepreneurial mindset. We are:

A leading manufacturer of nylon 6 resins and films, which are used to make products important to everyday life – from automotive parts, carpeting, and food packaging to wire and cable, building materials and sports apparel

Fully integrated into many important building blocks of chemistry, including caprolactam, ammonium sulfate fertilizer, and many other chemical intermediates used to make products that make our world go round

Respected by customers far and wide as trusted partner that can be counted on for quality products, sustainable solutions and reliable supply.

A career at AdvanSix means opportunity and possibility for people who seek variety, responsibility and hands-on experience in a friendly, dynamic workplace.

Role Responsibilities:

- Actively participates as a member of Technology team to develop new concepts for caprolactam, ammonium sulfate, Nylon resins, Chemical Intermediates and/or completely new processes.
- Engineering responsibilities include: Producing draft PFD’s and P&IDs for process concepts; producing heat and material balances for new processes; conducting laboratory or pilot plant experiments to develop data needed to properly size plant scale equipment; conducting laboratory experiments to develop all needed safety and reactivity data to allow the proper safe design of pilot plant and full scale equipment; leading process hazard analysis for pilot plant operations. Produce all needed technical information for the development of a full scale process in a Technology Package.
- Lead projects from small scale and batch reactors and be able to translate data to a continuous operation.
- Act as technical support for our resins pilot plant and batch reactor operations.
- Take lead in engineering responsibilities for designing, overseeing installation of laboratory and pilot plant instrumentation and equipment.
- Supervise experimental operations.
- Develop test and operational procedures for pilot plant and operations.
- Support existing manufacturing and customer applications world-wide.
- Develop and modernize analytical technology on small scale equipment to be implemented at our plants and at customer applications.
- Explore and implement advanced instrumentation to replace antiquated benchtop methods in all areas where possible. Train areas and operators on the new equipment, when installed, and be a technical expert for troubleshooting problems with the new analytical equipment.
- Improve knowledge through effective and consistent communication of learnings and failures.

Basic Qualifications:

- BS/MS or PhD in chemical engineering with 2-5 years experience in design, construction and operation of small scale Pilot Plants and product development.
Preferred Qualifications:

- Proven track record of successfully commercializing new technology from lab scale to manufacturing plant.
- Strong background in developing process engineering design scope for new processes.
- Requires experience with experimental design and statistical analysis.
- Strong background in analytical chemistry and proven track record in analytical improvements.
- Experience with spectroscopy, and group titration, DSC, and spectrometry.
- Experience with reactor engineering a plus.
- Six Sigma training a plus.
- Ability to plan and lead projects a plus.
- Modeling experience a plus.
- Familiarity with methods development a plus.
- Excellent communication and documentation skills.
- Bias for action and results oriented mindset.
- Technical competence - statistical, analytical, mechanical, chemical and computer skills.
- Ability to work both independently, and in team environments.
- Project Management a plus.

Advansix is an equal opportunity employer. Qualified applicants will be considered without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality, sex, religion, or veteran status.

Not ready to apply?
Save for Later (index.jsp?method=cappservicesOpportunity.save&opportunityID=279&layoutID=2092)

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Other Jobs at AdvanSix

Colonial Heights, VA

Colonial Heights, VA

Colonial Heights, VA

Process Technology Leader

Job Number 267
Colonial Heights, Virginia

Are you searching for a rewarding career with a great team of talented people who are leaders in their fields – from research, engineering and agronomy to information technology, supply chain and marketing? Do you believe in driving results in a friendly environment that is open to creative ideas and diverse perspectives?

If so, you’ve come to the right place: AdvanSix, a company that is built on a rich history of teamwork, innovation and customer focus, and that has a fun, entrepreneurial mindset. We are:

- A leading manufacturer of nylon 6 resins and films, which are used to make products important to everyday life – from automotive parts, carpeting, and food packaging to wire and cable, building materials and sports apparel.
- Fully integrated into many important building blocks of chemistry, including caprolactam, ammonium sulfate fertilizer, and many other chemical intermediates used to make products that make our world go round.
- Respected by customers far and wide as trusted partner that can be counted on for quality products, sustainable solutions and reliable supply.

A career at AdvanSix means opportunity and possibility for people who seek variety, responsibility and hands-on experience in a friendly, dynamic workplace.

POSITION OVERVIEW

As a key member of the A6 R&D Technology team, the Process Technology Leader will provide leadership and technical direction to support the technology and business/operations strategy. This includes the development of process and performance improvement ideas, right first time scale-up of new technology and shepherding the projects through A6 stage-gate portfolio management process. The Technology Leader will play a key role in integration and coordination of critical process technology resources in delivering targeted benefits and results to the A6 business contribution margin by working closely with members of the polyamide and small molecule chemistry groups, application technology, process engineering, production engineering, operations and commercial teams.

TARGETED OUTCOMES

- Develop and grow a capable process technology team who is able to deliver a pipeline of value generation projects.
- Coordinate development of the premise, business cases and execution plan (includes scale-up and pilot plant) for key growth and capacity improvement programs/projects.
- Lead the process technology growth and improvement programs to include execution of defined plans to deliver results.

KEY RESPONSIBILITIES

- Define process chemistry and unit operations for new processes for new and existing products.
- Develop process data for scale-up and plant design.
- Basic understanding of chemistry and chemical engineering.
- Scope, design and build small scale process equipment in labs and pilot plants.
- Process development and piloting of Chemical Intermediates, Ammonium Sulfate and Resins.
• Responsible for definition of technology (process technology data packages), including preliminary design creation
• Preliminary process modeling and simulation
• Pilot plant operations
• Interacts with polyamide chemistry, small molecule chemistry and applications technology groups
• Key R&D interface with Engineering & Operations
• Provides process support and advanced trouble shooting, including root cause analysis for existing and new products
• Knowledgeable in process economics
• HSE to ensure inherent safe designs
• Manage selection, transfer of definition of technology and process optimization at third party toll converters
• Maintain ownership of process technology projects portfolio from idea generations through validation stages in the Stage-Gate model to ensure that business decisions are being made in a timely manner
• Maintain and improve the technology development process in an opportunistic environment
• Lead, mentor and develop process technology team members
• Develop and implement a multi-year plan that builds high-quality laboratory and pilot plant capabilities which enable value pipeline generation
• Coordinate technical sessions to generate ideas to address longer-term business and operational needs
• IP creation and FTP input

ADDITIONAL QUALIFICATIONS
• Bachelor's degree in Chemistry or Chemical Engineering, MS or PhD in Chem Engineering preferred
• Ideal candidate has BS in Chemistry and MS or PhD in Chemical Engineering
• 10+ years of chemicals or petro-chemicals technology experience
• 5+ years of direct supervisory or technology project leadership experience
• Excellent written and verbal communication skills required
• Ability to lead and collaborate with cross-functional teams

REQUIRED SKILLS AND COMPETENCIES
• Assertive, results-oriented leader with the ability to collaborate across multi-disciplinary teams in a fast paced, results oriented matrix organization
• Ability to understand business financials and prioritize technology programs to drive business profitability
• Ability to gather competitive intelligence especially on competitor's production process and products
• Strategic thinker with strong problem solving skills
• Ability to integrate and influence across multiple functions within the organization to deliver results
• Demonstrated ability to effectively lead teams to deliver results via multiple complex technical programs
• Demonstrated product development experience with design for Six Sigma experience a plus

AdvonSix is an equal opportunity employer. Qualified applicants will be considered without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality, sex, religion, or veteran status.

Apply (index.jsp?method=cappPortal:showApplyToJob&job=267)
R&D Engineering Specialist - Solution Phase Polymerization

Location: US-VA-Richmond
Category: Research and Development

More information about this job:

Overview:
Responsible for providing new technology development, scale-up and product support for research programs serving Afton Chemical’s polymers businesses. Using laboratory units and fundamental polymerization reaction engineering models to guide product development and in addition to developing fundamentals for scale up from laboratory-scale apparatus to large, continuous pilot plants.

Responsibilities:
- Actively leads major Polymers R&D programs in a formal program leader role and participates in other programs to varying degrees in a mentor role.
- Couples commercial solution phase polymerization process knowledge with a fundamental knowledge of polymerization reaction engineering to guide scale-up of new polymers technologies (catalysts, process, or products).
- Helps translate the Polymers technology drivers to polymerization process technology opportunities and polymerization process technology opportunities to business opportunities.
- As a recognized expert in solution phase polymerization process technology, serves as a resource to other technologists and management.
- Interfaces with business units to develop technical targets and to ensure smooth technology handoff.
- Monitors developments in internal and external polymerization process technologies and related business opportunities and recommends new R&D initiatives/directions to management.
- Drives leveraging opportunities with external institutions.
- Takes action to ensure continuity and evolution of critical capabilities and infrastructure required to allow the organization to deliver advantaged polymerization process technologies.
- Acts as expert resource for troubleshooting and improvement of commercial polymerization processes.

Qualifications:
- Ph.D. in Chemical Engineering, or related field with a minimum of 5 years of relevant experience in Polymerization Process Research.
- Demonstrated expertise in the solution phase polyolefin manufacturing platform, although experience in other polyolefin manufacturing process platforms (i.e., dispersion or slurry) is also desirable.
- Proven track record (as evidenced by patents/applications or professional journal publications) of new polymerization catalyst or process technology development.
- Demonstrated ability to handle multiple priorities and stakeholders.
- Proficiency in the use of polymerization reaction engineering and kinetic models.
- Excellent administrative and organizational competencies.
- Excellent analytical and communication skills.

Preferred Knowledge/Skills/Abilities:
- Knowledge of laboratory and pilot-unit safety practices.
- Previous experience operating continuous polymerization lab and/or pilot units.
• Familiarity with the basics of catalyst chemistry for polyolefin manufacture (i.e., Ziegler-Natta and single-site organometallic).

• Familiarity with basic polyolefin analytical and characterization techniques.

• Proficient with simulation tools such as COMSOL, gPROMS, PRO/II, Aspen Engineering Suite

An Equal Employment Opportunity/Affirmative Action Employer. All qualified applicants will receive consideration for employment without regard to the individual’s race, color, sex, national origin, religion, age, disability, genetic information, status as a military veteran or any other characteristic protected by applicable law.

Options:

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Share on your newsfeed
R&D Scientist - Automatic Transmission Fluids

Location: US-VA-Richmond
Category: Research and Development

More information about this job:

Overview:
The objective of this role is to develop Automatic Transmission Fluid (ATF) formulations to meet the technical needs of key global Original Equipment Manufacturers (OEMs) as directed by manager.

Responsibilities:
- Technical lead and/or project lead for customer specific and OEM (Original Equipment Manufacturers) based formulations globally as directed
- Build relationships and be the primary technical interface for marketing, CTS, OEM relationship managers, and OEM TS for supported OEMs
- Build relationships and be the primary technical resource for formulation questions for supported OEMs
- Summarize technical data and make in depth technical presentations for internal and external audiences
- Provide strategic insight for OEM opportunities
- Visit customers/OEMs as needed

Qualifications:

EDUCATION & EXPERIENCE MINIMUMS:
- Ph.D. in Chemistry or Chemical Engineering, or equivalent combination of experience and education required
- 5+ years of formulation experience preferred
- Fluency in Japanese a plus, but not required

SKILLS/ABILITIES:
- Creative thinking and planning – Ability to identify additive approaches/formulations to meet customer needs.
- Decision Making: Ability to use structured processes and tools to make decisions
- Relationships: Ability to network, build, and nurture relationships within and across-SBU teams and external customers; ability to work well with others and to influence without authority
- Communication: Ability to communicate in timely and effective manner to wide variety of Afton and external customers. Writing of technical reports and presentations required. Able to explain the complex in understandable manner to technical and non-technical audiences.
- Organization: Use of Project Management, Stage Gate, and structured processes to consistently deliver results when working on complex and multiple programs.
- Positive attitude, independent worker, flexible, responsive, and pro-active
- Formulation experience is strongly desired
- Statistical background and use of DOE (design of experiments)
- Able to travel as required with up to 25% domestic and/or international travel at times

An Equal Employment Opportunity/Affirmative Action Employer. All qualified applicants will receive consideration for employment without regard to the individual's race, color, sex, national origin, religion, age, disability, genetic information, status as a military veteran or any other characteristic protected by applicable law.

Options:

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Chemical Engineer, GS-0893-11/12/13 Job Openings in Washington, DC - Department Of Homeland Security Recruitment 2017

USJobDesk.com - Today's work recruitment is very competing, which is why should you operate wisely and it's not just a challenging thing to do. USJobDesk.com will provide you with the opportunity to undertake it, therefore you can make the suitable conclusion with better strategy to obtain fast and greater end result. Like that you will definitely get better prospective client along with less dangerous live later on. Department Of Homeland Security is probably the companies that one could confidence to give family and friends ideal as well as much better stay in the future. Becoming a member of this business will make a person competent to attain your current target much easier as well as produce the desire become a.

To help make the organization imaginative and prescient vision along with objective arrives correct; Department Of Homeland Security will be wide open for fresh place seeing that Chemical Engineer, GS-0893-11/12/13 within Washington, DC begin as April 2017. All people who's enthusiastic about filling up that nonincome producing, you should attend this kind of Chemical Engineer, GS-0893-11/12/13 April 2017 recruitment with Washington, DC. It can be encouraged for all those players to prepare most necessary specifications because of this work recruitment treatment, for the reason that method will be needing you to provide suitable specs that this corporation needs due to this situation. If you are you are this may load the actual standards, you can test to see more info about Chemical Engineer, GS-0893-11/12/13 April 2017 in Washington, DC below.

1. Current Job Openings
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About the Agency

Apply for this exciting position to support the CG missions of safeguarding our Nation’s maritime interests in the heartland, in the ports, at sea, and around the globe.

For over two centuries the The U.S. Coast Guard has protected the maritime economy and the environment, we
defend our maritime borders, and we save those in peril. This history has forged our character and purpose as America’s Maritime Guardian - Always Ready for all hazards and all threats.

This position is located in the Department of Homeland Security, U.S. Coast Guard, Deputy Commandant for Operations, Assistant Commandant for Prevention Policy, Director Commercial Regulations & Standards, Office of Design & Engineering Standards, Hazardous Materials Division, in Washington, DC.

Duties The incumbent will serve as a chemical engineer in the Hazardous Materials Division responsible for administering standards for the marine transportation of hazardous materials on commercial vessels. Being a Coast Guard civilian makes you a valuable member of the Coast Guard team. Typical work assignments include:

1. Evaluating and interpreting legislation for its effect on transportation of packaged and bulk hazardous material by water.
2. Providing policy and procedural consultation, advice, and guidance on complex scientific, regulatory, and compliance issues in a chemical engineering area of expertise to government entities, academia, the media, industry representatives, and within the organization.
3. Reviewing scientific reports, such as chemical process or product submissions and laboratory analyses.
4. Reviewing accident reports involving hazardous materials, analyzing the causes of the accidents, analyzing the costs and benefits of designs, practices, or procedures.
5. Researching and preparing final background and decision papers for the signature of the agency director, including organizing, analyzing and summarizing relevant reports and publications.
6. Attending and participating in symposia, conventions, public hearings, and meetings related to hazardous materials transportation safety.

Duties performed at the GS-12 and GS-11 may require more supervision than the full performance level (GS-13).

Travel Required

- Occasional Travel
- This position requires occasional travel.

Relocation Authorized

- Yes
- PCS expenses will be authorized.

Job Requirements Key Requirements

- U.S. Citizenship is required.

Qualifications Basic Requirements:

Degree: professional engineering. To be acceptable, the curriculum must: (1) be in a school of engineering with at least one curriculum accredited by the Accreditation Board for Engineering and Technology (ABET) as a professional engineering curriculum; or (2) include differential and integral calculus and courses (more advanced than first-year physics and chemistry) in five of the following seven areas of engineering science or physics: (a) statics, dynamics, (b) strength of materials (stress-strain relationships); (c) fluid mechanics, hydraulics; (d) thermodynamics; (e) electrical fields and circuits; (f) nature and properties of materials (relating particle and aggregate structure to properties); and (g) any other comparable area of fundamental engineering science or physics, such as optics, heat transfer, soil mechanics, or electronics.

OR

Combination of education and experience — college-level education, training, and/or technical experience that furnished (1) a thorough knowledge of the physical and mathematical sciences underlying professional
engineering, and (2) a good understanding, both theoretical and practical, of the engineering sciences and techniques and their applications to one of the branches of engineering. The adequacy of such background must be demonstrated by one of the following:

- **Professional registration** — Current registration as a professional engineer by any State, the District of Columbia, Guam, or Puerto Rico. Absent other means of qualifying under this standard, those applicants who achieved such registration by means other than **written test** (e.g., State grandfather or eminence provisions) are eligible only for positions that are within or closely related to the specialty field of their registration. For example, an applicant who attains registration through a State Board’s eminence provision as a manufacturing engineer typically would be rated eligible only for manufacturing engineering positions.

- **Written Test** — Evidence of having successfully passed the Engineer in Training (EIT) examination, or the written test required for professional registration, which is administered by the Boards of Engineering Examiners in the various States, the District of Columbia, Guam, and Puerto Rico.

Applicants who have passed the EIT examination and have completed all the requirements for either (a) a bachelor’s degree in engineering technology (BET) from an accredited college of university that included 60 semester hours of courses in the physical, mathematical, and engineering sciences, or (b) a BET from a program accredited by the Accreditation Board for Engineering and Technology (ABET) may be rated eligible for certain engineering positions at GS-5. **Eligibility** is limited to positions that are within or closely related to the specialty field of the engineering technology program. Applicants for positions that involve highly technical research, development, or similar functions requiring an advanced level of competence in basic science must meet the basic requirements in paragraph A.

**Remarks:** The diversity in kind and quality of BET programs, graduates of other BET programs are required to complete at least 1 year of additional education or highly technical work experience of such nature as to provide reasonable assurance of the possession of the knowledge, skills, and abilities required for professional engineering competence. The adequacy of this background must be demonstrated by passing the EIT examination.

- **Specified academic courses** — Successful completion of at least 60 semester hours of courses in the physical, mathematical, and engineering sciences and in engineering that included the courses specified in the basic requirements. The courses must be fully acceptable toward meeting the requirements of a professional engineering curriculum as described in paragraph A.

- **Related curriculum** — Successful completion of a curriculum leading to a bachelor’s degree in engineering technology in an appropriate professional field, e.g., physics, chemistry, architecture, computer science, mathematics, hydrology, or geology, may be accepted in lieu of a degree in engineering, provided the applicant has had at least 1 year of professional engineering experience acquired under professional engineering supervision and guidance. Ordinarily there should be either an established plan of intensive training to develop professional engineering competence, or several years of prior professional engineering-type experience, e.g., in interdisciplinary positions. (The above examples of related curricula are not all-inclusive.)

Note: An applicant who meets the basic requirements as specified in A or B above may qualify for positions in any branch of engineering unless selective factors indicate otherwise, or unless he/she qualifies under the provisions of B.2 related to the EIT examination or BET degree.

**AND SPECIALIZED EXPERIENCE:**

**GS-11 level:** Applicants must have one year of specialized experience equivalent to the GS-9 level in the federal service; OR, 3 years of progressively higher level graduate education leading to a Ph.D. degree, or Ph.D. or equivalent doctoral degree; OR, A combination of education and experience to meet the total qualification requirements. Forty hours of work per week in the specialized field for 12 months is equivalent to 1 year of full-time experience, and, generally, 18 graduate semester hours is equivalent to 1 full-time year of graduate study. The
applicant's percentage of specialized work experience (ex. 6 months equals 50%) and the percentage of graduate study (ex. 45 graduate hours for a GS-11 equals 50% where 18 graduate hours constitute a full-time year) must total at least 100%.

GS-12 level: Applicants must have one year of specialized experience equivalent to the GS-11 level in the federal service.

Specialized experience for the GS-11 and GS-12 levels includes serving as a technical advisor or consulting engineer to incorporate current safety technologies and regulatory requirements into the design, construction, and operation of deepwater port facilities; analyzing information to formulate chemical engineering recommendations; writing reports on consumer, scientific, and regulatory issues related to chemical engineering; and identifying hazardous materials transportation research needs to develop research proposals.

GS-13 level: Applicants must have one year of specialized experience equivalent to the GS-12 level in the federal service. Specialized experience includes serving as a technical advisor or consulting engineer to incorporate current safety technologies and regulatory requirements into the design, construction, and operation of deepwater port facilities; evaluating analysis and development studies to recommend support for organization programs; analyzing information to formulate chemical engineering recommendations; writing reports on consumer, scientific, and regulatory issues related to chemical engineering; and identifying hazardous materials transportation research needs to develop research proposals.

Specialized experience is experience that has equipped you with the particular ability, skill, and knowledge to successfully perform the duties of this position and is typically in or related to this line of work.

National Service Experience (i.e., volunteer experience): Experience refers to paid and unpaid experience, including volunteer work done through National Service programs (e.g., Peace Corps, AmeriCorps) and other organizations (e.g., professional; philanthropic; religious; spiritual; community; student; social). Volunteer work helps build critical competencies, knowledge, and skills and can provide valuable training and experience that translates directly to paid employment. You will receive credit for all qualifying experience, including volunteer experience.

This position does have a positive education requirement. If you are including education on your resume, report only attendance and/or degrees from schools accredited by accrediting institutions recognized by the U.S. Department of Education. See Required Documents section for details.

FOREIGN EDUCATION: Education completed in foreign colleges or universities may be used to meet Federal qualification requirements if you can show that your foreign education is comparable to education received in accredited educational institutions in the United States. It is your responsibility to provide such evidence with your application. See Recognition of Foreign Qualifications click here.

All qualification requirements must be met by the closing date of the announcement. This includes Time-In-Grade requirements for current status employees applying through merit promotion procedures. Status applicants applying for a promotion must have 52 weeks of service at the next lower grade.

Security Clearance: Q, Non-sensitive

Additional Information

As one of the leading company in USA, Department Of Homeland Security opens a variety of opportunities for employees to grow and make them as future leaders of the professional and disciplined. Department Of Homeland Security also offers a dynamic work environment in order to encourage employees to contribute optimally, and at the same time is able to learn new skills and knowledge through the company program.

If you are interested and qualified to follow the job recruitment, you have to prepare yourself and send your application letter immediately. Only candidates who meet the criteria for Chemical Engineer, GS-0893-11/12/13 in Washington, DC, Washington, DC who will be called to attend interview. If you still do not satisfy with our job recruitment information above, you can try to read other job recruitment information that we provide in our website.
which still located in Washington, DC region from any other company. You can also try to find other job recruitment information for Chemical Engineer, GS-0693-11/12/13 at Washington, DC below.

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9 days ago - Child and Family Services Agency / Washington

Executive Assistant and 'Happiness' Manager
You treat people kindly and enjoy helping others, but also want to learn and grow yourself. This is a great opportunity for a detail-oriented, self-starter to...
14 days ago - Interactive Strategies / Washington
Public Affairs and Administrative Assistant (#16100)
Acts as the point of contact between the office and internal/external clients, including receiving calls, taking messages, routing correspondence and welcoming...
2 days ago - Québec Government Office in New York / Washington

Research Intern – Health Policy Center
Collect state and/or county-level information on Medicaid policies, Marketplace premiums, and other health system characteristics....
16 hours ago - The Urban Institute / Washington
12-Apr-2017
Corrosion and Coatings Engineer 3
NN SHIPBUILDING (0265)
Newport News-Virginia-United States
17337BR

External Job Description
Analyzes, researches, designs and develops materials and their related fabrication and application processes to develop and optimize materials for use in engineering design of and/or application in structures, systems and subsystems. Applies principles of chemistry, physics, and material behavior to develop metallic, non-metallic and composite material and processing specifications, fabrication and assembly processes. Develops, analyzes and applies material properties and design allowables, processing processes and quality engineering specifications. Material analyses may include failure analysis of components, systems and subsystems, life predictions, and definition and requirement specifications. May review and approve subcontractor material processing procedures.

Department/Cost Center
E33: Coating Tech&Mat Eng

US Citizenship Required for this Position
Yes

Relocation Assistance
Relocation assistance will be available

Clearance Type
Secret

Minimum Education
Bachelor's Degree

Shift
1st

Schedule
Full-time

Travel
Yes, 25% of the time

Basic Qualifications
5 Years with an ABET accredited Bachelors in Science; 3 Years with an ABET accredited Masters; 0 Years with PhD.

Preferred Qualifications
This position will directly support surface preparation, application, coating, and corrosion control methods on Aircraft Carriers and Submarines and within manufacturing shops and/or facilities.
The candidate will understand and relate material specifications and process specifications via technical design products for trade execution. In-depth understanding of Navy paint systems, primers, topcoats and coatings processes is essential. The candidate will participate in coating application process improvement initiatives. Position requires developing scope of work documents and defining requirements using system engineering principles. The candidate will ensure document instruction compliance to process specification requirements. In the course of these duties, the candidate must be able to communicate effectively to interface with designers, engineers, suppliers, vendors, trades, and all levels of management and government representatives. The candidate should be able to apply problem solving analytical skills to the resolution of complex engineering problems. Assigned duties may including the participation in discrepancy and corrective action resolution, lessons learned activities, and have the ability to make persuasive technical arguments. Should possess broad knowledge of military and industry specifications and be familiar with IR&D program activities.

Company Statement

Huntington Ingalls Industries is America’s largest military shipbuilding company and a provider of professional services to partners in government and industry. For more than a century, HII’s Newport News and Ingalls shipbuilding divisions in Virginia and Mississippi have built more ships in more ship classes than any other U.S. naval shipbuilder. HII’s Technical Solutions division provides a wide range of professional services through its Fleet Support, Integrated Missions Solutions, Nuclear and Environmental, and Oil and Gas groups. Headquartered in Newport News, Virginia, HII employs nearly 37,000 people operating both domestically and internationally.

EEO Statement

Product Developer at George Andrew Group LLC
Roanoke, VA

About the Job

Manufacturer of high performance composite materials seeks a Product Developer to join their Technology team. Located near Roanoke, this company develops and produces fiber reinforced thermoplastic materials that are sold into a variety of markets. A skilled Product Developer is needed to lead development programs that introduce new products, as well as improve performance of existing products. If you are interested in working with a top-flight organization, I invite you to contact me for a confidential conversation.

As Product Developer, you will lead multiple programs to identify and develop innovative products for future commercialization. You will collaborate with the company Commercial and Marketing teams to develop niche products that meet specific customer needs. You will enhance the existing product line to improve various performance parameters. Typical duties/responsibilities will include:

- Identify and develop new product technologies to add to the company product "pipeline."
- Manage new programs, pressing toward commercialization while honoring highest quality and performance standards.
- Identify new raw materials and processes to enhance performance of products.
- Collaborate with internal departments to develop new products with strong commercialization potential.
- Collaborate with external customers to identify and implement improvements to existing products to meet specific application needs; to address on-going program issues; and to ensure successful transition into the commercial arena.
- Guide the work of Lab Technicians if assigned.
- Properly manage program budgets.
- Develop and deliver presentations to both internal and external audiences.

This position reports to the Technology Director.

This is a career track position.

The position offers a competitive salary commensurate with experience, a comprehensive benefits package, and relocation assistance.

To be considered for this position, you must meet the following requirements:
- Ph.D. Degree in Material Science Engineering, Polymer Engineering, Chemical Engineering is preferred. M.S. degree with appropriate experience will be considered.
- Experience in the development of fiber reinforced composite materials in a manufacturing setting is preferred. Materials development experience in an academic setting in conjunction with industrial partners/customers will be considered.
- Ability to conduct rigorous development projects using accepted scientific methods (e.g., statistical DOE), taking the projects from concept through to manufacturing scale-up.
- Six Sigma training/certification is a strong preference.
- Ability to identify and pursue new product opportunities.
- Ability to interface effectively with external customers in the development of product improvement ideas and programs.
- Ability to work collaboratively and effectively with peer Developers and other company department personnel.
- Ability to work effectively on multiple programs, sometimes as a team member, sometimes as team lead.
- Ability to travel periodically to customer sites (domestic).
- Excellent written and verbal communication skills.
- Energetic, driven, "self-starter" personality with a passion for the work.
- Personal integrity.

Please send your Word formatted resume to flohankenhofer@georgeandrewgroup.com. All materials are handled in confidence.

Key words: Chemical Engineer; Materials Science Engineer; composite materials; thermosets; lamination; compression molding; materials development.

Job summary

Apply
Employment Opportunities

Position: Assistant/Associate Professor
Department: School of Engineering and Technology

Date Posted: 02/21/2017
Closing Date: Open Until filed

Description

The Hampton University School of Engineering and Technology invites nominations and applications for highly qualified candidates for a full time nine (9) month tenure track position in the area of chemical engineering. Please note that tenure-track positions are offered at the discretion of the University conditional upon expertise, credentials, and qualifications of the successful candidate(s). The anticipated start is August 21, 2017.

Founded in 1868, Hampton University is a leading historically black university (HBCU) located on the Virginia Peninsula in the City of Hampton. It is a privately endowed, co-educational, non-sectarian institution of higher learning with accreditation by the Southern Association of Colleges and Schools, and the State Council of Higher Education of Virginia. The School of Engineering and Technology includes the Department of Engineering, Department of Architecture, and Department of Aviation. The programs are ABET, NAAB, and AABI accredited.

The Department of Engineering offers BS degrees in chemical, computer, and electrical engineering and has a long history of funded research in areas including energy, materials, nanotechnology, biomedical and health applications, controls, manufacturing, reverse engineering, environmental monitoring, transportation, computer networking, and engineering education. Projects have included collaborations with colleagues within the School of Engineering and Technology, other Schools on campus (notably the School of Science and School of Business), and with colleagues at other academic institutions, in industry, and at federal agencies.

Duties and Responsibilities

The successful candidate is expected to develop and lead independent research programs of international prominence and teach a full load of undergraduate courses in the chemical engineering and the fundamentals of engineering curricula. Faculty will collaborate on various research initiatives (including some of an interdepartmental nature).

Requirements

Applicants must have a PhD in Chemical Engineering and have a demonstrated record of excellence in teaching, leadership and research. The successful candidates' expertise is expected to complement existing departmental strengths in catalysis, energy, fluid-particle systems and nanomaterials.

Qualifications

Preference will be given to candidates who can demonstrate previous teaching experience at the university level.

The successful candidate(s) will possess the following skills and abilities:

- High level of energy and initiative,
- Excellent organizational and interpersonal skills,
- Written record of securing external funding, and
- Proven ability to handle multiple priorities while maintaining a high level of professionalism and attention to detail.

How to Apply

Review of applications will begin immediately and will continue until the position is filled. Salary is commensurate with rank/experience. Interested candidates should submit a letter of interest, curriculum vitae, personal contact information, and a list of three professional references (names and addresses) electronically to joyce.shirazi@hamptonu.edu, or to the following address via US mail:

Joyce Shirazi, DSc, PE
Dean, School of Engineering and Technology
Hampton University
Hampton, VA 23668
Hampton University is an Affirmative Action/Equal Opportunity Employer.

Return to Employment Opportunities List

Forms

- Application for Faculty Employment
- Supplemental Application Questionnaire
- Voluntary Self-Identification of Disability
This posting cannot receive an online application from your Diverse Jobs account. To apply, follow the employer's instructions within their job description.

Virginia Tech
Location: Blacksburg, VA 24061
Job Type: Full-Time
Job Schedule: Full-Time

Assistant/Associate Professor Biopolymer Materials

Virginia Tech is a public land-grant university, committed to teaching and learning, research, and outreach to the Commonwealth of Virginia, the nation, and the world. Building on its motto of Ut Prosim (that I may serve), Virginia Tech is dedicated to InclusiveVT-serving in the spirit of community, diversity, and excellence. We seek candidates who adopt and practice the Principles of Community, which are fundamental to our on-going efforts to increase access and inclusion, and to create a community that nurtures learning and growth for all of its members. Virginia Tech actively seeks a broad spectrum of candidates to join our community in preparing leaders for the world.

Position Summary:
The Department of Sustainable Biomaterials at Virginia Tech is seeking applications for the position of assistant/associate professor in the area of biopolymer materials. Virginia Tech has strong academic programs in biomaterials science, polymers, materials science, biology, and materials science and engineering. The tenure-track position will be at the Assistant/Associate Professor level and will be an academic year (9 month) appointment. The position will be split approximately 50% fundamental or applied research and 50% teaching. The successful candidate is expected to develop an internationally recognized research program in biomaterials from renewable resources, with major focus on biopolymers. Annual teaching responsibilities will include a minimum of one undergraduate course and one graduate course in the related areas of expertise. The successful candidate will be encouraged to develop new courses in their area of expertise. There will be teaching and research opportunities in collaboration with the Macromolecules Innovation Institute at Virginia Tech. The position provides excellent opportunities to develop a strong interdisciplinary program with other researchers in the department and on the Virginia Tech campus in fields including polyaccharide chemistry, wood composites and adhesives, polymer science, materials science, biology, and macromolecular science and engineering. Cooperation and collaboration within the department, across our campus, and with colleagues at other institutions is expected, thus strong collaborative skills are required. The successful candidate will be expected to obtain extramural funding, publish in refereed journals, participate in meetings of professional societies, serve as chairperson for graduate students, and serve on graduate committees.

Required Qualifications:
Candidates must have a Ph.D. in chemistry, polymer science, wood science, chemical engineering, biomaterials, materials science engineering, macromolecular science and engineering, or closely allied fields, with demonstrated experience in biomaterial science. The successful candidate must be able to communicate effectively with people at all levels in university, industry, and government sectors.

Preferred Qualifications:

To apply please click here.

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Multi Rank Instructional Faculty Position

Virginia Tech, founded in 1872 as a land-grant institution, is currently ranked as a Top 25 Public University by US News & World Report and a Top 25 Public Research University by the National Science Foundation. Through a combination of its three missions of learning, discovery, and engagement, Virginia Tech continually strives to accomplish the charge of its motto: Ut Prosim (That I May Serve). As the Commonwealth's most comprehensive university and its leading research institution, Virginia Tech serves a diverse population of 30,000+ students and 8000+ faculty and staff from over 100 countries, and is engaged in research around the world. Invent the Future at Virginia Tech.

Position Summary:
Primary Responsibilities Include:
-Teaching undergraduate and graduate coursework in chemical engineering
-Establishment and/or continued development of an internationally recognized research program in chemical engineering

Please see http://www.che.vt.edu for a complete description of position responsibilities and the department.

Required Qualifications:
-Doctoral degree in chemical engineering or a closely related field
-Record of scholarship/research and record of external funding for research for appointment at the associate professor level
-Effective communication skills
-Candidates with interests in materials, energy, water and sustainability
-Experience in or promise for supervising graduate student research and theses
-Interest and/or experience in mentoring students, both undergraduate or graduate, in research activities

Preferred Qualifications:
-Interest and experience working effectively with a diverse student population
-Ability and willingness to work collaboratively with faculty from a variety of disciplines
-Commitment to excellence in teaching and scholarship

To apply, please click here!
Postdoctoral Associate

Virginia Tech is a public land-grant university, committed to teaching and learning, research, and outreach to the Commonwealth of Virginia, the nation, and the world. Building on its motto of Ut Prosim (that I may serve), Virginia Tech is dedicated to InclusiveVT-serving in the spirit of community, diversity, and excellence. We seek candidates who adopt and practice the Principles of Community, which are fundamental to our on-going efforts to increase access and inclusion, and to create a community that nurtures learning and growth for all of its members. Virginia Tech actively seeks a broad spectrum of candidates to join our community in preparing leaders for the world.

Position Summary:
The Computational Catalysis Lab led by Prof. Hongjiang Xin at Virginia Tech (http://www.xingroup.org) has an opening for a post-doctoral associate position. The post-doctoral associate will use density functional theory calculations to investigate the activation of small alkane molecules on single site catalysts including metal-organic frameworks and supported single-atom catalysts.

Required Qualifications:
Applicants are expected to have a PhD in chemistry, physics, chemical engineering, materials science, or a related discipline, a strong background in electronic structure theory, experience in using a variety of quantum mechanical computational packages, including Quantum Espresso, VASP, or CP2K. The candidates should demonstrate competence in computational heterogeneous catalysis and have excellent communication skills including the ability to write peer-reviewed journal articles and give oral presentations at national scientific conferences.

Preferred Qualifications:

To apply please click here!

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**MATERIALS, COMPUTER, ELECTRONICS, AEROSPACE, OR CHEMICAL ENGINEER**

**Naval Education and Training Command**

1 vacancy in the following locations:

- Camp Pendleton, CA
- China Lake, CA
- Corona, CA
- El Centro, CA
- Fallbrook, CA

**Additional Locations are listed below.**

Work Schedule is Full Time - Permanent

Opened Monday 11/14/2016
Closes Monday 11/13/2017

**Salary Range**

$51,011.00 to $96,004.00 / Per Year
Job Overview

Summary

The Navy and Marine Corps team offers innovative, exciting and meaningful work linking military and civilian talents to achieve our mission and safeguard our freedoms. Department of the Navy provides competitive salaries, comprehensive benefits, and extensive professional development and training. From pipefitters to accountants, scientists to engineers, doctors to nurses—the careers and opportunities to make a difference are endless. Civilian careers—where purpose and patriotism unite!

The selectee for this position serves as a MATERIALS, COMPUTER, ELECTRONICS, AEROSPACE, OR CHEMICAL Engineer.

THIS IS AN EXPEDITED HIRING AUTHORITY ANNOUNCEMENT. The Duncan Hunter National Defense Authorization Act (NDAA) FY 2009 provides that the Secretary of Defense can designate acquisition positions as shortage positions and recruit and appoint highly qualified persons to these positions. This announcement is open to accept resumes from candidates interested in helping the Department of the Navy meet our mission requirements for the acquisition of systems, equipment and facilities.

This is a public notice announcement; under this recruitment procedure, each location/installation, identified in this public notice will make selections for vacancies as they occur. There may or may not be actual/projected vacancies at the time you submit your application. Please read this Public Notice in its entirety prior to submitting your application for consideration. These positions are being filled under Expedited Hiring Authority (EHA) for acquisition positions located at Department of Navy installations identified in this public notice. Positions may be filled as permanent with a full-time work schedule. Pay will vary by geographic location.

NOTE: Notices of Results (NORs) will not be sent to applicants who apply to this announcement.

**Please DO NOT contact this office regarding status of application. Pay will vary by geographic location.**

Duties

-Determines and advises on a material's essential composition, atomic and molecular configuration, and processing.
-Provides advice on the design, construction, and operation of computer systems, including hardware and software and their
integration.
- Provides advice on electronic circuits, circuit elements, equipment, systems, and associated phenomena concerned with electromagnetic or acoustical wave energy or electrical information for purposes such as communication, computation, sensing, control, measurement, and navigation.
- Creates, develops, tests, launches, operates, maintains, remodels, and decommissions aeronautical vehicles and structures.
- Analyzes chemical processes utilized by industries and scientific technologies to produce useful products and systems.

Travel Required
- Occasional Travel
- Travel depends upon position description and availability of funding.

Relocation Authorized
- No

Job Requirements

Key Requirements

- You must be a US Citizen.
- Males must be registered or exempt from Selective Service. www.sss.gov
- Selectee must be determined suitable for federal employment.
- Selectee may be required to successfully complete a probationary period.
- Selectee is required to participate in the direct deposit pay program.
- See Other Information section for additional requirements.

Qualifications

In order to qualify for this position, your resume must provide sufficient experience and/or education, knowledge, skills, and abilities, to perform the duties of the specific position for which you are being considered. Your resume is the key means we have for evaluating your skills, knowledge, and abilities, as they relate to this position. Therefore, we encourage you to be clear and specific when describing your experience.

BASIC REQUIREMENTS FOR ENGINEERING SERIES: Applicants must meet one of the following basic requirements from the Office of Personnel Management (OPM) Qualifications Standards found here:

MINIMUM QUALIFICATION REQUIREMENTS FOR GS-11: Your resume must demonstrate at least one year of specialized experience at or equivalent to the GS-09 grade level or pay band in the Federal service or equivalent experience in the private or public sector OR possess a Ph.D. or equivalent doctoral degree; OR 3 full years of progressively higher level graduate education leading to such a degree. Such education must demonstrate the knowledge, skills, and abilities necessary to do the work OR have a combination of experience and education as described which, when combined, is equivalent to 100% of the qualification requirement. Specialized experience must demonstrate the following:

1) Applying knowledge of materials, computer, electronics, aerospace, or chemical engineering to research, interpret, and carry out materials, computer, electronics, aerospace, or chemical engineering assignments; 2) Carrying out, interpreting, and explaining basic engineering computations and calculations; 3) Reading, manipulating, analyzing, interpreting, and conveying engineering findings. NOTE: This information must be supported in your resume to be considered for the position.

MINIMUM QUALIFICATION REQUIREMENTS FOR GS-12: Your resume must demonstrate at least one year of specialized experience at or equivalent to the GS-11 grade level or pay band in the Federal service or equivalent experience in the private or public sector. Specialized experience must demonstrate the following:

1) Applying knowledge of materials, computer, electronics, aerospace, or chemical engineering to provide guidance on the planning, design, construction, testing, or maintenance of engineering projects; 2) Collecting and analyzing engineering data to solve problems, develop reports, and provide recommendations; 3) Preparing, providing, and evaluating conventional engineering plans, designs, design specifications, and related documentation. NOTE: This information must be supported in your resume for you to be considered for this position.
MINIMUM QUALIFICATION REQUIREMENTS FOR GS-13: Your resume must demonstrate at least one year of specialized experience at or equivalent to the GS-12 grade level or pay band in the Federal service or equivalent experience in the private or public sector. Specialized experience must demonstrate the following: 1) Applying knowledge of materials, computer, electronics, aerospace, or chemical engineering to oversee, research, interpret, and carry out engineering assignments; 2) providing technical leadership on the planning, design, construction, testing, or maintenance of engineering projects; and 3) leading teams to resolve materials, computer, electronics, aerospace, or chemical engineering problems. NOTE: This information must be supported in your resume for you to be considered for this position.

Additional qualification information can be found from the following Office of Personnel Management website: https://www.opm.gov/policy-data-oversight/classification-qualifications/general-schedule-qualification-standards/#url=GS-PROF

You will receive credit for all qualifying experience, including volunteer and part-time experience. You must clearly identify the duties and responsibilities in each position held and the total number of hours per week.

Experience refers to paid and unpaid experience, including volunteer work done through National Service programs (e.g., professional, philanthropic, religious, spiritual, community, student, social). Volunteer work helps build critical competencies, knowledge, and skills and can provide valuable training and experience that translates directly to paid employment.

DEFENSE ACQUISITION WORKFORCE IMPROVEMENT ACT (DAWIA): This position is covered under the Defense Acquisition Workforce Improvement Act (DAWIA) and requires additional education, training and experience. This position has been identified as a Career Field Facilities Engineering at Level 2 or 3. If you possess DAWIA Certification, please indicate your Certification Level and Career Field information in your resume. Applicants not certified may still apply and be selected, but must achieve certification within 24 months of appointment. Certification requirements may be viewed at http://icatalog.dau.mil/onlinelocatalog/Careervl.aspx.

As part of the application process, you must complete and submit an occupational questionnaire. To preview this questionnaire and determine if your experience matches the required skills for this position, click the following link: View Assessment Questions

Please follow all instructions carefully. Errors or omissions may affect your rating and/or appointment eligibility.

For positions requiring positive education requirements, or if you are using education to meet all or part of the qualification requirements, you must submit a copy of your transcripts or an itemized list of college courses which includes equivalent information from the transcript (course title, semester/quarter hours, and grade/degree earned) in your resume. See OPM's General Policies for information on crediting education. Education completed in foreign colleges or universities may be used to meet the qualification requirements if the applicant can provide documentation indicating that the foreign education is comparable to that received in an accredited educational institution in the United States. It is the responsibility of the applicant to provide such evidence when applying for further information, visit: http://www.ed.gov/about/offices/list/ous/international/usnei/us/edlite-visitus-forrecog.html

Degree audit is not acceptable.

-A secret security clearance is a requirement of this position. Failure to obtain and maintain the required level of clearance may result in the withdrawal of a position offer or removal. If you possess a security clearance, please indicate the level and termination date in your resume.

-Occasional travel may be required.

Security Clearance
Secret

Additional Information

Additional Information

What To Expect Next

When the application process is complete, your application will be reviewed to determine if you meet the hiring eligibility and qualification requirements for which you requested consideration. You will be rated based on the information provided in your resume and responses to the questionnaire, along with your supporting documentation to determine your level of knowledge, skill, and ability, related to the job requirements.

Best qualified applicants will be referred to the hiring manager. The selecting official may choose to conduct interviews, and once the selection is made, you will receive a notification of the decision.

Stay informed of changes to your application status by signing up for automatic email alerts at: https://www.usajobs.gov/Applicant/Application/ListApplications.
BENEFITS

Department of the Navy offers a comprehensive benefits package that includes, in part, paid vacation, sick leave, holidays, a 401K-type retirement plan, and an Employee Assistance Program. More information can be found at:

Other Information

A 40 hour work week is typical of this position.
Relocation and/or recruitment incentives may or may not be authorized.

This position is covered by the Department of Defense Priority Placement Program.

Additional vacancies may be filled by this announcement.

A tentative offer of employment will be rescinded if the selectee fails to meet the pre-employment requirements, including failure to report to any of the scheduled appointments.

If selected below the full performance level, incumbent will not be noncompetitively promoted to the next higher grade level. Promotion is not implied.

The Department of the Navy uses E-Verify to confirm the employment eligibility of all newly hired employees. To learn more about E-Verify, including your rights and responsibilities, visit www.dhs.gov/E-Verify.

Federal Annuitant Information: The selection of an annuitant is subject to the Department of Defense and Department of the Navy policy on the employment of annuitants. Policy information may be found at:

ICTAP Applicants: To be considered well-qualified and exercise selection priority as an ICTAP candidate, displaced Federal employees must satisfy all qualification requirements for the position and receive a rating of 85 or higher. For more information about ICTAP eligibility please review the following link:

Veteran's Preference Information

Military Spouse Preference (MSP)

This job originated on www.usajobs.gov. For the full announcement and to apply, visit www.usajobs.gov/GetJob/ViewDetails/456054800. Only resumes submitted according to the instructions on the job announcement listed at www.usajobs.gov will be considered.

- Additional Duty Location Info

Additional Duty Location Info

1 vacancies in the following locations

- Camp Pendleton, CA
- China Lake, CA
- Corona, CA
- El Centro, CA
- Fallbrook, CA
- Lemoore, CA
- Monterey, CA
- Monterey, CA
- Point Mugu, CA
- Port Hueneme, CA
- San Diego, CA
- Seal Beach, CA
- Groton, CT
- Washington DC, DC
- Jacksonville, FL
- Key West, FL
- Mayport, FL
- Orlando, FL
- Panama City, FL
- Pensacola, FL
- Pensacola, FL
- Atlanta, GA
- Atlanta, GA
- Kings Bay, GA
- Honolulu, HI
- Kurehoo, HI
- Pearl Harbor, HI
- Great Lakes, IL
- Crane, IN
- New Orleans, LA
- Annapolis, MD
- Bethesda, MD
- Indian Head, MD
- Patuxent River, MD
- Bath, ME
- Kittery, ME
- Pascagoula, MS
- Camp Lejeune, NC
- Cherry Point, NC
- Portsmouth, NH
- Lakehurst, NJ
- Fallon, NV
- Saratoga Springs, NY
- Mechanicsburg, PA
- Philadelphia, PA
- State College, PA
- Newport, RI
- Charleston, SC
- Corpus Christi, TX
- Corpus Christi, TX
- Fort Worth, TX
- Alexandria, VA
- Arlington, VA
- Dahlgren, VA
- Dam Neck Naval Facility, Virginia Beach, VA
- Newport News, VA
- Norfolk, VA
- Portsmouth, VA
- Quantico, VA
- Quantico, VA
- Virginia Beach, VA
- Yorktown, VA
- Bangor, WA
- Bremerton, WA
- Keyport, WA
- Naval Air Station Whidbey Island, WA
- Silverdale, WA
- Marinette, WI

How to Apply

How to Apply

To begin the process, click the Apply Online button to create an account or log in to your existing USAJOBS account. Follow the prompts to complete the occupational questionnaire. Please ensure you click the Submit My Answers button at the end of the process.

To apply for this position, you must provide a complete Application Package which includes:

- Complete Resume.
- Complete Assessment Questionnaire. View Occupational Questionnaire.
- Other supporting documentation as required. Please see the "REQUIRED DOCUMENTS" section and review the applicant checklist link to determine if there are other documents you are required to submit.

Your complete application (resume, assessment questionnaire, and all supporting documents) must be received by 11:59 pm Eastern Standard Time (EST) on Monday, November 13, 2017. Applications received after Monday, November 13, 2017 may result in an ineligible rating and loss of consideration. If more than one resume is received, only the last resume received and processed will be reviewed.

Note: To check the status of your application or return to a previous or incomplete application, log into your USAJOBS account: https://mydon.usajobs.gov/Account/Login select Application Status, and click on the more information link under the application status for this position. You'll be directed to the Details page in Application Manager that will display the status of your application, documentation received and processed, and any correspondence related to this application. Your uploaded documents may take several hours to clear the virus scan process so please plan appropriately.

***You are encouraged to apply online. Applying online will allow you to review and track the status of your application.***

If you are unable to apply online or unable to upload your supporting documents follow the directions located at: http://www.secnav.navy.mil/donhr/Documents/CivilianJobs/Applicant_Info_How_to_Apply_via_Fax.pdf

Note: Faxing an application package (eg. 1203-FX) will not allow you to review and track the status of your application unless you have completed the application process in USAJOBS.

This Vacancy ID is 1847124

Do not email or send hard copy resumes/applications to the Contact Information or Agency Information listed in this vacancy announcement. All resumes/applications received at the addresses listed in the Contact Information or Agency Information will be destroyed and will not be considered for this vacancy announcement.

"It is the applicant’s responsibility to verify that all information in their resume and documents, whether uploaded or faxed, are received, legible, and accurate. HR will not modify answers/documents submitted by an applicant."

**How You Will Be Evaluated**

When the application process is complete, we will review your resume to ensure you meet the hiring eligibility and qualification requirements listed in this announcement. You will be rated based on the information provided in your resume and responses to the Occupational Questionnaire, along with your supporting documentation.

You will be evaluated and rated under Category Rating selection procedures. Additional points are not added for veterans' preference; however, preference is still applied. Applicants eligible for veteran's preference will receive selection priority over non-veterans.

If you meet the qualification requirements, your application will be placed in one of three categories:

Best Qualified- Candidates in this category possess exceptional skills and experience to exceed well above the minimum requirements for announced position.

Well Qualified- Candidates in this category possess good skills and experience above the minimum requirements for announced position.

Qualified- Candidates in this category meet the minimum experience requirements for announced position.

If, after reviewing your resume and supporting documentation, a determination is made that you inflated your qualifications and/or experience, your score may be adjusted to more accurately reflect your abilities or you may be found ineligible/not qualified.

Please follow all instructions carefully. Errors or omissions may affect your rating or consideration for employment.

**Required Documents**

The documents you are required to submit vary based on what you are claiming (i.e., applying as a veteran or disabled veteran, applying as a military spouse, etc.). Please review the following link to see if there are any documents you need to provide: http://www.secnav.navy.mil/donhr/Documents/CivilianJobs/ApplicantChecklist_External.pdf
Department of the Navy

Naval Education and Training Command

Contact

DON Employment Info Center EIC
Phone: (800)378-4559
TDD: 866 577 5723
Email: DONEIC@NAVY.MIL

Address

Naval Education and Training Command
Naval Support Activity
Mechanicsburg
PA

Note: We cannot accept applications on behalf of Federal Agencies. Application instructions are listed within the Job Description.
Principle Chemical Process Engineer

Job ID: 00337969
Category: Engineering
Posted Date: March 8, 2017

Description
Principle Chemical Process Engineer

This role provides a unique opportunity to identify and implement improvements and enhancements to the Process Safety within specific Honeywell business units.

Honeywell International is a $38 billion diversified technology and manufacturing global leader. Honeywell has more than 132,000 employees in 70 countries around the world and has a demonstrated heritage of both innovation and achievement.

Honeywell Performance Materials and Technologies is a $6 billion global leader in providing customers with technologies and materials for petroleum refining and petrochemical processes and high-performance specialty materials, including fluorine products; specialty films and additives; advanced fibers and composites; intermediates; specialty chemicals; and electronic materials and chemicals.

Honeywell Performance Materials and Technologies (PMT) is seeking an experienced Principle Chemical Process Engineer to work interactively with plant operations, project teams, technology and the business team to identify and implement improvements to existing processes, support ongoing operations, and execute growth and new product development strategies. The primary function is to be the PMT Engineering focal point for projects and other activities in the Packaging and Composites business of Advanced Materials. The Principle Engineer will also support other Advanced Materials projects and engineering initiatives as needed. This position can be located within Honeywell offices in our Baton Rouge, LA; Colonial Heights, VA; or Morris Plains, NJ Facilities.
Duties and Responsibilities

• Act as PMT Engineering focal point for the Packaging and Composite business, both for existing plants and new projects.
• Become process engineering expert in the Aclar® manufacturing value chain and Spectra Fiber by working with other experts and on-the-job learning.
• Work proactively within the Manufacturing Technology Center for P&C to improve existing operations and resolve operating issues, and to develop the AOP and STRAP
• Work with external contractors and vendors to execute capital projects
• Apply engineering standards and procedures on projects.
• Apply engineering tools on projects.
• Propose and initiate improvements to existing manufacturing operations and operations that in the Packaging and Composites business area.
• Work with Technology to identify and qualify new sources of raw materials, tollers and new product development as the need arises.
• Be process engineering lead engineer on new product development, technology scale up and other capital projects, as assigned.
• Travel 25 to 30% of the time

Qualifications

Basic Qualifications

• Bachelors in Chemical Engineering
• Minimum 13 years chemical engineering experience including polymerization and film extrusion

Preferred Qualifications

• Master and/or PHD in Engineering preferred
• Experience in fluropolymer processing (monomer to resin production)
• Experience in film extrusion (resin to film production)
• Experience in fiber production a plus
• Strong experience in capital project work, including front end engineering design
• Ability to take complex open ended problem from the business, develop scope options, and effectively communicate best option
• Project Management and leadership experience desirable
• Experience in plant startup and follow-up of operations
• Strong written, verbal and interpersonal communications skills
• Ability to function well within a team based work
• Capable of working under limited to minimal supervision
• Ability to analyze complex technical issues and develop engineering solutions
• Strong computer skills, including process simulation tools such as Aspen or Unisim
• Strong written and verbal communication skills
• Demonstrated ability to work effectively with individuals at all levels of an organization
• Ability to travel 25-30%

IND123

Honeywell is an equal opportunity employer.
Qualified applicants will be considered without regard to age, race, creed, color, national origin, ancestry, marital status, affectional or sexual orientation, gender identity or expression, disability, nationality, sex, or veteran status.

Apply

JOBS YOU MIGHT LIKE

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Kansas City, MO

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Brno, Jihomoravsky Kraj

Program Manager
Brno, Jihomoravsky Kraj

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Product Specialist - Rheology

Anton Paar USA | Ashland, VA

The Product Specialist applies scientific knowledge and principles to provide in-depth training and assistance to Anton Paar sales staff and customers on the proper use of highly complex measuring and laboratory instruments. The Product Specialist also represents the company as a technical expert with respect to the assigned product line.

Responsibilities:

- Provides customers with technical assistance on the proper use of proprietary hardware and software.
- Performs installations for new instruments at customer sites.
- Conducts market and competitive analysis from relevant sources such as marketing reports and research, publications, conferences, trade shows, and product demonstrations.
- Determines experimental design for prospect testing, conducts said testing, and completes a professional report thereof.
- Assists in developing sales aids and promotional materials, such as application notes and reports.
- Researches, writes, and presents technical articles, papers, and posters.
- Maintains the highest level of knowledge of company products and services and the underlying scientific and technical principles.
- Performs other duties as assigned.

Requirements:

- Analytical problem solving and creative thinking skills.
- Excellent verbal/written communication and interpersonal skills.
- Exceptional customer service skills.
- Ability to complete projects satisfactorily, on time, and with little supervision.
- Advanced knowledge of the theoretical and practical application of engineering science and technology.
- Frequent overnight travel is required.
- Must maintain a valid driver's license and passport.

Qualifications:

- Bachelor's degree required in electrical, mechanical or chemical engineering, chemistry, physics or related field.
- Master's degree or PhD in electrical, mechanical or chemical engineering, chemistry, physics or related field preferred.
- 3 years industrial laboratory experience and/or 3 years of experience working in the analytical instrumentation industry preferred.
- Experience in the asphalt industry preferred.

We offer you:

Anton Paar USA offers a unique and rewarding position within an innovative and rapidly expanding company and service organization. We offer a highly competitive salary, an outstanding benefits package and an opportunity for professional growth within the Anton Paar organization.

Anton Paar USA is an Equal Opportunity and Affirmative Action Plan Employer.
Females/Minorities/Disabled/Veterans are welcome

Entry:
Immediately

Divisions:
- Marketing / Purchasing / Sales
- Technical Support

Apply for this job
PROJECT ENGINEER
DATE: APR 4, 2017
LOCATION: CHANTILLY, VA, US, 20151
Requisition ID: 6422
All Locations: Chantilly, VA (Virginia)

Responsibilities

SUMMARY OF RESPONSIBILITIES
Serve as a Project Engineer, Future Architectures, GEOINT Innovations Office, National Systems Group. Provide direct support to the government on pre-acquisition activities for the next generation acquisition program. The GEOINT Future Architectures Group provides acquisition planning and decision support studies/analyses for future GEOINT programs frequently teaming with intelligence community and industry partners to formulate our nation's next generation of GEOINT.

- Organizing multi-disciplinary teams to conduct design modeling, simulation, and analyses in support of future acquisitions
- Concept development, cost analysis, analyses of alternatives, requirements development, and participation in both the drafting of acquisition solicitations (e.g. RFI, RFP, BAA) and review/evaluation of contractor proposals
- Identifying, tasking and tracking Engineering Technology Group resources for addressing acquisition, concept, and design issues
- Maintain a working knowledge of both current and future GEOINT acquisitions including relevant advanced technology developments, tracking and reporting Aerospace contributions to both the customer and Aerospace management
- Some travel will be necessary to support prime contractor activities

Qualifications

REQUIRED QUALIFICATIONS

- A Bachelor's degree in science, engineering or related technical discipline
- A minimum of 8 years of experience
- Demonstrated experience supporting the design of GEOINT spacecraft hardware
- Working knowledge of the acquisition process for National Technical Means programs
- Working knowledge of IMINT related technology
- Ability to work in a highly dynamic Program Office environment with a mix of government, FFRDC, and SETA personnel with quickly changing priorities
- Ability to work closely with senior government management
- Excellent interpersonal, leadership, written and oral communication skills
- Current SSBI required
- This position requires the ability to obtain and maintain a security clearance, which is issued by the U.S. government. U.S. citizenship is required to obtain a security clearance.

PREFERRED QUALIFICATIONS

- An advanced degree in science, engineering or related technical discipline
- Demonstrated experience with the broader intelligence community, specifically with those organizations responsible for representing end-user needs
- Demonstrated project management experience leading multi-disciplinary teams with a highly technical staff
- Working knowledge of ground and communications technology
- Working knowledge of the commercial GEOINT activities
- Working knowledge of the GEOINT enterprise including ground, air, and space

PHYSICAL REQUIREMENTS/WORK ENVIRONMENTS

- Position requires sitting most of the time at a workstation, using a computer
- Exposure to general office noise
- Local travel to off-site meetings and air travel to Aerospace or Customer office locations is required.
- Ability to communicate with individuals and groups in person, by phone and telepresence.
- While performing the duties of this job, the employee will typically work in an office environment.

Transcript Requirement

Transcripts are required for this position.

Additional Requisition Details
System Job Title: PROJ ENGINEER
Clearance Requirement: TS/SSBI
Access: SCI
Polygraph: Counter Intelligence Polygraph
Relocation Available: Yes
Employment Type: Regular
Work Schedule: Full Time
Company Statement
The Aerospace Corporation has provided independent technical and scientific research, development, and advisory services to national security space programs since 1960. We operate a federally funded research and development center (FFRDC) for the United States Air Force and the National Reconnaissance Office, and support all national security space programs. We also apply more than 50 years of experience with space systems to provide critical solutions to technologically complex systems in such areas as communications, shipping, law enforcement, and cyber, among others.
From our inception, our highly skilled technical staff has focused on ensuring the success of every mission and developing the most effective and economic space-related hardware and software in the world. Our greatest asset is the technical expertise of our people. Our state-of-the-art laboratory facilities are staffed by some of the leading scientists in the world.

Equal Opportunity Commitment
The Aerospace Corporation is an Equal Opportunity/Affirmative Action employer. We believe that a diverse workforce creates an environment in which unique ideas are developed and differing perspectives are valued, producing superior customer solutions. All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of race, gender, gender identity or expression, color, religion, national origin, sexual orientation, protected veteran status, or disability status.

NEAREST MAJOR MARKET: WASHINGTON DC
JOB SEGMENT: PROJECT ENGINEER, ENGINEER, SECURITY CLEARANCE, DRAFTING, AEROSPACE ENGINEERING, ENGINEERING, GOVERNMENT

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The Aerospace Corporation is an Equal Opportunity/Affirmative Action employer. All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of race, gender, gender identity or expression, color, religion, national origin, sexual orientation, protected veteran status, or disability status. If you're an individual with a disability or a disabled veteran who needs assistance using our online job search and application tools, or need reasonable accommodation to complete the job application process, please contact us by phone at 310.336.5432 or by email at ieo.mailbox@aero.org. Please note that only requests for disability-related assistance in using online tools, or for reasonable accommodation, will receive a response after contacting this phone number and mailbox.
R&D Engineer - Polymerization Solutions
FPC Fairfax • Winchester, VA 22601
~ FPC Fairfax is located in Winchester, VA & works nationwide.~

~ My client, a noted global chemical manufacturer, is looking for a Top-Notch Polymers Engineer for this newly-created, high visibility position, to provide powerful & collaborative leadership, cross functionally, be part of a powerful team, taking products from inception, to the laboratory, to commercialization. --

~ As the ‘go-to’, the role is a critically important, integral part of new product development, with exciting projects & initiatives that will move the global vision forward. A complex & rewarding opportunity where you will work with some of the finest teams to be found. --

Location: Excellent East Coast location - numerous amenities - low COL.~

Compensation: Competitive package (skills dependent), bonus potential & relocation assistance provided.~

Professional benefit: A+ organization - solid - well positioned - stellar future.~

Overview of basic duties, among others:~

~ Lead Polymer R&D projects & programs in this critically important role - drive accountability.~

~ With commercial solution phase knowledge & polymerization reaction engineering, guide scale up of new polymer technologies - i.e. process, catalyst, etc.~

~ Interpret technologies to process >opportunities >business opportunities.~

~ As expert/resource in solution phase technology - interface with BUs to help develop technical targets - troubleshoot - continuous improvement opportunities.~

~ Collaborate with management, recommending new R&D initiatives & business opportunities.~

~ Keep up to date accurate project data - risk - stage gate, etc.~

Must have:~

~ PhD Chemical Engineering or related will be considered~

~ 4+ years relevant experience & successful leadership in Polymerization Process Research~

~ Demonstrated expertise in the solution phase polyolefin manufacturing - other polymers manufacturing processes considered~

~ Track record (e.g. patents or applications or publications) new polymerization catalyst, etc.~

~ Deep knowledge & experience in polymers or catalyst industries manufacturing process~

~ Use of polymerization reaction engineering and kinetic models~

~ Ziegler Natta & metallocene - catalyst systems ~

~ Demonstrated project management~
- Technical – business/financial acumen
- Problem solving – analytical (e.g. Kapner Tregoe)
- Travel as required

Personal attributes:
- Highly strategic
- Critical thinking
- Ability to lead without direct authority – build consensus
- Inclusive with team spirit
- Articulate
- Integrity

Job Type: Full-Time

Required education:
- Doctorate

Required experience:
- Polymer: 5 years

30+ days ago - save job

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Please review all application instructions before applying to HPC Fairfax.

23 people have already applied to this job on Indeed.

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R&D ENGINEERING SPECIALIST
AT CPS
Date Posted: 4/17/2017
JOB DESCRIPTION

R&D Engineering Specialist needed for the US in the Northeast. US CITIZEN/PERM RESIDENT. If interested, and for more information, please contact Stephanie Kemp: [Click Here To Join]

JOB REQUIREMENTS

Qualifications:

- PhD in chemical engineering, chemistry, polymer science and engineering
- 5+ years of relevant experience in Polymerization Process Research
- Demonstrated experience in the solution phase polyolefin manufacturing platform, experience in other polyolefin manufacturing process platforms (dispersion or slurry) also desirable
- Proven track record of new polymerization catalyst or process technology development
- Excellent communication and interpersonal skills
- US CITIZEN/PERM RESIDENT
JOB SNAPSHOT

Employee Type: Full-Time

Location: Hopewell, VA

Job Type: Engineering, Science

Experience: At least 5 year(s)

Date Posted: 4/17/2017

ABOUT US

CPS, Inc. is one of the leading recruiting and professional staffing firms in the country. With over 40 years of recruiting expertise, the recruiters of CPS, Inc. have the market and technical knowledge to understand your employment needs. We provide permanent placement in the following industries: Accounting and Finance, Actuarial, Advertising.

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Communications Specialist Jobs | Telecommunications Manager Jobs | Jobs in Richmond, Virginia | Communications Specialist Jobs in Richmond, Virginia
Research Assistant Professor

When applying for this position, I understand that all information on my application is subject to verification. In addition, criminal background checks are a condition of employment.

Below you will find the details for the position including any supplementary documentation and questions you should review before applying for the opening. To apply for the position, please click the Apply for this Job link/button.

If you would like to bookmark this position for later review, click on the Bookmark link. If you would like to print a copy of this position for your records, click on the Print Preview link.

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Posting Details

Position Information

Position Number: F53850
Position Type: Teaching and Research Faculty
Rank: Assistant Professor
Working Title: Research Assistant Professor
School/Unit: School of Engineering
Department: Chemical & Life Science Engineering
Number of Months: 12
Tenure Status: Non-Tenure Eligible
Grant funded position? Yes - Continuation of this position depends on funding of the grant.

Position Summary and Qualifications

To value discovery and creativity of our entire engineering community; students, faculty and staff; to value diversity of ideas of our engineering community; students, faculty and staff; to value personalized attention in teaching, learning, and service to all of our constituents including our students; their families, our industrial partners and collaborators, and colleagues throughout the university and business communities; and to value the significant and positive impact of our people and ideas in the promotion of regional and global prosperity involving research and life sciences. In addition all goals and objectives of the School of Engineering complement the Mission of the University.

Chief purpose of this position in support of above mission or goal

This position will assist in providing a dramatic change in pharmaceutical manufacturing technology while increasing access to life-saving medicines worldwide.

Position Responsibilities

This position will be playing an important role to carry out the development of chemical and engineering process improvements leading to significant cost reductions for HIV drugs and related starting materials. Collaborations with other institutions will also be a part of this project. In addition, the candidates will participate in proposal preparation, guiding students, and writing scholarly articles.

- Candidates must have earned a PhD degree in chemical engineering or chemistry.
- Candidates must desire to actively participate in creating and nurturing a highly collaborative, creative, innovative, and entrepreneurial culture.
- The successful candidate must have demonstrated experience working in and fostering a diverse faculty, staff, and student environment or commitment to do so as a faculty member at VCU.
- Candidates should possess the capabilities to effectively operate at the interface of chemistry and chemical engineering.

Preferred Qualifications

- Significant pharmaceutical manufacturing experience is preferred.

Posting Detail Information

Date Posted 03/14/2017
Open Until Filled No
Application Deadline Date 04/20/2017
Proposed Hire Date 05/01/2017
Type of Search National
Application Process/Additional

Candidates should submit a curriculum vitae detailing their research, teaching and leadership experiences and a list of three references. Application materials should be
Information

uploaded to www.vcujobs.com, position F53850. Questions should be sent to Tom Roper, Ph.D., Chair of the Search Committee, at tdroper@vcu.edu. The position will close on April 20, 2017.

Virginia Commonwealth University is an equal opportunity, affirmative action university providing access to education and employment without regard to age, race, color, national origin, gender, religion, sexual orientation, veteran's status, political affiliation or disability.

Posted Salary

Supplemental Questions

Required fields are indicated with an asterisk (*).

1. * How did you find out about this position?
   - Alumni association magazine
   - Chronicle of Higher Education
   - Community event
   - Email notification
   - HERC (Higher Ed Recruitment Consortium)
   - Higher education publication
   - Internal Recruiter
   - Job fair
   - Job site (e.g. Monster.com)
   - Listserv
   - Newspaper
   - Professional association/journal
   - Referred by person/employee
   - Search firm notification
   - VCU vacancy listing - eJobs
   - Other

2. * If you selected "Other" for your referral source, please indicate where you heard about this posting? (If you did not select "Other," please enter "n/a."

(Open Ended Question)

Applicant Documents

Required Documents

1. Cover Letter/Letter of Application
2. Other Document
3. Curriculum Vitae (CV)

Optional Documents
Residency Status Employee Type Time Type
U.S. Citizenship Required Regular Full Time
Clearance Top Secret/SCI Desired Experience
w/Poly

More information about this job:

Overview:

Vencore is a proven provider of information solutions, engineering and analytics for the U.S. Government. With more than 40 years of experience working in the defense, civilian and intelligence communities, Vencore designs, develops and delivers high impact, mission-critical services and solutions to overcome its customers’ most complex problems.

Headquartered in Chantilly, Virginia, Vencore employs 3,800 engineers, analysts, IT specialists and other professionals who strive to be the best at everything they do.

Vencore is an AA/EEO Employer - Minorities/Women/Veterans/Disabled

Responsibilities:

This position is in support of a dynamic and fast-paced operational and analytic environment with diverse customers. The candidate will be tasked with providing hands-on support to customer management, and facilitating the strategic and tactical implementation of the customer’s Division objectives. This SI will work horizontally and vertically across the mission to facilitate mission execution in terms of long term strategic initiatives as well as short term taskings. The successful candidate must have exemplary project integration skills, strong communication skills (oral and written), and must quickly get up to speed on the mission, its technology, and business rhythms.

Specific Job Description:

- Orchestrating planning and execution activities in direct support of the customer’s strategic priorities.
- Developing programmatic documents and briefings in alignment with the customer’s strategic plan, including CM of these documents/briefings
- Coordination and drafting of responses to various data calls from the parent organization
- Maintenance of the customer SharePoint site
- Review data and develop monthly and quarterly metrics.
- Facilitate communications and build relationships within the Sponsor, the IC, and industry partners to include meeting coordination and notes.
- Develop, define, and document data flows and recommend process improvements.

Qualifications:

Required Skills:
Required Skills:
• Systems Integrator or Project Engineer.
• Demonstrated experience providing plans, policy, and outreach activities.
• Demonstrated experience investigating issues and providing resolution.
• Demonstrated experience supporting strategic planning processes, and tracking progress against the plan.
• Demonstrated experience facilitating high priority actions and communications with senior leaders and technical SMEs.
• Demonstrated experience writing and editing technical documentation.
• Demonstrated project management experience: coordinating and planning budgets, spend plans, and performance metrics.
• Strong business, social, and customer acumen.
• Operations experience
• Instructional design experience

Desired Skills:
• Microsoft SharePoint
• 9+ years relevant experience with BS, or 7+ years with MS.
• Demonstrated experience with analytic, operational, and engineering teams.
• Demonstrated ability to drive change.
• Experience directly supporting sponsor.
• Strong self-starter, goal oriented and good team contributor.

Requires 10 to 12 years with BS/BA or 8 to 10 years with MS/MA or 5 to 7 years with PhD.

Options:

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Not ready to apply? Connect with us for general consideration.

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Senior Scientist, Upstream Process Development

Employer: Celgene
Location: Alexandria, Virginia (US)
Salary: Not Specified
Posted: Apr 07, 2017
Closes: May 05, 2017
Ref: 17000206

Description
This Sr. Scientist position in Biologics Upstream Process Development will focus initially on a bispecific program, and be responsible for the development of scalable cell culture processes, for research and Tox material production, and for scale up and transfer of processes to GMP facilities for clinical manufacturing, towards IND submission by the year end of 2017.

Responsibilities will include, but are not limited to, the following:
1. Developing highly productive upstream processes in a timely manner for novel protein therapeutics such as bispecific antibodies.
2. Using sound scientific and engineering principles to design robust and scalable upstream processes, in consideration of various bioreactor configurations and process formats.
3. Collaborating closely with Cell Line Development (CLD) and Downstream Process Development (DSP) groups to improve workflow efficiency and overall process yield.
4. Leading tech transfer to CMOs for process scale-up and GMP manufacturing including risk assessment and mitigation strategy development.
5. Performing PIP for production support and troubleshooting.
6. Participating in cross-functional collaborations to meet project timelines and material supply requirements.
7. Understanding the IP landscape around subject technologies, and developing IP strategies to ensure FTO and to create and strengthen the patent estate in the field.
8. Writing technical summary and development reports for efficient knowledge management and regulatory filing support.
9. Publishing or presenting scientific findings in peer-reviewed journals or conferences, and...
contributing to industrial collaborations
9. Providing supervision and guidance to junior scientists or associates

*I-LI-KM1
BIO-PRIORITY

Qualifications

Ph.D. in chemical engineering, biological sciences, or relevant disciplines, with 6-8 years industrial experience in mammalian cell culture for the production of recombinant protein therapeutics

Skills/Knowledge Required:

?Ph.D. in chemical engineering, biochemistry, or appropriate technical disciplines

?6-8 + years industrial bioprocess experience with a proven track record of accomplishments in the design, development, and implementation of bioreactor cell culture processes including troubleshooting and decision making
Hands-on experience with upstream development laboratory activities. Knowledge of upstream process equipment at development and pilot scales.

Proven technology transfer and scale-up experience.

Demonstrated ability to simultaneously manage multiple projects, and to function in a collaborative/team oriented environment.

Ability to introduce new technologies to accelerate upstream process development and improve process efficiency.

Good verbal and written communication skills.

Strong project leadership and resource management skills.
Celgene is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status.

Celgene complies with all applicable national, state and local laws governing nondiscrimination in employment as well as employment eligibility verification requirements of the Immigration and Nationality Act. All applicants must have authorization to work for Celgene in the U.S.

More jobs like this
- Life Sciences jobs in Alexandria
- Molecular Biology jobs in Alexandria
- Chemistry jobs in Alexandria
- Chemical Engineering jobs in Alexandria
Position: Senior Scientist/Engineer (CBRNE) / Program Manager
Location: Arlington, VA
Start Date: ASAP
Number of Openings: 1
Education: PhD (Chemistry, Chemical Engineering, System Engineering, Biochemistry, Biology or related discipline)
Years of Experience: 8-15

Position Summary: Incumbent will serve in myriad capacities as a senior scientist/engineer, subject matter expert, principal investigator, system architect, technical lead, task lead or program manager focused on research, development, and fielding of CBRNE signature collection, analysis or exploitation sensor or forensic science technologies, methods and services. Incumbent must work collaboratively with colleagues from multiple disciplines and may be required to support multiple, concurrent programs or investigations from similar or differing disciplines. Incumbent must possess senior scientific and program leadership skills as demonstrated by past experience.

Required Experience:

- Program Management/Principal Investigator experience conducting or managing CBRNE sensor development or forensic science programs for the US national or homeland security market. Experience must include leading collaborative technical efforts across multidisciplinary teams consisting of scientists and engineers to meet technical, cost, and schedule goals.
- A minimum of 8 years' experience serving as a Program Manager, Principal Investigator or Subject Matter Expert for the design, development, and delivery of CBRNE sensor or forensic science technologies.
- Experience serving as a product architect or system engineering lead for a CBRNE sensor development/forensic technology program.
- Experience with US Government acquisition and contracting process and systems.
- Experience with business and proposal development activities including developing client relationships, shaping programs and opportunities, and leading the preparation of white papers and technical proposals.
- Proposal leadership and technical writing, to include familiarity with all components of capture (themes, technical approach, costing, past performance).
- Technical and program management experience to include: project and program planning, execution, scheduling, work breakdown and project organization.
- Extensive written and interpersonal communication experience, demonstrating a capacity to represent a wide array technical and programmatic content to Company staff and clientele and all levels of authority.

Apply Now

* Fields Are Required

About You:

First Name*
Last Name*
Initial

Contact Info:

Email*
Confirm Email*
Careers

Current Openings (https://careers.sosi.com/)

Company Overview

For 25 years, clients in the private and public sectors have relied upon SOSI International LLC (SOSI) for critical operations in the world’s most challenging environments. SOSI is privately held, was founded by its current ownership in 1989, maintains corporate headquarters in New York City, and specializes in providing logistics, construction, training, intelligence, and information technology solutions to the defense, diplomatic, intelligence and law enforcement communities.

All qualified applicants will receive consideration for employment and will not be discriminated against on the basis of race, color, religion, sex, sexual orientation, gender identity, national origin, age, disability, or protected veteran status. SOSI takes affirmative action in support of its policy to advance employment of individuals who are minorities, women, protected veterans, and individuals with disabilities.

1-170413-5184: Image Scientist
Job Category: Intelligence
Duty Location: U.S. - Virginia - Charlottesville
Type of Position: Full Time
Requisition Number: 1-170413-5184

JOB DESCRIPTION
SOS International LLC (SOSI) is seeking an Image Scientist to provide scientific and technical support as a member of a multi-disciplinary team of applied remote sensing professionals. The candidate will be responsible to include full implementation of remote sensing capabilities including analysis and production, test and evaluation, data processing, exploitation, and dissemination, intelligence production and workflow. The candidate will provide technical input to developers and test and execute exploitation algorithms, tools, and methodologies to extract valuable information from complex airborne and satellite sensor data, to include spectral, thermal, and/or synthetic aperture radar (SAR).

The candidate works with government Image Scientists to develop and apply new analytical quality standards and guidelines and my lead small production teams focused on a particular customer, target, or region. Performs duties with minimal oversight; applies knowledge of state-of-the-art technologies; provides technical assistance to project leaders and program managers. Prepares and delivers technical presentations for community-sponsored Geospatial Intelligence (GEOINT) symposia, meetings, working groups and collection exercises.

ESSENTIAL JOB DUTIES

Operational Knowledge. Successful completion of the tasks in this effort requires operational knowledge of the following capabilities:

- Expertise in the continuum of remote sensing and applying image science and remote sensing production and development solutions to meet intelligence requirements
- Advanced knowledge in interpreting results from onboard and offline algorithms and automated processors in order to address intelligence requirements
- Experience with RemoteView, Socet3GXP or equivalent electronic light table before the performance period begins
- Experience in ENVI is required and assumed to include the basic ENVI course, Spectral Processing in ENVI, or equivalent spectral processing courses
- Thorough knowledge of remote sensing imaging and non-imaging systems (e.g., multispectral, hyperspectral, thermal, radar, OPIR, and Infrared)

MINIMUM REQUIREMENTS

- Current Top Secret clearance based on a Single Scope Background Investigation (SSBI) and Sensitive Compartmented Information (SCI) eligible
- Five years previous experience in an operational production setting exploiting multi- and hyperspectral data, including use of software-based exploitation tools such as ENVI, FSTK, GeoReplay or ERDAS and applying atmospheric correction and spectral matching algorithms to data
- Two-year Intelligence Community (IC) experience with National Geospatial-Intelligence Agency (NGA), Defense Intelligence Agency (DIA), US Air Force National Air and Space Intelligence Center (USAFAA/GOSIC), and/or U.S. Army National Ground Intelligence Center
- Comprehensive understanding of electro-magnetic phenomenology is required, with an emphasis on recent experience exploiting spectral, hyperspectral, thermal, overseas persistent Infrared (OPTIR) airborne high revisit area (HVIA) data.
- Expansive understanding of ground, airborne and space-based spectral collection platforms and collection methods

DESIRED QUALIFICATIONS

Two year experience writing IDL/Matlab/Python programming code toward developing applications to improve image-processing efficiency and/or algorithms focused on target detection and identification

EDUCATION/CERTIFICATIONS

Requared
- PhD from an accredited school in a field of basic or applied science or engineering. (Typical fields of study include, Remote Sensing, Chemistry, Physics, Biology, Geology, Electrical Engineering, Mechanical Engineering, Chemical Engineering, Environmental Science, Geography, and the Agricultural Sciences)
- In special cases, with the discretion of the appropriate Government representative, commensurate experience will be accepted in lieu of educational requirements.

Additional Education Desired
- Remote Sensing or related “primer” courses
- Remote Sensing or related processing courses
- Workshop or geospatial intelligence analytical thinking
- Requirements management training or at least one year equivalent experience

TRAINING:

Required
- Training in ENVI or equivalent spectral processing software.

Desired
- AHI or equivalent training in MASINT.
- ERDAS Imagine
- Common Spectral MASINT Exploitation Capability (COSMECT)
- Remote View

ADDITIONAL INFORMATION
WORK ENVIRONMENT

- Relatively fast-paced, time-critical environment
- May require deployment to areas declared as danger zones by the US Department of State
The Tauri Group offers:
- Highly competitive salaries
- 401k, including competitive matching
- Profit-sharing plan
- Highly competitive health insurance, including dental, vision, and long-term care
- Tuition assistance
- Eight paid hours a year that you can devote to charity

Tauri Group is an Equal Opportunity Employer.

**Title**  
CDP Pharmaceutical Senior Scientist (BIOENGINEER - Level V)

**Responsibilities**
We are seeking a senior scientist who understands the drug development/FDA processes to support the JPEO-CBD JPM Medical Countermeasures Systems, Chemical Defense Pharmaceuticals (CDP) at Ft. Detrick MD. The ideal candidate is someone who has demonstrated experience working on programs that moved products through the drug development process.

Candidates must have a current SECRET clearance.

**Responsibilities**
- Provides program management, product development, acquisition program strategic planning, contract guidance, oversight, and advisory services for the CDP
- Provides expertise in designing and conducting non-clinical studies, including application of biostatistics to analyze study points and implementation of GLP (21 CFR 58) toxicity studies and US FDA Animal Rule (21 CFR 314.600 and 601.90) studies to evaluate efficacy of biodefense pharmaceuticals
- Advises CDP on current good laboratory procedures; FDA Animal Rule requirements, application procedures, and implementation; FDA requirements for IND and NDA submission, approvals, and licensure; preparation for and conduct of DA Type A, B, and C meetings; and FDA qualification of drug development tools

**Qualifications**
**Education and Experience Required**
- Education: PhD in Organic Chemistry, Biochemistry, Chemical Engineering, Pharmacology, Toxicology, or Biochemical Engineering AND 10+ years of Industry experience in pharmaceutical/biotechnology advanced development (IND to FDA approval)
- Alternate Education: Master’s Degree in Organic Chemistry, Biochemistry, Chemical Engineering, Pharmacology, Toxicology, or Biochemical Engineering AND 15+ years of Industry experience in pharmaceutical/biotechnology advanced development (IND to FDA approval)
- DABT and/or RAC certification is highly desirable.
- Demonstrated pharmaceutical experience by providing evidence of patents achieved or multiple publications authored in peer-reviewed journals
- Previously served as the Director or Principal Investigator of a commercial pharmaceutical or biotechnology company with experience in filing IND applications, developing clinical protocols with the FDA, or participating in a project(s) involving completion of IND-enabling pre-clinical studies
- Previously served as a team lead, with experience writing and reviewing multiple IND applications, 510k submissions, Pre-Market Approvals (PMAs), New Drug Applications (NDAs), Biological License Applications (BLAs), cla-waived applications, Drug Master Files (DMF), clinical trial protocols, regulatory submissions, and technical reports
- 10+ years of experience designing studies to assess pre-clinical and clinical testing for safety, efficacy, and risk evaluation for drugs and therapeutic biologics
- 10+ years of experience in pre-clinical and clinical drugs, vaccines, biologics, or assays advanced development (IND to FDA licensure)
5+ years of working experience with Microsoft Office, to include MS Outlook, MS Project, MS PowerPoint, MS Excel, and MS Word

Apply Now
WEAPONS OF MASS DESTRUCTION SPECIALIST
AT BOOZ ALLEN HAMILTON
Date Posted: 3/24/2017

JOB DESCRIPTION
Job Number: R0000491

Booz Allen Hamilton has been at the forefront of strategy and technology for more than 100 years. Today, the firm provides management and technology consulting and engineering services to leading Fortune 500 corporations, governments, and not-for-profits across the globe. Booz Allen partners with public and private sector clients to solve their most difficult challenges through a combination of consulting, analytics, mission operations, technology, systems delivery, cybersecurity, engineering and innovation expertise.

Weapons of Mass Destruction Specialist
Key Role:

Leverage expertise as a Weapons of Mass Destruction (WMD) specialist to determine and evaluate the effects of WMD, Chemical,
Biological, Radiological, and Nuclear (CBRN) threats, Toxic Industrial Chemicals and Toxic Industrial Materials (TIC/TIM), and Hazmat Materials on the assessed mission. Support the mission by analyzing the health effects, CBRN and hazmat detection, identification sampling, and Emergency Response and Consequence Management tailored to the specific and local threats of the assessed mission. Identify all aspects of WMD related issues and provide recommendations to mitigate or eliminate identified vulnerabilities.

Basic Qualifications:

- 10 years of experience with assessing and analyzing WMD hazards and their impact

- Experience with using Hazard Prediction and Assessment Capability (HPAC), Area Locations of Hazardous Atmospheres (Aloha), and other current WMD computer simulations modeling tools

- Experience with preparing Microsoft PowerPoint presentations, reports, and whitepapers

- Knowledge of the WMD threat environment and potential methods for employing WMD in a variety of scenarios and conditions and comprehend threats posed by hazardous industrial materials

- Knowledge of WMD mitigation measures, technologies, and applicable US government standards

- Knowledge of Microsoft Office

- TS/SCI clearance

- BS degree

Additional Qualifications:

- Experience with personal protective equipment, facility, and infrastructure protection, including
mail handling and hazard plume modeling

- Experience in a chemical or biological defense role
- Experience with conducting vulnerability based assessments similar to BSA's
- Knowledge of DoD and federal, state, and local doctrine and guidelines on WMD defense and associated security, safety, and reliability programs
- Knowledge of force protection and emergency management programs as they apply to managing WMD incidents and response measures
- Knowledge of current WMD and CBRNE R&D programs
- Knowledge of health effects, CBRN and hazmat detection, identification sampling, emergency response, and consequence management
- Ability to develop plausible threat scenarios and provide coherent reports on vulnerabilities and mitigation measures, including engineering design reviews
- Ability to prepare and present informational material regarding WMD and hazardous materials
- Possession of excellent oral and written communication skills
- MA, MS, or PhD degree in a medical or scientific field
- Prior Active or Reserve/National Guard Duty Military as a Branch or MOS qualified Chemical or Medical Corps Officer/Senior Enlisted or comparable civilian expertise

Clearance:

Applicants selected will be subject to a security investigation and may need to meet eligibility requirements for access to classified information. TS/SCI clearance is required.
Integrating a full range of consulting capabilities, Booz Allen is the one firm that helps clients solve their toughest problems. By their side to help them achieve their missions. Booz Allen is committed to delivering results that endure.

We are proud of our diverse environment, EOE, M/F/Disability/Vet.

---

**JOB SNAPSHOT**

- **Employee Type:** Full-Time
- **Location:** Alexandria, VA
- **Job Type:** Engineering, Information Technology, Science
- **Experience:** Not Specified
- **Date Posted:** 3/24/2017

---

**ABOUT US**

Booz Allen...
Booz Allen Hamilton has been at the forefront of strategy and technology for more than 100 years. Today, the firm provides management and technology consulting and engineering services to leading Fortune 500 corporations, governments, and not-for-profits across the globe. Booz Allen partners with public and private sector clients to solve their most difficult challenges through a combination of consulting, analytics, mission operations, technology, systems delivery, cybersecurity, engineering, and innovation expertise.

CHECK OUT OUR SIMILAR JOBS
Public Safety Jobs | Safety Director Jobs | Jobs in McLean, Virginia
| Public Safety Jobs in McLean, Virginia
Appendix F - Student Demand

Chemical and Life Science Engineering, Ph.D.
Student Demand Survey Results

Mailing: March 17, 2017
Follow-Up: March 24, 2017
Report: March 29, 2017

Target: Enrolled Seniors in Biology, Bioinformatics, Chemical and Life Science Engineering, Chemistry, and Physics, and Graduate students in Bioinformatics, Chemistry, Engineering, and Physics and Applied Physics

Population: 742
Respondents: 47

If VCU offered the Chemical and Life Science Engineering, Ph.D., would you enroll?

<table>
<thead>
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<th>Frequency</th>
<th>Valid Percent</th>
</tr>
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<tr>
<td>Valid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Definitely</td>
<td>7</td>
<td>14.9</td>
</tr>
<tr>
<td>Very likely</td>
<td>8</td>
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<tr>
<td>Likely</td>
<td>12</td>
<td>25.5</td>
</tr>
<tr>
<td>Somewhat likely</td>
<td>8</td>
<td>17.0</td>
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<tr>
<td>Not at all likely</td>
<td>12</td>
<td>25.5</td>
</tr>
<tr>
<td>Total</td>
<td>47</td>
<td>100.0</td>
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What academic year do you think you would enter the Chemical and Life Science Engineering, Ph.D. program (assuming it was open for enrollment)?

<table>
<thead>
<tr>
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<th>Frequency</th>
<th>Valid Percent</th>
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<tr>
<td>2018</td>
<td>27</td>
<td>64.3</td>
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<tr>
<td>2019</td>
<td>8</td>
<td>19.0</td>
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<td>2020</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>2021</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>14.3</td>
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<tr>
<td>Total</td>
<td>42</td>
<td>100.0</td>
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Which one of the following degrees are you currently pursuing? (Select only one degree. If you graduated recently, select that degree or select Other to add the name of the degree program.)

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<thead>
<tr>
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<th>Frequency</th>
<th>Valid Percent</th>
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<tr>
<td>Biology BS</td>
<td>3</td>
<td>7.3</td>
</tr>
<tr>
<td>Bioinformatics BS</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Bioinformatics MS</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Chemical and Life Science Engineering BS</td>
<td>14</td>
<td>34.1</td>
</tr>
<tr>
<td>Chemistry BS</td>
<td>10</td>
<td>24.4</td>
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<tr>
<td>Chemistry MS</td>
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<tr>
<td>Engineering MS</td>
<td>6</td>
<td>14.6</td>
</tr>
<tr>
<td>Physics BS</td>
<td>4</td>
<td>9.8</td>
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<tr>
<td>Physics and Applied Physics MS</td>
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<td>7.3</td>
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<td>Other</td>
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</tr>
<tr>
<td>Total</td>
<td>41</td>
<td>100.0</td>
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What year do you expect to receive the degree you are currently pursuing? (If you graduated recently, select Other.)

<table>
<thead>
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<th>Valid</th>
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<th>Valid Percent</th>
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<td>18</td>
<td>42.9</td>
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<tr>
<td>2018</td>
<td>19</td>
<td>45.2</td>
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<td>--</td>
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<tr>
<td>Other</td>
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<tr>
<td>Total</td>
<td>42</td>
<td>100.0</td>
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What is your gender?

<table>
<thead>
<tr>
<th>Valid</th>
<th>Frequency</th>
<th>Valid Percent</th>
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<tbody>
<tr>
<td>Female</td>
<td>21</td>
<td>50.0</td>
</tr>
<tr>
<td>Male</td>
<td>21</td>
<td>50.0</td>
</tr>
<tr>
<td>I prefer not to say</td>
<td>0</td>
<td>--</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100.0</td>
</tr>
</tbody>
</table>
What is your ethnicity? (Select all that apply.)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian or Alaskan Native</td>
<td>1</td>
</tr>
<tr>
<td>Asian</td>
<td>5</td>
</tr>
<tr>
<td>Black or African American</td>
<td>6</td>
</tr>
<tr>
<td>Hawaiian or Pacific Islander</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic or Latino(a)</td>
<td>2</td>
</tr>
<tr>
<td>White</td>
<td>26</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
</tr>
<tr>
<td>I prefer not to say</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total Checked</strong></td>
<td><strong>44</strong></td>
</tr>
</tbody>
</table>
Appendix G - CLSE Industrial Advisory Board

Leonard J. Buckley, Ph.D.
Director, Science and Technology Division
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4850 Mark Center Drive
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Email: lbuckley@ida.org

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Technology management leader, Global Engineering Services
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Phone: (540) 298-4160
Email: betty_hannoun@merck.com

Peter J. Lipowicz, Ph.D.
Senior principal scientist, Scientific Affairs
Tobacco Regulatory and Health Services, Altria Client Services RD&E
Center for Research and Technology
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Richmond, Virginia 23219-1434
Phone: (804) 335-2321
Email: Peter.J.Lipowicz@altria.com

Joseph W. Roos, Ph.D.
Director, fuels research and development,
Afton Chemical
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Richmond, Virginia 23219-4300
Phone: (804) 788-6328
Email: Joe.roos@aftonchemical.com
Appendix H - Resources and Equipment

The Department Chemical and Life Science is currently housed in two locations - fourth floor of a 120,000 square-foot building (Engineering West) that was completed and opened for occupancy in the summer of 1998 and a space in the Virginia Biotechnology Research Park (BioTech Eight).

The Engineering West facility contains large classrooms, each with 1200 sq. ft. of space, and a number of research laboratories, 600-700 sq. ft. each, for all programs housed. CLSE maintains eight research laboratories, with a total of nine fume hoods. BioTech Eight is a three-story, 76,000-square-foot building offering wet/dry laboratory, office and flex space for tenants. Research laboratories of four CLSE faculty are located in the BioTech Eight space.

The CLSE department maintains a large inventory of advanced educational and research equipment including a Nicolet FT-Raman module with diode pumped laser system, a Hewlett-Packard 690/5973 GCMS system with FID and autosampling, a Hewlett-Packard HPLC system, a Perkin-Elmer Lambda-40 UV-VIS spectrophotometer, a Biacore 3000 (currently housed in the Eugene P. and Lois E. Trani Center for the Life Sciences), a Microphotonics variable angle ellipsometer, a gel permeation chromatograph, a Perkin-Elmer Pyris differential scanning calorimeter/thermogravimetric analyzer, BAS CV-100 potentiometer/galvanostat, a Leica inverted microscope, Eppendorf centrifuge, CO2 incubators, and laminar flow hoods.

VCU Nano Characterization Center

The VCU Nano Characterization Center (NCC) (http://www.nano.vcu.edu/) is a research core facility of the VCU Office of Research and located in the Institute for Engineering and Medicine. The NCC is also a partnership between the VCU School of Engineering and the VCU College of Humanities and Sciences. As a core research facility, resources and services are available by contract to not only university faculty but industry as well. The NCC provides access to over $11 million in sophisticated materials characterization equipment and analytical services unique to the mid-Atlantic region. Facilities at the NCC are widely used by CLSE faculty with research interests in the areas of Materials Science and Engineering.

These include Scanning Electron Microscopes (Hitachi SU-70 FE-SEM, JEOL LV-5610 SEM, Zeiss Auriga FIB-SEM), Microscopes (Zeiss LSM 710 Laser Scanning Microscope, Nikon Eclipse LV100D) and other analytical characterization equipment (Zeiss Libra 120, PANalytical MPD X'Pert Pro, ThermoFisher ESCAlab 250, Bruker SkyScan 1173 High Energy Micro-CT, Viscotec GPCMax, PANalytica Epsilon 3XLE and Horiba LABRam HR Evolution Confocal Raman Spectrometer).

Wright Virginia Microelectronics Center (W-VMC)

The C. Kenneth and Dianne Harris Wright Virginia Microelectronics Center features a 7,500-square-foot Class-1000 cleanroom for the fabrication and development of a wide array of micro- and nanofabricated devices, as well as state-of-the-art materials. The Interdisciplinary Cleanroom is multiuser research and educational facility and accessible to School of Engineering faculty. Device fabrication includes high-speed solid-state electronic devices, optical devices,
silicon MOS transistors, micro-electro-mechanical systems, solar cells, microfluidic components, surface acoustic wave devices, biochips, and other state-of-the-art microsensors and systems. Devices are fabricated on materials ranging from MOCVD- and MBE-grown semiconductors, wide bandgap semiconductors and III-V semiconductors to conventional silicon and dielectric materials. The W-VMC currently has all the basic fabrication facilities required for microelectronics, as well as microsensors, microelectromechanical systems (MEMS) and nanofabrication. These include – Karl Suss MA-56 contact aligners, Electromask Pattern Generator for mask fabrication and a Wyko Optical Surface Profiler.

Support Facilities in the Life and Medical Sciences

A feature of the proposed degree program is the synergistic interaction of engineering with the Life and Medical Sciences. The VCU Medical Center is one of the leading comprehensive academic medical centers in the country and stands alone as the only academic medical center in Central Virginia. The medical center includes an 820-bed hospital, outpatient clinics, a 600-physician-faculty group practice, and the Virginia Commonwealth University health sciences schools of Allied Health Professions, Dentistry, Medicine, Nursing and Pharmacy. The VCU Medical Center is the site for the region’s only Level 1 Trauma Center and offers state-of-the-art care in more than 200 specialty areas including organ transplantation, head and spinal cord trauma, burn healing, and cancer treatment. As a leader in healthcare research, VCU Medical Center offers patients the opportunity to choose to participate in programs that advance evolving treatment, such as those sponsored by the National Cancer Institute through the VCU Massey Cancer Center, Virginia’s first NCI-designated cancer center. The VCU Medical Center maintains the following shared resource facilities: Biostatistics, Clinical Research, Flow Cytometry and Imaging, Research Histopathology Core Facility, Hybridoma-Monoclonal Antibody, MALDI-TOF Mass Spectrometry, Molecular Biology, Molecular Biology Supply Center, Nucleic Acid, Structural Biology, Transgenic Mouse and Knockout, Virus Vectors.

Virginia Commonwealth University’s Eugene P. and Lois E. Trani Center for Life Sciences fosters interdisciplinary research and instruction. The building houses the Department of Biology, the Center for Environmental Studies, the Center for the Study of Biological Complexity, a satellite lab of the Nucleic Acid Research Facility, and the Bioinformatics Computational Core Laboratory Suite. The 4-floor, 132,000-sq.-ft. facility creates and academic quadrangle on the southwest corner of the Monroe Park Campus. Science and math faculty – as well as education professors who prepare future science teachers – will be within steps of one another’s classrooms and laboratories. The facility contains exciting new learning spaces including seven classrooms, two lecture halls, computer labs, and a student study lounge – all equipped with state-of-the-art multimedia technology. The Life Sciences building features 17 undergraduate instructional laboratories. In addition to general biology and anatomy laboratories, the building offers specialty laboratories for advanced courses. These include genetics, molecular biology, bioinformatics, ecology, environmental science, botany, physiology and microbiology. A rooftop greenhouse is a research-grade facility that can control humidity, temperature, and light. The 3,000-square-foot greenhouse supports a pesticide-free room and three environments simultaneously: desert, mild climates much like Central Virginia, and tropical. An aquatics facility, located in the basement, houses up to 20 research tanks for controlled experiments on both marine and freshwater fish, amphibians, and other aquatic organisms.
Appendix I - Library Report and Resources

Library Resources

The current library resources are sufficient to support the proposed graduate program. The VCU Libraries offer a print collection of over 1.7 million volumes and over 13,000 periodical subscriptions housed in The James Cabell Branch Library on the Monroe Park Campus and the Thompkins-McGaw Library on the Medical School Campus. VCU’s current vigorous collection building activities will enhance the monograph collection in areas of interest in the proposed graduate program. The library holdings also contain extensive collections of digital indexes and full-text digital periodicals. Among these electronic resources are Compendex Plus (Engineering Index), Cambridge Scientific Abstracts, Inspcc, Web of Science, and WorldCat. The university community has access to leading-edge web-based services as well as instruction and individual reference consultation. Library resources are at the disposal of VCU students, teachers, and researchers from any campus computer and from anywhere in the world with access to the internet and proper authentication. VCU Libraries maintain affiliations with many national and international library and publishing organizations to provide access to materials not held at VCU. Materials not held by VCU are available through the interlibrary loan service. Additionally, VCU is a founding member of the Association of Southeastern Research Libraries, the Scholarly Publishing and Academic Resource Coalition, and the Coalition for Network Information. VCU is also a participant in the National Network of Libraries of Medicine and a member of the Virtual Library of Virginia and the Southeastern Library Network, among others.
Proposal to create a new Ph.D. in Pharmaceutical Engineering
STATE COUNCIL OF HIGHER EDUCATION FOR VIRGINIA
PROGRAM PROPOSAL COVER SHEET

1. Institution
Virginia Commonwealth University

2. Academic Program (Check one):
   New program proposal   X
   Spin-off proposal
   Certificate document

3. Name/title of proposed program
   Pharmaceutical Engineering

4. CIP code

5. Degree/certificate designation
   Ph.D.

6. Term and year of initiation
   Fall 2018

7a. For a proposed spin-off, title and degree designation of existing degree program

7b. CIP code (existing program)

8. Term and year of first graduates
   Fall 2020

9. Date approved by Board of Visitors

10. For community colleges:
    date approved by local board
    date approved by State Board for Community Colleges

11. If collaborative or joint program, identify collaborating institution(s) and attach
    letter(s) of intent/support from corresponding chief academic officers(s)

12. Location of program within institution (complete for every level, as appropriate and
    specify the unit from the choices).

   Departments(s) or division of  ______________________________

   School(s) or college(s) of  School of Engineering & School of Pharmacy

   Campus(es) or off-campus site(s)  VCU Health Sciences & Monroe Park Campus

   Mode(s) of delivery: face-to-face   X   distance (51% or more web-based)   
   hybrid (both face-to-face and distance)   

13. Name, title, telephone number, and e-mail address of person(s) other than the
    institution's chief academic officer who may be contacted by or may be expected to
    contact Council staff regarding this program proposal.

Deborah S. Noble-Triplett, Ph.D., Sr. Vice-Provost for Academic Affairs
Scott F. Oates, Ph.D., Director, Academic Integrity and Assessment
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<table>
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<td>New program proposal <strong>X</strong></td>
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<td></td>
<td>Spin-off proposal</td>
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<td>Certificate document</td>
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<td>date approved by local board</td>
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<td></td>
<td>date approved by State Board for Community Colleges</td>
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<tr>
<td>12. Location of program within institution (complete for every level, as appropriate and specify the unit from the choices).</td>
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</tr>
<tr>
<td>Departments(s) or division of</td>
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<tr>
<td></td>
<td>School(s) or college(s) of <strong>School of Engineering &amp; School of Pharmacy</strong></td>
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<td></td>
<td>Campus(es) or off-campus site(s) <strong>VCU Health Sciences &amp; Monroe Park Campus</strong></td>
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<td>hybrid (both face-to-face and distance)</td>
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<td></td>
</tr>
<tr>
<td>Deborah S. Noble-Triplett, Ph.D., Sr. Vice- Provost for Academic Affairs</td>
<td></td>
</tr>
<tr>
<td>Scott F. Oates, Ph.D., Director, Academic Integrity and Assessment</td>
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</table>
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DESCRIPTION OF THE PROPOSED PROGRAM

Program Background

The Schools of Pharmacy and Engineering at Virginia Commonwealth University (VCU) request approval for the establishment and implementation of a new Pharmaceutical Engineering Ph.D. program. The program is to be jointly owned and administered through a partnership between the two schools with an anticipated admission of the first class for fall 2018.

The purpose of the Ph.D. degree program is to train students in pharmaceutical engineering concepts related to the design, development, manufacture and regulation of pharmaceutical products and devices. It will address the growing need for a new generation of researchers trained in cross-disciplinary and interdisciplinary science who recognize the need for a team-based approach to solving challenges related to the design and manufacturing of pharmaceutical products. These graduates will be fluent in the challenges to be addressed in the pharmaceutical, regulatory, entrepreneurial and academic environments.

This first in the nation Ph.D. program\(^1\) will take a structured approach towards the cross-disciplinary nature of pharmaceutical engineering, taking into account the needs of the employer base and market opportunities within the region and the Commonwealth of Virginia, and also the expertise existing at VCU. This program is unique and does not exist in the Commonwealth, region or nation. The uniqueness of the program will derive from the partnership and team approach between the Schools of Pharmacy and Engineering and that will span coursework, mentoring, and research. This partnership is possible due to the co-located nature of the schools as well as the strong desire of the leadership at VCU to develop a cross-disciplinary Ph.D. program in this important area. While there are several other programs in the nation (Appendix B) which offer tracks or concentrations in pharmaceutical engineering within other Ph.D. programs, they do not span the entirety of the engineering and pharmaceutics space which is necessary to understand the development of drug products. Students who successfully complete the proposed program will be highly desirable to employers because of their ability to work across scientific and organizational boundaries, and more importantly fill in the knowledge gap at the interface of engineering and pharmaceutics, where many product failures occur.

With the creation of the Pharmaceutical Engineering Ph.D. program, VCU is seeking to become a national leader in education of the both pharmaceutical workforce of today and innovators that lead future developments. The Pharmaceutical Engineering Ph.D. program will not provide such opportunities in isolation, but it will coordinate with the Ph.D. programs in the School of Pharmacy and School of Engineering to produce a highly qualified and entrepreneurial workforce that is highly valued by industry, its regulators, and local communities. The proposed Pharmaceutical Engineering Ph.D. program will be the center of a collaboration among VCU's current Ph.D. programs such as Pharmaceutical Sciences Ph.D. with concentrations in medicinal chemistry and pharmaceutics, Biomedical Engineering Ph.D., and Engineering Ph.D. with a concentration in Chemical and Life Science Engineering.

\(^1\) There are several other schools (see appendix B) which have a track of pharmaceutical engineering within a Ph.D. program, however, this would be the first Pharmaceutical Engineering Ph.D. program in the U.S.
The Engineering Ph.D. with a concentration in Chemical and Life Science Engineering is also proposing a Ph.D. program for SCHEV approval. Although the proposed PhD programs in Chemical and Life Science Engineering and Pharmaceutical Engineering are distinctly different in content and objectives, they share specific core capabilities that complement their respective programs. Fundamental principles (drawing on the discipline of chemical engineering) common to these proposed programs are employed in a broad range of applications including energy, agriculture, consumer products, and health care. One of the research interests of the Chemical and Life Science Engineering faculty is to apply the chemical engineering principles to chemical process development that can serve as an enabling element of the pharmaceutical engineering program. Likewise, pharmaceutical engineering applies these principles to research interests such as drug formulation development, drug delivery systems and preparation of the drug active ingredient. As in many application-specific technologies, pharmaceutical engineering relies on a broad range of skills in order to provide a holistic educational experience and CLSE is one of those enabling capabilities. The approval of the proposed Chemical and Life Science Ph.D. program is critical to the overall strategy of transforming VCU into a leader in developing the pharma and biopharma workforce of the future.

Figure 1 below illustrates that the Pharmaceutical Engineering Ph.D. program will be an interdisciplinary and collaborative program, drawing from the knowledge and research interests of Ph.D. programs in VCU’s School of Engineering and School of Pharmacy. The Pharmaceutical Sciences Ph.D. programs in medicinal chemistry and pharmaceutics are in the School of Pharmacy; the Biomedical Engineering Ph.D. and the proposed Chemical and Life Science Ph.D. in the School of Engineering. The proposed Pharmaceutical Engineering Ph.D. will be the collaboration space where the areas of research and expertise from these Ph.D. programs will be able to work together. Taken together, this collaboration among the Schools of Pharmacy and Engineering will complete the educational framework to make VCU and the Commonwealth as a leader in education and innovation in the Pharma and Biopharma field.
The proposed Pharmaceutical Engineering Ph.D. will be the first program of its kind in the United States and no similar degree is offered in the Commonwealth of Virginia. This unique educational opportunity for students is possible at VCU because of the already strong collaborative efforts among Pharmacy Ph.D.-Medicinal Chemistry; Pharmacy Ph.D. Pharmacuetics; Biomedical Engineering Ph.D.; and the proposed Chemical and Life Science Engineering Ph.D. programs. The proposed Pharmaceutical Engineering Ph.D. program forms part of a purposeful VCU strategy for education and research excellence in pharmaceuticals and medical treatments, which include other programs above in Figure 1. Each of these programs, as an element of VCU’s strategy to improve health care, relies on each other; each program contributes knowledge and research that contributes to the possibilities and successes of the others.

The proposed Pharmaceutical Engineering Ph.D., as a high profile research and Ph.D. program, will attract students from across the state, as well as nationally and internationally. However, a high profile program cannot be created within VCU’s current Ph.D. programs due to i) the necessary collaborative teaching and research elements among the proposed Pharmaceutical Engineering Ph.D. the current Ph.D. programs, and the proposed Chemical and Life Science Ph.D., as illustrated above; ii) the fact that it would no longer be a first in the nation degree program and iii) a much lowered profile, attractiveness and cross-disciplinarity of the program (not unique) if it is only a concentration within and existing engineering or pharmacy program.

Additional information on the program differentiation and synergies will be provided in the subsequent section entitled “Relationship to Existing Degree Programs”.

VCU seeks, with the proposed Pharmaceutical Engineering Ph.D. program, to create a “World Class” learning experience leading to educational outcomes that are aligned with the structure and function of the “pharmaceutical development and sciences” of the pharmaceutical industry. Example areas include:

1. **Generation and Control of Pharmaceutical Active Ingredients:** This addresses the science and engineering in the cost effective and efficient generation and control of pharmaceutical active ingredients with emphasis on the theory and application of continuous processing and particle control and understanding, including micro- and nano- drug particle technology.

2. **Engineering and Science of Pharmaceutical Materials:** This important area bridges the understanding of the physical and chemical properties of the pharmaceutical active ingredient

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2 See Appendix B for a complete listing of competitor programs. There are no programs which confer the degree of Ph.D. in Pharmaceutical Engineering

with the requirements for the formulated medicine to enable drug delivery to the target site, often via a nanotechnology based approach.

3. **Formulation Engineering and Science**: This core area will focus on the scientific understanding, development, and production of the dosage forms, including formulation and devices, with particular emphasis on inhalation therapy and innovative drug delivery strategies.

The areas described above reflect some of the many areas where researchers and educators at VCU Schools of Engineering and Pharmacy have shown prominence at the national and international level. They also correspond to some of the critical areas identified by both the White House, and National Science and Technology Council and have precedent for funding both from governmental and industrial sources.

This degree program allows doctoral students to experience cross-disciplinary pharmaceutical engineering education and research at VCU. This program is being built on partnerships and teamwork among departments, disciplines, and research teams in both schools, as well as reaching out to areas of chemistry, medicine, the VCU Center for Clinical and Translational Research, and the VCU School of Business. The proposed approach to education and research will begin to address one of the key issues in the pharmaceutical and related regulatory professions, namely, that the challenges are almost always cross functional in nature, but the traditional education paradigm is not. The program aims to break that paradigm via our interdisciplinary approach towards the Ph.D. degree and prepare VCU graduates for excellence in the following areas:

- **Academia** – leaders in student focused education, research and entrepreneurial thinking.
- **Pharmaceutical and Biotech Industry** – high performing and collaborative research scientists who can problem solve, and contribute from day 1, and that are also capable of diversifying the industry through entrepreneurial efforts.
- **Government Regulators** – knowledgeable scientists who are able to understand the products they are regulating at both a broad and detailed level.

**Impact**

The Schools of Engineering and Pharmacy have had an exciting vision for the potential of this program since discussions first began between the deans of both schools after long time collaborative efforts between the faculties of both schools in an area defined as pharmaceutical engineering. This enthusiasm is shared by other leaders at VCU, who have strongly supported the development of the proposal of this first in the nation program. This proposed program has also been shared with senior representatives of major pharmaceutical companies, with colleagues at other academic institutions and regulatory agencies, and there is strong support for the kind of program that VCU will be able to establish. The proposed program will be an important part of the Virginia higher education community. The founding schools take that responsibility seriously and are committed to returning value to the Commonwealth through this program.

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1. **Richmond Metropolitan Area**: The establishment of this program will enhance the visibility of both the School of Engineering and School of Pharmacy locally and will promote collaborative efforts between VCU and the Pharmaceutical and Biotech industry, which have a strong presence in the Richmond metropolitan area. For example, VCU has started to work closely with Pfizer, which has located its worldwide consumer R&D site in Richmond, and will serve as an opportunity for employment for program graduates. Existing collaborations with Pfizer have already resulted in the significant contributions to an undergraduate course at VCU titled Pharmaceutical Engineering. The planned location of didactic laboratories in Pharmaceutical Engineering at the VCU Health Campus and Biotech Eight will promote collaboration with the Virginia Biotech Park. A specific and unique aspect of this program will be in approaches to entrepreneurship and establishment of start-up entities related to the program. The location of both the Smith Building (Pharmacy) and Biotech Eight (Engineering), close to the academic and health sciences campuses, and VCU’s research office will serve as an incubator for new ideas, ultimately leading to economic benefit for the locality.

2. **Commonwealth of Virginia**: The founding schools and faculty that will be participating in the program have already begun to build collaborations around concepts of Pharmaceutical Engineering within the Commonwealth. For example, representatives of the two VCU schools recently met with colleagues at Virginia Tech to establish a team to create novel, personalized pharmaceutical formulations. The intent of these types of collaborations is to promote interaction between students at Virginia universities and allow accessing of research funds and infrastructure that are targeted to promote such cooperation. The proposed Ph.D. program will seek to return value to the Commonwealth by emphasizing entrepreneurship, which has the potential to bring together venture capital, engaged students, and ultimately to provide employment opportunity for graduates in the biotechnology or manufacturing sectors. The student leaders in the proposed program will take a proactive role in engaging relevant biotechnology companies in the Commonwealth, particularly in northern Virginia. These contacts will ultimately lead to increased economic benefit, and a larger population of graduates remaining in the state and addressing the challenges put forth in the “Virginia Bioscience Economy Initiative”.

3. **Southeast Region**: While entrepreneurial efforts will largely focus on the Commonwealth, the Pharmaceutical Engineering program will graduate students and scholars which have been trained to be of added value to the biotech industry across the country. Many small biotech companies, such as those located nearby in the Research Triangle Park NC, have limited staff and thus the ability of a single scientist to work across multiple traditional boundaries becomes critical. The program will enhance the already significant reputation of the Pharmacy school, particularly in the inhalation therapy area, and produce diverse scientific leaders who will be valuable to biotech employers. The establishment of the program, along with unique positioning to align

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with the development divisions of Pharma, will establish VCU as a premier school that the large and small employers in the southeast will be able to draw from.

Mission

The proposed Pharmaceutical Engineering Ph.D. program complements VCU’s mission and strategic plan as an urban research university, as evidenced by the following statements from VCU’s mission.

As the premier urban, public research university in Virginia, VCU’s mission is to advance knowledge and student success through its commitments to:

- an engaged, learner-centered environment that fosters inquiry, discovery and innovation in a global setting
- research that expands the boundaries of new knowledge and creative expression and promotes translational applications to improve human health
- interdisciplinary collaborations that bring new perspectives to complex problems and mobilize creative energies that advance innovation and solve global challenges
- health care that strives to preserve and restore health for all people, to seek the cause and cure of diseases through groundbreaking research, and to educate those who serve humanity
- diversity that provides a climate of inclusion, a dedication to addressing disparities wherever they exist, and an opportunity to explore and create in an environment of trust
- sustainable, university-community partnerships that enhance the educational, economic and cultural vitality of the communities VCU serves in Virginia and around the world.  

By its very nature this degree program promotes the “interdisciplinary collaborations that bring new perspectives....and advance innovations to solve global challenges.” Moreover, the proposed Ph.D. in Pharmaceutical Engineering exemplifies the VCU motto “Make It Real” by focusing on education and research that directly impacts patient care and brings potential economic benefit to the Commonwealth. Finally, the program aligns with the strategic themes of the School of Engineering and the School of Pharmacy by:

- Preparing students to be entrepreneurial leaders, by engaging them with learning opportunities which focus on applicable solutions to important health care topics.
- Focusing didactic learning on the deep knowledge required for success in solving today’s problems and the laboratory research program on future focused groundbreaking research.
- Developing a student research program which focuses on clearly defined challenges, building a solution oriented team, and developing novel multidisciplinary solutions to promote and accelerate discovery and translational application of new technologies

7 http://www.vcu.edu/about/leadership.html
• Targeting a diverse student population by implementing an effective recruiting plan and promoting a supportive atmosphere for students so as to ensure a high retention rate.

• Building a sense of community engagement for students within the program for local innovative scientific collaboration, capstone projects in the didactic laboratories, mentoring of undergraduate students and by fostering group outreach activities in the local community.

This proposed Ph.D. program is an integral part of the overall desire to make VCU a leader in the area of education and research to promote health care outcomes in the area of pharmaceuticals and related medical therapies. The program completes and integrates the pharmaceutical education and research workflow along with the related proposed Chemical and Life Science Engineering Ph.D. program and existing programs such as Biomedical Engineering Ph.D., Pharmaceutical Science Ph.D. concentrations, Medicinal Chemistry and Pharmacetics. The Pharmaceutical Engineering Ph.D. program has been created to provide an educational background to understand the key technical aspects required for pharmaceuticals product development. In addition the proposed program has been designed to be distinct from the other related VCU programs. These distinctions include excellence in the key areas of generation and control of active ingredients, drug delivery, nanomedicine, and formulation engineering.

The act of conceiving, planning and ultimately implementing the Pharmaceutical Engineering Ph.D. program at VCU indicates that the leadership of the schools are committed to developing innovative programs which will attract participants based on student interest, future research trends, and the needs of employers.

Admission Criteria

Applications will be submitted to the Graduate School at VCU and evaluated for fall admissions in accordance with the Graduate School guidelines and admission requirements. A Pharmaceutical Engineering Graduate Program Committee, composed of faculty members from the School of Engineering and the School of Pharmacy will be responsible for recruitment and selection of new students from the pool of students meeting the standards for admission into the Graduate School.

Admission requirements for the Ph.D. program in Pharmaceutical Engineering

• Graduation with a Bachelor's degree, or Master's degree (or equivalent professional program) from an accredited college or university, with a degree in a discipline that provides an appropriate background for graduate-level study in pharmaceutical engineering, including but not limited to pharmacy, chemistry, bioengineering, chemical engineering, materials science, mechanical engineering, biomedical engineering.

• A minimum GPA of 3.0 on a 4.0 scale or higher in undergraduate studies is required. Those individuals who have earned a professional doctoral degree must have a minimum GPA of 3.0 on a 4.0 scale for all the work at this level.

• International applicants for whom English is not their native language must meet university admission requirements for performance on the Test of English as a Foreign Language or International English Language Testing System. Acceptance of an applicant...
is based on the recommendation of the Admissions Committee with approval of the program chairs and the associate dean for graduate studies. To download application forms or to apply online, students will be directed to the VCU Graduate School's website.

- Applicants must submit letters of recommendation from three present or former instructors or other individuals qualified to evaluate their ability to engage in interdisciplinary graduate study in pharmaceutical engineering.
- A current resume or curriculum vita is required.
- Applicants must provide a written personal statement describing their research interests, motivation, education and goals in pursuing this degree as well as evidence of the student’s suitability to pursue such a degree and indicate potential advisors.
- The GRE is not required but students are encouraged to submit their scores as additional evidence of their qualifications. Competitive scores are greater than 300 for combined Quantitative and Verbal and 4.0 Analytical score. The GRE cannot be used in place of other admissions requirements.

Target Population

The program will target individuals who wish to pursue an academic or pharmaceutical research career and have an interest in pharmaceutical engineering. Specifically, the program will target:

- Students with an appropriate B.S. degree in relevant subject areas, such as pharmacy, biology, chemistry, mechanical engineering, biomedical engineering, chemical engineering, and materials science.
- Students with an appropriate M.S. degree in relevant subject areas, such as pharmacy, biomedical engineering or chemical engineering
- Doctor of Pharmacy (Pharm. D) graduates who wish to pursue an academic research career

Considering that both the Chemical and Life Science Ph.D. and Pharmaceutical Engineering Ph.D. programs are progressing for SCHEV review, it is important to acknowledge that there will be some overlap in the target populations for these two programs. This is not unexpected given that students will have interest in either program depending on their intended career goals. Other existing Ph.D. programs such as chemistry, and biology also draw from this population. Both the Pharmaceutical Engineering and Chemical and Life Science Ph.D. programs will seek to bring a national and international student population to the state of Virginia and are thus targeting an audience that is much broader than that sampled at VCU.

As a part of the SCHEV review process a survey is conducted to gauge the interest of potential students in the program. Because the Chemical and Life Science Ph.D. and the Pharmaceutical Engineering Ph.D. programs are progressing simultaneously, there will be necessary overlap between the survey populations. The survey (see Projected Student Demand section) overlap should be viewed in the context of the much larger geographical population (national and international) which both Chemical and Life Science Ph.D. and Pharmaceutical Engineering will seek to access and draw from for this important area of expansion for VCU (and the Commonwealth).
As this is a new program for the Commonwealth, the program may attract applicants who previously undertook graduate studies at pharmacy and engineering schools both inside and outside Virginia. In light of this possibility, individuals will be targeted locally and also at a national level. Female and under-represented minority applicants will be encouraged to apply. We will develop relationships with other programs at VCU that have succeeded in attracting minority students in the biomedical field, particularly with the Center for Health Disparities, which also has participation from faculty in the Pharmaceutical Engineering program.

The target population will be recruited through a number of avenues to ensure an excellent and diverse group of candidates. The program will be advertised at career fairs in regional institutions (Virginia Tech, College of William & Mary, University of Virginia, George Mason) and at national pharmaceutical and engineering career fairs as well as professional society meetings of the research focus areas (as for example American Association of Pharmaceutical Scientists Annual Meeting, International Society of Pharmaceutical Engineers, American Institute of Chemical Engineers). It will also be promoted at the most relevant conferences on pharmaceutical and engineering research.

We will seek to recruit women and underrepresented minorities in engineering and the sciences by:

- Marketing at conferences such as the Annual Biomedical Research Conference for Minority Students (ABRCMS).
- Specific contacts with professional societies which represent diverse engineering and pharmacist populations.
- Creating links with Historically Black Colleges and Universities (HBCUs), the Hispanic Association of Colleges and Universities (HACU) and local colleges and universities with a high percentage of women engineering and pharmacy students.

The program will have a strong online presence on the VCU Schools of Pharmacy and Engineering websites and brochures will be available electronically and in hard copy.

**Curriculum**

**Credit Hours and Time to Degree**
The proposed Pharmaceutical Engineering Ph.D. program has two points of entry; thus, credits to degree vary accordingly. For students entering with a B.S. degree, the program may be completed with a minimum of 63 credits. For students entering with an MS with a thesis, the program can be completed with 45-60 credits; for students entering with an MS without a thesis, the program can be completed with 54-69 credits. Regardless of the credits to degree, all students must satisfy common curriculum elements, including 9 credits of core courses, which comprises 25% of the didactic coursework as required by SCHEV, regardless of the entry point, as shown in Table 1.

<table>
<thead>
<tr>
<th>Table 1: Pharmaceutical Engineering Points of Entry and Course Requirements</th>
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<tbody>
<tr>
<td><strong>Curricular Elements</strong></td>
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<tr>
<td>Pre-requisite courses</td>
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<tr>
<td>Core courses</td>
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</tbody>
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9
<table>
<thead>
<tr>
<th>Research area courses</th>
<th>9</th>
<th>9</th>
<th>9</th>
</tr>
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<tbody>
<tr>
<td>Research credits</td>
<td>33</td>
<td>24**</td>
<td>33</td>
</tr>
<tr>
<td>Seminars</td>
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<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Elective courses</td>
<td>9</td>
<td>9***</td>
<td>9***</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>63-69</td>
<td>45-60</td>
<td>54-69</td>
</tr>
</tbody>
</table>

*For students entering with a degree in Pharmaceutics, Chemical Engineering, or other B.S. or higher degrees that demonstrate appropriate pre-requisite knowledge, up to 6 credits of pre-requisites may be waived upon program directors' consent.

** For students entering with an M.S. with thesis, only 24 research credits are required.

*** For students entering with an M.S., up to 9 credits of electives may be waived upon advisor's and program directors' consent.

Students entering with a B.S. degree are expected to need four years to complete the program. Those entering with an M.S. degree will need at least three years. Time to degree is also affected by a student’s enrollment status (i.e., part-time or full-time.) Appendix C provides sample plans for the BS and MS entry points for full-time and part-time students. A period of residence of at least three consecutive semesters is required. Residency is defined as registration for at least nine credits per semester. However, the proposed program will require students to take up to 12 credits per semester, as indicated in the sample plans. A time limit of eight calendar years, beginning at the time of first registration, is placed on work to be credited towards the Ph.D. degree.

**Focus and Strength of the Curriculum**
The focus of the curriculum for the Ph.D. in Pharmaceutical Engineering is to produce graduates with the fundamental knowledge, methods, techniques, critical-thinking and communication skills to become the next generation of scientific leaders and innovators in pharmaceutical engineering. Students will have acquired the specific knowledge to research the complexities of chosen areas in pharmaceutical engineering. They will also have the breadth of knowledge on the critical issues facing other disciplines that interface with the pharmaceutical engineering, thus having the multi-disciplinary tools necessary to innovate and lead the efficient development new drug products. Graduates will be ready to become the entrepreneurial future leaders in pharmaceutical engineering with the expertise to identify critical need areas in the field, leading to innovative products and job creation.

Strengths of the curriculum include providing foundational knowledge; core courses that furnish students with the knowledge and skills necessary for interdisciplinary work in pharmaceutical engineering; research area courses for developing specialized research skills; seminars led by recognized researchers in pharmaceutical engineering and by students themselves so as to develop their communication skills; electives for developing additional breadth and specialized knowledge and entrepreneurial skills; and research hours. The sections below summarize the elements of the curriculum that comprise these strengths.
**Foundational Courses: 0-6 credits**

There is a total of 6 credit hours (4 x 1.5 credit hours) of prerequisite courses. The sequence CPES 504, CPES 505, CPES 506 and CPES 507, each consisting of 1.5 credit hours, will cover the introductory aspects of Pharmaceutical Engineering. Students will develop a broad knowledge of pharmaceutical engineering and sciences as it related to the development of pharmaceutical products, including the various stages of drug product development, the engineering and science related to the synthesis, processing and manufacturing and control of Active Pharmaceutical Ingredients (APIs), and the engineering and formulation science of APIs into various dosage forms, including basic concepts of pharmacokinetics and drug disposition, and the basic concepts of preclinical testing and regulatory affairs.

Students entering the program with a B.S. or M.S. in Chemical Engineering or Pharmaceutical Sciences (or other equivalent level of education/equivalent coursework) may request a waiver of up to 6 didactic prerequisite credits of the CPES 504, 505, 506 and 507 sequence. Approval from the research advisor and program directors is required.

**Core Curriculum Courses: 9 credits**

There is a total of 9 credit hours of required core didactic courses. The sequence CPES 604, CPES 605, CPES 606, and CPES 607 (1.5 credit hours each) will cover advanced aspects of pharmaceutical engineering, including those discussed in the CPES 500 sequence, as well as advanced drug formulation and delivery systems, advanced tools for the characterization of APIs and drug products, and advanced concepts of pharmacokinetics and drug disposition. Two didactic laboratories (CPES 609 and CPES 709, 1 credit hour each), are also part of the core classes, and cannot be waived. These labs are designed for the students to work in multidisciplinary teams and will expose the students to both narrowly focused projects and open-ended exercises (capstone work). Laboratory experiments will be related to topics covered in the didactic pharmaceutical engineering classes. Students who obtain a waiver to any of the prerequisite classes are still responsible for demonstrating required knowledge through the competent execution of the work in PCEU 609 and PCEU 709. A 1 credit hour of Scientific Integrity (CPES 601) is the other didactic course in the sequence, for a total of 9 credit hours.

**Research Area Courses: 9 credits**

There is a total of 9 credits of required Research Area didactic courses. While breadth of knowledge will be obtained from the required core didactic lectures and the accompanying laboratories discussed earlier, the required research area classes will provide depth of knowledge in a specific area or interest/research, thus helping the students to identify and solve cutting edge health care issues in the field of pharmaceutical engineering. The intent of the VCU Pharmaceutical Engineering Ph.D. program is to allow the student and supervisor to create a flexible curriculum based on the interests of the student in conjunction with the supervisor's guidance on the fit of the concentration with future industry and employment trends. The "Research Area" course sequence should be presented by the students to the directors of the program, who will officially approve the sequence of classes along with the rest of the plan of work.
Some examples of research areas are presented below; however, this will be an active area of expansion, with new topics and research areas as new faculty join the program, and new research directions develop through collaborative efforts.

**Example #01: Nanomedicine.** In the broad sense of the word, nanomedicine can be defined as the use of nanotechnologies applied to medicine. More specifically, nanomedicine is the area of research that seeks to develop novel nano-sized tools to prevent, diagnose/understand, and treat diseases. Faculty participating in the Pharmaceutical Engineering Ph.D. program are particularly interested in developing novel biomaterials for the delivery of small molecule active pharmaceutical ingredients (APIs) and biomacromolecules in the treatment of a variety of diseases. Relevant coursework would include the following for a total of 9 credits:

- PCEU 691 Special Topics in Nanomedicine (3 credits)
- BIOS 543 Statistical Methods I (3 credits), and
- PCEU 624 Advanced Pharmacokinetics (3 credits)

These classes are described in detail below.

**Example #02: Particle generation and formulation engineering.** The pharmaceutical, generic and related regulatory fields often operate in expertise silos related to the control of active pharmaceutical ingredient (API), and formulated product. This concentration provides additional depth in both the aforementioned areas and in addition provides critical cross functional skills in understanding the implications of manufacture on the performance of the medicine. Students excelling in this concentration would be uniquely placed to solve and implement new ways of manufacture, such as continuous crystallization, and address key challenges that reach across existing technical skills in academics and industry. Relevant coursework would include the following for a total of 9 credits:

- PCEU 612 Adv Physical Pharmacy and Biopharmaceutics (3 credits)
- CLSE 656 Adv Chemical Reaction Engineering (3 credits)
- CHEM 605 Physical Organic Chemistry (3 credits)

These classes are described in detail below.

**Research: 24-33 credits**

For those entering the program with a B.S., a minimum of 33 research credits will be required, while a minimum of 24 credit hours of research will be required for those entering the program with an M.S. or higher degree in related area. Students will learn how to work independently and as part of the naturally multidisciplinary teams present in the laboratories of the various principal investigator at VCU that participate in the Pharmaceutical Engineering Ph.D. program. Students will also enhance their research planning and execution skills by closely interacting with their graduate mentors in testing their hypotheses that guide their dissertation. They will also develop their writing skills, and will understand the requirements for successful scholarly publication by guiding the preparation and submission of their dissertation work, manuscripts in peer reviewed journals, and aiding the PIs in submission of intra and extramural grants.
Elective Courses: 0-9 credits

For students entering the program with a B.S., there is a total of 9 credit hours of elective courses to be taken. These courses should be selected in close consultation and with the approval of the graduate students' research advisors, and can be tailored to the student's goals. They can be directly related to their scientific area of interest, but they can also have other components that will promote other relevant skills, such as entrepreneurship. A list of example elective classes is provided below. The Pharmaceutical Engineering Ph.D. program will also offer the opportunity to apply elective credits towards an alternative research project in another laboratory. This unique offering, CPES 691 Laboratory Rotation in Pharmaceutical Engineering will allow students to participate in a research opportunity which will broaden their research experience in an alternative area. CPES 691 may be used for up to 9 credits in the elective category. The experience may include a laboratory at VCU, another institute, or an industrial setting. The proposed plan of study under CPES 691 should be proposed by the research advisor and approved by the directors for the Pharmaceutical Engineering Ph.D. program.

Seminars: 3 credits

There is a total of 3 credit hours of required seminar in pharmaceutical engineering. Except for the first year, students will register for 1 credit hour of seminar per year (two semesters = 1 cr). The seminars will be a combination of research seminars, where nationally and internationally recognized researchers in the area of pharmaceutical engineering and sciences will be speaking, as well as student presentations. All students are expected to use this forum to present their progress (towards their dissertation) in the form of an oral presentation. This presentation, delivered upon approval by the research advisor, will take place every year, starting in year two with a literature review and proposed plan of work; followed by research seminar on year three and final seminar on year four, which may or may not be the dissertation presentation. The seminar series helps achieve our learning outcomes, including the identification of key problems in the health care field as it pertains to pharmaceutical engineering and to develop strong communication skills to disseminate scientific knowledge and understand the need for lifelong learning. Special seminars on entrepreneurship will also help students hone such professional skills and motivate them to engage in this area. Seminar is on a pass or fail grading scale.

Mentoring Opportunities

It is also important to note that students will have an opportunity to develop effective teaching and mentoring skills such as performing teaching duties as teaching assistants, as well as mentoring junior PhD, M.S. and undergraduate students that usually make up the laboratory teams at VCU. Those students that may be directly admitted as research assistants by their mentors, or are self-supported will also be offered a one-semester opportunity to learn effective teaching skills by performing teaching assistant duties under the supervision of her/his mentor. Graduate student engagement in the community will be achieved thorough volunteer opportunities (judge in science fair in the metro area, volunteer science experiments at the science museum or high / middle / elementary schools), by hosting day visits from students and others interested in the community and eventually opening up the lab for high school students for controlled summer projects.
**Pharmaceutical Engineering PhD Curriculum: An example for entry with a B.S. degree**

Below are the required courses for a student entering the program with a B.S. Descriptions of the courses are presented afterwards. Samples plans of study for each entry points and for part time students are described in Appendix C.

**Foundation Courses** 6 credit hours; may be waived

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPES 504/505</td>
<td>Pharmaceutical Engineering Fundamentals I</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td>CPES 506/507</td>
<td>Pharmaceutical Engineering Fundamentals II</td>
<td>3</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Core Courses** 9 credits hours required; no course may be waived

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPES 601</td>
<td>Scientific Integrity</td>
<td>1</td>
<td>Y</td>
</tr>
<tr>
<td>CPES 604/605</td>
<td>Advanced topics in Pharmaceutical Engineering I</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td>CPES 606/607</td>
<td>Advanced topics in Pharmaceutical Engineering II</td>
<td>3</td>
<td>Y</td>
</tr>
<tr>
<td>CPES 609</td>
<td>Pharmaceutical Engineering Lab I</td>
<td>1</td>
<td>Y</td>
</tr>
<tr>
<td>CPES 709</td>
<td>Pharmaceutical Engineering Lab II</td>
<td>1</td>
<td>Y</td>
</tr>
</tbody>
</table>

**Research Area Courses†** 9 credit hours to be selected in consultation with advisor; no waiver for this requirement

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCEU 691</td>
<td>Special Topics in Nanomedicine</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>BIOS 543</td>
<td>Statistical Methods I</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>PCEU 624</td>
<td>Advanced Pharmacokinetics</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>PCEU 612</td>
<td>Adv Physical Pharmacy and Biopharmaceutics</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 656</td>
<td>Adv Chemical Reaction Engineering</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CHEM 605</td>
<td>Physical Organic Chemistry</td>
<td>3</td>
<td>N</td>
</tr>
</tbody>
</table>

†These courses represent a sample of research areas; future course offerings for research areas are contingent upon directions in industry and research.

**Electives** 9 credit hours required to be selected in consultation with advisor; may be waived for M.S. entry students

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
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</thead>
<tbody>
<tr>
<td>CLSE 675</td>
<td>Polymers in Medicine</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>EGRB 613</td>
<td>Biomaterials</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>BIOS 544</td>
<td>Statistical Methods II</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>Course Code</td>
<td>Course Title</td>
<td>Credit Hours</td>
<td>New Course</td>
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</tr>
<tr>
<td>NANO 570</td>
<td>Nanoscale Physics</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>NANO 571</td>
<td>Nanoscale Chemistry</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>NANO 650</td>
<td>Experimental Techniques in Nanoscience I</td>
<td>1.5</td>
<td>N</td>
</tr>
<tr>
<td>NANO 651</td>
<td>Experimental Techniques in Nanoscience II</td>
<td>1.5</td>
<td>N</td>
</tr>
<tr>
<td>NANO 661</td>
<td>Computational Nanoscience</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 675</td>
<td>Polymers in Medicine</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 650</td>
<td>Quantitative Analysis in CLSE</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 562</td>
<td>Advanced Systems Biology Engineering</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 563</td>
<td>Metabolic Engineering</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CLSE 544</td>
<td>Applied Transport Phenomena</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CHEM 632</td>
<td>Chemometrics</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>CHEM 633</td>
<td>Mass Spectrometry</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>PCEU 507</td>
<td>Pharmaceutics and Biopharmaceutics I</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>PCEU 509</td>
<td>Pharmaceutics and Biopharmaceutics II</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>MGMT 321</td>
<td>Survey of Entrepreneurship</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>MGMT 423</td>
<td>Social Entrepreneurship</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>MGMT 435</td>
<td>New Venture Strategy and Initiation</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>MGMT655</td>
<td>Entrepreneurship</td>
<td>3</td>
<td>N</td>
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</table>

Seminars 3 credit hours required; no waivers allowed

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPES 680</td>
<td>Pharmaceutical Engineering Seminar</td>
<td>3x1</td>
<td>Y</td>
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</table>

Research 24-33 credits hours required; no waivers allowed

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>Credit Hours</th>
<th>New Course</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPES 690</td>
<td>Pharmaceutical Engineering Directed Research</td>
<td>0.5-12</td>
<td>Y</td>
</tr>
</tbody>
</table>

Course Descriptions
Below are descriptions of the courses for each of the elements of the curriculum.

Foundational Courses
There is a total of 6 credits of pre-requisite courses, divided in 4 x 1.5 credit hour modules, which cover introductory topics in pharmaceutical engineering. Those are CPES 504/505 Pharmaceutical Engineering Fundamentals I (total 3 credits), and CPES 506/507 Pharmaceutical Engineering Fundamentals II (total 3 credits).

- CPES 504/505 and 506/507. Pharmaceutical Engineering Fundamentals I and II – 1.5 credits each (total 6 credits). New courses.
- Semester-long modules; 1.5 lecture hours each. Fundamentals of Pharmaceutical Engineering. Topics will include introductory concepts in drug discovery and development; drug and product characterization; drug formulation and delivery; drug and
dosage form stability; degradation and safety; PK/PD; biopharmaceutical principles in the
development of dosage forms; drug product manufacturing, and control; bioanalytical
testing; regulatory aspects in drug and dosage form development including clinical trials
and the approval process; basic concepts of thermodynamics, kinetics and transport in the
pharmaceutical industry, unit operations in the pharmaceutical industry; materials
engineering in the pharmaceutical industry, process intensification strategies in the
pharmaceutical industry.

Students entering the program with a B.S. or M.S. in Chemical Engineering or Pharmaceutical
Sciences (or other equivalent level of education/equivalent course work) may request a waiver of
the 6 credits of pre-requisite course work with approval from the research graduate advisor and
the program directors.

Core Courses
There is a total of 9 credits of didactic core courses, including 4 x 1.5 credit hour Advanced
Pharmaceutical Engineering modules, Pharmaceutical Engineering Laboratories, and Scientific
Integrity, as detailed below.

CPES 604/605 and CPES 606/607. Advanced Topics in Pharmaceutical Engineering I
and II  2x1.5 credits each (total 6 credits). New courses.
Semester-long modules; 1.5 lecture hours each. Advanced Topics in Pharmaceutical
Engineering. Those represent advanced topics in areas including: drug discovery and
development; drug and product characterization; drug formulation and delivery; drug and
dosage form stability; degradation and safety; PK/PD; biopharmaceutical principles in the
development of dosage forms; drug product manufacturing, and control; bioanalytical
testing; regulatory aspects in drug and dosage form development including clinical trials
and the approval process; basic concepts of thermodynamics, kinetics and transport in the
pharmaceutical industry, unit operations in the pharmaceutical industry; materials
engineering in the pharmaceutical industry, process intensification strategies in the
pharmaceutical industry. Required and cannot be waived.

CPES 609. Pharmaceutical Engineering Laboratory I. 1 credit. New course.
Semester course; 1 laboratory hour. 1 credit. Didactic laboratory in pharmaceutical
engineering. Consists of narrowly focused laboratory experiments, covering various
aspects discussed in CPES 504/505 and 506/507. Required and cannot be waived.

CPES 709. Pharmaceutical Engineering Laboratory II. 1 credit. New course.
Semester course; 1 laboratory hour. 1 credit. Didactic laboratory in pharmaceutical
engineering. Consists of both narrowly focused laboratory experiments and open-ended
projects (capstone), covering various aspects discussed in CPES 504/505, 506/507 and
604/605, and 606/607. Required and cannot be waived.
CPES 601. Scientific Integrity. 1 credit. New course.
Semester course; 1 lecture hour. 1 credit. A survey of contemporary issues relating to responsible conduct in research. Topics include academic integrity, mentoring, authorship and peer review, use of humans and animals in biomedical research, ownership of data, intellectual property, conflict of interest, scientific record keeping, collaborative research, research misconduct, and genetic technology. Graded as pass/fail. Required and cannot be waived.

No waiver will be given for the laboratories, where students will work in multidisciplinary teams and exposed to both narrowly focused projects and open-ended exercises (capstone). Laboratory experiments will be related to topics covered in the didactic pharmaceutical engineering classes. Students who obtain any waiver to any of the didactic classes are responsible for demonstrating required knowledge through the competent execution of the work in the laboratories.

**Research Area Courses**
There is a total of 9 credits of required Research Area didactic courses. While breadth of knowledge will be obtained from the required core didactic courses and the accompanying laboratories discussed earlier, the required research area courses will provide depth of knowledge in a specific concentration area, thus helping the students to identify and solve cutting edge health care issues in the field of pharmaceutical engineering. While we provide some example concentration areas below, we do expect this to be an active area of expansion as new faculty join the program, and new research directions develop through collaborative efforts.

**Nanomedicine.** Relevant coursework would include:

- **PCEU 691** Special Topics in Nanomedicine 3 credits
  Semester course; 1-5 lecture hours. 1-5 credits. Presentation of subject matter is by lectures, tutorial studies, and/or library assignments in selected areas of advanced study not available in other courses or as part of the training in research.

- **BIOS 543** Statistical Methods I 3 credits
  Semester course; 3 lecture hours. 3 credits. Prerequisite: graduate standing, or one course in statistics and permission of instructor. Basic concepts and techniques of statistical methods, including: the collection and display of information, data analysis, and statistical measures; variation, sampling and sampling distributions; point estimation, confidence intervals and tests of hypotheses for one and two sample problems; principles of one-factor experimental design, one-way analysis of variance and multiple comparisons; correlation and simple linear regression analysis; contingency tables and tests for goodness of fit.

- **PCEU 624** Advanced Pharmacokinetics 3 credits
  Semester course; 3 lecture hours. 3 credits. An advanced treatment of the kinetics of drug absorption, distribution, and elimination utilizing mathematical models, and digital computers for analysis of linear and nonlinear biologic systems.

**Particle generation and formulation engineering.** Relevant coursework would include:

- **PCEU 612** Adv Physical Pharmacy and Biopharmaceutics 3 credits
Semester course; 3 credits. Phase equilibria and phase transfer kinetics related to biopharmaceutics will be covered. The relationship between physiochemical properties of a drug dosage form and drug absorption, along with the correlation between in vitro tests used to evaluate dosage forms and in vivo measures of drug absorption will be covered. The course assumes that the student has a basic understanding of pharmacokinetics, physical chemistry and statistics.

CLSE 656 Advanced Chemical Reaction Engineering 3 credits
Semester course; 3 lecture hours. 3 credits. This course builds upon fundamental principles of chemical reaction engineering including integration of mass balances, reactor design equations and chemical rate laws. Emphasis is given to development of mathematical models and computational simulation of chemical reaction systems with multiple reactions. Additional topics include analysis of systems with unknown reaction parameters and mechanisms and bioprocess/biochemical approaches to chemical production.

CHEM 605 Physical Organic Chemistry
3 credits
Semester course; 3 lecture hours. 3 credits. The theory and application of physical methods in the study of the behavior of organic compounds. Topics covered include homogeneous kinetics, equilibria, acid-base catalysis, and the quantitative correlation of structure and reactivity as they apply to the understanding of the mechanisms of organic reactions.

Research Courses
Research credits are designed so that the student can focus on experiments required for the development of a successful dissertation and published work.

CPES 690 Pharmaceutical Engineering Directed Research 0.5-12 credits
Learn the necessary tools and execute research leading to PhD in Pharmaceutical Engineering.

Elective Courses
For those students entering the program with a B.S., there is a total of 9 credit hours of elective courses to be taken. These courses should be selected in close consultation and with the approval of the graduate students' research advisors, and can be tailored to the student's goals. They are part of the plan of work and will also require approval from the program directors.

They can be directly related to their scientific area of interest, but they can also have other components that will promote other relevant skills, such as entrepreneurship. The intent of the program is to allow flexibility in elective selection in consultation with the research advisor. The list below is representative of elective options and not exhaustive.

A general elective course will be:

CPES 691 Laboratory Rotation in Pharmaceutical Engineering. 1-3 credits.
Semester course. Laboratory rotation. Can be repeated, as long as in a different topic.
Maximum of 3 credits per semester.
The Pharmaceutical Engineering Ph.D. program will also offer the opportunity to apply elective credits towards an alternative research project in another laboratory. This unique offering, CPES 691, will allow students to participate in research that will provide an experience in an area that broadens their skillset and research capabilities. CPES 691 may be used for up to 9 credits in the elective category. The experience may include a laboratory at VCU, another institute, or an industrial setting. The proposed plan of study under CPES 691 should be proposed by the research advisor and approved by the co-directors for Pharmaceutical Engineering.

**Nanomedicine:** example of elective didactic courses in the Concentration area of Nanomedicine

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLSE 675</td>
<td>Polymers in Medicine</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Semester course; 3 lecture hours. 3 credits. This course is based on the need for integration of engineering and materials science of polymers with applications in life science engineering. Basic principles of polymer science including structural concepts at the molecular-, nano-, micro- and macro-scales are emphasized so that the student can understand structure/function correlation. The course treats polymer synthesis, molecular weight, morphology and surface science at an introductory level, but quantitative correlations are emphasized. Surface science is emphasized, as medical applications are often dependent on the interaction of a solid polymer with an in vivo environment (tissue, blood, membrane). The polymers chosen for emphasis include polyethylene (hip, knee replacement), poly(vinylchloride) (blood bags, catheters), polyurethanes (artificial heart, wound care) and silicones (implants, catheters). The use of polymers in drug delivery applications is explored, including osmotic-pressure-driven drug delivery. Concepts surrounding polymeric surface modifiers are developed, including applications such as enhanced biodurability and biocidal function.</td>
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<tr>
<td>EGRB 613</td>
<td>Biomaterials</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Semester course; 3 lecture hours. 3 credits. Prerequisite: Undergraduate material science or permission of the instructor. Primary and secondary factors determining the performance of materials used for implants in the human body. Topics will include metallurgy of stainless steel, cobalt-chromium alloys, titanium alloys, biocompatibility of implant materials, mechanical and physical properties of biomaterials, corrosion of biomaterials and medical polymers.</td>
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<tr>
<td>BIOS 544</td>
<td>Statistical Methods II</td>
<td>3</td>
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<td></td>
<td>Semester course; 3 lecture hours. 3 credits. Advanced treatment of the design of experiments and the statistical analysis of experimental data using analysis of variance (ANOVA) and multiple-regression. Includes the use of a statistical software package for data analysis.</td>
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<tr>
<td>NANO 570</td>
<td>Nanoscale Physics</td>
<td>3</td>
</tr>
<tr>
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<td>Semester course; 3 lecture hours. 3 credits. This course builds a fundamental understanding of the unique properties of materials with nanoscale dimensions and emphasizes the physics and thermodynamics underlying several phenomena encountered in nanotechnology. The course starts from a general description of size effects and then moves to describe the fundamental aspects of nanocluster physics such as magic</td>
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numbers, and concludes with a description of the theory and fabrication of nanoscale devices.

NANO 571  Nanoscale Chemistry 3 credits
Semester course; 3 lecture hours. 3 credits. This course builds a fundamental understanding of the unique chemical properties of materials with nanoscale dimensions and emphasizes the synthetic chemistry encountered in nanotechnology. The course starts from a description of crystallization and growth models and concludes with discussion of several different synthetic approaches of nanoscale systems.

NANO 650  Experimental Techniques in Nanoscience I 1.5 credits
Semester course; 1.5 lecture hours. 1.5 credits. The course will focus on a variety of instrumental methods and techniques commonly applied to the characterization of nanomaterials. Particular attention will be placed on the theory behind the measurements, instrument safety, sample preparation and data analysis/interpretation. Topics will focus on X-ray, optical and electron characterization techniques.

NANO 651  Experimental Techniques in Nanoscience II 1.5 credits
Semester course; 1.5 lecture hours. 1.5 credits. The course will focus on a variety of instrumental methods and techniques commonly applied to the characterization of nanomaterials. Particular attention will be placed on the theory behind the measurements, instrument safety, sample preparation and data analysis/interpretation. Topics will cover morphological and physical properties characterization tools.

NANO 661  Computational Nanoscience 3 credits
Semester course; 3 lecture hours. 3 credits. Open only to students admitted to the Nanoscience and Nanotechnology Ph.D. program. Introduction to computational methods used to model true nanostructures containing more than 10<sup>5</sup> atoms and whose assembly, morphology and properties are governed by noncovalent interactions. Structural and dynamic aspects of the computational methods will be covered throughout the course. Applications to nanotechnology and environmental cleanup will be covered through special topics assignments during the semester and discussed by the end of the course.

*Particle generation and formulation engineering: example of elective didactic courses in the Concentration area of Reactions and formulation engineering*

CLSE 675  Polymers in Medicine 3 credits
Semester course; 3 lecture hours. 3 credits. This course is based on the need for integration of engineering and materials science of polymers with applications in life science engineering. Basic principles of polymer science including structural concepts at the molecular-, nano-, micro- and macro-scales are emphasized so that the student can understand structure/function correlation. The course treats polymer synthesis, molecular weight, morphology and surface science at an introductory level, but quantitative correlations are emphasized. Surface science is emphasized, as medical applications are often dependent on the interaction of a solid polymer with an in vivo environment (tissue,
blood, membrane). The polymers chosen for emphasis include polyethylene (hip, knee replacement), poly (vinyl chloride) (blood bags, catheters), polyurethanes (artificial heart, wound care) and silicones (implants, catheters). The use of polymers in drug delivery applications is explored, including osmotic-pressure-driven drug delivery. Concepts surrounding polymeric surface modifiers are developed, including applications such as enhanced biodurability and biocidal function.

CLSE 650   Quantitative Analysis in CLSE  3 credits
Semester course; 3 lecture hours. 3 credits. An understanding of the quantitative descriptions of chemical and biological processes is required for engineering analysis, including prediction and design. Analytical approaches are necessary to simplify and provide limits of complex behavior. These approaches include perturbation theory and scaling, density functional formulations, control theory, and stability theory. This course represents the applied mathematical foundations on equilibrium and nonequilibrium analysis of chemical and biological systems.

CLSE 562   Advanced Systems Biology Engineering  3 credits
Semester course; 3 lecture hours. 3 credits. The system-level properties of biology will be surveyed to understand how DNA leads to cellular behavior through complex molecular interactions. Theoretical and experimental concepts associated with high-throughput data (genomics, transcriptomics, metabolomics, fluxomics, and proteomics), cellular regulation and computational modeling will be introduced. Bioinformatics analysis, integration of data and current challenges are discussed.

CLSE 563   Metabolic Engineering  3 credits
Semester course; 3 lecture hours. 3 credits. The principles and methods used in metabolic engineering of microbes will be covered. Theoretical and experimental concepts associated with metabolite production, strain design, strain construction and strain characterization will be introduced. Design principles, metabolic engineering challenges, metabolic engineering applications and ethical considerations of genomic alterations are discussed.

CLSE 544   Applied Transport Phenomena  3 credits
Semester course; 3 lecture hours. 3 credits. Provides the basis for analyzing mass, energy and momentum transport issues in environmental, chemical, biological and industrial processes. Molecular mechanisms of momentum transport, energy transport and mass diffusion are utilized to develop an engineering analysis of a given process. This molecular approach is complemented with macroscopic mass, momentum and mechanical energy balances.

CHEM 632   Chemometrics  1.5 credits
Modular course; 3 lecture hours. 1.5 credits per module. Computer methods for experimental design and data analysis of spectroscopic, electrochemical and chromatograph data. Topics include sampling theory, detection limits, curve resolution, Fourier transform-based instruments and factor analysis.
CHEM 633  Mass Spectrometry  1.5 credits
Modular course; 3 lecture hours. 1.5 credits per module. Topics include mass spectrometry ionization methods, mass analyzers, theory and applications for ion structure determination.

PCFU 507  Pharmacuetics and Biopharmaceutics I  3 credits
Semester course; 3 lecture hours. 3 credits. Designed to describe the physico-chemical and biopharmaceutical principles fundamental to the development of pharmaceutical dosage forms. Topics will include pharmaceutical calculations, solid-state properties, solubility, partitioning, solution properties, disperse systems, micromeritics, diffusion, dissolution and release rates, drug and dosage form stability and degradation, pharmaceutical manufacture, and compounding.

PCFU 509  Pharmacuetics and Biopharmaceutics II  3 credits
Semester course; 3 lecture hours. 3 credits. Designed to describe the biopharmaceutical principles fundamental to the development of pharmaceutical dosage forms, including parenteral products, solutions, disperse systems, semisolids, solids and novel drug delivery systems. The formulation, manufacture, control, biopharmaceutics and relevant patient-pharmacist interactions of the major dosage forms will be addressed and presented by route of administration.

Additional Elective Options
The Pharmaceutical Engineering Ph.D. program is built to encourage students to develop the skills needed to add economic value to the Commonwealth of Virginia, and to be leaders of innovation in their chosen area of work. As such the program offers the opportunity to take elective courses to prepare students to leverage their scientific training with education in business acumen in the form of entrepreneurship. Below are listed the courses that may be used as electives in this area of study, including lower level courses that may be needed to engage scientist in the area and have required prerequisites to attend higher level management classes – classes at 300 and 400 level, however, will not count towards the degree.

MGMT 321  Survey of Entrepreneurship  3 credits
NOTE: may be taken/required as pre-req for MGMT655 depending on level of student, but will not count towards total elective credits.
Semester course; 3 lecture hours. 3 credits. Underlying concepts in entrepreneurship; the importance of entrepreneurs and the problems they face; entrepreneur characteristics and competencies; what makes an idea entrepreneurial; managing relations, ethics and sustainability; opportunity recognition, critical thinking and emphasis on innovative concept development; detailed concept feasibility analysis.

MGMT 423  Social Entrepreneurship  3 credits
NOTE: may be taken/required as pre-req for MGMT655 depending on level of student, but will not count towards total elective credits.
Semester course; 3 lecture hours. 3 credits. Restricted to students who have completed at least 54 credit hours (junior standing). An advanced management course in promoting societal good through entrepreneurial activities. Students will learn the various forms of
entrepreneurship that benefit society, developing an understanding of the many contexts in which such entrepreneurship occurs and its impact on society. Students will identify issues of societal/environmental marginalization, ideate potential solutions, generate in-depth research relevant to course projects and take part in presentations regarding their findings and the development of a socially conscious venture.

MGMT 435 New Venture Strategy and Initiation 3 credits
NOTE: may be taken/required as pre-req for MGMT655 depending on level of student, but will not count towards total elective credits. Continuous courses; 3 lecture hours. 3-3 credits. First semester: provides students with an integrated strategic analysis of entrepreneurial firms and how they establish competitive advantage. Second semester: engages students in intensive development of a comprehensive business plan using knowledge and skills from MGMT 435.

MGMT 436 New Venture Strategy and Initiation 3 credits
NOTE: may be taken/required as pre-req for MGMT655 depending on level of student, but will not count towards total elective credits. Continuous courses; 3 lecture hours. 3-3 credits. First semester: provides students with an integrated strategic analysis of entrepreneurial firms and how they establish competitive advantage. Second semester: engages students in intensive development of a comprehensive business plan using knowledge and skills from MGMT 435. Students should take MGMT 436 immediately following MGMT 435.

MGMT655 Entrepreneurship 3 credits
Semester course; 3 lecture hours. 3 credits. Individual and corporate entrepreneurship in high and low technology enterprises. Develops an understanding of the role of entrepreneurship in management theories and practices. Students will develop comprehensive venture analysis plans for presentation.

Seminar
There is a total of 3 credit hours of required seminar in Pharmaceutical Engineering. Except for the first year, students will register for 1 credit hour of seminar per year (two semesters = 1 cr). The seminars will be a combination of research seminars, where nationally and internationally recognized researchers in the area of Pharmaceutical Engineering and Sciences will be speaking, as well as student presentations. All students are expected to use this forum to present their progress (towards their dissertation) in the form of an oral presentation. This presentation, delivered upon approval by the research advisor, will take place every year, starting in year #02 with a literature review and proposed plan of work; followed by research seminar on year #3 and final seminar on year #04 which may or may not be the dissertation presentation.

The seminar series helps achieve our learning outcomes, including the identification of key problems in the health care field as it pertains to pharmaceutical engineering and to develop strong communication skills to disseminate scientific knowledge and understand the need for
lifelong learning. Special seminars on entrepreneurship will also help students hone such professional skills and motivate them to engage in this area. Seminar is on a pass or fail grading scale

Requirements and Procedures
Major degree requirements are detailed below.

Typical time line with respect to requirements – example for full time students entering with a B.S. degree

Year #01
Fall semester
- Have identified research advisor before arriving
- Upon arrival, select research area course sequence and electives with advisor
- Start development of original research
- Appoint student advisory committee

Spring semester
- Finish core didactic classes
- Continue development of original research
- Take written/oral qualifying examination

Year #02
Fall semester
- Finish concentration requirements
- Continue development of original research

Spring semester
- Finish elective class sequence
- Continue development of original research
- Admission to candidacy; i.e., have passed qualifying exam, pass comprehensive exams, which include: (i) written proposal and (ii) oral defense of that proposal

Year #03
Fall semester
- Continue development of original research

Spring semester
- Continue development of original research

Year #04
Fall semester
- Continue development of original research

Spring/summer semesters
- Prepare dissertation and deliver final oral defense
Degree Requirements
General information

• All full-time graduate students are expected to register for a minimum of 9 hours of graduate credits per fall/spring semester and three hours in the summer. Registration to no more than 1 credit is required for the semester in which the student has applied for graduation.

• Most of the credits required in the student’s program must be those designated as exclusively for graduate students — that is, those at the 600 level or above. A maximum of 6 credits can be used for courses with a designation 500 or above, excluding any pre-required courses the students may need to take in pharmaceutical engineering.

• Graduate students are required to remain in good academic standing through the course of their degree program. Unsatisfactory student performance includes:
  o The assignment of a grade of "U" or "D" or "F" in any course
  o Failure to maintain a cumulative Grade Point Average of at least 3.0
  o More than 6 semester hours or 20% of didactic credits, whichever is greater, attempted at a "C" grade or below
  o Failure to pass the written or oral comprehensive examination
  o Lack of progress or failure to pass the final examination
  o Failure to fulfill teaching assistant or research assistant duties
  o Failure to comply with minimum professional standards of conduct

• A student whose performance is unsatisfactory must successfully petition the dean of the Graduate School to continue in the graduate program. Unsatisfactory performance also constitutes grounds for the termination of financial assistance to the student.

• Graduate students may not take the qualifying examination or the comprehensive examination (written proposal or oral exam) for the Ph.D. candidacy if their overall GPA is less than 3.0. Students may not take the final oral examination (thesis/dissertation defense) for the Ph.D. degree if their overall GPA is below 3.0. The student’s Advisory Committee is the examining body for the administration of the qualifying examination, comprehensive examinations and the final examination.

In addition to these requirements, students should also fulfill the requirements set forth by the university.

Advisor and advisory committee
The student’s advisor and advisory committee
The student’s research advisor holds the primary responsibility for providing the appropriate guidance and counsel essential to the scholarly development of the student. An Advisory Committee is appointed shortly after the permanent advisor is selected and approved, and serves as both an examining and consultative body. The Advisory Committee functions as a source of counsel and assists in the development of the student. Each student shall have an advisor and an Advisory Committee. The advisor should complete the Graduate Student Advisory Committee and Course Plan Form and upon completion, the student should distribute copies to all graduate committee members and the directors for Pharmaceutical Engineering.
Selection of Major Research Advisor ("Advisor")

In general, students will be admitted to the PhD program in Pharmaceutical Engineering upon selection by graduate faculty who is willing to serve as their major research advisor. In the event of admission without advisor assignment, students meet with all eligible graduate faculty and then select their advisor upon faculty’s agreement by the end of their first semester. It is the student responsibility to make sure they fulfill all requirements for graduation in a timely manner, including selecting appropriate classes in consultation with their advisors, completing all requirements for PhD candidacy by the end of the second year, and maintaining good academic standing. If not compliant, the student has one semester to satisfy all the requirements. If after the additional semester the student is not compliant then the student may be subject to being removed from the program for non-compliance.

Duties of the Advisor

- The advisor shall, with the Student Advisory Committee, have responsibility for guiding the student's academic and research program.
- The advisor shall develop a course plan for student's didactic program. The proposed program should be filed with the directors of the Pharmaceutical Engineering Program no later than the end of the first semester of study, and no less than 12 months prior to Ph.D. candidacy.
- The advisor shall, on the basis of the proposed didactic and scholarly program for the student, identify members of the faculty to comprise the Student Advisory Committee and elicit their agreement to serve.
- The advisor shall supervise the student's research work, publication of their work in peer reviewed journals, and thesis preparation, and will chair the examining committee for the students' qualifying exam, comprehensive exam, and defense of their dissertation (Ph.D.)
- The Advisor shall collect necessary information on the student’s performance so that progress can be evaluated on an annual basis.

The Graduate Student Advisory Committee ("Advisory Committee")

- Composition – The composition of the Graduate Student Advisory Committee should include in its membership individuals having a broad level of relevant scientific expertise and experience in advanced degree education and should comply with VCU Graduate School rules.
- Appointment – The Student Advisory Committee shall be appointed no later than the end of the first semester of study after matriculation, and no less than 12 months prior to Ph.D. candidacy. Appointment of the Student Advisory Committee must be done prior to the administration of any part of the qualifying and comprehensive examinations. The composition of the Advisory Committee shall be such that significant areas of the student's scholarly program are represented in the expertise of the faculty members.
- The committee for the Ph.D. candidate shall consist of a minimum of five members as follows: the student's Advisor (who serves as Chair of the Committee); at least three other members of the graduate faculty of the Pharmaceutical Engineering program, and at least one other member of the graduate faculty from programs other than Pharmaceutical Engineering.
- A faculty member who is not a member of the graduate faculty may be appointed to a Student Advisory Committee after nomination by student’s advisor, appointment to
affiliate graduate faculty by the one of the Deans (Pharmacy or Engineering) and the Dean for Graduate School at VCU, and with notification of the directors of Pharmaceutical Engineering Program.

- The student’s advisor submits a completed Graduate Student Advisory Committee and Course Plan Form to the directors of the Pharmaceutical Engineering Program. Appointment of the Advisory Committee is effected upon approval by the directors of the Pharmaceutical Engineering Program.
- Should changes/additions to the Advisory Committee become necessary, a revised form must be submitted for approval by the directors of the Pharmaceutical Engineering Ph.D. program.

**Duties of the Student Advisory Committee.**

- The Student Advisory Committee shall work with the student's advisor in guiding the student's graduate program and must meet formally at least annually to ensure timely progress toward degree completion.
- The Student Advisory Committee will also serve as a consultative body to provide scholarly counsel. The body of experimental work to be incorporated into the dissertation is subject to approval of the membership of the Student Advisory Committee. The faculty advisor and the student have the responsibility to advise when the meeting of the Advisory Committee should take place, and it is the student’s responsibility to schedule an appropriate time for this meeting with their committee members.
- The Student Advisory Committee shall conduct the qualifying exam, comprehensive (candidacy) exams and Final Oral Defense examinations.

**Progress and Completion of the Degree**

**Execution of Research**

- Each student must conduct an original investigation under the supervision of the permanent advisor, prepare a dissertation/thesis reporting the results of this research and an analysis of its significance in relation to existing scientific knowledge. This study is reported first in peer-reviewed work (at least submitted) and then in a dissertation prepared in acceptable form and style.
- The nature of scholarship is such that the role of the faculty advisor is particularly critical in providing guidance in the identification of a suitable area of investigation and the progressive accumulation of data, which constitute the body of the dissertation. In order to ensure that appropriate progress in the maturation of the student as a professional is achieved, continuing communication between the student and faculty advisor is essential. It is in the best interest of the student that the expectations of the faculty advisor be fully understood and discussed as appropriate, including expected number and impact of peer-reviewed publications before graduation. The student has the obligation to gain an understanding of what will be regarded by the faculty advisor as a satisfactory standard of accomplishment.
- A minimum of two peer-reviewed publications are required for graduation, with a minimum status of one accepted and one submitted. A maximum of one of these may be a review article.
- The body of experimental work to be incorporated into the dissertation is subject to the approval of the Student Advisory Committee members. The Advisory Committee should,
therefore, be formally consulted as the research project nears completion to ensure that there is agreement with respect to the material deemed necessary and sufficient for incorporation into the thesis. Such consultation will normally occur in the form of meetings of the Advisory Committee with the student. The dissertation is prepared in an acceptable form and style with the counsel of the Faculty Advisor and university guidelines.

The formal structure of advanced degree programs provides a basis for ensuring that the standards of performance are maintained and that students are treated equitably while engaged in training that develops an appropriate level of professional rigor and accomplishment. At least once a year a performance assessment will be communicated to the student by the advisor, with notification to the directors of the Pharmaceutical Engineering Program, in writing. Such written assessment may include areas of concern with respect to the timely development of the student in the program, which warrant particular attention and the actions the student must take to remedy deficiencies if they wish to remain in the program and retain funding. Students are awarded a grade for research activity by the faculty advisor in each semester. A grade other than "satisfactory" is a matter of serious concern and requires review and possible action that may lead to dismissal.

**Execution of Other Duties**

- **Coursework** – A minimum GPA of 3.0 is required for promotion in the program. Failure to maintain at least a 3.0 will automatically result in probation. Failure to raise the GPA to the minimum by the end of the next semester will result in termination from the program; readmission will occur only upon approval of department graduate faculty.
- **Teaching Responsibilities** - All students are required to perform some teaching (One semester of teaching, as defined by the Pharmaceutical Engineering program, is the required minimum). The teaching responsibilities must be completed and documented to a satisfactory level. Failure to do so, as indicated by the respective course coordinator, will automatically result in probation. Students receiving probation must teach at least one more semester and receive a satisfactory report from their teaching supervisor, or termination from the program will result. Examples of unsatisfactory teaching performance can result from failure to appear at scheduled times without prior approval, for the absence, failure to fulfill duties as specified by the teaching supervisor, or unprofessional conduct exhibited during teaching duties. Documentation of teaching duties must be submitted to the graduate coordinator prior to the Final Oral Defense.
- **Professional Conduct** – Any action by a graduate student in a program considered to be unprofessional conduct shall constitute cause for disciplinary action, including possible probation, expulsion or loss of funding. Students are expected to follow VCU code of conduct. [http://www.president.vcu.edu/behavior/](http://www.president.vcu.edu/behavior/)

**Admission to Candidacy**

- The development of the individual as an independent research scientist is a critical component of the Ph.D. degree. The potential for such development is assessed on the basis of both mastery of subject matter and research competency as judged in the context of written and oral examinations administered at the level of the program. Students are admitted to candidacy on the basis of completing required coursework and examinations
as required and the recommendation of the faculty advisor, Student Advisory Committee and the director for Pharmaceutical Engineering. Advancement to candidacy should take place prior to initiating the third academic year in the program.

Degree Candidacy Review

Doctoral students undergo review when they pass their qualifying exam and comprehensive exam (see below), which consists in a written component and oral presentation component.

- Qualifying Examination- The qualifying exam consists in a combined written/oral examination to be taken before the beginning of their second year in the program, and after clearing their pre-requisite sequence, didactic core sequence and laboratories. A majority “pass” from the Advisory Dissertation Committee is required for the student to advance. In case the student is not successful in the first iteration, a second examination with the same format will be automatically scheduled for the end of the following semester. Failing a second attempt will result in removal from the program unless extenuating circumstances, in which case approval from the research advisor and the program directors will be required for defining an alternate course of action.
  - The written qualifying examination will consist of questions related to those pre-requisite, core classes and laboratory work. They will be prepared by faculty involved with teaching of those classes and will be open-ended or specific questions, with the format (open book or closed book and time allowed to solve the problems) to be determined by the faculty preparing the questions.
  - The oral qualifying examination, which will be executed by the Student’s Advisory Committee, includes defending the answers to the written examination in the presence of the Advisory Committee. The members of the Advisory Committee can further inquire the student in areas related to the questions (see above) and answers will count towards the examination grade (pass/fail).

- Written Comprehensive Exam – Comprehensive exams are administered to the Ph.D. students based on research proposals. The proposal should be written by the students followed by an “oral” presentation (defense of proposal). The research proposal should be in an R21 (NIH) format – exactly, including budget and other requirements. The topic of the proposal must be related to the student’s doctoral dissertation project and agreed upon with the graduate advisor, particularly the aims of the proposal. The student Advisory Committee will evaluate the written proposal and will grade on pass/fail.

- Oral Comprehensive Exam – After passing the written examination(s), the student is eligible for the oral examination. The oral examination is conducted by the Student Advisory Committee and is chaired by the student’s major advisor. The oral examination is administered to assess the ability of the candidate to integrate information and display an appropriate mastery of problem-solving capabilities. This is to be a defense of their written exam, and can include questions related to general concepts in Pharmaceutical Engineering as well as those pertaining to the proposed work.

- Time line – The oral examination must be completed successfully at least six months before submission of the dissertation, but no later than the end of second year of the program.

- Attendance – The oral comprehensive examination is open to all members of the faculty. If a committee member knows in advance that they will be unable to attend the
examination, a substitute can be obtained with the prior approval of the directors of the Pharmaceutical Engineering Program.

- Oral Exam Format – Faculty members in attendance may ask questions of the candidate. Their questions should be presented and then non-committee members should be excused. The Advisory Committee then asks questions. Faculty members other than those on the examining committee shall not vote on the success or failure of the candidate.

- Voting (written and oral exam) – A favorable vote by the examining committee (all members of body being required to vote) with no more than one negative vote, is required to pass the examination. Members of the examining committee must vote on the performance as either pass or fail. The members of the examining committee must indicate the outcome of the exam by completing and submitting Oral Comprehensive Examination Form to the directors of the Pharmaceutical Engineering Program.

- Failure to pass Should the student fail the oral comprehensive examination, the examination may be retaken only on approval by the directors of the Pharmaceutical Engineering Program in consultation with the student’s Advisor. As a general guide, the re-examination, provided that approval is gained, should be administered within three months of the approval date. Only one re-examination is allowed.

**Final Oral Defense**

- **Final Oral Defense Preparation** The faculty advisor determines when the thesis or dissertation document can serve as the basis for the Final Oral Defense.

- **Notification** – With approval of the faculty advisor, copies of the dissertation consistent with University standards shall be provided to the members of the Student Advisory Committee ten (10) working days or more before the date of the defense of the dissertation. Receipt of the dissertation is indicated by the signature of the Advisory Committee members on the Notice of Final Oral Defense form. Signature of the Advisory Committee members on the Notice of Final Oral Defense form is not an endorsement of the dissertation document. The Faculty Advisor has the responsibility of ensuring that the document is in a form that can adequately provide a basis for the defense.

- **Following acceptance of the dissertation defense schedule by the committee, the student must submit a copy of the dissertation and a request for scheduling of the final examination to the directors of the Pharmaceutical Engineering Graduate Program a minimum of ten (10) working days in advance of the examination date.**

- **Exam Format and Attendance** – The Final Oral Defense examination is open to all members of the faculty. If a committee member knows in advance that they will be unable to attend the examination, that member should be replaced by submitting a revised Course Plan for approval to the directors of the Pharmaceutical Engineering program. Faculty members in attendance may ask questions to the candidate. All but the Advisory Committee members are then invited to leave the room. The Advisory Committee will then ask questions. Faculty members other than those on the examining committee shall not vote on the success or failure of the candidate.

- **Voting** – A favorable vote by the examining committee (all members of body being required to vote) with no more than one negative vote, is required to pass the examination. All members of the examining committee must vote on the performance as
either pass or fail. After passing the final examination, Committee members must complete the Dissertation Defense Form, which the Committee Chair then submits to the directors of the Pharmaceutical Engineering Program. This form is NOT the signature page that must appear in the final version of the thesis or dissertation. At this stage the Advisory Committee has NOT approved the document as final but only that the candidate has completed an examination on the content of the document.

- Failure to Pass – If the outcome is negative, the Final Oral Defense may be retaken with the approval of the directors of the Pharmaceutical Engineering Program.

Completion

- Graduation Application – In the normal course of the development of the thesis/dissertation project, the student’s advisor will indicate to the student a point in time when the project has reached sufficient maturity that the writing of the thesis/dissertation should be initiated. At this point the candidate should complete and file the Graduation Application on-line (http://www.vcu.edu/enroll/forms/graduation/), which indicates an anticipated completion date. An email is sent to all students at the beginning of each semester detailing the procedures and timelines for students expected to graduate in that semester. The student should consult the School and university calendars for deadline dates for completion of each part of the graduation application. This form must be co-signed by the faculty advisor, and the directors of the Pharmaceutical Engineering program.

- Writing the Dissertation – Students routinely underestimate the time required to complete the writing of the dissertation document and the creation of a version conforming to the University policy. As the process of creating the document is initiated, a copy of the VCU Thesis Manual should be consulted for guidance. Copies of the manual are available on the University web site: http://www.graduate.vcu.edu/community/thesis.html.

- Format – The student should correctly format the thesis/dissertation using the library’s electronic thesis and dissertation online submission and template (http://www.graduate.vcu.edu/community/thesis.html). Current policy affords considerable flexibility in the format of the document but certain requirements, particularly those describing page margins, MUST be followed. Candidates should consult with the directors of the Pharmaceutical Engineering program to ensure that an acceptable format is being followed in the creation of the document when the on-line template cannot be used.

- Completion of Dissertation – The Student Advisory Committee approves the thesis document as acceptable after the Final Oral Defense has been successfully completed. Corrections or modifications of the dissertation document may be requested by the Advisory Committee. Approval of the dissertation as acceptable is indicated by the signature of all members of the Advisory Committee on the Signature Page of the thesis (available at: http://www.pharmacy.vcu.edu/sub/current/studentres.aspx). Approval of the dissertation by the Advisory Committee must be unanimous. Two original signed copies of the Signature Page should be obtained by the student. A complete copy of the dissertation, along with the Signature Page, is then submitted to the directors of the Pharmaceutical Engineering Program for signature by the Deans (School of Pharmacy and Engineering), and the Dean of the Graduate School.
• In order to facilitate communication of results after graduation, the dissertation should be in a form that can easily be converted to a publication. It is the responsibility of the student and faculty advisor to ensure this is the case.
• Submission of the dissertation document should be done on-line (http://www.graduate.vcu.edu/community/thesis.html), along with submission of hard-copies as required by the program. The following forms are also to be delivered to the library when the dissertation is submitted: the completed Signature Page, the Survey of Earned Doctorate form (can be obtained from the Director of the Pharmaceutical Sciences Graduate Program or Graduate School) and the University Microfilm International Agreement Form obtained on-line at http://www.library.vcu.edu/services/binding.html. For those submitting in print, the Libraries requires a Special Collections Agreement Form, also found at http://www.library.vcu.edu/services/binding.html

Student Retention and Continuation Plan

Each student will have a faculty advisor assigned before the start of the program or soon after entry to the program to help guide them through their degree. The advisor will monitor student performance and assist students as needed in accessing the resources they require to complete the program, including but not limited to tutoring, time management and coordination of resources across campus. Students will create yearly objectives in consultation their advisor. At the end of each year the student will provide a written self-assessment and the faculty advisor will also provide a written assessment. Both the self-assessment and the advisor review will be submitted to the directors of the Pharmaceutical Engineering Program.

The Student’s Advisory Committee will compile the faculty review, the self-assessment, and any other relevant information such as progress against the curriculum requirements, and assess the student progress as “Satisfactory” or “Unsatisfactory.” The Student’s Advisory Committee and faculty advisor will work together to suggest ways to ensure continued success, or to address any areas of concern.

Once constituted, the student will meet with their Student’s Advisory Committee no less than once a year to monitor progress and recommend any additional or remedial actions. The student will meet with their research advisor on a mutually agreeable schedule, but not less than once per month to assess progress. These meetings will also help ensure the student’s research is focused and the student is making progress towards their final thesis.

In addition, in years two and beyond, students will be required to give an annual formal oral presentation on their research open to all faculty members, postdoctoral scientists and graduate students.

Each student supported by VCU or non-VCU funds will be paid a stipend commensurate with the VCU guidelines to allow them to focus on their graduate studies. Supported students are highly discouraged to work outside VCU while pursuing their PhD degree and should dedicate all their efforts towards completing their course work and dissertation. For the final two years this
stipend will be supported through non-VCU funds or through VCU funding via the laboratory in which they are carrying out their research. This will allow the student to focus on their graduate program and promote retention of students where finances may be an issue. Thesis advisors must provide evidence that they can financially support the research component of their student's degree program.

The program will promote the formation of Student’s Advisory Committee and of activities whereby both faculty and students engage in professional, cultural and other activities to help integrate and retain students.

Faculty

The proposed program brings together tenure-track faculty from 6 departments (Biomedical Engineering, Chemistry, Chemical and Life Science Engineering, Pharmaceutics, Mechanical and Nuclear Engineering and Medicinal Chemistry) spanning two schools and a college at Virginia Commonwealth University: the School of Engineering, the School of Pharmacy, and the College of Humanities & Sciences. As the program grows, we expect to include faculty from other departments across campus including the School of Medicine.

There are six existing core faculty who will deliver the new pharmaceutical engineering coursework. All faculty are full time members of the School of Engineering or School of Pharmacy. The faculty range from full professors with over twenty years of experience in fields related to pharmaceutical engineering to assistant professors beginning their own independent research careers. All faculty have a Ph.D. degree. As part of this proposal there will be an additional six new faculty hires at the Ph.D. level (four are budgeted and being recruited at this time – two positions for the School of Engineering, and two for the School of Pharmacy and an additional two further hires requested in the budget plans for this proposal submitted and approved by VCU.) Those new faculty will also contribute to the pharmaceutical engineering coursework, student mentorship and research.

There are additional faculty who are committed to participating in this program as research mentors. Their expertise fits the scope and focus of the degree program. The faculty are members of the VCU School of Engineering, VCU School of Pharmacy, and VCU College of Humanities and Sciences. They have been selected based on their specific interests in Pharmaceutical Engineering. Appendix D presents abbreviated curriculum vitae for the faculty delivering the core curriculum for the program; Appendix D presents abbreviated curriculum vitae for faculty delivering research area and elective courses. Appendix F summarizes faculty research that is funded.

Graduate teaching assistants will be utilized in the resourcing of the didactic laboratory classes, CPES 606 and CPES 609 and other classes, as well as being involved in research experiences in Pharmaceutical Engineering. Expected duties will include laboratory and instrument maintenance, consumable ordering, and assisting students during the lab. The graduate teaching assistant must have successfully completed the courses in a previous year and demonstrated excellence in laboratory practice.
The program will be led jointly by Drs. Roper and da Rocha, who both hold full-time faculty appointments at VCU. The program will be administered and delivered from VCU Main Campus, and the Virginia Biotechnology Science Park. The VCU campus is split into the Monroe Park Campus and Medical Center Campus where participating faculty are located.

**Program Administration**

The program will be administered by the directors of the Pharmaceutical Engineering Program at VCU. They will devote 0.25 FTE each of their time to manage day-to-day operations as the program is being established, and then activities for program maintenance, including curriculum, and student management, establishment and enforcement of policies, requirements and procedures, and program evaluation and reporting. They will also be responsible for teaching assignments for didactic and laboratory classes, and any evaluation of teaching of faculty and teaching assistants that contribute to the program. Reporting, with a formal written document to be put together on an annual basis, will be directly to the Deans of both Pharmacy and Engineering. The co-directors will be supported by a 1.0FTE administrative assistant position to perform those activities.

A committee consisting of faculty (VCU and outside), and members of the private sector and government will be formed to serve in the Pharmaceutical Engineering Review Board, which will serve to provide input in all areas related to the program, and will help catalyze efforts related to self-improvement in terms of curriculum, student experience, student placement and impact of the program to the Commonwealth and beyond. Bi-annual meetings with the program faculty and administrative stakeholders, including the Dean of the School of Pharmacy and Engineering, will serve to guide self-assessment exercises, with outcomes and assessments to be included in the annual report to the Deans.

**Student Assessment**

At VCU, all degree programs are mandated by university policy to maintain a plan for assessing student learning outcomes. This plan includes the identification of program level student learning outcomes; direct and indirect methods for assessing the degree to which students are achieving the expected outcomes; and procedural and logistical plans for administering the assessments, analyzing the findings, and using the information to improve student learning. All degree programs report annually the assessment findings and plans for using the findings in a centralized assessment data management system.

The plan for assessing student learning in the Pharmaceutical Engineering Ph.D. program is framed by the graduate school goals for both the School of Engineering’s and the School of Pharmacy which are presented below. The goals for the Pharmaceutical Engineering Ph.D. degree derive from these important areas and reflect the translational nature of the program. Following this are four tables that illustrate the alignment of program goals to learning outcomes; learning outcomes to curriculum; learning outcomes to assessments; and assessments to targets.

**Goals for VCU School of Engineering Graduate Students**

The VCU School of Engineering offers instruction and experiential learning in three categories: core competency areas, topical areas of specialization, and interdisciplinary research. This
education will prepare students with the technical and business skills to
- provide a significant impact to Virginia's and the nation's industries and businesses;
- extend the boundaries of knowledge through critical thinking, problem solving, research and scholarship;
- aid in the advancement and application of engineering knowledge.

Goals for VCU School of Pharmacy Graduate Students
The mission of the VCU School of Pharmacy is to achieve excellence in professional and graduate programs through innovative education and leading-edge research. The VCU School of Pharmacy will graduate outstanding future pharmacists and scientists who will improve human health, foster exemplary research, and provide sustaining contributions to interprofessional patient care.
- provide students a quality education through rigorous and innovative academic programs that prepare students for careers in a 21st century global environment.
- provide innovative interprofessional education.
- engage students in high impact academic and extra-curricular experiences that expand learning and engage students in self-reflection.
- grow the next generation of researchers and scholars who will focus on the discovery of new knowledge and the advancement of clinical applications.
- increase the commercialization of intellectual property and university-based technologies to advance innovation and economic development.

Goals for Students and Learning Outcomes

Table 2 presents the program goals students and the expected learning outcomes for the proposed Pharmaceutical Engineering Ph.D. program.

Table 2: Pharmaceutical Engineering, Ph.D.: Program Goals for Students and Student Learning Outcomes

<table>
<thead>
<tr>
<th>Program Goals for Students</th>
<th>Expected Learning Outcomes</th>
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</table>
| The Pharmaceutical Engineering Ph. D. program will prepare students with a broad knowledge of pharmaceutical engineering and sciences as it applies to the development of pharmaceutical drug products. | Core Knowledge: Students will demonstrate the knowledge and understanding of core concepts and processes necessary for developing pharmaceutical drug products, including the following:  
  a. Stages of drug product development.  
  b. Engineering and science related to the synthesis, processing, and manufacturing and control of active pharmaceutical ingredients (APIs).  
  c. Engineering and formulation science of APIs into various dosage forms, including advanced drug formulation and delivery systems such as nanomedicines.  
  d. Advanced tools for the characterization of APIs and... |

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<table>
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<tr>
<th>The Pharmaceutical Engineering Ph.D. program will prepare students with a strong foundation of skills on which to build pharmaceutical research and development careers.</th>
<th>Solve Problems: Students will be able to identify and solve problems in healthcare that are relevant to pharmaceutical engineering.</th>
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<td>Innovate: Students will be able to develop entrepreneurial approaches to pharmaceutical engineering that may lead to innovation in the health care field.</td>
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<td></td>
<td>Scholarly Writing: Students will be able to demonstrate the ability to write for scholarly publications and research grants.</td>
</tr>
<tr>
<td>The Pharmaceutical Engineering Ph.D. program will prepare students with leadership skills for long-term career success.</td>
<td>Independent &amp; Collaborative: Students will be able to demonstrate the ability to carry out independent and collaborative work.</td>
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<td></td>
<td>Communicate Scientific Knowledge: Students will be able to communicate scientific knowledge and discoveries.</td>
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<tr>
<td></td>
<td>Teach &amp; Mentor: Students will be able to demonstrate the ability to teach and mentor.</td>
</tr>
<tr>
<td></td>
<td>Plan &amp; Execute Research: Students will be able to demonstrate the ability to plan and execute research projects.</td>
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<tr>
<td></td>
<td>Community Engagement: Students will be able to demonstrate that they understand and will participate in community engagement/outreach.</td>
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*Learning Outcomes and the Curriculum*

The curriculum for the Pharmaceutical Engineering Ph.D. program has been designed to provide students with learning opportunities to achieve the expected learning outcomes. Table 3 below illustrates this alignment, identifying the expected learning outcome and the element of the Pharmaceutical Engineering Ph.D. curriculum designed to foster the outcomes.

**Table 3: Learning Outcomes and Curricular Elements**

<table>
<thead>
<tr>
<th>Expected Learning Outcomes</th>
<th>Curricular Elements</th>
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<tr>
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<td>Core Concepts</td>
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<tr>
<td></td>
<td>• Core courses and laboratories performance</td>
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<td></td>
<td>• Written and Oral qualifying examinations</td>
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**Learning Outcomes and Assessments**

Each learning outcome will be assessed with a direct assessment of student performance. These assessments are embedded in the program requirements and procedures. Program requirements that will be used to assess student learning include the Written Comprehensive Exam, the Oral Comprehensive Exam, the Final Oral Defense, and the Dissertation, as well as written feedback from advisors, and course coordinators.

Performances will be assessed with rubrics for each of the learning outcomes. Rubrics identify key traits of the learning outcomes and performance scales for exceeding, meeting, and not meeting the expected learning. Indirect assessments will also be used, including course grades, professional publications, and participation in outreach activities. A summary of learning outcomes and assessments is shown in Table 4 below.
<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessments</th>
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<tbody>
<tr>
<td>Core Concepts</td>
<td>Direct assessments: written and oral qualifying examination, written&lt;br&gt;comprehensive exam, oral comprehensive exam, dissertation, dissertation defense&lt;br&gt;Indirect assessments: course grades in core courses</td>
</tr>
<tr>
<td>Solve Problems</td>
<td>Direct assessments: written and oral qualifying examination, written&lt;br&gt;comprehensive exam, oral comprehensive exam, dissertation, dissertation defense&lt;br&gt;Indirect assessments: course grades in directed research, publications, presentations at scientific meetings</td>
</tr>
<tr>
<td>Innovate</td>
<td>Direct assessments: written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense&lt;br&gt;Indirect assessments: publications, presentations at scientific meetings, invention disclosure notification filed</td>
</tr>
<tr>
<td>Scholarly Writing</td>
<td>Direct assessments: written qualifying examination, written&lt;br&gt;comprehensive exam, dissertation&lt;br&gt;Indirect assessments: publications, presentations at scientific meetings</td>
</tr>
<tr>
<td>Independent &amp; Collaborative</td>
<td>Direct assessments: written feedback from advisor on directed&lt;br&gt;research&lt;br&gt;Indirect assessments: publications, presentations at scientific meetings</td>
</tr>
<tr>
<td>Communicate Scientific Knowledge</td>
<td>Direct assessments: written and oral qualifying examination, written&lt;br&gt;comprehensive exam, oral comprehensive exam, dissertation, dissertation defense, pharmaceutical engineering seminars&lt;br&gt;Indirect assessments: publications, presentations at scientific meetings</td>
</tr>
<tr>
<td>Teach &amp; Mentor</td>
<td>Direct assessments: Course coordinator's observation and written&lt;br&gt;feedback</td>
</tr>
<tr>
<td>Plan &amp; Execute Research</td>
<td>Direct assessments: written feedback from advisor on directed&lt;br&gt;research: written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense, grant proposals submitted</td>
</tr>
<tr>
<td>Community Engagement</td>
<td>Indirect assessments: publications, presentations at scientific meetings</td>
</tr>
<tr>
<td>-----------------------</td>
<td>--------------------------------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>Direct assessments: written feedback from VCU community engagement project coordinator OR written feedback from community engagement representative</td>
</tr>
</tbody>
</table>

**Learning Outcomes and Performance Targets**

In Table 5 the performance target for each of the assessments is summarized.

**Table 5: Assessments and Performance Targets**

<table>
<thead>
<tr>
<th>Learning Outcomes</th>
<th>Assessments</th>
<th>Performance Targets</th>
</tr>
</thead>
</table>
| Core Concepts     | Direct assessments: written and oral qualifying examination, written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense | • 90% of students will meet or exceed criteria on qualifying exams  
|                   | Indirect assessments: course grades in core courses                         | • 90% of students will have at least a 3.0 GPA                  |
| Solve Problems    | Direct assessments: written and oral qualifying examination, written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense | • 90% of students will meet or exceed criteria on qualifying exams  
|                   | Indirect assessments: course grades in directed research (CPES 690), publications, presentations presented at scientific meetings | • 90% of students will achieve no less than a grade of satisfactory (S) in directed research  
|                   |                                                                             | • 100% of students will have an external presentation  
|                   |                                                                             | • 100% of students will have co-authored two external publications prior to graduation |
| Innovate | Direct assessments: written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense | • 90% of students will meet or exceed criteria on comprehensive exams.  
• 100% of students will meet or exceed criteria on dissertation and dissertation defense |
|---|---|---|
| | Indirect assessments: publications, presentations at scientific meetings, disclosure filed | • 100% of students will have an external presentation  
• 100% of students will have co-authored two external publications prior to graduation  
• 50% students will have an invention disclosure notification filed by the time they graduate |
| Scholarly Writing | Direct assessments: written qualifying examination, written comprehensive exam, dissertation | • 90% of students will meet or exceed criteria on the written qualifying exam  
• 90% of students will meet or exceed criteria on the written comprehensive exam  
• 100% of students will meet or exceed criteria on the written dissertation |
| | Indirect assessments: publications, presentations at scientific meetings | • 100% of students will have an external presentation  
• 100% of students will have co-authored two external publications prior to graduation |
| Independent & Collaborative | Direct assessments: Written feedback from advisor on directed research | • 100% of students will meet or exceed the advisors expectations for demonstrated independence and collaboration |
| | Indirect assessments: publications, presentations at scientific meetings | • 100% of students will have an external presentation  
• 100% of students will have co-authored two external publications prior to graduation |
| Communicate Scientific Knowledge | Direct assessments: written and oral qualifying examination, written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense, Pharmaceutical Engineering seminars | • 90% of students will meet or exceed criteria on the qualifying exams.  
• 90% of students will meet or exceed criteria on comprehensive exams.  
• 100% of students will meet or exceed criteria on dissertation and dissertation defense.  
• 90% of students will successfully complete the requirements of a research and literature based presentation in the seminar course. |
| Indirect assessments: publications, presentations at scientific meetings | • 100% of students will have an external presentation  
• 100% of students will have co-authored two external publications prior to graduation |
| Teach & Mentor | Direct assessments: Course coordinator's observation and review | • 100% of students will meet or exceed the expectations of the course coordinator as demonstrated in the written feedback. |
| Plan & Execute Research | Direct assessments: Written feedback from advisor on directed research: written comprehensive exam, oral comprehensive exam, dissertation, dissertation defense, grant proposal writing | • 90% of students will meet or exceed the expectations of the advisor as demonstrated by written feedback.  
• 90% of students will meet or exceed criteria on comprehensive exams.  
• 100% of students will meet or exceed criteria on dissertation and dissertation defense.  
• 90% students will have actively participated in external grant proposals sent by their advisors as measured by written feedback from the advisor. |
| Indirect assessments: Indirect assessments: Publications, presentations at scientific meetings | • 100% of students will have an external presentation  
• 100% of students will have co-authored two external publications prior to graduation |
| Community Engagement | Direct assessments: Written feedback from VCU community engagement project coordinator OR written feedback from community engagement representative | • 100% of students will have demonstrated a positive community impact as determined by written feedback from the VCU project coordinator OR the community engagement representative |

**Administration of the Assessment Plan**
The administration of direct assessments will be part of preparing for and conducting student qualifying examinations, comprehensive examination and dissertation defense. The rubric will be prepared and distributed by the program directors. The assessments will be kept on file at the office of the Pharmaceutical Engineering program directors. Direct assessments requirements for directed research, the pharmaceutical engineering seminar, the teaching/mentoring assessment, grant writing and the community service project will be prepared by the directors of the Pharmaceutical Engineering Ph.D. program and distributed to the relevant parties for feedback. This documentation will be returned to the program directors’ office and stored in the student file.

The administration of indirect measures will be coordinated by the office of the program directors. Metrics on publications and presentations will be captured in the students’ file as well as an overall program metric spreadsheet. The direct and indirect assessments will be used as part of the Pharmaceutical Engineering Ph.D. program yearly assessment (see “program assessment” section).

**Workplace Competencies and Employment Skills**
The program will train Ph.D. graduates for careers in the biotech, pharmaceutical or generic areas of industry. It will also prepare students for employment in regulatory authorities and academic instructional settings, as well as those innovators that are capable of engaging in entrepreneurial activities. It will address the growing demand for a new generation of researchers, trained in the cross-disciplinary and interdisciplinary science and engineering, who recognize the need for a team based approach to solving challenging problems that patients face, and who can be prepared to innovate on current problems, and define the key challenges for the future of the field.

Graduates entering the workforce will be able to:
- Act as content experts in their focus area of research e.g. engineering associated with active ingredient, particle control, formulation, drug delivery and their relationships to biopharmaceutics.
- Solve problems that manifest themselves in cross-discipline challenges, where Pharmaceutical Engineers can form a technical bridge across multiple functions.
- Build and lead research teams to identify new areas of innovation in the field
- Interact with scientists from across disciplines when solutions of an interdisciplinary nature are required for patient health
- Coach and mentor more junior staff members or students
• Effectively communicate and disseminate their research findings
• Propose novel areas of research and obtain internal or external funding as needed

**Program Assessment**

At the end of each course, students will complete course and instructor evaluations; and the course coordinator (and instructors) will complete course assessments, both administered by the Pharmaceutical Engineering Graduate Program Committee (PharmE-GPC). Based on these evaluations, the PharmE-GPC, alongside the course coordinator, will determine any changes to content or delivery mechanism that may be required to be made in subsequent years. Particular attention will be given to the new courses.

It is expected that more than 90% of students will pass these courses and the course and instructor evaluations are overall rated at least as "satisfactory". Should this standard not be met, a review will take place, regarding teaching and examination procedures. External advice may be sought in this review procedure.

The first formal internal assessment of the Pharmaceutical Engineering graduate program will take place when the first class of students complete all the required didactic courses, by the end of spring semester, first year of enrollment. It is expected that more than 90% of students in the program will perform at or above the satisfactory level, defined as having a cumulative grade point average of 3.0 or higher. Should this standard not be met, a PharmE-GPC review will take place, regarding student admission, course structure and administration, and teaching and examination procedures. External advice may be sought in this review procedure.

Performance of each student will be assessed annually by his/her Advisory Committee, with respect to the expectations in the previous “Student Assessment” section. It is expected that more than 90% of students will receive “satisfactory” in their evaluations and 90% will pass their Qualifying Exams. Should this standard not be met, a PharmE-GPC review will take place, regarding student admission, course structure and administration, teaching and examination procedures, as well as research project and laboratory procedures. External advice may be sought in this review procedure.

The program will also be assessed when students undergo their comprehensive exams and final dissertation defense. It is expected that more than 90% of students will successfully pass the comprehensive exams and defend their dissertations. Should this standard not be met, a PharmE-GPC review will take place, regarding student’s research project and laboratory procedures. External advice may be sought in this review procedure.

In addition, VCU evaluates all academic programs through two internal review mechanisms: the Academic Program Review (APR) and the Assessment Quality Review (AQR). The Pharmaceutical Engineering doctoral (Ph.D.) program will undergo these reviews according to the schedule established by the university.

The APR involves an intensive review of degree programs in an academic unit. Data are entered into the university’s online system called WEAVE (Write expected outcomes; Establish criteria
for success; Assess performance; View results; Effect improvement), a web-based software application used to manage student learning outcomes assessment for all degree programs. The program review process includes a self-study and evaluation that is multidimensional, an external review and an implementation of the action plan. The self-study serves the dual purposes of demonstrating accountability and improving performance.

Every three years, the program will participate in the AQR, an evidence-based self- and peer-review of 14 quality criteria of a degree or certificate program's assessment plan and practices. These 14 criteria are organized within five standards and three overarching values that provide the framework for high quality assessment of student learning.

- Values: Transparency, Integrity, Efficacy
- Standards: Mission Statement; Goals and Outcomes for Student Learning
- Curriculum Assessment Processes; Improving Student Learning

**Benchmarks of Success**

The following metrics that focus on the assessment of program outcomes and effectiveness will also be monitored:

The VCU Pharmaceutical Engineering Ph.D. program will attract and retain qualified students.
- Minimum of 20 applicants per year
- Minimum incoming GPA of 3.0

The VCU Pharmaceutical Engineering Ph.D. students will be nationally competitive in winning grant funding
- 90% of domestic students submitting a personal fellowship by their third year

The VCU Pharmaceutical Engineering Ph.D. program will encourage dissemination of student project findings.
- Publications co-authored by students - 90% of students publishing one or more journal papers in peer-reviewed journals within one year of graduation
- Presentations - 90% of students will have presented their research at one local and one international conference by their final year

The VCU Pharmaceutical Engineering Ph.D. program will encourage timely degree completion.
- 90% graduation rate within the four year time frame for the program
- 90% retention of students through to graduation

The VCU Pharmaceutical Engineering Ph.D. program graduates will find jobs or achieve career advancement in their specialty, or chosen field.
- 90% of graduates will enter the work force within six months of completing the degree in positions including post-doctoral research positions, academic faculty positions, positions in private companies and positions with government agencies.
Expansion of Existing Programs

This program is not an expansion of an existing program, certificate, option, track, major, or concentration.

Relationship to Existing Degree Programs

As discussed in previous sections the Pharmaceutical Engineering Ph.D. forms an integral part of VCU’s plans to become a leader in the area of health care education and research. In doing so the Schools of Engineering and Pharmacy are creating this novel program, which will be the first in the nation to specifically issue a Ph.D. in Pharmaceutical Engineering and the first to offer the unique collaboration between the two schools. It has been noted that the Pharmaceutical Engineering Ph.D. works in cooperation with several other programs, including the School of Pharmacy’s Pharmaceutical Sciences Ph.D. (concentrations in Medicinal Chemistry and Pharmacetics), the School of Engineering’s Biomedical Engineering, Ph.D. and the proposed Chemical and Life Science Engineering Ph.D. Together, in partnership and teamwork, the Pharmaceutical Engineering Ph.D. will provide an educational workflow that will make VCU a leader in pharmaceutical health care education and innovation. The program has been specifically designed to work in cooperation with these programs, yet maintain a distinct curriculum and culture.

An important aspect for improving health care and in particular, pharmaceuticals, is the multidisciplinary and translational nature of the field. The historical educational and organizational structures often result in challenges and lost opportunities that occur at the interface of functions. The Pharmaceutical Engineering Ph.D. program is specifically designed to provide students an educational experience that will prepare them to problem solve and innovate across the pharmaceutical and health care areas. In order to achieve this, students must necessarily develop breadth of understanding across a number of fields that will allow them to become effective innovators and leaders. The proposed Ph.D. program has been designed to both work in cooperation, and be distinctive from other VCU degree programs, such as the Pharmaceutical Sciences and proposed CLSE Ph.D. programs.

In order to understand the relationship to existing degree programs with respect to differentiation, it is useful to compare the expertise gained in relevant areas of study for the proposed Chemical and Life Science Engineering Ph.D. program as well as the existing Biomedical Engineering Ph.D. and the Pharmaceutical Sciences Ph.D. concentrations.

The didactic core curriculum of the proposed program is designed to provide breadth in the area of development of pharmaceutical and medical therapies, commensurate with what might be expected of an initial degree in the key competency areas of pharmaceutics and engineering as listed in Figure 3 (a qualitative representation). Specifically the overlap can be defined as bringing students of varied background to competence in several key areas of pharmaceutics and chemical engineering listed in Figure 3. Areas of competence related to pharmaceutics include biopharmaceutics, pharmacokinetics, and physical pharmacy, and those related to CLSE include reactor engineering, materials science, and life sciences engineering. Note that this overlap is
only generated in engineering and pharmaceutics topics relevant to the Pharmaceutical Engineering program. This breadth of understanding is a key aspect of the degree program and provides the required background to solve problems and innovate across the pharmaceutical therapies space.

The remainder of the curriculum is designed to deliver depth in research areas of focus such as formulations engineering of medicines, pharmaceutical particle generation and control, and nanomedicine. The depth of knowledge gained in these areas is distinct from other Ph.D. programs that exist at VCU. These areas form key links with other areas of the pharmaceuticals workflow such as reaction engineering, and pharmacokinetics.

![Graph: Depth of Pharmaceutical Engineering Knowledge for Areas of Competence](image)

**Figure 3:** A qualitative representation showing the breadth vs depth for key areas of competence for the Pharmaceutical Engineering Ph.D. program.

The positioning of the Pharmaceutical Engineering Ph.D. program has been considered in detail in relation to the existing and proposed Chemical and Life Science Engineering Ph.D. programs and optimized to overlap only where necessary to provide students with required breadth to be industry, academics and regulatory leader and to draw expertise and synergism to propel the program to national prominence.

**Collaboration or Standalone**

The Pharmaceutical Engineering program is a collaborative program between the Schools of Engineering and Pharmacy. The program will be jointly administered by the two schools, having leadership and faculty from each school supporting the program. The Ph.D. degree in
Pharmaceutical Engineering will be awarded jointly by both the School of Pharmacy and the School of Engineering. A memorandum of understanding (MOU) has been developed between the two schools and is included in the appendix (Appendix A).

Justification for the Proposed Program

Response to Current Needs

The justification for establishing the Ph.D. program in Pharmaceutical Engineering is to address the demand for engineers in the area of pharmaceutical development and manufacturing who are able to pursue multifaceted approaches to current and future challenges in the field. The current doctoral programs that exist do not address the cross-functional nature of the challenges of the pharmaceutical industry sector and have a narrow focus on either chemistry or formulation expertise. The VCU proposal for a Ph.D. in pharmaceutical engineering will be the only such degree program in the United States, and will start from a position of great strength as it takes advantage of the expertise that exists in the Schools of Pharmacy and Engineering.

The Pharmaceutical Engineering Ph.D. program is designed to work in synergy with other programs at VCU to complete a pharmaceuticals and health treatment educational workflow as discussed in the proposal background. The educational elements are created to have minimal overlap with existing programs, yet provide the breadth necessary for graduates to be leaders in interdisciplinary and translational research.

The pharmaceutical industry has undergone tremendous changes over the past years with challenges to both therapeutic innovation and profitability. In order to address these structural challenges, various approaches to address R&D inefficiencies have been taken including a global view of the pharmaceutical market and a focus on innovative therapies8. At the same time, efficiency programs and outsourcing of activities have resulted in the shifting of more activities from the traditional pharma sector to the CROs9.

The opportunity for innovation and globalization of health care

Key conclusions from the Price-Waterhouse-Coopers “Pharma 2020” report include the need for medicines that can be afforded by the worlds increasingly health conscious population, as well as the need for innovative therapies that will be reimbursable by cost sensitive governments. The proposed VCU Ph.D. program in Pharmaceutical Engineering addresses these challenges directly in the development of the didactic curriculum and areas of faculty research interests.

"Its core problem is lack of innovation in making effective new therapies for the world’s unmet medical needs."

8 From Vision to Decision Pharma 2020
“By 2020, the context in which Pharma operates will be very different from that which prevails today. And one of the recurring motifs in all the shifts we have described is globalization”.

“Current global economic trends and developments within the pharmaceutical industry are combining to drive the greater use of CROs”.

The need for increased research focus in key areas of pharmaceutical engineering and science

The White House Office of Science and Technology Policy, National Institutes of Health, and industry publications have articulated areas of emphasis that align with key areas of research for the proposed program in Pharmaceutical Engineering at VCU. These include the focus on continuous manufacturing, drug delivery, and inhaled therapeutics.

1. The theme of “continuous manufacture of pharmaceuticals” has been highlighted by the Subcommittee for Advanced Manufacturing of the National Science and Technology Council.\(^\text{10}\)

   “Continuous manufacturing may reduce manufacturing costs, which currently consume as much as 27 percent of the revenue for many pharmaceutical companies, by up to 40 to 50 percent.”\(^\text{11}\)

   In this 2016 report it is highlighted that although many industries have moved to continuous manufacturing platforms, the pharmaceutical industry has been slow to follow due to the inherently low likelihood of the clinical success of new drugs, and the need to lock in production processes earlier owing to regulatory considerations.

   “However, the broad adoption of such strategies has lagged behind in the pharmaceutical and biotechnology industry because of the product development paradigm.”\(^\text{12}\)

   These barriers are now being challenged due to the potential of personalized medicine and the need to produce smaller volumes of drugs. The increased funding in this area was also noted in this report and VCU has already received funding in this area with the “Pharmacy on Demand” project being specifically mentioned.\(^\text{13}\)

2. The engineering and science associated with pharmaceutical materials and drug delivery systems continues to be an important area for both education and research. Drug delivery


\(^{11}\) ibid p29

\(^{12}\) ibid p29

\(^{13}\) ibid p33
technologies have the potential to deliver drugs more effectively to their intended cellular or tissue targets thus reducing the potential for side effects.\textsuperscript{14}

"Biotechnology advances are leading to improved medications that can target diseases more effectively and precisely. Researchers have begun to reformulate drugs so they may be more safely used in specific conditions. The more targeted a drug is, the lower its chance of triggering drug resistance, a cautionary concern surrounding the use of broad-spectrum antibiotics.\textsuperscript{15}"

VCU faculty are currently involved in the education and research associated with materials characterization, control in order to enable efficient drug delivery.\textsuperscript{16} There is existing course content as well as research efforts including, among others, the laboratories of Professors Hu Yang and Sandro R. da Rocha. VCU also has a significant and long standing presence in one of the key areas of drug delivery, namely inhalation therapy. Several laboratories in the Pharmacy and Engineering school continue to be involved in this critical area of education and research including the laboratories of Professors Masahiro Sakagami, Michael Hindle Worth Longest and Sandro da Rocha. This area continues to be an important driver of health outcomes with the top 5 inhaled therapies accounting for over $12B in sales in 2014.\textsuperscript{17}

The need for improved engineering and sciences education at the interfaces of chemistry, formulation, and materials science

As the pharmaceutical industry continues to evolve to meet the needs of patients and take advantage of new areas of research, there is a corresponding need to develop educational programs that train students to be at the forefront of pharmaceutical development and engineering. This concept of evolution and continual improvement of the industry and regulatory framework is well supported by agencies such as the FDA who has underscored the importance of the field to patient health.

"The health of our citizens depends on the availability of safe, effective and affordable medicines. In the future, pharmaceutical manufacturing will need to employ innovation, cutting edge scientific and engineering knowledge, and the best principles of quality management to respond to the challenges of new discoveries (e.g., complex drug delivery systems and nanotechnology) and ways of doing business such as individualized therapies or genetically tailored treatments."\textsuperscript{18}

\textsuperscript{15} ibid
\textsuperscript{16} School of Pharmacy, Virginia Commonwealth University. [no date] Research at the School of Pharmacy [online]. Virginia Commonwealth University. Available at: http://www.pharmacy.vcu.edu/research/ [Accessed 20 Dec 2016]
\textsuperscript{17} MM&M Therapeutic Focus. April 2015 Respiratory [online].MM&M-online.com Available at: http://media.mmm-online.com/documents/114/therapeutic_focus_respiratory_28440.pdf [Accessed 30Nov 2016]
\textsuperscript{18} The PAT team and Manufacturing Science Working Group [2004]. Innovation and Continuous Improvement in Pharmaceutical Manufacturing Pharmaceutical CGMPs for the 21st Century [online]. Food and Drug
The formation of this innovative proposed Ph.D. program is targeted to address one of the key undesirable effects in both industry and academics, which is the tendency of organizations and subunits to become silos. Often technical units work for the best outcome of their particular technical area but do not always address the root causes of failure that do not respect organizational barriers. This was recognized by the Process Analytical Technologies (PAT) and Manufacturing sciences working group, which has highlighted the concern.

"Significant uncertainty is created when a particular disciplinary design team must try to connect their subsystem to another disciplinary subsystem (e.g., Clinical-CMC-CGMP). Each subsystem can have its own goals and constraints that must be satisfied along with the system level goals and constraints. It is possible that goals of one subsystem may not necessarily be satisfactory from the view of another."19

The report further concludes with the need to support education and continued funding of new approaches to quality and manufacturing.

"The traditional empirical approaches will need to be replaced with a much more fundamental scientific understanding. This will require the talent and know-how of many scientific and technical disciplines. Without sufficient and sustained support our Nation's pharmaceutical education and research system will be unable to meet the needs of the desired state. Significant collaboration and cooperation among industry, academia, and public agencies (e.g., National Science Foundation and National Institutes of Health) including FDA will be necessary to find solutions to this challenge."20

Summary
The proposed Ph.D. program in Pharmaceutical Engineering will be well placed to respond to current and future challenges in preparing students for careers in industry, regulatory agencies and academic settings, as well as the next generation of innovators and entrepreneurs in this area. This collaborative program will be the first in the nation to offer such a degree and VCU is uniquely placed to offer such a program with co-located Schools of Pharmacy and Engineering, and offering students educational opportunities across multiple related disciplines.

Employment Demand

A summary of the recent 12-month history of hiring in the area of Pharmaceutical Engineering in both the US and local Virginia labor market has been prepared by the VCU Office of Continuing and Professional Education (Appendix B).

The report prepared by the office indicates that: "An advanced demand report through Labor Insight™21 reveals that Virginia is number 7 among the Top 15 states in the U.S. in the last 12

19 Ibid p.33
20 Ibid p.33
21 Labor Insight™ | Burning Glass Technologies, October 2016
months hiring for pharmaceutical engineers. Labor Insight pulled 143 job postings in the last 12 months across the state of Virginia for job titles labeled specifically as pharmaceutical engineering or pharmaceutical engineer. There is a strong concentration of these jobs in the state, with a much higher demand than average. The Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) was the fifth largest hiring region in the country with 142 postings, and the Richmond, VA Metropolitan Statistical Area (MSA) was tenth with 54 postings over the last 12 months."

The program therefore will be targeting an area of hiring where job growth is higher than the national average, and where the proposed Pharmaceutical Engineering Ph.D. can serve as an important initiative for the Commonwealth of Virginia.

The pharmaceutical engineering discipline is a relatively new discipline that contains elements of a variety of related sciences such as pharmaceutics, chemical engineering, biomedical engineering, nanosystems engineering, and medical research. Given the cross functional nature of the discipline the future job prospects do not link perfectly with any of the above traditional disciplines but contains elements of each. For example, a pharmaceutical engineer will be more aligned to hiring within the pharmaceutical industry than the chemical industry, which has a more cyclical nature. The pharmaceutical, and related regulatory fields require a high level of education among their scientific staff with many pharma companies hiring a significant percentage of Ph.D. graduates.

The report from the Office of Continuing and Professional Education further states that: "...Labeled by the U.S. Department of Labor as "Bright Outlook" occupations, biomedical engineering, biochemical engineering, nanosystems engineering, and bioinformatics science are expected to grow rapidly in the next several years with large numbers of job openings or new and emerging occupations. Chemical engineering, biochemical engineering, nanosystems engineering and chemistry are considered green occupations, and are expected to see a change in employment demand or work or worker requirements including tasks, skills, knowledge and credentials with the green economy."

According to the report there are more than 337,000 workers in these fields with almost 188,000 job openings predicted nationwide over the next 8 years. Table 6 indicates a strong level of future job creation in the Commonwealth from employers that may require scientists with skills in areas related to Pharmaceutical Engineering.

Table 6: Future Openings for Pharmaceutical Engineering Related Fields in the State of Virginia

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Openings in the Next Eight Years</th>
<th>Increase</th>
</tr>
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<tbody>
<tr>
<td>Chemical Engineering</td>
<td>30</td>
<td>1%</td>
</tr>
<tr>
<td>Biomedical Engineering</td>
<td>20</td>
<td>25%</td>
</tr>
<tr>
<td>Biochemist and Biophysicist</td>
<td>30</td>
<td>16%</td>
</tr>
<tr>
<td>Medical Scientist</td>
<td>90</td>
<td>15%</td>
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In summary the projected employment need and outlook is strongly supportive of the ability to provide graduates with employment in Virginia and nationwide. In addition, the data point to an exciting opportunity to fill a need for more graduates in the area of Pharmaceutical Engineering within the localities of Washington-Arlington-Alexandria and Richmond Virginia.

Relevant recent job postings as required are contained in Appendix G

**Student Demand**

VCU surveyed 918 students including enrolled seniors in Biology B.S., Biomedical Engineering B.S., and Chemistry B.S. Additionally, graduate students in Biochemistry, Biology, Biomedical Engineering, Mechanical and Nuclear Engineering, Pharmaceutical Sciences, and Pharmacy were surveyed between March 17 and March 29, 2017. (See Appendix F.) The students were asked: “If VCU offered the Pharmaceutical Engineering Ph.D., would you enroll?” Of the 103 students who responded, 74 expressed a level of interest in enrolling: 9 (9%) said “Definitely;” 15 (15%) said “Very Likely;” 20 (20%) said “Likely;” 30 (30%) said “Somewhat Likely.” Seventy-five (75) students indicated that between 2018 and 2020 they would enroll in this proposed program. VCU expects to attract qualified applicants from outside of VCU as well, nationally and internationally, who are interested in a program emphasizing data science and cybersecurity. The number of potential applicants from VCU seeking admission to this proposed program will exceed the number of available acceptance slots (7).

Letters of support from prospective students have been obtained and are located in Appendix I. Any personal information has been redacted.

**State Council of Higher Education for Virginia**

**Summary of Projected Enrollments in Proposed Program**

**Table 7: Projected enrollment**

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<tr>
<td>HDCT 7</td>
<td>FTES 7</td>
<td>HDCT 14</td>
<td>FTES 14</td>
<td>HDCT 21</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>GRAD 8</td>
</tr>
</tbody>
</table>

**Assumptions:**

Full-time students: 100% / Part-time students: 0%
Full-time students average credit hours per semester: 9
Full-time post baccalaureate students graduate in 4 years
All modeling assumes baccalaureate students.
For simplicity of budget forecasting in the spreadsheet, a 100% retention model was used.

*Assumes actual graduation in fall 2022
Duplication

There is no similar program at any degree level in existence at VCU. The relationship to existing programs has been discussed in previous sections.

There is no similar program, at any degree level, within the State of Virginia. This is due to the unique partnership between the School of Pharmacy and School of Engineering to support this plan. This significant collaboration is not possible in other locations in the state due to the lack of co-location of Ph.D. granting schools outside of Richmond.

Currently there are no such collaborative programs at the Ph.D. level in other universities outside of Virginia but this potential does exist at several institutions. Teaching, research and industry trends are likely to encourage other schools to embark on such a higher level program. The ambition of the leadership in the two founding schools is for VCU to be the first to establish such a program and maintain the highest quality outcome for students.

Projected Resources for the Proposed Program

Full-time Faculty - No full time faculty will teach exclusively in this proposed degree program. All teaching faculty will be shared with existing degree programs from the Schools of Engineering and Pharmacy.

Part-time Faculty - Program faculty will be shared with existing engineering and pharmacy programs. We anticipate that 3 courses, and a seminar will be offered each semester and these courses will be assigned to existing or new faculty within the programs. Any new faculty hires will be absorbed by the participating programs. The new course content will be developed by existing, as well as the additional faculty hires planned by the two participating schools.

Adjunct Faculty - For planning purposes, there are no plans to utilize adjunct faculty to initiate or sustain the program.

Graduate Assistants - Institutional support for promising graduate students is requested from the VCU graduate school to provide a total of 10 permanent ongoing positions (i.e. support for 5 new students each year for 2 years, inclusive of tuition, fees, and stipend). The programs will be responsible for covering fees and stipend for the second year. Once students move to 3rd and 4th year, they will be supported by grants from the student's scientific advisor, or other agencies. We also expect to attract non-VCU funded (i.e. external agency funding) students in similar fashion as today's experience in both schools. The budget for these graduate assistantships are outlined in the costs section below.

In all cases the responsibility for those students initially supported by the VCU graduate school will transition to the advisor in year 3.

Classified Positions - Funds for 1 full-time classified staff position has been requested. These individuals will support the graduate program leadership in managing the graduate school
admissions process, providing student orientation, tracking student progress through the program and interfacing with the university systems for training accountability and assisting with all other issues related to the program.

Targeted Financial Aid - No targeted financial aid is projected to initiate or sustain the proposed degree program.

Equipment – Equipment requirement is envisioned for both laboratory courses and research. The Pharmaceutical Engineering team will provide research equipment via grants and donations. One-time costs associated with the development of laboratory modules are being requested for a total of US$300,000.00. This proposed request for the development of the laboratory modules represent approximately 1/3 of what is required for an appropriately designed Pharmaceutical Engineering instructional laboratory, but will result in the ability to have the courses delivered by the proposed program start date. The remaining monies and/or equipment will be provided by faculty initiated grants or corporate donations.

Facilities Improvement – The program anticipates the placement of three new engineering faculty which will contribute to the Pharmaceutical Engineering program into Biotech Eight, 3rd floor, with associated laboratory space, as well as one additional didactic laboratory. This space will become available to VCU as the result of movement of the current occupant, TruHealth. It is proposed that the funding for the faculty laboratory renovations will be supplied via external funding aligned with the concepts of Pharmaceutical Engineering. A non-recurring cost of $200,000 is requested for space renovations associated with the Engineering didactic laboratory course component. Ongoing rent for the space will be covered by overhead returns from public and private grants.

Three new School of Pharmacy faculty who will contribute to the Pharmaceutical Engineering program will be housed in the Smith Building, located on the VCUHS campus. Funds of $600,000 are requested to renovate lab space in Smith building for the 3 hires allocated to school of Pharmacy, and an additional $200,000 for the renovation of the space required for the didactic laboratory.

In total the non-recurring requests for space renovation associated with the program are $1,000,000.

Other Resources – $5,000 per year are being requested for expenses related to graduate student recruiting, including travel and the publication of brochures and other recruiting materials.

Telecommunications – A budget of $30,000 is requested to support distance learning in one Biotech Eight classroom. We also anticipate about $14,000 per year in teaching laboratory materials and supplies when fully operational.
Part A: Answer the following questions about general budget information.

- Has the institution submitted or will it submit an addendum budget request to cover one-time costs? Yes  No X
- Has the institution submitted or will it submit an addendum budget request to cover operating costs? Yes  No X
- Will there be any operating budget requests for this program that would exceed normal operating budget guidelines (for example, unusual faculty mix, faculty salaries, or resources)? Yes  No X
- Will each type of space for the proposed program be within projected guidelines? Yes  X  No
- Will a capital outlay request in support of this program be forthcoming? Yes  No X

Part B: Fill in the number of FTE and other positions needed for the program

<table>
<thead>
<tr>
<th>Program Initiation Year 2018 - 2019</th>
<th>Expected by Target Enrollment Year 2021 - 2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total FTE positions</td>
<td></td>
</tr>
<tr>
<td>On-going and reallocated</td>
<td>Added (New)</td>
</tr>
<tr>
<td>Added (New)</td>
<td>Added (New)***</td>
</tr>
<tr>
<td>Full-time faculty FTE*</td>
<td>0.00  0.00</td>
</tr>
<tr>
<td>Part-time faculty FTE**</td>
<td>2.00  0.00</td>
</tr>
<tr>
<td>Adjunct faculty</td>
<td>0.00  0.00</td>
</tr>
<tr>
<td>Graduate assistants (HDCT)</td>
<td>0.00  7.00</td>
</tr>
<tr>
<td>Classified positions</td>
<td>0.00  1.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2.00  8.00</td>
</tr>
<tr>
<td></td>
<td>22.00  32.00</td>
</tr>
</tbody>
</table>

*Faculty dedicated to the program. **Faculty effort can be in the department or split with another unit. *** Added after initiation year. Note: Graduate Assistant cost total from all sources
### Part C: Estimated resources to initiate and operate the program

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year</th>
<th>Expected by Target Enrollment Year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2018 - 2019</td>
<td>2021 - 2022</td>
</tr>
<tr>
<td>Full-time faculty</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>salaries</td>
<td></td>
<td>0.00</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Part-time faculty (faculty FTE split with unit(s))</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>salaries</td>
<td>$240,000</td>
<td>$120,000</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$60,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Adjunct faculty</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>salaries</td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>fringe benefits</td>
<td></td>
<td>$0</td>
</tr>
<tr>
<td>Graduate assistants</td>
<td>0.00</td>
<td>7.00</td>
</tr>
<tr>
<td>salaries</td>
<td>$140,000</td>
<td>$420,000</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$128,201</td>
<td>$384,603</td>
</tr>
<tr>
<td>Classified Positions</td>
<td>0.00</td>
<td>1.00</td>
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<tr>
<td>salaries</td>
<td>$40,000</td>
<td>$40,000</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$10,000</td>
<td>$10,000</td>
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</table>

**Personnel cost**

<table>
<thead>
<tr>
<th></th>
<th>Program Initiation Year</th>
<th>Expected by Target Enrollment Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>salaries</td>
<td>$240,000</td>
<td>$180,000</td>
</tr>
<tr>
<td>fringe benefits</td>
<td>$60,000</td>
<td>$138,201</td>
</tr>
<tr>
<td>Total personnel cost</td>
<td>$300,000</td>
<td>$318,201</td>
</tr>
<tr>
<td>Equipment</td>
<td>$150,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Library</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Telecommunication costs</td>
<td>$30,000</td>
<td>$0</td>
</tr>
<tr>
<td>Other costs</td>
<td>$600,000</td>
<td>$409,200</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>$1,050,000</td>
<td>$907,401</td>
</tr>
</tbody>
</table>

*1,330,000 of total in year 1-2 are one time costs
Part D: Certification Statement(s)

The institution will require additional state funding to initiate and sustain this program.

[ ] Yes [ ] No

Signature of Chief Academic Officer

Signature of Chief Academic Officer

If ‘no,’ please complete Items 1, 2, and 3 below.

1. Estimated $\$\$ and funding source to initiate and operate the program.

<table>
<thead>
<tr>
<th>Funding Source</th>
<th>Program initiation year 2018-2019</th>
<th>Target enrollment year 2021-2022</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reallocation within the School of</td>
<td>$100,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Engineering (Note below the impact this will have within the department.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reallocation within the School of</td>
<td>$100,000</td>
<td>$150,000</td>
</tr>
<tr>
<td>Pharmacy (Note below the impact this will have within the department.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reallocation within the Graduate</td>
<td>$231,184</td>
<td>$302,143</td>
</tr>
<tr>
<td>School (Note below the impact this will have within the school or college.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reallocation within VCU (One-time</td>
<td>$780K in FY18, $550K in FY19</td>
<td>0</td>
</tr>
<tr>
<td>dollars) (Note below the impact this will have within the institution.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reallocation within VCU (recurring)</td>
<td>$363,400</td>
<td>$363,400</td>
</tr>
<tr>
<td>Other funding sources (Specify and note if these are currently available or anticipated.)</td>
<td>$37,016 - Sponsored projects to cover grad student tuition, stipend, fees.</td>
<td>$770,654 - Sponsored projects to cover grad student tuition, stipend and fees.</td>
</tr>
</tbody>
</table>
2. Statement of Impact/Funding Source(s). A separate detailed explanation of funding is required for each source used and a statement of impact on existing resources.

Reallocation within the School of Engineering

Within the School of Engineering there are existing faculty lines which will be used to hire against the headcount need for the Pharmaceutical Engineering Ph.D. program. As such, this proposal has no impact on the overall School of Engineering budget.

Reallocation within the School of Pharmacy

Within the School of Pharmacy there are existing faculty lines which will be used to hire against the headcount need for the Pharmaceutical Engineering Ph.D. program. As such, this proposal has no impact on the overall School of Pharmacy budget.

Reallocation within the Graduate School

The VCU Graduate School has proposed the support of the program at a level of 3 graduate assistantships each year with an award period of two years resulting in an ongoing support level of 6 graduate assistantships (6 FTE) on an ongoing basis. This allocation will be made from existing graduate school resources as a result of other programs that require fewer resources going forward. Therefore there is no impact on the Graduate School budget.

Reallocation within VCU

Discussions are ongoing within VCU regarding the one time requests for equipment and laboratory renovation noted in the budget. Outcomes from these discussions will be managed within the existing institutional budget.

Discussions are ongoing within VCU regarding the support of additional faculty lines requested for the program. These may come from existing or future funds allocated to VCU for hiring of exceptional faculty candidates. Outcomes from these discussions will be managed within the existing institutional budget.

Other funding sources

As the program begins and expands, sponsored projects will be required to support graduate research assistantships including tuition, fees and stipends. Existing and new faculty will be expected to apply for, and obtain funds from external sources such as government grants and contracts, non-profit organizations, and industrial projects in order to provide these funds.
Appendices
Appendix A: Memorandum of Understanding for the Pharmaceutical Engineering Initiative

Date: August 31, 2015

To: Barbara D. Boyan, Ph.D., Dean
VCU School of Engineering.

From: Joseph T. DiPiro, Pharm.D. Professor and Dean,
VCU School of Pharmacy

RE: Memorandum of Understanding - Pharmaceutical Engineering at VCU.

The pharmaceutical industry is seeking better understanding of the science and fundamentals behind its operations; to improve the control and optimization of its processes. This has led to FDA initiatives focused on Quality by Design (QbD) and Process Analytical Technology (PAT), both of which are driving industry to replace empiricism with sound strategies for pharmaceutical engineering throughout each product's life cycle. The scope of pharmaceutical engineering covers the processes concerning the conversion of drugs and biologics into pharmaceutical products; from conception, research and design, through operation, scale-up, manufacturing, packaging, quality assurance, marketing and distribution. This is stimulating the demand for educated professionals with joint training in the Pharmaceutical Sciences and Engineering.

Virginia Commonwealth University (VCU) Schools of Pharmacy and Engineering plan to collaborate and offer specialty programs in Pharmaceutical Engineering. Both Schools (SOP and SOE) have identified a need for specialty tracks and electives to serve the future needs of undergraduate, professional and graduate students with career interests in the pharmaceutical industry.

In spring 2015, a 3 credit introductory special topics course, ENGR 591 Pharmaceutical Engineering was coordinated by Frank Gupton, Department Chair of Chemical and Life Sciences Engineering. The course was taught and assessed jointly by Dr. Gupton (1 credit), Drs. Byron, Hindle and Sakagami of Pharmaceutics (1 credit) and scientists from Pfizer Consumer Healthcare (1 credit). The course will be repeated in 2016 and formally offered across disciplines in VCU Course bulletins thereafter.

In addition to professional programs, VCU School of Pharmacy offers well established Ph.D., M.S., M.P.S. (Master of Pharmaceutical Sciences) and combined (Pharm. D., Ph.D., Pharm. D., M.S. etc.) degree programs spanning the pharmaceutical sciences. These programs enable students to tailor their education to cater for specialist research in different specialties or tracks. Several tracks offered by the Department of Pharmaceutics are centered on drug product development topics that cater for individual students seeking careers in drug delivery research and development. A number of courses that are presently offered by pharmaceutics’ faculty provide core instructional materials that enable graduates to pursue careers with industry in a highly (FDA) regulated environment.

Among its programs, VCU School of Engineering offers undergraduate and graduate degrees in Chemical and Life Sciences Engineering (CLSE), Mechanical and Nuclear Engineering (ENGM) and Biomedical Engineering (BME). Because the pharmaceutical industry and its regulators must interface
the development of drugs with biologically compatible delivery systems and devices, students in these engineering disciplines often select educational tracks that overlap with students from the School of Pharmacy seeking careers in industry.

The pharmaceutical industry in the Richmond metropolitan area is well represented and able to contribute to joint offerings between SOP and SOE. Pfizer Consumer Healthcare operates product development and production locally, as does Afton Scientific. Local contract research companies like PPD Pharma focus on drug development and our own Biotech Park has produced several successful start-ups such as Kaleo Pharma. School alumni are presently employed by FDA’s Center for Drug Evaluation Research and each of these companies. Most important, our VCU alumni (graduate students and postdoctoral fellows) have advised the creation of joint programs to cater for the needs of industry both in terms of educating scientists for future recruitment and educating postgraduate scientists from industry itself.

In this agreement, VCU Schools of Pharmacy and Engineering acknowledge that they have a mutual interest in developing the specialty known as pharmaceutical engineering. They agree to evaluate and develop programs that cater for its needs. Funded research collaborations between the two schools are centered presently on graduate programs involving drug delivery, product design and medical device functionality (PCEU, EGRM and BME). Course and program collaborations exist between PCEU, CLSE (ENGR 591) and EGRM (PCEU690, PCEU897, ENGR690, ENGR697).

The schools agree to work together to expand and add to these collaborations. Specifically, they will:

1. Ensure that Pharmaceutical Engineering is a priority in their School strategic plans.
2. Hire faculty independently and jointly to enable programmatic growth to satisfy future student demands.
3. Develop and provide resources for additional funded research collaborations.
4. Establish income and resource sharing plans for these programs.

By signing below we commit our schools to work together in good faith to organize successful joint programs in pharmaceutical engineering.

<table>
<thead>
<tr>
<th>SOP Responsible Person Signature</th>
<th>Printed Name</th>
<th>Date</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>SOE Responsible Person Printed Name</th>
<th>Printed Name</th>
<th>Date</th>
</tr>
</thead>
</table>
Appendix B: Employment Demand Survey

PHARMACEUTICAL ENGINEERING

Ph.D. Program

9 W. Cary Street
P.O. Box 842505
Richmond, Virginia 23284-2505

October 28, 2016

VIRGINIA COMMONWEALTH UNIVERSITY

Office of Continuing and Professional Education
“It is important that the way that pharmaceuticals are manufactured be re-imagined,” says Barbara D. Boyan, Ph.D., dean of the VCU School of Engineering. “Pharmaceutical engineering is an emerging interdisciplinary science that brings engineering concepts to the development, manufacture and regulation of pharmaceutical products and devices. VCU brings critical expertise to this challenge.”

Dr. DiPiro, dean of the VCU School of Pharmacy says: "We are entering an exciting era where the greatest advances in pharmaceutical development and delivery will come from cross-disciplinary efforts. The collaboration of pharmaceutical sciences with engineering has great potential to train scientists at the forefront of our disciplines and produce significant advances in pharmaceutical products."

PROGRAM DESCRIPTION

The development of a Doctor of Philosophy Degree (Ph.D.) program in Pharmaceutical Engineering is a collaboration between the Department of Chemical and Life Science Engineering in VCU’s School of Engineering and the VCU School of Pharmacy. This new Ph.D. program, which has an anticipated start date of Fall 2018, brings together the expertise of two schools at Virginia Commonwealth University. It is intended to prepare students to work in and to lead research and development in an emerging, interdisciplinary field. The Ph.D. in Pharmaceutical Engineering will be the first doctoral program of its kind in the United States, with a focus in Pharmaceutical Engineering, which is a branch of pharmaceutical science and technology that involves the development and manufacturing of products, processes, and components in the pharmaceuticals industry.

TARGET MARKET

The pharmaceutical engineering discipline combines a variety of related sciences, from pharmaceutical sciences and pharmacology, to chemical and biomedical engineering, nanotechnology and biotechnology. Occupational titles in this field can include: medicinal chemists, analytical chemists, clinicians/pharmacologists, chemical engineers and biomedical engineers. With a background in both science and engineering, those studying pharmaceutical engineering can conduct product and process design, quantitative analysis, or even pursue careers in business or law.

24 Definition: https://en.wikipedia.org/wiki/Pharmaceutical_engineering
According to the United States Department of Labor, a considerable amount of work-related skill, knowledge, or experience is needed in the chemist, chemical engineering, biochemical engineering and biomedical engineering fields. 20% of biochemical engineers report that their positions required doctoral degrees, and 20% of biomedical engineers also report that doctoral degrees were required for their positions. Some related occupations, including biochemist and biophysicist, bioinformatics scientist, medical scientist and nanosystems engineer require extensive preparation with extensive skill, knowledge, and experience needed for employment. 41% of biochemists and biophysicists report that their positions required doctoral degrees, while 32% report needing post-doctoral training. 45% of medical scientists, excluding epidemiologists, report that post-doctoral training was needed for their positions, and 29% report that doctoral degrees were required. 29% of nanosystems engineers report that doctoral degrees were required for their positions.

Across the US, there is projected to be much faster than average growth (14% or higher growth) for biomedical engineers through 2024. Labeled by the U.S. Department of Labor as “Bright Outlook” occupations, biomedical engineering, biochemical engineering, nanosystems engineering, and bioinformatics science are expected to grow rapidly in the next several years with large numbers of job openings or new and emerging occupations. Chemical engineering, biochemical engineering, nanosystems engineering and chemistry are considered green occupations, and are expected to see a change in employment demand or work or worker requirements including tasks, skills, knowledge and credentials with the green economy. Combined, there were more than 337,000 workers in these occupations across the U.S. in 2014, with nearly 118,000 openings projected through 2024. In 2014, there were 1,200 chemical engineers and 370 biomedical engineers and related titles employed throughout Virginia; biochemical engineers were not listed separately. A 1% increase in job openings in chemical engineering is expected, with a projected 30 openings annually through 2024 across the state resulting from turnover and new job creation; 20 job openings in biomedical engineering are projected annually, representing a 25% change between 2014 and 2024. Biochemist and Biophysicist positions are projected to increase by 16% across the state through this time period, with 30 projected annual job openings. Positions for medical scientists are expected to see 15% growth with 90 projected annual job openings through 2024.

These workers may devise processes for manufacturing pharmaceuticals by applying principles and technology of chemistry, physics, and engineering; determine the effects of drugs, serums, hormones, and other
substances on tissues and vital processes of living organisms; conduct research using bioinformatics theory and methods in the pharmaceutical area; engage in clinical investigation, research and development, or other related activities.

PEER INSTITUTIONS

There are still relatively few academic programs with a focus in pharmaceutical engineering, with pharmaceutical engineers often receiving training in related programs such as chemical and biomedical engineering. The University of Michigan was the first to launch an academic program in this area, and Rutgers is the only to offer an option in a doctoral program as a concentration in pharmaceutical engineering.

California State University, Fullerton – University Extended Education

- Certificate in Pharmaceutical Engineering

Illinois Institute of Technology, Chemical and Biological Engineering

- Certificate in Pharmaceutical Engineering (12 credit hours)

New Jersey Institute of Technology, Chemical, Biological & Pharmaceutical Engineering

- Master of Science in Pharmaceutical Engineering

Purdue University

- Master of Science in Pharmaceutical Engineering (proposed)

Rutgers School of Engineering

- Ph.D. in Chemical and Biochemical Engineering with an option in Pharmaceutical Engineering
- Master of Engineering in Pharmaceutical Engineering and Science
- Master of Science in Chemical and Biomedical Engineering with an option in Pharmaceutical Engineering

Stevens Institute of Technology

- Pharmaceutical Manufacturing Master’s Program

University of Michigan, College of Engineering

- Master of Engineering in Pharmaceutical Engineering (currently under review and revision; closed to new students) – based on their website; first graduate degree program in the US developed specifically to prepare a new generation of pharmaceutical and engineering professionals – 30 credit hours

University of Washington, Department of Bioengineering

- Online Master of Pharmaceutical Engineering

Following is a sampling of peer institutions offering similar programming at the doctoral level.
<table>
<thead>
<tr>
<th>Institution</th>
<th>Program</th>
<th>Features/Benefits</th>
<th>Tuition/Fees</th>
<th>Format</th>
</tr>
</thead>
</table>
| Rutgers School of Engineering     | Ph.D. in Chemical and Biomedical Engineering with an Option in Pharmaceutical Engineering | • 5 required pharmaceutical engineering core courses  
• 30 credit hours of coursework and 52 credit hours of research, done in the pharmaceutical area | Most students applying for tuition in the Ph.D. program receive one to five years of support through fellowships, teaching and research assistantships | Classroom |
| University of Michigan College of Pharmacy | Ph.D. in Pharmaceutical Sciences; Ph.D. in Medicinal Chemistry         | • Interdisciplinary programs  
• Chemistry, engineering, biochemistry and biology are integrated with pharmacology  
• 13 credits of core classes + 17 credits in electives | Long history of funding most of its Ph.D. students; financial aid through fellowships, research & teaching assistantships | Classroom |
| The University of Texas at Austin College of Pharmacy | Ph.D. in Pharmaceutical Sciences; Ph.D. in Translational Science | • State-of-the-art research facilities  
• Drug Dynamics Institute  
• Interdisciplinary track with areas of specialization include medicinal chemistry & biopharmaceuticals | $6,605 per semester based on 9 credit hours | Classroom |
| University of Buffalo School of Pharmacy and Pharmaceutical Sciences | Ph.D. in Pharmaceutical Sciences | • 4-6 years of graduate study  
• 72 graduate credit hours | Full stipend with 100% tuition waiver; scholarships | Classroom |
<table>
<thead>
<tr>
<th>Institution</th>
<th>Program</th>
<th>Features/Benefits</th>
<th>Tuition/ Fees</th>
<th>Format</th>
</tr>
</thead>
</table>
| St. John’s University             | Ph.D. in Pharmaceutical Sciences                                      | • 60 credits  
• Areas of specialization include medicinal chemistry                                                                                                                                                | $1,350 per credit            | Classroom     |
| College of Pharmacy and Health Sciences |                                                                             |                                                                                                                                  |                               |               |
| Northeastern University            | Ph.D. in Medicinal Chemistry and Drug Discovery (Specialization); Ph.D. in Pharmaceutical Sciences, Interdisciplinary Concentration (can add Engineering as a specialization) | • Interdisciplinary - student can focus on more than one area in biomedical science  
• Flexible for those employed                                                                                                                   | Tuition waivers/stipends for research or teaching of $25,000-$30,000 per year | Classroom     |
| Bouvé College of Health Sciences   |                                                                             |                                                                                                                                  |                               |               |
| Center for Drug Discovery         |                                                                             |                                                                                                                                  |                               |               |
| Campbell University               | PharmD/MS in Pharmaceutical Sciences (Dual degree)                       | • Prepares students for a variety of career options, including drug discovery, R&D & manufacturing  
• New 42,000 square foot teaching facility                                                                                                        | $18,100 per semester plus fees; financial aid available | Classroom     |
| College of Pharmacy & Health Sciences |                                                                             |                                                                                                                                  |                               |               |

**PROFESSIONAL ASSOCIATIONS**

The International Society for Pharmaceutical Engineering (ISPE)\(^{25}\) is a professional organization which serves 18,000 members in 90 countries from all areas of the pharmaceutical manufacturing industry. The organization offers a private certification – the Certified Pharmaceutical Industry Professional (CPIP) designation.

\(^{25}\) http://www.ispe.org/
DESCRIPTION OF THE LABOR MARKET

An advanced demand report through Labor Insight™ reveals that Virginia is number 7 among the Top 15 states in the U.S. in the last 12 months hiring for pharmaceutical engineers. Labor Insight™ pulled 143 job postings in the last 12 months across the state of Virginia for job titles labeled specifically as pharmaceutical engineering or pharmaceutical engineer. There is a strong concentration of these jobs in the state, with a much higher demand than average. The Washington-Arlington-Alexandria, DC-VA-MD-WV Metropolitan Statistical Area (MSA) was the fifth largest hiring region in the country with 142 postings, and the Richmond, VA Metropolitan Statistical Area (MSA) was tenth with 54 postings over the last 12 months.

26 Labor Insight™ | Burning Glass Technologies, October 2016
Appendix C: Sample Plans of Study

Pharmaceutical Engineering PhD Curriculum: An example for Entry with a B.S. degree Full Time

<table>
<thead>
<tr>
<th>Course Rubric</th>
<th>Course Title</th>
<th>New</th>
<th>Hours</th>
<th>Waiver</th>
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<tbody>
<tr>
<td>*CPES 504/505</td>
<td>Pharmaceutical Engineering Fundamentals I</td>
<td>Y</td>
<td>2x1.5</td>
<td>Y</td>
</tr>
<tr>
<td>*CPES 506/507</td>
<td>Pharmaceutical Engineering Fundamentals II</td>
<td>Y</td>
<td>2x1.5</td>
<td>Y</td>
</tr>
<tr>
<td>*CPES 609</td>
<td>Pharmaceutical Engineering Laboratory I</td>
<td>Y</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>*XXXX XXX</td>
<td>Research Area elective #01</td>
<td>N</td>
<td>3</td>
<td>N</td>
</tr>
<tr>
<td>*CPES 601</td>
<td>Scientific Integrity</td>
<td>Y</td>
<td>1</td>
<td>N</td>
</tr>
<tr>
<td>CPES 690</td>
<td>Pharmaceutical Engineering Directed Research</td>
<td>Y</td>
<td>0.5-12</td>
<td>N</td>
</tr>
</tbody>
</table>

**Spring Semester (minimum 11 credits required)**

| *CPES 604/605 | Advanced topics in Pharmaceutical Engineering I | Y   | 2x1.5 | N      |
| *CPES 606/607 | Advanced topics in Pharmaceutical Engineering II | Y   | 2x1.5 | N      |
| *CPES 709     | Pharmaceutical Engineering Laboratory II       | Y   | 1     | N      |
| *XXXX XXX     | Research Area elective #02                    | N   | 3     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research  | Y   | 1-12  | N      |

**Summer Semester (minimum 3 credits required)**

| CPES 690      | Pharmaceutical Engineering Directed Research | Y   | 1-6   | N      |

**Year #02**

| *XXXX XXX     | Research Area elective #03                    | N   | 3     | N      |
| XXXX XXX      | Elective #01                                 | N   | 3     | N      |
| XXXX XXX      | Elective #02                                 | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar            | Y   | 1     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research  | Y   | 1-12  | N      |

**Spring Semester (minimum 9 credits required)**

| XXXX XXX      | Elective #03                                 | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar            | Y   | 0     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research  | Y   | 1-12  | N      |

**Summer Semester (minimum 3 credits required) (apply for Ph.D. Candidacy)**

| CPES 690      | Pharmaceutical Engineering Directed Research  | Y   | 1-6   | N      |

**Year #03**

| CPES 700      | Research in Pharmaceutical Engineering        | Y   | 1-15  | N      |
| CPES 680      | Pharmaceutical Engineering Seminar            | Y   | 1     | N      |

**Spring Semester Year #03 (minimum 9 credits required)**

| CPES 700      | Research in Pharmaceutical Engineering        | Y   | 1-15  | N      |
| CPES 680      | Pharmaceutical Engineering Seminar            | Y   | 0     | N      |

**Summer Semester (minimum 3 credits required)**

| CPES 690      | Research in Pharmaceutical Engineering        | Y   | 1-6   | N      |

**Year #04**

| CPES 700      | Research in Pharmaceutical Engineering        | Y   | 1-15  | N      |
| CPES 680      | Pharmaceutical Engineering Seminar            | Y   | 1     | N      |

**Spring Semester (minimum 9 credits required)**

| CPES 700      | Research in Pharmaceutical Engineering        | Y   | 1-15  | N      |
CPES 680  Pharmaceutical Engineering Seminar  Y  0  N

*Summer Semester*

CPES 690  Research in Pharmaceutical Engineering  Y  1-6  N

* Foundational courses; * Required courses; * Research Area electives

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**Pharmaceutical Engineering PhD Curriculum: An example for Entry with a B.S. degree**

**PART TIME**

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| **Year #02**  | **Fall Semester (minimum 6 credits required)**           |     |       |        |
| *CPES 609     | Pharmaceutical Engineering Laboratory I                  | Y   | 1     | N      |
| ^XXXX XXXX    | Research Area elective #01                              | N   | 3     | N      |
| *CPES 601     | Scientific Integrity                                    | N   | 1     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-12  | N      |
| **Spring Semester (minimum 6 credits required)**        |                                                   |     |       |        |
| ^XXXX XXXX    | Research Area elective #02                              | N   | 3     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-12  | N      |
| **Summer Semester (minimum 3 credits required)**        |                                                   |     |       |        |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-6   | N      |

| **Year #03**  | **Fall Semester (minimum 6 credits required)**           |     |       |        |
| ^XXXX XXXX    | Research Area elective #03                              | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar                       | Y   | 1     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-12  | N      |

| **Spring Semester (minimum 6 credits required)**        |                                                   |     |       |        |
| XXXX XXXX     | Elective #01                                            | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar                       | Y   | 0     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1.12  | N      |

| **Summer Semester (Ph.D. Candidacy)**                    |                                                   |     |       |        |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-6   | N      |

| **Year #04**  | **Fall Semester (minimum 6 credits required)**           |     |       |        |
| XXXX XXXX     | Elective #02                                            | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar                       | Y   | 1     | N      |
| CPES 690      | Pharmaceutical Engineering Directed Research            | Y   | 1-12  | N      |

| **Spring Semester (minimum 6 credits required)**        |                                                   |     |       |        |
| XXXX XXXX     | Elective #03                                            | N   | 3     | N      |
| CPES 680      | Pharmaceutical Engineering Seminar                       | Y   | 0     | N      |
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C-2
### Summer Semester (Ph.D. Candidacy)

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Pharmaceutical Engineering PhD Curriculum: An example for students entering with a MS without thesis. In this example 9 credits of Electives are assumed to be waived based on previous work. Seminar is taken from first year to finish in 3 years. PhD Candidacy can only be achieved after all Research Electives have been taken.

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£ Prerequisite courses
* Required courses
† Research Area electives
Pharmaceutical Engineering PhD Curriculum: An example for students entering with a MS with thesis. In this example 9 credits of Electives are assumed to be waived based on previous work, as well as 9 credits of research. PhD Candidacy can only be achieved after all Research Electives have been taken.

### PART TIME.

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*Prerequisite courses / *Required courses / ^Research Area electives
Appendix D: Abbreviated CVs for Core Faculty

Dr. Thomas D. Roper, Ph.D., 1992, Organic Chemistry, University of Virginia, Director of Pharmaceutical Engineering. Research specialization in 3D printing of dose forms, long acting therapy development, nanomaterials and particle sciences, Continuous chemical reaction engineering, Cost effective therapeutic treatments for the developing world.

Dr. B. Frank Gupton, Ph.D., Chemistry, Virginia Commonwealth University, Professor and Chair. Research specialization in cross-coupling catalysis, flow chemistry/continuous chemical processing, organic synthesis in pharmaceutical applications.

Dr. Hu Yang, Ph.D., 2004, Chemical engineering, University of Akron, Qimonda Associate Professor. Research specialization in clickable polymers for drug delivery, brain cancer therapy, drug delivery for glaucoma.

Dr. Michael Hindle, Ph.D., 1992, Pharmaceutical Technology, University of Bradford, UK, Peter R. Byron Distinguished Professor.

Dr. Masahiro Sakagami, Ph.D., 2000, Pharmaceutical Sciences, Virginia Commonwealth University, Associate Professor and Graduate Program Director. Research specialization in the area of pulmonary biopharmaceutics and pharmacology for inhaled drugs and experimental therapeutics as well as regulatory sciences for inhaled drug products.

Dr. Sandro da Rocha, Ph.D., 2000, Chemical Engineering, The University of Texas at Austin, Associate Professor and Director of Pharmaceutical Engineering. Research specialization in nanomedicine, noninvasive drug & gene delivery, biomaterials, cancer nanotechnology and aerosol formulation.
Appendix E: Abbreviated CVs for Non-Core Faculty

Dr. Barbara Boyan, Ph.D., 1975, Comparative biochemistry and physiology, Rice University, Houston, TX. Dean, School of Engineering. Research specialization in biomaterial and stem cells with an interest in oral health.

Dr. Stephen S. Fong, Ph.D., 2004, Bioengineering, University of California, San Diego. Research Specialization in metabolic engineering, computational metabolic modeling and biorefineries.

Dr. Ram B. Gupta, Ph.D., 1993, Chemical Engineering, University of Texas, Austin, Professor and Associate Dean for Research. Research specialization in supercritical carbon dioxide technology, hydrogen fuel, renewable fuels, batteries, bioenergy, nanoparticles and smart medicine.

Dr. Nastassja A. Lewinski, Ph.D., 2011, Bioengineering, Rice University, Assistant Professor. Research specialization in biological effects of nanoparticles, advanced in vitro exposure systems, nanomedicine.

Dr. Michael H. Peters, Ph.D., 1981, Chemical Engineering, Ohio State University, Professor. Research specialization in protein engineering, peptide biomimetics, protein misfolding, time force autocorrelation, and multiple time scale perturbation theory.

Dr. Christina Tang, Ph.D., 2012, Chemical Engineering, North Carolina State University, Assistant Professor. Research specialization in multifunctional polymer nanomaterials, self-assembly of metal-polymer nanoparticles, rheology of polymers/biopolymers.

Dr. Xuejun Wen, Ph.D., 2003, Bioengineering, University of Utah, Salt Lake City, M.D., Medicine, 1994, Henan Medical University, Zhengzhou, China, William H. Goodwin Professor. Research specialization in biomaterials – natural, pure synthetic and hybrid, stem cell biology and engineering, cell/tissue engineering and regenerative medicine.

Dr. Kenneth J. Wynne, Ph.D., 1965, Inorganic Chemistry, University of Massachusetts, Commonwealth Professor. Research specialization in surface polymer science, kinetics of nanoscale and mesoscale diffusion, antimicrobial and cytocompatible coatings.

Dr. Vamsi K. Yadavalli, Ph.D., 2004, Chemical Engineering, Pennsylvania State University, Associate Professor. Research specialization in functional biomaterials, nanoscale surface characterization, microfabricated biosensors.

Dr. P. Worth Longest, Ph.D., 2002, Mechanical Engineering, NC State University, Professor. Research specialization in respiratory drug delivery, biotransport, medical devices.

Dr. Rong Huan, Ph.D., 2006, Medicinal Chemistry, Department of Medicinal Chemistry and Molecular Pharmacology, Purdue University. Research Specialization in mechanisms of protein post-translational modifications, epigenetic pathways, targeted cancer therapies.
Dr. Matthew S. Halquist, Ph.D., 2012, Pharmaceutical Sciences, Virginia Commonwealth University, Assistant Professor and Director of Bioanalytical Core Laboratory. Research specialization using analytical tools to develop, validate, and employ methods for testing of pharmaceuticals, biomarkers, and biological molecules in various complex matrices using liquid chromatography tandem mass spectrometry (LC-MS/MS).

Dr. Dayanjan S Wijesinghe, Ph.D. 2008, Biochemistry and Molecular Biology, Virginia Commonwealth University, Assistant Professor, Research specialization in Pharmacometabolomics, Nanoliposomal drug delivery, biomarkers to predict clinical trajectories for preclinical interventions, wound healing.

Dr. Rebecca L. Heise, PhD, 2008, Bioengineering, University of Pittsburgh, Assistant Professor Research Specialization in pulmonary mechanobiology and regenerative medicine.

Dr. Phillip M. Gerk, Ph.D., 2000, Clinical Pharmaceutical Sciences, University of Kentucky, Associate Professor. Research specialization in drug transport and metabolism.

Dr. Katherine Belecki, Ph.D., 2013, Bioorganic Chemistry, The Johns Hopkins University, Research specialization in synthetic organic chemistry, pharmaceutical process engineering, biocatalysis, and natural products chemistry.
Appendix F: Current Faculty Funding

Dr. Barbara Boyan, Dean of the School of Engineering

NIH #1R01AR052102-05 to 10 (Boyan); 4/1/11 to 3/31/17; Mechanisms of Cell Surface Interaction; This grant studies the mechanisms that mediate the responses of mesenchymal cells to biomaterials.

Food and Drug Administration (Ku/Boyan): 11/1/11 to 12/31/18; Atlantic Pediatric Device Consortium. This grant funds the core activities for technology development of devices for children. Specific projects at VCU include studies on a hydrogel device for treatment of craniotomy defects due to suturectomies for craniosynostosis.

Institut Straumann AG (Boyan); 3/1/16 to 2/28/17; Oral Healthcare Technologies; bone graft substitutes, osteogenic factors, dental implant surface design, immune responses.

Dr. Stephen S. Fong, Associate Professor

Jeffress Memorial Trust, “Genomic and transcriptomic analysis of an unculturable marine bacterial symbiont”, $100,000, 2013-2015, co-PI


Gates Foundation, “The Medicines for All Initiative: Tenofovir, TDF, TAF, and Darunavir”, 2015-2016, $150,000, co-PI

VCU Presidential Research Quest Fund, “A Greener Route to Blockbuster Statin Drugs”, 2015-2016, $50,000, co-PI

VCU Presidential Research Quest Fund, “D2-Tex Next Generation Smart Fabric for Detection and Detoxification of Chemical Warfare”, 2015-2016, $50,000, co-PI

Dr. Ram B. Gupta, Professor

Alabama Center for Paper and Bioresource Research & Education, “Conversion of bio-butanol to jet fuel”, $25,000, 2011-2012, PI

British Petroleum - Gulf of Mexico Research Initiative, “A smart dispersant formulation with reduced environmental impact and amount needed”, $180,000, 2011-2015, PI


The Sweet Living Group, “Testing of the ECO-UV Ultraviolet Protection within the Textiles and Detergents”, $6,300, 2014-2014, PI
Dr. B. Frank Gupton, Professor and Department Chair

Bill & Melinda Gates Foundation (OPP1151406), Medicines for All: Dolutegravir, $4,900,000, 2016-17, PI

Defense Advanced Research Projects Agency, Make-It, $1,245,000 Co-PI

Bill & Melinda Gates Foundation (OPP1134441), Medicines for All Planning Grant, $575,000, 2015-16, PI

Virginia Biosciences Health Research Corporation, Three Wave Mixing Technique for Chiral Analysis in Continuous Process Manufacturing, $400,000, 2015-2017, Co-PI

Bill & Melinda Gates Foundation (OPP1128257), Medicines for All: Tenofovir, $4,999,542, 2015-16, PI

NSF, I/UCRC Center for Rational Catalyst Synthesis, $325,000, 2015-2020, Co-PI

Bill & Melinda Gates Foundation (OPP1108573), Medicines for All: Nevirapine, $4,390,944, 2014-15, PI

NSF, Collaborative Research Planning Grant, $11,500, 2014-15, Co-PI

Boehringer Ingelheim Pharmaceuticals, Inc., Development of Asymmetric Heterogeneous Hydrogenation Catalysts, $50,000, 2013-14, PI

Clinton Health Access Initiative, Development of Reaction Conditions for Conversion of Artemisinic Acid to Dihydroartemisinic Acid, $24,000, 2013-14, PI

Clinton Health Access Initiative, Third Generation Nevirapine Process, $62,500, 2012-13, PI

Dr. Nastassja A. Lewinski, Assistant Professor

Honeywell International Inc., “Nanotechnology-enabled thermal stabilization of nylon”, $85,000, 2016-2017, PI

Commonwealth Center for Advanced Manufacturing, “Synthesis and characterization of gold nanoparticles”, $90,000, 2016-2017, PI

Canon Virginia Inc., “Characterization of gold recovery process”, $100,000, 2016-2017, co-PI

Commonwealth Center for Advanced Manufacturing, “Characterization of gold precursor solution”, $5,000, 2016, PI

Dr. Thomas D. Roper, Professor

Defense Advanced Research Projects Agency, DARPA-BAA-15-39; Pharmacy on Demand; $800,000, 2016-2018, PI
Dr. Christina Tang, Assistant Professor

VCU Presidential Research Quest Fund, “D2-Tex Next Generation Smart Fabric for Detection and Detoxification of Chemical Warfare”*, $50,000, 2015-2017, PI

Canon Virginia Inc., “Characterization of Gold Recovery Processes”, $100,000, 2016, PI

Commonwealth Center for Advanced Manufacturing, “Synthesis and Characterization of Gold Nanoparticles”, $90,000, 2016, co-PI


Dr. Xuejun Wen, Professor, Alice T. and William H. Goodwin Jr. Endowed Chair

NIH/NINJDS, 1R01NS093985, “Combination of HIPSCS and Bioengineering to Repair Injured Pediatric Brain”, $381,416, 2016-2021, co-I


NSF, CBET 1346387, “CAREER: A novel space-creation concept to enhance the survival and functionality of transplanted human stem cells”, $242,691, 2013-2014, PI

Dr. Kenneth J. Wynne, Commonwealth Professor

NSF, DMR 1608022, “Nanostructured surface modification for antimicrobial effectiveness and cytocompatibility”, $390,000, 2016-2019, PI

VCU Center for Clinical and Translational Research, “Toward eliminating catheter associated urinary tract infections (CAUTI)”, $50,000, 2016-2017, PI


SAIF Batterics, “Polymer hermeticity”, $82,000, 2013 – 2014, PI

Dr. Vamsi K. Yadavalli, Associate Professor


VCU Presidential Research Quest Fund: “Chemical Signatures of Environmental Pathogens for
Microbial Forensics”, $50,000, 2015-2016, PI


SAFT Batteries, “Polymer hermeticity”, $82,000; 2013 – 2014, co-PI

Dr. Hu Yang, Associate Professor


National Institutes of Health (R01EY024072), “Hybrid nanoparticles for glaucoma”, $1,293,612, 9/30/2014–6/30/2017, PI.


National Science Foundation, REU, supplement to CAREER Award CBET0954957, $22,813, 5/1/2012–7/31/2016 (NCE), PI.

National Science Foundation (CBET0954957), Faculty Early Career Development (CAREER) Award, “CAREER: Surface-engineering of monocytes for anticancer drug delivery”, $450,000, 8/1/2010–7/31/2016 (NCE), PI.

National Institutes of Health/National Center for Advancing Translational Sciences (CTSA Award UL1TR000058), CCTR Endowment Fund Multi-School Research Award, “Nanoparticle mediated delivery to increase CEH and regress atherosclerotic plagues”, $130,000, 7/1/2014–12/31/2015, Co-PI.

Massey Cancer Center, Multi-Investigator Award (2013-MIP-01), “Synthetically lethal TopoII ATM inhibitor nanoparticles for glioma therapy”, $100,000, 10/1/2013–4/15/2015, PI.


Massey Cancer Center, Pilot Project Award, “Development of vectors for targeted airway-mediated anti-cancer drug delivery”, $30,000, 7/1/2011–6/30/2012, PI.

Dr. Michael Hindle, Peter R. Byron Distinguished Professor.


Dr. Masahiro Sakagami, Associate Professor.


Dr. Phillip M. Gerk, Associate Professor.


Center for Innovative Technology (Virginia), “A New Strategy for Buprenorphine Oral Delivery”, $100,000, 2014-2016, PI.


Dr. Rong Huan, Assistant Professor

9/16-07/21 NIH/NIGMS R01GM117275, Protein N-terminal methylation mechanisms and inhibition, Principal Investigator, $200,000/year.
07/16-06/17 American Cancer Society Institutional Research Grant: Protein N-terminal Methyltransferase 1 in Colorectal Cancer, Principal Investigator, $30,000.

07/16-06/17 VCU Massey Cancer Center’s Developmental Therapeutics Project Grant Investigate effects of NTMT1 inhibition on human colon cancer xenograft mice, Principal Investigator, $4,000

Dr. Dayanjan S. Wijesinghe, Assistant Professor

1 U01 HD087198-01 (Chalfant, Walsh, Wijesinghe, 09/17/2015 – 08/31/2019 NIH/NICHD, $785,041. The Utilization of Photonics Technology to Rapidly Detect Bioactive Lipids Associated with Preeclampsia Development

Dr. Rebecca L. Heise, Assistant Professor

VCU PERQ “Developing a Practical Delivery Device and Animal Proof-of-Concept Data for a New Inhaled Surfactant Therapy Developed at VCU” $40,000, 7/2016-12/2017, co-PI

National Science Foundation (CMMI-1351162) “CAREER: Propagation of Lung Fibrosis through Mechanotransduction” $400,000, 2/2014-1/2019, PI

National Institutes of Health (R01AG041823-01) “Age Dependent Mechanical Ventilator-Induced Inflammation: Modeling & Experiments” $1,200,000, 8/1/2012-5/31/2017, PI

Dr. Matthew S. Halquist, Assistant Professor.

Center for the Study of Tobacco Products at Virginia Commonwealth University (For support of P50 Tobacco Centers of Regulatory Science (TCORS- 1P50DA036105-01), “Determination of toxicants (i.e. nicotine, tobacco specific nitrosamines) in human biological fluids following the use of electronic cigarettes”, $504,969, 2013-2018, PI.

Batelle Memorial Institute (For support of U01-FDA) “Determination of nicotine, cotinine, and tobacco specific nitrosamines in human biological fluids following the use of electronic cigarettes and cigars”, $252,628, 2014 – 2016, PI.

Dr. Sandro da Rocha, Associate Professor.

VCU- Presidential Quest Fund “Placental Targeting for Noninvasive Fetal Therapy” - Granted June 2016 (1 year) – U$25,000 (da Rocha: PI, Gerk, collaborator).

NSF-DMR: “Dendrimeric Doxorubicin: a Nanoplatform for Cancer Therapy” - Granted 08/01/15 (2+1 year) – U$ 330,000 (PI: da Rocha, 100%).

Dr. Katherine Belecki, Research Assistant Professor
VCU Presidential Research Quest Fund, "A Greener Route to Blockbuster Statin Drugs: Harnessing the Power of Biocatalysis and Flow Chemistry in the Synthesis of Crestor® $50,000.00, 7/1/2015 – 6/30/2017

Dr. P. Worth Longest, Professor
National Institutes of Health/National Heart Lung and Blood Institute (HL107333-04), R01 Award, "Effective Delivery of Pharmaceutical Aerosols during Non-Invasive Ventilation", $1,862,772, 6/1/11 – 3/31/17, PI (joint).

University of Florida (Subcontract from US FDA contract # HHSF223201310223C), contract, "Applicability of in silico, in vitro and pharmacokinetics studies to elucidate critical API changes in nasal suspension formulations", $266,576, 1/1/2014 – 9/30/2017, Co-PI.

US Food and Drug Administration (U01FD004570), U01 Award, "Predictive Lung Deposition Models for Safety and Efficacy of Orally Inhaled Drugs", $250,000, 9/15/2012 – 9/30/2016, PI.

National Institutes of Health/National Institute of Child Health and Human Development (R21HD073728), R21 Award, "Nanoaerosols from Wick Electrospray for Improved Drug Delivery to Infants", $387,114, 8/5/2012 – 4/30/2016, PI.
Appendix G: Recent Job Postings
Associate Director, Engineering Job

Merck & Co., Inc. Kenilworth, N.J., U.S.A. known as Merck in the United States and Canada, is a global health care leader with a diversified portfolio of prescription medicines, vaccines and animal health products. Today, we are building a new kind of healthcare company – one that is ready to help create a healthier future for all of us.

Our ability to excel depends on the integrity, knowledge, imagination, skill, diversity and teamwork of an individual like you. To this end, we strive to create an environment of mutual respect, encouragement and teamwork. As part of our global team, you'll have the opportunity to collaborate with talented and dedicated colleagues while developing and expanding your career.

At Merck's manufacturing campus in Elkton, Virginia, we currently have an Associate Director, Engineering position within the Technical Services team. The manufacturing facility is located in the Shenandoah Valley along the Shenandoah River and the Blue Ridge Mountains – just a short distance from the University of Virginia and James Madison University.

The successful candidate will have the opportunity to apply their enthusiasm and technical skills as a member of a
A multidisciplinary team supporting the operation of pharmaceutical/biopharmaceutical/vaccine product manufacturing facilities.

Assignments and duties will include:

- Achieving Safety, Quality, and Environmental compliance excellence in all assignments
- Managing multiple technical and capital projects and assembling and leading multidisciplinary teams across many functional areas
- Learning new processes and procedures
- Leading and conducting significant technical investigations and analyses, recommending corrective actions, and seeing them through to successful, sustainable implementation
- Writing, reviewing, improving documentation for technical and regulatory compliance excellence
- Contributing to process and equipment safety reviews
- Teaching, coaching, mentoring, and learning from team members

Educational requirements:

- B.S. degree in chemical engineering, biochemical engineering, biological systems engineering, biology, biochemistry, chemistry or related life science or engineering discipline and a minimum of ten years of relevant industrial experience

- M.S. degree in chemical engineering, biochemical engineering, biological systems engineering, biology, biochemistry, chemistry or related life science or engineering discipline and a minimum of eight years of relevant industrial experience

- Ph.D. in chemical engineering, biochemical engineering, biological systems engineering, biology, biochemistry, chemistry or related life science or engineering discipline and a minimum of three years of relevant industrial experience

The successful candidate must have:
>2 years of experience in a manufacturing environment
• management experience of >= 2 direct reports
• demonstrated success in managing and delivering multiple complex technical and capital projects
• demonstrated ability to lead people via influence as opposed to formal reporting structures
• excellent technical, organizational, interpersonal, collaborative, and verbal/written communication skills - including excellent presentation skills and the ability to communicate with employees at all levels including senior management
• strong problem solving skills and a hands-on approach to problem solving, with a bias toward going to see problems for oneself in the field
• the ability to examine an issue from diverse perspectives (safety, compliance, maintenance, automation, equipment, process, and people) in order to best understand and resolve it
• enthusiasm, confidence and initiative-taking ability needed for continuous learning and its applications

Preferred:

• small and large molecule drug substance experience
• experience working in a cGMP environment
• biologics or vaccine processing experience
• sterile processing experience

If you are the kind of individual who thrives on challenge and possess the technical, leadership, business, and communication skills that are of value to our business, we invite you to apply. Consistently cited as a great place to work, we discover, develop, manufacture and market a wide range of vaccines and medicines to address unmet medical needs. Each of our employees is joined by an extraordinary sense of purpose - bringing Merck’s finest achievements to people around the world.

Qualifications
Education Minimum Requirement:

BS/BA – Engineering, Science or related disciplines.

Required Experience and Skills:

- >2 years of experience in a manufacturing environment
- Demonstrated success in managing and delivering multiple complex technical and capital projects
- Management experience of >/= 2 direct reports
- Demonstrated ability to lead people via influence as opposed to formal reporting structures
- Excellent technical, organizational, interpersonal, collaborative, and verbal/written communication skills - including excellent presentation skills and the ability to communicate with employees at all levels, including senior management
- Strong problem solving skills and a hands-on approach to problem solving, with a bias toward going to see problems for oneself in the field
- The ability to examine an issue from diverse perspectives (safety, compliance, maintenance, automation, equipment, process, and people) in order to best understand and resolve it
- Enthusiasm, confidence and initiative-taking ability needed for continuous learning and its applications

Preferred Experience and Skills:

See above in

Our employees are the key to our company’s success. We demonstrate our commitment to our employees by offering a competitive and valuable rewards program. Our Company’s benefits are designed to support the wide range of goals, needs and lifestyles of our employees, and many of the people that matter the most in their lives. If you need an accommodation for the application process please email us at staffingoador@merck.com.
Search Firm Representatives Please Read Carefully:
Merck & Co., Inc. is not accepting unsolicited assistance from search firms for this employment opportunity. Please, no phone calls or emails. All resumes submitted by search firms to any employee at Merck via email, the Internet or in any form and/or method without a valid written search agreement in place for this position will be deemed the sole property of Merck. No fee will be paid in the event the candidate is hired by Merck as a result of the referral or through other means.

Visa sponsorship is not available for this position.

For more information about personal rights under Equal Employment Opportunity, visit:

EEOC Poster
EEOC GINA Supplement

Merck is an equal opportunity employer, Minority/Female/Disability/Veteran – proudly embracing diversity in all of its manifestations.

Job: Chemical Engineering

Job Title: Assoc. Dir, Engineering

Primary Location: NA-US-VA-Elkton

Employee Status: Regular

Number of Openings: 1

Shift (if applicable): 1st

Hazardous Materials: No

Company Trade Name: Merck
More jobs like this

- Physical Sciences jobs in Virginia
- Engineering jobs in Virginia
- Chemical Engineering jobs in Virginia
Bioanalytical Associate/Research Scientist - Pharmaceutical Product Development - Immunoassay R&D

Job description

Our Team is Growing!

Associate Research Scientist/Research Scientist - Immunochemistry (Immuno Research and Development)

(ELISA, Immunoassay, Bioanalytical Testing)

Note: This role is based in PPD's Bioanalytical Laboratory in Richmond, Virginia. A relocation package is available to Virginia for this opportunity.

Responsibilities

The Research Scientist-Immunoassay Development position involves the following responsibilities:

- Responsible for the regulatory and scientific conduct of assay design and development, development, method development and validation, bioanalytical projects, and/or other specialty technologies.

- Routinely acts as the technical project leader for multiple projects, interacts with clients on a weekly basis (or as needed) to provide updates, reviews and evaluates data, writes reports and protocols.

Education and Experience

- Bachelor's degree or equivalent and relevant formal academic/vocational qualification + previous experience that provides the knowledge, skills, and abilities to perform the job (comparable to 5+ years) or equivalent combination of education, training, & experience. OR

- Master's degree and previous experience that provides the knowledge, skills, and abilities to perform the job (comparable to 4+ years) OR

- PhD and previous experience that provides the knowledge, skills, and abilities to perform the job (comparable to 2+ years)

- Additional Experience: Any Research Evaluation Level of 1+ years

- Strong experience with ELISA and Immunoassay development

- Knowledge of Immunogenicity a plus

- Experience or knowledge of ECL, MSD, Gyros

- Ability to independently perform root cause analysis for method investigations

- Experience with GLP, Regulatory environment preferred

- Experience working in the CRO or Pharmaceutical industry a plus

- Proficiency on technical operating systems

- Proven problem solving and troubleshooting abilities
• Proven ability in technical writing skills

• Time management and project management skills

• Good written and oral communication skills

• Ability to work in a collaborative work environment with a team

• Ability to train junior staff

• Keyward summary: Immunoassay, method development, assay development, method validation, assay validation, bioanalytical, ligand-binding assays, ELISA, ECL, electrochemiluminescence, MSD, meso-scale discovery, gyros, gyrolab, immunogenicity, ADA (anti-drug antibodies), NAb (neutralizing antibodies), GLP, CRO, antibody-drug conjugates, biosimilar, RIA (radioimmunoassay)

• 401k with matching contributions, life insurance, long term and short term disability insurance, flexible medical and dependent care spending accounts.

• Work life balance programs including paid time off for vacation/sick time, paid holidays, floating holiday and vacation sell back program.

• Wellness benefits including health and wellness programs, fitness facility access or discount, health coaching and more.

• Education reimbursement and tuition assistance programs, professional development training, skills training, education loan repayment plan, dependent scholarship program and more

• Employee appreciation events, service recognition awards, annual reviews, merit plan and bonus plan

• Community connections and activities including philanthropic engagement, volunteer service projects and more

• Other great options including pet insurance, legal and financial services plan, auto and home insurance discounts.

• Work is performed in a laboratory and/or a clinical environment with exposure to electrical office equipment.

• Occasional drives to site locations, occasional domestic travel

• Exposure to biological fluids with potential exposure to infectious organisms

• Rare exposure to skin and lung irritants, radiation, toxic materials and hazardous waste

• Personal protective equipment required such as protective eyewear, garments and gloves.

• Exposure to fluctuating and/or extreme temperatures on rare occasions.

• Ability to work in an upright and/or stationary position for 6-8 hours per day

• Repeated hand movement of both hands with the ability to make fast, simple, repeated movements of the fingers, hands, and wrists in a seated task environment

• Occasional crouching, stooping, with frequent bending and twisting of upper body and neck

• Light to moderate lifting and carrying (or otherwise moves) objects including luggage and laptop computer with a maximum lift of 15-20 lbs.

• Ability to access and use a variety of computer software developed both in-house and off-the-shelf.

• Ability to communicate information and ideas so others will understand with the ability to listen to and understand information and ideas presented through spoken words and sentences

• Frequently interacts with others to obtain or relate information to diverse groups.

• Works independently with little guidance or reliance on oral or written instructions and plans work schedules to meet goals. Requires multiple periods of intense concentration.

• Performs a wide range of variable tasks as dictated by variable demands and changing conditions with little predictability as to the occurrence. Ability to perform under stress. Ability to multi-task.
Regular and consistent attendance.

**PPD Benefits Overview**

**Knowledge, Skills and Abilities:**

PPD offers comprehensive a benefits offering including medical, dental, vision, pharmacy, employee assistance program, wellness program options and more.

**Other Benefits Include**

**Physical Requirements:**

Pharmaceutical Product Development, LLC is firmly committed to Equal Employment Opportunity (EEO) and prohibits employment discrimination for employees and applicants based on age, race, color, pregnancy, gender, gender identity, sexual orientation, national origin, religion, marital status, citizenship, disability or protected veteran or other status protected by federal, state, and/or local law.

**Organization**

Lab Operations

**Primary Location**

North America-United States-Virginia Richmond

**Industry**

Biotechnology, Pharmaceuticals, and Research

**Employment Type**

Part-Time

**Experience**

Not Applicable

**Job Function**

Science
See how you compete to the competition

Apply

Meet PPD
Biotechnology · 10001+ employees · Founded 1985 · Privately Held

Company
PPD is a leading global contract research organization providing comprehensive, integrated drug development, laboratory and lifecycle management services. Our clients and partners include pharmaceutical, biotechnology, medical device, academic and government organizations. With offices in 46 countries and more than 16,000 professionals worldwide, PPD applies innovative technologies, therapeutic expertise and a firm commitment to quality to help clients and partners bend the cost and time curve of drug development to deliver life-changing therapies that improve health. For more information, visit www.ppd.com.

Similar Jobs
Marketing and Communications Manager
- Richmond, Virginia Area
- 1 year ago
- Posted 11 hours ago

Director of Admissions and Marketing
- Richmond, Virginia

Search for people by companies and more...
Chemical Engineer

Overview:

The position will be responsible for conducting research and development on the properties of chemical materials and processes. The individual will be part of the team working on the development of new chemical materials and processes, and will be involved in the selection of appropriate materials for specific applications.

Responsibilities:

Identify, characterize, and assess chemical threats worldwide.

Specific Responsibilities Include:

- Working as a chemical subject matter expert in a collaborative environment with analysts and partners
- Working in a dynamic environment and using current and emerging technologies
- Analyzing a wide variety of classified and unclassified information
- Working with a variety of analytical tools
- Conducting chemical and forensic analysis
- Authoring technical and policy papers on chemical weapons
- Attending meetings and working with the agency and industry partners
- Participating in operational planning and training exercises

Qualifications:

Required Qualifications:

- Ph.D. in a relevant science or engineering discipline
- Experience in a relevant science or engineering discipline
- Excellent verbal and written communication skills
- Strong analytical and problem-solving skills
- Active Top Secret SCI clearance Required
Denied Qualifications:

- Lack of experience in related fields.
- Inability to demonstrate technical expertise.
- Insufficient knowledge in key areas.
- Limited understanding of current trends.
- Inadequate ability to work independently.
- Poor communication skills.
- Inability to manage stress.
- Inconsistent performance history.
- Limited ability to adapt to change.
- Lack of teamwork skills.
- Inability to meet deadlines.
- Insufficient problem-solving skills.
- Limited ability to learn new technologies.
- Inadequate experience in relevant industries.
- Limited ability to handle confidential information.
- Inability to work in a fast-paced environment.
- Limitations in language proficiency.
- Insufficient ability to work under pressure.
- Limited ability to maintain high standards.
- Inability to work effectively in a diverse environment.
- Lack of experience in specific areas.
- Insufficient knowledge in critical areas.
- Inability to handle complex situations.
- Limited ability to communicate effectively.
- Inadequate experience in related fields.
- Inability to work efficiently.
- Limited ability to handle pressure.
- Insufficient understanding of current trends.
- Inadequate problem-solving skills.
- Limitations in technical expertise.
- Inability to meet expectations.
- Limited ability to adapt to new technologies.
- Insufficient experience in relevant industries.
- Insufficient ability to handle confidential information.
- Limited ability to learn new skills.
- Inadequate performance history.
- Inability to work effectively in a fast-paced environment.
- Lack of experience in specific areas.
- Inadequate understanding of key issues.
- Limited ability to handle complex situations.
- Inability to communicate effectively.
- Inadequate problem-solving skills.
- Limitations in technical expertise.
- Inability to meet expectations.
- Limited ability to adapt to new technologies.
- Insufficient experience in relevant industries.
- Inadequate ability to handle confidential information.
- Limited ability to learn new skills.
- Insufficient performance history.
- Inability to work effectively in a fast-paced environment.
- Lack of experience in specific areas.
Pharmaceutical Process Manager Job at Chemonics International in Arlington, VA

[Position No Longer Available]

Click 'Apply Now' to be directed to the job detail page on the Chemonics International website.

**Position:**
Pharmaceutical Process Manager

**Company:**
Chemonics International

**Job Location(s):**
Arlington, VA

**Start Date:**
As soon as possible

**Employment Term:**
Regular

**Employment Type:**
Full Time

**Starting Salary Range:**
Not Provided

**Required Education:**
Graduate Degree

**Required Experience:**
5 to 20+ years

**Required Security Clearance:**
None

**Related Categories:**
Engineering - General, Business Ops - Research/Development

**Position Description**

Pharmaceutical Process Manager

**Location:**
Arlington, VA

Supply Chain Solutions
Senior
Full time

Regular

**Description**

Chemonics seeks a pharmaceutical process manager who will support Procurement and Supply Management (PSM) headquarters supply chain staff, field offices, Ministries of Health, United States Government (USG) President's Emergency Plan for AIDS Relief (PEPFAR), and additional external collaborators to provide technical assistance in direct support of PSM's Task Order (TO) 1 - HIV/AIDS, with assistance to other PSM TOs as required. Procurement and Supply Management (PSM), is a 5-year, multi-billion dollar United States Agency for International Development (USAID) funded project. It will consolidate the procurement and assistance components of the current USAID DELIVER and USAID Supply Chain Management System (SCMS) programs and will be the primary vehicle through which USAID will procure and provide health commodities to partner countries and provide assistance to improve countries' management of the supply chains for such commodities. To support global health initiatives in HIV/AIDS, malaria, maternal and child health, and reproductive health, the project has three primary objectives: global commodity procurement and logistics, systems strengthening to support in-country supply chain management, and collaboration via strategic engagement to improve long-term global supply of health commodities.

The Pharmaceutical process manager will help the PSM team understand the manufacturing cost structure of selected pharmaceutical products. The Process Manager will oversee engineering active pharmaceutical ingredient (API) formulations.
pharmaceutical products. The Process Manager will reverse engineer active pharmaceutical ingredient (API) formulations, identifying the manufacturing processes required to produce them. With an understanding of the manufacturing processes, the Process Manager will assist the PSM Source Team in negotiating price reductions with manufacturers. The Process Manager will collaborate with other donors with similar objectives, and be a thought leader in pharmaceutical manufacturing process continuous improvement. The Process Manager will visit pharmaceutical manufacturer plants and work directly with suppliers to reduce costs.

Responsibilities include:

- Collaborate with the PSM Source Team to target pharmaceutical formulations and suppliers, at various stages of the manufacturing process, for detailed process cost analysis.
- Share knowledge and information with other global donor organizations with a common interest in reducing the cost of lifesaving drugs.
- Provide thought leadership in the area of market shaping activities through manufacturing process analysis and reverse engineering.
- Participate in relevant USAID Technical Working Group (TWGs) and other working groups, as appropriate.
- Visit selected pharmaceutical company manufacturing operations, and work with manufacturing personnel to identify cost savings.
- Contribute to or write PSM reports, articles and technical documents.
- Represent PSM at international meetings, as required.
- Respond to ad hoc requests from USAID/Washington

Qualifications:

- Minimum 5 years of pharmaceutical manufacturing process analysis experience and a PhD degree in Chemistry or;
- Minimum 8 years of Pharmaceutical manufacturing process analysis experience and a Master’s degree in Chemistry.
- Minimum of 3 years’ experience working in pharmaceutical manufacturing operations, with experience writing reports on results of process analysis.
- Experience improving pharmaceutical manufacturing processes, preferably at the API stage.
- Experience collaborating with global international development donors on reducing the cost of pharmaceutical products.
- Experience with giving presentations at major conferences.
- Experience publishing academic quality studies related to pharmaceutical manufacturing.
- Strong analytical and statistical aptitude.
- Experience working in resource constrained countries.
- A proven ability to work as part of a team and to be self-managing.
- Proficient in excel, word processing, and presentation applications.
- Current knowledge of existing developments in the field of laboratory supplies and technology, desired.
- Working proficiency in French, Spanish and/or Portuguese, desired.

Application Instructions:

- Apply through our Career Center at No telephone inquiries, please. Finalists will be contacted.
- Chemonics is an equal opportunity/Affirmative Action employer and does not discriminate in its selection and employment practices. All qualified applicants will receive consideration for employment without regard to race, color, religion, sex, national origin, political affiliation, sexual orientation, gender identity, marital status, disability, protected veteran status, genetic information, age, or other legally protected characteristics. Military veterans, AmeriCorps, Peace Corps, and other national service alumni are encouraged to apply. Excellent written and oral communication skills.

[Position No Longer Available]
Global R&D Analytical, Technology and Operations Lead

Title:
Global R&D Analytical, Technology and Operations Lead

Job ID:
1038195

Location:
United States-Virginia-Richmond

Last Date to Apply For Job:

Full-Time

US and Puerto Rico Employment Information

This employer participates In E-Verify: English [Link] [Spanish [Link]]

Right to Work Poster: English [Link] [Spanish [Link]]

EEO is the Law Poster: English [Link] [Spanish [Link]]

About Pfizer

A career at Pfizer offers opportunity, ownership and impact.

All over the world, Pfizer colleagues work together to positively impact health for everyone, everywhere. Our colleagues have the opportunity to grow and develop a career that offers both individual and company success; be part of an ownership culture that values diversity and where all colleagues are energized and engaged; and the ability to impact the health and lives of millions of people. Pfizer, a global leader in the biopharmaceutical industry, is continuously seeking top talent who are inspired by our purpose to innovate to bring therapies to patients that significantly improve their lives.

Role Description

under the general direction of the SVP Global Health, the Global R&D Analytical, Technology and Operations Lead is responsible to lead and drive the R&D platform core sciences and related technologies essential to the growth of Pfizer Consumer Healthcare in support of the overall Product Design, Products Research, and Development processes across Global Health and Wellness and on a regional basis.

Leads and executes general administration of the Global PCH R&D Development hub and site located in Richmond Virginia and ensures compliance with applicable regulatory and compliance requirements. Interfaces directly with multiple regulatory and government agencies. Represents Pfizer externally with community agencies and partners. Provides oversight to the PCH R&D Capital budget and partner with internal stakeholders to build capabilities and platform solutions for deployment across the PCH R&D network and 3rd party strategic partners.

Responsibilities

1. Provides leadership oversight and direction to the cross-category core sciences, technology and R&D operational functions to ensure accurate, timely and appropriately validated data and systems in support of product development activities and regulatory/compliance requirements. Accountable for, but not limited to, the following major R&D functions: Global PCH Analytical Science and Development, Materials and Product Chemistry, Global PCH Clinical and Consumer Supply Operations, cGMP R&D pilot manufacturing, Statistics, Microbiological Science, PCH Global Import / Export, Laboratory Operations.

2. Identifies, assesses and executes opportunities to build capabilities at Richmond site as well as across PCH R&D network, either physical or functional, and provide recommendation and action plans to PCH senior leadership. Ensures platform and operational consistency and connectivity across Global PCH R&D sites, and applicable 3rd party development partners.

3. Ensures colleague training and talent development leading to robust succession plans. Ensures effective and efficient scientific and laboratory based policies and procedures are in place (with a continuous improvement approach) to provide robust, complete, accurate, and validated data packages (e.g., analytical, statistical, stability and microbiology) acceptable (subscription ready) for global filings to Boards of Health.

4. Provides single point of accountability for Richmond site operations. Leads Richmond Site Leadership Council and executes site objectives and initiatives in partnership with matrix leadership teams.

5. Partners with Business Technology to implement laboratory based technology and data systems. Leads the development and execution of laboratory and R&D
network strategies in partnership with site leaders across the R&D network. Allocates resources in support of on-going site strategy and develops plans to enable deliverables of Health and Wellness, R&D network and the site engineering and site services delivery model.
6. Serve as an active team member of Global Health Leadership Team.
7. Coordinates and serves as point of contact for senior leader and external visits and events at Richmond site.
8. Develops an engaged work force and positive culture.

Qualifications
Degree - PhD in pharmaceutical, chemical, physical or biological sciences. A lesser Scientific degree will be considered with commensurate experience.
- 10+ years of related industry experience
- At least 8 years of experience leading a mid-size to large team.
- Successful track record in leading and developing individuals within a matrix environment.
- Professional maturity and presence with advanced written and verbal communication skills.
- Able to develop pathways in ambiguous situations and adapt to frequent change
- Demonstrated experience in design and launch of a broad range of global consumer products, preferred.
- Role model of the OWNITI culture

PHYSICAL/MENTAL REQUIREMENTS
A detail-oriented strategic leader with the ability and presence to develop and execute strategic plans, initiatives with organizational influence.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS
International and domestic travel required on an as needed basis. Approximately 10-20%

EEO & Employment Eligibility
Pfizer is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. Pfizer also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. Pfizer is an E-Verify employer.

Additional Offer Details:
Relocation Package Available
Professionals

Associate - Chemical Arts

Greenblum & Bernstein, P.L.C. is looking for a motivated patent prosecution associate in the chemical arts. Responsibilities for this position will primarily include preparing and prosecuting patent applications, conducting validity, infringement and freedom to operate studies, as well as client counseling and participation in litigation. The ideal candidate has a degree in chemistry or chemical engineering, and excellent academic credentials and communication skills. This candidate preferably has at least two years of experience in patent prosecution (preferably including at least two years of PTO experience). Salary is commensurate with experience and our compensation package is competitive with other top-tier intellectual property firms in the D.C. area.

As part of our team-oriented approach, the ideal candidate will have the opportunity to work closely with attorneys who are former high ranking PTO employees in a collegial atmosphere. This candidate will also have the opportunity to work on matters for large corporations, mid-size enterprises, universities, as well as smaller startups.

Undergraduate degree in the Chemical arts. Excellent academic credentials. 2-4 years of prior prosecution experience. PTO experience preferred.

Associate - Biochemical Arts

Greenblum & Bernstein, P.L.C. is looking for a motivated patent prosecution associate in the biotechnology field. Responsibilities for this position will primarily include preparing and prosecuting patent applications, conducting validity, infringement and freedom to operate studies, as well as client counseling and participation in litigation. The ideal candidate has a doctorate degree in biotechnology, and excellent academic credentials and communication skills. This candidate preferably has at least two years of experience in patent prosecution (preferably including at least two years of PTO experience). Salary is commensurate with experience and our compensation package is competitive with other top-tier intellectual property firms in the D.C. area.

As part of our team-oriented approach, the ideal candidate will have the opportunity to work closely with attorneys who are former high ranking PTO employees in a collegial atmosphere. This candidate will also have the opportunity to work on matters for large corporations, mid-size enterprises, universities, as well as smaller startups.
Doctorate degree in biotechnology or closely related discipline. Excellent academic credentials.
Two+ years of prior prosecution experience (PTO experience preferred).
Biochemist - II (Associate)

08-03-2016  Elkton, VA  113627

Job Description

Recruiter Profile

Hi, my name is Viren Sharma
Let me know if you have questions

919-230-9952 *4080
viren.sharma@spectraforce.com
Position details:
Client: Leading Pharmaceutical Client
Job Title: Biochemist
Location: Elkton, VA (22827)
Duration: 1 year contract (Possibility of Extension)
Shift: 8:00 AM to 5:00 PM

Qualifications:

Required Qualifications and Experience:
- B.S., M.S., or Ph.D. degree in biological scientific or engineering field (such as chemical or biochemical engineering, biochemistry, microbiology, molecular biology)
- Minimum of one year of hands-on experience with bio separations unit operation at lab and/or pilot scale including for example: filtration, chromatography – low and high pressure, centrifugation, homogenization, crystallization
- Demonstrated strong written and verbal communication skills
- Demonstrated strong interpersonal skills including collaboration, teamwork, and flexibility as well as ability to work independently and take initiative when appropriate
- Proven analytical abilities and ability to solve technical problems

Preferred Qualifications And Experience:
- Pharmaceutical industry experience
- Experience in a GMP or regulated environment
- Experience with experimental design
- Experiences requiring problem solving to meet customer or production needs
- Industry experience in sterile processing, manufacturing, or process development
- Ability to use statistics to understand process conditions and capabilities is helpful but not required

Responsibilities:
- Conduct hands on laboratory scale and pilot scale process development and investigation work for biologic and vaccine products (prepare buffers, operate equipment, prepare and analyze samples, etc.)
- Maintain excellent laboratory records and GLP, GMP documentation
- Collaborate constructively with the laboratory team and partners in Manufacturing, Quality, Research, etc.
- Execute project work under the guidance of a senior engineer
- Collect and analyze data

Medical Science Liaison

Arlington, Virginia, United States

Research & Development Dec 05, 2016 147459

Allergan plc (NYSE: AGN) is a bold, global pharmaceutical company and a leader in a new industry model - Growth Pharma. Allergan is focused on developing, manufacturing and commercializing branded pharmaceuticals and biologic products for patients around the world.

Allergan markets a portfolio of best-in-class products that provide novel treatments for the central nervous system, eye care, medical aesthetics and dermatology, urology, women's health, urology, anti-infective and cardiovascular therapeutic categories. With commercial operations in approximately 100 countries, Allergan is committed to working with physicians, healthcare providers and patients to deliver innovative and meaningful treatments that help people around the world live longer, healthier lives.

Our success is powered by our world-class team's commitment to being Bold for Life. Together, we build bridges, power ideas, act fast and drive results for our customers and patients around the world by always doing what is right.

At Allergan you will have the opportunity to thrive in a fast-paced, strategic environment where bold, innovative thinking is just welcomed. It's encouraged. Across all functions, we relish the opportunity to help our people fulfill their potential. Our rapid growth strategy means plenty of opportunities to step into the spotlight.

Join our bold team! Learn more at www.Allergan.com.

Position Description

Develops and maintains professional relationships with internal and external customers to provide comprehensive medical and scientific support to Allergan initiatives in assigned therapeutic areas. Facilitates information, education, and research activities for physicians and ancillary healthcare professionals regarding current and future therapies in development or commercialized by Allergan. Works closely with other Allergan personnel to ensure information, education, and research needs of healthcare professionals are met and to ensure scientific and technical training needs of commercial organizations are identified and met.

The employee must conduct their work activities in compliance with all Allergan internal requirements and with all applicable regulatory requirements. Allergan internal requirements include compliance with ethics, environmental health and safety, financial, human resources, and general business policies.
Requirements

Responsible for maintaining annual expenses within assigned budget parameters
Responsible for accurate and timely documentation of above activities
Identify, develop and maintain professional relationships with thought leaders, academic centers and researchers in assigned areas of therapeutic interest to ensure access to current medical and scientific information on Allergan products.

Upon request, present data on Allergan products to healthcare professionals including physicians, academic institutions, researchers, and other healthcare professionals.
Support research initiatives as requested by Allergan R&D, Clinical Operations, and Medical Affairs Departments.
Serve as internal medical and scientific resource to assigned Allergan therapeutic areas for development of disease state and product communications and materials that are medically accurate, balanced, and consistent with regulatory guidelines.
Support Round Table and Advisory Board sessions to ensure accuracy of scientific and clinical data.
Conducts on-going training to medical affairs, field sales and other internal personnel as directed.
May provide support for payer-facing activities to public and commercial managed markets.

Preferred Skills/Qualification

- Preferred minimum 5 year total specific industry experience (pharma, device, etc.) and minimum 4 years post professional degree practice or relevant transferable experience (clinical practice, academic research, regulatory/scientific)
- Knowledge of applicable pharmaceutical industry legal and regulatory guidelines
- Proficiency in Excel, Word, Power Point and other software skills
- Conveys information clearly, using a variety of media, to individuals and groups
- Excellent written/verbal communication skills
- Strong interpersonal skills
- Strong presentation and teaching skills
- Ability to convey clinical and non-clinical technical information effectively
- Strong planning and organizational skills
- Ability to travel 50-60%
- Strong team and leadership skills

Advanced degree with health science background (Pharm.D, M.D, Ph.D., preferred)
Management Sciences for Health

Principal Technical Advisor, Health Economics and Financing

All times are in Coordinated Universal Time.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Senior</th>
<th>Job ID</th>
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<td>Location</td>
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<td>Project/Program</td>
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<tr>
<td>Reports To</td>
<td>Pharmaceutical System Team Lead</td>
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More information about this job

Overview

Management Sciences for Health (MSH) is preparing a proposal in response to the anticipated USAID-funded global pharmaceutical systems strengthening project. The program will build on the achievements of the MSH-implemented Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. In continuation of the SIAPS program, this anticipated opportunity will work to assure access to quality pharmaceutical products and effective pharmaceutical services to achieve desired health outcomes.

OVERVIEW:

MSH seeks an experienced technical advisor with significant, relevant expertise and experience in the analysis, strengthening, development and implementation of health economics and financing at all levels of the health system, in the context of emerging and low and middle income countries. Expertise and prior experience related to health financing functions and their reforms, in particular related to purchasing, pooling, and coverage and benefit entitlement decisions that can improve upon efficient and sustainable use of resources, is essential. Skills related to financing of pharmaceutical services and systems, health benefit plans and related analysis of and development for medicine benefits package, and/or financial strategy development to support drugs procurement, storage, and distribution are highly desirable. This position provides technical leadership in contributing to strengthening pharmaceutical policies and practices from economics and financing aspects.

Specific Responsibilities

Support to Country Programs (35%)

- Support assisted countries to assess their pharmaceutical financing frameworks, health technology assessments and strategies in the context of Universal Health Coverage (UHC), and provide technical support to improve policy and practices.
- Provide assisted countries with technical support for the development and implementation of technical approaches and strategies for improving pharmaceutical financing processes within and outside of health benefit plans.
- Provide technical support to program staff at HQ and in the field to develop strategies for pharmaceutical financing that examine efficiencies to maximize health and increase value for money while increasing cost-effectiveness of pharmaceutical services, reducing out-of-pocket expenditures thereby increasing access to essential medicines and supplies.
Provide technical leadership in health economics and/or financing related to pharmaceutical systems to internal and external initiatives (25%)

- Maintain liaison with USAID and other donor agencies, foundations, universities, and NGOs working on related activities.
- Strengthen global thought leadership of the project in the area of health economics/financing in relation to pharmaceutical systems.

Report program outcomes; disseminate lessons learned and best practices (25%)

- Participate in developing appropriate program metrics for measuring the outcomes and impact of implemented system interventions:
  - Seek opportunities for dissemination of lessons learned, research, publications, and other development and communications activities.
  - Participate in the development of reports on SIAPS in accordance with the monitoring and evaluation (M&E) plan, objectives, and USAID intermediate results.
  - Support the development and review of operations research protocols and facilitate multi-country studies in common technical areas; facilitate sharing of technical approaches across SIAPS-assisted countries.

Present reports and updates; develop strategies for new business opportunities (10%)

- Provide Pharmaceutical System Cluster Lead with written technical briefs on a quarterly basis, including country and global updates on technical issues and/or issues of strategic importance.
- Support Pharmaceutical System Cluster Lead to develop new business opportunities and updates on recent developments/trends in global pharmaceutical financing.

Supervise Staff (5%)

- Supervise technical staff as assigned.

Qualifications and Experience

MINIMUM QUALIFICATIONS AND EXPERIENCE:

- Post-graduate degree in a health-related field with specialized training and/or experience in health economics and/or financing; economist, physician, administrator, or pharmacist qualification preferred.
- Prior senior-level experience in relation to health benefit plans and pharmaceutical systems, cost-effectiveness and efficiency analyses, development of medicine benefit packages, or medicine-related financial analysis and technical assistance is strongly desirable.
- Minimum 8 years' experience – however 10 years' is preferred – working in international public health financing and economics with demonstrated engagement with relevant regional and international bodies and associations.
- Minimum of 5 years' experience in development and support of pharmaceutical financing required, experience in low and middle income countries preferred.
- Relevant understanding of pharmaceutical services and systems strengthening preferred, including the implementation of prevention, care, and treatment programs in developing countries in any of the following areas:
  - Reproductive health, maternal/child health (MCH), HIV/AIDS, Malaria, Neglected Tropical Diseases (NTD), and Tuberculosis (TB).
- Demonstrated experience in working with multidisciplinary teams is required.

Physical Demands

- 30% international travel.
- Keyboard use, pulling drawers, lifting papers <10 lbs.

Background Information

Management Sciences for Health (MSH), a global health nonprofit organization, uses proven approaches developed over 40 years to help leaders, health managers, and communities in developing nations build stronger health systems for greater health impact. We work to save lives by closing the gap between knowledge and action in public health. Since its founding in 1971, MSH has worked in over 150 countries with policy makers, health professionals, and health care consumers to improve the quality, availability, and affordability of health services. Working with governments, donors, non governmental organizations, the private sector, and health agencies, MSH...
responds to priority health problems such as HIV & AIDS; tuberculosis; malaria; maternal, newborn and child health; family planning and reproductive health; and chronic non-communicable diseases such as cancer, diabetes, and lung and heart disease. Through strengthening capacity, investing in health systems innovation, building the evidence base, and advocating for sound public health policy, MSH is committed to making a lasting difference in global health.

EEO Statement

Management Sciences for Health is an equal opportunity employer offering employment without regard to race, color, religion, gender, sexual orientation, gender identity, age, national origin, citizenship, physical or mental disability, or protected veteran status.

Reports To

Pharmaceutical System Team Lead

*Go back to the welcome page*

Application FAQs

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Job Description

About HHMI

Howard Hughes Medical Institute (HHMI) is a science philanthropy whose mission is to advance biomedical research and science education for the benefit of humanity. We empower exceptional scientists and students to pursue fundamental questions about living systems, and work to share scientific discoveries with researchers, students, and science-curious individuals around the world.

Founded in 1953 by aviator and industrialist Howard R. Hughes, HHMI is headquartered in Chevy Chase, Maryland, and employs more than 2,500 people across the U.S. Visit hhmi.org/careers to learn more about working at HHMI.

About Janelia

Janelia Research Campus is a pioneering research center in Ashburn, Virginia, where scientists pursue fundamental questions in neuroscience and imaging. The Howard Hughes Medical Institute (HHMI) launched Janelia in 2006, establishing an intellectually distinctive environment for scientists to do creative, collaborative, hands-on work. To learn more about working at Janelia, visit janelia.org/careers.

Job Description:

The Howard Hughes Medical Institute's Janelia Research Campus is looking for an outstanding Research Scientist or Postdoctoral Associate interested in acquiring and analyzing state-of-the-art anatomical data to analyze axon projections in the mouse brain with unprecedented resolution and scale. The Mouse Light project team is an ongoing collaborative effort involving several research groups at Janelia. The team generates reconstructions of neuronal morphology, tracking individual axonal projections across the entire mouse brain. We seek a candidate interested in furthering our efforts by continuing to expand our library of imaged and reconstructed neurons and using this dataset to discover new principles of neuronal connectivity. Due to its early success, the project has received additional resources to increase the throughput of axonal reconstruction on an aggressive timeline. Individuals with a strong background in fluorescent microscopy and neurobiology who are interested in neuronal connectivity are encouraged to apply.

The Janelia Research Campus is a unique, world-class research institute with a major focus on the development of cutting-edge imaging and analysis tools. Candidates interested in this position would also have the opportunity to work closely with experts working on related neuroscience questions at Janelia (e.g., Nelson Spruston, Scott Sternson, Karl Svoboda, Adam Hantman, Josh Dudman and others).

Principal Responsibilities:

* Utilize state-of-the-art whole-brain imaging platform to collect high resolution data of labeled neurons across
the entire mouse brain.

* Efficiently utilize and develop tools to analyze unique neuro-morphological data.

* Work collaboratively with a team of scientists, software engineers, and annotators/proofreaders to implement an effective strategy for next generation high-throughput neuronal morphology identification and reconstruction.

**Preferred Qualifications:**

* PhD in Neuroscience, Biology, Physics, Engineering or a related discipline.

* Strong background in fluorescent microscopy and neurobiology.

* Familiarity with programming languages such as Java, C/C++, Matlab, Python for analyzing imaging and morphological data.

* Ability to work and support interdisciplinary work in small groups.

* Ability to develop novel approaches.

**Additional Information:**
To apply, please upload your CV, cover letter, and include the names and contact information of three references.

**HHMI is an Equal Opportunity Employer.**

**Required Skills**

null

**Required Experience**

null

Don't forget to mention Naturejobs when applying.

**Apply through the recruiter's website**

This recruiter would like you to apply via their website. Follow the link below for further instructions. When applying for this position please quote the following requisition number: Howard Hughes Medical Institute (HHMI)-hhmi-528-908

- Apply via recruiter
Job details

Employer
Howard Hughes Medical Institute (HHMI)
Website
http://www.hhmi.org
Location
- Ashburn, VA, United States

Posted
about 1 month ago
Expires
March 25, 2017
Job type
Other
Salary
Unspecified
Qualifications
Unspecified
Employment type
Unspecified
Job hours
Unspecified

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Pfizer
Sr. Director, Product Design & Development, Vitality & in Richmond City, Virginia

About Pfizer
A career at Pfizer offers opportunity, ownership and impact all over the world. Pfizer colleagues work together to positively impact health for everyone, everywhere. Our colleagues have the opportunity to grow and develop a career that offers both individual and company success; be part of an ownership culture that values diversity and where all colleagues are energized and engaged, and the ability to impact the health and lives of millions of people. Pfizer, a global leader in the pharmaceutical industry, is continuously seeking top talent who are inspired by our purpose to innovate to bring therapies to patients that significantly improve their lives.

Role Description
The Sr. Director, Design & Development reports to the Vitality & Wellbeing Lead and is the R&D leader within the team. The Design & Development Lead will identify and ensure on-time delivery of solutions for Vitality & Wellbeing platforms in Heartburn, Digestive Health (more broadly), Sexual Health and Sleep/Stress/Energy/Mental Acuity. This is a hybrid leadership role, in which the colleague will operate at a strategic level (working with need-state lead and key partners) to identify innovative opportunities and technologies while also directly managing the scientists engaged in delivering the programs needed to achieve the team’s growth targets. He or she will also build and maintain an engaged and innovative culture within the R&D team. This position will require strong partnership and collaboration across global functions, Health and Wellness teams, PGS, etc.

Responsibilities
Provide pipeline solutions (products and technologies) for the Vitality & Wellbeing consumer needs - Heartburn, Digestive Health, Sexual Health and Sleep/Stress/Energy/Mental Acuity. Provide solutions that support continued growth of core Vitality & Wellbeing brands - Nexium, Preparación H, etc. Quickly identify and learn new technology applications for Vitality & Wellbeing solutions and lead Design team in the uptake, application, and delivery of technology. Identify and drive key technology platforms and lead definition of clear technology/innovation roadmap to achieve growth targets in new and existing consumer areas. Provide direction and leadership to the product design teams to deliver consumer-led innovation which support delivery of the Vitality & Wellbeing strategy and financial commitments. Ensure that product design team’s approach to innovation and delivery is robust, scientifically sound, compliant, and places a premium on commercial feasibility and consumer surprise/delight. Provide oversight and leadership to the Project Teams as assigned or serve as a Project Technical Leader. Contribute to a collaborative team dynamic within the Vitality & Wellbeing team by cultivating positive connections with cross-functional leaders within and outside of the VAXX team. Develop, mentor and reward colleagues to develop a rich pipeline of future P&L leaders.
Qualifications

Degree - PhD preferred in pharmaceutical, physical or biological sciences. Masters Degree will be considered with commensurate experience. Minimum 12 years of industry experience, with particular emphasis in the consumer healthcare products space and ideally in both research and development. Strong leadership, collaboration/relationship-building, skills and ability to engage across multiple functions/cultures at a senior level. Experience developing NDA (new drug application) products and bringing both NDA and monograph products to market. Experience in Digestive Health and/or Recoto-OTC Switch preferred. Proven ability to deliver innovation in a quick and nimble manner in a high-paced consumer environment. Experience working in a virtual and matrix environment. Open minded. Dares to try new things and is willing to take well-considered risk. Strategic thinker with strong execution and oversight capabilities. Professional maturity and presence with advanced written and verbal communications skills. Ability to use sound judgment in ambiguous situations and adapt to frequent change. PHYSICAL / MENTAL REQUIREMENTS: Learning and change agility.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS: Approximately 15% travel (domestic international) or as necessary.

EEO & Employment Eligibility

Pfizer is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. Pfizer also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. Pfizer is an E-Verify employer.

Sr. Director, Product Design & Development, Virility & Richmond City, Virginia 23224-1852

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Senior Principal Development Engineer

Title:
Senior Principal Development Engineer

Job ID:
1040783

Location:
United States-Connecticut-Groton

Full-Time  Regular

About Pfizer
A career at Pfizer offers opportunity, ownership and impact.

All over the world, Pfizer colleagues work together to positively impact health for everyone, everywhere. Our colleagues have the opportunity to grow and develop a career that offers both individual and company success; be part of an ownership culture that values diversity and where all colleagues are energized and engaged; and the ability to impact the health and lives of millions of people. Pfizer, a global leader in the biopharmaceutical industry, is continuously seeking top talent who are inspired by our purpose to innovate to bring therapies to patients that significantly improve their lives.

Role Description
As a member of the Groton Engineering Technologies group in Chemical R&D, will provide engineering process development, technology transfer, and regulatory filing support for the development of robust, safe, and economical manufacturing processes for small molecule drug substance intermediates and APIs to internal Pfizer and external API manufacturing facilities. As a technology leader, will identify, develop, and apply existing and new chemical development technology to advance process understanding.

Responsibilities
- On API project teams, applies chemical engineering principles (reaction kinetics, thermodynamics, heat and mass transfer, and mixing effects) to evaluate and develop scalable and robust processes for the manufacture of active drug substances.
- Develops and applies new and existing process technologies to enable development and transfer of safe and scalable processes to API manufacturing facilities,
- Leverages engineering modeling to efficiently probe the design space in the laboratory and rapidly develop optimal manufacturing processes.
- Working in a modern automated laboratory, performs laboratory experiments to develop process understanding using a One Factor at a Time (OFAT) and/or a Design of Experiments (DoE) methodology as
appropriate. Performs experiments to understand reaction mechanisms and kinetics, stability, solvent exchange, etc.
- Supports technology transfer of drug substance processes to internal Pfizer API manufacturing facilities and external suppliers. Serves as a key point of accountability for new product site registration and validation activities. May spend significant time at the PGS launch site supporting process validation and Pre-Approval Inspection (PAI) activities. Applies chemical engineering skills and specific process knowledge to understand and resolve scale-up issues during transfer.
- Contributes to the preparation of the CMC section of the NDA.
Participates in data verification, PAI preparedness, and post submission query response.
- Champions the development of novel laboratory development instrumentation and software modeling tools to improve process understanding. Leads the development and implementation of new and existing workflows and methodologies.
- Remains current with the process engineering and chemistry literature. Collaborates and prepares internal research reports and technical presentation. May collaborate and author external publications and present research at external conferences.

Qualifications

Required Education/Experience
BS/MS Chemical Engineering with a minimum of 9 years relevant chemical or pharmaceutical process development and technology transfer experience or PhD in Chemical Engineering with a minimum of 4 years of experience. Experience in working in a fine chemical or API manufacturing facility with a good knowledge of batch unit operations is strongly preferred.

Required Technical Skills
A good understanding of organic chemistry and chemical engineering principles. Familiarity with in-situ analytical tools (e.g. FTIR, FBRM, and UV/Vis) and common analytical chemistry instrumentation including UPLC, HPLC, and MS.

Preferred Technical Skills
A working knowledge of organic and/or physical organic chemistry and chemical engineering principles. A working knowledge of reaction modeling, material property prediction, and simulation using computational tools including: DynoChem, Visimix, Aspen, Fluent, and Cosmotherm. Working knowledge of application of in-situ analysis tools to process understanding including: FTIR, FBRM, and UV/Vis. Working knowledge of UPLC, MS, and NMR spectroscopy.
PHYSICAL/MENTAL REQUIREMENTS
Ability to work in a laboratory environment performing experiments in a laboratory fume hood. Ability to perform complex data analysis.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS
Will be required to occasionally travel internationally (0-10%) to support clinical manufacturing activities as well as technology transfer to commercial manufacturing.

EEO & Employment Eligibility
Pfizer is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. Pfizer also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. Pfizer is an E-Verify employer.

Sunshine Act
Pfizer reports payments and other transfers of value to health care providers as required by federal and state transparency laws and implementing regulations. These laws and regulations require Pfizer to provide government agencies with information such as a health care provider's name, address and the type of payments or other value received, generally for public disclosure. Subject to further legal review and statutory or regulatory clarification, which Pfizer intends to pursue, reimbursement of recruiting expenses for licensed physicians may constitute a reportable transfer of value under the federal transparency law commonly known as the Sunshine Act. Therefore, if you are a licensed physician who incurs recruiting expenses as a result of interviewing with Pfizer that we pay or reimburse, your name, address and the amount of payments made currently will be reported to the government. If you have questions regarding this matter, please do not hesitate to contact your Talent Acquisition representative.

Additional Offer Details:
Relocation Package Available
as appropriate.

Computational Chemist - Materials Science

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Role Description

The computational senior scientist will utilize state-of-the-art computational chemistry and crystallographic tools to characterize the solid-state properties of Pfizer molecules so that their properties and performance can be predicted. This will enable Pfizer project teams to de-risk their programs and move rapidly to clinical studies in patients and ultimately to commercialization. The role is highly collaborative and requires extensive work on multi-disciplinary project teams. There is also a significant role to be played in the development of new computational methods to address gaps in current knowledge/capabilities.

Responsibilities

- Apply state-of-the-art computational approaches to predict the properties and performance of crystalline and amorphous drug substance samples.
- Use computational techniques (including matched molecular pair analysis, full interaction maps, solvation energy calculations and hydrogen bonding propensity analyses) to compare and rank new molecules against existing three-dimensional crystal structures (such as those in the Cambridge Crystallographic Database (CSD)).
- Make recommendations for targeted crystallization experiments and/or modifications to the molecular structure to provide enhanced...
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physical properties and stability of the material in the solid state.
- Oversee the work of external partners conducting computational analyses, and provide tactical guidance and critical analysis of their work.
- Solve scientific problems using contemporary solid state computational techniques.
- Participate on multidisciplinary project teams, and collaborate with colleagues to define and recommend screening and characterization strategies according to project timelines.
- Lead the development of new scientific approaches and knowledge within the global Material Sciences organization.

Qualifications
- PhD in Chemistry, Physics, Materials Science or Engineering, or a closely-related discipline. Or a Master's degree in these disciplines with 10 years of relevant experience in industry or academia.
- Strong data analysis skills and knowledge of statistical concepts is expected.
- Understanding of the physical properties needed for drug substance manufacture and formulation into drug product is desired.
- A strong interest and motivation to learn new technologies and concepts is expected.
- Good organizational skills, the ability to work independently, and excellent oral and written communication skills are required.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS
Occasional travel required (USA & UK)

PHYSICAL/MENTAL REQUIREMENTS
- Strong coding skills in a scientific programming language: C/C++, Python, Perl; with demonstrated evidence of coding expertise and data analysis.
- Competent in UNIX/Linux and HPC environments for submission and monitoring of jobs
- Experience with computational chemistry software (Gaussian, qChem, GAMESS-US, cp2k, quantum espresso and VASP) and the CCDC tools preferred.
- Knowledgeable of fundamental physical chemistry and materials science concepts such as thermodynamics, solvation, crystallography, symmetry, nucleation and crystal growth — either through coursework or experience.
- Strong analytical and mathematical skills (geometry, algebra, statistics, differential calculus)

EEO & Employment Eligibility
Pfizer is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. Pfizer also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. Pfizer is an E-Verify employer.

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Additional Offer Details:

Relocation Package Available

Management retains right to change the job specifications and provisions of this job as appropriate.

Sr. Scientist, Better Breathing Product Design

Title:
Sr. Scientist, Better Breathing Product Design

Job ID:
1045213

Location:
United States-Virginia-Richmond

Last Date to Apply For Job:
01/24/2017

Full-Time Regular

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Role Description
This position within the Better Breathing design group will be responsible for the formulation development, process development, scale-up, and technical transfer of new consumer healthcare products. Included will be the responsibility for the pharmaceutical product development across a broad range of respiratory programs. He/she must demonstrate strong technical ability and be able to apply innovative approaches and technologies. The position has no supervisory responsibility, however, individual will lead programs, cross-functional teams and operational initiatives and provide technical guidance to other junior level product design scientists/technicians in executing development projects. The individual must also possess a high degree of empathy for consumers and have passion for developing optimal products/packaging that fit consumer needs and lifestyles.

Responsibilities
1. Product Design;
   • Independently, design and initiate studies to support prototype development, validation activities, investigations, product chemistry evaluations to facilitate BB product development.
   • Play a major role in transfer of technology to both internal and 3rd party manufacturing facilities.
   • Perform data collection and analysis, discuss conclusions regarding
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progress of work, and effectively communicate information to
supervisor in the form of discussions and reports.
• Author protocols, reports, and other technical documents (i.e. FLF,
specifications) as part of the product design and technology transfer
process. Author documents for regulatory submissions.
• Establish and monitor developmental stability programs to assess
viability of dosage forms.

2. Innovation
• Evaluate new ingredients/equipment/technology and assist in making
recommendations to support core products, product improvements
and/or line extensions.
• Aggressively pursue intellectual property and patent applications.

3. Aligning with Marketing
• Interact with Marketing and Product Research functions on project,
innovation and consumer insight related activities.

4. Problem Solving
• Solve problems using multiple problem-solving tools and techniques
using appropriate resources, personal knowledge, experience, and
available data.
• Assist Junior scientists with technical challenges
• Present information on issues to leadership with recommendations on
next steps.

5. Organizational and Talent Development
• Coach and mentor junior level staff
• Assist in training junior level staff and guide the work of these
individuals on the development team.
Serve as an area representative, or lead local project teams, technology
transfer teams, task forces or committees as required

Qualifications
A degree in Pharmacy, Pharmaceutics, Pharmaceutical Science or
Technology, Chemistry, Chemical Engineering or related field with
minimum experience requirements listed below or equivalent work
experience is required.

BS degree with a minimum of 7 years of relevant experience
MS degree with a minimum of 5 years of relevant experience
Ph.D. degree with a minimum of 2 years of relevant experience

Experience with/knowledge of NDA and/or analogous submissions to
ex-US governmental boards of health

Demonstrated experience in conventional solid oral dosage form
development.
Possesses proven written and oral communication skills and organizational skills.

An awareness of recent advances relevant to formulation development and drug delivery.

The ability to employ risk management in decision making.

Scientific creativity and a passion for developing optimal consumer healthcare products.

Demonstrated ability to lead cross-functional teams and programs of modest complexity.

PHYSICAL/MENTAL REQUIREMENTS
Ability to lift modest weights (to 25 pounds) and sufficient dexterity to operate equipment are required.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS
Business Travel of approximately 10% will be required.

EEO & Employment Eligibility

Pfizer is committed to equal opportunity in the terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. Pfizer also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. Pfizer is an E-Verify employer.

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licensed physician who incurs recruiting expenses as a result of interviewing with Pfizer that we pay or reimburse, your name, address and the amount of payments made currently will be reported to the government. If you have questions regarding this matter, please do not hesitate to contact your Talent Acquisition representative.

Additional Offer Details:

Relocation Package Available

Management retains right to change the job specifications and provisions of this job as appropriate.

Job details

Material Product Development
Requisition ID: WD102755
Position: Full time
Open date: Jan 6, 2017 5:10 PM
Functional area: Science and Technology
Location: Pennsylvania
Required degrees: Phd/Doctorate
Experience required: 2 years
Relocation: Not Indicated

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Basic qualifications:
- Phd in Pharmaceutics, Chemical Engineering, or other related fields with a minimum of 2 yrs of industrial experience in drug product development

Preferred qualifications:
- Experience in developing phase appropriate formulations and manufacturing processes for small molecules including oligonucleotides
- Experience in developing injectable formulations or oral solid dosage forms is preferred
- Good understanding of physico-chemical properties and biopharmaceutics is desired
- Experience in continuous processes is desired
- Familiar with cGMP and regulatory requirements for manufacturing operations and documentation,
- Good oral and written communication skills

Details:
- Member of a team responsible for enabling the progression of NCE's from candidate selection to product commercialization
- Develop phase appropriate formulations to support clinical studies and ultimately commercialization
- Develop and optimize processes for the manufacture of drug products and participate in manufacturing of clinical supplies
- Design and execute DOE: scale up studies, and participate in technology transfer
- Prepare development reports and participate in preparing regulatory documents
- Lead matrix teams or a member of matrix teams supporting product development

Contact Information:
You may apply for this position online by selecting the Apply now button.

If you require an accommodation or other assistance to apply for a job at GSK, please contact the GSK HR Service Centre at 1-877-694-7547 (US Toll Free) or +1 801 567 5155 (outside US)

GSK is an Equal Opportunity/Affirmative Action Employer. All qualified applicants will receive equal consideration for employment without regard to race, color, national origin, religion, sex, pregnancy, marital status, sexual orientation, gender identity/expression, age, disability, genetic information, military service, covered/protected veteran status or any other federal, state or local protected class.

Important notice to Employment businesses/ Agencies

GSK does not accept referrals from employment businesses or employment agencies in respect of the vacancies posted on this site. All employment businesses/agencies are required to contact GSK's human resources department before referring any candidates to GSK. The obtaining of prior written authorization is a condition precedent to any agreement (verbal or written) between the employment business/agency and GSK. In the absence of such written authorization being obtained, any actions undertaken by the employment business/agency shall be deemed to have been performed without the consent or contractual agreement of GSK. GSK shall therefore not be liable for any fees arising from such actions or any fees arising from any referrals by employment businesses/agencies in respect of the vacancies posted on this site.

Please note that if you are a US Licensed Healthcare Professional or Healthcare Professional as defined by the laws of the state issuing your license, GSK may be required to capture and report expenses (GSK incurs, on your behalf, in the event you are afforded an interview for employment. This capture of applicable transfers of value is necessary to ensure GSK's compliance to all federal and state US Transparency requirements. For more information, please visit GSK's Transparency Reporting For the Record (http://fortherecord.paymentus.gsk.com/) site.
Associate Director/ Senior Bioprocess Engineer

Posted: 20.12.16
Location: United States
Salary: Highly Competitive
Reference No: US.SC.EP.10303

Our client is looking for a result-driven, motivated Senior Bioprocess Engineer who will provide technical supports for manufacturing processes for new biological products, optimising existing processes and designing new technologies.

Job Role:

This position will be responsible for direct oversight of contract organizations (CMO) performing cell culture/ fermentation process development and clinical/commercial manufacturing activities of monoclonal antibodies, fusion proteins and other novel biologics for clinical studies and commercial launch. This position will work with collaborators/partners and CMOs to participate in cross-functional teams. This role requires a strong scientific background, strong communication skill and demonstrated ability to develop biologics for clinical and commercial use.

Job Responsibilities:

Oversee cell culture manufacture process development, technology transfer and CMO-based manufacturing of large molecules, including but not limited to monoclonal antibodies, fusion proteins, and antibody-drug conjugates in early to late stage clinical development as well as commercial launch.
Provide technical support to CMOs/partners in cell culture fermentation process, such as optimization of process performance at various manufacturing scales, through an understanding of engineering and biological factors that influence process performance and product quality, process scale-up, batch record updates/review/approval, as needed.
Ensure scalable, commercially-viable biological manufacturing processes are properly developed at different CMOs, implemented and validated as necessary.
Actively participate in process characterization at CMO site through detailed performance monitoring and trending of in-process Critical Process Parameters (CPP) and drug substance Critical Quality Attributes (CQA).
Plan, create and manage the execution of process validation protocols for biopharmaceutical manufacturing processes.
Provide engineering support to manufacturing process to improve efficiency, sustain product quality, and reduce cost of goods.

Establish and communicate key project milestones and manage timelines for multiple manufacturing campaigns occurring at different CMO sites globally

Qualifications/Minimum Requirements:

PhD in biochemical engineering, chemistry or equivalent and a minimum of 4-6 years of relevant industry experience or a MS degree in chemical engineering, biochemical engineering or relevant related field and a minimum of 7-10 years of relevant industry experience or equivalent

Demonstrated technical proficiency in biologic drug substance manufacturing processes (particularly monoclonal antibodies) focusing on cell culture operations from pilot to Phase 3/commercial scale

Good inter-personal skill to work with regulatory, QA, QC, CRO and CMO.

Direct experience in preparing and reviewing CMC documentation for regulatory filings to support global regulatory submissions from IND to BLA as well as regulatory inspections

A minimum of 5 years process operations experience in an automated biotechnology manufacturing facility subject to Good Manufacturing Practices (GMP) regulations will be a big plus.

To Apply:

Please click on the Apply button. Please include a short note outlining why you are interested in the role and why you think you are suitable.

In case you have difficulty in applying or if you have any questions, please call Ediliz Perez on +1 646 768 9726 or upload your CV on our website www.proclinical.com.

A full job description is available on request.

ProClinical is a specialist employment agency and recruitment business, providing job opportunities within major pharmaceutical, biopharmaceutical, biotechnology and medical device companies.
About the company

A career at the company offers opportunity, ownership and impact.

All over the world, the company colleagues work together to positively impact health for everyone, everywhere. Our colleagues have the opportunity to grow and develop a career that offers both individual and company success; be part of an ownership culture that values diversity and where all colleagues are energized and engaged, and the ability to impact the health and lives of millions of people. The company, a global leader in the biopharmaceutical industry, is continuously seeking top talent who are inspired by our purpose to innovate to bring therapies to patients that significantly improve their lives.

Role Description

The Senior Scientist will be part of the Biopharmaceutics Group and will provide guidance and recommendations on biopharmaceutics aspects for drug products during their entire lifecycle from early development to post market changes.

Responsibilities

- Provide technical guidance for regulatory submissions for bioweavers for marketed products and recommend strategies for establishing bioequivalence for drug products.
- Develop and advance concepts of translational biopharmaceutics with a focus to improve predictive capabilities by linking in vitro drug product performance attributes to in vivo performance attributes.
- Assist in developing biopharmaceutics models for drug product design in vitro drug product evaluation using principles of quality by design and understanding of drug product manufacturing processes.
- Work in collaboration with Drug Product Design colleagues globally to address the biopharmaceutics needs of oral, parenteral, transdermal, and other delivery routes.
- Work closely with global teams in Pharmaceutical Sciences and Pharmaceutical Global Supply organizations involved with selection of API final formulation, design of dosage forms and development of manufacturing processes of drug product.
- Demonstrated abilities to work in cross-disciplinary teams and ability to partner with cross-disciplinary subject matter experts in Pharmacokinetics (PK), Drug Development, Biostatistics, and Clinical Pharmacology departments.

Qualifications

- Ph.D. with minimum 1-3 years, MS with 7+ years, or BS with 10+ years of experience in Industry in Pharmacometrics, Biopharmaceutics, Pharmaceutical Sciences, Chemistry, Biochemistry, Chemical Engineering, Physical Chemistry, Biophysics or allied disciplines.
- Experience in using and interpreting biopharmaceutics modeling, physicochemical solubility & dissolution and biological (passive, transporter mediated, efflux) transport phenomena, interpretation and use of in vitro permeability measurements, or in vivo/in vitro drug metabolism studies, and interpretation of pre-clinical and clinical pharmacokinetic data.
- Strong organizational skills, interpersonal, written, and verbal communication skills.
- Enthusiasm towards all aspects of biopharmaceutics and drug delivery.
- Experience in generating and interpreting biopharmaceutical data and models; understanding of formulation development, pre-formulation studies, or demonstrated capability with pharmacokinetic models for predicting exposure following oral and other routes of delivery.
- Knowledge or experience in later stage drug product development.
- Strong scientific leadership and direction of new technology initiatives.

PHYSICAL/MENTAL REQUIREMENTS:

Includes activities in both laboratory and office settings; approximately 50% time in each of these settings. Some lifting in the laboratory. Ability to perform mathematical calculations and ability to perform complex data analysis.

NON-STANDARD WORK SCHEDULE, TRAVEL OR ENVIRONMENT REQUIREMENTS:

10% travel (domestic and international)

Other Information - Internal

Colleagues who are issued an Incident Final Warning (IFW) on or after January 1, 2016, are not eligible to post and compete for a position for a period of 12-months from the date an IFW is issued.

EEO & Employment Eligibility

The company is committed to equal opportunity in terms and conditions of employment for all employees and job applicants without regard to race, color, religion, sex, sexual orientation, age, gender identity or gender expression, national origin, disability or veteran status. The company also complies with all applicable national, state and local laws governing nondiscrimination in employment as well as work authorization and employment eligibility verification requirements of the Immigration and Nationality Act and IRCA. The company is an E-Verify employer.

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Job description

PRIMARY PURPOSE OF POSITION:
This position is responsible for managing development and subsequent manufacturing of biological processes from cell line development through upstream and downstream processing at contract manufacturing organizations. The development and manufacturing functions are performed outside the company. Management of CMOs and CROs is a critical aspect of the job and will include frequent visits to the contractors depending on the intensity of the ongoing activities. The role involves significant cross-functional collaboration with other functions, including non-clinical, analytical, quality assurance, and regulatory departments.

MAJOR DUTIES OF POSITION:

- Manage and support development, scale-up, production and tech transfer of processes within or between CMOs.
- Design and manage cell line development, cell bank creation and safety and stability testing.
- Remove the bottlenecks and rationalize processes to optimize processes consistency, yield, and robustness.
- Ensure all experiments and activities are documented appropriately in accordance with GMPs.
- Contribute to preparation and submission of CMC portions of regulatory submissions and updates (IND, BLA, and post marketing commitments).
- Will be responsible to design and manage in-process stability studies and interpret stability data to establish in-process stability data and DS storage times and specifications.
- Will design, manage, and support process characterization studies and develop control strategies for process validation.
- Support process investigations and help determine root cause of excursions during development and commercial manufacturing.
- Work effectively with team members and contractors both in-person and remotely. Provide direction, support, and corrective action as needed.
- Ensure that all processes are in line with health, safety, environmental and quality requirements including regulations, policies, applicable guidelines and procedures.
- Have a high level of scientific curiosity and keep informed of technical developments within the industry by attending conferences and reviewing papers that advocating a culture of continuous improvement.

KNOWLEDGE AND SKILL REQUIREMENTS:

- PhD in Biochemistry / Biology / Chemical Engineering, with 8-10 years biological process development and manufacturing experience with a strong record of achievement. If Masters Degree, 12+ years experience.
- Proven hands-on experience with cultivating cells, operating microbial fermenters and/or mammalian bio reactors as well as harvesting material using centrifugation, depth filtration and/or TFF.
- Demonstrated, in-depth understanding of environmental, nutritional and mechanical factors influencing cell growth, productivity and longevity.
- Hands-on experience with purification techniques including operation of TFF and UFDF systems.
- In depth understanding of charge and size based separation mechanisms and manipulation of operating conditions for optimal separation of target protein from process and product related impurities.
- Demonstrated experience in tech transfer of a process from development to manufacturing or between manufacturing sites.
- Working knowledge of CMC regulatory requirements for biological pharmaceutical products at various stages of development as well as practical application of principles of QbD.
- Exemplary record of effective communication and influence with cross-functional level of intensity.

PHYSICAL DEMANDS:
To perform this job successfully, an individual must be able to perform each essential duty satisfactorily. The requirements listed are representative of the knowledge, skill, and/or ability required. The individual must be able to:

- Lift and move up to 25 lbs.
- Sit, stand, kneel, stoop, walk, use hands to finger, handle, or feel, crawl, and reach with hands and arms.
- Use the telephone and communicate clearly with a host of external individuals, domestically and globally.
- Work at computer for extensive periods of time.
- Work in a fast paced working environment managing multiple tasks.
- May require up to 30% travel, domestic and global, at times on short notice.

Industry
Pharmaceuticals

Employment type
Full-time

Experience
Director

Job function
Research
AD/Director Pharmaceutical Development
at Theravance Biopharma (View all jobs):
South San Francisco

Job Scope
The main job activities include working in the CMC team and other cross-functional project teams to support and enable the compound and drug product development, including designing and developing formulations and processes, optimizing and scaling up the manufacturing processes, manufacture of clinical trial materials (CTMs) in support of clinical studies, regulatory submission and commercialization.

Duties and Responsibilities
- As a technical and project lead, as well as subject matter expert (SME), lead the efforts in designing and conducting formulation development, process development, process optimization, scale-up, process validation, clinical and commercial manufacturing.
- Prepare and review manufacturing batch records, product development report and other development-related documents.
- Work with cross-functional teams (CMC, QA, Regulatory and DMPK) to ensure development of products in a timely and cost-effective manner.
- Support and enable regulatory submission.
- Evaluate, select, and manage contract manufacturers for drug product development scale-up and GMP drug product manufacturing.

Qualifications
- PhD in pharmaceutical science or related scientific discipline with 12+ years drug product development experience, or BS/MS degree with extensive industry experience (15+ years).
- Experience and extensive working experience with parenteral formulation/drug product development, process scale-up, and aseptic manufacturing.
- Experience in drug product IND/NDAs/IMPD regulatory filing.
- Extensive knowledge and working experience of CGMP and drug product development regulations.
- Experience in selecting and managing CROs/CMOs for drug product development and manufacturing.
- Demonstration of technical leadership, scientific excellence, and creativity.
- Demonstration of strong project and team management skills, ability to work effectively with cross-functional teams.
- Strong Interpersonal skills, ability to communicate clearly, concisely, and effectively in both written and oral context.

Apply for this Job

(Optional)

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Last Name *

Email *

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Location (City) * Enter a location
U.S. Equal Opportunity Employment Information (Completion Is Voluntary)

Individuals seeking employment at Thorsness Biopharma are considered without regards to race, color, religion, national origin, age, sex, marital status, ancestry, physical or mental disability, veteran status, gender identity, or sexual orientation. You are being given the opportunity to provide the following information in order to help us comply with federal and state Equal Employment Opportunity/Affirmative Action recordkeeping, reporting, and other legal requirements.

Completion of the form is entirely voluntary. Whatever your decision, it will not be considered in the hiring process or thereafter. Any information that you do provide will be recorded and maintained in a confidential file.

Gender [Please select ]

Are you Hispanic/Latino?

Race & Ethnicity Definitions

If you believe you belong to any of the categories of protected veterans listed below, please indicate by making the appropriate selection. As a government contractor subject to Vietnam Era Veterans Readjustment Assistance Act (VEVRAA), we request this information in order to measure the effectiveness of the outreach and positive recruitment efforts we undertake pursuant to VEVRAA. Classification of protected categories is as follows:

A "disabled veteran" is one of the following: a veteran of the U.S. military, ground, naval or air service who is entitled to compensation (or who but for the receipt of military retired pay would be entitled to compensation) under laws administered by the Secretary of Veterans Affairs; or a person who was discharged or released from active duty because of a service-connected disability.

A "recently separated veteran" means any veteran during the three-year period beginning on the date of such veteran's discharge or release from active duty in the U.S. military, ground, naval, or air service.

An "active duty wartime or campaign badge veteran" means a veteran who served on active duty in the U.S. military, ground, naval or air service during a war, or in a campaign or expedition for which a campaign badge has been authorized under the laws administered by the Department of Defense.

An "Armed forces service medal veteran" means a veteran who, while serving on active duty in the U.S. military, ground, naval or air service, participated in a United States military operation for which an Armed Forces service medal was awarded pursuant to Executive Order 12585.

Veteran Status

[Please select ]
Job description

The Director, Research will collaborate on project teams to conduct nonclinical efficacy and safety studies in support of Adamas' neurological diseases projects. In this capacity, the individual will develop nonclinical strategies and oversee the design, execution, analysis, and reporting of the research components of discovery and development programs. The successful individual will possess the relevant background and experience in neuroscience in order to effectively execute program objectives. This position will be based in Emeryville, CA and will report to the Senior Director, Research.

Responsibilities:

- Formulates nonclinical strategies in support of multiple CNS-related projects;
- Assumes ownership of nonclinical activities in support of projects and drive activities to completion with minimal supervision;
- Develops and manages nonclinical efficacy and safety studies with budgets, timelines, and risk assessment;
  - Contributes to the design, execution, data analysis, and writing of study reports for nonclinical studies;
  - Identifies, evaluates, and manages external collaborations and CROs;
  - Closely interacts with CROs to monitor the execution of GLP and non-GLP studies;
- Contributes to the writing of nonclinical sections for project development plans;
- Reviews and interprets scientific literature to guide program objectives;
- Prepares and edits nonclinical components of documents for regulatory submission (e.g., INDs, investigator brochures, NDAs, and briefing documents);
- Communicates findings to project teams;
- Represents Research on project teams;
- Interacts very closely with the following functions to ensure consistency of development strategies:
  - Clinical Research
  - Pharmaceutical Development
  - Regulatory
  - Commercial
  - Intellectual Property
- Ensures compliance with corporate policies and procedures, as well as, US healthcare laws and regulations.

Qualifications:

- PhD, DVM, or equivalent degree in neuroscience, pharmacology, pharmaceutical sciences, or related discipline;
- 10+ years experience in a drug development environment within a biopharmaceutical industry;
- Leadership experience managing projects and/or internal and external personnel;
- Strong research background in neuroscience, with extensive knowledge of neurodegenerative and/or psychiatric diseases, as demonstrated by publication record;
- Experience writing and contributing to regulatory submissions;
- Strong quantitative and analytical skills;
- Ability to prioritize and drive results with high scientific rigor;
- Excellent verbal and written communication skills;
- Thorough knowledge of FDA and ICH guidance documents including GLP regulations preferred;
- Experience with IND/NDA enabling toxicology studies preferred;
- Successful experience in fast-paced entrepreneurial environment;
- Fit with Adamas culture and values.
Employment type
Full-time

Experience
Director

Job function
Research

Meet the team at Adamas Pharmaceuticals, Inc.

Jonathon Holt - 3rd
Director Research at Adamas Pharmaceuticals, Inc. for 1 year
Raleigh, NC

Meet Adamas Pharmaceuticals, Inc.
Pharmaceuticals - 100-500 employees - Founded 2002 - Public Company

Company
The Adamas team is dedicated to improving the daily lives of those affected by chronic neurologic disorder, such as Alzheimer’s disease, Parkinson’s disease, multiple sclerosis and epilepsy. We have pioneered a platform based on an understanding of the disease's biology and the drug response to provide demonstrable symptomatic relief without additional toxicity issues. By utilizing this approach, we have developed a portfolio of chronic-treatment therapeutics to address chronic neurologic disorders.
Scientist - Pharmacokinetics and Drug Metabolism

Category: Scientific
Job ID: R-29524
Location: US – Massachusetts – Cambridge
Posted Date: January 4, 2017

Amgen is seeking a Scientist to join the Pharmacokinetics & Drug Metabolism (PKDM) department at our Kendall Square site in Cambridge, Massachusetts.

In this role you will add to the discovery and non-clinical development of small and large molecule therapeutics. You will be responsible for establishing and implementing PKDM strategy to achieve project team goals integrating pharmacokinetic and pharmacodynamic (PKPD) analysis with other aspects of drug discovery including disease biology, chemistry/protein sciences, toxicology and clinical pharmacology to advance the best therapeutic candidates. In addition, this position will make meaningful and innovative contributions to PKPD modeling and simulation in support of Amgen’s drug discovery efforts.

In this position the core responsibilities are to:

Serve as a subject matter expert on the pharmacokinetics and pharmacodynamics of small and large molecule therapeutics, communicate results, and collaborate with scientists cross-functionally and across our thre-site PKDM scientific community (Cambridge, MA, San Francisco and Thousand Oaks, CA)

Work with the PKDM project team representative and/or directly with disease biology experts to design appropriate pharmacodynamic (PD) studies to evaluate biology, PD and/or efficacy models, and to establish PKPD relationships to best meet therapeutic objectives

Devise, articulate, and implement strategies for improvement of the PKPD properties for candidate molecules and influence candidate selection

Communicate with PKDM project team representatives, experimentalists and
In addition to the core responsibilities, the position provides the opportunity to pursue scientific inquiries into the fundamental physiological and biochemical factors that determine the pharmacokinetic and pharmacodynamics properties of small and large molecule therapeutics. A collaborative and highly capable scientific cross-site community at Amgen is available to support these efforts. Interactions and collaboration with academic and other external scientists is encouraged.

#LI-POST

Basic Qualifications

Doctorate degree
OR

Master's degree and 4 years of scientific experience
OR

Bachelor's degree and 6 years of scientific experience

Preferred Qualifications

Ph.D. in pharmaceutical, chemical, or biological science

2+ years of drug discovery and/or development experience

Knowledge/expertise of PK, PD and/or distribution of small molecule and biological therapeutics

Expertise using PKPD modelling platforms (e.g. WinNonlin, Phoenix, Matlab)

Critical thinking, and demonstrated ability to communicate with team members across broad disciplines

Effective oral and written communication skills.

Amgen is committed to unlocking the potential of biology for patients suffering from serious illnesses by discovering, developing, manufacturing and delivering innovative human therapeutics. This approach begins by using tools like advanced human genetics to unravel the complexities of disease and understand the fundamentals of human biology.

Amgen focuses on areas of high unmet medical need and leverages its expertise to strive for solutions that improve health outcomes and dramatically improve people's lives. A biotechnology pioneer since 1980, Amgen has grown
reached millions of patients around the world and is developing a pipeline of medicines with breakaway potential.

Amgen is an Equal Opportunity employer and will consider all qualified applicants for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, protected veteran status, or disability status.

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Associate Director/Director, Manufacturing Science and Technology

200 Technology Square - Cambridge - USA - MA

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Associate Director/Director, Manufacturing Science and Technology

Position Summary

This position is part of Moderna’s new Manufacturing Science and Technology team responsible for ensuring the robust execution of our mRNA platform in cGMP Manufacturing. The main responsibility for this position is to be the process owner and technology transfer lead for drug product formulation and aseptic fill finish processes. The individual will work closely with Drug Product Process Development, Manufacturing, and Quality to ensure successful implementation of cGMP drug product manufacturing processes.

This position will also support the successful design, qualification, and startup of clinical drug product cGMP manufacturing operations at Moderna’s new facility in Norwood, MA.

The individual will serve as a subject matter expert for formulation and fill finish equipment design, qualification, and startup. Success in this position requires expertise in all aspects of aseptic drug product manufacturing, the ability to work hands on, and the ability to collaborate in a cross-functional, fast paced environment.

Responsibilities

- Lead cross functional technology transfer teams for aseptic formulation and sterile filling operations. This includes nanoparticle formulation processes and lyophilization processes.
- Track and coordinate project milestones for technology transfer including raw materials, equipment readiness, analytical testing, process information, and manufacturing documents to initiate and complete batches per the production schedule.
- Coordinate technology transfer with contract manufacturing organizations responsible for formulation and sterile filling activities.
- Ensure cGMP batch documentation allow the process to

About Us

Our Mission and Vision

At moderna, we are pioneering the development of a new class of drugs made of messenger RNA (mRNA). This novel drug platform builds on the discovery that modified mRNA can direct the body’s cellular machinery to produce nearly any protein of interest, from native proteins to antibodies and other entirely novel protein constructs that can have therapeutic activity inside and outside of cells.

We have a clear mission to propel the field of mRNA science forward and deliver new medicines to patients and a unique vision for how to achieve this mission.

Our Mission: To deliver on the promise of transformative messenger RNA (mRNA) science to bring new medicines to patients.

Our Vision: To unlock the potential of mRNA Therapeutics™ by establishing an ecosystem of teams and partners that will work together to develop the broadest possible array of drugs, across diverse therapeutic areas and routes of administration, for serious diseases that are not treatable today.
achieve the intended process control strategy. Ensure that the process is capable of achieving control limits and specifications.
• Investigate, identify root cause, and identify CAPA for manufacturing deviations.
• Trend process performance. Establish data analytics to serve as metrics, to assist in investigations, and as feedback to Process Development for scale up / process transfer.
• Author technical reports and protocols in support of cGMP activities.
• Coordinate sampling plans for GMP batches related to lot release, stability, and characterization.
• Partner with Process Development to ensure successful process transfer.
• Assist in equipment selection, qualification, and startup activities. Work with Manufacturing to ensure robust procedures are utilized for operation of equipment.
• Manage external vendors to ensure delivery of raw materials, equipment, or services, on time and within budget.

Minimum Qualifications

• Biochemical engineer, Chemical engineer, or Biochemistry background. Ph.D. with 6+ years of experience or MS/BS with 12+ years of experience in a pharmaceutical or biotechnology company.
• Expertise in sterile and aseptic fill finish operations.
• Demonstrated experience in technology transfer and technical support of sterile processes.

Preferred Qualifications

• Demonstrated knowledge of cGMPs and experience providing technical support in a cGMP manufacturing environment.
• Experience in nanoparticle formulation technology transfer.
• Experience in lyophilization process technology transfer.
• Experience in selection, procurement, and qualification of aseptic and sterile processing equipment.
• Demonstrated expertise in scale up and process transfer for filtration, formulation, and filling operations.
• Experience in selection, procurement, and qualification of primary container closure.
• Experience in single use bioprocessing technologies.
• Experience in risk assessment and characterization of extractables and leachables.
• Experience in validation of sterile manufacturing processes including cleaning, autoclaving, depyrogenation, sterile filter, container closure, and process validation.
• Experience in labeling and packaging of sterile products to produce finished goods.
• Proven track record leading and managing cross functional teams.
• Knowledge of data management tools and statistical process control.

Modern therapeutics does not accept unsolicited resumes from any source other than directly from candidates. For the protection of all parties involved in the recruiting process, resumes will only be accepted from recruiters/agencies if a signed agreement is in place at the inception of the recruiting effort and authorized for a specified position. Unsolicited resumes sent to Moderna therapeutics from recruiters/agencies do not constitute any type of relationship between the recruiter/agency and Moderna therapeutics and do not obligate Moderna therapeutics to pay fees if we hire from those resumes.

EEO Disclosure

Moderna is committed to equal employment opportunity and non-discrimination for all employees and qualified applicants without regard to a person's race, color, gender, age, religion, national origin, ancestry, disability, veteran status, genetic information, sexual orientation or any characteristic protected under applicable law. Moderna will make reasonable accommodations for qualified individuals with known disabilities, in accordance with applicable law.

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Principal Formulation Scientist
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Job Description

Job Title: Principal Formulation Scientist – New Product Development
Line Manager: Job Title Sr. Director, Sub Category Lead
Job Purpose:
The Principal Formulation Scientist supports new product development by functioning in two or more of the following capacities. At any given time, responsibilities may vary depending on specific business needs:
- Broad-based technical leadership that spans across multiple therapeutic categories and or scientific disciplines and is a recognized expert in the scientific community.
- Developing and executing technical strategies across multiple therapeutic categories and/or scientific disciplines.
- Project Leadership of complex global projects.

Key Responsibilities:

- They will demonstrate world class technical expertise in formulation science (i.e., tablets, capsules, liquids, confectionary), providing leadership in the direction and development of that specialist area regarded as critical to future business growth. They will operate at the interface of functional disciplines, both inside and outside of NPD, and coordinate the activities of specialists to design work programmes and participate in their execution to provide support to development projects or existing projects.

- She/He may lead complex global projects or have overall leadership responsibility for multiple projects (2-6) within a single area or across multiple therapeutic areas.

- They will lead these projects across all R&D functions. They will manage overall work priorities and ensure team activities are in accordance with company standards and regulations, taking into account scientific, budgetary and timing objectives.

- This Principal Development Scientist may provide technical leadership in the development and execution of technical strategy across multiple therapeutic categories and acts as a technical expert in supporting all NPD and Innovation in his/her areas of expertise. Can help facilitate resolution of complex technical problems.

- Coaches and mentors staff to become proficient in technical skills and to develop new technical skills in support of technical strategy and/or business needs.

Other Key Responsibilities Include:

- Makes wide ranging, independent decisions on projects and technical issues.
- Acts as a liaison to evaluate external technology and develop new technical expertise internally.
- Stays current with technologies and industry practices and applies relevant information to Consumer Healthcare.

- Develops strong links with external scientific community including academicals, trade associations and professional bodies.
- Explores and identify new technologies as appropriate with the agreement of the key stakeholders and develop expertise internally.
- Identifies, evaluates and delivers new technology, materials or ingredients.
- Ensures that research upholds highest scientific standards.
- Presents findings at conferences, publishes paper, authors patents.
- Coaches and mentors peers and other staff to develop new technical skills.
- Works with Manager to assess staff for potential growth for others within the organization.
- Communicates collaboratively and influences staff at all organisational levels with both internally and externally with specific organizations.

- Facilitates and manages internal and external relationships within Consumer Healthcare, as a whole, and with external groups toward fostering a "an environment of knowledge sharing when applicable."
- Works across different scientific disciplines and integrates knowledge from a variety of sources; resolves conflicting data and opinions between these functions is essential.
Champions creativity in teams to deliver innovation to the business.
Operates on specific assignments which may be of short duration (e.g. due diligence of development partners), or long term (e.g. lead outsourcing
Initiative to low cost country) in a manner that reflects the challenges in a professional and confidential manner.
Provides technical input and direction from a product development perspective to the Therapeutic Category Team and related functions as the expert

Knowledge / Education / Previous Experience Required
A. Educational Background
1. Minimum Level of Education: MS degree
   Area of Specialisation: Chemical, Pharmaceutical, Nutritional or related science
2. Preferred Level of Education: Ph.D. degree
   Area of Specialisation: Chemical, Pharmaceutical, Nutritional or related science
Minimum Level of relevant Job-Related Experience required: 15 years (MS); 10 years (Ph.D.)

- Excellent understanding of Drug and Food GMPs as relevant to Consumer Healthcare as well as familiar with
  FDA, European and global regulatory requirements, such as ICH
- Track record of coaching and mentoring peers and other staff
- Competency to lead large, complex, global teams with track record of on time delivery of multiple initiatives
- Experience with key technologies and industry norms and applies to different areas of responsibilities as required
- Creative and imaginative in approaching diverse R&D projects

Experience: 10 years

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Senior Manager, Global Head of Pharmaceutical Technical Sciences

Requisition ID: WD90033

Position: Full time
Open date: Sep 13, 2016 11:29 AM
Functional area: Science and Technology
Location: Maryland
Required degrees: PhD/Doctorate
Experience required: 10 years
Relocation: Yes

Basic qualifications:
- PhD in Pharmaceutical Sciences or a closely related discipline, with 10 years of experience in a formulation team with a focus on vaccines or recombinant proteins
- Proven experience managing a team
- Excellent organizational and communication skills
- Negotiation and influencing skills
- Ability to work and lead in a highly collaborative multi-cultural environment
- Experience with novel adjuvants and nucleic acids would be highly valued

Preferred qualifications:
Same

Details:
The Global Head of Pharmaceutical Technical Sciences is responsible for establishing and maintaining the appropriate level of pharmaceutical technical sciences and formulation expertise at each of the 3 global RDC sites in US, Belgium and Italy. He or she will serve as the lead scientist for ensuring smooth and effective transfer of Drug Product into later stage development, including oversight on all data, documents and supporting evidences.

On behalf of TRD, the role will build and lead the interface between the research groups at RDCs, both directly and in collaboration with TRD heads. The position will ensure that consideration for indumentisation of proposed antigen workstream and novel adjuvant candidates are accounted for early in development, in order to improve efficiency and ultimately product robustness. Additionally, he or she will provide pre-formulation information which informs preclinical formulation, the choice of potential delivery systems, and the scientific basis for successful product development.

The position must establish and maintain strong collaboration and interaction both locally and globally with internal and external partners and contribute to project plans for delivering the CMC strategy and Project objectives. The role also ensures that the content and quality of regulatory submissions, both nonclinical and CMC modules, meet requirements in all markets.

He or she will be responsible for recruiting, coaching and leading a high performance team in the US, as well as leading QbD locally for the team, within the global initiative and helping to define the CQA in all pre-clinical projects/platforms.

Contact Information:
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Job details

Scientist Drug Product Formulation
Requisition ID: WD96480
Position: Full time
Open date: Nov 10, 2010 6:11 PM
Functional area: Science and Technology
Location: Maryland
Required degrees: Ph.D./Doctorate
Experience required: 5 years
Relocation: Not Indicated

Basic qualifications:
- BS, MS or Ph D in Pharmaceutical Sciences, Chemistry, Biochemistry, Biology, Chemical Engineering or related discipline with 5-7 years (BS), 3-5 years (MS) or 0 -3 (Ph.D.) of laboratory research experience.
- Expertise in formulation development of vaccine drug product formulations
- Understanding of formulations for nucleic acids
- Able to work independently and take scientific direction from senior scientists
- Excellent communication and presentation skills

Preferred qualifications:
Same as Basic

Details:
We are looking for a motivated research scientist dedicated to the formulation and characterization of novel vaccine drug products. Experience with nucleic acids and liposomes are required. This a bench scientist position and the incumbent is expected to have hands on expertise in formulation of delivery systems for nucleic vaccine drug products. Prior experience with initiation of stability studies and DoE by QbD is required. He/She should have a strong understanding of characterization of nucleic acid based vaccine formulations. An understanding of ICH Guidelines, cGMP and FDA is needed. He/She will be responsible for transfer of formulations in to late stage development and expected to write SCPs and drug product technical reports. This position requires excellent organizational skills and the ability to work in a highly collaborative environment.

Contact information:
You may apply for this position online by selecting the Apply now button.
If you require an accommodation or other assistance to apply for a job at GSK, please contact the GSK HR Service Centre at 1-877-684-7547 (US Toll Free) or +1 601 587 6155 (outside US)

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Job details

Expert Scientist, Drug Product Development
Requisition ID: WD102232
Position: Full time
Open date: Jan 4, 2017 1:35 PM
Functional area: Science and Technology
Location: Maryland
Required degrees: Bachelors
Experience required: 3 years
Relocation: Not Indicated

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Basic qualifications:
- PhD with 3+ years of industry experience
- MS with 6+ years of industry experience OR
- BS with 9+ years of industry experience.

- A good understanding of vaccine formulation science, freeze-drying technologies and key analytical assays is required.
- Knowledge about physical characterization of the vaccine formulation using high-end instrumentation is required.
- Must have experience supporting drug product process transfers to clinical manufacturing for all phases of development.
- Ability to effectively work and perform within a team of dedicated scientists is essential.
- Must be able to solve complex problems through analytical thinking to identify and understand alternatives using knowledge gained through formal education, experience and sound judgment.
- Requires conceptual and practical experience with the project management function.
- Must have the ability to work with cross-functional teams and communicate effectively.

Preferred qualifications:
- Management experience is a plus

Details:
The Expert Scientist is expected to lead, design and execute scientific studies in support of technical programs as they progress from early development into Phase I/II, Phase III, technology transfer and process performance qualification at the intended commercial site.

Designs and leads specific development workflows autonomously, in line with business priorities, following the Quality by Design framework.

Independently responsible for the conception, design, implementation, and interpretation of scientific and technical data to support projects.

Collaborates with and/or leads scientific staff to design, implement, and interpret the data from development workflows.

Makes sound scientific/technical and business decisions based on a balance of data, analysis and experience.

Functions effectively as a core team member on multiple concurrent project workflows and established work processes.

Solves complex problems through collaborations with others, taking a new perspective on existing solutions.

Provides guidance to new team members and acts as a resource for colleagues with less experience.

Generates strong relationships in the area of technical development with high quality partners beneficial to the organization, both internally and externally, to strengthen development/implementation of new methods/technologies.

Prepares and presents scientific data within Technical R&D including Technical Development Team and may represent GSK externally (conferences, etc).

Authors and reviews technical protocol, reports and manufacturing support documents in support of various project development stages.

Utilizes technical process knowledge to meet regulatory requirements appropriate for stage of development.

Communicates effectively within TRD and with external stakeholders and is able to defend scientific and technical decisions at the appropriate technical board.

Benchmarks specific technologies in own functional area to bring technology to state of the art.

Contributes to and drives strategy and technical development planning and accountability in the execution thereof.
Ensure execution of the function's risk assessment and escalate at relevant bodies. Development of mitigation plans.

Act as a voice and ambassador of its department at various governance bodies/meetings.

Leads and implements the respect of the GxP/EHS/QA rules application.

Contact Information:
You may apply for this position online by selecting the Apply now button.

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Job details

Senior Manager, Drug Product Development, U.S.
Requisition ID: WD89007
Position: Full time
Open date: Mar 13, 2010 12:01 PM
Functional area: Science and Technology
Location: Maryland
Required degrees: Doctorate
Experience required: 6 years
Relocation: Not indicated

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Basic qualifications:
- PhD with 6+ years related experience, or Master's Degree in related scientific field with 10+ years related experience, or Bachelor's Degree in related scientific field with 12+ years related experience. Total education and experience in vaccine-related domain of 10 years.
- Hands-on and in-depth understanding of different protein chemistry characterization and stabilization techniques, as well as pharmaceuticals relevant to drug product development including lyophilized, liquid and suspension dosage form in viral.
- Good understanding of cGMP, pharmacopeia testing and regulatory requirements for filing and registration of vaccine and/or biologics with some knowledge of quality by design also desirable.
- The qualified candidate must be able to effectively partner with diverse team members from various functions within vaccines, multiple countries, and multi-level within the organization.
- Must be a self-starter, able to work with minimal supervision in a matrix environment and effectively manage multiple projects.
- Regulatory experience in multiple geographical regions (US, EU, Asia), as well as formulation and process tech transfer experience is a plus.
- A thorough understanding of vaccine formulation science, freeze-drying technologies and key analytical assays is required.
- Knowledge about physical characterization of the vaccine formulations using high-end instrumentation is required.
- Ability to effectively work, perform, and lead within a team of dedicated scientists is essential.
- Must be able to solve complex problems through analytical thinking to identify and understand alternatives using knowledge gained through formal education, experience and sound judgment.
- Requires conceptual and practical experience with the project management function.
- Experience in technology transfer and scale-up of drug product processes is a plus.
- Management experience is required. The Senior Manager will have from 4 to 8 direct reports.

Preferred qualifications:
Same

Details:
Help establish the U.S. Drug Product Development function in Rockville, MD. Expected to lead and represent drug product development function on formulation and process development projects in a cross function matrix team environment and assist in regulatory filings.

Contact information:
You may apply for this position online by selecting the Apply now button.

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Senior Manager of Separation Sciences and Sizing

Requisition ID: WD92274

Position: Full time

Open date: Oct 21, 2010 12:27 PM

Functional area: Science and Technology

Location: Maryland

Required degrees: Doctorate

Experience required: Not Indicated

Relocation: Not Indicated

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Basic qualifications:
- PhD in Analytical Chemistry, Biochemistry, Pharmaceutical Science or related field
- At least 5 years of managerial experience with an emphasis on team leadership, communication, and problem solving
- 5+ years of industry experience analyzing vaccines, recombinant proteins, monoclonal antibodies, fusion proteins, and/or conjugate vaccine drug candidates using the following techniques:
  - Separation Sciences
    - HPLC and UPLC platforms
    - RP, SEC, HILIC, and IEX column chemistries
    - PDA, FLR, ELSD, MALS, and CAD detectors
  - Sizing Technologies
    - DLS, SIEVE, MALLS, A4, AUC, and LO
- Expert in the use of Waters instrumentation and Empower software
- Experience supervising the development, optimization, qualification and transfer of separation and sizing methods for release, stability, and IPC testing
- Demonstrated experience writing SOPs and method development, qualification, and transfer protocols and reports
- A deep understanding of QbD principles, with a strong emphasis on the measurement of CQAs.
- Must be a self-starter, and be able to work with minimal supervision in a matrix environment and effectively manage multiple projects.

Preferred qualifications:
Same as basic

Details:
The Senior Manager of Separation Sciences and Sizing will be integral to the establishment of analytical capabilities at the new GSK Vaccines US headquarters in Rockville, MD. The Senior Manager will be expected to lead a diverse team of highly skilled analytical scientists in the design and development of analytical methods to support the lifecycle of candidate vaccine programs. Responsibilities will also include the development and transfer of release methods for GMP testing for Phase 1 and Phase 2, according to Quality by Design principles, in partnership with the Technical Development, Quality and Regulatory teams.

Contact information:
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Job details

Process Development: Process/Automation Engineer

Requisition ID: WD91050
Position: Full time
Open Date: Jan 23, 2017 8:48 AM
Functional area: Engineering
Location: Pennsylvania
Greater London

Required degrees: Bachelors
Experience required: Not Indicated
Relocation: Not Indicated

Basic qualifications:
- BSc or MSc and/or PhD in Engineering or Science related discipline
- Experience in biological manufacturing processes and or technology
- Experience of technology transfer, establishment, and/or qualification in a GP biopharmaceutical, instrument, or medical device industry setting
- Experience with process/analytical/technology development using principles of design for manufacturability. Quality by Design (QbD) in the bio-therapeutics, medical device, instrument or cell therapy industries

Preferred qualifications:
- BSc or MSc and/or PhD in Chemical, Bio/Biocatalysts, Automation, Systems Engineering or other engineering related discipline
- Experience in the automation of cell therapy processing and/or analytical units operations
- Experience of manufacturing using single use systems
- Experience in the design and/or use of microfluidic devices for cell therapy processing and/or analytical units operations
- Expertise in the use of statistical experimental design, data analysis and development of highly capable manufacturing processes
- Excellent understanding and experience in the use of current Good Manufacturing Practices (cGMP)

Details:
Glia2SmithKline (GSK) runs a world leading research-based pharmaceutical company that combines both individuals of talent and technical resources to create a platform for the delivery of strong growth in a rapidly changing healthcare market. Our mission is to improve the quality of human life by enabling people to do more, feel better, and live longer. GSK’s Cell & Gene Therapy Platform is expanding to support an increasing portfolio of cell and gene therapies. The team is responsible for delivering the Chemistry, Manufacturing, and Control (CMC) aspects of the projects from early phase to launch and the development of innovative technologies to enable step-change improvements to cell & gene therapy manufacture.

StimuvistM gene therapy for ADA-SCID was approved in May 2016 via an MAA that supports patient access at the single site in Milan. We also have multiple other gene therapy programs in late stage development. More recently, GSK has announced a significant collaboration in the T-cell immunotherapy with Adaptimmune and other licensing/partnership opportunities are being pursued. GSK’s strategic collaboration with Miltenyi Biotec seeks to optimise the manufacture and delivery of these personalised therapies using increased automation and leading edge processing technology. The progression of our own portfolio together with the maturation of the emerging gene therapy technologies created an imperative for GSK to now increase its investment in this field and establish an ‘end-to-end’ leading platform. This will enable delivery of the portfolio in Rare Diseases and Oncology as well as ensuring that GSK is able to capture the potential of the emerging technologies in other therapeutic areas.

A highly motivated, independent individual with a track record of process and/or systems engineering is sought to work within this team. Your duties will include and are not limited to:
- Work collaboratively with C> scientific leads, process/analytical development scientists, QC, Operations, and CMC to ensure delivery of robust, capable, efficient, scalable, and validated manufacturing processes for production
- Work with internal and external collaborators, propose, define, develop and validate innovative manufacturing and automation technologies and approaches to make step changes in manufacturability of cell-gene therapy products
- Apply principles of concurrent engineering to ensure manufacturability of processes developed by the process development team
- Ensure the health, safety and environmental performance of our manufacturing processes
- Contribute to the definition and delivery of development/manufacturing programmes outsourced to external Contract Manufacturing Organisations
- Support the development of a portfolio of ex-vivo gene therapies from early to late stage by providing expert input to project teams, directing development work, reviewing data, supporting regulatory interactions
- Engage with external cell-gene therapy process engineering and manufacturing experts
- Maintain awareness of new, emerging automation/manufacturing technologies and competitor process technology/manufacturing activity

You will have:
- Significant experience in the development, automation, and manufacture of biotherapeutics, medical devices, instruments, and/or cell therapy products
- A strong track record working closely with process development scientists to establish efficient clinical and commercial manufacturing processes
- Experience of virus manufacturing or cell processing would be an advantage
- Excellent communication and project management skills to facilitate interactions with internal groups and with external collaborators and partners

The successful candidate will report to the Head of Cell & Gene Therapy Engineering within C> and will be based at Upper Merion, PA in the US or Stevenage.
Hertfordshire in the UK
When applying for this role, please use the ‘cover letter’ of the on-line application to describe how you meet the competencies required for this role, as outlined in the job requirements above.

*LI GSK*

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Job details

Investigator/Senior Investigator
Requisition ID: WD102887
Position: Full time
Open date: Jan 19, 2017 5:00 PM
Functional area: Science and Technology
Location: Pennsylvania
Required degrees: PhD/Doctorate
Experience required: 3 years
Relocation: Not Indicated

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Basic qualifications:
- PhD in Pharmacology, Chemical Engineering, or other related fields with a minimum of 3 yrs of industrial experience in drug product development

Preferred qualifications:
- Expertise in developing phase appropriate formulations and manufacturing processes for small molecules
- Expertise in developing oral solid dosage forms and/or injectable formulations is preferred
- Experience in leading product development matrix team is preferred
- Good understanding of physico-chemical properties and biopharmaceutics is desired.
- Experience in continuous processes is desired.
- Demonstrated networking skills through interactions across departments, divisions, and disciplines
- Familiar with cGMP and regulatory requirements for manufacturing operations and documentation.
- Good oral and written communication skills

Details:

Member of a team responsible for enabling the progression of NCE's from candidate selection to product commercialization.
Lead matrix teams or a member of matrix teams supporting product development.
Progress drug product design & development aspects of projects, or areas of specialty, utilizing substantial experience and expertise as part of a Product Development & Supply technical matrix team and broader matrix teams.
Exercise professional judgment to determine the most appropriate course of action for a project.
Contributes to Drug Product Design & Development strategies.
Develop phase appropriate formulations to support clinical studies and ultimately commercialization.
Develop and optimize processes for the manufacture of drug products and participate in manufacturing of clinical supplies.
Design and execute DOE, scale up studies, and participate in technology transfer.
Prepare development reports and participate in preparing regulatory documents.
Propose and deliver innovative approaches to achieve project goals.
Provide correct interpretation of results and perform complex data management and analysis.

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Appendix H: Student Survey

Pharmaceutical Engineering, Ph.D.
Student Demand Survey Results

Mailing: March 17, 2017
Report: March 29, 2017

Target: Enrolled Seniors in Biology, Biomedical Engineering, and Chemistry and Graduate students in Biochemistry, Biology, Biomedical Engineering, Mechanical and Nuclear Engineering, Pharmaceutical Sciences, and Pharmacy

Population: 919
Respondents: 108

1. If VCU offered the Pharmaceutical Engineering, Ph.D., would you enroll?

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<th>Frequency</th>
<th>Valid Percent</th>
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<tr>
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<tr>
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<td>Not at all likely</td>
<td>29</td>
<td>28.2</td>
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<tr>
<td>Total</td>
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<td>100.0</td>
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2. What academic year do you think you would enter the Pharmaceutical Engineering, Ph.D. program (assuming program is open for enrollment)?

<table>
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<th>Frequency</th>
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<td>I would not enroll</td>
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</table>

3. Which one of the following areas of study are you currently pursuing? (If you graduated recently, select that area of study.)
<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Biochemistry</td>
<td>14</td>
<td>16.3</td>
</tr>
<tr>
<td>Valid Biology</td>
<td>16</td>
<td>18.6</td>
</tr>
<tr>
<td>Valid Biomedical Engineering</td>
<td>19</td>
<td>22.1</td>
</tr>
<tr>
<td>Valid Chemistry</td>
<td>10</td>
<td>11.6</td>
</tr>
<tr>
<td>Valid Pharmaceutical Sciences</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Valid Pharmacy</td>
<td>23</td>
<td>26.7</td>
</tr>
<tr>
<td>Valid Other</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Total</td>
<td>86</td>
<td>100.0</td>
</tr>
</tbody>
</table>

4. What year do you expect to receive the degree you are currently pursuing? (If you graduated recently, select Other.)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
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<td>Valid 2017</td>
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<td>48.9</td>
</tr>
<tr>
<td>2018</td>
<td>32</td>
<td>36.4</td>
</tr>
<tr>
<td>2019</td>
<td>6</td>
<td>6.8</td>
</tr>
<tr>
<td>2020</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>4.5</td>
</tr>
<tr>
<td>Total</td>
<td>88</td>
<td>100.0</td>
</tr>
</tbody>
</table>

5. What is your gender?

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Valid Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid Female</td>
<td>42</td>
<td>54.5</td>
</tr>
<tr>
<td>Male</td>
<td>33</td>
<td>42.9</td>
</tr>
<tr>
<td>I prefer not to say</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Total</td>
<td>77</td>
<td>100.0</td>
</tr>
</tbody>
</table>
6. What is your ethnicity? (Select all that apply.)

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Indian or Alaskan Native</td>
<td>2</td>
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<tr>
<td>Asian</td>
<td>15</td>
</tr>
<tr>
<td>Black or African American</td>
<td>13</td>
</tr>
<tr>
<td>Hawaiian or Pacific Islander</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic or Latino(a)</td>
<td>5</td>
</tr>
<tr>
<td>White</td>
<td>50</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
</tr>
<tr>
<td>I prefer not to say</td>
<td>4</td>
</tr>
<tr>
<td>Total Checked</td>
<td>95</td>
</tr>
</tbody>
</table>
Appendix I: Prospective Student Support Letters
To Whom It May Concern:

I am writing here as to ask for support to an exciting and intriguing proposal for the development of a Ph.D. program in Pharmaceutical Engineering. I am a current Ph.D. candidate in Chemical Engineering in which my research is conducted in the Pharmaceutics Department at Virginia Commonwealth University. I have a unique background as to having received a B.S. degree in Biomedical Physics Honors and an M.S. degree in Biomedical Engineering. Therefore, I have approached scientific research from multiple perspectives within engineering and the fundamental sciences. Since the beginning of my research career, I have seen the wonderful benefits of collaboration between various fields and utilization of multidisciplinary programs in providing excellent research and pushing the bounds of innovation. There is a great need for more programs to harness interdisciplinary thought, especially to those in the medical field in which many complex challenges require an understanding of multiple fields in order to achieve successful outcomes. I believe this program can meet these goals. If this program had existed when I began my doctoral research, I would have most definitely applied. As in my current program, there is a major gap between my actual studies and how that translates to the research that I am conducting currently. I obtain a very good engineering approach to problem solving, however, I have not been able to benefit from more pharmaceutical based approaches that my current program does not offer. I believe this program can most definitely fill this educational gap and produce researchers who gain a wide knowledge of both engineering-oriented and pharmaceutical-oriented goals, which is needed for any pharmaceutical product developed within or outside academia. Such a program as being developed here can benefit those students who are interesting development of pharmaceutical products in which a background in multiple areas will be greatly beneficial in producing highly skilled researchers. As this program would be the first of its kind in the nation, I believe this program can benefit Virginia Commonwealth University by pushing the boundaries of innovation and harnessing the multidisciplinary approach that this program will bring as well as producing researchers who will be able to approach highly complex problems with multiple approaches. I hope you will kindly consider the benefits such a program can offer to future researchers and the pharmaceutical field.

Graduate Research Assistant
Wayne State University
Department of Chemical Engineering & Materials Science

Visiting Scholar
Virginia Commonwealth University
Department of Pharmaceutics
Pharmaceutical Engineering Letter of Support

To: Thomas D Roper <tdroper@vcu.edu>, srdarocha@vcu.edu

Fri, Jan 20, 2017 at 11:45 AM

I am currently a junior pursuing a dual degree in Chemical and Life Science Engineering and Professional Chemistry. In the future, I plan on conducting research in both pharmaceutical drug development and process optimization. This program is of particular interest to me because it seems to effectively blend API synthesis, process optimization, and pharmaceutical policy into a single comprehensive program. An issue that myself and many of my peers with similar interests have had is with the lack of such specialized graduate programs available. This synthesis of chemical engineering and chemistry is especially exciting because it would finally create a platform for students to approach pharmaceuticals from a chemist's point of view, focusing on high yield, small batch reactions, and then apply engineering concepts to enhance efficiency and/or viably scale up and optimize underlying processes. I believe that a program such as this will produce a new generation of uniquely specialized individuals aptly prepared for broadening the horizons of pharmaceutical synthesis and production, which will undoubtedly bring notoriety to VCU.
Letter of Support

Since the whole sciences are related to each other, and the learning outcomes for the new program had got my attention. I believe that the new program will be one of the best PhD programs in the country and around the world, and will attract researchers from everywhere. Furthermore, it will help achieving more successes in the drug development and the public health. From my experience as a graduate student in the department of pharmaceutics, I believe that it's important to start the Pharmaceutical Engineering PhD program in our university to attract more researchers and scientists, which will improve the student learning outcome, and to get more success in the drug development process. The Pharmaceutical Engineering PhD Program will be a unique program, and will gain admirations from all scientists, doctors, and engineers.

19/1/2017
To home it may concern,

This is in support of the newly proposed program "Pharmaceutical Engineering".

As a Biomedical Engineering graduate student with a life science background, I have always tried to approach matters from different angles; therefore, I fully understand the advantage of having an interdisciplinary program. I strongly believe such an interdisciplinary program as Pharmaceutical Engineering will fill the gap between pharmacy and engineering, which will potentially lead to the design, development and discovery of new valuable products. Moreover, students will have a unique learning experience that embraces topics from different approaches. I believe the program will be very valuable not only for the university but also for the city and state as it is the first PhD program of its kind in the nation. This can attract highly qualified faculty, researchers and students from all over the world, which will have educational, medical and economic benefits. I, thereby, urge you to approve this program.

Thank you.

Regards,

[Signature]
To whom it may concern,

I am writing to recommend the PhD program in Pharmaceutical Engineering at Virginia Commonwealth University. My Bachelor of Science degree in Chemistry was earned at Randolph-Macon College in 2016, and now I am a Master of Science student in Chemical and Life Science Engineering at VCU. I am currently working in a Pharmaceutical Engineering laboratory, with three years of laboratory experience from my undergraduate institution. Even with my chemistry background in addition to my new engineering knowledge, there was a lot to learn inside and outside of the lab about Pharmaceutical Engineering research. All of this background information was mentioned in order to provide an example for the level of preparedness that a student who wishes to enter the pharmaceutical industry must have in order to succeed or even feel comfortable.

Because of the great knowledge of pharmaceutical research that a student must possess in order to enter the pharmaceutical industry, I believe that a program designed to prepare students who specifically would like to enter the Pharmaceutical Engineering industry is a necessity. I believe that this program will prepare students with a proper Organic Chemistry and engineering background to go forward in pursuing a career in the pharmaceutical industry.

As a student who is now beginning to look at career opportunities, I see a great need for a specialized program that will give students the necessary tools and abilities to stand out in a competitive interview and excel in their careers. Furthermore, I believe that this program will draw many top-tier students to this institution and bring great success to our engineering school.
To whom it may concern,

My name is [REDACTED] and I am a first-year graduate student here at VCU transitioning over from a BS in Chemistry to get my Masters in Chemical and Life Science Engineering. I have had the pleasure of joining Dr. Roper's pharmaceutical engineering team as a part of my experience here, and when I heard of the possibility of a PhD Program for Pharmaceutical Engineering, I couldn't help but offer my support. As the total package of scientific overlap between medicine, life sciences, and engineering, I believe that this program could be a paramount example of what VCU stands for.

This program could fulfill a niche for people just like me; those with an interest in medicine and improving the quality of life for people across the world, but those not necessarily as interested in becoming a doctor or attending the pharmacy school. I believe that the chance to do meaningful work in a Pharmaceutical Engineering Program here could not only attract more students to VCU's Engineering School, but it would also take full advantage of having an engineering school, medical school, and pharmacy school so close together and bring what VCU has to offer full circle.

Sincerely,

[REDACTED]
asking for letter of support to Pharmaceutical Engineering Program

To: Sandro R da Rocha <srda_rocha@vcu.edu>

Thu, Jan 19, 2017 at 9:13 AM

Hi Dr. da Rocha,

Please see below for my letter of support. Please let me know if the letter needs to be more formalized.

My name is [redacted] and I am currently in my third year of the doctoral program in Pharmaceutical Sciences at VCU. I am writing to show my support for the creation of the Ph.D. degree program in Pharmaceutical Engineering. Prior to joining VCU, I had been working in pharmaceutical development for a number of years, so naturally, I was looking into pharmaceutical engineering programs to extend my training. This was when I realized that program options in this area are next to none. Therefore, I am extremely excited to hear about the possible creation of a pharmaceutical engineering degree program at VCU. I believe such a program that provides training in pharmaceutical, regulatory, entrepreneurial and academic settings would greatly benefit the university and the community as a whole. Being the first of its kind, the program would set VCU apart as being able to provide the foundation to train researchers across the multiple disciplines needed to develop and produce successful pharmaceutical products. Also, VCU's proximity to regulatory authorities, as well as small and large pharmaceutical companies, enables collaboration with the community that would further strengthen the caliber of scientists that are trained through this program. The creation of a doctoral program in pharmaceutical engineering is the next logical step for progression of academics at VCU as it is an institution recognized for its expertise in pharmaceutical research.

[Quoted text hidden]
[Quoted text hidden]

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