According to the Centers for Disease Control, the number of Americans with diagnosed diabetes more than tripled (from 5.6 million to 20.9 million) between 1980 and 2011, predicting a continually increasing diabetes disease burden. There is a clear need for truly novel approaches to decrease this burden and to develop such approaches will require bringing the full breadth of modern technological, computational and biological advances to tackling diabetes mechanisms and complications.

This in turn requires the development of an interdisciplinary workforce with backgrounds in the physical sciences and engineering, geared to the development of innovative technologies for treatment of diabetes and related diseases.

The program has the possibility of transforming diabetes research – and hence therapies – by harnessing burgeoning advances in (i) imaging, from molecular to tissue levels, (ii) modeling, both biological and computational and (iii) tissue engineering, driven by researchers in the physical, computational and biomedical engineering fields, to address questions directly and broadly relevant to diabetes and its complications.

MENTORS AND TRAINEES

Each trainee will be dually mentored (either equally involved or primary and secondary), one with a strength in bioengineering/physical sciences, and one with a strength in diabetes or metabolism more broadly.

Two new pre-Doc and one new post-Doc slot are available each ear, with a maximum of two years support available.

The goals of the program include: defining the field of bio-engineering and related research as broadly as possible, involving young faculty mentors who are on the cutting edge of new bioengineering and diabetes research, selecting outstanding faculty who are leaders in bioengineering and diabetes research fields, sparking new collaborations between the life science and technology-based faculty, supporting already-formed clusters of relevant researchers that cross departments and disciplines, including mentors who share a commitment to pre- and post-Doctoral education and training, and a willingness to participate in program activities.

If interested in participating as mentor or trainee, please fill out form below, or contact Dr. Nichols for more information
T32 Proposal for Name of Applicant

Mentor: Name of Mentors

Biomedical focus:

Bioengineering focus:

1. Proposed periods of time on the T32

2. Research focus of the mentors:

3. Projects to be pursued by the trainee during the research year

4. Training Objectives:

5. Proposed Coursework (if any):

6. Potential Deliverables (manuscripts, national presentations, grant):

7. Future Plans of the trainee

Statement from the faculty mentor committing to the proposed research plan
Criteria for Selection of Mentors: Mentoring in the program will cover the spectrum of research options. In assembling this group of mentors, we have sought to:

- Define the field of bio-engineering and related research as broadly as possible
- Involve young faculty mentors who are on the cutting edge of new bioengineering and diabetes research,
- Select outstanding faculty who are leaders in bioengineering and diabetes research fields,
- Spark new collaborations between the life science and technology-based faculty
- Encourage potential partners between junior and senior faculty in different disciplines, and
- Support already-formed clusters of relevant researchers that cross departments and disciplines.
- Include mentors who share a commitment to pre- and post-Doctoral education and training, and a willingness to participate in program activities.

Participating faculty mentors: Currently there are ~35 faculty mentors representing 11 departments or divisions on the medical school and Danforth campuses. The composition of this group of mentors is not fixed and may be modified by the FTC with approval from the Advisory Committee.

3.5 Proposed Training

3.5a Training Level, Degree Distribution, and Training Duration: (1) We can provide training support for PhD graduate students. Suitable individuals will have a background in engineering or quantitative sciences and will be registered as members of SEAS, DBBS, Chemistry, Physics or Mathematics graduate programs. (2) We propose to train post-doctoral researchers who have Ph.D. degrees in quantitative sciences or engineering. Only faculty mentors with strong track records of research funding from federal or other sources have been selected and it is assumed that they will be able to ensure continued funding beyond the fellowship period. We can support 6 trainees per year through this program (4 pre-doctoral students and 2 post-doctoral trainees per year) at steady state. Each trainee will typically be supported for two years and so in the first and final years of the award, we are requesting only 2 pre-doctoral and one post-doctoral slots. While a minimum of 2 years of research training is required, in practice a longer period will typically be necessary in order for these individuals to develop a substantive foundation for a competitive research career. After the first two years, pre- and post-Doctoral fellows may also be able to obtain support from other agencies, such as the American Diabetes Association and American Heart Association to extend their training to the 4-5 years that are realistically required either to complete a Ph.D., or to become competitive for an independent position following post-Doctoral training.

3.5ai Pre-doctoral specific requirements: Fellowship support is available to students in graduate programs in DBBS, Chemistry, Physics, Mathematics, Computer Science, BME, Mechanical Engineering, and Electrical Engineering. Students typically apply for fellowship support during their first year of graduate school, although they may apply during their second year. Students are normally supported for the first two years in their committed thesis laboratory(ies). Applicants must complete a 1-page information form and submit a paragraph about their interests, a description of their proposed dissertation research (if in the second year of graduate school), and three letters of recommendation. Programmatically, we will choose fellows who represent a cross-section of the 3 bioengineering/physical science foci under the umbrella of the program. Each student will be required to submit a progress report at the end of the first year of training to receive funding for the second year. To achieve the translational training goals of the program, graduate students are required to have two mentors, one from one of the three bioengineering/physical sciences foci (Imaging, Modeling, Engineering), and a second mentor in the clinical and experimental diabetes focus. In some cases the thesis project will clearly require joint supervision, as for instance in cases where an engineering student is building or developing a device or process, and then testing the device in tissues, or in animal or human subjects. In other cases, the graduate student will be required to spend either a block of time in the secondary mentor’s lab, or to shadow the mentor in clinical practice. In this regard, the tailored didactic program in clinical diabetes (see below) will ensure significant exposure to clinical concerns and translational questions that the trainees’ research will be seeking to address.

Academic Requirements: Graduate students in the program are required to complete core courses of their parent program. PhD degree requirements (e.g., qualifying/cumulative exams, pre-thesis proposals, etc.) are determined by students’ “home” doctoral programs, but the core courses in the BME PhD program provide a model background for students accepted into this program. The BME Ph.D. degree requires completion of 72 credits, of which a minimum of 36 must be graduate courses, including a core curriculum. This is fulfilled by taking 5 BME core courses with at least one from each of 3 of the BME course groupings, with the balance of the courses consisting of electives. BME students accepted into this training program will typically be
expected to take 3 of the 5 requisite courses from those allocated to their chosen bioengineering focus (see color coding in Chart I). Students from other programs will also be required to take 3 courses from the listed BME courses that are specific to their chosen focus area within this training program, but may receive a waiver of this requirement if core courses from their “home” program are deemed equivalent.

Students admitted to this program within their first year will be required to carry out rotations in program mentor’s laboratories, while those accepted in their second year of graduate school will be expected to have already chosen at least their primary mentor.

Although not required, all trainees in our program will be permitted and encouraged to attend appropriate segments of the Clinical Rounds and Research Seminars. Finally, for all of the graduate programs affiliated with the program, relevant additional courses may be taken as electives but, in terms of program length, additional relevant elective coursework should not add any time to degree completion.

3.5aii Post-Doctoral specific requirements: For those with doctoral degrees, once a candidate contacts a faculty member or members about the prospect of coming to WU, they are typically invited to the University to present a seminar, funded using discretionary institutional funds. If the candidate is appropriate for this program, members of the FTC will attend the seminar and meet with the candidate. Criteria to be considered in selecting the candidate and project will include appropriateness of technical background of the candidate and the relevance of the proposed post-Doctoral training to the overall goals of the program. Trainees will be required to prepare a one page document that includes a statement of the problem they propose to tackle, and/or the hypothesis they propose to test and an outline of the approach (with specific aims) they will utilize. Once accepted into the program, the formal training elements of the program will depend on the background of the applicant. For those with purely engineering backgrounds, trainees will be required to take (1) Molecular Cell Biology for Engineers, BMES530 course, including the test sections of the course and to perform adequately. For those with substantial prior biological education and equivalent prior training, this requirement will be waived. All post-Doctoral trainees will be required to participate in (2) Clinical Diabetes for Engineers and (3) Practical Challenges in Clinical Diabetes courses that are detailed above, along with the graduate student trainees. As appropriate, these post-Doctoral trainees can also audit any of the relevant graduate courses and programs detailed above.

3.5b Career Development Committees: (i) Pre-doctoral students For pre-doctoral students, the committee will be comprised of the thesis committee, which will be expected to have representation from at least two of engineering, basic science and clinical science fields, including the dual mentors from the faculty mentors lists. At the end of their first year of training, all graduate trainees are required to prepare Individual Development Plans (IDPs). The Program Directors of SEAS and DBBS have endorsed all students using the AAAS instrument http://myidp.sciencecareers.org/, which will be assessed by the thesis committee and by the FTC, who will provide feedback to the trainee regarding intermediate and longer term career paths. (ii) Post-doctoral trainees All post-doctoral trainees will also be required to prepare IDPs as above, as part of the acceptance mechanism into the program. Each post-doctoral trainee’s program will be guided with the assistance of a Career Development Committee that will consist of the two mentors and the FTC. With attention to the trainees’ personal IDP, this group will assess progress at 6 month intervals and provide feedback in four areas: (1) Scholarship - is the project feasible? Are logical plans developed based on current findings? What is a suitable body of work that merits preparation of a manuscript? (2) Collaboration - how might the trainee’s work benefit from additional interactions? What is the best way to structure an interaction that is mutually beneficial to all involved? (3) Self-Management Skills - is the trainee appropriately able to prioritize tasks? What is the best way to refocus efforts when a research direction appears to fail? Is the trainee able to balance work and personal life? (4) Independence - will the trainee get appropriate credit for her/his successes? Have the mentors and trainee identified an exit strategy for leaving the mentors labs with a body of work that can be pursued by the trainee independently?

3.5c Evaluation of Trainee Performance: Trainee performance is monitored by four mechanisms: (1) Mentor assessments. Faculty mentors will provide written feedback on a standardized form regarding trainee performance to the Fellowship Training Committee at 6 month intervals. Mentors will score performance on a numerical scale for aspects of training such as oral presentations, evaluation of pertinent literature, design and interpretation of experiments, abstract and manuscript preparation, grant writing, and scientific ethics. They will also be asked to provide written narrative feedback on the same form. (2) Thesis Committee/Career Development Committee assessments. The program director will solicit feedback from these groups as above. (3) Written progress reports. These documents (one page and in a format modeled on NIH RO1 progress reports) will be required annually. (4) Formal research presentations. Fellows Research Day will
take place twice a year, one time in the school of engineering, and one time in the medical school. The first will be a stand-alone event, the second will be in concert with the Endocrine Fellows Research Day, during which clinical trainees in diabetes will also present. Each event will require that each trainee make a 10 min presentation to faculty and other fellows. The presentation will be followed by a 5 min question period.