BU BME Department

Handbook for QBP Trainees

2024

National Institutes of Health Training Program in Quantitative Biology and Physiology (QBP)

There are two core required courses for all PhD candidates and each has a laboratory component (**BE 605: Molecular Bioengineering and BE 606: Quantitative Physiology**). The additional required courses for QBP fellows are BE 604: Statistics & Numerical Methods, BE 559: Foundations of Biomedical Data Science and Machine Learning and in areas of quantitative and engineering-based systems biology and physiology. Table A below provides an overview of these courses. Please select two courses from the first three columns and two from the Scale-Independent column.

TABLE A: QUANTITATIVE AND ENGINEERING BASED BIOLOGY AND PHYSIOLOGY COURSES

Molecular and Genetic Engineering	Cellular-to-Tissue Level Engineering	Tissue-to-Organ Level Engineering	Scale-Independent Analysis/Modeling
BE 500 (Tomic) Introduction to Systems Immunology: Bridging Immunology and Engineering	BE 500 (Tomic) Introduction to Systems Immunology: Bridging Immunology and Engineering	BE 508: Quantitative Studies of Respiratory and Cardiovascular Systems	BE 500 (Dunlop/Morgan): Introduction to Biological Feedback Control
BE 500 (Dunlop/Morgan): Introduction to Biological Feedback Control	BE 500 (Dunlop/Morgan): Introduction to Biological Feedback Control	BE 524: Skeletal Tissue Mechanics	BE 500 (Galagan): Programming Fundamentals for BME Data Analysis with Python
BE 556: Optical Spectroscopic Imaging	BE 504: Polymers and Soft Materials	BE 567: Nonlinear Systems in Biomedical Engineering	BE 504: Polymers and Soft Materials
BE 560: Biomolecular Architecture	BE 517: Optical Microscopy of Biological Materials	BE 570: Introduction to Computational Vision	BE 511: Biomedical Instrumentation
BE 562: Computational Biology	BE 521: Continuum Mechanics for Biomedical Engineers	BE 710: Neural Plasticity and Perceptual Learning	BE 515: Introduction to Medical Imaging
BE 564: Biophysics of Large Molecules	BE 533: Biorheology	BE 726: Fundamentals of Biomaterials	BE 519: Speech Signal Processing
BE 566: DNA Structure and Function	BE 549: Structure and Function of the Extracellular Matrix	BE 727: Principles and Applications of Tissue Engineering	BE 521: Continuum Mechanics for Biomedical Engineers
BE 567: Nonlinear Systems in Biomedical Engineering	BE 555: Introduction to Biomedical Optics	BE 771: Introduction to Neuroengineering	BE 533: Biorheology
BE 568: Systems Biology of Human Disease	BE 556: Optical Spectroscopic Imaging	BE 772: Neuroengineering Devices	BE 559: Foundations of Biomedical Data Science and Machine Learning
BE 700 (Ngo): Chemical and Physical Methods for Determining the Molecular Organization of the Cell	BE 567: Nonlinear Systems in Biomedical Engineering	BE 788: Soft Tissue Biomechanics	BE 562: Computational Biology
BE 704: Cancer Biology and Oncology for Engineers	BE 700 (Khalil): Methods and Logic in Quantitative Biology		BE 567: Nonlinear Systems in Biomedical Engineering
BE 745: Nanomedicine	BE 704: Cancer Biology and Oncology for Engineers		BE 703: Numerical Methods and Modeling in BME
BF 768: Biological Data Base Design			BE 747: Advanced Signals and Systems for BME

BI 645: Cellular and Molecular Neurophysiology	BE 707: Quantitative Studies of Excitable Cells BE 709: From Cells to Tissue – Engineering Structure and Function BE 726: Fundamentals of Biomaterials BE 727: Principles and Applications of Tissue Engineering BE 771: Introduction to Neuroengineering BE 772: Neuroengineering Devices BE 773: Advanced Optical Microscopy BI 645: Cellular and Molecular Neurophysiology		MA 565: Math Models in the Life Sciences

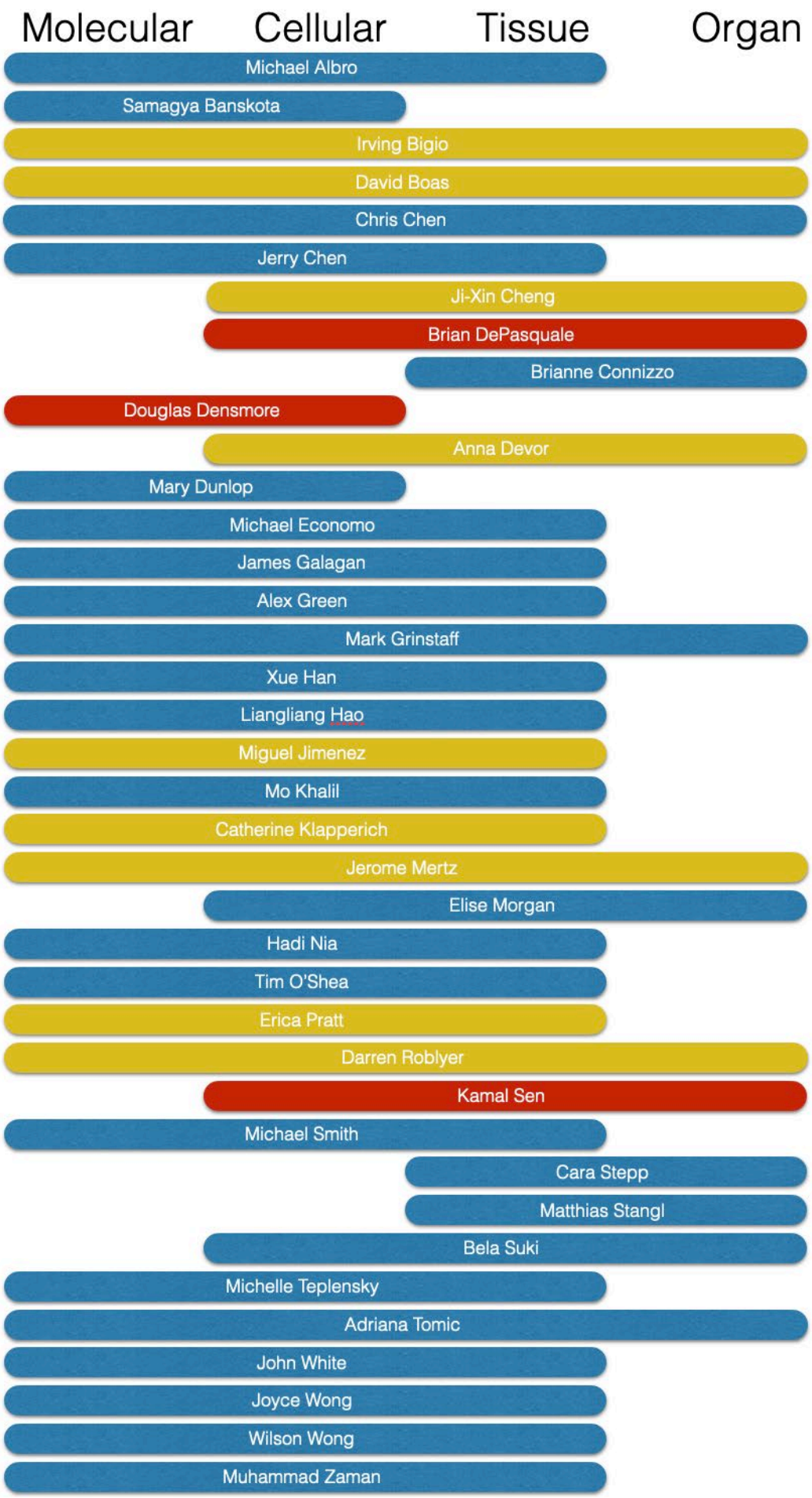
QBP fellows must be sure to complete coursework in synthesizing a quantitative and systems approach at two distinct scales of biology (e.g., molecular-cell, cell-tissue, or tissue-organ) and be exposed to experimental methods at some level.

Rotation and Mentor Selection

Students must perform a minimum of three and are encouraged to perform four lab rotations. The rotations must in the laboratories listed in Table B below which span four levels of biology and physiology inclusive of a level termed "behavioral or integrative". Students must select from at least three distinct laboratories and ensure these selections cover at least three distinct columns. Moreover, note that several laboratories are listed in multiple columns. This occurs because these faculty members are engaged in research projects that span several biological levels. Students must show that a rotation in a lab for a particular column engaged the student in experiences associated with that column's theme. This rotation system ensures that QBP fellows experience biology over multiple scales, regardless of which laboratory they select for their dissertation topic.

TABLE B: QBP LABORATORY ROTATION AREAS

NOTE: PIs who are mostly computational are in red. PIs who work largely in instrumentation are in yellow. "Wet" experimentalists are in blue.


Molecular
Cellular
Tissue
Organ
Michael Albro
Samagya Banskota
Irving Bigio
David Boas
Chris Chen
Jerry Chen
Ji-Xin Cheng
Brian DePasquale
Brianne Connizzo
Douglas Densmore
Anna Devor
Mary Dunlop
Michael Economo
James Galagan
Alex Green
Mark Grinstaff
Xue Han
Liangliang Hao
Miguel Jimenez
Mo Khalil
Catherine Klapperich
Jerome Mertz
Elise Morgan
Hadi Nia
Tim O'Shea
Erica Pratt
Darren Roblyer
Kamal Sen
Michael Smith
Cara Stepp
Matthias Stangl
Bela Suki
Michelle Teplensky
Adriana Tomic
John White
Joyce Wong
Wilson Wong
Muhammad Zaman

Please note that this table changes every year as new faculty members arrive. Please consult with Prof. John White for any questions regarding laboratory selections.

Program Cohesion, Retention, Enhancement and Information Flow

The program cohesion and cultural components include: monthly journal club and dinners, active involvement in annual retreats and participation on our Annual Symposium in Quantitative Biology and Physiology run by and for QBP, SB2 and TRB fellows. Each trainee beyond their third year in the BME program gives a talk at the symposium.