Department of Biomedical Engineering

Professor Bin He, Department Head
bhe1@andrew.cmu.edu

Professor Conrad M. Zapanta, Associate Department Head for
Undergraduate Education
czapanta@cmu.edu

Professor Keith Cook, Associate Department Head for Graduate Education
keicook@andrew.cmu.edu

Location: Scott Hall 4N201
Phone: 412-268-3955
www.bme.cmu.edu

Biomedical Engineering Overview

Biomedical engineering education at Carnegie Mellon University reflects
the belief that a top biomedical engineer must be deeply trained in
both a traditional engineering practice and biomedical sciences. The
unique additional major program leverages extensive collaborations with
sister departments in the College of Engineering and with major medical
institutions in Pittsburgh. This collaborative approach, combined with a
rigorous engineering education, confers unique depth and breadth to the
education of Biomedical Engineering graduates.

Students who elect Biomedical Engineering as a major must also
declare a major in one of the traditional engineering disciplines:
Chemical Engineering, Civil & Environmental Engineering, Electrical &
Computer Engineering, Materials Science & Engineering, or Mechanical
Engineering.

The curriculum, demanding but readily feasible to complete in four years, is
highly rewarding to motivated students.

Common Requirements for the Additional Major

The Biomedical Engineering additional major program takes advantage of
curricular overlaps between Biomedical Engineering and traditional
engineering majors, such that the dual major can be completed in four years
with only a modest increase in course requirements. The requirements for
Biomedical Engineering consist of the core, the tracks, and the capstone
design course. The core exposes students to basic facets of biomedical
engineering to lay a foundation. The tracks allow students to build depth in
a specific aspect of biomedical engineering. The capstone design (https://
www.cmu.edu/bme/Academics/Undergraduate%20Programs/Resources/
undergrad_design.html) project engages students in teamwork to develop
real-world applications.

The additional major in Biomedical Engineering should be declared at the same time when declaring a traditional engineering major.

Course Requirements for the Additional Major

Minimum units required for additional major: 93–102

Students majoring in Biomedical Engineering must meet three sets of
requirements:

1. Biomedical Engineering (BME)
2. A traditional engineering discipline, and
3. College of Engineering General Education (https://engineering.cmu.edu/
education/undergraduate-programs-curriculum/general-education)

sequence.

The Quality Point Average (QPA) for courses that count toward the
additional major must be 2.00 or better. No course taken on a pass/fail or
audit basis may be counted toward the additional major.

The course requirements for the BME portion of the additional major are as follows:

Core Courses

(\textit{all required})

\begin{tabular}{lll}
\textbf{Units} & \\
03-121 Modern Biology- Fall and Spring & 9 \\
03-151 or 03-151 Honors Modern Biology & \\
42-101 Introduction to Biomedical Engineering- Fall and Spring & 12 \\
42-201 Professional Issues in Biomedical Engineering- Fall and Spring & 3 \\
42-202 Physiology- Fall and Spring & 9 \\
42-203 Biomedical Engineering Laboratory- Fall and Spring & 9 \\
42-302 Biomedical Engineering Systems Modeling and Analysis- Fall and Spring & \\
42-401 Foundation of BME Design-Fall* & 6 \\
42-402 BME Design Project- Spring & 9 \\
\end{tabular}

\* Also known as 03-206 for Health Professions Program (http://
www.cmu.edu/hpp) students.

\* 42-401 serves as the precursor/pre-requisite for 42-402 BME Design Project.

Tracks (Completion of one track is required)

- Biomaterials and Tissue Engineering (BMTE) (https://www.cmu.edu/bme/
  Academics/Undergraduate%20Programs/bmte_track.html))
- Biomechanics (BMEC (https://www.cmu.edu/bme/Academics/
  Undergraduate%20Programs/bmec_track.html))
- Biomedical Signal and Image Processing (BISP (https://www.cmu.edu/
  bme/Academics/Undergraduate%20Programs/bisp_track.html))
- Cellular and Molecular Biotechnology (CMBT (https://www.cmu.edu/
  bme/Academics/Undergraduate%20Programs/cmbt_track.html))
- Neuroengineering (Neuro (https://www.cmu.edu/bme/Academics/
  Undergraduate%20Programs/neuro_track.html))
- Self-Designed Biomedical Engineering (SBME (https://www.cmu.edu/
  bme/Academics/Undergraduate%20Programs/sbme_track.html))

Biomaterials and Tissue Engineering (BMTE) Track

Overview

The BMTE track addresses issues at the interface of materials science,
bioengineering, and engineering. The topics include the interactions between
materials and cells or tissues, the effects of such interactions on cells
and tissues, the design of materials for biological applications, and the
engineering of new tissues.

Targets

The BMTE track is ideal for students interested in combining the education of
Biomedical Engineering with Materials Science & Engineering or with
Chemical Engineering. Both provide the necessary foundation in chemistry
and/or materials science. Students of this track may develop careers in
biotechnology, tissue engineering, biopharmaceuticals, and medical devices
that leverage materials properties.

Requirements

In addition to the Biomedical Engineering core courses, students in the
BMTE Track must take the following combination of three courses:

- One (1) Required BMTE elective
- Two (2) BMTE Electives (either Required or Additional)
**BMTE Electives**

Required BMTE Electives (must take one of the following)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>42/27-411</td>
<td>Engineering Biomaterials- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-612/27-520</td>
<td>Tissue Engineering- Spring</td>
<td>12</td>
</tr>
</tbody>
</table>

42-670: Special Topics: Biomaterial Host Interactions in Regenerative Medicine- Fall 12

Additional BMTE Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-320</td>
<td>Cell Biology</td>
<td>9</td>
</tr>
<tr>
<td>42-613</td>
<td>Polymeric Biomaterials- Spring</td>
<td>9</td>
</tr>
<tr>
<td>42-620</td>
<td>Engineering Molecular Cell Biology- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-624</td>
<td>Biological Transport and Drug Delivery- Spring</td>
<td>9</td>
</tr>
<tr>
<td>42-673</td>
<td>Special Topics: Stem Cell Engineering- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-676</td>
<td>Bio-nanotechnology: Principles and Applications</td>
<td>9</td>
</tr>
<tr>
<td>42-x00</td>
<td>BMES Research* or 39-500 Honors Research Project* or 42-6XX Clinical Course (Surgery for Engineers/Precision Medicine/ICU Medicine)</td>
<td>9-12</td>
</tr>
</tbody>
</table>

* The 42-x00 research project (42-200/300/400 Sophomore/Senior Biomedical Engineering Research Project OR 39-500 Honors Research Project) must be on a BME topic that is aligned to the track, supervised or co-supervised by a BME faculty member, and conducted for 9 or more units of credit.

Some Special Topics and newly offered or intermittently offered courses may be acceptable as BMTE track electives. Students should consult with their BME advisors and petition the BME Undergraduate Affairs Committee for permission to include such courses as BMTE track electives.

Sample schedules can be found on the BMTE page on the BME website.

**Biomechanics (BMEC) Track**

**Overview**

The BMEC track addresses the application of solid or fluid mechanics to biological and medical systems. It provides quantitative understanding of the mechanical behavior of molecules, cells, tissues, organs, and whole organisms. The field has seen a wide range of applications from the optimization of tissue regeneration to the design of surgical and rehabilitation devices.

**Targets**

The BMEC track is ideally suited to the combined education of Biomedical Engineering and Mechanical Engineering or Civil & Environmental Engineering. Both provide the necessary foundation in the underlying physical principles and their non-Biomedical Engineering applications. This track may also appeal to students of Electrical & Computer Engineering who are interested in biomedical robotics. Education in biomechanics enables students to pursue careers in medical devices or rehabilitation engineering.

**Requirements**

In addition to the Biomedical Engineering core courses, students in the BMEC Track must take the following combination of three courses:

- One (1) Required BMEC Elective
- Two (2) BMEC Electives (either Required or Additional)

**BMEC Electives**

Required BMEC Electives (must take at least one of the following)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>42-341</td>
<td>Introduction to Biomechanics- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-645/24-655</td>
<td>Cellular Biomechanics- Intermittent</td>
<td>9</td>
</tr>
<tr>
<td>42-646</td>
<td>Molecular Biomechanics- Intermittent</td>
<td>9</td>
</tr>
<tr>
<td>42-648</td>
<td>Cardiovascular Mechanics- Spring</td>
<td>12</td>
</tr>
</tbody>
</table>

Additional BMEC Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>33-441/03-439</td>
<td>Introduction to BioPhysics- Fall</td>
<td>10</td>
</tr>
<tr>
<td>42-444</td>
<td>Medical Devices- Fall and Spring</td>
<td>9</td>
</tr>
<tr>
<td>42-447</td>
<td>Rehabilitation Engineering- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-640/24-658</td>
<td>Image-Based Computational Modeling and Analysis- Spring</td>
<td>12</td>
</tr>
<tr>
<td>42-643</td>
<td>Microfluids- Intermittent</td>
<td>12</td>
</tr>
<tr>
<td>42-647</td>
<td>Continuum Biomechanics: Solid and Fluid Mechanics of Physiological Systems</td>
<td>12</td>
</tr>
<tr>
<td>42-x00</td>
<td>BMES Research* or 39-500 Honors Research Project* or 42-6XX Clinical Course (Surgery for Engineers/Precision Medicine/ICU Medicine)</td>
<td>9-12</td>
</tr>
</tbody>
</table>

Some Special Topics, newly offered or intermittently offered courses may be acceptable as track electives. Students should consult with their advisors and petition the BME Undergraduate Affairs Committee for permission to include such courses as track electives.

Sample schedules can be found on the BMEC page on the BME website.

**Biomedical Signal and Image Processing (BSIP) Track**

**Overview**

The BSIP track addresses biomedical phenomena based on the information embedded in sensor-detected signals, including digital images and nerve electrical pulses. Students in this track will gain understanding of the technologies involved in acquiring signals and images, the mathematical principles underlying the processing and analysis of signals, and the applications of signal/image processing methods in basic research and medicine.

**Targets**

This track aligns most naturally with a combined education of Biomedical Engineering and Electrical & Computer Engineering, which lays a solid foundation in signal processing principles. This track prepares students for careers in medical imaging or smart prosthetics. It also interfaces with many clinical practices including radiology, neurology/neurosurgery, and pathology.

**Requirements**

In addition to the Biomedical Engineering core courses, students in the BSIP Track must take the following combination of three courses:

- One (1) Required BSIP elective
- Two (2) BSIP Electives (either Required or Additional)

**BSIP Electives**

Required BSIP Electives (must take at least one of the following)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>42-431</td>
<td>Introduction to Biomedical Imaging and Image Analysis</td>
<td>12</td>
</tr>
<tr>
<td>42-630</td>
<td>Introduction to Neuroscience for Engineers- Spring</td>
<td>12</td>
</tr>
<tr>
<td>42-631</td>
<td>Neural Data Analysis- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-632</td>
<td>Neural Signal Processing- Spring</td>
<td>12</td>
</tr>
</tbody>
</table>

Additional BSIP Electives

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-534</td>
<td>Biological Imaging and Fluorescence Spectroscopy- Spring</td>
<td>9</td>
</tr>
<tr>
<td>15-386</td>
<td>Neural Computation- Spring</td>
<td>9</td>
</tr>
<tr>
<td>16-725</td>
<td>(Bio)Medical Image Analysis- Spring</td>
<td>12</td>
</tr>
<tr>
<td>18-491</td>
<td>Fundamentals of Signal Processing*</td>
<td>12</td>
</tr>
<tr>
<td>42-426</td>
<td>Biosensors and BioMEMS- Intermittent</td>
<td>9</td>
</tr>
<tr>
<td>42-437</td>
<td>Biomedical Optical Imaging-Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-447</td>
<td>Rehabilitation Engineering- Fall</td>
<td>9</td>
</tr>
<tr>
<td>42-640/24-658</td>
<td>Image-Based Computational Modeling and Analysis- Spring</td>
<td>12</td>
</tr>
<tr>
<td>42-682</td>
<td>Bioinstrumentation and Measurement</td>
<td>12</td>
</tr>
</tbody>
</table>
Cellular and Molecular Biotechnology (CMBT) Track

Overview
The CMBT track emphasizes fundamentals and applications of biochemistry, biophysics, and cell biology, and processes on the nanometer to micrometer size scale. Students in this track acquire understanding of the molecular and cellular bases of life processes, and build skills in quantitative modeling of live cell-based biotechnologies and in technologies that exploit the unique properties of biomolecules in non-biological settings.

Targets
The CMBT track is ideally suited for the combined education of Biomedical Engineering and Chemical Engineering, which provides a strong core of chemistry and molecular processing principles. The track may also interest students of Mechanical Engineering, Materials Science & Engineering, or Civil & Environmental Engineering who have an interest in molecular biophysics, and cell biology, and processes on the nanometer to micrometer size scale. Students in this track acquire understanding of the molecular and cellular bases of life processes, and build skills in quantitative modeling of live cell-based biotechnologies and in technologies that exploit the unique properties of biomolecules in non-biological settings.

Requirements
In addition to the Biomedical Engineering core courses, students in the CMBT Track must take the following combination of three courses:

- One (1) Required CMBT Elective
- Two (2) CMBT Electives (either Required or Additional)

CMBT Electives
Required CMBT Electives (must take at least one of the following)

- 42-620 Engineering Molecular Cell Biology- Fall 12
- 42-623 Cellular and Molecular Biotechnology- Intermittent 9
- 42-624 Biological Transport and Drug Delivery- Spring 9

Additional CMBT Electives

- 03-320 Cell Biology 9
- 42-606/622 Bioprocess Design 9
- 42-643 Microfluids-Intermittent 12
- 42-645/24-655 Cellular Biomechanics- Intermittent 9
- 42-646 Molecular Biomechanics- Intermittent 9
- 42-673 Special Topics: Stem Cell Engineering- Fall, every other year 9
- 42-676 Bio-nanotechnology: Principles and Applications- Fall 9
- 42-x00 BME Research* or 39-500 Honors Research Project* or 42-6XX Clinical Course (Surgery for Engineers/Precision Medicine/ICU Medicine) 9-12

* The 42-x00 research project (42-200/300/400 Sophomore/Junior/Senior Biomedical Engineering Research Project OR 39-500 Honors Research Project) must be on a BME topic that is aligned to the track, supervised or co-supervised by a BME faculty member, and conducted for 9 or more units of credit.

Some Special Topics, newly offered or intermittently offered courses may be acceptable as track electives. Students should consult with their advisors and petition the BME Undergraduate Affairs Committee for permission to include such courses as track electives.

Sample schedules can be found on the CMBT (https://www.cmu.edu/bme/Academics/Undergraduate%20Programs/cmbt_track.html) page on the BME website.

Neuroengineering (Neuro) Track

Overview
The Neuroengineering (Neuro) track uses engineering techniques to examine, understand, and apply the properties of complex neural systems. Areas of interest include the research and development of neuroengineering technologies for sensing, interfacing, imaging, and modulating the nervous systems. Examples of applications include brain-computer interfaces for use in paralysis, neural stimulation device design for sensory and motor prostheses and basic science research, and neural recording and imaging devices.

Targets
This track aligns most naturally with a combined education of Biomedical Engineering and Electrical & Computer Engineering, which lays a solid foundation in signal processing principles. This track prepares students for careers in brain-computer interfaces, neural stimulators, and neuroprosthetics.

Requirements
In addition to the Biomedical Engineering core courses, students in the BMEC Track must take the following combination of three courses:

- One (1) Required Neuro Elective
- Two (2) Neuro Electives (either Required or Additional)

Neuro Electives

**REQUIRED Neuro ELECTIVES (MUST TAKE AT LEAST ONE OF THE FOLLOWING)

- 42-631 Neural Data Analysis 9
- 42-632 Neural Signal Processing 12

Other courses as approved

**ADDITIONAL Neuro ELECTIVES

- 42-437 Biomedical Optical Imaging- Fall 9
- 42-630 Introduction to Neuroscience for Engineers- Spring 12
- 42-676 Bio-nanotechnology: Principles and Applications- Fall 9
- 18-370 Fundamentals of Control 12
- 18-460 Optimization 12
- 15-386 Neural Computation 9
- 42-x00 BME Research* or 39-500 Honors Research Project* or 42-6XX Clinical Course (Surgery for Engineers/Precision Medicine/ICU Medicine) 9-12

Other courses as approved

* The 42-x00 research project (42-200/300/400 Sophomore/Junior/Senior Biomedical Engineering Research Project OR 39-500 Honors Research Project) must be on a BME topic that is aligned to the track, supervised or co-supervised by a BME faculty member, and conducted for 9 or more units of credit.

Some Special Topics, newly offered or intermittently offered courses may be acceptable as track electives. Students should consult with their advisors and petition the BME Undergraduate Affairs Committee for permission to include such courses as track electives.

Sample schedules can be found on the Neuro (https://www.cmu.edu/bme/Academics/Undergraduate%20Programs/neuro_track.html) page on the BME website.
Self-Designed Biomedical Engineering (SBME) Track

The SBME track is aimed at helping highly motivated students who have a strong sense of career direction that falls beyond the scope of regular Biomedical Engineering tracks, and allows students to choose courses relevant to the theme from across the University. Students are allowed to design the “track” portion of the curriculum in consultation with the faculty. Example themes include medical robotics, neural engineering, or computational biomedical engineering.

Requirements

In addition to the Biomedical Engineering core requirements, students must take three elective courses of at least 9 units each. These elective courses must form a coherent theme that is relevant to biomedical engineering. In addition, at least one of the elective courses must be judged by the Biomedical Engineering Undergraduate Affairs Committee to have substantial biological or medical content.

If undergraduate research is part of the SBME track, the research project must be on a BME topic that is aligned to the track, supervised or co-supervised by a BME faculty member, and conducted for 9 or more units of credit.

Petition Procedure

1. Students wishing to pursue a self-designed track should first consult with the Biomedical Engineering Undergraduate Affairs Committee. Contacts for the Committee are Prof. Robert Tilton (https://www.cmu.edu/bme/People/Faculty/profile/tilton.html) (committee chair), and Prof. Conrad Zapanta (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) (Biomedical Engineering Associate Head of Undergraduate Affairs).

2. A SBME track proposal must be submitted electronically to Prof. Conrad Zapanta (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) (Biomedical Engineering Associate Head of Undergraduate Affairs).

3. Once approved, the student must sign an agreement listing the theme and the three courses comprising the SBME track.

4. In the event that issues beyond the student’s control, such as course scheduling or cancellation, prevent the student from completing the approved course plan, the student may petition the Biomedical Engineering Undergraduate Affairs Committee to
   - Substitute a course with another course that fits the approved theme, OR
   - Complete one of the regular tracks (all classes)

Minor in Biomedical Engineering

Professor Conrad M. Zapanta, Associate Department Head of Undergraduate Education
czapanta@cmu.edu
www.bme.cmu.edu

The minor program is designed for engineering students who desire exposure to biomedical engineering but may not have the time to pursue the Biomedical Engineering additional major. The program is also open to students of all colleges and is popular among science majors. In conjunction with other relevant courses, the program may provide a sufficient background for jobs or graduate studies in biomedical engineering. Students interested in a medical career may also find this program helpful.

The Biomedical Engineering minor curriculum is comprised of three core courses and three electives. Students pursuing the minor may contact the BME Associate Head for Undergraduate Education (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) (http://www.cmu.edu/bme/People/ADH) for advice. Students interested in declaring a Biomedical Engineering minor should contact either the BME Associate Head for Undergraduate Education (https://www.cmu.edu/bme/People/Faculty/profile/czapanta.html) or the Biomedical Engineering Undergraduate Program Coordinator (https://www.cmu.edu/bme/People/Administration).

Requirements

Minimum units required for minor: 57

<table>
<thead>
<tr>
<th>Course</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>03-121</td>
<td>Modern Biology</td>
</tr>
<tr>
<td>03-151</td>
<td>Honors Modern Biology</td>
</tr>
<tr>
<td>42-101</td>
<td>Introduction to Biomedical Engineering</td>
</tr>
<tr>
<td>42-202</td>
<td>Physiology</td>
</tr>
<tr>
<td>42-xxx</td>
<td>BME Elective (&gt;= 9 units). Any course offered by the Department of Biomedical Engineering numbered 42-300 or higher and worth at least 9 units</td>
</tr>
<tr>
<td>xx-xxx</td>
<td>Elective I (&gt;= 9 units)</td>
</tr>
<tr>
<td>xx-xxx</td>
<td>Elective II (&gt;= 9 units)</td>
</tr>
</tbody>
</table>

Some Special Topics, newly offered or intermittently offered 42-xxx may be acceptable as electives. Students should consult with their advisors and petition the Biomedical Engineering Undergraduate Affairs Committee for permission to include such courses.

Notes

* Elective I cannot be a required course in the student’s major. It may be
  1. Any required or additional track elective course selected from any of the five Biomedical Engineering tracks. See the online catalog (https://www.cmu.edu/bme/Academics/Undergraduate%20Programs/Resources/catalog.html) for a listing of courses.
  2. Any 42-xxx course with a 42-300 or higher number and worth at least 9 units.
  3. 42-203 Biomedical Engineering Laboratory (or the cross-listed version 03-206 for students in the Health Professions Program). The course has a limited capacity and priority is given to students who have declared the Additional Major in Biomedical Engineering.
  4. One semester of 42-200 Sophomore BME Research Project, 42-300 Junior BME Research Project, 42-400 Senior BME Research Project or 39-500 Honors Research Project. The project must be supervised by a core or courtesy Biomedical Engineering faculty member and for 9 or more units.

** Priority for enrollment in 42-203 or 03-206 will be given to students who have declared the Additional Major in Biomedical Engineering. If sufficient room in the course remains after all majors have been accommodated in a given semester, students who have declared the Biomedical Engineering Designated Minor will be given the next priority for enrollment. If space still allows, other students will be enrolled.

Full-Time Faculty

ABBOTT, ROSALYN, Assistant Professor of Biomedical Engineering – Ph.D., University of Vermont, 2011;
BARATI FARIMANI, AMIR, Assistant Professor, Mechanical Engineering and Biomedical Engineering – Ph.D., University of Illinois at Urbana-Champaign, 2015;
BARTH, ALISON L., Professor, Biological Sciences, and Biomedical Engineering – Ph.D., University of California, Berkeley, 1997;
BEHRMANN, MARLENE, George A. and Helen Dunham Cowan Professor of Cognitive Neuroscience Center for the Neural Basis of Cognition and Department of Psychology Professor, Biomedical Engineering – Ph.D., University of Toronto, 1991;
BETTINGER, CHRISTOPHER J., Professor of Biomedical Engineering and Materials Science & Engineering – Ph.D., Massachusetts Institute of Technology, 2008;
BRUCHEZ, MARCEL P., Professor of Biological Sciences, Chemistry, and Biomedical Engineering – Ph.D., University of California, Berkeley, 1998;
CAL, YANG, Associate Research Professor, Biomedical Engineering – Ph.D., West Virginia University, 1997;
CAMPBELL, PHIL G., Research Professor, Institute of Complex Engineering Systems, Biomedical Engineering, Biological Sciences, Materials Science & Engineering – Ph.D., The Pennsylvania State University, 1985;
CHALACHEVA, P. SANG, Assistant Teaching Professor of Biomedical Engineering – Ph.D., University of Southern California, 2014;
CHAMANZAR, MAYSAM, Assistant Professor, Electrical and Computer Engineering, Biomedical Engineering – Ph.D., Georgia Institute of Technology, 2012;
CHASE, STEVEN M., Associate Professor of Biomedical Engineering and Center for the Neural Basis of Cognition – Ph.D., Johns Hopkins University, 2006;