



Volgenau School of Engineering

BIOENGINEERING, B.S.

2020 - 2021

Bioengineering, also referred to as biomedical engineering, is the application of engineering tools and approaches to solve problems in biology and medicine. It is a broad and growing field that draws upon rapid advances in technology and computation, as well as on unprecedented growth in basic biological understanding.

This program provides i) a scientific foundation in math, physics, biology, chemistry and physiology, ii) broad introductions to bioengineering technology platforms including medical imaging, devices, computational biomedicine, neurotechnology, biomaterials and nanomedicine followed by a deepening of knowledge in one of these areas through a concentration and iii) translational courses showing how new technologies can be implemented in clinical medicine and then commercialized by industry partners. Engineering design experiences are built into each year of the curriculum culminating in a senior design project. The impact of engineering, technologies and computer science on biomedicine is immense, and can only be harnessed through integrative multidisciplinary training in Bioengineering. With the growing demand for better health care, the need for bioengineers is high.

The multidisciplinary training in this field makes graduates competitive for positions in government and in biomedical industry. The BS in Bioengineering also enables students to continue their education in graduate school or medical school.

The bachelor's program in Bioengineering is accredited by the Engineering Accreditation Commission of ABET (<http://www.abet.org>).

Admission Requirements

Admission to George Mason is competitive; the number of qualified candidates generally exceeds the number of new students who can be accommodated. An offer of admission is valid only for the semester for which the student applied. Application for undergraduate admission can be made online at George Mason's website <http://admissions.gmu.edu>.

Freshman Requirements

The following factors are considered when reviewing applications for admission:

- Cumulative high school grade point average for course work completed in grades 9 through 12.
- Level of difficulty of course work elected throughout the high school years particularly in English, mathematics, laboratory science, and foreign language.
- Scores from the Scholastic Aptitude Test (SAT) and/or American College Test (ACT), and Test of English as a Foreign Language (TOEFL) if appropriate.

Transfer Requirements

The university accepts qualified students who wish to transfer from other colleges. A transfer applicant who has completed at least 30 semester hours of transferable credit must submit two copies of official transcripts from each collegiate institution attended. Transfer applicants with fewer than 30 semester hours of transferable credit must also submit a copy of their secondary school record, as well as SAT or ACT scores.

Degree Requirements

The curriculum requires a minimum 122 total credit hours (with the exception of the BMPH concentration), which can be completed within eight semesters. At least 45 semester hours of the degree requirements must be at the 300 level or above. Students may wish to consider an extra semester or two for the purpose of lightening the course load (particularly for those with part-time employment); participating in Cooperative Education (with local industry); or adding extra courses to deepen their knowledge in engineering and/or the basic sciences.

Concentrations

Students choose one of six concentrations from the list provided: Computational Biomedical Engineering, Biomedical Imaging and Devices, Biomaterials and Nanomedicine, Neurotechnology and Computational Neuroscience, Bioengineering Health Care Informatics, and Bioengineering Prehealth. The first four concentrations are based on our department's research pillars.

Bioengineering, BS

2020-2021 Sample Schedule for BS in Bioengineering (all but BMPH)

Concentrations:

Computational Biomedical Engineering (CBM)

BENG Concentration Courses:
 BENG 420 Biomedical Data Analytics (3)
 BENG 430 Continuum Biomechanics and Transport II (3)
 BENG 435 Multi-scale Modelling and Simulation in Biomedicine (3)

Biomedical Imaging and Devices (BMID)

BENG Concentration Courses:
 BENG 420 Biomedical Data Analytics (3)
Pick 2 courses from the following:
 BENG 437 Medical Image Processing (3)
 BENG 470 Bioinstrumentation and Devices II (3)
 BENG 438 Advanced Biomedical Imaging (3)

Biomaterials and Nanomedicine (BNM)

BENG Concentration Courses:
 BENG 413 Molecular Engineering Laboratory (3)
 BENG 421 Cell and Tissue Engineering (3)
 BENG 441 Nanomedicine and Drug Delivery (3)

Neurotechnology and Computational Neuroscience (NTCN)

BENG Concentration Courses:
 BENG 327 Cellular, Neurophysiological, and Pharmacological Neuroscience (3)
Pick 2 courses from the following:
 BENG 429 Mason-Inova Applied Technologies (3)
 BENG 434 Computational Modelling of Neurons and Networks (3)
 BENG 487 Neuroinformatics (3)
 BENG 426 Neural Engineering (3)

Bioengineering Health Care Informatics (BHI)

BENG Concentration Courses:
 HAP 360 Introduction to Health Information Systems (3)
 HAP 361 Health Databases OR IT 214 Database Fundamentals (3)
 HAP 464 Electronic Health Record Configuration and Data Analysis (3)

Bioengineering Prehealth (BMPH)

See separate BMPH sample schedule

First Semester

MATH 113 Analytic Geometry & Calculus I
 CHEM 271 Chemistry for Engineers
 CHEM 272 Chemistry for Engineers, Lab
 BENG 101 Introduction to Bioengineering
 Mason Core (ENGH 101)¹

Total Hours

Credits

4
3
1
3
3

14

Second Semester

MATH 114 Analytic Geometry & Calculus II²
 PHYS 160 University Physics I
 PHYS 161 University Physics I Lab
 CS 112 Introduction to Computer Programming
 CHEM 310 Survey of Organic Chemistry

Total Hours

Credits

4
3
1
4
3

15

Third Semester

MATH 213 Analytic Geometry & Calculus III
 MATH 203 Linear Algebra³
 PHYS 260 University Physics II
 PHYS 261 University Physics II Lab
 BIOL 213E Cell Structure and Function³
 Mason Core (Literature)¹

Total Hours

17

Fourth Semester

MATH 214 Elementary Differential Equations²
 BENG 230 Continuum Biomechanics and Transport I
 BENG 240 Biomaterials
 BENG 241 Biomechanics and Biomaterials Lab
 BENG 214 Physiology for Engineers
 BENG 320 Bioengineering Signals & Systems

Total Hours

16

Fifth Semester

BENG 414 Pathophysiology & New Techn. in Human Diseases
 STAT 360 Introduction to Statistical Practice II
 BENG 330 Computational Methods in BE
 BENG 331 Computational Methods in BE Lab
 ENGH 302 Advanced Composition (Nat Sci. and Multidisc.)¹
 BENG 391 BE Professional Development

Total Hours

14

Sixth Semester

BENG 360 Biomedical Imaging
 BENG 370 Bioinstrumentation and Devices I
 BENG 371 Bioinstrumentation and Devices Lab
 BENG 350 Neural System Designs
 BENG Concentration #1
 Mason Core (Global Understanding)¹

Total Hours

16

Seventh Semester

BENG 492 Senior Advanced Design Project I
 BENG Concentration #2
 Mason Core¹
 Technical Elective³
 Mason Core¹

Total Hours

15

Eighth Semester

BENG 493 Senior Advanced Design Project II
 BENG Concentration #3
 Technical Elective³
 Mason Core¹
 ECON 103 or PSYC 100 or SOCI 101¹

Total Hours

15

¹<http://catalog.gmu.edu/mason-core> Mason Core Categories: One course from each: Oral Communication, ENGH101, Arts, Global Understanding (OR BENG 475, Intellectual Property, Regulatory Concepts, & Product, if approved as Mason Core), Literature, Western Civilization/World History, Social Behavioral Science (ECON 103 or PSYC 100 or SOCI 101). ENGH 101 and Mason Core-Literature must be completed before taking ENGH 302.

²MATH 114 and MATH 214: B- and above required.

³All bioengineers will be required to register for a specific section of MATH 203 including a 1-hour recitation with practical applications and for a specific section of BIOL 213.

³Students choose from sets of approved technical electives.