

# **Department of Biomedical Engineering Undergraduate Handbook**

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**Department of Biomedical Engineering  
University of Arkansas  
120 John A. White Jr. Engineering Hall  
Fayetteville, Arkansas 72701**

\*This document is intended to be a guide to students in the biomedical engineering program. Students should refer to the University Catalog of Studies for official degree requirements.

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## Introduction

**Biomedical engineering** encompasses the creation, design, and operation, of processes / technology related to the broad field of human healthcare. The profession traditionally has focused on applications related to the development of instrumentation and diagnostic equipment, discovery of novel treatment options, production of new therapeutics, and the elucidation of underlying biophysical phenomena. Newer applications of biomedical engineering take advantage of the ever deepening understanding of human physiology and molecular genetics, as related to prevention, detection, and treatment of medical conditions.

The **Program Education Objectives** of the undergraduate BMEG program at the University of Arkansas, Fayetteville are to produce graduates that are capable of:

1. Succeeding in practice at the interface between life science and engineering, or in other professional activities, or in post-baccalaureate studies.
2. Utilizing their engineering education/experience in creating new knowledge or enabling technologies for improvement of human health and healthcare.
3. Conducting themselves with high standards of professional ethics and integrity
4. Being aware of the limits of their knowledge and initiate self-directed learning to create future professional opportunities for themselves in biomedical engineering.

Completion of the degree requirements provides for the following **educational outcomes**:

- an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
- an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
- an ability to communicate effectively with a range of audiences
- an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
- an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
- an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
- an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.

These educational outcomes are experienced within the context of biology and physiology appropriate to solving problems at the interface of engineering and biology.

## Faculty



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## Staff



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## Facilities

### **BMEG Office Suite**

The BMEG Office Suite is located at **ENGR 120** (479-575-4667, [bmeginfo@uark.edu](mailto:bmeginfo@uark.edu)). Study tables are available for student use during office hours.

### **Research Centers**

State-of-the art research facilities of our faculty are located in **Engineering Research Center (ENRC, 535 W Research Center Blvd)** and **Cato Springs Research Center (CSRC, 1475 W Cato Springs Rd)**, approximately 2 miles south from the main campus. Shuttles are available for travel back and forth from BELL to ENRC and CSRC. Please refer to the [shuttle schedule](#) for more information.

### **BMEG Teaching Laboratory**

BMEG Teaching Laboratory is located at **ENGR 119**, and is used for BMEG laboratory courses such as Bioinstrumentation, Biomaterials, Biomolecular Engineering, Systems and Signals Analysis and Biomedical Microscopy.

### **BMEG Design Laboratory**

BMEG Design Laboratory is located at **ENGR 113**, and is used by students enrolled in Biomedical Design Courses. The laboratory is fully equipped with the resources needed to design, fabricate and test biomedical prototypes.

### **BMEG Computer Lab**

BMEG Computer Lab is located at **ENGR 109**, and is available for all BMEG students to use during and after hours.

### **vLab**

Students can access latest versions of several computer lab software (e.g. MATLAB) virtually from any computer through [vLab](#), a virtual Windows desktop provided by the IT services. Please refer to the website (<http://vlab.uark.edu/>) for instructions and a list of available software.

### **MATLAB**

Students may also download and activate MATLAB on their personal computers free of charge through [IT services](#).



## Biomedical Engineering Curriculum

### B.S.Bm.E Eight-Semester Degree Program (prior to Fall 2018)

\*Students who started the university prior to Fall 2018 are under this curriculum, but may choose to migrate to the new curriculum on the next page.

#### Freshman Year

Fall Semester		Spring Semester	
GNEG 1111 Introduction to Engineering I	1	GNEG 1121 Introduction to Engineering II	1
MATH 2554 Calculus I	4	MATH 2564 Calculus II	4
CHEM 1103 University Chemistry I	3	Freshman Science Elective with lab*	4
PHYS 2054 University Physics I	4	HIST 2003 or HIST 2013 or PLSC 2003	3
ENGL 1013 English Composition I	3	ENGL 1023 English Composition II	3
	<b>15</b>		<b>15</b>

#### Sophomore Year

Fall Semester		Spring Semester	
BMEG 2613 Introduction to BME	3	BMEG 2813 Biomechanical Engineering	3
Sophomore Science Elective with Lab**	4	BMEG 2904 Biomedical Instrumentation	4
MATH 2574 Calculus III	4	MATH 2584 Differential Equations	4
BIOL 1543/41L Principles of Biology	4	BIOL 2533 Cell Biology	3
	<b>15</b>	Fine Arts Elective	3
			<b>17</b>

#### Junior Year

Fall Semester		Spring Semester	
BMEG 3634 Biomaterials	4	BMEG 3653 Biomed. Model. & Num. Methods	3
BMEG 3124 Biomed Signals & Systems	4	BMEG 3824 Biomolecular Engineering	4
CHEM 3603/01L Organic Chemistry I	4	CHEG2133 or MEEG 3503 Fluid Mechanics	3
CHEG 2313 or MEEG 2403 Thermodynamics	3	CHEM 3613/11L Organic Chemistry II	4
Social Science Elective	3	BIOL 2213/11L Human Physiology	4
	<b>18</b>		<b>18</b>

#### Senior Year

Fall Semester		Spring Semester	
BMEG 4813 Biomedical Engineering Design I	3	BMEG 4823 Biomedical Engineering Design II	3
BMEG 4623 Biomedical Transport Phenomena	3	BMEG Elective	3
BMEG Elective	3	BMEG Elective	3
Science Elective	3	Humanities Elective	3
Social Science Elective	3	Social Science Elective	3
	<b>15</b>		<b>15</b>

\*The Freshman Engineering Science Elective must be chosen from either CHEM 1123/1121L or PHYS 2074.

\*\*The Sophomore Science Elective must be PHYS 2074 (if CHEM 1123/1121L was chosen as the Freshman Engineering Science Elective) or CHEM 1123/1121L (if PHYS 2074 was chosen as the Freshman Engineering Science Elective. That is, both courses are required for the degree)

## B.S.Bm.E Eight-Semester Degree Program (starting Fall 2018)

\*Students who start the university Fall 2018 and later are required to follow this degree plan, which includes a few curriculum changes from the previous degree plan (highlighted).

<b>Freshman Year</b>			
<b>Fall Semester</b>		<b>Spring Semester</b>	
GNEG 1111 Introduction to Engineering I	1	GNEG 1121 Introduction to Engineering II	1
MATH 2554 Calculus I	4	MATH 2564 Calculus II	4
CHEM 1103 University Chemistry I	3	Freshman Science Elective with lab*	4
PHYS 2054 University Physics I	4	HIST 2003 or HIST 2013 or PLSC 2003	3
ENGL 1013 English Composition I	3	ENGL 1023 English Composition II	3
	<b>15</b>		<b>15</b>
<b>Sophomore Year</b>			
<b>Fall Semester</b>		<b>Spring Semester</b>	
BMEG 2614 Introduction to BME	4	BMEG 2813 Biomechanical Engineering	3
Sophomore Science Elective with Lab**	4	BMEG 2904 Biomedical Instrumentation	4
<b>MATH 3083 Linear Algebra</b>	<b>3</b>	MATH 2584 Differential Equations	4
BIOL 1543/41L Principles of Biology	4	BIOL 2533 Cell Biology	3
	<b>15</b>	Fine Arts Elective	3
			<b>17</b>
<b>Junior Year</b>			
<b>Fall Semester</b>		<b>Spring Semester</b>	
BMEG 3634 Biomaterials	4	BMEG 3653 Biomed. Model. & Num. Methods	3
BMEG 3124 Biomed Signals & Systems	4	BMEG 3824 Biomolecular Engineering	4
CHEM 3603/01L Organic Chemistry I	4	<b>BMEG 3801 Clinical Obs and Needs Finding</b>	<b>1</b>
CHEG 2313 or MEEG 2403 Thermodynamics	3	CHEG2133 or MEEG 3503 Fluid Mechanics	3
Social Science Elective	3	BIOL 2213/11L Human Physiology	4
	<b>18</b>	<b>STAT 2023 Biostatistics</b>	<b>3</b>
			<b>18</b>
<b>Senior Year</b>			
<b>Fall Semester</b>		<b>Spring Semester</b>	
BMEG 4813 Biomedical Engineering Design I	3	BMEG 4823 Biomedical Engineering Design II	3
BMEG 4623 Biomedical Transport Phenomena	3	BMEG Elective	3
BMEG Elective	3	BMEG Elective	3
Science Elective	3	Humanities Elective	3
Social Science Elective	3	Social Science Elective	3
	<b>15</b>		<b>15</b>

\*The Freshman Engineering Science Elective must be chosen from either CHEM 1123/1121L or PHYS 2074.

\*\*The Sophomore Science Elective must be PHYS 2074 (if CHEM 1123/1121L was chosen as the Freshman Engineering Science Elective) or CHEM 1123/1121L (if PHYS 2074 was chosen as the Freshman Engineering Science Elective. That is, both courses are required for the degree)

## Science Electives

Students can select from the following or others approved by department:

BIOL 2323 General Genetics	CHEM 2263 Analytical Chemistry
BIOL 2443 Human Anatomy	CHEM 2613 Organic Physiological Chemistry
BIOL 2013 General Microbiology	CHEM 3203 Forensic Chemistry
BIOL 4263 Cell Physiology	CHEM 3453 Elements of Physical Chemistry
BIOL 4313 Molecular Cell Biology	CHEM 3504 Physical Chemistry I
BIOL 4653 Cancer Biology	CHEM 3514 Physical Chemistry II
BIOL 4713 Basic Immunology	CHEM 3813 Introduction to Biochemistry
	CHEM 4813H Honors Biochemistry I
	CHEM 4843H Honors Biochemistry II

## BMEG Electives

Students should select from the following list based on their field of interest. Check with department regarding updated list every semester:

BIOL 4167 Dynamic Models in Biology  
BIOL 4233 Genomics and Bioinformatics  
BMEG 4403 Biomedical Microscopy (Irr)  
BMEG 4243 Advanced Biomaterials and Biocompatibility (Irr)  
BMEG 4103L/M Nanotechnology Laboratory (Fa)  
BMEG 4213 Cell and Tissue Mechanics (Irr)  
BMEG 4413 Tissue Engineering (Irr)  
BMEG 4513 Biomedical Optics and Imaging  
BMEG 470V Special Topics in Biomedical Engineering (Irr) : *Varies by semester*  
BMEG 460V Individual Study \*  
BMEG 460VH Honors Individual Study \*  
BMEG 450VH Honors Thesis\*

Biomedical engineering-related courses in College of Engineering (4000 or above) approved by advisor and undergraduate coordinator

\* Between BMEG 460V, 460VH and 450VH, up to 3 hours total may be counted towards a BMEG elective requirement.

## Fine Arts, Humanities Requirement (6 hours)

Select 3 hours each from categories “a” and “b”

### **a. Fine Arts:**

ARCH 1003 Basic Course in the Arts:  
Architecture Lecture  
ARHS 1003 Basic Course in the Arts: Art  
Lecture  
COMM 1003 Basic Course in the Arts: Film  
Lecture  
DANC 1003 Basic Course in the Arts:  
Movement and Dance  
DRAM 1003 Theater Appreciation  
LARC 1003 Basic Course in the Arts: The  
American Landscape  
MLIT 1003 Basic Course in the Arts: Music  
Lecture  
MLIT 1013 Music Lecture for Music Majors

### **b. Humanities**

Any intermediate I foreign language\*  
ARCH 1013 Diversity and Design  
CLST 1003 Intro to Classical Studies: Greece  
CLST 1013 Intro to Classical Studies: Rome  
COMM 1233 Media, Community and  
Citizenship  
HUMN 1124H Honors Equilibrium of Cultures,  
500-1600  
HUMN 2003 Intro to Gender Studies  
HUMN 2124H Honors Twentieth Century  
Global Culture  
PHIL 2003 Intro to Philosophy  
PHIL 2103 Intro to Ethics  
PHIL 2203 Logic  
PHIL 3103 Ethics and the Professions  
WLIT 1113 World Literature I  
WLIT 1123 World Literature I

\*Typically numbered 2003. See Department of World Languages, Literatures and Cultures in the J. William Fulbright College of Arts and Sciences chapter in the Undergraduate Catalog.

## Social Sciences Requirement (9 hours)

Select from at least two different fields of study

AGEC 1103 Principles of Agricultural Microeconomics  
AGEC 2103 Principles of Agricultural Macroeconomics  
ANTH 1023 Intro to Cultural Anthropology  
COMM 1023 Communication in a Diverse World  
ECON 2013 Principles of Macroeconomics  
ECON 2023 Principles of Microeconomics  
ECON 2143 Basic Economics: Theory and Practice  
GEOG 1123 Human Geography  
GEOG 2003 World Regional Geography  
HESC 1403 Life Span Development  
HESC 2413 Family Relations  
HIST 1113 Institutions and Ideas of World Civilizations I  
HIST 1123 Institutions and Ideas of World Civilizations II  
HIST 2003 History of the American People to 1877\*\*

HIST 2013 History of the American People 1877 to  
Present\*\*  
HUMN 1114H Honors Roots of Culture to 500 C.E.  
HUMN 2114H Honors Birth of Modern  
Culture,1600-1900  
PLSC 2003 American National Government\*\*  
PLSC 2013 Intro to Comparative Politics  
PLSC 2203 State and Local Government  
PSYC 2003 General Psychology  
RESM 2853 Leisure and Society  
RSOC 2603 Rural Sociology  
SOC 2013 General Sociology  
SOC 2033 Social Problems

\*\* If not selected to meet the three hours of U.S. History requirement

Please refer to the [Undergraduate Course Catalog](#) for more complete information on degree requirements and academic policy.

## **Pre-Medical Requirements**

Students wanting to meet premedical requirements should look into admission requirements for specific medical schools. Although not required for the BMEG degree, generally, students are recommended to take:

- Biochemistry as Science Elective
- Genetics and Statistics, in addition to the BMEG required curriculum.
- Please refer to up-to-date admissions criteria for [UAMS](#) as an example.

Students interested in pursuing pre-med should sign up for the UA Premedical Program listserv (go to <http://premed.uark.edu> for more information).

## **College of Engineering Graduation Requirements**

Students should stay up to date with graduation requirements enforced by the College of Engineering and the University and make sure that these requirements are met before graduation. Detailed information can be found on the [Undergraduate Catalog College of Engineering Requirements](#). Some key requirements are:

1. A GPA of no less than 2.0 in all courses in the major area of study.
2. No more than 8 hours of “D” grades towards BMEG requirements.
3. A minimum of 20 credit hours at the 3000 level or above within the College of Engineering from the University of Arkansas.

## **Biomedical Engineering Curriculum Flowchart**

Please refer to the Student Resources section on the [BMEG departmental website](#) for the most up-to-date curriculum flowchart.

## Advising Procedures

At the beginning of the sophomore year, each student is assigned an adviser to help select courses that fit within the required program of study and to assure that courses are taken in the appropriate sequence. **Prior to registering for the next semester, each student must meet with his/her adviser to go over the progress and to select courses.** Students will not be able to register unless their adviser removes the advising hold in UAConnect.

Procedures to complete before seeing your adviser:

1. Fill out/update your [Biomedical Engineering Undergraduate Advising Sheet](#) with all course credits you have earned. Bring this form to advising. It will be submitted to the adviser at advising.
2. Refer to the [Biomedical Engineering Undergraduate Flow Chart](#) and select courses for next semester and enter these into the Advising Sheet. Look up courses in [UAConnect](#) and/or the [Undergraduate Course Catalog](#) for a complete, up-to-date listing of pre-requisites and co-requisites.
3. Using [UAConnect](#), access the Schedule of Classes and prepare a trial schedule. Make sure required course **pre-requisites** are complete and that you sign up for course **co-requisites**.
4. In [UAConnect](#), check your assigned advisor before your advising session.
5. Check the **advising** schedule provided by the Program Coordinator and/or by your academic advisor by email and plan on meeting with your advisor ASAP to ensure that their advising holds are removed in time for registration. Your advisor may choose to participate in group advising (pre-scheduled blocks of time) or by appointment only.
6. Remember that all **registration holds (negative service indicators) must be removed** before you can register. Such holds include advising holds but can also be financial holds from Parking and Transit, Student Health Center, or the Treasurer's Office. Once all holds are removed, you may register in UACONNECT during your assigned registration period.

Academic advising is a service provided by the University to assist students in making thoughtful decisions related to their academic experiences, and maximizing their educational and career opportunities. Our faculty advisers do their best to work with you, but remember that the student possesses the final responsibility for successful completion of a degree.

# Registration

## UAConnect

The University requires students to use [UAConnect](#) to view the schedule of classes and to register for classes. For assistance with UAConnect for registration, contact the [Registrar's Office](#) (575-5451) or [UAConnect help](#).

## Registration periods

Students must register during one of the formal registration periods. Visit [UAConnect](#) to view your available registration dates.

## Schedule Changes and Add/Drop

Students can make changes to their schedules (add and/or drop courses) using [UAConnect](#) during the first five class days of the semester. A student may drop a full-semester course during the first 10 class days without having the drop shown on the official academic record. After the first 10 class days, and before the drop deadline of the semester, a student may drop a course, but a mark of "W" (withdrawal) will be recorded. For fee refund schedules and add/drop deadlines for specific semesters, refer to the [Academic Semester Calendar](#) at the Registrar's Office.

## Registration Overrides

Students unable to register for **Engineering courses** due to **pending transfer credits** causing **pre- and co-requisite conflicts**, **time conflicts** or **class full** may be placed in a course upon case-by-case approval from the **course instructor(s)** and the **undergraduate coordinator** within the enrollment period.

If a student needs a temporary override to register for a **BMEG course** due to **pre/co-requisites**, **class full**, **and/or instructor permission needed**, the student should (for time conflict or non-BMEG courses, see next section):

1. Fill out and submit the [Biomedical Engineering Online Course Override Form](#) available through the Student Resources section of the BMEG departmental website.
2. Upon approval from the course instructor and the undergraduate coordinator, the student should be able to register for the course. It is the student's responsibility to make sure that the credits for pre-requisite courses are transferred in time before the start of the semester. Pre- and co-requisite courses are checked at the beginning of the semester and students not meeting pre-requisites or co-requisites will be dropped from the enrolled course.

If a student needs an override to register for an **Engineering course** (outside of BMEG) or a BMEG course for reasons due to **time conflict**, the student should:

1. Fill out the [College of Engineering Override Form](#). Obtain course information directly from UACONNECT and specifically indicate reason for override in "Comments" section in addition to checking all reasons that apply.
2. Contact the **course instructor** and obtain his/her approval and signature on the form.

3. Contact the **undergraduate coordinator** and obtain his/her approval and signature on the form in the section for Department Head's Approval.
4. Submit the completed override form to the **Student Records Office, BELL 3189**.

Students that require override for courses **outside the College of Engineering** should contact the home department of the course for which they are enrolling and follow appropriate procedures required by the department.

## Transfer Students

- If you are transferring into BMEG from a different department/college/institution, please consult the **undergraduate coordinator** regarding your course transfers.
- If you wish to obtain credit for a class taken at another institution or by tests, you may look up **course equivalencies** on the [Registrar's website](#). Please discuss further questions with your adviser and/or the undergraduate coordinator.

## Study Abroad

There are now three study abroad programs that are BMEG-specific:

- Aarhus University, Denmark
- Universidad Carlos III, Madrid, Spain
- University of Technology, Sydney Australia.

Please visit <http://studyabroad.uark.edu> and or contact Dr. Bryan Hill ([bwhill@uark.edu](mailto:bwhill@uark.edu)) for more specific information about application to these and other programs.

## Honors Program

The Honors Program in the Department of Biomedical Engineering is designed for high-ability students who are interested in more vigorous and in-depth academic challenges. In order to graduate from the Honors Program, students must take **a minimum of 12 hours of honors courses**, with **at least 6 of the 12 hours in BMEG** including BMEG 450VH Honors Thesis as an honors student in the Department of Biomedical Engineering. Below are the honors courses offered in the BMEG department of which one is required:

- BMEG 3653H Biomedical Modeling and Numerical Methods
- BMEG 3824H Biomolecular Engineering
- BMEG 4623H Biomedical Transport Phenomena

In addition to the honors coursework, honors students are required to complete an **honors thesis research project** under the direction of a faculty mentor. BMEG honors students are required to identify a research mentor and project before the end of their junior year. Please refer to the [Biomedical Engineering Honors Program Handbook](#) for more details regarding the requirements and benefits of the Honors Program.



## **Undergraduate Research**

Opportunities are available for undergraduate BMEG students to participate in research. Students can participate through the **Honors Program**, as well as just by working with an individual faculty member. Refer to the [BMEG departmental website](#) for descriptions of research activities within the department. A student may get involved in research by contacting individual faculty members about their research program. Research funding and/or student stipends are available through resources such as [SURF \(Statewide Undergraduate Research Fellowships\)](#) and [Honors College Undergraduate Research Grants](#) through the Honors College. Refer to the [Honors College website](#) for more information.

## **Student Organizations**

### **Biomedical Engineering Society (BMES)**

Faculty Advisor: Dr. Kartik Balachandran ([kbalacha@uark.edu](mailto:kbalacha@uark.edu))

The Biomedical Engineering Society at the University of Arkansas promotes the education and advancement of biomedical engineering by engaging members in insightful discussions and organized events. Its goals are to:

1. Introduce current research being conducted by UA professors as well as those from other institutions.
2. Explore professional opportunities in industry, medicine and academia.
3. Provide a networking platform for members to gain experience in biomedical engineering through internships.

Refer to <http://rso.uark.edu/bmes> or email at [bmes@uark.edu](mailto:bmes@uark.edu) for more information.

### **Engineering World Health (EWH)**

Faculty Advisor: Dr. Jeffrey Wolchok ([jwolchok@uark.edu](mailto:jwolchok@uark.edu))

The Engineering World Health (EWH) chapter exists to inspire and mobilize the biomedical engineering community to improve the quality of health care in the developing world. Specifically, to provide members with enhanced opportunities to participate in EWH activities, such as designing novel medical technologies appropriate for developing countries building medical devices for use in developing countries, and promoting understanding and goodwill between the developed and developing world.

Email [ewh@uark.edu](mailto:ewh@uark.edu) for more information.

### **Alpha Eta Mu Beta (Biomedical Honor Society)**

Faculty Advisor: Dr. Michelle Kim ([mmkim@uark.edu](mailto:mmkim@uark.edu))

The UARK AEMB chapter exists to recognize the academic achievements of students, to honor distinguished faculty and alumni, and promote excellence in the field of biomedical engineering. This organization will provide opportunities for professional development and organize resources to be

successful in the field of biomedical engineering. Eligible students may apply for induction starting the end of the sophomore year.