

Annual Graduate Program Report

Biomedical Engineering Department (BMEG)
University of Arkansas

Degree Programs:

Biomedical Engineering (MSBME, non-thesis)
Biomedical Engineering (MSBME, Healthcare Entrepreneurship, non-thesis)
Biomedical Engineering (MSBME, thesis)
Doctor of Philosophy (PhD) in Engineering

Report Period

May 16, 2024 – May 15, 2025
Summer 2024, Fall 2024, and Spring 2025

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Contact Information

Dr. Kartik Balachandran
Professor and Graduate Coordinator
Department of Biomedical Engineering
University of Arkansas
479-575-3376
kbalacha@uark.edu

PROGRAM GOALS FOR BMEG MS. AND PHD PROGRAMS

Program goals are broad general statements of what the program intends to accomplish and describes what a student will be able to do after completing the program. The program goals are linked to the mission of the university and the strategic plan of the College of Engineering (COE).

Accordingly, the program goals of the MS and PhD programs in Biomedical Engineering 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-master's or Ph.D. studies.
2. Utilizing their advanced engineering education in creating new knowledge or enabling technologies for improvement of human health and healthcare.
3. Continuously upgrading their knowledge in their chosen specialty by initiating self-directed learning.

STUDENT LEARNING OUTCOMES

Student Learning Outcomes are defined in terms of the knowledge, skills, and abilities that students will know and be able to do as a result of completing a program. These student learning outcomes are directly linked to the accomplishment of the program goals.

The graduates of the MS and PhD programs in Biomedical Engineering will either be capable of the following or possess the following attributes:

1. Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.
2. Functioning in multidisciplinary teams to find effective solutions to complex technical problems and/or the design of new products and processes to improve human health and health care.
3. Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.
4. In-depth and up-to-date knowledge within a specialized field in Biomedical Engineering.
5. An understanding of ethical and professional responsibility
6. To effectively communicate their findings/ideas to a technical and non-technical audience

The prescribed outcomes are met through the curriculum followed by the students.

PROCESS FOR ASSESSING STUDENT LEARNING OUTCOMES

A process must be defined and documented to regularly assess student learning and achievement of student learning outcomes. The results of the assessment must be utilized as input for the improvement of the program.

The process for assessing student outcomes (MS and PhD) are outlined in **Table 1**. The specific outcomes that each assessment measures are also listed.

Table 1. Student outcomes assessment matrix.

	Outcome 1: Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.	Outcome 2: Functioning in multidisciplinary teams to find effective solutions to complex technical problems and/or the design of new products and processes to improve human health and health care.	Outcome 3: Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.	Outcome 4: In-depth and up-to-date knowledge within a specialized field in Biomedical Engineering.	Outcome 5: An understanding of ethical and professional responsibility	Outcome 6: To effectively communicate their findings/ideas to a technical and non-technical audience
Graduating student cumulative GPA				x		
Annual student academic review				x		
Assessment of student performance in core graduate classes: BMEG 5103 Design and Analysis of Experiments in Biomedical Research	x		x			
Participation in graduate seminar					x	x
Comprehensive examination (MS non-thesis), Thesis (MS) Candidacy Exam (PhD) and Dissertation defense (PhD)	All outcomes					
Exit interviews	All outcomes					
Employment data	All outcomes					

PROGRAM ASSESSMENT RESULTS

1. Graduating student cumulative GPA (cGPA) – Outcome 4

Table 2 provides the results from all students graduating with a MS or PhD degree in the 2024/25 year of assessment. The metric for success is for 100% of students to achieve at least a 3.0 cGPA. Based on the data below, we have achieved the stated criterion.

Table 2. Cumulative GPA for graduating BMEG students in assessment year 2024/25

Degree	Student Name	Graduating Term	cGPA
MS (non-thesis)	Daniel Sanders	1246	3.850
MS (non-thesis)	Faith Pearrow	1246	3.739
MS (thesis)	Justin Dykstra	1246	3.467
MS (thesis)	Mads Ancker	1246	3.875
PhD	Tommaso Benigni	1246	4.000
PhD	Emory Gregory	1246	3.657
PhD	Alexis Ivy	1246	4.000
PhD	Kaitlyn Elmer	1249	4.000
PhD	April Mordi	1249	3.811
PhD	Paola Monterroso-Diaz	1249	3.917
MS (non-thesis)	Gerson Fajardo	1253	3.667
MS (thesis)	Lance Cordes	1253	4.000
MS (thesis)	Nicholas Powell	1253	4.000
PhD	Angeline Rodriguez	1253	3.824
PhD	Shelby Bess	1253	3.625
PhD	Inha Baek	1253	3.714
PhD	Xiaolei Hao	1253	3.667

2. Annual student Academic Review – Outcome 4

As the deadline for submission of the annual review forms is June 30, we are still in the process of compiling the data for this outcome.

3. Assessment of student performance in core graduate classes

Student performance in the Core Graduate Classes as listed in Table 1 will be used to measure success in this particular assessment criterion. Each core class will be assessed via a specific assessment rubric compiled in **Appendix A** of this report.

BMEG 5103: Design and Analysis of Experiments in Biomedical Research – Outcome 1

A single exam or homework problem was identified which requires the student to conceive, design, analyze and implement systems relating to human healthcare. The criteria for success in this metric was for 90% of the students to achieve a score of 70% or more. As per the results detailed in Appendix A, we have achieved this metric. Representative student reports for this specific metric are on file in the BMEG Department and can be made available upon request.

BMEG 5103: Design and Analysis of Experiments in Biomedical Research – Outcome 3

A single exam or homework problem was identified which requires the student to use modern analytical, simulation, and diagnostic tools and techniques used in the healthcare industry. The criteria for success in this metric was for 90% of the students to achieve a score of 70% or more. As per the results detailed in Appendix A, we have not achieved this metric this year. Representative student reports for this specific metric are on file in the BMEG Department and can be made available upon request.

4. Participation in graduate seminar – Outcomes 5 and 6

All BMEG graduate students are required to enroll in the BMEG5800/01 (Fall) and BMEG5810/11 (Spring) Graduate Seminar classes each semester, excluding the summer semester. Students are also required to give either a research presentation or a chalk-talk seminar once per academic year. This will ensure that MS students give at least 2 presentations, and PhD students will give at least 4 presentations prior to their graduation. In the 2024-2025 academic year, due to the increased numbers of students in our program, only 75% of our BMEG graduate students were able to present at the graduate seminar class. We expect students to now be able to present once every academic three semesters.

5. Comprehensive examination (MS non-thesis), Thesis defense (MS thesis), Candidacy examination (PhD) and Dissertation defense (PhD) – All Outcomes

The comprehensive exam (MS), candidacy exam (PhD) and dissertation defense (PhD) are key assessment metrics for a graduate student in the BMEG program. Students will graduate only if they pass these assessment points. These examinations are meant to test achievement of the student in all the Outcomes listed in Table IX.1. The MS thesis defense, PhD qualifying exam and PhD dissertation defense are assessed using grading rubrics available on file in the BMEG Department, and on the BMEG Sharepoint secure website.

5.1 MS Comprehensive Examinations (Non-Thesis and Thesis)

All students in the BMEG MS Program must pass a comprehensive examination. Students may retake a failed comprehensive exam once upon the approval of the student's Thesis Committee (for Thesis option) or Advisory Committee (for Non-thesis option). A student who fails the comprehensive examination twice will be terminated from the program. Under no circumstances will a student be allowed to take the comprehensive examination more than twice.

5.1.1 MS Non-Thesis Comprehensive Examinations

For the non-thesis option, the comprehensive examination is an extensive written test of knowledge comprised of topics covered by the Biomedical Engineering Graduate Core courses. The comprehensive examination for the non-thesis option is administered by the Program Advisory Committee. **Table 3** compiles the list of students who have completed their MS Non-Thesis Comprehensive Exams.

Table 3. MS Non-Thesis Comprehensive Exam Results.

Student Name	Term	Status
Gerson Fajardo	1253	Pass
Alexis Applequist	1253	Pass
Gustavo Vaca Diez	1253	Pass

5.1.2 MS Thesis Defense

For the Thesis option, the comprehensive examination is an oral defense of the Master's thesis. The student is expected to demonstrate technical competence in the field directly related to the thesis research as well as a broader understanding of biomedical engineering research and the scientific method. The oral defense also assesses the student's ability to respond to questions in a rational, knowledgeable manner. The comprehensive examination for the Thesis option is administered by the Thesis Committee, and success of this metric is determined via an evaluation form. **Table 4** compiles the list of students who have completed their MS Thesis Defense.

Table 4. MS Thesis Defense Results.

Student Name	Term	Status
Mads Ancker	1246	Pass
Lance Cordes	1253	Pass
Nicholas Powell	1253	Pass

5.2 PhD Candidacy Examination

The candidacy examination/dissertation proposal is the first step in meeting the dissertation requirement. The Ph.D. candidacy examination consists of both written and oral components not only covering general didactic knowledge in biomedical engineering but also measuring the student's potential preparedness in a narrowly focused area sufficient to propose a rigorous research plan. The written component is a proposal encompassing the student's dissertation research. The oral component is a presentation of the written proposal. The candidacy exam assesses the student's understanding of the proposed research area, and why the proposed research plan is the most appropriate and practical approach given the current state of scientific understanding and the available resources. The Advisory Committee will assess the student's preparedness for continuation in the doctoral program. Final approval of the proposal is given by the student's Program Advisory Committee. **Table 5** below gives a list of the PhD candidates who passed their candidacy exams this reporting year.

Table 5. PhD Candidacy Examination Results.

Student Name	Term	Candidacy Status
Amanda Walls	1249	Pass
Erin Drewke	1249	Pass
Jesse Ivers	1249	Pass
Nimisha Tandon	1249	Pass

5.3 PhD Dissertation Defense

The PhD Dissertation Defense is a written and oral presentation of the dissertation to the Dissertation Committee. The candidate is tasked with constructing a convincing scientific argument which demonstrates: 1) the ability to clearly define a biomedical engineering research problem; 2) technical competency within his/her field; and 3) an understanding of the impact of the project relative to a broader scientific field. Success in this metric is determined by an evaluation form. **Table 6** below gives a list of the PhD candidates who passed their dissertation defense this reporting year.

Table 6. PhD Dissertation Defense Results.

Student Name	Term	Status
Alexis Ivy	1246	Pass
Tommaso Benigni	1246	Pass
Emory Gregory	1246	Pass
Kaitlyn Elmer	1249	Pass
April Mordi	1249	Pass
Paola Monterroso-Diaz	1249	Pass
Angeline Rodriguez	1253	Pass
Inha Baek	1253	Pass
Shelby Bess	1253	Pass
Xiaolei Hao	1253	Pass

6. Exit interviews – All Outcomes

Exit interviews are typically conducted by the BMEG Department Head the semester of graduation, along with an online exit interview survey. Exit interview survey data is stored within our Departmental servers, and is available on request.

7. Employment Data – All Outcomes

Employment data for all students obtaining employment in this reporting period is compiled below. Five of our students were not able to obtain gainful employment or continuation in professional/advanced degree programs within one month of graduation. We are continuing to follow up with them as they are still actively searching for employment.

Table 8. Employment data for graduating students.

Degree	Student Name	Graduating Term	Current Position, Employer
MS (thesis)	Justin Dykstra	1246	
MS (non-thesis)	Daniel Sanders	1246	Overnight Advocate, Northwest Arkansas Women's Shelter
MS (non-thesis)	Faith Pearrow	1246	Assistant Manager, City of Bentonville
MS (thesis)	Mads Ancker	1246	Life Science Automation Lead, Eltronic A/S
PhD	Alexis Ivy	1246	VC Analyst, Symbiosis
PhD	Tommaso Benigni	1246	Postdoctoral Fellow, I ³ R, UARK
PhD	Emory Gregory	1246	Postdoctoral Fellow, UARK
PhD	Kaitlyn Elmer	1249	Adjunct Faculty, John Brown University
PhD	April Mordi	1249	
PhD	Paola Monterroso Diaz	1249	
PhD	Angeline Rodriguez	1253	Program Technician, UARK Division of Agriculture
PhD	Inha Baek	1253	Postdoctoral Fellow, UARK
PhD	Shelby Bess	1253	Postdoctoral Fellow, UARK
PhD	Xiaolei Hao	1253	Process Engineer, Novonesis

MS (thesis)	Nicholas Powell	1253	Clinical Research Coordinator, Highlands Oncology
MS (non-thesis)	Gerson Fajardo	1253	
MS (thesis)	Lance Cordes	1253	

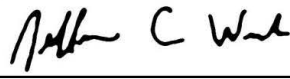
PLANNED CHANGES TO DEGREE PROGRAM

Our graduate programs will be undergoing their 7-yearly assessment by ADHE in Fall 2025. Therefore, no changes are currently planned until the external review is completed.

APPENDIX A.1 – BMEG 5103 ASSESSMENT RUBRIC (Outcome 1)

BMEG Graduate Program Assessment							
Outcome: (1) Conceiving, designing, analyzing, and implementing systems, processes and experiments related to improving human health and healthcare.							
Course Information							
Course Number	Course Title			Semester		Enrollment	
BMEG 5103	Design and Analysis of Experiments			Spring 2025		6 BMEG / 9 total	
Direct Measure of Student Achievement [Only BMEG graduate students]	A course project was identified which requires the student to <u>conceive, design, analyze and implement systems relating to human healthcare.</u>						
	Question (30pts): The purpose of this assignment is to analyze the types of statistical analyses that were performed during biomedical experiments using a review of published biomedical research. Namely, students working in teams of two or three identified a peer reviewed manuscript and described two different experiments with two different statistical analyses. The students then needed to design an experiment in the form of a homework problem that would utilize one of the statistical analyses presented and provide a solution (Assignment description and grading rubric attached)						
Assessment							
Student	Score		Student	Score		Student	Score
1	30/32						
2	30/32						
3	29/32						
4	29/32						
5	28/32						
6	28/32						
Number obtaining 70% or more of total points (>24)		6		Percent of students meeting criteria (target: 90%)		100%	
Instructor:		Jeff Wolchok					

APPENDIX A.2 – BMEG 5103 ASSESSMENT RUBRIC (Outcome 3)

BMEG Graduate Program Assessment							
<i>Outcome: (3) Using modern analytical, simulation, and diagnostic tools and techniques used in healthcare industry.</i>							
Course Information							
Course Number	Course Title			Semester		Enrollment	
BMEG 5103	Design and Analysis of Experiments			Spring 2025		6 BMEG / 9 total	
Direct Measure of Student Achievement [Only BMEG graduate students]	A homework assignment will be identified which requires the student to use modern analytical, simulation, and diagnostic tools and techniques used in the healthcare industry. (See attached homework – students use the statistical software package jmp to analyze the data)						
Assessment							
Student	Score (out of 10)		Student	Score		Student	Score
1	10						
2	10						
3	8						
4	7						
5	10						
6	6						
Number obtaining 70% or more of total points	5		Percent of students meeting criteria (target: 90%)		83%		
Instructor:	Jeff Wolchok						
			Signature				