

LSU

College of Engineering

**BIOLOGICAL AND AGRICULTURAL ENGINEERING
GRADUATE HANDBOOK**



Beginning Your Program	4
Graduate Degree Programs	6
Master of Science in Biological and Agricultural Engineering (Thesis)	8
Graduate Advisory Committee	
Minimum Requirements	
Sample Chronological Guide	
Master of Science in Biological and Agricultural Engineering (Non-Thesis)	11
Minimum Requirements	
Transfer-to-Thesis Option	
3+2 (Accelerated Master's Program)	14
Sample Chronological Guide	
PhD in Biological Engineering	16
Qualification for Entering Program	
PhD Program of Study	
Qualifying Examination	
General Examination	
Final Examination	
Sample Chronological Guide	
Assistantships	22
Student Life	24
Research Laboratories	26
Faculty Research Interests	28
The End of the Program	31

***Our mission is to
provide a biological and
agricultural engineering
program of excellence,
advancing knowledge
through teaching, basic
and applied research,
and outreach.***

WELCOME

Welcome to the Department of Biological & Agricultural Engineering (BAE) at LSU. Your interest is greatly appreciated. We strive to grow and maintain excellent graduate programs in biomedical engineering, bioenvironmental engineering, bioprocess engineering, and bioenergy. Your contribution in this endeavor is essential, and I commend you for accepting the challenge.

BAE has exciting research projects in cellular and molecular engineering, nano-bioengineering, bioenergy, water quality, irrigation, climatology, food processing engineering, and sensing. Many projects are interdisciplinary, and some have an international component. You can visit lsu.edu/eng/bae to learn more about our department. Please feel free to contact me if you have any questions or comments regarding our program.



Cristina M. Sabliov,
Richard R. & Betty S. Fenton
Alumni Professor and
Graduate Coordinator

csabliov@lsu.edu



**BEGINNING
YOUR
PROGRAM**

You have received letters from BAE and the Graduate School detailing your admission, and you should have been assigned to a faculty advisor who will guide you through your graduate program. If you need additional help, please visit the departmental graduate coordinator, Professor Cristina Sabliov.

Taking Your First Steps

- Start by visiting the main office in 149 E. B. Doran Hall. If you are on an assistantship, Administrative Program Specialist Donna Elisar (DElisar@agcenter.lsu.edu) will help you complete the required forms. Clerical assistance is also provided by Administrative Coordinator Angela Singleton (asingleton@agcenter.lsu.edu).
- Be sure to attend graduate student orientation. International students should also have been informed regarding their English language course requirements.
- Your advisor will assist you in registering for classes and discuss possible topics for your research/project. If you are on assistance, you will be assigned an office and provided keys to the areas you will use. Professor Chandra Theegala (ctheegala@agcenter.lsu.edu) will provide a security code and explain the system. Angela Singleton will help you obtain the needed keys.
- Contact Research Associate Tom McClure (TMclure@agcenter.lsu.edu) in the Metals Shop if you need assistance with fabrication of research equipment.
- If your research requires transportation, you must enroll in the defensive driving course required by the LSU AgCenter. To check out a vehicle, contact Angela Singleton.



**GRADUATE
DEGREE
PROGRAMS**

BAE offers a Master of Science in Biological and Agricultural Engineering (MSBAE) and a PhD in Biological Engineering (PBE).

The degree program leading to the MSBAE is offered in both thesis and non-thesis options. The thesis option requires 24 hours of coursework beyond the bachelor's degree and a publishable thesis. A thesis is also required of all students on a graduate research/teaching assistantship. The non-thesis option requires 36 hours beyond the bachelor's degree and a project.

Eighteen to 24 months is the usual time required for full-time students to complete the MSBAE. Completion of the PhD usually requires an additional three years.

A graduate student must assume full responsibility for knowledge of the Graduate School and BAE's rules and regulations concerning his or her degree program. It is not expected that students require the same degree guidance commonly given to undergraduates.

The MSBAE requires a baccalaureate degree from an engineering program accredited by the Accreditation Board for Engineering and Technology or the equivalent of the required engineering courses. Students pursuing the MSBAE without an engineering background may have to take additional courses to support their program of study. At least half of the graduate coursework must be taken in the College of Engineering.



MSBAE
(Thesis)

The focus of the MSBAE is education in engineering research. This program is designed to add to previous knowledge of engineering by including a thesis that demonstrates the student's ability to define problems, survey literature, and use experimental and/or analytical methods. The results must be of sufficient significance to be published as technical papers.

Minimum Requirements

- Twenty-four semester hours of approved graduate coursework, at least 12 of which must be above the 7000 level
- At least one advanced mathematics course of three credit hours
- Enrollment in Graduate Seminar (BE 7500) is required every year, with a maximum of one credit hour counting towards the graduate degree
- An acceptable thesis must be presented
- A minimum of six hours of thesis research credit (BE 8000) is required

The remainder of the program, including remedial coursework requirements, if any, is left to the discretion of the advisory committee. No more than six hours of BE 7909 is allowed.

A documented copy of all data collected during the course of the thesis research must be submitted to the advisor before graduation.

A final examination is also required of all degree candidates.

MSBAE Sample Chronological Guide

Semester 1

- Selection or appointment of major advisor
- Nine hours of coursework and three hours of BE 8000
- Selection of graduate advisory committee
- Development of approved plan of study
- Identification of research topic
- Identification of research objectives
- Preparation and presentation of thesis proposal, including literature review
- Submission of plan of study form and thesis research proposal to the department
- Begin research for experiments and thesis

Semester 2

- Development of a statistically valid experimental design
- Continue research for thesis
- Nine hours of coursework and three hours of BE 8000

Semester 3

- Conduct research through experiments
- Complete analysis of research data
- Six hours of coursework and six hours of BE 8000

Semester 4

- Twelve hours of BE 8000
- Thesis defense

Graduate Advisory Committee

The program of study will be guided by the student's graduate advisory committee, which consists of the major advisor and a minimum of two other members from the graduate faculty in BAE, and/or other developments related to the student's research area.



MSBAE
(Non-Thesis)

The non-thesis option is considered a terminal degree in a technical field. It is appropriate for practicing and/or employed engineers who wish to acquire advanced background and knowledge in chosen subject areas without having the need to pursue rigorous research. It can be earned with a part-time program of study and is generally not available to international students under the F1 Visa.

Minimum Requirements

- Thirty-six semester hours of approved graduate coursework, at least 18 of which must be above the 7000 level
- At least one advanced mathematics course of three credit hours
- Enrollment in Graduate Seminar (BE 7500) every year, with a maximum of one credit hour counting toward the graduate degree
- Must declare intent to join the MSBAE non-thesis option before beginning program of study

You must complete a three-credit project under BE 7909 and present a report approved by your major professor and advisory committee. The report is used in your final exam to portray your ability to conduct in-depth analysis of a biological engineering topic.

The remainder of the program, including remedial coursework requirements, if any, is left to the discretion of the advisory committee. No more than six hours of BE 7909 is allowed (a seminar presentation of your work to the faculty is required for each instance of BE 7909).

A final examination is required of all degree candidates.

Transfer-to-Thesis Options

Transferring from the non-thesis MSBAE to the thesis option may be done at any time. However, all of the requirements of the thesis degree program must be met. This includes the appointment of a new advisory committee and possibly a new major professor, as well as the formulation of a new plan of study and identification of a research area from which a thesis can be produced.

Courses taken in the non-thesis program may be applied to the thesis program only at the discretion of the new advisory committee.

If you are in the non-thesis option, you will not be eligible for any financial aid from the university. If you are currently in the thesis option and have received financial support from the department, you will not be permitted to switch to the non-theses option.



3+2 PROGRAM
(Accelerated Master's)

The 3+2 program is proposed as a procedure whereby all of the required credits for earning BS and MS degrees in biological engineering can be satisfied in five years. The primary motivation for the program is to facilitate and encourage our best undergraduate students to pursue a graduate degree in the department.

Junior Year (Third Year)

Sixth Semester

- Student classified as undergraduate.
- Invited to apply; application submitted, including Statement of Purpose
- Graduate advisor selected
- Research project identified
- Advisory committee formed
- Plan of study submitted

Senior Year (Fourth Year)

First Summer

- BE 3989 (Special Project) for undergraduate credit on thesis topic

Seventh Semester

- May take 4989 (Independent Study) for graduate credit
- Take GRE exam
- Apply for admission to the LSU Graduate School

Eighth Semester

- Participation encouraged in BE 7500 (Seminar)
- Graduate course (4000/7000)

Graduate Year (Fifth Year)

Second Summer

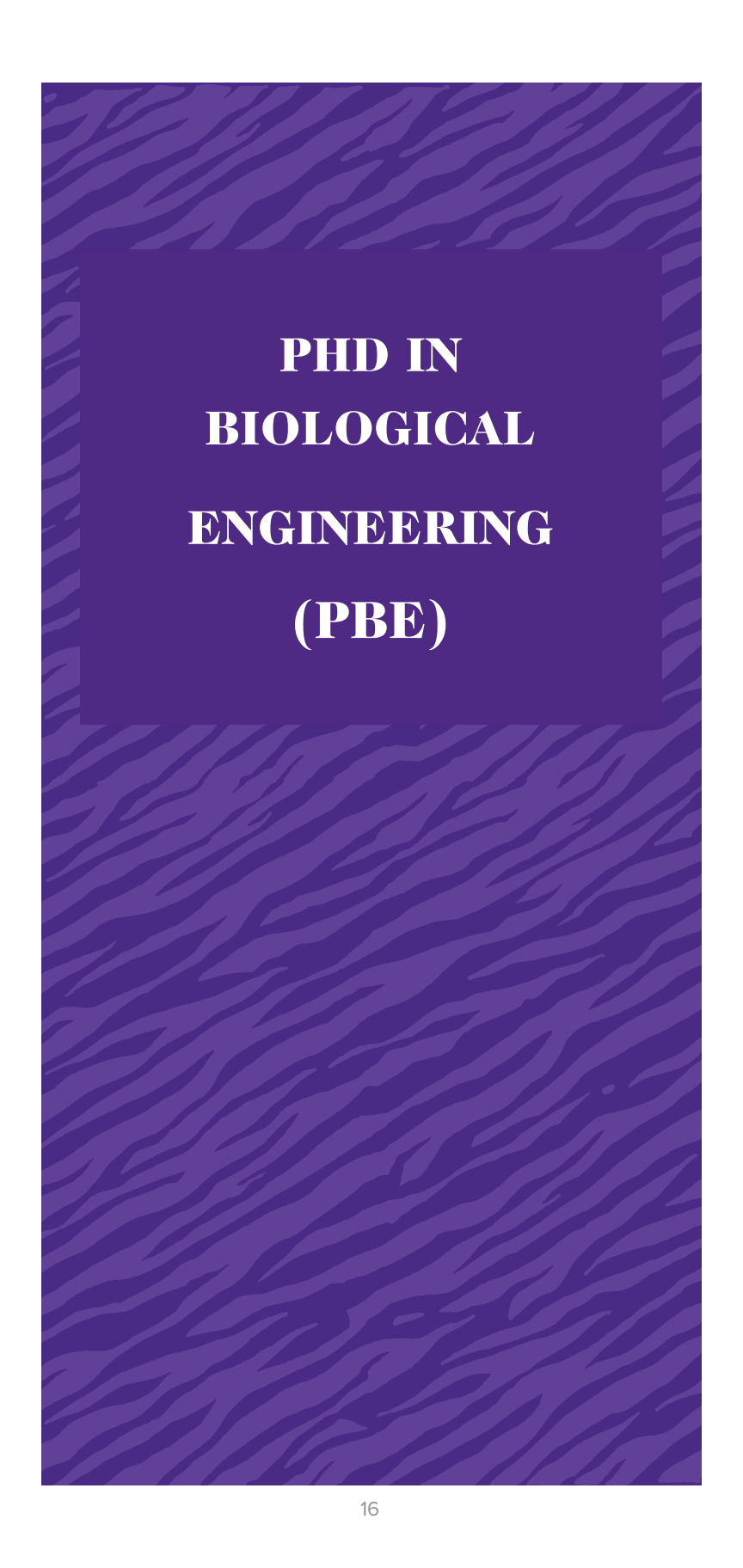
- BE 7909 (Advanced Topic)
- BE 7909 (Advanced Topic)
- Math 4XXX

Ninth Semester

- Three graduate courses (4000/7000)
- BE 8000

10th Semester

- Graduate course (4000/7000)
- BE 7500 (Seminar)
- BE 8000



**PHD IN
BIOLOGICAL
ENGINEERING
(PBE)**

Admission to the PhD Program in Biological Engineering will be made based on a recommendation by the graduate admission committee. The plan of study for each student will be developed in consultation with and approved by the student's graduate advisory committee. The committee will include the student's major advisor and at least two additional members of the graduate faculty such that the LSU Graduate School's requirements for graduate committees are satisfied.

Forty-two credit hours of non-research coursework beyond the bachelor of science are required with the following provisions:

- At least half credit hours at 7000 level or above
- At least half credit hours in the College of Engineering
- At least one (3 credit hours) advanced math or statistics course at 4000 or 7000 level
- At least 12 credit hours in biological engineering
- No more than six credits of BE 7909
- One credit hour of BE 7500

Students with an MS degree in biological engineering or a related field can transfer up to 21 credit hours of non-research coursework with approval of the director of graduate studies.

PhD students from other departments who choose BAE as a minor should be expected to take at least 12 hours of BE graduate credits to satisfy the requirements for a minor. The specific courses, which can include independent study, will be determined by the student's minor professor.

PhD Program of Study

According to the LSU Graduate School, a student is eligible to work toward a doctoral degree beginning with the semester in which he or she is formally admitted into a doctoral program. During the first six months in which a PhD student is enrolled, he or she should meet with his or her major professor and determine a future program of study for completing the PhD. The importance of this activity establishes a guide for students to follow for completing work needed to obtain the PhD.

The student should first prepare a working draft of the program of study. As a courtesy to the student's committee members, course titles and numbers should be listed. Then, the student, together with his or her major professor, should select the committee members who will review the proposed program of study. The student should provide copies of the drafted program of study to the committee members, who may approve, amend, or not approve the program of studies. If the proposed program is not approved, the major professor will assume responsibility for ensuring that the revised version is distributed among committee members for their approval. A copy of the approved program of study will be filed in the student's folder in the BAE academic secretary's office. The student's department-level academic course plan is subject to LSU Graduate School policy and departmental regulations.

Qualifying Examination

All PhD students must complete a milestone exam within 12 months of admission to the BE PhD program. This serves as the student's qualifying exam for continuing in the PhD program. The student's advisory committee will evaluate the written research proposal and presentation and recommend that the student continue in the PhD program or be transferred to an MS BAE program. Committee members must sign the qualifying exam report form when they agree that the student has satisfactorily completed the requirements for the exam. The signed form should be kept in the student's file folder in the BAE academic secretary's office. The major professor and student should also keep a copy of the signed form.

General Examination

At or near the completion of a PhD student's required coursework, he or she should schedule the general exam. In the BAE department, this exam is conducted by the student's advisory committee. In addition to the student's advisory committee, a graduate dean's representative will be appointed to serve as committee member for the general exam. This representative will continue to serve on the student's committee through the final exam. A "request for the general exam must be submitted to the LSU Graduate School by the student's department chair at least three weeks prior to the proposed examination date." Any changes to the committee "must be approved in advance by the dean of the LSU Graduate School."

The general exam consists of two parts—one written, the other oral. The written portion will be administered in a form decided on by the advisory committee. The oral portion includes an overview of the written exam, as well as an update on research progress to date.

The oral exam will involve the advisory committee plus the dean's representative, who will have a vote. There is no prescribed format or length of time required for this exam. The student presents the outcomes of the written general exam and presents an up-to-date report on research progress. To pass the general exam, the student must receive no more than one dissenting vote from the committee. All votes of the committee must be recorded and signed on the exam report cards provided by the LSU Graduate School. These cards should be given to the BAE academic secretary, who will forward them to the LSU Graduate School. If the student fails the general exam, the committee will attach a memorandum to the report card "specifying if the student will be allowed to retake the exam and any time constraints."

Further, the committee will determine the appropriate steps to be followed by the student with regard to continuing in the PhD program. A written report of these steps should be completed, with copies given to the committee members and student and filed in the student's folder in the BAE department.

Final Examination

The final exam can be scheduled no earlier than one “academic” year after the student passes the general exam. One “academic” year in this case, according to the LSU Graduate Bulletin, is the “interval between a general exam held early in one term and a final exam held toward the close of the following term.” The final exam may not be scheduled between semesters or when the university is not officially “open for business.” A request for the final exam must be submitted to the LSU Graduate School on the appropriate graduate school form at least three weeks prior to the proposed exam date, which must be on or before the published deadline for the current semester (see the LSU Academic Calendar for each individual semester deadline).

In no case should this request be submitted less than five weeks prior to the final date for submitting approved dissertations and final exam reports to the LSU Graduate School. The exam committee, including the dean’s representative, must have copies of the dissertation at least two weeks prior to the date of the final exam. The committee will determine whether the student should provide paper or electronic copies of the dissertation prior to the dissertation defense.

The final exam will be an oral exam primarily concerned with the dissertation, although the committee may opt to extend the subject matter. There is no prescribed format or length of time required for this exam. The major professor and committee members will be responsible for establishing the format and content of this exam. Dissertation defenses are open meetings for all members of the BAE department, and all faculty members and fellow students are strongly encouraged to attend.

To pass the final exam, the student must receive no more than one dissenting vote from the exam committee. All votes must be recorded on the exam report cards provided by the LSU Graduate School. Committee members who approve the dissertation should also sign the dissertation approval page. The signed exam report cards and dissertation title pages should be completed and presented to the BAE department academic secretary, who will forward them to the LSU Graduate School. Students are not permitted to handle the report cards; that is the responsibility of the student’s chair.

However, it is the student's responsibility to handle the approval pages. If the student fails the final exam, the advisory committee will attach a memorandum describing the report card, "specifying if the student will be allowed to retake the exam and any time constraints." Further, the committee will determine the appropriate steps to be followed by the student with regard to continuing in the PhD program. A written report of these steps should be completed, with copies given to the committee members and student and filed in the student's folder in the BAE department academic secretary's office.

Semester 1

- Selection or appointment of major advisor
- Selection of advisory committee
- Development of plan of study (final approval by student's graduate advisory committee)
- Identification of research topic
- Nine or 12 hours of coursework and three hours of thesis research

Semester 2

- Submission of graduate school plan of study and advisory committee forms
- Preparation of thesis proposal, including literature review
- Nine hours of coursework and three hours of research
- Completion of the qualifying exam

Semester 3

- Development of a statistically valid experimental design and conduct research
- Nine hours of coursework and three hours of research

Semester 4

- Completion of general examination
- Conduct of research
- Nine hours of coursework and three hours of research

Semester 5

- Completion of research data analysis
- Preparation of dissertation draft
- Six hours of coursework and three hours of research

Semester 6

- Final examination (dissertation defense)
- Twelve hours of thesis research



ASSISTANTSHIPS

Research and teaching assistantships are available to qualified students on a competitive basis. Graduate students on full-time assistantships are exempt from tuition costs but must pay fees, which may be done through payroll deduction. A full-time graduate student is one who is fully committed to graduate study and who devotes no appreciable time to duties not directly related to graduate work.

Full-time status does not depend solely on the number of hours for which a student registers; however, it is normally required that a full-time graduate student take at least nine semester hours of work (six in the summer).

Graduate assistants are considered full-time and are expected to register for a full load of graduate courses each semester until all degree requirements are completed. International students must maintain full-time status to keep a valid visa.

Graduate degree candidates in good standing are eligible for financial assistance. The candidate's commitment, in return for financial assistance, is one-half time in service and research on approved departmental projects. In selected cases, teaching responsibilities may be assigned.



STUDENT LIFE

Students are encouraged to have an active life outside of the classroom and laboratory. Many take advantage of the cultural and recreational activities that make LSU so rich. These include theatrical performances and concerts, both on and off campus, the University Recreational Center (UREC), numerous restaurants featuring local cuisine, festivals throughout the year, LSU sporting events, and more.



**RESEARCH
LABORATORIES**

In addition to modern, well-equipped teaching and research laboratories, the department has a complete research fabrication shop with expert technical staff. For field research work, students have access to major farm equipment and the 17 Louisiana Agricultural Experiment Stations located throughout the state. Cooperative research with the LSU Center for Advanced Microstructures and Devices (CAMD) and Pennington Biomedical Center is also available.

Additional labs include:

- ***BioMEMS and Biophotonics Lab***
Molecular biology, microscopy, and cell culture instrumentation to study engineering processes at the cellular and molecular level
- ***Bioprocessing and Colloidal Systems Lab***
Equipment suitable for synthesis and characterization of nano and colloidal systems designed for delivery of drugs, bioactives, and agrochemicals
- ***Bioprocess Engineering Lab***
Equipped with batch and continuous scale microwave heaters (915 and 2,450 MHz), a continuous microwave-based drying unit, RF reactors for bioprocessing, thermocatalytic reactors for fuel upgrading, network analyzer, and an electrostatic precipitator
- ***Muscle Foods Lab***
Pilot-scale facility equipped for work in new food product development and for exploration of novel food processing technologies
- ***Renewable Energy and Smart Grid Lab***
Well-equipped for biomass conversion research with high-pressure reactors, gasifiers, fermenters, and analytical equipment
- ***Rice Milling and Value-Added Lab***
A pilot-scale mill with individual units for cleaning, shelling, milling, and grading rice and special equipment for rice bran extrusion, stabilization, and bran oil extraction (solvent, supercritical, and microwave)
- ***Sensor Lab***
This facility contains GIS, GPS, and image analysis equipment for precision farming applications and sensors for yield monitoring of cotton, sugarcane, and other crops

- ***Cell-Free Synthetic Biology Lab***
Equipped with molecular biology research instruments, including various centrifuges, PCR, DNA/protein electrophoresis, multi-well plate reader, and incubators for pursuing the synthetic biology research by leveraging cell-free protein synthesis, genome engineering, and metabolic engineering
- ***LSU Community Playground Project Design Studio***
Meeting and design space with stations set up for group work, large white boards, and a computer station. Students use this space to create community-based playground designs and to complete project management activities (consolidating design ideas, detailed design, writing bid specifications, and developing volunteer construction plans)
- ***Biomedical Materials Deformation Lab***
Equipped with mechanical testing instrumentation and high-speed video-microscopy system designed for capture of deformation and fracture in bone tissue and engineering materials, along with suitable sample preparation capabilities
- ***Regenerative Engineering Lab***
Well-equipped with research capabilities in cell/molecular biology, molecular biomaterials, 3D bio-printing, and machine learning.



**FACULTY
RESEARCH
INTERESTS**

Carlos Astete, assistant professor (PhD, LSU 2010) – Astete’s research is centered on studying the development of polymeric nanoparticles as vehicles for delivery of active components for food, biopharmaceutical, and agricultural applications.

Richard Bengtson, professor emeritus (PhD, Oklahoma State University 1980) – Bengtson’s research focuses on soil erosion, hydrology, crop response to excess water stress and water management, and surface and groundwater quality.

Dorin Boldor, professor (PhD, North Carolina State University 2003) – Boldor’s research areas include bioprocessing, biofuels, and microwave heating and chemistry.

W. David Constant, chair and professor (PhD, LSU 1984) - Constant’s research area is fate and transport of chemicals in the environment with a focus on hazardous materials, waste sites, and water quality.

Philip Jung, assistant professor (PhD, University of Cincinnati 2010) – Jung’s research areas include engineering biomaterials for tissue regeneration and stem cell bioengineering.

Yongchan Kwon, assistant professor (PhD, Chungnam National University in South Korea 2012) – Kwon’s research focuses on cell-free synthetic biology applications encompassing expanding the genetic code, cell-free metabolic engineering, producing biomaterials, and developing a new toolkit for synthetic biology research.

Marybeth Lima, professor (PhD, Ohio State University 1996) – Lima’s research is centered on community-based design, playground design, and engineering education.

Elizabeth Martin, assistant professor (PhD, Tulane University 2013) – Martin’s research interests include biomedical research, tumor micro-environment, drug resistance, three-dimensional tissue matrices, cancer biomaterials, and cancer therapeutics.

W. Todd Monroe, professor (PhD, Vanderbilt University 2001) – Monroe’s research focuses on biomedical microfluidics, bioMEMS, biophotonics, and cellular and molecular engineering.

Cristina Sabliov, professor (PhD, North Carolina State University 2003) – Sabliov’s research includes nanotechnology, bioprocessing, and mathematical modeling.

Subramaniam Sathivel, professor (PhD, LSU 2001) – Sathivel’s research areas are food engineering and processing, microencapsulation technology, thermal and non-thermal processing, packaging and edible films, and bioactive compounds separation.

Chandra Theegala, professor (PhD, LSU 1997) – Theegala’s research includes water and wastewater treatment, agricultural byproducts and value-added products, bioenergy and alternative energy, and energy conservation.

Adjunct Faculty Research Interests

Giovanna Aita, professor in the Audubon Sugar Institute (PhD, LSU 2004) – Aita’s research areas are integrated technologies to convert biomass into higher value products, using antimicrobials to inhibit disease-causing microorganisms, and identifying and characterizing antimicrobial resistant bacteria.

Stacia Davis, assistant professor in the Red River Research Station (PhD, University of Florida 2014) – Davis’ primary program areas and initiatives are to establish an extension and outreach program that disseminates research-based results and addresses clientele concerns related to the development, operation, and efficient use of irrigation systems, as well as efficient irrigation scheduling.

Randy Price, assistant professor in the Dean Lee Research Station (PhD, University of Illinois 1999) – Price’s research focuses on remote sensing, automated systems, spray technology, and agricultural engineering.

Louis J. Thibodeaux, professor emeritus (PhD, LSU 1968) – Thibodeaux’s research areas are chemodynamics, transport, and fate of chemicals in the environment.

Kevin Hoffseth, assistant professor (PhD, University of California-Santa Barbara 2018) – Hoffseth’s research is targeted at the intersection of biomedical engineering and mechanics of materials, investigating deformation and fracture in cortical bone tissue under indentation and cutting.

**THE END
OF THE
PROGRAM**

BAE endeavors to make your time at LSU an enriching and mutually beneficial experience. Once it comes to conclusion, LSU requires electronic submission of all theses and dissertations. You should also archive research data and any publications to give to your advisor. In consultation with your advisor, disassemble your apparatus, return all instruments/tools/books, and empty your office. Finally, return all keys to Facility Services and make an appointment with Professor Sabliov for an exit interview.



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