Call to Order: Dr. Rebecca Robichaux-Davis, Chair

Welcome and Introductions

Discussion Item:

1. ETD Format and Submission (LIB 9010): Teri Robinson

Approval of Minutes: April 26, 2019

Report from UCCC: Dr. Dana Franz

1. Modification of the MS in Fashion Design & Merchandising
2. Modification of Ph.D. in Biological Engineering
3. Authorization to Plan and Addition of Ph.D. in Computational Biology
4. Authorization to Plan and Addition of MS in Computational Biology
5. Addition of Minor in Computational Biology

Report from the Graduate School: Dr. Peter Ryan

Old Business

1. Revision to the Graduate Catalog Policies and Procedures

New Business

Adjourn
I. The April 26th, 2019 meeting of the Graduate Council of Mississippi State University was called to order by Chair Dr. Rebecca Robichaux-Davis at 1:36 PM in the Templeton Room of Mitchell Memorial Library.

II. Dr. Robichaux-Davis asked for approval of the minutes from the March 29, 2019 meeting. Richard Harkess moved to approve and Don Grebner seconded. The motion passed unanimously.

III. Report from the Graduate School: No Report

IV. Report from the Graduate Student Association (GSA): Tori Marshall
Tori reported the following:

- The GSA will have a full officer team for 2019-2020 school year. There will be one officer who will attend every graduate council meeting of the academic year unlike the past year where meeting attendance was divided between two officers.
- The Fall 2019 Research Symposium is scheduled for October 5th. Interested students can begin applying now. The application is open on OrgSyn.
- Graduate Student Appreciation week was successful and the GSA greatly appreciates everything the Graduate School does for MSU’s graduate students.

V. Old Business:

1. Revision to the Graduate Catalog Policies and Procedures – Kari Babski-Reeves
The Graduate Council reviewed the proposed revisions to the graduate catalog policies and procedures that were briefly discussed at the last council meeting.

Council members brought forward the following:

- Will leave of absence work in conjunction with continuous enrollment? If so, can leave of absence be measured in “terms” instead of “months” for consistency? Currently, continuous enrollment is measured in terms. Also, does continuous enrollment work in conjunction with extension of time or can it be used in the middle of an extension to “stop the clock” on an extension?
- By applying continuous enrollment to readmission, the readmission policy will be more stringent. Currently, if a student doesn’t enroll in 3 consecutive terms, not including summer, then they must reapply. By applying continuous enrollment, if a student
does not enroll in one spring or fall term, they must reapply.

- All the policy statements with “shall” are now “may.” A suggestion was brought forward to leave the policies as “shall.” Waivers can be provided for those students with extenuating circumstances.
- In “Full-time Enrollment” section, take out “other universities.” The full-time enrollment status should only consider credits taken at MSU.
- Full-time summer enrollment is determined by the Office of Controller and Treasurer. The catalog definition and the controller’s definition are to be identical.
- There is inconsistency between the amount of transfer hours and unclassified hours students can apply to their chosen degree program. If students can transfer in 12 hours from another university, then allowing the same amount of unclassified credit hours to apply toward their degree would provide consistency.
- In the “English Language Test Score Requirements” section, include “and other acceptable English language equivalency exams” along with TOEFL and ILETS. Other equivalency exams will be acceptable if they have a TOEFL score conversion table/chart.
- In the “Admissions” section, expand the Equal Opportunity Statement to mirror MSU’s statement.
- In the “Masters Comprehensive Exam” section, the ninth bullet point states, “One negative vote will not constitute failure for a student on a preliminary/comprehensive examination. Two negative votes will constitute failure for a student on a preliminary/comprehensive examination. In the absence of a committee, one negative vote will constitute failure.” Remove the sentence, “In the absence of a committee, one negative vote will constitute failure,” because no one is voting in the absence of a committee.

After an extensive discussion, Robichaux-Davis asked for a motion to request a revision according to the before mentioned revisions, the revisions sent to the subcommittee before the meeting, and present a revised version for the committee to vote on, second by Hill.

VI. There being no further business, Robichaux-Davis asked for a motion to adjourn. Marler moved to adjourn, second by Grebner. The meeting adjourned at 3:32 p.m.
APPROVAL FORM FOR

DEGREE PROGRAMS

MISSISSIPPI STATE UNIVERSITY

NOTE: This form is a cover sheet that must accompany the degree program change proposal. The actual proposal should be prepared in accordance with format requirements provided in the Guide and Format for Curriculum Proposals published by the UCCC. Both cover sheet and proposal should be submitted to UCCC Mail Stop 9702 (281 Garner Hall), Phone: 325-9410.

College: College of Agriculture and Life Sciences  Department: School of Human Sciences
Contact Person: Charles Freeman  Mail Stop: 9745  E-mail: cf617@msstate.edu

Nature of Change: Modification  Date Initiated: 1/25/2019  Effective Date: 8/15/2019

Current Degree Program Name: Master of Science
Major: Fashion Design & Merchandising  Concentration: Design & Product Development OR Merchandising

New Degree Program Name: Master of Science
Major: Fashion Design & Merchandising  Concentration: Design & Product Development OR Merchandising

Summary of Proposed Changes: Modified the curriculum and courses required based on the addition of new faculty and program growth. The original degree proposal was written in 2015 and since then we have added 2 new faculty and had one retire – therefore the program direction and ability to offer more FDM specific courses necessitates this modification.

Approved:  Date: 2/7/19

Michael C. Newman
Department Head

Chair, College or School Curriculum Committee  Date: 4/11/19

Dean of College or School  Date: 4/11/19

Chair, University Committee on Courses and Curricula  Date: 4/23/19

Chair, Graduate Council (if applicable)
Chair, Deans Council

GRADUATE DEGREE MODIFICATION OUTLINE FORM
Use the chart below to make modifications to an existing Graduate Degree. All deleted courses and information should be shown in *italic* and all new courses and information in **bold**. Please include the course prefix, number, and title in both columns. Expand rows as needed.

**1 & 2. Current and Proposed Catalog Description and Curriculum Outline**

<table>
<thead>
<tr>
<th>CURRENT Degree Description</th>
<th>PROPOSED Degree Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree: Master of Science (M.S.)</td>
<td>Degree: Master of Science (M.S.)</td>
</tr>
<tr>
<td>Major: Fashion Design and Merchandising</td>
<td>Major: Fashion Design and Merchandising</td>
</tr>
<tr>
<td>Concentration 1: Merchandising</td>
<td>Concentration 1: Merchandising</td>
</tr>
<tr>
<td>Concentration 2: Design and Product Development</td>
<td>Concentration 2: Design and Product Development</td>
</tr>
</tbody>
</table>

The graduate degree (M.S.) in Fashion Design and Merchandising (FDM) will be offered through the School of Human Sciences at Mississippi State University. FDM is based on an interdisciplinary approach to understand consumers, fashion businesses and fashion and related industries in the context of fashion culture in the society. *It encompasses specialty areas in fashion design, product development, consumer behavior, textiles, historic costume, merchandising and international trade.* Graduates will become future leaders in the global fashion complex—textile, apparel, and retail industries—and promote the economic development of industry sectors that increase the quality of life for people around the world. They will also advance research and policy in areas related to the fashion complex to broaden the effects of academic application of research in practice, as well as governmental actions on the fashion complex. This degree is designed to provide students with an in-depth understanding of the fashion and retail industry, consumer behavior, product development, business principles, and technology applications. Students select a concentration in one of two areas: Merchandising or Design and Product Development.

**Admission Requirements**
An individual must have a valid admission status in the Office of The Graduate School to secure enrollment. Admission to graduate study is limited to the pursuit of requirements for the degree and the field of study as specified in the student's application and statement of purpose.

Qualified applicants for the FDM graduate program are expected to have interests and goals that are consistent with the department's faculty expertise and interests, as well as course offerings. Once all application materials have been submitted, applicants should contact the FDM graduate coordinator at (662)325-2950 to schedule an interview with members of the FDM graduate faculty. To accommodate international applicants, interviews can be conducted using distance technology. Admission decisions are based on a
holistic consideration of the applicant's credentials. For international, non-native speakers of English, a TOEFL score indicative of ability to successfully complete graduate work is required. See English Language Test Score Requirements in the MSU Graduate School catalog for more information.

Master's Admission Requirements

- meet all MSU Graduate School requirements for admission;
- have earned a baccalaureate degree in FDM or a related field;
- submit Graduate Record Examination (GRE) scores competitive with other applicants;
- submit three letters of recommendation, with at least two of the letters coming from individuals familiar with the applicant's academic work;
- current Resume of CV
- submit a sole-authored writing sample and/or creative portfolio;
- submit a personal statement (500-1,000 words) describing the applicant's purpose for undertaking graduate study, statement of commitment to concentration area (merchandising or design & product development), professional plans, career goals, and detailed research interests.

For those applicants not possessing a B.S. in Fashion Design and Merchandising, admission will be considered on a case-by-case basis. If accepted, those students will be required to complete up to four leveling courses from the FDM undergraduate core curriculum.

Design and Product Development:
- FDM 1533 Basic Apparel Construction
- FDM 2524 Textiles for Apparel
- FDM 2593 Product Development II
- FDM 4343 Patternmaking and Design

Merchandising:
- FDM 2333 Intro to Buying and Management
- FDM 2524 Textiles for Apparel
- FDM 3553 Fashion Retail Pricing
- FDM 4533 Merchandise Planning and Buying

Coursework
The master's degree in FDM requires 38 hours of course work and has a thesis and a non-thesis option. A specialization will require 12 hours of coursework completed in one of the areas at the master's level.

Financing Your Graduate Education
Although the School of Human Sciences does have a limited number of assistantship opportunities, students
creative apparel designs, concept/trend boards, fashion illustrations and/or technical sketches. The writing sample or creative digital portfolio should be e-mailed as an attachment to nhunt@grad.msstate.edu.

Coursework
The master's degree in FDM requires 37 hours of course work and has a thesis and a non-thesis option. A specialization will require 9 hours of coursework completed in one of the areas at the master's level. Financing Your Graduate Education
Although the School of Human Sciences does not have a limited number of assistantship opportunities, students are responsible for making their own arrangements for financing their graduate studies. For information about financial aid options and/or to complete a Free Application for Federal Student Aid (FAFSA), visit www.sfa.msstate.edu.

Careers
A professional with a M.S. degree in Fashion Design and Merchandising is prepared for a career as a merchandiser, buyer, trend forecaster, sales/e-commerce representative, retail management, fashion entrepreneur, fashion designer, product developer, technical designer, stylist, sourcing agent, and many other options within the global fashion industry.

The Merchandising concentration explores the business and product development aspects of the fashion and retail industry from finalized design to the end use by consumers and beyond. Coursework prepares students to conduct in-depth research and analysis in a variety of fields such as merchandising, buying, international trade, fashion business and retail operations. Students learn real-world application through lab experiences in settings that align with the students' career goals.

The Design and Product Development concentration explores the creative and product development aspects of the fashion and retail industry from trend innovation and concept to an end-use product and beyond. Coursework prepares students to conduct in-depth research and analysis in a variety of fields such as creative design, technical design, design processes and related creative industries. Students learn real-world application through lab experiences in settings that align with the students' career goals.

The Merchandising concentration explores the business and product development aspects of the fashion and retail industry from finalized design to the end use by consumers and beyond. Coursework prepares students to conduct in-depth research and analysis in a variety of fields such as merchandising, buying, international trade, fashion business and retail operations. Students learn real-world application through lab experiences in settings that align with the students' career goals.
## Required Courses:
- AIS 8803 Research Methods (3)
- EPY 6214 Educational and Psychological Statistics (4)
- HS 6424 Teaching Methods in Agriculture and Human Sciences (3) or AIS 8403 Directed Learning Experiences (3) if above courses taken at undergraduate level
- HS 6513 Social – Psychological Aspects of Clothing (3)

**Or** Restricted Electives (3) if above courses taken at undergraduate level*

* With approval of major professor and graduate committee

### Concentration (Choose one)

<table>
<thead>
<tr>
<th>Merchandising Concentration Courses:</th>
<th>9-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Restricted Electives (9)*</td>
<td></td>
</tr>
</tbody>
</table>

* With approval of major professor and graduate committee, select 3 courses (9 - 10 hours) related to student area of study.

<table>
<thead>
<tr>
<th>Design and Product Development Concentration Courses:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>HS 6343 Apparel Design II (3)</td>
<td></td>
</tr>
<tr>
<td>HS 6393 Creative Design Techniques (3)</td>
<td></td>
</tr>
<tr>
<td>HS 6733 Computer-Aided Design in Human Sciences (3)</td>
<td></td>
</tr>
</tbody>
</table>

**Or** Restricted Electives (9) if above courses taken at undergraduate level*

* With approval of major professor and graduate committee, select 3 courses (9 - 10 hours) related to student area of study.

## Required Outline

### PROPOSED CURRICULUM OUTLINE

<table>
<thead>
<tr>
<th>Required Courses:</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIS 8803 Research Methods to AEE (3)</td>
<td></td>
</tr>
<tr>
<td>EPY 6214 Educational and Psychological Statistics (4)</td>
<td></td>
</tr>
<tr>
<td>FDM 6424 Teaching Methods in Agriculture and Human Sciences (4) or AELC 8403 Directed Learning Experiences (3) if above course taken at undergraduate level</td>
<td></td>
</tr>
<tr>
<td>FDM 6613 Research in Fashion Consumer Behavior (3)</td>
<td></td>
</tr>
<tr>
<td>HDFS 8813 Seminar in HDFS (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 8000 Research/thesis (thesis option) (9) or FDM 8100 Creative Project (non-thesis option) (9)</td>
<td></td>
</tr>
</tbody>
</table>

### Concentration (Choose one)

<table>
<thead>
<tr>
<th>Merchandising Concentration Courses:</th>
<th>12</th>
</tr>
</thead>
<tbody>
<tr>
<td>FDM 6683 Research and Application in Fashion Entrepreneurship (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 6793 Research and Application in Digital Fashion Retailing (3)</td>
<td></td>
</tr>
<tr>
<td>Restricted Electives (6)*</td>
<td></td>
</tr>
</tbody>
</table>

* With approval of major professor and graduate committee, select one course related to student area of study.

<table>
<thead>
<tr>
<th>Design and Product Development Concentration Courses: (Select 4)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>FDM 6123: Research and Application in Product Development (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 6443 Advanced Patternmaking and Design (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 6563 Advanced Draping (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 6573: Advanced Portfolio Development (3)</td>
<td></td>
</tr>
<tr>
<td>FDM 6783 Experimental Fashion Design (3)</td>
<td></td>
</tr>
</tbody>
</table>
### 3. Justification and Learning Outcomes:

Recently, the Fashion Design and Merchandising program was approved to offer a M.S. degree. Since that time, we have hired a new faculty member in the design and product development area and have had a senior faculty member retire. We also anticipate hiring an instructor to start Fall 2019. This has enabled our current faculty to develop new graduate courses (submitted and approved) and develop more focused areas of graduate student study. Since its approval in 2016, the degree has not been modified and needs an update to reflect these new course offerings. The changes made to the graduate degree structure not only reflect the change in faulty expertise but also the changes to the accreditation standards recently presented to us. Learning objectives for the degree are listed below.

- Students will demonstrate the synergistic, integrative nature of the textile and apparel industries focusing on the apparel production, creative design, product development, merchandising, and retail operations, and students will apply this understanding to the current issues and opportunities of the globalized fashion and retail industry.

- Students will apply knowledge from their programs of study to the issues of creative design, communication of dress, technical and instructional design communication, and the business of a global fashion and retail industry.

- Students will integrate concepts of global interdependence as they relate to apparel and agriculture in their areas of specialization.

- Students will understand and apply appropriate technologies in addressing issues concerning the global fashion and retail industry.

- Students will understand resource development and sustainability and the impact that those concepts have on the growth of the global fashion and retail industry.

### 4. Support

Please see the attached letters of support.

### 5. Proposed 4 Letter Abbreviation

FDM

### 6. Effective Date

Fall 2019
February 1, 2019

Ms. Jessica Graves  
Chair, CALS Curriculum Committee  
Box 9815  
Mississippi State, MS 39762  

Ms. Graves:  

The School of Human Sciences Curriculum Committee has reviewed the Fashion Design and Merchandising (FDM) graduate degree modification proposal, and we support its approval. Modifications to the current degree are proposed because the program has added 2 new faculty and had one retire – therefore the program direction and ability to offer more FDM specific courses necessitates this modification. The proposal demonstrates the appropriate availability of staff, library support, and other necessary resources. We believe the proposed degree modification will benefit the students in our department as well as the industry.

Sincerely,

Joe D. Wilmoth, Chair  

Alisha Hardman, Member  

JuYoung Lee, Member  

Carley Morrison, Member
NOTE: This form is a cover sheet that must accompany the degree program change proposal. The actual proposal should be prepared in accordance with format requirements provided in the Guide and Format for Curriculum Proposals published by the UCCC. Both cover sheet and proposal should be submitted to UCCC Mail Stop 9702 (281 Garner Hall), Phone: 325-9410.

College: Engineering  Department: Agricultural and Biological Engineering

Contact Person: Anna Linhoss  Mail Stop: 9632  E-mail: alinhoss@abe.msstate.edu

Nature of Change: Change in coursework requirement  Date Initiated: February 20, 2019

Effective Date: January 1, 2020

Current Degree Program Name: Ph.D. in Engineering with a concentration in Biological Engineering

Major: Engineering  Concentration: Biological Engineering

New Degree Program Name: N/A

Major: N/A  Concentration: N/A

Summary of Proposed Changes:

We propose to decrease the required coursework for a PhD in Engineering with a Concentration in Biological Engineering from 63 hours to 48 hours. This change will:

1) Align Mississippi State University (MSU) with the curriculum of our peer and peer plus universities.
2) Align Biological Engineering with the degree requirements for Biomedical Engineering at MSU.
3) Align Biological Engineering with the degree requirements for other engineering departments at MSU.
4) Allow students more time to focus more on their dissertation and build independent research skills.
Approved:

[Signature]
Department Head

[Signature]
Chair, College or School Curriculum Committee

[Signature]
Dean of College or School

[Signature]
Chair, University Committee on Courses and Curricula

[Signature]
Chair, Graduate Council (if applicable)

[Signature]
Chair, Deans Council

Date:

3/29/19

4/8/19

4/9/19
### GRADUATE DEGREE MODIFICATION OUTLINE FORM

<table>
<thead>
<tr>
<th>CURRENT Degree Description</th>
<th>PROPOSED Degree Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree: Ph.D.</td>
<td>Degree: No change</td>
</tr>
<tr>
<td>Major: Engineering</td>
<td>Major:</td>
</tr>
<tr>
<td>Concentration: Biological Engineering</td>
<td>Concentrations: No change</td>
</tr>
</tbody>
</table>

Biological Engineering is that branch of the engineering profession which deals with engineering problems encountered in biological systems. The responsibilities of the Biological Engineer may include finding solutions to address the need for more complex food-producing systems, controlling and monitoring the deterioration of the earth's environment, the replacement of living organs, design and testing of artificial and engineered tissues, the use of new technologies to assist the disabled, and the creation of new engineering designs based on the inherently creative characteristics of living systems.

### CURRENT CURRICULUM OUTLINE

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA XXXX Graduate mathematics course</td>
<td>3</td>
</tr>
<tr>
<td>ABE XXXX Graduate-level coursework</td>
<td>48</td>
</tr>
<tr>
<td>8000-level coursework</td>
<td>10</td>
</tr>
<tr>
<td>Select two of the following:</td>
<td></td>
</tr>
<tr>
<td>• ABE 8911: Agricultural and Biological Engineering Seminar</td>
<td>2</td>
</tr>
<tr>
<td>• ABE 8921: Agricultural and Biological Engineering Seminar</td>
<td></td>
</tr>
<tr>
<td>Dissertation/Research</td>
<td>20</td>
</tr>
</tbody>
</table>

A preliminary examination, a dissertation, and an oral examination in defense of the dissertation are required. Doctoral students are required to take or have credit in a graduate level math course, **complete a minimum of 60 credit hours of coursework beyond the baccalaureate degree and complete 20 hours of dissertation research.**

### PROPOSED CURRICULUM OUTLINE

<table>
<thead>
<tr>
<th>Course</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MA XXXX Graduate mathematics course</td>
<td>3</td>
</tr>
<tr>
<td>Graduate-level coursework as approved by the committee</td>
<td>33</td>
</tr>
<tr>
<td>8000-level coursework as approved by the committee</td>
<td>10</td>
</tr>
<tr>
<td>Select two of the following:</td>
<td></td>
</tr>
<tr>
<td>• ABE 8911: Agricultural and Biological Engineering Seminar</td>
<td>2</td>
</tr>
<tr>
<td>• ABE 8921: Agricultural and Biological Engineering Seminar</td>
<td></td>
</tr>
<tr>
<td>Dissertation/Research</td>
<td>20-32</td>
</tr>
</tbody>
</table>

A preliminary examination, a dissertation, and an oral examination in defense of the dissertation are required. Doctoral students are required to take or have credit in a graduate level math course, **complete a minimum of 48 credit hours of coursework beyond the baccalaureate degree and complete 20-32 hours of dissertation research.**
JUSTIFICATION AND STUDENT LEARNING OUTCOMES

We propose to decrease the required coursework for a PhD in Engineering with a Concentration in Biological Engineering from 63 hours to 48 hours. This change will:

1) **Align Mississippi State University (MSU) with the curriculum of our peer and peer plus universities.** The coursework requirements for a PhD in Biological Engineering at peer and peer plus schools is shown in Table 1. At the six schools listed course requirements vary from ‘at the committee’s discretion’, to 64 hours. MSU’s current coursework requirement of 63 hours places us at the upper limit of our peer and peer plus universities. Reducing the required coursework for a Ph.D. in Biological Engineering at MSU will better align us with the requirements at our peer and peer plus universities.

<table>
<thead>
<tr>
<th>US News and World Report Ranking (ABE departments)</th>
<th>School</th>
<th>ABE PhD coursework degree requirements beyond BS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Purdue</td>
<td>42 hours</td>
</tr>
<tr>
<td>2</td>
<td>Iowa State</td>
<td>43 hours</td>
</tr>
<tr>
<td>3</td>
<td>Texas A&amp;M</td>
<td>36 hours</td>
</tr>
<tr>
<td>4</td>
<td>Univ. of Florida</td>
<td>54 hours</td>
</tr>
<tr>
<td>5 (tied)</td>
<td>Univ. of Illinois (UC)</td>
<td>64 hours</td>
</tr>
<tr>
<td>5 (tied)</td>
<td>Cornell</td>
<td>At the committee’s discretion</td>
</tr>
<tr>
<td></td>
<td><strong>Mississippi State</strong></td>
<td><strong>Existing 63 hours. Proposed 48 hours</strong></td>
</tr>
</tbody>
</table>

2) **Align Biological Engineering with the degree requirements for Biomedical Engineering at MSU.** The coursework requirements for a PhD in Biomedical Engineering in the Department of Agricultural and Biological Engineering at MSU is shown in Table 2. A Ph.D. in Biomedical Engineering requires a total of 48 hours of coursework while a Ph.D. in Biological Engineering from the same department requires 63 hours of coursework. Thus, reducing the required coursework for a Ph.D. in Biological Engineering will align us with the requirements for a Ph.D. in Biomedical Engineering.

<table>
<thead>
<tr>
<th>ABE 8511</th>
<th>Journal Reviews in Biomedical Engineering</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABE 8801</td>
<td>Clinical Experience for Biomedical Engineering</td>
<td>1</td>
</tr>
<tr>
<td>BIO 6514 or BIO 6114</td>
<td>Animal Physiology</td>
<td>4</td>
</tr>
<tr>
<td>ST 8114</td>
<td>Statistical Methods</td>
<td>4</td>
</tr>
<tr>
<td>8000-level or higher coursework</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>ABE XXXX</td>
<td>Graduate-level mathematics coursework</td>
<td>3</td>
</tr>
<tr>
<td>Additional Graduate level Coursework</td>
<td>29</td>
<td></td>
</tr>
</tbody>
</table>
3) **Align Biological Engineering with the degree requirements for other engineering departments at MSU.** In the College of Engineering, at MSU, the average coursework requirement is 44.8 hours (Table 3). At 63 required hours, Biological Engineering ranks second in the highest coursework requirements. Reducing the required coursework for a Ph.D. in Biological Engineering from 63 to 48 hours will align us with the requirements for a Ph.D. in other engineering departments at MSU.

<table>
<thead>
<tr>
<th>MSU Engineering Degree</th>
<th>Course Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ph.D. with Aerospace Engineering Concentration</td>
<td>30</td>
</tr>
<tr>
<td><strong>Ph.D. in Engineering with Concentration in Biological Engineering</strong></td>
<td>63</td>
</tr>
<tr>
<td>Ph.D. in Engineering with Applied Physics Concentration</td>
<td>18</td>
</tr>
<tr>
<td>Ph.D. in Biomedical Engineering</td>
<td>48</td>
</tr>
<tr>
<td>Ph.D. in Engineering with Chemical Engineering Concentration</td>
<td>36</td>
</tr>
<tr>
<td>Ph.D. in Engineering with Civil Engineering Concentration</td>
<td>75</td>
</tr>
<tr>
<td>Ph.D. in Computational Engineering</td>
<td>48</td>
</tr>
<tr>
<td>Ph.D. in Computer Science</td>
<td>43</td>
</tr>
<tr>
<td>Ph.D. in Electrical and Computer Engineering</td>
<td>42</td>
</tr>
<tr>
<td>Ph.D. in Industrial and Systems Engineering</td>
<td>48</td>
</tr>
<tr>
<td>Ph.D. in in Engineering with Mechanical Engineering Concentration</td>
<td>42</td>
</tr>
</tbody>
</table>

4) **Allow students more time to focus more on their dissertation and build independent research skills.**

At the Ph.D. level, students should learn how to think independently and cultivate the ability to develop and answer complex research problems. Within this context, coursework should fill gaps in knowledge; however, the majority of time should be spent on independent research. 63 hours of coursework is the equivalent of 21 3-hour courses or 3 full years of graduate coursework. Reducing the coursework load from 63 to 48 hours would allow Biological Engineering Ph.D. students more time to focus on innovative research and produce peer-reviewed publications.

**SUPPORT**

See attached
PROPOSED 4-LETTER ABBREVIATION

No Change

EFFECTIVE DATE

January 1, 2020
February 20, 2019

RE: The modification of coursework requirements for a Ph.D. in Engineering with Concentration in Biological Engineering

To: The University Committee on Courses and Curricula

The Department of Agricultural and Biological Engineering proposes to decrease the required coursework for a Ph.D. in Engineering with Concentration in Biological Engineering from 63 hours to 48 hours. This change will:

1. Align Mississippi State University (MSU) with the curriculum of our peer and peer plus universities.
2. Align Biological Engineering with the degree requirements for Biomedical Engineering at MSU.
3. Align Biological Engineering with the degree requirements for other engineering departments at MSU.
4. Allow students more time to focus more on their dissertation and build independent research skills.

The teaching faculty in the ABE department voted in support of these changes.

Approved: 

\[ Signature \]

Biological Engineering Graduate Coordinator

Date:

\[ 3/29/2019 \]

Department Head

\[ Signature \]

\[ 3/21/19 \]
NOTE: This form is a cover sheet that must accompany the degree program change proposal. The actual proposal should be prepared in accordance with format requirements provided in the Guide and Format for Curriculum Proposals published by the UCCC. Both cover sheet and proposal should be submitted to UCCC Mail Stop 9702 (281 Garner Hall), Phone: 325-9410.

College: Office of Academic Affairs

Contact Person: Peter Ryan
Nature of Change: Degree addition
Current Degree Program Name:

Major: 
Concentration:

Department:

Mail Stop: 9723  E-mail: ryan@provost.msstate.edu
Date Initiated: 3/5/19  Effective Date: Spring 2020

New Degree Program Name: Doctor of Philosophy

Major: Computational Biology  Concentration:

Summary of Proposed Changes:
The Office of Academic Affairs, in collaboration with the College of Arts & Sciences, Bagley College of Engineering, College of Agriculture and Life Sciences, and College of Veterinary Medicine proposes a new interdisciplinary graduate program in computational biology. Students will be prepared to pursue research positions in academia, government, and industry. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
NEW GRADUATE DEGREE OUTLINE FORM
Use the chart below to indicate your new degree outline. Please list required College and Major Required Courses and if appropriate Concentration Courses. Graduate programs that wish to specialize beyond the Major must have at least two concentrations. Add additional rows as needed for programs with more than two concentrations. Expand rows as needed

<table>
<thead>
<tr>
<th>Proposed New Degree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree: PhD</td>
</tr>
<tr>
<td>Major: Computational Biology</td>
</tr>
</tbody>
</table>

Graduate study leading to the Master of Science and Doctor of Philosophy degrees is offered in the area of computational biology. This interdisciplinary graduate program provides a firm foundation in computational methods and biological knowledge, and draws courses from various colleges to provide a flexible program of study.

<table>
<thead>
<tr>
<th>Proposed Curriculum Outline</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Required Courses:</td>
<td></td>
</tr>
<tr>
<td>CMB 8013 Applied Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>Seminar:</td>
<td></td>
</tr>
<tr>
<td>CMB 8011 Graduate Seminar</td>
<td>1</td>
</tr>
<tr>
<td>Computing:</td>
<td></td>
</tr>
<tr>
<td>CSE 6623 Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>CSE 6833 Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>Select one from below:</td>
<td></td>
</tr>
<tr>
<td>CSE 8673 Machine Learning</td>
<td>3</td>
</tr>
<tr>
<td>CSE 8833 Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>CSE 8163 Parallel and Distributed Scientific Computing</td>
<td></td>
</tr>
<tr>
<td>Statistics:</td>
<td></td>
</tr>
<tr>
<td>ST 8114 Statistical Methods</td>
<td>4</td>
</tr>
<tr>
<td>Life Sciences (select two from below):</td>
<td>6</td>
</tr>
<tr>
<td>BCH 6713 Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>BCH 8653 Genomes and Genomics</td>
<td></td>
</tr>
<tr>
<td>BIO 6113 Evolution</td>
<td></td>
</tr>
<tr>
<td>BIO 6143 Population Genetics</td>
<td></td>
</tr>
<tr>
<td>Additional approved electives</td>
<td>12</td>
</tr>
<tr>
<td>Dissertation:</td>
<td></td>
</tr>
<tr>
<td>CMB 9000 Dissertation Research</td>
<td>20</td>
</tr>
<tr>
<td>Total Hours</td>
<td>55</td>
</tr>
</tbody>
</table>

- At least 18 credit hours of GPA-graded coursework must be taken at the 8000-level or higher.
- Graduate courses completed as part of a master's degree or graduate courses completed prior to entry into the PhD program may, when approved by the student's graduate committee, be applied to the PhD degree requirements. The committee's decision will be documented by an "Attachment Sheet for Program of Study" form. The program of study will cover remaining coursework requirements. At least one course at the full graduate level in computer science and at least one course at the full graduate level in the life
sciences must be completed at MSU.

- A student that has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student's graduate committee.

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 2813 Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2383 Data Structures*</td>
<td>3</td>
</tr>
</tbody>
</table>

*This requirement can be satisfied by completing CSE 6753 Fundamentals of Computing with a grade of B or higher.

All undergraduate prerequisite courses listed must be satisfied. A PhD student’s program of study may include 6000-level prerequisite courses.

1. Curriculum Outline

Three new courses will be necessary and proposals have been submitted in CIM.

- CMB 8011 Graduate Seminar
- CMB 8013 Applied Computational Biology
- CMB 9000 Dissertation Research

2. Student learning outcomes and assessment

Learning outcomes:
1. Graduates will be prepared to serve in computational biology research positions in academia, industry, and government.
2. Graduates will be able to communicate effectively through scientific presentations and papers with a diverse audience of their peers in biology, molecular biology, computer science, and other areas of the computational and life sciences.
3. Graduates will be able to postulate well-reasoned hypotheses and apply sound scientific principles, knowledge, and methods to collect and analyze data to test these hypotheses.

Assessment methods:
Students will be expected to conduct research and present findings throughout their work in the graduate program. Students will also identify a dissertation topic and carry out the research related to that topic. This work will be described in their dissertation and presented at their dissertation defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology.

3. Support

A letter of support from the associate deans of colleges involved in the degree program is attached.

4. Proposed 4-letter abbreviation

COMB

5. Effective date:

Spring 2020
6. CIP Code;

26.1104
Appendix 7: Authorization to Plan a New Degree Program  
(Submit Appendix 7 in both PDF and Word Document Formats)

<table>
<thead>
<tr>
<th>Institution: Mississippi State University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Implementation:</td>
</tr>
<tr>
<td>May 16, 2019</td>
</tr>
<tr>
<td>Incremental, Six Year Cost of Implementation:</td>
</tr>
<tr>
<td>$791,277</td>
</tr>
<tr>
<td>Incremental, Six-Year Per Student Cost of Implementation:</td>
</tr>
<tr>
<td>$15,826</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Will it attract new students to the university?</th>
</tr>
</thead>
<tbody>
<tr>
<td>☒ Yes  ☐ No</td>
</tr>
<tr>
<td>Potential Six-Year, New Revenue:</td>
</tr>
<tr>
<td>$1,701,799</td>
</tr>
<tr>
<td>Potential New, Six-Year Revenue Per Student:</td>
</tr>
<tr>
<td>$34,036</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Program Title as will Appear on Academic Program Inventory, Diploma, and Transcript:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational Biology</td>
</tr>
<tr>
<td>26.1104</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Name of Degree(s) to be Awarded:</th>
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</thead>
<tbody>
<tr>
<td>Doctor of Philosophy</td>
</tr>
<tr>
<td>55</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Credit Hour Requirements to Earn the Degree:</th>
</tr>
</thead>
</table>

List any institutions within the state offering similar programs:

None

Responsible Academic Unit(s):

Office of Academic Affairs

<table>
<thead>
<tr>
<th>Number of Students Expected to Enroll in First Six Years:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year One 5</td>
</tr>
<tr>
<td>Year Two 5</td>
</tr>
<tr>
<td>Year Three 10</td>
</tr>
<tr>
<td>Year Four 10</td>
</tr>
<tr>
<td>Year Five 10</td>
</tr>
<tr>
<td>Year Six 10</td>
</tr>
<tr>
<td>Total 50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Graduates Expected in First Six Years:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year One 1</td>
</tr>
<tr>
<td>Year Two 3</td>
</tr>
<tr>
<td>Year Three 3</td>
</tr>
<tr>
<td>Year Four 3</td>
</tr>
<tr>
<td>Year Five 5</td>
</tr>
<tr>
<td>Year Six 5</td>
</tr>
<tr>
<td>Total 20</td>
</tr>
</tbody>
</table>

Program Summary:

The interdisciplinary computational biology PhD degree program will prepare students for research positions in academia, government, and industry. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
Institution:

1. Describe the proposed program and explain how it fits within the mission of the institution.

The proposed program will train students to become independent researchers in the highly interdisciplinary area of computational biology, which encompasses diverse specializations and involves faculty in almost every college in the university. This program will build upon the University’s strength in the areas of genomics, evolutionary genetics, statistics, big data, machine learning, and others to offer rigorous preparation and opportunities for high-impact research. This program helps Mississippi State University fulfill its mission to enhance its strength in agriculture, engineering, and natural sciences. It also has the potential to help Mississippi State contribute to the economic development of the state by producing a workforce with the skills needed for modern biological research.

2. Provide the information used to determine Mississippi’s need for this program. Be specific and provide supporting data.

While computational biology is a well-established research area, it is an emerging discipline for formal education and training in academia. Universities across the country are beginning to offer graduate and undergraduate programs in computational biology to train the next generation of scientists who will be using computational methods and big data to answer important questions in the life sciences. In the SEC, the University of Georgia offers a graduate program in Integrated Life Sciences and Vanderbilt University offers a graduate degree in Biomedical Informatics. These are degrees that offer training comparable to a computational biology program. Establishing this program at Mississippi State University will ensure that Mississippi is a leader in the South in producing computational biologists.

The primary need for this program is indicated by the research interests of faculty at Mississippi State University. Researchers have found that answering key questions about life often requires the use of new technologies and the collection of massive amounts of data. These new technologies have driven what has been termed the “big data revolution” in science, which has necessitated computational approaches in almost all areas of the life sciences. Those on the forefront are already using the educational infrastructure and skills of the faculty at Mississippi State to produce graduates that are well-prepared in these areas. The proposed degree program will allow students to earn the credential (PhD in Computational Biology) that is most closely aligned with their expertise and interests. This degree will often allow graduates to pursue positions that might not have been available with a degree in the life sciences, or positions that will have a significantly higher pay rate.

There is a need for computational biology researchers within Mississippi. Several research labs and institutes across the state conduct research in computational biology, including the University of Mississippi Medical Center, USDA-Agricultural Research Service (ARS), US Forest Products Lab, and the US Army Corps of Engineers Engineer Research and Development Center (ERDC). Many Mississippi State University graduate students and PhD graduates have gone on to research scientist positions with these organizations.

As we continue to produce highly-skilled graduates in computational biology, Mississippi will become more
attractive to genomics, biotechnology, and pharmaceutical industries. Surrounding states such as Alabama and Tennessee have recently been able to attract such industries.

3. Provide information on employment (supporting data must include state and national employment statistics or career opportunities (include potential earnings range).

Graduates of this program will go on to research positions in academia, industry, and government. In addition to faculty positions in academia, prior Mississippi State University PhD graduates that would have been potential candidates for this degree program have pursued positions such as bioinformatician at a medical school, computational scientist at a research university, senior researcher at an international industry research lab, research scientist for a consumer products corporation, and manager of information technology research cyberinfrastructure for a major research institute.

As of May 14, 2018 over 100 jobs in the area of computational biology had been posted at the International Society for Computational Biology (ISCB) web site within the past three months, the premier international professional organization for computational biologists. Many more jobs requiring the skills of computational biologists are regularly posted to the Association for Computing Machinery, Computing Research Association, Academic Keys, and other employment sites.

According to the Mississippi Department of Employment Security occupational projections, the need for postsecondary teachers in the biological sciences is expected to grow by over 17% by 2024, and computer science postsecondary teachers by over 11%. These jobs pay on average $72,000-$79,000. However, employment in biological sciences positions (paying on average approximately $77,000) is expected to primarily remain steady or even drop slightly over this period. The proposed program has the potential to provide trained scientists to fill positions in Mississippi and possibly attract additional industry to the state, alleviating this concern.

4. Describe any other benefits to the institution, state, region, or nation including research, service, and teaching efforts that might result from offering this program.

Many faculty members likely to be involved in this program have a record of outreach to K-12 students and teachers. For example, Dr. Nanduri (Basic Sciences, College of Veterinary Medicine) and Dr. Perkins (Computer Science, Bagley College of Engineering) have helped to instruct workshops of Mississippi teachers in the area of computational biology. Dr. Hoffmann (Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture and Life Sciences) and Dr. Perkins have received funding from Mississippi State University to instruct undergraduate and high school students in construction, administration, and use of clusters of miniature portable computers for genomics research.

Drs. King (Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture and Life Sciences), Nanduri, and Perkins have each pursued federal grants for training graduate students in this area. The establishment of this degree program will make Mississippi more competitive for these grant funds, which would attract students from around the region and the country to graduate studies in Mississippi.
5. Using expected enrollment, provide the total anticipated budget for the program including implementation and 5 subsequent years (total of 6 years) of operation: any anticipated direct, indirect, and incremental costs necessary to start the program; anticipated, incremental annual revenue based on student enrollment; and other sources of funding.

<table>
<thead>
<tr>
<th>Year</th>
<th>Incoming Students</th>
<th>Total Enrollment</th>
<th>Start-Up Costs</th>
<th>A Additional Annual Costs</th>
<th>B Additional Annual Revenue</th>
<th>C Non-Tuition Revenue</th>
<th>A - (B+C) Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-2020</td>
<td>5</td>
<td>5</td>
<td>$104,736</td>
<td>$31,251</td>
<td>$48,600</td>
<td>$104,736</td>
<td>$(122,085)</td>
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<td>2020-2021</td>
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<td>9</td>
<td>$109,980</td>
<td>$32,814</td>
<td>$86,076</td>
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<td>$(163,242)</td>
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<td>2021-2022</td>
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<td>16</td>
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<td>$149,904</td>
<td>$115,461</td>
<td>$(230,910)</td>
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<tr>
<td>2022-2023</td>
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<td>23</td>
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<td>$(305,809)</td>
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<tr>
<td>2023-2024</td>
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<td>30</td>
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<td>$284,580</td>
<td>$127,296</td>
<td>$(373,890)</td>
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<tr>
<td>2024-2025</td>
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<td>$0</td>
<td>$39,886</td>
<td>$333,180</td>
<td>$0</td>
<td>$(293,294)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>118</td>
<td></td>
<td>$578,707</td>
<td>$212,570</td>
<td>$1,123,092</td>
<td>$578,707</td>
<td>$(1,489,230)</td>
</tr>
</tbody>
</table>

Please explain what has been included in the costs and revenues.

Start-Up Costs: one-time costs associated with offering this program

Direct, Incremental Costs: additional annual costs to the university as a result of offering this program

Incremental Revenue: additional annual revenue assuming that this program will bring in new students paying full tuition

Non-Tuition Revenue: external funds, grants, contracts or other revenues attributable to the addition of this program

Differential: all revenues minus all costs

Enrollment estimates assume 1 student graduates after the first year of the program, increasing to 3 during years 2-4, and up to 5 during year 5. Start-Up costs include the cost of 3 graduate assistantship positions to attract students to the program during the first 5 years, at $22,000 annually, plus tuition and fees. Additional annual costs include 12.5% salary release for a graduate coordinator annually, and half the cost of offering an additional section of CSE 6833 Introduction to Algorithms (shared with the MS program) including fringes, assuming 9-month salary of $100,000. Additional annual revenue includes tuition from enrolled students (75% out of state). Non-tuition revenue reflects expected support for 3 graduate assistantship positions available through new grants or contracts.
6. Indicate where the proposed program is offered within the state and explain anticipated consequences on enrollment in other institutions offering the program, including any ramifications on the Ayers settlement.

There are no institutions in Mississippi offering the proposed program.

7. What is the specific basis for determining the number of graduates expected in the first six years?

It is estimated that approximately 25 faculty at Mississippi State University will participate in the program by serving as major professor for PhD students. It is also expected that each faculty member will have approximately 1-2 students that will pursue this computational biology degree, while they also direct students in other programs. This gives 25-50 students enrolled in the program at any time. A number of other students are likely to begin the degree before having selected a major professor. It will take approximately 3-5 years to for a student to finish the program if entering immediately after completing the baccalaureate. Upon instituting the program, some students will immediately transfer from programs such as biological sciences, molecular biology, and computer science, leading to a number of graduates during the first 1-3 years of the program.

Almost all of the resources needed to offer this program already exist at MSU. MSU faculty are active in computational biology research and offer a more-than-adequate number of related courses to be used as program electives. A graduate studies committee consisting of one member from each involved College at MSU will make programmatic decisions. The only resource that will need to be added is salary for a graduate coordinator (a member of this committee, to be rotated every three years) to handle administrative tasks.

Five graduate teaching assistantship (GTA) positions are budgeted as startup costs during the first five years. These positions will be funded by non-tuition revenue.
Appendix 8: New Degree Program Proposal
(Submit Appendix 8 in both PDF and Word Document Formats)

Institution:
Date of Implementation: Spring 2020
Incremental, Six-Year Cost of Implementation: $791,277
Incremental, Six-Year Per Student Cost of Implementation: $15,826

Will it attract new students to the university? ☒ Yes ☐ No
Potential Six-Year, New Revenue: $1,701,799
Potential New, Six-Year Revenue Per Student: $34,036

Program Title as will Appear on Academic Program Inventory, Diploma, and Transcript: Computational Biology
Six-Digit CIP Code: 26.1104

Name of Degree(s) to be Awarded: Doctor of Philosophy
Total Credit Hour Requirements to earn the degree: 55

List any institutions within the state offering similar programs:
None

Responsible Academic Unit(s):
Institutional Contact: Dr. Peter Ryan
Office of Academic Affairs
Phone: 662-325-0730
Email: ryan@provost.msstate.edu

Check one of the boxes below related to SACSCOC Substantive Changes.
☑ Proposed Program is Not a Substantive Change ☐ Proposed Program is a Substantive Change

Number of Students Expected to Enroll in First Six Years:
Year One 5
Year Two 5
Year Three 10
Year Four 10
Year Five 10
Year Six 10
Total 50

Number of Graduates Expected in First Six Years:
Year One 1
Year Two 3
Year Three 3
Year Four 3
Year Five 5
Year Six 5
Total 20

Program Summary:
The interdisciplinary computational biology PhD degree program will prepare students for research positions in academia, government, and industry. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
1. Describe how the degree program will be administered including the name and title of person(s) who will be responsible for curriculum development and ongoing program review.

A graduate studies committee will be formed consisting of one full-time tenured or tenue-track faculty from each college participating in the program. A college will be determined to be participating in the program if one of its faculty members is serving as major professor for a student in the program, or if one of its faculty members teaches a course that is required for the degree. Initially, committee membership will consist of:

Dr. Brian Counterman, Associate Professor, Department of Biological Sciences, College of Arts and Sciences

Dr. Federico Hoffmann, Associate Professor, Department of Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture and Life Sciences

Dr. Bindu Nanduri, Associate Professor, Department of Basic Sciences, College of Veterinary Medicine

Dr. Andy Perkins, Associate Professor, Department of Computer Science and Engineering, Bagley College of Engineering

This committee will be responsible for making admissions decisions, as well as programmatic decisions. The committee will also hear student petitions, approve or disapprove requirements completed at other institutions, and decide on other matters on a case-by-case basis. The committee will also be responsible for maintaining the curriculum and keeping it current.

The committee will select one of its members to serve as graduate coordinator. Initially graduate coordinator duties will be fulfilled by both Drs. Counterman and Perkins. The graduate coordinator will serve a three-year term after which a different committee member will serve as graduate coordinator. The graduate coordinator will be responsible for the logistics of handling applications for admission, admitting students, communicating and soliciting decisions from the committee, meeting with prospective and current students, and advising any students that have not yet selected a major professor.

2. Describe the educational objectives of the degree program including the specific objectives of any concentrations, emphases, options, specializations, tracks, etc.

Learning outcomes:
1. Graduates will be prepared to serve in computational biology research positions in academia, industry, and government.
2. Graduates will be able to communicate effectively through scientific presentations and papers with a diverse audience of their peers in biology, molecular biology, computer science, and other areas of the computational and life sciences.
3. Graduates will be able to postulate well-reasoned hypotheses and apply sound scientific principles, knowledge, and methods to collect and analyze data to test these hypotheses.

Assessment methods:
Students will be expected to conduct research and present findings throughout their work in the graduate program. Students will also identify a dissertation topic and carry out the research related to that topic. This work will be described in their dissertation and presented at their dissertation defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology.

3. Describe any special admission requirements for the degree program including any articulation agreements that have been negotiated or planned.

There are no special admission requirements for the degree program. The program has two prerequisite courses (CSE 2383 Data Structures and CSE 2813 Discrete Structures), but these prerequisite courses may be taken simultaneously with graduate-level coursework after admission into the program. Admission into the program will be determined by a vote of the Graduate Studies Committee.

4. Describe the professional accreditation that will be sought for this degree program. If a SACSCOC visit for substantive change will be necessary, please note.

No professional accreditation is currently available or will be sought for this program.

5. Describe the curriculum for this degree program including the recommended course of study (appending course descriptions for all courses) and any special requirements such as clinical, field experience, community service, internships, practicum, a thesis, etc.

   a. Coursework

   Students will complete a minimum of 35 hours of coursework and 20 hours of dissertation research.

   Major Required Courses:

   CMB 8011 Graduate Seminar 1
   CMB 8013 Advanced Computational Biology 3
   CSE 6623 Computational Biology 3
   CSE 6833 Algorithms 3

   Computing (Select one):
   CSE 8673 Machine Learning
   CSE 8833 Algorithms
   CSE 8163 Parallel and Distributed Scientific Computing 3

   Statistics:
   ST 8114 Statistical Methods 4

   Life Sciences (Select two):
   BCH 6713 Molecular Biology
   BCH 8653 Genomes and Genomics
   BIO 6113 Evolution
   BIO 6143 Population Genetics 6

   Additional Approved Electives 12

   Dissertation:
   CMB 9000 20
• At least 18 credit hours of GPA-graded coursework must be taken at the 8000-level or higher.
• Graduate courses completed as part of a master’s degree or graduate courses completed prior to entry into the PhD program may, when approved by the student’s graduate committee, be applied to the PhD degree requirements. The committee’s decision will be documented by an “Attachment Sheet for Program of Study” form. The program of study will cover remaining coursework requirements.
• A student that has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student’s graduate committee. At least one course at the full graduate level must be taken in computer science and at least one course at the full graduate level in the life sciences must be taken at MSU.
• All undergraduate prerequisite courses must be satisfied. A PhD student’s program of study may include 6000-level prerequisite courses.

b. Preliminary Examination

A preliminary examination will be scheduled after the student has completed, or is within 6 hours of completing, all course work and has had a dissertation topic approved by members of his/her committee. The examination will consist of a written examination and an oral examination administered by the student’s graduate committee.

The major professor will collect the questions into a single examination that will be given to the student and Committee members. The time allotted for preparing written answers will be approximately 7 days. Written answers to the examination will be returned to the major professor who will distribute copies of all of the student's written answers to all of the Committee members.

The oral examination for the major exam will be scheduled approximately one week after the written answers have been completed by the student. During the oral portion of the major exam the student will give a short presentation to introduce his/her research topic and address any issues related to the examination that were raised by a committee member or that the student has determined need clarification. Further questioning related to the written examination by the committee is expected during the oral examination.

Students will be graded pass/fail by the student’s graduate committee on both the written and oral portion of the examination. Two negative votes will result in a failing grade. One negative vote will not result in a failing grade. The student must pass both the written and oral portion to pass the preliminary examination. The student will be permitted one retry for each examination. A second attempt to pass the examination must be accomplished within four to six months of failure. A second failure results in dismissal from the program.

c. Dissertation Proposal

The dissertation proposal provides the student with the opportunity to formally present his/her dissertation proposal to the Graduate Committee. The proposal also allows for questioning by the Committee to clarify the objectives of the proposal, and allows for adjustment of objectives
until agreement is reached between the student and the Graduate Committee.

The student will submit a written proposal to the graduate committee at least one week prior to the oral presentation. The format of the proposal shall conform to the University's Standard for Preparing Theses and Dissertations.

The presentation shall consist of an oral presentation of the dissertation proposal that is open to the student's graduate committee only. At this time, the student and his/her Committee may negotiate specific changes in the proposed work.

The written proposal should contain a literature review in the proposed research area, a clear thesis statement, a description of the significance of the proposed area to the field, a proposed procedure for the conduct of the research and publication plan. The acceptability of the proposal will be determined by the Committee.

d. Dissertation

As required by the Graduate School, all candidates for the PhD degree in Computational Biology must submit a dissertation that exhibits mastery of the techniques of research and a distinct contribution to the field under investigation and study. The student's graduate committee must approve the dissertation topic, the outline, and both the initial and final submissions to the Library.

e. Dissertation Defense/Final Examination

The final examination is an oral defense of the dissertation that is open to the public. There is an open question period that is open to the public, and a closed question period open only to the candidate and the graduate committee. The examination will cover the research related to the dissertation.

The acceptability of the dissertation will be determined by the graduate committee.

6. Describe the faculty who will deliver this degree program including the members' names, ranks, disciplines, current workloads, and specific courses they will teach within the program. If it will be necessary to add faculty in order to begin the program, give the desired qualifications of the persons to be added.

All of the faculty necessary to teach program courses, mentor students, and direct research are already present at MSU. The faculty below are expected to be available to advise students. All of these faculty are full-time instructional or research faculty at MSU. Some of the faculty will teach courses that are either required for or will be accepted as electives for the degree. In those cases, the relevant courses are listed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Courses taught</th>
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<tbody>
<tr>
<td>Matthew Brown</td>
<td>Assistant Professor</td>
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<td>Matthew Ballinger</td>
<td>Assistant Professor</td>
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<tr>
<td>Brian Counterman</td>
<td>Associate Professor</td>
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<tr>
<td>Amy Dapper</td>
<td>Assistant Professor</td>
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<tr>
<td>Angus Dawe</td>
<td>Professor and Head</td>
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<tr>
<td><strong>Biological Sciences</strong></td>
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<tr>
<td>Matthew Brown</td>
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<td>BIO 6990 Evolution of Infectious Diseases</td>
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<tr>
<td>Matthew Ballinger</td>
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<td>GRD 8013 Applied Computational Biology</td>
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<tr>
<td>Brian Counterman</td>
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<td>Amy Dapper</td>
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<td>BIO 6113 Evolution</td>
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<tr>
<td>Angus Dawe</td>
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<td>Name</td>
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<tr>
<td>Jean-Francois Gout</td>
<td>Assistant Professor</td>
<td>BIO 6143 Population Genetics</td>
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<tr>
<td>Heather Jordan</td>
<td>Assistant Professor</td>
<td>BIO 6990 Microbial Ecology</td>
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<tr>
<td>Ling Li</td>
<td>Assistant Professor</td>
<td>BIO 6990 Plant Data Resources</td>
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<tr>
<td>Mark Welch</td>
<td>Associate Professor</td>
<td>BIO 6113 Evolution</td>
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<tr>
<td>Nick Fitzkee</td>
<td>Associate Professor</td>
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<tr>
<td>Steven Gwaltney</td>
<td>Professor</td>
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<td>Charles Webster</td>
<td>Professor</td>
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<tr>
<td>Andy Perkins</td>
<td>Associate Professor</td>
<td>CSE 6623 Computational Biology</td>
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<tr>
<td>John Swan</td>
<td>Professor</td>
<td>CSE 8990 Visualization with R</td>
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<tr>
<td>TJ Jankun-Kelly</td>
<td>Associate Professor</td>
<td>CSE 8413 Visualization</td>
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<tr>
<td>Mahalingam Ramkumar</td>
<td>Associate Professor</td>
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<td>Lauren Priddy</td>
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<td>Raj Prabhu</td>
<td>Assistant Professor</td>
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<td>Bo Tang</td>
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<td>John Ball</td>
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<td>Russell Carr</td>
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<tr>
<td>Larry Hanson</td>
<td>Professor</td>
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<tr>
<td>Attila Karsi</td>
<td>Associate Professor</td>
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<tr>
<td>Mark Lawrence</td>
<td>Professor</td>
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<tr>
<td>Bindu Nanduri</td>
<td>Associate Professor</td>
<td>CVM 8993 Functional Genomics</td>
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<tr>
<td>Cyprianna Swiderski</td>
<td>Associate Professor</td>
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<tr>
<td>Amelia Woolums</td>
<td>Professor</td>
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<tr>
<td>Daniel Peterson</td>
<td>Professor and Director</td>
<td>BCH 8653 Genomes and Genomics</td>
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<tr>
<td>George Popescu</td>
<td>Assistant Research Professor</td>
<td>BCH 8990 Systems Biology</td>
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<tr>
<td>Federico Hoffmann</td>
<td>Associate Professor</td>
<td>GRD 8011 Seminar</td>
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<tr>
<td>Jonas King</td>
<td>Assistant Professor</td>
<td>BCH 6990 Introduction to Public Health</td>
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<tr>
<td>Jeffrey Dean</td>
<td>Professor and Head</td>
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<tr>
<td>Name</td>
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<tr>
<td>Shien Lu</td>
<td>Professor</td>
<td>BCH 6713 Molecular Biology</td>
</tr>
<tr>
<td>Zhaohua Peng</td>
<td>Professor</td>
<td>BCH 8633 Enzymes, BCH 6414 Protein Methods</td>
</tr>
<tr>
<td>Xueyan Shan</td>
<td>Assistant Research Professor</td>
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<tr>
<td>Sorina Popescu</td>
<td>Assistant Professor</td>
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<tr>
<td>Florencia Meyer</td>
<td>Associate Professor</td>
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**Plant and Soil Sciences**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Brian Baldwin</td>
<td>Professor</td>
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<tr>
<td>Te Ming Tseng</td>
<td>Assistant Professor</td>
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<tr>
<td>Richard Harkess</td>
<td>Professor</td>
</tr>
<tr>
<td>Kambham Reddy</td>
<td>Research Professor</td>
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<tr>
<td>Guihong Bi</td>
<td>Research Professor</td>
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**Animal and Dairy Sciences**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Jamie Larson</td>
<td>Associate Professor</td>
</tr>
<tr>
<td>Caleb Lemley</td>
<td>Assistant Professor</td>
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<tr>
<td>Henry Paz Manzano</td>
<td>Assistant Professor</td>
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<tr>
<td>Derris Devost-Burnett</td>
<td>Assistant Professor</td>
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**Poultry Science**

<table>
<thead>
<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Pratima Adhikari</td>
<td>Assistant Professor</td>
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<tr>
<td>Mary Beck</td>
<td>Professor and Head</td>
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</table>

**Wildlife, Fisheries and Aquaculture**

<table>
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<tr>
<th>Name</th>
<th>Position</th>
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<tbody>
<tr>
<td>Guiming Wang</td>
<td>Professor</td>
</tr>
<tr>
<td>Garret Street</td>
<td>Assistant Professor</td>
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</table>

7. Describe the library holdings relevant to the proposed program, noting strengths and weaknesses. If there are guidelines for the discipline, do current holdings meet or exceed standards?

The Mississippi State library has adequate holdings for the proposed program. In general, the academic community in the areas of computational biology and bioinformatics makes widespread use of open source repositories for software, data and tutorials, and open access journals and books, which means that there is a wealth of resources freely and readily available. Specifically, the MSSTATE library has access to the 10 top-ranked journals in the field of Mathematical and Computational Biology.

1. Bioinformatics (Open Access)
2. PLOS Computational Biology (Open Access)
3. BMC Bioinformatics (Open Access)
4. Briefings in Bioinformatics
5. Database: The Journal of Biological Databases & Curation (Open Access)
6. Journal of Theoretical Biology
7. BMC Systems Biology (Open Access)
8. GigaScience (Open Access)
9. IEEE/ACM Transactions on Computational Biology and Bioinformatics
10. Genomics, Proteomics & Bioinformatics (Open Access)
The MSU library has access to additional journals that are relevant in the field. In addition, our library has access to additional relevant resources through Ebsco Academic Search Complete, Scopus, and other databases available in the online portal of the library. Finally, students can get additional materials through interlibrary loans.

8. Describe the procedures for evaluation of the program and its effectiveness in the first six years of the program, including admission and retention rates, program outcome assessments, placement of graduates, changes in job market need/demand, ex-student/graduate surveys, or other procedures.

Assessment methods:
Students will be expected to conduct research and present findings throughout their work in the graduate program. Students will also identify a dissertation topic and carry out the research related to that topic. This work will be described in their dissertation and presented at their dissertation defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology. Exit surveys will be performed for all graduates to determine job placement at graduation. The graduate coordinator will track admission and retention rates, and changes in the job market need and demand nationally and within the state.

9. What is the specific basis for determining the number of graduates expected in the first six years?

It is estimated that approximately 25-50 faculty at Mississippi State University will participate in the program by serving as major professor for PhD students. It is also expected that each faculty member will have approximately 1-2 students that will pursue this computational biology degree, while they also direct students in other programs. This gives 25-50 students enrolled in the program at any time. A number of other students are likely to begin the degree before having selected a major professor. It will take approximately 3-5 years to for a student to finish the program if entering immediately after completing the baccalaureate. Upon instituting the program, some students will immediately transfer from programs such as biological sciences, molecular biology, and computer science, leading to a number of graduates during the first 1-3 years of the program.

Almost all of the resources needed to offer this program already exist at MSU. MSU faculty are active in computational biology research and offer a more-than-adequate number of related courses to be used as program electives. A graduate studies committee consisting of one member from each involved College at MSU will make programmatic decisions. The only resource that will need to be added is salary for a graduate coordinator (a member of this committee, to be rotated every three years) to handle administrative tasks.
Additional Approved Electives (if not taken to fulfill other requirements):

BCH 6414 Protein Methods: 4 hours.
BCH 6713 Molecular Biology: 3 hours.
BCH 6804 Molecular Biology Methods: 4 hours.
BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BCH 8243 Molecular Biology of Plants: 3 hours.
BCH 8633 Enzymes: 3 hours.
BCH 8643 Molecular Genetics: 3 hours.
BCH 8653 Genomes and Genomics: 3 hours.
BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BIO 6133 Human Genetics: 3 hours.
BIO 6113 Evolution: 3 hours.
BIO 6143 Population Genetics: 3 hours.
BIO 6443 Bacterial Genetics: 3 hours.
BIO 6990 Special Topics in Biological Sciences: 1-9 hours.
CSE 6163 Designing Parallel Algorithms: 3 hours.
CSE 6214 Introduction to Software Engineering: 4 hours.
CSE 6503 Database Management Systems: 3 hours.
CSE 6633 Artificial Intelligence: 3 hours.
CSE 6753 Foundations in Computation: 3 hours.
CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
CSE 8413 Visualization: 3 hours.
CSE 8673 Machine Learning: 3 hours.
CSE 8813 Theory of Computation: 3 hours.
CSE 8833 Algorithms: 3 hours.
CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8303 Advanced Immunology: 3 hours.
CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
CVM 8503 Epidemiology/Biostatistics: 3 hours.
CVM 8990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8993 Functional Genomics: 3 hours.
ST 6243 Data Analysis I: 3 hours.
ST 6253 Data Analysis II: 3 hours.
ST 8214 Design and Analysis of Experiments: 4 hours.

Course Descriptions (required and elective courses)

BCH 6414 Protein Methods: 4 hours.
(Prerequisite: Coregistration in BCH 4603/6603). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of protein biochemistry
BCH 6713 Molecular Biology: 3 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of basic molecular process such as synthesis of DNA, RNA, and protein in both prokaryotic and eukaryotic cells. Offered fall semester. (Same as GNS 6713)

BCH 6804 Molecular Biology Methods: 4 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of molecular biology. (Same as GNS 4804/6804),

BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.  
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BCH 8243 Molecular Biology of Plants: 3 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of plant development at the molecular level. Emphasis will be placed on the influence of nucleic acid metabolism on plant development

BCH 8633 Enzymes: 3 hours.  
(Prerequisites: BCH 4613/6613). Three hours lecture. A study of enzymes; their purification, classification, kinetics and mechanisms

BCH 8643 Molecular Genetics: 3 hours.  
(Prerequisites: PO 3103, or BIO 3103, and Coregistration in BCH 5613/7613). Three hours lecture. Study of the gene and its expression with emphasis on structure and function in higher organisms. (Same as GNS 8643)

BCH 8653 Genomes and Genomics: 3 hours.  
(Prerequisites: BCH 4113/6113 or BCH 4713/6713 or BCH 8643 or consent of instructor). Overview of genome structure and evolution with emphasis on genomics, the use of molecular biology, robotics, and advanced computational methods to efficiently study genomes. (Same as PSS 8653)

BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.  
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BIO 6133 Human Genetics: 3 hours.  
(Prerequisite: BIO 1134 and BIO 1144 or BIO 2113 or consent of instructor) Three hours lecture Principles of Mendelian and molecular genetics as applied to humans. Description and causes of human genetic diseases and other anomalies. (Same as GNS 4133/6133)
BIO 6113 Evolution: 3 hours.
(Prerequisites: MA 1313 or equivalent, BIO 1134 and BIO 1144, BIO 3103 or BIO 4133).
Historical development of evolutionary theory; phylogeny and systematic; historic or organic evolution; molecular and phenotypic variation in populations; genetic drift and natural selection; speciation

BIO 6143 Population Genetics: 3 hours.
(Prerequisite: Both BIO 1134 and 1144, or BIO 2113, or consent of instructor. Three hours lecture. Study of the structure of genetic variation in populations and its applications in life sciences

BIO 6443 Bacterial Genetics: 3 hours.
(Prerequisites: BCH 4603, BIO 3304 or consent of instructor). Three hours lecture. The genetics of bacteria and their viruses including: replication, rearrangement, repair, transfer, regulation, and methods of manipulation and analysis of DNA

BIO 6990 Special Topics in Biological Sciences: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CMB 8011 Graduate Seminar: 1 hour.
This course serves as an introduction to the graduate program in computational biology and will introduce students to common methods and current research in bioinformatics and computational biology.

CMB 8013 Applied Computational Biology: 3 hours.
This course focuses on the application of computational methods and tools to explore biological processes and diversity.

CSE 6163 Designing Parallel Algorithms: 3 hours.
(Prerequisites: Grade of C or better in CSE 3324 or CSE 4733/6733). Three hours lecture. Techniques for designing algorithms to take advantage efficiently of different parallel architectures. Includes techniques for parallelizing sequential algorithms and techniques for matching algorithms to architectures

CSE 6214 Introduction to Software Engineering: 4 hours.
(Prerequisite: CSE 2383 with a grade of C or better). Three hours lecture. Two hours laboratory. Introduction to software engineering; planning, requirements, analysis and specification, design; testing; debugging; maintenance; documentation. Alternative design methods, software metrics, software project management, reuse, and reengineering

CSE 6503 Database Management Systems: 3 hours.
(Prerequisites: CSE 2383 and CSE 2813, both with a grade of C or better). Three hours lecture. Modern database models; basic database management concepts; query languages; database
design through normalization; advanced database models; extensive development experience in a
team environment

CSE 6623 Computational Biology: 3 hours.
(Prerequisite:BCH 4113/6113 or equivalent and CSE 1384 or CSE 4613/6613 ). Three hours
lecture. Computational analysis of gene sequences and protein structures on a large scale.
Algorithms for sequence alignment, structural and functional genomics, comparative genomics,
and current topics

CSE 6633 Artificial Intelligence: 3 hours.
(Prerequisite:Grade of C or better in CSE 2383 and CSE 2813) Three hours lecture. Study of the
computer in context with human thought processes. Heuristic programming; search
programming; search strategies; knowledge representation; natural language understanding;
perception; learning

CSE 6753 Foundations in Computation: 3 hours.
(Prerequisite: CSE 1213 or CSE 1233 or CSE 1273 or CSE 1284 with a grade of C or better, or
permission of instructor). Three hours lecture. Foundational concepts of computational algorithm
design and analysis. (No credit for student in Computer Science, Computer Engineering, or
Software Engineering degree programs)

CSE 6833 Introduction to Analysis of Algorithms: 3 hours.
(Prerequisites:CSE 2383, CSE 2813, and MA 2733 with a grade of C or better). Three hours
lecture. Study of complexity of algorithms and algorithm design. Tools for analyzing efficiency;
design of algorithms, including recurrence, divide-and-conquer, dynamic programming and
greedy algorithms

CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing
subject matter areas not covered in existing courses. (Courses limited to two offerings under one
title within two academic years)

CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
(Prerequisite:CSE 4163/6163). Three hours lecture. Algorithms for distributed scientific
computing; performance evaluation; scheduling and load balancing issues for scientific
applications; architectural issues affecting performance

CSE 8413 Visualization: 3 hours.
(Prerequisites:CSE 4413/6413). Three hours lecture. Essential algorithms for three-dimensional
rendering and modeling techniques; viewing transformations, illumination, surface modeling;
methodologies for visualization of scalar and vector fields in three dimensions

CSE 8673 Machine Learning: 3 hours.
(Prerequisite: CSE 4633/6633 ). Three hours lecture. Introduction to machine learning, including
computational learning theory, major approaches to machine learning, evaluation of models, and
current research
CSE 8813 Theory of Computation: 3 hours.
(Prerequisite: CSE 3813). Three hours lecture. Study of abstract models of computation, unsolvability, complexity theory, formal grammars and parsing, and other advanced topics in theoretical computer science

CSE 8833 Algorithms: 3 hours.
(Prerequisites: CSE 4833/6833). Three hours lecture. Advanced techniques for designing and analyzing algorithms, advanced data structures, case studies, NP-completeness including reductions, approximation algorithms

CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
(Prerequisite: CSE 4833/6833). Three hours lecture. Complexity of sequential algorithms, theory of complexity, parallel algorithms

CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 8303 Advanced Immunology: 3 hours.
(Prerequisite: BIO 6413 or equivalent or consent from the instructor). Three hours lecture. Advanced theory and concepts of immunology, structure and function of immune mechanisms are discussed in detail

CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
Three hours lecture. This course addresses basic principles of how the body reacts to the presence of a drug or toxin and the mathematical expression of drug residues

CVM 8503 Epidemiology/Biostatistics: 3 hours.
(Prerequisite: ST 8114) Three hours lecture. Fundamental principles of descriptive and analytical epidemiology

CVM 8990 Special Topics in Veterinary Medicine: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 8993 Functional Genomics: 3 hours.
(Prerequisites: BCH 6713 Molecular Biology and ST 6243 Data analysis or consent of instructor). Three hours lecture. Fundamental concepts, technology, and applications of
functional genomics, such as microarray, yeast hybrid systems, and RNA inference, emphasizing experimental design, analysis, and applications in biomedical research

ST 6243 Data Analysis I: 3 hours.
(Prerequisite: MA 2743, Corequisite MA 3113). Three hours lecture. Data description and descriptive statistics, probability and probability descriptions, parametric one-sample and two-sample inference procedures, simple linear regression, one-way ANOVA. Use of SAS. (Same as MA 4243/6243)

ST 6253 Data Analysis II: 3 hours.
(Prerequisite: MA/ST 4243/6243 and MA 3113). Three hours lecture. Multiple linear regression fixed, mixed, and random effect models; block design; two-factor analysis of variance; three-factor analysis of variance; analysis of covariance. Use of SAS. (Same as MA 4253/6253)

ST 8114 Statistical Methods: 4 hours.
(Prerequisite: MA 1313). Three hours lecture. Two hours laboratory. Fall and Spring semesters. Descriptive statistics; sampling distributions; inferences for one and two populations; completely random, block, Latin square, split-plot designs; factorials; simple linear regression; chi-square tests

ST 8214 Design and Analysis of Experiments: 4 hours.
(Prerequisite: ST 8114) Three hours lecture. Three hours laboratory. Offered spring semester. Procedures in planning and analyzing experiments; simple, multiple, and curvilinear regression; factorial arrangement of treatments; confounding; fractional replication; block designs; lattices; split-plots
March 26, 2019

To Whom It May Concern,

It is my pleasure to write this letter of support for the development of a computational biology interdisciplinary graduate program. A core group of faculty (Drs. Perkins, Counterman, Hoffman, and Nanduri) across four colleges (Engineering, Arts & Sciences, College of Agriculture & Life Sciences, and the Vet School) have worked together to create a wonderful proposal for graduate students at the masters and doctoral level interested in working in computational biology. The degree will be housed in the Provost’s office with courses offered in the four colleges. Students will work with their major professor within the discipline itself (computer sciences, biological sciences, bio chemistry, or vet medicine) to work toward their degree plan.

Arts & Sciences is supportive of the development of this program. We look forward to working collaboratively with the Provost’s Office, College of Engineering, College of Agriculture and Life Sciences, and the Vet School to assist with oversight and also to help market the program to our students. Please let us know if you need additional information.

Sincerely,

[Signature]

Nicole Rader
Associate Dean for Academic Affairs,
College of Arts & Sciences
Professor, Sociology
Mississippi State University
March 22, 2019

RE: Proposed Interdisciplinary Computational Biology Program

To Whom it May Concern,

I am pleased to write this letter of support for the development of a multidisciplinary graduate degree program in Computational Biology. For a number of years we have run a successful NSF REU program in this area under the direction of Andy Perkins. The popularity of this effort, as well as internal desire of students to engage in this area of endeavor illustrates a need for an educational opportunity. The Bagley College of Engineering is supportive of the development of this program housed in the Office of the Provost. The college will work with the other units involved to promote the program and provide oversight of those aspects that are under the purview of the college. If there are any additional questions or if I need to clarify anything that I’ve stated, please do not hesitate to let me know.

Sincerely,

Kari Babski-Reeves  
Associate Dean for Research and Graduate Studies  
IRB Chair
March 27, 2019

To Whom It May Concern:

The College of Agriculture & Life Sciences fully supports the development of a multidisciplinary graduate degree program in computational biology. We look forward to collaborating with the Provost’s Office and participating colleges to oversee and promote the program.

Sincerely,

Emily E. Shaw
Director of Undergraduate & Graduate Academic Advising
College of Agriculture & Life Sciences
March 26, 2019

To Whom it May Concern,

The College of Veterinary Medicine fully supports the development of multidisciplinary graduate degree program in computational biology. We appreciate the effort and dedication required to create this curriculum and are confident in its success. We look forward to collaborating with the Provost’s Office and participating colleges to oversee and promote the program.

Sincerely,

Ron McLaughlin
Associate Dean for Administration
Professor of Surgery
College of Veterinary Medicine
APPROVAL FORM FOR

DEGREE PROGRAMS
MISSISSIPPI STATE UNIVERSITY

NOTE: This form is a cover sheet that must accompany the degree program change proposal. The actual proposal should be prepared in accordance with format requirements provided in the Guide and Format for Curriculum Proposals published by the UCCC. Both cover sheet and proposal should be submitted to UCCC Mail Stop 9702 (281 Garner Hall), Phone: 325-9410.

College: Office of Academic Affairs
Department:

Contact Person: Peter Ryan Mail Stop: 9723 E-mail: ryan@provost.msstate.edu
Nature of Change: Degree addition Date Initiated: 3/5/19 Effective Date: Spring 2020
Current Degree Program Name:

Major: Concentration:

New Degree Program Name: Master of Science
Major: Computational Biology Concentration:

Summary of Proposed Changes:
The Office of Academic Affairs, in collaboration with the College of Arts & Sciences, Bagley College of Engineering, College of Agriculture and Life Sciences, and College of Veterinary Medicine proposes a new interdisciplinary graduate program in computational biology. Students will be prepared to pursue research positions in academia, government, and industry. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
NEW GRADUATE DEGREE OUTLINE FORM
Use the chart below to indicate your new degree outline. Please list required College and Major Required Courses and if appropriate Concentration Courses. Graduate programs that wish to specialize beyond the Major must have at least two concentrations. Add additional rows as needed for programs with more than two concentrations. Expand rows as needed

<table>
<thead>
<tr>
<th>Proposed New Degree</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree: MS (non-thesis)</td>
<td></td>
</tr>
<tr>
<td>Major: Computational Biology</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Curriculum Outline</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Required Courses:</td>
<td></td>
</tr>
<tr>
<td>Seminar:</td>
<td></td>
</tr>
<tr>
<td>CMB 8011 Graduate Seminar in Computational Biology</td>
<td>1</td>
</tr>
<tr>
<td>CMB 8013 Applied Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>Computing:</td>
<td></td>
</tr>
<tr>
<td>CSE 6623 Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>CSE 6833 Introduction to Algorithms</td>
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</tr>
<tr>
<td>Statistics:</td>
<td></td>
</tr>
<tr>
<td>ST 8114 Statistical Methods</td>
<td>4</td>
</tr>
<tr>
<td>Life Sciences (select two from below):</td>
<td>6</td>
</tr>
<tr>
<td>BCH 6713 Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>BCH 8653 Genomes and Genomics</td>
<td></td>
</tr>
<tr>
<td>BIO 6113 Evolution</td>
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<tr>
<td>BIO 6143 Population Genetics</td>
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<tr>
<td>Additional approved electives</td>
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</tr>
<tr>
<td>Total Hours</td>
<td>32</td>
</tr>
</tbody>
</table>

- At least 13 credit hours of GPA-graded coursework must be taken at the 8000-level or higher.
- A student that has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student's graduate committee. At least one course at the full graduate level in computer science and at least one course at the full graduate level in the life sciences must be completed at MSU.
PROPOSED New Degree
Degree: MS (thesis)
Major: Computational Biology

Graduate study leading to the Master of Science and Doctor of Philosophy degrees is offered in the area of computational biology. This interdisciplinary graduate program provides a firm foundation in computational methods and biological knowledge, and draws courses from various colleges to provide a flexible program of study.

<table>
<thead>
<tr>
<th>Proposed Curriculum Outline</th>
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<td></td>
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<td></td>
</tr>
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<td>BIO 6713 Evolutionary Biology</td>
<td></td>
</tr>
<tr>
<td>BIO 6143 Population Genetics</td>
<td></td>
</tr>
<tr>
<td>Additional approved electives</td>
<td>6</td>
</tr>
<tr>
<td>CMB 8000 Thesis Research</td>
<td>6</td>
</tr>
<tr>
<td>Total Hours</td>
<td>32</td>
</tr>
</tbody>
</table>

- At least 16 credit hours of GPA-graded coursework must be taken at the 8000-level or higher.
- A student that has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student's graduate committee. At least one course at the full graduate level in computer science and at least one course at the full graduate level in the life sciences must be completed at MSU.

Prerequisites

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 2183 Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2383 Data Structures*</td>
<td>3</td>
</tr>
</tbody>
</table>

*This requirement can be satisfied by completing CSE 6753 Fundamentals of Computing with a grade of B or higher.
All undergraduate prerequisite courses listed must be satisfied. A MS student’s program of study may include 6000-level prerequisite courses.

1. Curriculum Outline
   
   Three new courses will be necessary and proposals have been submitted in CIM.
   
   CMB 8011 Graduate Seminar
   CMB 8013 Applied Computational Biology
   CMB 8000 Thesis

2. Student learning outcomes and assessment
   
   Learning outcomes:
   1. Graduates will be prepared to serve in computational biology research positions in academia, industry, and government.
   2. Graduates will be able to communicate effectively through scientific presentations and papers with a diverse audience of their peers in biology, molecular biology, computer science, and other areas of the computational and life sciences.
   3. Graduates will be able to postulate well-reasoned hypotheses and apply sound scientific principles, knowledge, and methods to collect and analyze data to test these hypotheses.

   Assessment methods:
   Students will be expected to conduct research and present findings throughout their work in the graduate program. Students will also identify a thesis topic and carry out the research related to that topic. This work will be described in their thesis and presented at their thesis defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Students choosing the coursework option will present a class or research project as part of their final examination, which will allow their committee to assess their proficiency in communication. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology.

3. Support
   
   A letter of support from the associate deans of colleges involved in the degree program is attached.

4. Proposed 4-letter abbreviation
   
   COMB

5. Effective date:
   
   Spring 2020
Appendix 7: Authorization to Plan a New Degree Program  
(Submit Appendix 7 in both PDF and Word Document Formats)

<table>
<thead>
<tr>
<th>Institution: Mississippi State University</th>
<th>Incremental, Six Year Cost of Implementation:</th>
<th>Incremental, Six-Year Per Student Cost of Implementation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of Implementation:</td>
<td>$212,570</td>
<td>$2,501</td>
</tr>
<tr>
<td>Will it attract new students to the university?</td>
<td>Potential Six-Year, New Revenue: s962,280</td>
<td>Potential New, Six-Year Revenue Per Student: $11,321</td>
</tr>
<tr>
<td>☒ Yes ☐ No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Program Title as will Appear on Academic Program Inventory, Diploma, and Transcript:</td>
<td>Computational Biology</td>
<td>26.1104</td>
</tr>
<tr>
<td>Name of Degree(s) to be Awarded:</td>
<td>Total Credit Hour Requirements to Earn the Degree:</td>
<td></td>
</tr>
<tr>
<td>Master of Science</td>
<td>32</td>
<td></td>
</tr>
</tbody>
</table>

List any institutions within the state offering similar programs:
None

Responsible Academic Unit(s): Institutional Contact: Dr. Peter Ryan  
Phone: 662-325-0730  
Email: ryan@provost.msstate.edu

Office of Academic Affairs

<table>
<thead>
<tr>
<th>Number of Students Expected to Enroll in First Six Years:</th>
<th>Number of Graduates Expected in First Six Years:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year One 5</td>
<td>Year One 3</td>
</tr>
<tr>
<td>Year Two 10</td>
<td>Year Two 5</td>
</tr>
<tr>
<td>Year Three 15</td>
<td>Year Three 10</td>
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<tr>
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<td>Year Four 15</td>
</tr>
<tr>
<td>Year Five 20</td>
<td>Year Five 15</td>
</tr>
<tr>
<td>Year Six 20</td>
<td>Year Six 20</td>
</tr>
<tr>
<td>Total 85</td>
<td>Total 68</td>
</tr>
</tbody>
</table>

Program Summary:

The interdisciplinary computational biology MS degree program will provide students the technical skills to perform computational biology work and research duties in academia, government, and industry. It will also prepare students to enter PhD studies in computational biology and related areas. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
1. Describe the proposed program and explain how it fits within the mission of the institution.

The proposed program will train students to become independent researchers in the highly interdisciplinary area of computational biology, which encompasses diverse specializations and involves faculty in almost every college in the university. This program will build upon the University’s strength in the areas of genomics, evolutionary genetics, statistics, big data, machine learning, and others to offer rigorous preparation and opportunities for high-impact research. This program helps Mississippi State University fulfill its mission to enhance its strength in agriculture, engineering, and natural sciences. It also has the potential to help Mississippi State contribute to the economic development of the state by producing a workforce with the skills needed for modern biological research.

2. Provide the information used to determine Mississippi’s need for this program. Be specific and provide supporting data.

While computational biology is a well-established research area, it is an emerging discipline for formal education and training in academia. Universities across the country are beginning to offer graduate and undergraduate programs in computational biology to train the next generation of scientists who will be using computational methods and big data to answer important questions in the life sciences. In the SEC, the University of Georgia offers a graduate program in Integrated Life Sciences and Vanderbilt University offers a graduate degree in Biomedical Informatics. These are degrees that offer training comparable to a computational biology program. Establishing this program at Mississippi State University will ensure that Mississippi is a leader in the South in producing computational biologists.

The primary need for this program is indicated by the research interests of faculty at Mississippi State University. Researchers have found that answering key questions about life often requires the use of new technologies and the collection of massive amounts of data. These new technologies have driven what has been termed the “big data revolution” in science, which has necessitated computational approaches in almost all areas of the life sciences. Those on the forefront are already using the educational infrastructure and skills of the faculty at Mississippi State to produce graduates that are well-prepared in these areas. The proposed degree program will allow students to earn the credential (MS in Computational Biology) that is most closely aligned with their expertise and interests. This degree will often allow graduates to pursue positions that might not have been available with a degree in the life sciences, or positions that will have a significantly higher pay rate.

There is a need for computational biology researchers within Mississippi. Several research labs and institutes across the state conduct research in computational biology, including the University of
Mississippi Medical Center, USDA-Agricultural Research Service (ARS), US Forest Products Lab, and the US Army Corps of Engineers Engineer Research and Development Center (ERDC). Many Mississippi State University graduates have gone on to positions with these organizations.

As we continue to produce highly-skilled graduates in computational biology, Mississippi will become more attractive to genomics, biotechnology, and pharmaceutical industries. Surrounding states such as Alabama and Tennessee have recently been able to attract such industries.

3. Provide information on employment (supporting data must include state and national employment statistics or career opportunities (include potential earnings range).

Graduates of this program will go on to research positions in academic labs, industry, and government. Prior Mississippi State University graduates that would have been potential candidates for this degree program have pursued positions such as bioinformatician at a medical school, a computation specialist at a genomics facility, and a forensic biologist with the state government.

Graduates of this program would also have the necessary background to pursue a PhD degree in one or more of the areas of computational biology, bioinformatics, biological sciences, molecular biology, or others. Graduates would likely be sought after for postsecondary instructor positions in these areas at universities and community colleges.

As of May 14, 2018 over 100 jobs in the area of computational biology had been posted at the International Society for Computational Biology (ISCB) web site within the past three months, the premier international professional organization for computational biologists. Many more jobs requiring the skills of computational biologists are regularly posted to the Association for Computing Machinery, Computing Research Association, Academic Keys, and other employment sites.

According to the Mississippi Department of Employment Security occupational projections, the need for postsecondary teachers in the biological sciences is expected to grow by over 17% by 2024, and computer science postsecondary teachers by over 11%. These jobs pay on average $72,000-$79,000. However, employment in biological sciences positions (paying on average approximately $77,000) is expected to primarily remain steady or even drop slightly over this period. The proposed program has the potential to provide trained scientists to fill positions in Mississippi and possibly attract additional industry to the state, alleviating this concern.

4. Describe any other benefits to the institution, state, region, or nation including research, service, and teaching efforts that might result from offering this program.

Many faculty members likely to be involved in this program have a record of outreach to K-12 students and teachers. For example, Dr. Nanduri (Basic Sciences, College of Veterinary Medicine) and Dr. Perkins (Computer Science, Bagley College of Engineering) have helped to instruct workshops of Mississippi teachers in the area of computational biology. Dr. Hoffmann (Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture and Life Sciences) and Dr. Perkins have received funding from Mississippi State University to instruct undergraduate and high school students in construction, administration, and use of clusters of miniature portable computers for genomics research.

Drs. King (Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture

Revised 10/2/18
and Life Sciences), Nanduri, and Perkins have each pursued federal grants for training graduate students in this area. The establishment of this degree program will make Mississippi more competitive for these grant funds, which would attract students from around the region and the country to graduate studies in Mississippi.

5. Using expected enrollment, provide the total anticipated budget for the program including implementation and 5 subsequent years (total of 6 years) of operation; any anticipated direct, indirect, and incremental costs necessary to start the program; anticipated incremental annual revenue based on student enrollment; and other sources of funding.

<table>
<thead>
<tr>
<th>Year</th>
<th>Incoming Students</th>
<th>Total Enrollment</th>
<th>Start-Up Costs</th>
<th>A Additional Annual Costs</th>
<th>B Additional Annual Revenue</th>
<th>C Non-Tuition Revenue</th>
<th>A – (B+C) Differential</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019-2020</td>
<td>5</td>
<td>5</td>
<td>$0</td>
<td>$31,251</td>
<td>$41,580</td>
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<td>2020-2021</td>
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<td>$36,808</td>
<td>$0</td>
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<td>2021-2022</td>
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<tr>
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<tr>
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<td>$212,570</td>
<td>$962,280</td>
<td>$0</td>
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</table>

Please explain what has been included in the costs and revenues.

**Start-Up Costs:** one-time costs associated with offering this program

**Direct, Incremental Costs:** additional annual costs to the university as a result of offering this program

**Incremental Revenue:** additional annual revenue assuming that this program will bring in new students paying full tuition

**Non-Tuition Revenue:** external funds, grants, contracts or other revenues attributable to the addition of this program

**Differential:** all revenues minus all costs

Enrollment estimates assume 3 students graduate after the first year of the program, increasing to 5 during years 2, 10 after year 3, up to 15 after year 4 and 5, and 20 after year 6. Additional annual costs include 12.5% salary release for a graduate coordinator annually, and half the cost of offering an additional section of CSE 6833 Introduction to Algorithms (shared with the PhD program) including fringes, assuming 9-month salary of $100,000. Additional annual revenue includes tuition from enrolled students (50% out of state).

Almost all of the resources needed to offer this program already exist at MSU. MSU faculty are active in computational biology research and offer a more-than-adequate number of related courses to be used as program electives. A graduate studies committee consisting of one member from each involved College at MSU will make programmatic decisions. The only resource that will need to be added is salary for a graduate coordinator (a member of this committee, to be rotated every three years) to handle administrative tasks.

Revised 10/2/18
6. Indicate where the proposed program is offered within the state and explain anticipated consequences on enrollment in other institutions offering the program, including any ramifications on the Ayers settlement.

There are no institutions in Mississippi offering the proposed program.

7. What is the specific basis for determining the number of graduates expected in the first six years?

It is estimated that approximately 25 faculty at Mississippi State University will participate in the program by serving as major professor for MS students. It is also expected that each faculty member will have approximately 2-3 students that will pursue this computational biology degree (including both thesis and non-thesis tracks), while they also direct students in other programs. This gives 25-50 students enrolled in the program at any time. A number of other students are likely to begin the degree before having selected a major professor. It will take approximately 2 years to for a student to finish the program if entering immediately after completing the baccalaureate. Upon instituting the program, some students will immediately transfer from programs such as biological sciences, molecular biology, and computer science, leading to a number of graduates during the first year of the program.

Revised 10/2/18
Appendix 8: New Degree Program Proposal
(Submit Appendix 8 in both PDF and Word Document Formats)

<table>
<thead>
<tr>
<th>Institution:</th>
<th>Incremental, Six-Year Cost of Implementation:</th>
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</tr>
</tbody>
</table>

Program Title as will Appear on Academic Program Inventory, Diploma, and Transcript: Computational Biology
Six-Digit CIP Code: 26.1104

Name of Degree(s) to be Awarded: Master of Science
Total Credit Hour Requirements to earn the degree: 32

List any institutions within the state offering similar programs:
None

Responsible Academic Unit(s):
Office of Academic Affairs
Institutional Contact: Dr. Peter Ryan
Phone: 662-325-0730
Email: ryan@provost.msstate.edu

Check one of the boxes below related to SACSCOC Substantive Changes.

- [ ] Proposed Program is Not a Substantive Change
- [x] Proposed Program is a Substantive Change

<table>
<thead>
<tr>
<th>Number of Students Expected to Enroll in First Six Years:</th>
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Program Summary:

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1. Describe how the degree program will be administered including the name and title of person(s) who will be responsible for curriculum development and ongoing program review.

A graduate studies committee will be formed consisting of one full-time tenured or tenue-track faculty from each college participating in the program. A college will be determined to be participating in the program if one of its faculty members is serving as major professor for a student in the program, or if one of its faculty members teaches a course that is required for the degree. Initially, committee membership will consist of:

Dr. Brian Counterman, Associate Professor, Department of Biological Sciences, College of Arts and Sciences

Dr. Federico Hoffmann, Associate Professor, Department of Biochemistry, Molecular Biology, Entomology & Plant Pathology, College of Agriculture and Life Sciences

Dr. Bindu Nanduri, Associate Professor, Department of Basic Sciences, College of Veterinary Medicine

Dr. Andy Perkins, Associate Professor, Department of Computer Science and Engineering, Bagley College of Engineering

This committee will be responsible for making admissions decisions, as well as programmatic decisions. The committee will also hear student petitions, approve or disapprove requirements completed at other institutions, and decide on other matters on a case-by-case basis. The committee will also be responsible for maintaining the curriculum and keeping it current.

The committee will select one of its members to serve as graduate coordinator. Initially graduate coordinator duties will be fulfilled by both Drs. Counterman and Perkins. The graduate coordinator will serve a three-year term after which a different committee member will serve as graduate coordinator. The graduate coordinator will be responsible for the logistics of handling applications for admission, admitting students, communicating and soliciting decisions from the committee, meeting with prospective and current students, and advising any students that have not yet selected a major professor.

2. Describe the educational objectives of the degree program including the specific objectives of any concentrations, emphases, options, specializations, tracks, etc.

Learning outcomes:

1. Graduates will be prepared to serve in computational biology research positions in academia, industry, and government.

2. Graduates will be able to communicate effectively through scientific presentations and papers with a diverse audience of their peers in biology, molecular biology, computer science, and other areas of the computational and life sciences.

3. Graduates will be able to postulate well-reasoned hypotheses and apply sound scientific principles, knowledge, and methods to collect and analyze data to test these hypotheses.
Assessment methods:
Students will be expected to conduct research and present findings throughout their work in the graduate program. Students will also identify a thesis topic and carry out the research related to that topic. This work will be described in their thesis and presented at their thesis defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Students choosing the coursework option will present a class or research project as part of their final examination, which will allow their committee to assess their proficiency in communication. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology.

3. Describe any special admission requirements for the degree program including any articulation agreements that have been negotiated or planned.

There are no special admission requirements for the degree program. The program has two prerequisite courses (CSE 2383 Data Structures and CSE 2813 Discrete Structures), but these prerequisite courses may be taken simultaneously with graduate-level coursework after admission into the program. Admission into the program will be determined by a vote of the Graduate Studies Committee.

4. Describe the professional accreditation that will be sought for this degree program. If a SACSCOC visit for substantive change will be necessary, please note.

No professional accreditation is currently available or will be sought for this program.

5. Describe the curriculum for this degree program including the recommended course of study (appending course descriptions for all courses) and any special requirements such as clinical, field experience, community service, internships, practicum, a thesis, etc.

a. Coursework

Students will complete a minimum of 26 hours of coursework and 6 hours of thesis research. Students pursuing a non-thesis degree will take 32 hours of coursework.

Major Required Courses:

CMB 8011 Graduate Seminar 1
CMB 8013 Advanced Computational Biology 3
CSE 6623 Computational Biology 3
CSE 6833 Algorithms 3

Statistics:
ST 8114 Statistical Methods 4

Life Sciences (Select two):
BCH 6713 Molecular Biology 6
BCH 8653 Genomes and Genomics
BIO 6113 Evolution
BIO 6143 Population Genetics

Additional Approved Electives 6

Thesis:
CMB 8000 6

Total 32
• At least 13 credit hours of GPA-graded coursework must be taken at the 8000-level or higher for thesis students, and at least 16 credit hours of GPA-graded coursework must be taken at the 8000-level or higher for non-thesis students.

• Graduate courses completed as part of a master’s degree or graduate courses completed prior to entry into the MS program may, when approved by the student’s graduate committee, be applied to the MS degree requirements. The committee’s decision will be documented by an “Attachment Sheet for Program of Study” form. The program of study will cover remaining coursework requirements.

• A student that has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student’s graduate committee. At least one course at the full graduate level must be taken in computer science and at least one course at the full graduate level in the life sciences must be taken at MSU.

• All undergraduate prerequisite courses must be satisfied. A MS student’s program of study may include 6000-level prerequisite courses.

• Students pursuing the non-thesis track will substitute an additional 6 credit hours of Additional Approved Electives in place of the GRD 8000 Thesis house.

b. Thesis Proposal (thesis track only)

The thesis proposal provides the student with the opportunity to formally present his/her thesis proposal to the Graduate Committee. This proposal should be scheduled at least one semester prior to the semester in which the student plans to graduate. The proposal also allows for questioning by the Committee to clarify the objectives of the proposal, and allows for adjustment of objectives until agreement is reached between the student and the Graduate Committee.

The student will submit a written proposal to the graduate committee at least one week prior to the oral presentation. The format of the proposal shall conform to the University's Standard for Preparing Theses and Dissertations

The presentation shall consist of an oral presentation of the thesis proposal that is open to the student's graduate committee only. At this time, the student and his/her Committee may negotiate specific changes in the proposed work.

The written proposal should contain a literature review in the proposed research area, a clear thesis statement, a description of the significance of the proposed area to the field, a proposed procedure for the conduct of the research and publication plan. The acceptability of the proposal will be determined by the Committee.

c. Thesis (thesis track only)

As required by the Graduate School, all candidates for the PhD degree in Computational Biology must submit a thesis that exhibits mastery of the techniques of research and a distinct contribution to the field under investigation and study. The student’s graduate committee must approve the thesis topic, the outline, and both the initial and final submissions to the Library.
d. Thesis Defense/Final Examination

The final examination is an oral defense of the thesis that is open to the public. There is an open question period that is open to the public, and a closed question period open only to the candidate and the graduate committee. The examination will cover the research related to the thesis. The acceptability of the thesis will be determined by the graduate committee.

For non-thesis track students, the final examination will consist of a presentation on a class project or other research topic, followed by a question period covering the presentation and all graduate-level coursework.

6. Describe the faculty who will deliver this degree program including the members’ names, ranks, disciplines, current workloads, and specific courses they will teach within the program. If it will be necessary to add faculty in order to begin the program, give the desired qualifications of the persons to be added.

All of the faculty necessary to teach program courses, mentor students, and direct research are already present at MSU. The faculty below are expected to be available to advise students. All of these faculty are full-time instructional or research faculty at MSU. Some of the faculty will teach courses that are either required for or will be accepted as electives for the degree. In those cases, the relevant courses are listed.

<table>
<thead>
<tr>
<th>Name</th>
<th>Rank</th>
<th>Courses taught</th>
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<tbody>
<tr>
<td><strong>Biological Sciences</strong></td>
<td></td>
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</tr>
<tr>
<td>Matthew Brown</td>
<td>Assistant Professor</td>
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</tr>
<tr>
<td>Matthew Ballinger</td>
<td>Assistant Professor</td>
<td>BIO 6990 Evolution of Infectious Diseases</td>
</tr>
<tr>
<td>Brian Counterman</td>
<td>Associate Professor</td>
<td>GRD 8013 Applied Computational Biology</td>
</tr>
<tr>
<td>Amy Dapper</td>
<td>Assistant Professor</td>
<td>BIO 6113 Evolution</td>
</tr>
<tr>
<td>Angus Dawe</td>
<td>Professor and Head</td>
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<tr>
<td>Jean-Francois Gout</td>
<td>Assistant Professor</td>
<td>BIO 6143 Population Genetics</td>
</tr>
<tr>
<td>Heather Jordan</td>
<td>Assistant Professor</td>
<td>BIO 6990 Microbial Ecology</td>
</tr>
<tr>
<td>Ling Li</td>
<td>Assistant Professor</td>
<td>BIO 6990 Plant Data Resources</td>
</tr>
<tr>
<td>Mark Welch</td>
<td>Associate Professor</td>
<td>BIO 6113 Evolution</td>
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<tr>
<td><strong>Chemistry</strong></td>
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<tr>
<td>Nick Fitzkee</td>
<td>Associate Professor</td>
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<tr>
<td>Steven Gwaltney</td>
<td>Professor</td>
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<tr>
<td>Charles Webster</td>
<td>Professor</td>
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<tr>
<td><strong>Computer Science and Engineering</strong></td>
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<tr>
<td>Andy Perkins</td>
<td>Associate Professor</td>
<td>CSE 6623 Computational Biology</td>
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<tr>
<td>John Swan</td>
<td>Professor</td>
<td>CSE 8990 Visualization with R</td>
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<tr>
<td>TJ Jankun-Kelly</td>
<td>Associate Professor</td>
<td>CSE 8413 Visualization</td>
</tr>
<tr>
<td>Mahalingam Ramkumar</td>
<td>Associate Professor</td>
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<tr>
<td><strong>Agricultural and Biological Engineering</strong></td>
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<tr>
<td>Lauren Priddy</td>
<td>Assistant Professor</td>
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<tr>
<td>Raj Prabhu</td>
<td>Assistant Professor</td>
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<tr>
<td><strong>Electrical and Computer Engineering</strong></td>
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<tr>
<td>Name</td>
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<tr>
<td>Bo Tang</td>
<td>Assistant Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
</tr>
<tr>
<td>John Ball</td>
<td>Assistant Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
</tr>
<tr>
<td>Russell Carr</td>
<td>Associate Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
</tr>
<tr>
<td>Larry Hanson</td>
<td>Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
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<tr>
<td>Attila Karsi</td>
<td>Associate Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
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<tr>
<td>Mark Lawrence</td>
<td>Professor</td>
<td>Basic Sciences, College of Veterinary Medicine</td>
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<tr>
<td>Bindu Nanduri</td>
<td>Associate Professor</td>
<td>Clinical Sciences, College of Veterinary Medicine</td>
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<td>CVM 8993 Functional Genomics</td>
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<tr>
<td>Cyprianna Swiderski</td>
<td>Associate Professor</td>
<td>Clinical Sciences, College of Veterinary Medicine</td>
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<tr>
<td>Amelia Woolums</td>
<td>Professor</td>
<td>Pathobiology and Population Medicine, College of Veterinary Medicine</td>
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<tr>
<td></td>
<td></td>
<td>Pathobiology and Population Medicine, College of Veterinary Medicine</td>
</tr>
<tr>
<td>Daniel Peterson</td>
<td>Professor and Director</td>
<td>Institute for Genomics, Biocomputing and Biotechnology</td>
</tr>
<tr>
<td>George Popescu</td>
<td>Assistant Research Professor</td>
<td>Institute for Genomics, Biocomputing and Biotechnology</td>
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<td></td>
<td></td>
<td>BCH 8653 Genomes and Genomics</td>
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<td></td>
<td>BCH 8990 Systems Biology</td>
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<tr>
<td>Federico Hoffmann</td>
<td>Associate Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Jonas King</td>
<td>Assistant Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Jeffrey Dean</td>
<td>Professor and Head</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Shien Lu</td>
<td>Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Zhaohua Peng</td>
<td>Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Xueyan Shan</td>
<td>Assistant Research Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Sorina Popescu</td>
<td>Assistant Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Florencia Meyer</td>
<td>Associate Professor</td>
<td>Biochemistry, Molecular Biology, Entomology and Plant Pathology</td>
</tr>
<tr>
<td>Brian Baldwin</td>
<td>Professor</td>
<td>Plant and Soil Sciences</td>
</tr>
<tr>
<td>Te Ming Tseng</td>
<td>Assistant Professor</td>
<td>Plant and Soil Sciences</td>
</tr>
<tr>
<td>Richard Harkess</td>
<td>Professor</td>
<td>Plant and Soil Sciences</td>
</tr>
<tr>
<td>Kambham Reddy</td>
<td>Research Professor</td>
<td>Plant and Soil Sciences</td>
</tr>
<tr>
<td>Guihong Bi</td>
<td>Research Professor</td>
<td>Plant and Soil Sciences</td>
</tr>
<tr>
<td>Jamie Larson</td>
<td>Associate Professor</td>
<td>Animal and Dairy Sciences</td>
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<tr>
<td>Caleb Lemley</td>
<td>Assistant Professor</td>
<td>Animal and Dairy Sciences</td>
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<tr>
<td>Henry Paz Manzano</td>
<td>Assistant Professor</td>
<td>Animal and Dairy Sciences</td>
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<tr>
<td>Derris Devost-Burnett</td>
<td>Assistant Professor</td>
<td>Animal and Dairy Sciences</td>
</tr>
<tr>
<td>Pratima Adhikari</td>
<td>Assistant Professor</td>
<td>Poultry Science</td>
</tr>
</tbody>
</table>
7. Describe the library holdings relevant to the proposed program, noting strengths and weaknesses. If there are guidelines for the discipline, do current holdings meet or exceed standards?

The Mississippi State library has adequate holdings for the proposed program. In general, the academic community in the areas of computational biology and bioinformatics makes widespread use of open source repositories for software, data and tutorials, and open access journals and books, which means that there is a wealth of resources freely and readily available. Specifically, the MSSTATE library has access to the 10 top-ranked journals in the field of Mathematical and Computational Biology.

1. Bioinformatics (Open Access)
2. PLOS Computational Biology (Open Access)
3. BMC Bioinformatics (Open Access)
4. Briefings in Bioinformatics
5. Database: The Journal of Biological Databases & Curation (Open Access)
6. Journal of Theoretical Biology
7. BMC Systems Biology (Open Access)
8. GigaScience (Open Access)
9. IEEE/ACM Transactions on Computational Biology and Bioinformatics
10. Genomics, Proteomics & Bioinformatics (Open Access)

The MSU library has access to additional journals that are relevant in the field. In addition, our library has access to additional relevant resources through Ebsco Academic Search Complete, Scopus, and other databases available in the online portal of the library. Finally, students can get additional materials through interlibrary loans.

8. Describe the procedures for evaluation of the program and its effectiveness in the first six years of the program, including admission and retention rates, program outcome assessments, placement of graduates, changes in job market need/demand, exit student/graduate surveys, or other procedures.

Assessment methods:
Students will be expected to conduct research and present findings throughout their work in the graduate program. Students choosing the thesis track will also identify a thesis topic and carry out the research related to that topic. This work will be described in their thesis and presented at their thesis defense. Each student’s committee members will complete an evaluation form assessing the student’s effectiveness in their communication and research skills. Students choosing the coursework option will present a class or research project as part of their final examination, which will allow their committee to assess their proficiency in communication. Graduates will also be tracked after graduation to determine whether they were employed in research positions in computational biology. Exit surveys will be performed for all graduates to determine job placement at graduation. The graduate coordinator will track admission and retention rates, and changes in the job market need and demand nationally and within the state.
9. What is the specific basis for determining the number of graduates expected in the first six years?

It is estimated that approximately 25-50 faculty at Mississippi State University will participate in the program by serving as major professor for MS students. It is also expected that each faculty member will have approximately 1-2 students that will pursue this computational biology degree (including both thesis and non-thesis tracks), while they also direct students in other programs. This gives 25-50 students enrolled in the program at any time. A number of other students are likely to begin the degree before having selected a major professor. It will take approximately 2 years to for a student to finish the program if entering immediately after completing the baccalaureate. Upon instituting the program, some students will immediately transfer from programs such as biological sciences, molecular biology, and computer science, leading to a number of graduates during the first year of the program.
Additional Approved Electives (if not taken to fulfill other requirements):

BCH 6414 Protein Methods: 4 hours.
BCH 6713 Molecular Biology: 3 hours.
BCH 6804 Molecular Biology Methods: 4 hours.
BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BCH 8243 Molecular Biology of Plants: 3 hours.
BCH 8633 Enzymes: 3 hours.
BCH 8643 Molecular Genetics: 3 hours.
BCH 8653 Genomes and Genomics: 3 hours.
BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BIO 6133 Human Genetics: 3 hours.
BIO 6113 Evolution: 3 hours.
BIO 6143 Population Genetics: 3 hours.
BIO 6443 Bacterial Genetics: 3 hours.
BIO 6990 Special Topics in Biological Sciences: 1-9 hours.
CSE 6163 Designing Parallel Algorithms: 3 hours.
CSE 6214 Introduction to Software Engineering: 4 hours.
CSE 6503 Database Management Systems: 3 hours.
CSE 6633 Artificial Intelligence: 3 hours.
CSE 6753 Foundations in Computation: 3 hours.
CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
CSE 8413 Visualization: 3 hours.
CSE 8673 Machine Learning: 3 hours.
CSE 8813 Theory of Computation: 3 hours.
CSE 8833 Algorithms: 3 hours.
CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8303 Advanced Immunology: 3 hours.
CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
CVM 8503 Epidemiology/Biostatistics: 3 hours.
CVM 8990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8993 Functional Genomics: 3 hours.
ST 6243 Data Analysis I: 3 hours.
ST 6253 Data Analysis II: 3 hours.
ST 8214 Design and Analysis of Experiments: 4 hours.

Course Descriptions (required and elective courses)

BCH 6414 Protein Methods: 4 hours.
(Prerequisite: Coregistration in BCH 4603/6603). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of protein biochemistry.
BCH 6713 Molecular Biology: 3 hours.
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of basic molecular process such as synthesis of DNA, RNA, and protein in both prokaryotic and eukaryotic cells. Offered fall semester. (Same as GNS 6713)

BCH 6804 Molecular Biology Methods: 4 hours.
(Prerequisite: Coregistration in BCH 4613/6613). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of molecular biology. (Same as GNS 4804/6804)

BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BCH 8243 Molecular Biology of Plants: 3 hours.
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of plant development at the molecular level. Emphasis will be placed on the influence of nucleic acid metabolism on plant development

BCH 8633 Enzymes: 3 hours.
(Prerequisites: BCH 4613/6613). Three hours lecture. A study of enzymes; their purification, classification, kinetics and mechanisms

BCH 8643 Molecular Genetics: 3 hours.
(Prerequisites: PO 3103, or BIO 3103, and Coregistration in BCH 5613/7613). Three hours lecture. Study of the gene and its expression with emphasis on structure and function in higher organisms. (Same as GNS 8643)

BCH 8653 Genomes and Genomics: 3 hours.
(Prerequisites:BCH 4113/6113 or BCH 4713/6713 or BCH 8643 or consent of instructor). Overview of genome structure and evolution with emphasis on genomics, the use of molecular biology, robotics, and advanced computational methods to efficiently study genomes. (Same as PSS 8653)

BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BIO 6133 Human Genetics: 3 hours.
(Prerequisite: BIO 1134 and BIO 1144 or BIO 2113 or consent of instructor)Three hours lecture Principles of Mendelian and molecular genetics as applied to humans. Description and causes of human genetic diseases and other anomalies. (Same as GNS 4133/6133)
BIO 6113 Evolution: 3 hours.  
(Prerequisites: MA 1313 or equivalent, BIO 1134 and BIO 1144, BIO 3103 or BIO 4133).  
Historical development of evolutionary theory; phylogeny and systematic; historic or organic evolution; molecular and phenotypic variation in populations; genetic drift and natural selection; speciation

BIO 6143 Population Genetics: 3 hours.  
(Prerequisite: Both BIO 1134 and 1144, or BIO 2113, or consent of instructor. Three hours lecture. Study of the structure of genetic variation in populations and its applications in life sciences

BIO 6443 Bacterial Genetics: 3 hours.  
(Prerequisites: BCH 4603, BIO 3304 or consent of instructor). Three hours lecture. The genetics of bacteria and their viruses including: replication, rearrangement, repair, transfer, regulation, and methods of manipulation and analysis of DNA

BIO 6990 Special Topics in Biological Sciences: 1-9 hours.  
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CMB 8011 Graduate Seminar: 1 hour.  
This course serves as an introduction to the graduate program in computational biology and will introduce students to common methods and current research in bioinformatics and computational biology.

CMB 8013 Applied Computational Biology: 3 hours.  
This course focuses on the application of computational methods and tools to explore biological processes and diversity.

CSE 6163 Designing Parallel Algorithms: 3 hours.  
(Prerequisites: Grade of C or better in CSE 3324 or CSE 4733/6733). Three hours lecture. Techniques for designing algorithms to take advantage efficiently of different parallel architectures. Includes techniques for parallelizing sequential algorithms and techniques for matching algorithms to architectures

CSE 6214 Introduction to Software Engineering: 4 hours.  
(Prerequisite: CSE 2383 with a grade of C or better). Three hours lecture. Two hours laboratory. Introduction to software engineering; planning, requirements, analysis and specification, design; testing; debugging; maintenance; documentation. Alternative design methods, software metrics, software project management, reuse, and reengineering

CSE 6503 Database Management Systems: 3 hours.  
(Prerequisites: CSE 2383 and CSE 2813, both with a grade of C or better). Three hours lecture. Modern database models; basic database management concepts; query languages; database
design through normalization; advanced database models; extensive development experience in a team environment

CSE 6623 Computational Biology: 3 hours.
(Prerequisite:BCH 4113/6113 or equivalent and CSE 1384 or CSE 4613/6613 ). Three hours lecture. Computational analysis of gene sequences and protein structures on a large scale. Algorithms for sequence alignment, structural and functional genomics, comparative genomics, and current topics

CSE 6633 Artificial Intelligence: 3 hours.
(Prerequisite:Grade of C or better in CSE 2383 and CSE 2813) Three hours lecture. Study of the computer in context with human thought processes. Heuristic programming; search programming; search strategies; knowledge representation; natural language understanding; perception; learning

CSE 6753 Foundations in Computation: 3 hours.
(Prerequisite: CSE 1213 or CSE 1233 or CSE 1273 or CSE 1284 with a grade of C or better, or permission of instructor). Three hours lecture. Foundational concepts of computational algorithm design and analysis. (No credit for student in Computer Science, Computer Engineering, or Software Engineering degree programs)

CSE 6833 Introduction to Analysis of Algorithms: 3 hours.
(Prerequisites:CSE 2383, CSE 2813, and MA 2733 with a grade of C or better). Three hours lecture. Study of complexity of algorithms and algorithm design. Tools for analyzing efficiency; design of algorithms, including recurrence, divide-and-conquer, dynamic programming and greedy algorithms

CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
(Prerequisite:CSE 4163/6163). Three hours lecture. Algorithms for distributed scientific computing; performance evaluation; scheduling and load balancing issues for scientific applications; architectural issues affecting performance

CSE 8413 Visualization: 3 hours.
(Prerequisites:CSE 4413/6413). Three hours lecture. Essential algorithms for three-dimensional rendering and modeling techniques; viewing transformations, illumination, surface modeling; methodologies for visualization of scalar and vector fields in three dimensions

CSE 8673 Machine Learning: 3 hours.
(Prerequisite: CSE 4633/6633 ). Three hours lecture. Introduction to machine learning, including computational learning theory, major approaches to machine learning, evaluation of models, and current research
CSE 8813 Theory of Computation: 3 hours.
(Prerequisite: CSE 3813). Three hours lecture. Study of abstract models of computation, unsolvability, complexity theory, formal grammars and parsing, and other advanced topics in theoretical computer science.

CSE 8833 Algorithms: 3 hours.
(Prerequisites: CSE 4833/6833). Three hours lecture. Advanced techniques for designing and analyzing algorithms, advanced data structures, case studies, NP-completeness including reductions, approximation algorithms.

CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
(Prerequisite: CSE 4833/6833). Three hours lecture. Complexity of sequential algorithms, theory of complexity, parallel algorithms.

CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 8303 Advanced Immunology: 3 hours.
(Prerequisite: BIO 6413 or equivalent or consent from the instructor). Three hours lecture. Advanced theory and concepts of immunology, structure and function of immune mechanisms are discussed in detail.

CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
Three hours lecture. This course addresses basic principles of how the body reacts to the presence of a drug or toxin and the mathematical expression of drug residues.

CVM 8503 Epidemiology/Biostatistics: 3 hours.
(Prerequisite: ST 8114). Three hours lecture. Fundamental principles of descriptive and analytical epidemiology.

CVM 8990 Special Topics in Veterinary Medicine: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CVM 8993 Functional Genomics: 3 hours.
(Prerequisites: BCH 6713 Molecular Biology and ST 6243 Data analysis or consent of instructor). Three hours lecture. Fundamental concepts, technology, and applications of
functional genomics, such as microarray, yeast hybrid systems, and RNA inference, emphasizing experimental design, analysis, and applications in biomedical research

ST 6243 Data Analysis I: 3 hours.
(Prerequisite: MA 2743, Corequisite MA 3113). Three hours lecture. Data description and descriptive statistics, probability and probability descriptions, parametric one-sample and two-sample inference procedures, simple linear regression, one-way ANOVA. Use of SAS. (Same as MA 4243/6243)

ST 6253 Data Analysis II: 3 hours.
(Prerequisite: MA/ST 4243/6243 and MA 3113). Three hours lecture. Multiple linear regression fixed, mixed, and random effect models; block design; two-factor analysis of variance; three-factor analysis of variance; analysis of covariance. Use of SAS. (Same as MA 4253/6253)

ST 8114 Statistical Methods: 4 hours.
(Prerequisite: MA 1313). Three hours lecture. Two hours laboratory. Fall and Spring semesters. Descriptive statistics; sampling distributions; inferences for one and two populations; completely random, block, Latin square, split-plot designs; factorials; simple linear regression; chi-square tests

ST 8214 Design and Analysis of Experiments: 4 hours.
(Prerequisite: ST 8114) Three hours lecture. Three hours laboratory. Offered spring semester. Procedures in planning and analyzing experiments; simple, multiple, and curvilinear regression; factorial arrangement of treatments; confounding; fractional replication; block designs; lattices; split-plots
March 26, 2019

To Whom It May Concern,

It is my pleasure to write this letter of support for the development of a computational biology interdisciplinary graduate program. A core group of faculty (Drs. Perkins, Counterman, Hoffman, and Nanduri) across four colleges (Engineering, Arts & Sciences, College of Agriculture & Life Sciences, and the Vet School) have worked together to create a wonderful proposal for graduate students at the masters and doctoral level interested in working in computational biology. The degree will be housed in the Provost’s office with courses offered in the four colleges. Students will work with their major professor within the discipline itself (computer sciences, biological sciences, bio chemistry, or vet medicine) to work toward their degree plan.

Arts & Sciences is supportive of the development of this program. We look forward to working collaboratively with the Provost’s Office, College of Engineering, College of Agriculture and Life Sciences, and the Vet School to assist with oversight and also to help market the program to our students. Please let us know if you need additional information.

Sincerely,

Nicole E. Rader
Associate Dean for Academic Affairs,
College of Arts & Sciences
Professor, Sociology
Mississippi State University
March 22, 2019

RE: Proposed Interdisciplinary Computational Biology Program

To Whom it May Concern,

I am pleased to write this letter of support for the development of a multidisciplinary graduate degree program in Computational Biology. For a number of years we have run a successful NSF REU program in this area under the direction of Andy Perkins. The popularity of this effort, as well as internal desire of students to engage in this area of endeavor illustrates a need for an educational opportunity. The Bagley College of Engineering is supportive of the development of this program housed in the Office of the Provost. The college will work with the other units involved to promote the program and provide oversight of those aspects that are under the purview of the college. If there are any additional questions or if I need to clarify anything that I’ve stated, please do not hesitate to let me know.

Sincerely,

[Signature]

Kari Babski-Reeves
Associate Dean for Research and Graduate Studies
IRB Chair
March 27, 2019

To Whom It May Concern:

The College of Agriculture & Life Sciences fully supports the development of a multidisciplinary graduate degree program in computational biology. We look forward to collaborating with the Provost’s Office and participating colleges to oversee and promote the program.

Sincerely,

Emily E. Shaw
Director of Undergraduate & Graduate Academic Advising
College of Agriculture & Life Sciences
March 26, 2019

To Whom it May Concern,

The College of Veterinary Medicine fully supports the development of multidisciplinary graduate degree program in computational biology. We appreciate the effort and dedication required to create this curriculum and are confident in its success. We look forward to collaborating with the Provost’s Office and participating colleges to oversee and promote the program.

Sincerely,

Ron McLaughlin
Associate Dean for Administration
Professor of Surgery
College of Veterinary Medicine
NOTE: This form is a cover sheet that must accompany the degree program change proposal. The actual proposal should be prepared in accordance with format requirements provided in the Guide and Format for Curriculum Proposals published by the UCCC. Both cover sheet and proposal should be submitted to UCCC Mail Stop 9702 (281 Garner Hall), Phone: 325-9410.

College: Office of Academic Affairs  Department: 

Contact Person: Peter Ryan  Mail Stop: 9723  E-mail: ryan@provost.msstate.edu 
Nature of Change: Minor addition  Date Initiated: 3/5/19  Effective Date: Spring 2020 
Current Degree Program Name:  

Major:  Concentration:  

New Degree Program Name: Graduate Minor 
Major: Computational Biology  Concentration:  

Summary of Proposed Changes: 
The Office of Academic Affairs, in collaboration with the College of Arts & Sciences, Bagley College of Engineering, College of Agriculture and Life Sciences, and College of Veterinary Medicine proposes a new interdisciplinary graduate program in computational biology. Students will be prepared to pursue research positions in academia, government, and industry. Students will complete rigorous preparation in computer science, the life sciences, and statistics, and work with faculty from across campus on research at the intersection of these areas. This program will build upon the significant computational biology work currently being done at Mississippi State and will leverage resources already available in terms of faculty, classes, and facilities.
Approved:

[Signature]
Department Head

[Signature]
Chair, College or School Curriculum Committee

[Signature]
Dean of College or School

[Signature]
Chair, University Committee on Courses and Curricula

[Signature]
Chair, Graduate Council (if applicable)

[Signature]
Chair, Deans Council

Date:

4/9/2019

April 12, 2019
NEW GRADUATE DEGREE OUTLINE FORM

Use the chart below to indicate your new degree outline. Please list required College and Major Required Courses and if appropriate Concentration Courses. Graduate programs that wish to specialize beyond the Major must have at least two concentrations. Add additional rows as needed for programs with more than two concentrations. Expand rows as needed.

<table>
<thead>
<tr>
<th>Proposed New Degree</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree: Graduate minor</td>
<td></td>
</tr>
<tr>
<td>Major: Computational Biology</td>
<td></td>
</tr>
<tr>
<td>Graduate study leading to a minor in the area of computational biology. This interdisciplinary graduate minor provides a solid basis in computational approaches and biological knowledge. Courses are drawn from various colleges to provide a broad perspective.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Proposed Curriculum Outline</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Required Courses:</td>
<td></td>
</tr>
<tr>
<td>CMB 8013 Applied Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>Computing:</td>
<td></td>
</tr>
<tr>
<td>CSE 6623 Computational Biology</td>
<td>3</td>
</tr>
<tr>
<td>CSE 6833 Introduction to Algorithms</td>
<td>3</td>
</tr>
<tr>
<td>Statistics:</td>
<td></td>
</tr>
<tr>
<td>ST 8114 Statistical Methods</td>
<td>3</td>
</tr>
<tr>
<td>Life Sciences (select one from below):</td>
<td>3</td>
</tr>
<tr>
<td>BCH 6713 Molecular Biology</td>
<td></td>
</tr>
<tr>
<td>BCH 8653 Genomes and Genomics</td>
<td></td>
</tr>
<tr>
<td>BIO 6113 Evolution</td>
<td></td>
</tr>
<tr>
<td>BIO 6143 Population Genetics</td>
<td></td>
</tr>
<tr>
<td>Additional approved elective</td>
<td>3</td>
</tr>
<tr>
<td>Total Hours</td>
<td>18</td>
</tr>
</tbody>
</table>

- At least 9 credit hours of GPA-graded coursework must be taken at the 8000-level or higher.
- Graduate courses completed as part of a master’s degree or graduate courses completed prior to entry into the MS or PhD program may, when approved by the student’s graduate committee, be applied to the minor requirements. The committee’s decision will be documented by an “Attachment Sheet for Program of Study” form. The program of study will cover remaining coursework requirements.
- A student who has taken any of the above courses for undergraduate credit may use the undergraduate course to meet the graduate requirement and substitute another graduate-level course approved by the student’s graduate committee.

Prerequisites

<table>
<thead>
<tr>
<th>Prerequisites</th>
<th>Required Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSE 2183 Discrete Structures</td>
<td>3</td>
</tr>
<tr>
<td>CSE 2583 Data Structures*</td>
<td>3</td>
</tr>
</tbody>
</table>

*This requirement can be satisfied by completing CSE 6753 Fundamentals of Computing with a grade of B or higher.

All undergraduate prerequisite courses listed must be satisfied. A PhD student’s program of study may include
6000-level prerequisite courses,

1. Curriculum Outline

   One new course will be necessary, and a proposal has been submitted as part of the MS/PhD program in computational biology.

   CMB 8013 Applied Computational Biology

2. Student learning outcomes and assessment

   a. Graduates will be prepared to apply computational biology and bioinformatics tools and techniques to answer research questions in biology, molecular biology, computer science, veterinary medicine, and other related areas.

   b. Graduates will be able to communicate effectively through scientific presentations and papers with a diverse audience of their peers in biology, molecular biology, computer science, veterinary medicine, and other areas of the computational and life sciences.

   Students will complete a minor exam in which their graduate committee members will ensure proper knowledge of bioinformatics tools and techniques. As part of this exam, students will give a presentation on a class project or research topic from which the committee can assess their proficiency in communication. Students will also participate in team projects and give presentations as part of the required coursework.

3. Support

   A letter of support from the associate deans of colleges involved in the degree program is attached.

4. Proposed 4-letter abbreviation

   COMB

5. Effective date:

   Spring 2020
Additional Approved Electives (if not taken to fulfill other requirements):

BCH 6414 Protein Methods: 4 hours.
BCH 6713 Molecular Biology: 3 hours.
BCH 6804 Molecular Biology Methods: 4 hours.
BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BCH 8243 Molecular Biology of Plants: 3 hours.
BCH 8633 Enzymes: 3 hours.
BCH 8643 Molecular Genetics: 3 hours.
BCH 8653 Genomes and Genomics: 3 hours.
BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.
BIO 6133 Human Genetics: 3 hours.
BIO 6113 Evolution: 3 hours.
BIO 6143 Population Genetics: 3 hours.
BIO 6443 Bacterial Genetics: 3 hours.
BIO 6990 Special Topics in Biological Sciences: 1-9 hours.
CSE 6163 Designing Parallel Algorithms: 3 hours.
CSE 6214 Introduction to Software Engineering: 4 hours.
CSE 6503 Database Management Systems: 3 hours.
CSE 6633 Artificial Intelligence: 3 hours.
CSE 6753 Foundations in Computation: 3 hours.
CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
CSE 8413 Visualization: 3 hours.
CSE 8673 Machine Learning: 3 hours.
CSE 8813 Theory of Computation: 3 hours.
CSE 8833 Algorithms: 3 hours.
CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8303 Advanced Immunology: 3 hours.
CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
CVM 8503 Epidemiology/Biostatistics: 3 hours.
CVM 8990 Special Topics in Veterinary Medicine: 1-9 hours.
CVM 8993 Functional Genomics: 3 hours.
ST 6243 Data Analysis I: 3 hours.
ST 6253 Data Analysis II: 3 hours.
ST 8214 Design and Analysis of Experiments: 4 hours.

Course Descriptions (required and elective courses)

BCH 6414 Protein Methods: 4 hours.
(Prerequisite: Coregistration in BCH 4603/6603). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of protein biochemistry
BCH 6713 Molecular Biology: 3 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of basic molecular process such as synthesis of DNA, RNA, and protein in both prokaryotic and eukaryotic cells. Offered fall semester. (Same as GNS 6713)

BCH 6804 Molecular Biology Methods: 4 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Two hours lecture. Four hours laboratory. A comprehensive course to teach the student the modern methods of molecular biology. (Same as GNS 4804/6804)

BCH 6990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.  
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BCH 8243 Molecular Biology of Plants: 3 hours.  
(Prerequisite: Coregistration in BCH 4613/6613). Three hours lecture. A study of plant development at the molecular level. Emphasis will be placed on the influence of nucleic acid metabolism on plant development

BCH 8633 Enzymes: 3 hours.  
(Prerequisites: BCH 4613/6613). Three hours lecture. A study of enzymes; their purification, classification, kinetics and mechanisms

BCH 8643 Molecular Genetics: 3 hours.  
(Prerequisites: PO 3103, or BIO 3103, and Coregistration in BCH 5613/7613). Three hours lecture. Study of the gene and its expression with emphasis on structure and function in higher organisms. (Same as GNS 8643)

BCH 8653 Genomes and Genomics: 3 hours.  
(Prerequisites: BCH 4113/6113 or BCH 4713/6713 or BCH 8643 or consent of instructor). Overview of genome structure and evolution with emphasis on genomics, the use of molecular biology, robotics, and advanced computational methods to efficiently study genomes. (Same as PSS 8653)

BCH 8990 Special Topics in Biochemistry, Molecular Biology, Entomology and Plant Pathology: 1-9 hours.  
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

BIO 6133 Human Genetics: 3 hours.  
(Prerequisite: BIO 1134 and BIO 1144 or BIO 2113 or consent of instructor)Three hours lecture Principles of Mendelian and molecular genetics as applied to humans. Description and causes of human genetic diseases and other anomalies. (Same as GNS 4133/6133)
BIO 6113 Evolution: 3 hours.
(Prerequisites: MA 1313 or equivalent, BIO 1134 and BIO 1144, BIO 3103 or BIO 4133). Historical development of evolutionary theory; phylogeny and systematic; historic or organic evolution; molecular and phenotypic variation in populations; genetic drift and natural selection; speciation

BIO 6143 Population Genetics: 3 hours.
(Prerequisite: Both BIO 1134 and 1144, or BIO 2113, or consent of instructor. Three hours lecture. Study of the structure of genetic variation in populations and its applications in life sciences

BIO 6443 Bacterial Genetics: 3 hours.
(Prerequisites: BCH 4603, BIO 3304 or consent of instructor). Three hours lecture. The genetics of bacteria and their viruses including: replication, rearrangement, repair, transfer, regulation, and methods of manipulation and analysis of DNA

BIO 6990 Special Topics in Biological Sciences: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CMB 8011 Graduate Seminar: 1 hour.
This course serves as an introduction to the graduate program in computational biology and will introduce students to common methods and current research in bioinformatics and computational biology.

CMB 8013 Applied Computational Biology: 3 hours.
This course focuses on the application of computational methods and tools to explore biological processes and diversity.

CSE 6163 Designing Parallel Algorithms: 3 hours.
(Prerequisites: Grade of C or better in CSE 3324 or CSE 4733/6733). Three hours lecture. Techniques for designing algorithms to take advantage efficiently of different parallel architectures. Includes techniques for parallelizing sequential algorithms and techniques for matching algorithms to architectures

CSE 6214 Introduction to Software Engineering: 4 hours.
(Prerequisite: CSE 2383 with a grade of C or better). Three hours lecture. Two hours laboratory. Introduction to software engineering; planning, requirements, analysis and specification, design; testing; debugging; maintenance; documentation. Alternative design methods, software metrics, software project management, reuse, and reengineering

CSE 6503 Database Management Systems: 3 hours.
(Prerequisites: CSE 2383 and CSE 2813, both with a grade of C or better). Three hours lecture. Modern database models; basic database management concepts; query languages; database
design through normalization; advanced database models; extensive development experience in a team environment.

CSE 6623 Computational Biology: 3 hours.
(Prerequisite: BCH 4113/6113 or equivalent and CSE 1384 or CSE 4613/6613). Three hours lecture. Computational analysis of gene sequences and protein structures on a large scale. Algorithms for sequence alignment, structural and functional genomics, comparative genomics, and current topics.

CSE 6633 Artificial Intelligence: 3 hours.
(Prerequisite: Grade of C or better in CSE 2383 and CSE 2813) Three hours lecture. Study of the computer in context with human thought processes. Heuristic programming; search programming; search strategies; knowledge representation; natural language understanding; perception; learning.

CSE 6753 Foundations in Computation: 3 hours.
(Prerequisite: CSE 1213 or CSE 1233 or CSE 1273 or CSE 1284 with a grade of C or better, or permission of instructor). Three hours lecture. Foundational concepts of computational algorithm design and analysis. (No credit for student in Computer Science, Computer Engineering, or Software Engineering degree programs)

CSE 6833 Introduction to Analysis of Algorithms: 3 hours.
(Prerequisites: CSE 2383, CSE 2813, and MA 2733 with a grade of C or better). Three hours lecture. Study of complexity of algorithms and algorithm design. Tools for analyzing efficiency; design of algorithms, including recurrence, divide-and-conquer, dynamic programming and greedy algorithms.

CSE 6990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing subject matter areas not covered in existing courses. (Courses limited to two offerings under one title within two academic years)

CSE 8163 Parallel and Distributed Scientific Computing: 3 hours.
(Prerequisite: CSE 4163/6163). Three hours lecture. Algorithms for distributed scientific computing; performance evaluation; scheduling and load balancing issues for scientific applications; architectural issues affecting performance.

CSE 8413 Visualization: 3 hours.
(Prerequisites: CSE 4413/6413). Three hours lecture. Essential algorithms for three-dimensional rendering and modeling techniques; viewing transformations, illumination, surface modeling; methodologies for visualization of scalar and vector fields in three dimensions.

CSE 8673 Machine Learning: 3 hours.
(Prerequisite: CSE 4633/6633). Three hours lecture. Introduction to machine learning, including computational learning theory, major approaches to machine learning, evaluation of models, and current research.
CSE 8813 Theory of Computation: 3 hours.
(Prerequisite: CSE 3813). Three hours lecture. Study of abstract models of
computation, unsolvability, complexity theory, formal grammars and parsing, and other advanced
topics in theoretical computer science

CSE 8833 Algorithms: 3 hours.
(Prerequisites: CSE 4833/6833). Three hours lecture. Advanced techniques for designing and
analyzing algorithms, advanced data structures, case studies, NP-completeness including
reductions, approximation algorithms

CSE 8843 Complexity of Sequential and Parallel Algorithms: 3 hours.
(Prerequisite: CSE 4833/6833). Three hours lecture. Complexity of sequential algorithms, theory
of complexity, parallel algorithms

CSE 8990 Special Topics in Computer Science and Engineering: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing
subject matter areas not covered in existing courses. (Courses limited to two offerings under one
title within two academic years)

CVM 6990 Special Topics in Veterinary Medicine: 1-9 hours.
Credit and title to be arranged. This course is to be used on a limited basis to offer developing
subject matter areas not covered in existing courses. (Courses limited to two offerings under one
title within two academic years)

CVM 8303 Advanced Immunology: 3 hours.
(Prerequisite: BIO 6413 or equivalent or consent from the instructor). Three hours lecture.
Advanced theory and concepts of immunology, structure and function of immune mechanisms
are discussed in detail

CVM 8403 Principles of Pharmacology and Pharmacokinetics: 3 hours.
Three hours lecture. This course addresses basic principles of how the body reacts to the
presence of a drug or toxin and the mathematical expression of drug residues

CVM 8503 Epidemiology/Biostatistics: 3 hours.
(Prerequisite: ST 8114) Three hours lecture. Fundamental principles of descriptive and analytical
epidemiology

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CVM 8993 Functional Genomics: 3 hours.
(Prerequisites: BCH 6713 Molecular Biology and ST 6243 Data analysis or consent of
instructor). Three hours lecture. Fundamental concepts, technology, and applications of
functional genomics, such as microarray, yeast hybrid systems, and RNA inference, emphasizing experimental design, analysis, and applications in biomedical research

ST 6243 Data Analysis I: 3 hours.
(Prerequisite: MA 2743, Corequisite MA 3113). Three hours lecture. Data description and descriptive statistics, probability and probability descriptions, parametric one-sample and two-sample inference procedures, simple linear regression, one-way ANOVA. Use of SAS. (Same as MA 4243/6243)

ST 6253 Data Analysis II: 3 hours.
(Prerequisite: MA/ST 4243/6243 and MA 3113). Three hours lecture. Multiple linear regression fixed, mixed, and random effect models; block design; two-factor analysis of variance; three-factor analysis of variance; analysis of covariance. Use of SAS. (Same as MA 4253/6253)

ST 8114 Statistical Methods: 4 hours.
(Prerequisite: MA 1313). Three hours lecture. Two hours laboratory. Fall and Spring semesters. Descriptive statistics; sampling distributions; inferences for one and two populations; completely random, block, Latin square, split-plot designs; factorials; simple linear regression; chi-square tests

ST 8214 Design and Analysis of Experiments: 4 hours.
(Prerequisite: ST 8114) Three hours lecture. Three hours laboratory. Offered spring semester. Procedures in planning and analyzing experiments; simple, multiple, and curvilinear regression; factorial arrangement of treatments; confounding; fractional replication; block designs; lattices; split-plots
March 26, 2019

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It is my pleasure to write this letter of support for the development of a computational biology interdisciplinary graduate program. A core group of faculty (Drs. Perkins, Counterman, Hoffman, and Nanduri) across four colleges (Engineering, Arts & Sciences, College of Agriculture & Life Sciences, and the Vet School) have worked together to create a wonderful proposal for graduate students at the masters and doctoral level interested in working in computational biology. The degree will be housed in the Provost’s office with courses offered in the four colleges. Students will work with their major professor within the discipline itself (computer sciences, biological sciences, bio chemistry, or vet medicine) to work toward their degree plan.

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Professor, Sociology
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Associate Dean for Research and Graduate Studies  
IRB Chair
March 27, 2019

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Director of Undergraduate & Graduate Academic Advising
College of Agriculture & Life Sciences
March 26, 2019

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Sincerely,

Ron McLaughlin
Associate Dean for Administration
Professor of Surgery
College of Veterinary Medicine