Academic Program Review
Self-Study Document
September 2015

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Executive Summary

PEER REVIEW TEAM CHARGE
Please examine the department and its programs and make recommendations that will help in planning improvements. Your resources are a self-study report prepared by the department, copies of materials from the program’s last review, information you gain through personal interactions while visiting Texas A&M University, copies of strategic plans and goal-setting documents at the department, college, and/or university level, and any additional information requested by you or by the department. Within the broad charge of recommending ways the department can continue to improve are some specific questions that we would like you to address:

- Based on the data / information provided in the self-study report or gathered by the review team, what are the department’s overall strengths and weaknesses?
- How well do the department’s strategic goals align with those of its college and with those of Texas A&M University?
- How would you compare this department with its peers?
- What improvements (including student learning and faculty development) has the department made since the previous program review?
- With only current resources or a modest infusion of new ones, what specific recommendations could improve the department’s performance, marginally or significantly?

OVERVIEW OF THE PROGRAM
The Department of Biology at Texas A&M University is in the College of Science, along with departments of Chemistry, Physics and Astronomy, Mathematics, and Statistics. Biology currently has 40 tenured and tenure-track faculty members, whose large teaching role is complemented by 12 non-tenure track lecturers, senior lecturers and instructional assistant professors. We offer undergraduate degrees in biology, microbiology, molecular and cell biology, and zoology to more than 1,500 majors, and we offer Ph.D. programs in biology and microbiology for approximately 100 graduate students (Table 1).

Research in the department spans the breadth of biology, from ecology and evolution to molecular, cellular, and developmental biology, and our research is supported by a wide array of funding sources. Many departmental faculty members actively participate in campus-wide interdepartmental graduate and research programs, including Genetics, Neuroscience, Molecular and Environmental Plant Sciences, and the newly formed faculty of Ecology, Evolution, and Behavioral Biology.

Table 1

<table>
<thead>
<tr>
<th>Degree Offered</th>
<th>2009-2010</th>
<th>2010-2011</th>
<th>2011-2012</th>
<th>2012-2013</th>
<th>2013-2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.A.</td>
<td>31</td>
<td>16</td>
<td>28</td>
<td>30</td>
<td>31</td>
</tr>
<tr>
<td>B.S.</td>
<td>267</td>
<td>311</td>
<td>310</td>
<td>273</td>
<td>266</td>
</tr>
<tr>
<td>M.S.</td>
<td>5</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Ph.D.</td>
<td>7</td>
<td>9</td>
<td>14</td>
<td>16</td>
<td>14</td>
</tr>
<tr>
<td>Totals</td>
<td>310</td>
<td>342</td>
<td>357</td>
<td>323</td>
<td>315</td>
</tr>
</tbody>
</table>
OVERVIEW OF THE SELF STUDY

The Department of Biology at Texas A&M University offers five distinct undergraduate curricula for over 1,500 undergraduate majors and two distinct Ph.D. programs for our 100 graduate students. We have the 3rd highest number of majors on campus, and we teach the 4th highest number of students of any department. To put our teaching program in perspective, our department teaches over one-fourth of what the entire College of Agriculture and Life Sciences teaches. Our teaching budget does not fully cover these obligations, and for the past two years, we have had to partially fund our teaching mission with approximately $500,000 from indirect costs funds generated by grants to our faculty. We have a core of 38 tenured and tenure-track faculty members who are responsible for teaching nearly all of our upper-division courses and our graduate courses, and who provide meaningful research experiences for our majors in their laboratories. This gives us a student:faculty ratio of 42:1, which presents additional challenges. To continue to excel in our teaching mission will require additional teaching funds and faculty positions.

Our overall research activity places us in the 65th percentile of biology departments at all land grant universities, but we do not fare as well when compared to our aspirant peers, which are departments of biology in land grant schools in the American Association of Universities. Again, our small size relative to these peer departments and the breadth of life sciences we cover is not conducive to the development of core groups of researchers who can share ideas and resources, and use the resultant synergies to build a strong national reputation. New faculty positions would not only help us meet our obligations to the students, they would also allow us to improve our research productivity.

Our department’s students and faculty survived major budget cuts during 2010-12 without too much damage, but we did lose five and a half staff positions then. The duties of most of those positions have been assumed by remaining staff members, who already had their own full-time jobs. None of these positions have been re-filled.

The Department of Biology recently adopted a strategic plan to help us grow and improve. Many of the specific goals of that plan are directed toward improving our research enterprise, but we also have major goals for enhancing education at both graduate and undergraduate levels. Many of the strategies we are pursuing to achieve these goals were intentionally designed to require minimal additional resources from the university or our college. However, plans to use departmental resources to improve our research capabilities have been set back by the increasing need to use indirect costs generated by our research program to support our teaching.

Dr. H. Joseph Newton, dean of the College of Science for the past 15 years, will step down from that position soon. Joe’s leadership and support for the Department of Biology has been indispensable through good times, and even more so during challenging times. Our new dean, Dr. Meigan Aronson, will officially take over on October 1, 2015, and we look forward to working with her to achieve the goals and aspirations outlined here.
Introduction to Department

BRIEF HISTORY
The Agricultural and Mechanical College of Texas first opened its doors on October 4, 1876. A Department of Biology did not exist at that time. Instead, the original 107 students enrolled in a four-year curriculum that began with courses in botany and natural history for freshmen. Upper-level courses included chemistry, farm tillage, horticulture, arboriculture, and care of stock. In the 1890s, an introductory course in zoology was added to the freshmen curriculum, and upper-level courses were offered in comparative physiology and comparative anatomy.

The Department of Biology emerged in the early 1900s, after a short duration as the Department of Botany and Zoology. Over the next several decades a graduate program developed, and by 1930, seventy-two graduate students were among the 2,790 students enrolled at A&M. During these formative years of the biology graduate curriculum, courses included cytology, plant morphology, plant physiology, advanced vertebrate anatomy, and advanced bacteriology.

Departmental faculty in 1940 consisted of eleven people: four professors, two associate professors, two assistant professors, and three instructors, all but two holding doctoral degrees. Following World War II, as the student body rapidly grew, the Department of Biology faculty also expanded to twenty-one people by 1947. At this time, we offered four graduate courses in botany, six in zoology, and one in bacteriology. Biochemistry also first appeared as part of the biology curriculum.

By the 1950s, the Department of Biology occupied part of what is now the Biological Sciences Building East (BSBE). The adjoining Biological Sciences Building West (BSBW) was completed in 1966. Until the 1990s, much of the space in these buildings was occupied by other departments, including Entomology, Wildlife Sciences, and Biochemistry. BSBE was renovated in the 1980's, as were parts of BSBW. Today, all of BSBE and BSBW are occupied by biology offices and laboratories. In addition, four biology faculty members are located near BSBE and BSBW in Butler Hall (built in 1917), and six more faculty members are located in the Interdisciplinary Life Sciences Building (built in 2010), which is several hundred yards from the other biology buildings.

From the mid-1960's to the mid-1980s, the student body at Texas A&M University grew from 12,000 to 35,000, and biology enrollment grew concomitantly. During this time, the major emphasis in the department was our teaching mission, which focused on a large population of pre-med majors and service courses for agriculture students and others who were required to take two science courses as part of their general education.

In the mid-1980's, Texas A&M University decided on a new path to excellence that placed a major emphasis on research and new faculty recruitment. Dr. Timothy Hall was recruited from the University of Wisconsin and the biotechnology industry to direct this massive undertaking (see Table 2). The Department of Biology embraced this opportunity and made significant strides in the enhancement of its graduate and research training programs, with particular focus on areas that included plant biotechnology, microbial genetics, and cellular and developmental biology of plants and animals. Coincident with the increased emphasis on research, funding for
research activities from state, federal, and industrial sources increased dramatically. Unfortunately, faculty and graduate student numbers declined throughout 1990s, due to retirements, faculty taking prestigious positions elsewhere and other forms of attrition, to just 28 tenured and tenure-track professors in 2002, although per capita research productivity and extramural funding remained strong.

Table 2

<table>
<thead>
<tr>
<th>Department Heads Since 1980</th>
<th>Years of Service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helmut W. Sauer</td>
<td>1981-1983</td>
</tr>
<tr>
<td>Walter M. Kemp (Acting)</td>
<td>1983-1984</td>
</tr>
<tr>
<td>Timothy C. Hall</td>
<td>1984-1992</td>
</tr>
<tr>
<td>Terry L. Thomas (Interim)</td>
<td>1992-1994</td>
</tr>
<tr>
<td>Terry L. Thomas</td>
<td>1994-2002</td>
</tr>
<tr>
<td>Vincent M. Cassone (Interim)</td>
<td>2002-2003</td>
</tr>
<tr>
<td>Vincent M. Cassone</td>
<td>2003-2008</td>
</tr>
<tr>
<td>Uel Jackson McMahan</td>
<td>2008-2012</td>
</tr>
<tr>
<td>Thomas D. McKnight (Interim)</td>
<td>2013-2014</td>
</tr>
<tr>
<td>Thomas D. McKnight</td>
<td>2014 - Present</td>
</tr>
</tbody>
</table>

Two major events conspired to improve the Department of Biology’s fortunes in 2002. First, President Robert Gates recognized similar tremendous losses of faculty across campus, and he implemented his Faculty Reinvestment Plan to hire 450 new faculty members within 4 years. This plan was designed to help achieve the goals of Vision 2020, the university’s long-term strategic plan. The Department of Biology embarked on an aggressive round of faculty hiring. Second, since the hiring of new faculty would necessarily increase pressure for quality research space, Biology and many departments in the Colleges of Agriculture and Life Sciences, Engineering, Liberal Arts, and Science were demanding consideration for occupancy in the planned Interdisciplinary Life Sciences Building (ILSB). Recognizing that even the entire ILSB could not completely accommodate our entire education and research missions, the Department of Biology proposed an alternative to the university to enable its expansion. Our plan entailed renovation of moribund teaching and research space in historic Butler Hall to house the departmental administrative, advising, and business services offices, as well as several research laboratories. This move also allowed for significant renovation in BSBE and BSBW. As a consequence of strong leadership provided by President Gates, Dean Joseph Newton, and Biology Department Head Vincent Cassone, the Department of Biology hired 14 assistant professors and three full professors during the Faculty Reinvestment Plan from 2003 to 2007.

Dr. U. J. (Jack) McMahan replaced Dr. Cassone as department head in December of 2008, shortly after our department’s last external review, and he served in this capacity until December of 2012. During much of this time, the university and the department were subject to several rounds of budget cuts. Under Dr. McMahan’s leadership, we were able to weather these cuts without too much damage to our faculty or students, although we did have to release two non-tenure-track lecturers. The Biology Department staff was not as fortunate. We permanently lost five full-time staff positions, and one full-time position was moved to half-time. Duties of these positions were assumed by other staff members who already had their own full-time jobs. Although the worst of the budget cuts are behind us, we are increasingly forced to use departmental research funds to support our teaching program.
Dr. Joseph Newton, who has served as dean of the College of Science for the past 15 years, will step down from that position on September 30, 2015. His leadership and support for the Department of Biology was indispensable through the heady days of the Faculty Reinvestment Plan, and even more so during the budget crises and other challenging times. We are looking forward to working with our new dean, Dr. Meigan Aronson, to help us achieve the goals and aspirations discussed in this document.

The Department of Biology was last reviewed in April, 2008. A summary of recommendations from that review, the department’s response to those recommendations, and the current status of our implementation of those responses are presented in Appendix A.

This brief history of Biology at Texas A&M University was adapted from departmental histories written by Dr. Larry Dillon and Dr. William Fife, former members of the Biology faculty, and updated for this review.

MISSION AND GOALS

VISION: The Department of Biology at Texas A&M University seeks to be an international leader in biological research and education, and a flagship for the life sciences at Texas A&M University and the State of Texas. Many of the grand challenges in science, including human health, energy supplies, and conservation of our environment, are deeply ingrained in basic biological research. A key strength of our department lies in its broad scope of fundamental research in the life sciences, from molecular and cellular biology, to organismal development and neurobiology, to the ecology and evolution of populations. We will build upon these strengths to provide excellent educational opportunities, recruit outstanding faculty, postdoctoral scientists, and graduate students, and through our research, impact the grand challenges in science.

MISSION: The Department of Biology conducts and disseminates innovative scientific research that is both disciplinary and transdisciplinary, provides service to the community, trains outstanding doctoral-level research scientists, and provides a high-impact undergraduate education that prepares students for life-long learning through the development of critical thinking skills, research experiences, and a broad intellectual perspective. Our students will be well prepared to further their education in graduate and professional schools or to pursue careers in biology, biotechnology, or health related fields.

GOALS: Specific goals of the Department of Biology are briefly listed below and detailed in our strategic plan, which is attached as Appendix B. All of our goals align with the first three imperatives of the university’s strategic plan, Vision 2020 (Appendix C). Those imperatives are (1) elevating our faculty and their teaching, research and scholarship, (2) strengthening our graduate programs, and (3) enhancing the undergraduate academic experience.

Goal 1: Recruit, retain, and develop excellent faculty
Goal 2: Increase extramural research funding
Goal 3: Increase the number and impact of publications
Goal 4: Improve our research infrastructure
Goal 5: Enhance the visibility of faculty’s contributions and accomplishments
Goal 6: Develop and promote an internationally-recognized doctoral graduate program
Goal 7: Enhance the undergraduate academic experience for our departmental majors
ADMINISTRATIVE STRUCTURE

As detailed in our organizational chart (Figure 1) the departmental administration consists of the department head, an associate head for operations, an associate head for academic affairs, a graduate advisor, the director of lower-division instruction, and the director of our undergraduate advising office. The department head, Dr. Thomas McKnight, oversees all administrative, organizational, research, teaching and service functions of the department. Ms. Lieu Jean is assistant to the department head, and because of budget cuts in the last few years, she also serves as assistant to both associate department heads.

Mr. Will Bailey is our academic business administrator. He is responsible for details of the departmental budget, and like Ms. Jean, he too has taken on additional responsibilities due to loss of staff during the budget cuts. He is now our departmental liaison to Human Resources, and he is involved in every hire the department makes. He has become the direct supervisor of the departmental office staff and several other departmental employees.

The associate head for operations, Dr. Deborah Bell-Pedersen, serves as head when he is not available. Additional duties for her position include chairing the department’s annual review and post-tenure review committee, overseeing the tenure and promotion process, implementing and expanding our faculty mentoring program, chairing our awards committee, advising the head on budgetary and operational matters, and developing opportunities for interactions between the Department of Biology and other units on campus.

The associate head for academic affairs, Dr. Wayne Versaw, is responsible for developing and implementing our teaching schedule each semester, coordinating hiring of lecturers and laboratory instructors with the director of lower-division instruction, and serving ex-officio on the undergraduate program committee, which is responsible for developing and implementing all five of our undergraduate curricula. He also works with our large undergraduate advising office and performs various other functions related to the academic affairs of the department, such as mediating grade disputes and student complaints.

Our graduate advisor, Dr. Arne Lekven, serves on the graduate recruiting and admissions committee and the graduate curriculum committee. He works with the associate head for academic affairs and the director of lower division instruction to assign graduate teaching assistants for our large courses, and he is responsible for overseeing the progress toward graduation for our Ph.D. students. Dr. Lekven is very capably assisted by Ms. Jennifer Bradford, our graduate program coordinator.

These four faculty administrators, along with four other senior professors and Ms. Jean and Mr. Bailey, constitute the department’s executive committee. This committee acts as a sounding board for the department head and as a clearing house for agenda items that will be discussed at our monthly faculty meetings.

Dr. Ira Greenbaum serves as director of our lower-division program, which coordinates the very large courses we teach at the freshman level. Ms. Camilla Sturdivant is the associate director of that program, who oversees a 2-person clerical staff and 5-person technical staff. Dr. Christopher Lee is the lower-division teaching coordinator who trains and supervises approximately 45 graduate teaching assistants and 10 full-time laboratory instructors.

Ms. Christine Farris is the director of our undergraduate programs, and she supervises a staff of four undergraduate advisors and a clerical worker in our undergraduate advising office. This office helps keep our
1,558 undergraduate majors on track for a timely graduation by assisting with registration, managing enrollment in oversubscribed courses, helping the associate head for academic affairs with scheduling classes for the upcoming semester, and keeping our catalog of courses up to date. Ms. Farris also works with her counterparts in other departments to resolve scheduling conflicts and coordinate cross-department initiatives.

The Department of Biology is supported by an amazingly dedicated and professional staff of 36 people, as outlined in the organization chart (Figure 1). We lost 5 ½ positions during the budget cuts beginning with the 2010 academic year, and none of these positions has been replaced. The duties and responsibilities of those previous staff positions have been assumed by remaining staff members, all of whom already had full-time jobs. Even when staff members have not had to formally assume duties from their previous colleagues, in many cases they have had to learn how to perform these duties as part of a cross-training effort. For instance, when our payroll office was reduced to one person, other staff members had to learn how to submit our payroll in case the one dedicated person was out. We can add remarkable resilience to the list of superlatives that our staff members embody.

A number of elected committees exist within the Department of Biology to provide faculty input to the administration. These committees are our graduate programs committee, graduate recruiting and admissions committee, undergraduate programs committee, and annual and post-tenure review committee. Departmental faculty and staff are also represented on numerous appointed committees. These include committees for departmental seminars, animal care, plant care, Instructional Equipment Enhancement Fee disbursement, and teaching lab safety. Other appointed committees, such as faculty search committees, are assembled periodically. Significant issues decided by committee, both academic and administrative, are discussed and voted on at monthly faculty meetings.

Graduate students in the Department of Biology are represented on departmental committees concerned with graduate programs. The president of the Biology Graduate Student Association (BGSA), an organization that fosters both academic and social activities, represents the graduate student body on the graduate program committee. Another graduate student, elected by the membership of the BGSA, serves as a voting member of our graduate recruiting and admissions committee. The BGSA president will begin attending faculty meetings in fall 2015 to report on discussions of graduate programs to the student body at large. Finally, a student elected by the BGSA represents the Department of Biology graduate student population at the University Graduate Council.
Figure 1. Department of Biology Organizational Chart
DEPARTMENT AND PROGRAM RESOURCES

FACILITIES: Laboratories and offices for tenured and tenure-track faculty in the Department of Biology are located in four buildings (Table 3.) Two of these buildings, Biological Sciences Building East (BSBE) and Biological Sciences Building West (BSBW), are connected by a common elevator and an enclosed walkway. The third building, Butler Hall, is located nearby. The fourth building, the Interdisciplinary Life Sciences Building (ILSB), houses six biology faculty members along with faculty from many other departments, and it is several hundred yards away from our main complex.

Many of our non-tenure-track faculty members have offices in the Heldenfels building, close to the main Biology complex. Heldenfels also houses our 300-seat lecture hall and teaching laboratories for freshman biology and our large (~850 students/semester) junior-level human and anatomy classes. All of these teaching labs operate close to their capacity. They are occupied from 8 am until 9:30 pm M-F, except Friday afternoons, when the staff resets them for the coming week.

**Table 3**

<table>
<thead>
<tr>
<th>Biology Buildings</th>
<th>Built</th>
<th>Renovated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Butler</td>
<td>1917</td>
<td>2006</td>
</tr>
<tr>
<td>BSBE</td>
<td>1950</td>
<td>1989; 2005 (partial); 2015 (lecture hall only)</td>
</tr>
<tr>
<td>BSBW</td>
<td>1966</td>
<td>1985 (partial); 2005 (partial)</td>
</tr>
<tr>
<td>Heldenfels (teaching only)</td>
<td>1975</td>
<td>2015 (lecture hall only)</td>
</tr>
<tr>
<td>ILSB</td>
<td>2010</td>
<td>N/A</td>
</tr>
</tbody>
</table>

1 Heldenfels is shared with two other departments. 2 ILSB is shared with many departments.

The total amount of space available is adequate for current needs of our department, but extensive renovations are required if we are to expand either our teaching or our research. Much of our underutilized space is poorly configured or lacks utilities suitable for research. The basement of Butler Hall, which houses teaching laboratories, is susceptible to flooding from both rain and sewage backups. Butler Hall has no emergency generator (and no place to put one), and no autoclaves or centralized dishwashing facility. Both BSBE and BSBW suffer from chronic leaks in the roof and from original designs optimized for teaching.

An additional problem in both Butler Hall and BSBE is that undergraduate teaching labs are interspersed with research labs, leading to congestion and chaos when classes change. One of our highest priorities is to move these teaching labs into other buildings (or less used areas of the same building) and renovate the vacated space for research. We are continually pursuing options to make this happen, but we have not yet had success. Renovations can take our old buildings only so far; ultimately, we need to plan for a new building.

Lecture space for our undergraduate classes is not nearly the challenge it was at the time of the previous review, when the Department of Biology had scheduling priority for only one medium-sized lecture hall. We now have priority for three lecture halls; one 300-student room in Heldenfels, one 280-student room in BSBE, and one 100-student classroom in a nearby building dedicated to teaching. Many of our smaller undergraduate classes and all of our formal and informal graduate classes are taught in various conference rooms throughout our department. While this situation is not ideal, it gives us more control over our teaching schedule.
Much of the common use equipment in the department was purchased in the 1980s as part of the research expansion under Dr. Hall’s leadership. This equipment is now worn out or obsolete, and we have just initiated a program to replace it. New common equipment in past year includes an ultracentrifuge, a super-speed centrifuge, a real-time PCR instrument, a Blue Pippen and other equipment for preparing next-gen DNA sequencing libraries, and a large cage-washer for our departmental vivarium.

FINANCES: For fiscal year 2016 (beginning 9-1-15), the Department of Biology is scheduled to receive $9.9 M from the College of Science. Although this is nearly 6% more than our FY 2008 budget, it represents less than a 1% per year increase. Our expenses are listed in Table 4. Major expenses for our undergraduate teaching labs include supplies, equipment, and periodic replacement of computers and microscopes. We use nearly $400,000 of the graduate enhancement category (95% of the total) to pay tuition for our graduate teaching assistants. The remaining $20K covers summer stipends for first-year students who are not yet affiliated with a lab, and true enhancements, such as travel grants and awards. While our overall budget has increased slightly in the past 7 years, the money available in our operating budget, which we use to run the rest of the department (seminar series, faculty job interviews, office supplies, telephone bills, copy machine rental, minor renovations, etc.) is 21% less than in 2008. Additionally, the university expects departments to cover half of a 3% merit raise for faculty and staff in 2016 and 2017. This represents a de facto cut of our operating budget of $105,000 in FY 16, and $210,000 in FY 17 and beyond.

Table 4

<table>
<thead>
<tr>
<th>EXPENSE</th>
<th>AMOUNT</th>
<th>PERCENT OF TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Salary (faculty, staff, graduate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>teaching assistants)</td>
<td>8,091,065</td>
<td>82</td>
</tr>
<tr>
<td>Teaching Labs</td>
<td>928,989</td>
<td>9</td>
</tr>
<tr>
<td>Graduate Enhancement</td>
<td>415,888</td>
<td>4</td>
</tr>
<tr>
<td>Operating Expenses</td>
<td>476,685</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>9,912,627</td>
<td>100</td>
</tr>
</tbody>
</table>

Although the federal and state economies have recovered since the recession that hit shortly after the 2008 external review, our department remains underfunded relative to the missions entrusted to us. We have the 3rd largest number of undergraduate majors on campus, and we teach the 4th highest number of students. For the past two fiscal years, our budget has not been adequate to cover this large teaching program, and in FY14 and FY15, we had a combined shortfall of over $500,000, mostly in the account we use to pay graduate teaching assistants in our undergraduate teaching laboratories. We have covered this obligation with indirect costs generated by external grants our faculty received. Because these funds are derived from our research activity, we typically reinvest them back into our research program, by using them for the departmental portion of new faculty start-up costs, common research equipment, and bridge funding to help productive laboratories that are between grants. Use of indirect costs funds to pay teaching assistants represents a substantial subsidy of our teaching program by our research program over the past two years. In addition, we have been asked to prepare for an additional shortfall of $500,000 for FY 16 (that is, we may receive only $9.4M of the $9.9M shown in Table 4). To achieve the goals of our strategic plan, it is essential that our yearly budget allocation fully funds our teaching program. This will allow us to use all of our indirect cost funds for hiring excellent new faculty and to improve our research enterprise.
Faculty members in the Department of Biology generated over $5.7 M in new funding in FY15. This is down from the $6.7 M in 2008, but it represents a slow increase from our low point of $4.5 M in 2011. The number of grants and amount of funding places us near the median for biology departments at all public land grant universities, but we are below the median for land-grant universities in the American Association of Universities. More detail is provided in the Faculty Profile section (pg. 33). Beginning Sept 1, 2015, 15% of indirect costs will be returned to the department (up from 10% in 2014) to reinvest in our research program, including new faculty start-up costs, common research equipment, and bridge funding. Thus, to be in a position to continue to hire new faculty, and to significantly improve our research enterprise, a major piece of our strategic plan is use these funds to provide incentives and assistance to further increase our faculty’s extramural funding.

DATE OF LAST EXTERNAL ACADEMIC PROGRAM REVIEW
The Department of Biology was last reviewed in April, 2008. That review, our response to the recommendations outlined in that review, and the current status of our efforts in those areas are attached as Appendix A.

OVERALL ANALYSIS
ALIGNMENT OF DEPARTMENT STRATEGIC GOALS WITH INSTITUTIONAL GOALS: The goals of our department’s strategic plan were developed to align with the first three objectives of Vision 2020 (Appendix C). The first objective is to elevate our faculty’s scholarship. While we are around the median of most measures for biology departments at public land grant schools, our short-term goal is to reach the median of land grant universities in the AAU. Our second objective is to enhance our graduate program by increasing the number and quality of students, particularly in our microbiology Ph.D. program. Our third objective is to enhance our undergraduate program. We will do this through outreach to high schools for top students and by developing an honors program to attract and retain the best students. Concurrently, we will increase high impact experiences and increase visibility of current high-impact pedagogical practices.

SHORT LIST OF IMPROVEMENTS MADE SINCE LAST ACADEMIC PROGRAM REVIEW:

1. Improvements affecting the faculty
   - Hired seven assistant professors and three professors who enhance our current strengths in circadian rhythms, microbiology, and neurobiology, and expanded our expertise in cell biology and structural biology. See Table 5.
   - Started a monthly faculty chalk talk series to give faculty the opportunity to informally discuss what they are working on, or thinking about working on, to get constructive feedback. This format has been particularly useful for honing specific aims for new proposals.
   - Initiated an internal grant review process in which faculty can have a proposal formally reviewed by TAMU faculty who have served on review panels prior to submission to funding agencies.
   - Expanded our formal mentoring program to include associate professors.
   - Instituted a travel fund for associate professors affiliated with our mentoring program to compensate for our geographical location that makes travel to meetings expensive. Assistant professors have generous start-up packages they can use for travel, and full professors typically have other resources they can use, but associate professors often need assistance to attend more than one meeting per year to strengthen their national and international reputation.
Table 5

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>Initial position</th>
<th>Previous Institution</th>
<th>Research Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.J. McMahan</td>
<td>2008</td>
<td>Professor and Head</td>
<td>Stanford</td>
<td>Neurobiology</td>
</tr>
<tr>
<td>Mark Harlow</td>
<td>2009</td>
<td>Assistant Professor</td>
<td>Stanford</td>
<td>Neurobiology</td>
</tr>
<tr>
<td>Steve Lockless</td>
<td>2009</td>
<td>Assistant Professor</td>
<td>Rockefeller</td>
<td>Structural Biology</td>
</tr>
<tr>
<td>Joseph Sorg</td>
<td>2010</td>
<td>Assistant Professor</td>
<td>Tufts</td>
<td>Microbiology</td>
</tr>
<tr>
<td>James Smith</td>
<td>2010</td>
<td>Assistant Professor</td>
<td>Mississippi State</td>
<td>Microbiology</td>
</tr>
<tr>
<td>Richard Gomer</td>
<td>2010</td>
<td>Professor</td>
<td>Rice</td>
<td>Cell Biology</td>
</tr>
<tr>
<td>Wesley Thompson</td>
<td>2013</td>
<td>Professor</td>
<td>U.T. Austin</td>
<td>Neurobiology</td>
</tr>
<tr>
<td>Christine Merlin</td>
<td>2013</td>
<td>Assistant Professor</td>
<td>U. Massachusetts</td>
<td>Biological Clocks</td>
</tr>
<tr>
<td>Jerome Menet</td>
<td>2013</td>
<td>Assistant Professor</td>
<td>Brandeis</td>
<td>Biological Clocks</td>
</tr>
<tr>
<td>Beiyan Nan</td>
<td>2015</td>
<td>Assistant Professor</td>
<td>U.C. Berkeley</td>
<td>Microbiology</td>
</tr>
</tbody>
</table>

2. Improvements affecting the undergraduate program

- Established a requirement to complete first two years of a common body of knowledge before taking upper-level courses.
- Established a capstone course that teaches students to write and present research findings.
- Implemented two study abroad courses; one in Costa Rica, and one on the Amazon.
- Developed two learning assessments that are administered to all biology students in their sophomore level courses. One focuses on basic cell and molecular biology, and the other focuses on ecology and evolutionary biology.
- Developed an on-line homework platform for introductory biology courses that stresses quantitative and data interpretation skills.
- Eliminated last vestige of our botany program to make better use of limited teaching resources.
- Began to develop an honors program that we hope to implement in fall 2016 to help us recruit and retain the best students.

3. Improvements affecting graduate program

- Developed the graduate course, BIOL 609, Molecular Tools, in 2009 to provide formalized training to biology graduate students in the theoretical and practical aspects of modern molecular methods. This course has become a mainstay in our graduate curriculum, with most Biology students including it in their degree plans.
- Established graduate travel awards to support graduate student attendance at national and international meetings, with the goal of ensuring that all graduate students present their research results at such meetings prior to graduating. This endeavor is very successful, and it has been greatly appreciated by our graduate students.
- In the past year, our graduate students developed an outreach committee to create STEM activities for children in the community. This committee created a sustainable program by meeting with schools in the area to assess their needs, obtaining resources for experiments, and collaborating with other departments. In the last year, our students participated in six STEM nights at schools in College Station and Navasota. Our students volunteered for several outreach events for organizations such as Women in Science and Engineering with the Expanding Your Horizons events, as well as the Texas Junior Academy of Science, The Big Event, Chemistry Open House, The TAMU Ecological Integration Symposium, Physicsfest, BioBlitz, and they have been
judges at local science fairs.

- Shortly after the previous review, we raised graduate stipends, and we raised them again in 2011 to $2,000 per month (Table 6.) Our intent was to continue with small incremental raises, but budget constraints have prevented any increase since 2011.

- Developed several new measures to assess the quality of training received in the graduate program. To facilitate data gathering, we developed new methods for collecting information from the graduate student population, the main example being an annual report that requests data on dates of reaching programmatic milestones, publications, and funding.

### Table 6

<table>
<thead>
<tr>
<th>Year</th>
<th>Monthly Stipend</th>
</tr>
</thead>
<tbody>
<tr>
<td>FY 2007</td>
<td>$1,584</td>
</tr>
<tr>
<td>FY 2008</td>
<td>$1,584</td>
</tr>
<tr>
<td>FY 2009</td>
<td>$1,835</td>
</tr>
<tr>
<td>FY 2010</td>
<td>$1,835</td>
</tr>
<tr>
<td>FY 2011</td>
<td>$2,000</td>
</tr>
<tr>
<td>FY 2012</td>
<td>$2,000</td>
</tr>
<tr>
<td>FY 2013</td>
<td>$2,000</td>
</tr>
<tr>
<td>FY 2014</td>
<td>$2,000</td>
</tr>
<tr>
<td>FY 2015</td>
<td>$2,000</td>
</tr>
<tr>
<td>FY 2016</td>
<td>$2,000</td>
</tr>
</tbody>
</table>
Graduate Programs and Curricula

**PROGRAMS OFFERED**

**GRADUATE PROGRAM IN BIOLOGY:** The Ph.D. degree program in biology is designed to educate students in evolutionary, cellular, molecular, and developmental biology and to prepare them for leadership positions in academic or industrial research. The Department of Biology offers a full spectrum of research opportunities reflecting the broad base of research programs in the department, including plant and animal molecular biology, ecology and evolutionary biology, molecular and cell biology of differentiation and development, gene structure and regulation in eukaryotic and prokaryotic organisms and their viruses, and cell structure and function. Students obtaining a degree in biology may also work closely with faculty in biochemistry, entomology, genetics, neuroscience, oceanography, plant physiology, medicine, and veterinary medicine.

**GRADUATE PROGRAM IN MICROBIOLOGY:** The Ph.D. program in microbiology is designed to train students in laboratory science, to provide factual background necessary for research, and to develop the critical faculties to analyze experimental results. Our Ph.D. program in microbiology offers opportunities for research in classical and molecular genetics, genomics, microbial development, microbial physiology, signal transduction, and pathogenic microbiology. Students will be well prepared for independent scientific research in medical, industrial, governmental, and academic contexts.

**PROGRAM CURRICULA**

For the biology Ph.D. program, students are required to take a minimum of four biology graduate courses from either or both foundation and specialization course listings. For the microbiology Ph.D. program, students must take the bacterial genetics course with three additional 3-credit-hour courses related to the field of microbiology. Students in either the biology or the microbiology program are also required to enroll in the following courses:

- 2 hours of Graduate Student Research Seminar
- 1 hour of Method of Teaching Biology Laboratory
- 1 hour Seminar in Graduate Orientation
- 1 hour Seminar in Department Colloquium
- 1 hour of Journal Club each Semester
- 1 hour of the Research Ethics Course

In addition to taking classes and seminars, all students must enroll in enough research hours to meet their degree requirements. Ph.D. students who enter the program with a master’s degree are required to take a total of 64 credit hours, whereas students who enroll with only a bachelor’s degree are required to take a total of 96 credit hours to fulfill their degree plan. We produce a graduate handbook to clarify our expectations and timelines (Appendix D). Graduate courses offered by our department are described in Appendix E. Average time to degree for our most recent cohort is 5.75 years for the Ph.D. in biology and 6.0 years for the Ph.D. in microbiology. More details are in the Student Profile section beginning on page 33.
ADMISSION CRITERIA

Qualified students are admitted to the department on a competitive basis. Applicants are judged on the basis of their grade point ratio (GPR) and Graduate Record Examination (GRE) scores, as well as on the basis of personal statements of interest, letters of recommendation, previous research experience, and individual interviews (generally in person for U.S. citizens at recruiting weekend or by Skype for international students. Care is taken that these requirements and review procedures do not bias the admission of otherwise qualified individuals.

A student's application must demonstrate a strong foundation in the natural sciences and address previous research experience. Three letters of recommendation and a personal statement are also required. The personal statement should describe the applicant's research interests and future goals.

All entering students are required to complete two research rotations in faculty labs, each lasting seven weeks. If they have not selected a major advisor after two rotations, they may complete one or two additional rotations. Entering students are expected to become established in a research program within their first year. For this reason, compatibility of an applicant's interests with the research of our faculty is a major consideration for admission.

Our department has no strict rules for GPR or standardized exam scores in graduate admission. GRE scores and GPR for graduate students admitted to the Department of Biology since 2008 are shown in Table 7. From 2008 to 2014, quantitative scores for incoming students have increased, while verbal scores have remained steady. For incoming international students, TOEFL scores for the period of 2014-15 averaged 102 for the total score. The minimum required TOEFL score for the Department of Biology is 100 total.

Table 7

<table>
<thead>
<tr>
<th>Year</th>
<th>BIOL GRE*</th>
<th>MICRO GRE*</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>154 (520)</td>
<td>161 (770)</td>
</tr>
<tr>
<td>2013</td>
<td>156 (540)</td>
<td>158 (740)</td>
</tr>
<tr>
<td>2012</td>
<td>151 (470)</td>
<td>156 (720)</td>
</tr>
<tr>
<td>2011</td>
<td>613</td>
<td>736</td>
</tr>
<tr>
<td>2010</td>
<td>548</td>
<td>724</td>
</tr>
<tr>
<td>2009</td>
<td>547</td>
<td>699</td>
</tr>
<tr>
<td>2008</td>
<td>520</td>
<td>721</td>
</tr>
</tbody>
</table>

*New scores since 2012 have been converted to equivalent old scores in parentheses.

In the graduate recruiting cycle for fall 2014 admission, 38 U.S. citizens applied, nine were accepted, and six enrolled. In that cycle, 66 international students applied, 15 were accepted and 12 enrolled. In total, the department received 104 applications that year, accepted 26 (25% of applicants), and enrolled 19 (73% of accepted) new students. For the current (fall 2015) recruiting cycle, we received 95 applications, of which 38% were domestic, and accepted 14 students (seven domestic and seven international). Eight students plan to enroll in the fall; one of those students was admitted last year but deferred until 2015.
NUMBER OF DEGREES AWARDED PER YEAR
The number of graduate degrees awarded each year is highly variable, with 17 Ph.D. and two M.S. degrees in 2013 compared to eight Ph.D. and five M.S. degrees in 2014. This variation seems to be a function of the relatively small numbers involved, and it is not a source of concern for us. More detail is provided in the Student Profile section beginning on page 33.

AVERAGE TIME TO DEGREE
Overall time to the Ph.D. in biology is 5.75 years, and the overall time to the Ph.D. in microbiology is 6.0 years. These times are close to the national averages. Time to graduation with a master’s degree is four years. However, we do not recruit students directly into our master’s curriculum, and much of this time was spent in our Ph.D. program before the decision was made to pursue a M.S. degree, instead. More details are provided in the Student Profile section beginning on page 33.

ACADEMIC ENHANCEMENTS / HIGH IMPACT OPPORTUNITIES FOR STUDENTS
- Development of the graduate course, BIOL 609, Molecular Tools. This course was developed in 2009 to provide formalized training to Biology graduate students in the theoretical and practical aspects of modern molecular methods. This course has become a mainstay in our graduate curriculum, with most Biology students including it in their degree plans.
- Establishment of Graduate Travel Awards. New funding from the Office of Graduate and Professional Studies has been provided in the form of “Graduate Enhancement Funds”, intended to improve the quality of graduate education. These funds are being used to support graduate student attendance at national and international meetings, with the goal of ensuring that all graduate students present their research results at such meetings prior to graduating. This endeavor is very successful, and has been embraced by the graduate student population.
- Over the last year, the graduate students have developed an outreach committee to create STEM activities for children in the community. This committee has created a sustainable program by meeting with schools in the area to assess need, obtaining resources for experiments, and collaborating with other departments. In the last year, we have participated in over six STEM nights at schools in College Station and Navasota. We have also had volunteers participate at several outreach events for organizations such as, Women in Science and Engineering with the Expanding Your Horizons events as well as the Texas Junior Academy of Science, The Big Event, Chemistry Open House, The TAMU Ecological Integration Symposium, Physicsfest, BioBlitz, and we have been judges at local science fairs.
- Graduate program assessment. Several new measures have been developed to assess the quality of training received in the graduate program. To facilitate data gathering, new methods for collecting pertinent information from the graduate student population have been developed, the main example being an annual report that requests data on dates of reaching programmatic milestones, publications and funding.

ASSESSMENT OF STUDENT LEARNING OUTCOMES
In the past, we made attempts at creating measurable objectives but were unable to obtain any concrete data on how well students were doing and if they were meeting their yearly milestones. During the past year, we worked with the Assessment Office to create new, measurable program and student learning objectives. We will new data on these objectives over the next few years. The data we will collect will enable us to measure each
student’s time to reach academic program milestones, publications, presentations, awards, and employment post-graduation.

We have also recently made a small, but significant, change to the forms used to assess students’ progress at their required annual committee meetings. Students now receive a numerical score on six evaluative criteria that reflect the development of important skills, such as critical thinking, hypothesis development, technical abilities, and communication. Data gathered from this assessment will further enhance our ability to evaluate the quality of student training and development.

OVERALL ANALYSIS
In general, our graduate program has remained stable over the past seven years in terms of student numbers, admissions criteria and time to degree. Efforts to develop meaningful measures of student learning outcomes had languished until the most current assessment cycle. Therefore, we had no rational basis for evaluating the quality of our graduate training, although we noted that our students have been very successful in securing employment post-graduation in post-doctoral, academic, and industrial positions. With the implementation of new measurement criteria, and the development of methods that ensure that faculty are mindful of these measurement criteria and communicate them to their students, we will have a rational basis to evaluate where we stand in terms of graduate training. At that point, it is anticipated that reasonable changes to enhance our graduate training will become clear.
Undergraduate Programs and Curricula

PROGRAMS OFFERED
Majors in the Department of Biology can choose among five undergraduate degrees; a Bachelor of Arts in Biology, and Bachelor of Science in Biology, Molecular and Cell Biology, Microbiology, and Zoology. Most of our students are in the BA or BS Biology curricula, with 80 to 100 students majoring in each of the other degree options, for a total of more than 1,500 departmental majors. Enrollment in each degree plan has been stable since the last review (Table 8), which was expected because enrollment increased by more than 25% from 2001 to 2007, so our introductory courses that serve as entry points for our majors now operate at maximum capacity. The department also offers a minor in Biology and five emphasis tracks for students interested in Marine Biology, Education, Human Biology, Ecological and Environmental Sciences, or Quantitative Biology.

### Table 8

<table>
<thead>
<tr>
<th>Year</th>
<th>BIOL BA</th>
<th>BIOL BS</th>
<th>BMCB</th>
<th>MBIO</th>
<th>ZOOL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>220</td>
<td>1072</td>
<td>94</td>
<td>82</td>
<td>99</td>
<td>1568</td>
</tr>
<tr>
<td>2009</td>
<td>198</td>
<td>1134</td>
<td>102</td>
<td>69</td>
<td>118</td>
<td>1623</td>
</tr>
<tr>
<td>2010</td>
<td>207</td>
<td>1112</td>
<td>121</td>
<td>79</td>
<td>104</td>
<td>1627</td>
</tr>
<tr>
<td>2011</td>
<td>211</td>
<td>1043</td>
<td>103</td>
<td>80</td>
<td>88</td>
<td>1530</td>
</tr>
<tr>
<td>2012</td>
<td>238</td>
<td>1092</td>
<td>105</td>
<td>88</td>
<td>83</td>
<td>1605</td>
</tr>
<tr>
<td>2013</td>
<td>215</td>
<td>1140</td>
<td>104</td>
<td>90</td>
<td>85</td>
<td>1636</td>
</tr>
<tr>
<td>2014</td>
<td>180</td>
<td>1113</td>
<td>85</td>
<td>100</td>
<td>78</td>
<td>1558</td>
</tr>
</tbody>
</table>

PROGRAM CURRICULA
The first two years of undergraduate study are nearly the same for all curricula in our department, which allows students great flexibility in changing their degree plans. All of our students take two years of biology, two years of chemistry, one year of math, and other courses to satisfy the university’s core curriculum. Our math requirement was changed in 2009 from one semester of finite math and one semester of calculus to two semesters of calculus. With this change, the Department of Mathematics developed a two-semester calculus series that emphasizes biological applications specifically for our majors. These courses now provide the prerequisites for students to take more advanced math courses, if they wish. Moreover, our math requirement is now equivalent to that of many peer institutions, including Purdue and Penn State. We are currently evaluating these courses to identify changes that could improve learning outcomes. Any changes will be implemented in collaboration with the Math faculty.

One important feature of our curriculum is that we require one course in molecular and cell biology (BIOL 213), and another in ecology, evolution, and genetics (BIOL 214) during the sophomore year as a way to keep tabs on our students in their second year and as a way to increase their readiness for upper-level courses. All of the degree plans in our department have the same state-mandated cap of 120 credit hours. Undergraduate curricula and course descriptions are attached as Appendices F and G, respectively.

NUMBER OF DEGREES AWARDED AND STUDENT RETENTION
The total number of degrees awarded to biology majors, like enrollment, remained relatively constant from the last review until 2013 (Table 9). However, data for 2014 indicate a decline of nearly 15% from the previous year.
This decline is primarily due to students transferring during or immediately after their first year to an Allied Health program (predominantly pre-nursing) that was established in 2011 by the Department of Health and Kinesiology. Interviews with students transferring to Allied Health or to other programs on campus revealed that the primary reasons for transfer were 1) poor academic success in their biology curriculum, 2) preference for a program with fewer math and science requirements, and 3) enrollment in Biology only because they did not gain admission to their first choice of majors. We cannot easily address the last two issues because reducing the rigor of our curricula to retain these students would jeopardize the needs of the others, and we choose not to bar admission of applicants based solely on their initial preference. We are, however, developing strategies to improve student success, which in turn should increase retention. These strategies include an on-line homework program for introductory biology, learning communities for new students, and creation of an honors program to attract and retain top students.

Unfortunately, increased retention of first-year biology majors will lead to increased enrollment in upper-level courses, some of which already have over 100 students (see Figure 2 on page 22). Regardless, the rate of change in number of majors (not the absolute number) is a metric used for funding of both the Department of Biology and the College of Science, so we must find solutions to this challenge. We have already modified our curricula and faculty teaching assignments to maximize throughput of our current student population. Additional faculty and facilities will be needed to sustain our teaching mission as increases in retention are realized.

Table 9

<table>
<thead>
<tr>
<th>Year</th>
<th>BA BIOL</th>
<th>BS BIOL</th>
<th>BS BMCB</th>
<th>BS MBIO</th>
<th>BS ZOOL</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>35</td>
<td>220</td>
<td>11</td>
<td>23</td>
<td>19</td>
<td>308</td>
</tr>
<tr>
<td>2009</td>
<td>30</td>
<td>218</td>
<td>22</td>
<td>13</td>
<td>12</td>
<td>295</td>
</tr>
<tr>
<td>2010</td>
<td>32</td>
<td>216</td>
<td>21</td>
<td>11</td>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td>2011</td>
<td>17</td>
<td>254</td>
<td>25</td>
<td>17</td>
<td>15</td>
<td>328</td>
</tr>
<tr>
<td>2012</td>
<td>28</td>
<td>255</td>
<td>21</td>
<td>17</td>
<td>17</td>
<td>338</td>
</tr>
<tr>
<td>2013</td>
<td>30</td>
<td>215</td>
<td>21</td>
<td>17</td>
<td>20</td>
<td>303</td>
</tr>
<tr>
<td>2014</td>
<td>31</td>
<td>172</td>
<td>25</td>
<td>18</td>
<td>11</td>
<td>257</td>
</tr>
</tbody>
</table>

Despite the recent decline in retention of our majors, the Department of Biology’s overall teaching load has not decreased (Table 10). This is because the Allied Health program and all other life science programs on campus require our introductory courses and one or more of our upper-level service courses, i.e., Human Anatomy and Physiology (BIOL 319 and 320) or Microbiology (BIOL 206 or 351). To place these numbers in perspective, our department’s student credit hours (SCH) were over 25% of what the entire College of Agriculture and Life Sciences taught, and our weighted SCHs were over 22% of their total for the 2014 academic year.

Table 10

<table>
<thead>
<tr>
<th>Year</th>
<th>Student Credit Hours</th>
<th>Weighted Student Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>40,478</td>
<td>119,179</td>
</tr>
<tr>
<td>2009</td>
<td>39,187</td>
<td>117,576</td>
</tr>
<tr>
<td>2010</td>
<td>41,927</td>
<td>125,068</td>
</tr>
<tr>
<td>2011</td>
<td>39,385</td>
<td>116,260</td>
</tr>
<tr>
<td>2012</td>
<td>38,021</td>
<td>115,807</td>
</tr>
<tr>
<td>2013</td>
<td>38,458</td>
<td>120,602</td>
</tr>
<tr>
<td>2014</td>
<td>39,947</td>
<td>126,006</td>
</tr>
</tbody>
</table>
ACADEMIC ENHANCEMENTS / HIGH IMPACT OPPORTUNITIES

The Department of Biology offers multiple high-impact opportunities to enhance the undergraduate experience of our majors, as well as non-majors who meet the prerequisites. These include inquiry-based courses, study-abroad courses, and undergraduate research. These topics, as well as efforts to enhance the professional development of our students, are summarized below.

INQUIRY-BASED COURSES: Our department currently offers five courses with inquiry-based, independent research components: Animal Physiology (BIOL 388), Cell Biology Lab (BIOL 423), Biological Imaging (BIOL 430), Laboratory for Regulatory and Behavioral Neuroscience (BIOL 435), and Laboratory in Immunology (BIOL 455). Inquiry-based approaches are being implemented in other courses, and independent research may be incorporated in one or two of these in the future as additional faculty and facilities become available.

STUDY ABROAD: The Department of Biology offers the only two study abroad opportunities available in the College of Science: Tropical Ecology Costa Rica (BIOL 400) and Amazon River Tropical Biology (BIOL 489). During the 2013-2014 school year, 212 students enrolled in our inquiry-based and study-abroad courses.

UNDERGRADUATE RESEARCH: Research, in the form of formal research courses in faculty labs (BIOL 291 and 491) and paid student-worker positions, is an important element of the teaching and research missions in the Department of Biology. During the 2013-2014 school year, 241 undergraduate students registered for credit to conduct independent research. These student researchers gain valuable laboratory experiences, and perform meaningful independent projects. Student findings are reported at local and national research meetings, and contribute to peer-reviewed publications and grant proposals. Biology Capstone (BIOL 495) is a key component of the student research experience. This course helps students formalize their research findings in both written and oral forms, and it will anchor the department’s honors program, which will begin in fall 2016. Unfortunately, it is not possible for our 38 core faculty members to provide research experiences for all of our 1,558 majors. Dr. Kathryn Ryan was appointed Undergraduate Research Coordinator in fall 2014 to help place as many students in research labs as possible, to facilitate their safety training, and to development assessments of their research experiences.

PROFESSIONAL DEVELOPMENT SKILLS: Careers in Life Science (BIOL 481) is a course that we initiated in 2013 in collaboration with the College of Science and the TAMU Career Center to provide our students with professional development skills that would facilitate their transition to the workforce and/or to graduate/professional programs. Although this course does not fit the typical definition of “high-impact”, it is a significant curricular enhancement. We are currently trying to coordinate an increase in the enrollment in this course from 25 to 50 students per year.

ASSESSMENT OF STUDENT LEARNING OUTCOMES

The Department of Biology uses multiple assessment instruments to evaluate student learning outcomes at the undergraduate level. Results of these assessments are summarized below.

CRITICAL THINKING ASSESSMENT TEST (CAT): CAT was designed at Tennessee Technological University with funding from the NSF to evaluate critical thinking and problem solving skills. The TAMU Office of Institutional Assessment has administered CAT on a three-year cycle to most academic programs on campus since 2010.
Department of Biology majors were assessed in 2013. Scores for our majors were 123% of the national comparison group, compared to 112% for the College of Science and 92% for the university as a whole.

**MOLECULAR CELL BIOLOGY (MCB) AND INTEGRATIVE EVOLUTIONARY BIOLOGY (IEB) ASSESSMENT QUIZZES:** These short quizzes were designed by Department of Biology faculty for our sophomore-level courses to assess retention and mastery of basic concepts that were introduced in our freshman courses. The MCB quiz was developed in 2010 and the IEB quiz in 2014. Our target measure is for 60% correct responses in the sophomore courses. We also administer these quizzes in upper-level courses to assess improvement with a target of 90% correct responses. The sophomore-level targets have been partially met; 73% correct responses on the MCB quiz and 45% correct on the IEB quiz. Scores on the MCB quiz improve to 85% when administered in our upper-level courses. However, scores on the IEB quiz improved only to 64% when administered in an upper-level course. We will review the IEB quiz to determine why scores are considerably lower than the MCB quiz. Changes in the content of the quiz and/or our courses may be warranted.

**MEDICAL SCHOOL AND GRADUATE SCHOOL ACCEPTANCE:** We set target measures of over 50% of students who take the MCAT will be admitted to medical school, and over 80% of students who report attending graduate programs will be participating in MS or PhD programs at Tier 1 institutions. These targets were partially met in 2013-2014. 49% of students who took the MCAT were admitted to medical schools (combined MCAT scores place our students in the 55-76th percentile), and 80% of our undergraduates who are pursuing graduate programs will attend Tier 1 institutions.

**GRADUATING SENIOR SURVEY:** All graduating seniors are asked to complete a survey of their educational experience and how it has prepared them for the future. Our target measures are 75% of graduating seniors will agree or strongly agree that their education has enabled them to 1) articulate current research problems in their field of study and 2) apply their knowledge to problems in their field. These targets have not yet been met, but we are getting close, with 71% and 73%, respectively.

**ANALYSIS: IMPROVEMENTS MADE AS A RESULT OF ASSESSMENTS OF STUDENT LEARNING OUTCOMES**

Our graduates perform well above the national comparison group on the critical thinking and problem solving assessment (CAT). However, our MCB assessment quiz has consistently shown that our students struggle disproportionately with empirical and quantitative problems compared to general knowledge. We are working to bolster mastery of these concepts in our introductory courses. Specifically, a team of faculty and graduate students recently generated a series of online homework and self-tests to actively engage students and provide the opportunity for practice and low-stakes self-assessment. These learning tools were used in fall 2014 in the first introductory biology course our majors, BIOL 111. Student feedback was uniformly positive with frequent requests for even more practice problems. Although no significant change was detected in overall exam scores or final grades, we identified and corrected what we perceive as a flaw in how the self-tests were implemented. We also refined our use of recitation sections in our sophomore-level courses to provide more practice and self-assessment.

Based on the finding from our graduating senior survey that half of our students applying to medical school are not admitted, we initiated the Careers in Life Science course to expose our students to opportunities in areas other than medicine and to enhance their job search skills (resume writing, interviewing, professional
communication, etc.). Topics explored in this course are also designed to help make students more competitive for admission to professional and graduate programs.

The graduating senior survey also revealed that approximately half our students have participated in undergraduate research, an astounding percentage, given our student:faculty ratio. We recently instituted programs to formalize safety training for these students, and are incorporating additional information on research opportunities into our departmental web site and the Careers in Life Science course to increase participation in undergraduate research.

We have not made any progress in decreasing the sizes of our upper-level classes, which could dramatically change how these courses are taught and maximize learning (Figure 2). Our junior course in ecology typically has 125 students per semester, and our introductory microbiology course, which serves our majors, has two sections of about 180 students each. Even senior-level courses in virology and integrative animal behavior have 80-100 students. Efforts to increase retention of our majors can only increase class size further. Our strategic plan prioritizes future faculty hires, particularly in microbiology. Once realized, the additional faculty will allow us to decrease class sizes in upper-level courses and, if possible, to dedicate course sections to our departmental majors. Dedicated introductory courses for our majors, similar to what other departments in the College of Science are able to provide, would be ideal, but this would require an additional increase in the number of faculty and access to more teaching laboratories. Coordinating these efforts would be a welcome challenge.

![Figure 2. Average Lecture Sizes for Biology Courses for Fall 2015. Numbers were accurate as of August 20, 2015, but there may be some changes before fall classes begin.](image-url)
Faculty Profile

CORE FACULTY

NUMBER OF CORE FACULTY: For purposes of this section, the university defines core faculty as professors with tenured or tenure-track positions and at least a 50% appointment in the Department of Biology. We currently have 40 tenured or tenure-track faculty members: 6 assistant professors, 17 associate professors, and 19 professors. This number is down about 10% from the 43 tenured and tenure-track faculty members we had in 2008 at the time of the last review. Most of these losses occurred when professors left the university, but we have lost core faculty members through other routes, as well. Michael Benedik is a full-time administrator at the university level (he was dean of faculties from 2012-2015, and he recently accepted the position of vice provost). Duncan MacKenzie is employed 66% by the university honors program. Two other faculty members, Drs. Tim Hall and Kathy Ryan, relinquished tenured and tenure-track positions, respectively, to take on new untenured positions. All of these changes combine to give us a core faculty, as defined by the university, of 38. Our current tenured and tenure-track faculty roster is presented below. Brief vitae are presented as Appendix H.

<table>
<thead>
<tr>
<th>19 Professors</th>
<th>15 Associate Professors</th>
<th>6 Assistant Professors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deborah Bell-Pedersen</td>
<td>Rodolfo Aramayo</td>
<td>Mark Harlow</td>
</tr>
<tr>
<td>Michael Benedik</td>
<td>Karl Aufderheide</td>
<td>Steve Lockless</td>
</tr>
<tr>
<td>Luis Rene Garcia</td>
<td>Ginger Carney</td>
<td>Jerome Menet</td>
</tr>
<tr>
<td>Richard Gomer</td>
<td>Charles Criscione</td>
<td>Christine Merlin</td>
</tr>
<tr>
<td>Ira Greenbaum</td>
<td>James Erickson</td>
<td>Beiyan Nan</td>
</tr>
<tr>
<td>Paul Hardin</td>
<td>Lawrence Griffing</td>
<td>Joseph Sorg</td>
</tr>
<tr>
<td>Andreas Holzenburg</td>
<td>Arne Lekven</td>
<td></td>
</tr>
<tr>
<td>Adam Jones</td>
<td>Xiaorong Lin</td>
<td></td>
</tr>
<tr>
<td>W. Michael Kemp</td>
<td>Duncan MacKenzie</td>
<td></td>
</tr>
<tr>
<td>Michael Manson</td>
<td>Alan Pepper</td>
<td></td>
</tr>
<tr>
<td>Thomas McKnight</td>
<td>Hongmin Qin</td>
<td></td>
</tr>
<tr>
<td>U. J. McMahan</td>
<td>Deborah Siegele</td>
<td></td>
</tr>
<tr>
<td>Bruce Riley</td>
<td>James Smith</td>
<td></td>
</tr>
<tr>
<td>Gil Rosenthal</td>
<td>Michael Smotherman</td>
<td></td>
</tr>
<tr>
<td>Matthew Sachs</td>
<td>Wayne Versaw</td>
<td></td>
</tr>
<tr>
<td>Terry Thomas</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wesley Thompson</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mary Wicksten</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mark Zoran</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Eleven of our 38 core faculty members are 62 years old or older, suggesting that up to 30% of our faculty could retire during the next 7-year review period. These potential losses, coupled with other forms of attrition, indicate that we will need to hire at least two new faculty members per year just to maintain our current numbers, and we will need to hire almost four per year to increase our core faculty to 50, which was a major
recommendation of the 2008 review (Appendix A). Our 10 tenured and tenure-track faculty hires since 2008 were listed in Table 5 on page 11. Our 16 core faculty losses since 2008 are detailed in Table 11.

### Table 11

<table>
<thead>
<tr>
<th>NAME</th>
<th>YEAR</th>
<th>TITLE</th>
<th>AREA</th>
<th>CURRENT POSITION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vincent Cassone</td>
<td>2008</td>
<td>Professor &amp; Head</td>
<td>Neurobiology/Clocks</td>
<td>University of Kentucky</td>
</tr>
<tr>
<td>Susan Golden</td>
<td>2008</td>
<td>Distinguished Professor</td>
<td>Microbiology/Clocks</td>
<td>UC San Diego</td>
</tr>
<tr>
<td>Jim Golden</td>
<td>2008</td>
<td>Professor</td>
<td>Microbiology</td>
<td>UC San Diego</td>
</tr>
<tr>
<td>Jin Xiong</td>
<td>2009</td>
<td>Assistant Professor</td>
<td>Bioinformatics</td>
<td>Unknown</td>
</tr>
<tr>
<td>Jim Manhart</td>
<td>2011</td>
<td>Associate Professor</td>
<td>Plant Biology</td>
<td>Retired</td>
</tr>
<tr>
<td>Hugh Wilson</td>
<td>2011</td>
<td>Professor</td>
<td>Plant Taxonomy</td>
<td>Emeritus</td>
</tr>
<tr>
<td>C.O. Patterson</td>
<td>2011</td>
<td>Professor</td>
<td>Microbiology</td>
<td>Emeritus</td>
</tr>
<tr>
<td>Timothy Hall</td>
<td>2012</td>
<td>Distinguished Professor</td>
<td>Plant Molecular Biol.</td>
<td>Sr. Distinguished Prof.</td>
</tr>
<tr>
<td>Tom Stidham</td>
<td>2012</td>
<td>Assistant Professor</td>
<td>Paleontology</td>
<td>Chinese Acad. Sci. Beijing</td>
</tr>
<tr>
<td>Brian Perkins</td>
<td>2012</td>
<td>Associate Professor</td>
<td>Developmental Biol.</td>
<td>Cleveland Clinic</td>
</tr>
<tr>
<td>Michael Benedik</td>
<td>2012</td>
<td>Professor</td>
<td>Microbiology</td>
<td>Vice Provost, TAMU</td>
</tr>
<tr>
<td>Thierry Lints</td>
<td>2014</td>
<td>Assistant Professor</td>
<td>Neurobiology</td>
<td>New Zealand</td>
</tr>
<tr>
<td>Duncan MacKenzie</td>
<td>2014</td>
<td>Associate Professor</td>
<td>Physiology</td>
<td>66% Honors /35% Biology</td>
</tr>
<tr>
<td>Kathrine Ryan</td>
<td>2014</td>
<td>Assistant Professor</td>
<td>Cell Biology</td>
<td>Inst. Assist. Prof. Biology</td>
</tr>
<tr>
<td>Keith Maggert</td>
<td>2015</td>
<td>Associate Professor</td>
<td>Epigenetics</td>
<td>University of Arizona</td>
</tr>
<tr>
<td>Robyn Lints</td>
<td>2015</td>
<td>Associate Professor</td>
<td>Developmental Biol.</td>
<td>New Zealand</td>
</tr>
</tbody>
</table>

**STUDENT TO FACULTY RATIO AND TEACHING LOAD:** With over 1,500 undergraduate majors and 100 graduate students, our student to core faculty ratio is over 42:1 (1,600: 38). However, because our department teaches basic biology courses for nearly every life science department on campus and because we have a large population of departmental majors, relatively few of our classes have as few as 42 students. The typical teaching assignment for core faculty members with active research programs is one and a half courses per year. There is a lot of variation among faculty members in meeting this obligation, but the most common scenario is for a professor to teach an undergraduate course in one semester and then share a graduate class with one other instructor in the other semester. In addition to their formal teaching duties, many professors also offer graduate seminars and journals clubs. This teaching load is typical for similar biology departments at our peer institutions. The only way we have been able to maintain this reasonable load in the face of increasing enrollment and static resources has been to hire many non-tenure-track lecturers and senior lecturers since the 2008 review (see the section on non-core faculty). New core-faculty hires at any level are excused from formal teaching assignments for the first year so they may establish or re-establish their research laboratories.

**CORE FACULTY PUBLICATIONS IN THE PAST FIVE YEARS:** During the most recent five-year period (1/1/10 to 12/31/14), our core faculty published 400 papers, which is an average of 2.1 papers per year per person. As data for the past three years from Academic Analytics shows (Figure 3), this rate of publication, and the rate these publications are cited, are at or near the average of biology faculty at all universities in the US. However our peers at public land-grant universities in the AAU publish on average 4.5 papers per year. Additionally, our faculty’s publications receive only about half of the citations per year relative to our peers. It is important to note that data from Academic Analytics for our department is skewed low by the inclusion of four non-core assistant research professors (about 10% of our core faculty). Individuals with the research assistant professor title must be included in any analysis according to the university, but for historical reasons, our department uses...
that title differently than other departments. All of our research assistant professors work under a tenured professor and do not have their own independent research program. All of their grants and publications are listed under their supervisor’s name, so including research assistant professors dilutes our per capita accomplishments. We are working to eliminate this title. Correction for this error places us at about the 65th percentile overall relative to all Ph.D.-granting biology departments in the US. Nevertheless, both our rates of publication and citation need significant improvement if we are to increase our overall rankings. Goal three of our department’s strategic plan (Appendix B) outlines approaches we are undertaking to accomplish this improvement.

**Figure 3. Publications and citations relative to all biology departments in and to biology departments at land grant universities in the AAU.** The red dot represents our department. The vertical black bar is the median of all departments in the comparison group. Dark regions on either side of the bar represent the second and third quartiles. Light regions represent the first and fourth quartiles. As mentioned in the text, when these data are calculated on core faculty alone, our overall ranking compared to all biology departments improves to the 65th percentile relative to all Ph.D.-granting biology departments.

**CORE FACULTY EXTERNAL GRANTS IN THE PAST FIVE YEARS:** Grant activity since the past review is summarized in Figure 4, which shows the total dollar amount of all grants awarded each year, the amount of direct research expenditures, the amount of indirect cost generated from these expenditures, and the total, (combined direct and indirect) costs. Although there has been a decline in every category since 2008 (which reflects a combination of current funding climate and faculty losses), there has been a significant increase since our low point in 2011.

**Figure 4. External grants to core faculty since last review.** Data are from Maestro, the university’s central research accounting platform, and show the total dollar amount awarded, the direct and expenditures, indirect costs generated, and the combined direct and indirect amounts. These data were augmented by including $600,000 of direct costs and $141,500 of indirect costs provided to Dr. Garcia by HHMI each year since 2008. Numbers for FY 2015 are reported through August 4.
According to data from Academic Analytics (Figure 5), our grant activity puts us near the median for all Ph.D. granting biology departments (and at the median for biology departments in non-AAU land grant universities.) However, we do not fare as well when compared to land grant universities in the AAU. There are two caveats to this interpretation, however. First, the per capita data are again skewed low by the inclusion of research assistant professors, and second, Academic Analytics does not include HHMI funding, which contributes $600,000 of direct costs of Dr. Garcia’s lab and $141,500 of indirect costs (paid as rent) to our department each year. Regardless of whatever our real standing is, we plan to increase our grant funding as detailed in goal two of our strategic plan (Appendix B).

Figure 5. Grant activity of Department of Biology relative to biology departments in all US universities and to land grant universities in the AAU. The median for each comparison is indicated by the black bar; quartiles are indicated by shaded boxes. The red dot indicates our department and includes research assistant professors.

FACULTY OTHER THAN CORE

NUMBER OF NON-CORE FACULTY: The Department of Biology has a large and dedicated group of academic professionals who individually and collectively do a terrific job of helping us fulfill all of the missions with which we are entrusted. Our non-core faculty includes several categories of non-tenure track classroom instructors, laboratory instructors, research assistant professors, and tenured professors in other departments with courtesy appointments in Biology. Our non-core faculty roster is presented below.

<table>
<thead>
<tr>
<th>Instructional Asst. Professors</th>
<th>Sr. Lecturers</th>
<th>Lecturers</th>
<th>Lab Instructors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rita Moyes</td>
<td>David Baumgardner</td>
<td>Phil Beremand</td>
<td>Ben Alexander</td>
</tr>
<tr>
<td>Kathryn Ryan</td>
<td>Bill Cohn</td>
<td>Chris Lee</td>
<td>Beth Armstrong</td>
</tr>
<tr>
<td></td>
<td>Carol Johnson</td>
<td>Asha Rao</td>
<td>Jennifer Cary</td>
</tr>
<tr>
<td></td>
<td>Lathi Taylor</td>
<td>Andy Tag</td>
<td>Chelsey Dankenbring</td>
</tr>
<tr>
<td></td>
<td>Wei Wan</td>
<td></td>
<td>Lauren Dobson</td>
</tr>
<tr>
<td></td>
<td>Leslie Winemiller</td>
<td></td>
<td>Sharon Epps</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Karine Gil-Weir</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Benjamin Kaster</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jacob Lyons</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Jerry Norton</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Elizabeth Pishko</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Mattie Squire</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Sabarithna Sundaram</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Gregory Whitaker</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Rachel Wright</td>
</tr>
</tbody>
</table>
Our classroom instructors include three lecturers, six senior lecturers, and two instructional assistant professors, who teach many of our large courses throughout all four years of the undergraduate curriculum. All of the lecturers and three of the senior lecturers do most of their teaching in our massive freshman biology program. They teach in both semesters of our introductory biology courses for life science majors and in two one-semester courses for non-science majors. Typically, each non-core freshman biology instructor teaches two 300-student lecture sections of the same class each semester.

Two senior lecturers teach our junior-level courses in human anatomy and physiology. Dr. Bill Cohn teaches BIOL 319, Human Anatomy and Physiology I, to over 450 students in two lecture sections each semester, and Dr. Lathi Taylor teaches BIOL 320, Human Anatomy and Physiology II, to approximately 400 students in two lecture sections each semester. They each teach a class of 140 students in our full-length summer session.

Dr. David Baumgardner is a senior lecturer who teaches our 300-level ecology course and its related lab sections. This class usually has 125 to 150 students in a single lecture session, and 32 of those students take the corresponding laboratory in two sections of 16 students each. Dr. Baumgardner also teaches a study abroad course in the summer session, where he supervises 12 to 15 students who do independent research at two field stations in Costa Rica; one on the coast and one in the cloud forest.

Dr. Rita Moyes is an instructional assistant professor who teaches various microbiology courses, ranging from MICR 206, Introductory Microbiology for non-majors (mostly allied health students) to our senior level immunology course and its associate laboratory. Dr. Moyes also oversees all of the microbiology teaching labs, including 20 lab sections (which meet twice each week) every semester for our 400-student MICR 351 Introductory Microbiology class for life science majors.

Dr. Kathryn Ryan is an instructional assistant professor who teaches molecular and cell biology courses at freshman, senior, and graduate levels. She also chairs our undergraduate program committee and oversees our undergraduate research program.

Dr. Joseph Bernardo is a research associate professor whose major responsibility, despite his title, is to teach two sections of our sophomore-level course in ecology and evolution each semester.

In addition to these academic professionals in the classroom, all with Ph.D.s and many years of experience, we also have a large contingent of laboratory instructors (12 in the 2014-15 academic year). These lab instructors each teach six sections of the laboratory portions of our large classes (freshman biology, human anatomy and physiology, and microbiology) every semester. They must have either a Ph.D. or an M.S. degree in a life science field. Our department has always had a few lab instructors, but we greatly expanded use of this title during the 2010 budget crises. Starting pay for these positions is $2,500 per month (for someone with an M.S.), which is only slightly more than the $2,000 per month we pay a graduate teaching assistant. However, lab instructors teach six sections per semester, while graduate TAs teach only two. Historically, our large undergraduate
program subsidized graduate programs in other life science departments by hiring many of their students as teaching assistants. In 2010, the budget crisis forced us to eliminate nearly all out-of-department graduate teaching assistants and replace them with lab instructors, thereby saving $350,000 per year. Unfortunately, this move also had unintended consequences because although lab instructors function like full-time graduate teaching assistants, they are considered faculty members under university regulations. This makes our department look much larger than it actually is. When these 12 positions are added to our classroom instructors, our per capita teaching efforts are diluted on official university reports.

Our remaining non-core faculty members include the four research assistant professors working directly under a tenured professor, who were mentioned above, and four tenured professors in other departments who have courtesy appointments in our department.

**STUDENT TO FACULTY RATIO AND TEACHING LOAD:** Of our 37 non-core faculty, there are 26 whose major duty is teaching. Typically, each of lecturers or senior lecturers teach two large classes each semester, with approximately 280 students in each freshman biology lecture section and 200 to 250 students in our anatomy and physiology lecture sections. Therefore, these instructors deal with approximately 500 students each semester. Laboratory instructors teach 6 sections of freshman biology or anatomy and physiology each semester, for a total of 120 to 150 students.

**FACULTY DIVERSITY**
Of our 38 core faculty members, seven are women (18%), three are Asian (8%), and two are Hispanic (5%). There has been little change in ethnic or gender diversity since the last review, but we are hopeful future hires will provide an opportunity to increase the diverse backgrounds and perspectives of our faculty. Of our 37 non-core faculty, 17 are women (46%), four are Asian (11%) and two are African American (5%).

**FACULTY QUALIFICATIONS**
The breadth of biology as a discipline and the wide arrange of courses our department covers means that we must recruit and hire faculty members from a very broad portion of the life sciences. Our only formal requirement is that all tenure-track faculty members have an earned Ph.D. and experience in a relevant field. Perhaps the best way to describe our requirements and qualifications is to present our current ad for assistant professors, which appeared in the June 26, 2015 issue of *Science* and is posted at various on-line sites:

The Department of Biology at Texas A&M University invites applications for two tenure-track Assistant Professor positions in evolutionary genomics, starting in the fall of 2016.

We will consider candidates pursuing innovative research in any area of evolutionary genomics, including empirical, theoretical or computational approaches applied to any taxonomic group. The criteria for selection will be uniqueness, creativity and excellence in research and scholarship. We require all candidates to have a Ph.D. and strongly encourage applications from candidates who will increase the exposure of our students to a diverse culture.

Successful candidates will be expected to develop externally funded research programs and to teach undergraduate and graduate courses. The Department of Biology (www.biology.tamu.edu) is part of an interactive and collegial research environment, offering a modern infrastructure and competitive startup packages. The broader Texas A&M research community includes a number of exciting interdepartmental programs, such as the new Ecology and Evolutionary Biology Doctoral Program.
Academic Program Review 2015

(eeb.tamu.edu), the Texas A&M Institute for Genome Sciences and Society (genomics.tamu.edu), and the Genetics Interdisciplinary Graduate Program (genetics.tamu.edu). Applicants should email a letter of intent, curriculum vitae, statements of research and teaching interests, and should arrange to have three letters of recommendation sent to evosearch@bio.tamu.edu. Review of applications will begin September 1, 2015.

Questions regarding this search should be directed to Dr. Adam G. Jones, chair of the search committee, at evosearch@bio.tamu.edu.

Texas A & M University is an Equal Opportunity/Affirmative Action employer that is dedicated to the goal of building a culturally diverse and pluralistic faculty and staff who are committed to teaching and working in a multicultural environment. We strongly encourage applications from women, minorities, veterans, individuals with disabilities, and the LGBTQ community. In addition, the University is responsive to the needs of dual career couples.

We have used similar wording in our position announcements for many years, although each announcement is tailored to our current needs. The chair of the search committee and the department head are required to undergo diversity training presented by the dean of faculties before any faculty position can be advertised. The search committee, which is appointed by the department head, screens applicants and presents a short list to the head and the dean. Upon their approval, the committee then invites candidates for an on-campus interview that typically lasts two to three days. After the last interview, candidates are discussed at a faculty meeting led by the chair of the search committee. Tenured and tenure-track faculty members then rank the candidates by secret ballot. The head presents the top candidates to the dean and, with her approval, begins negotiations. We verify candidates’ terminal degree by requesting formal transcripts from their previous institutions before we can hire them. Candidates must also pass a criminal background check.

We try to find laboratory space for new assistant professors near other labs with similar research interests to foster synergistic interactions, but given the fragmented nature of our buildings, this is not always possible. After the new hires have had a few months to settle in, they are asked to choose two official mentors. While there will be abundant opportunity for continual mentoring through the natural course of events, there is a formal meeting to discuss scientific and career progress each year. Previously, we dropped any expectation of formal mentoring once assistant professors were tenured, but in spring 2014, we extended our mentoring program to include associate professors to ensure they remain on track for promotion to full professor.

Progress and productivity of all faculty members in our department are reviewed annually by both an elected review committee (six tenured faculty members, and chaired by the associate head for operations) and by the department head. The committee spends much of their time each year evaluating our pre-tenure faculty. They provide feedback and encouragement and, if necessary, firm guidance on where the faculty members should focus their efforts to ensure a successful bid for tenure. Review by this committee also serves as the post-tenure review mandated for associate and full professors.

Assistant professors must submit an application for tenure no later than the end of their fifth year. The tenure package is relatively straightforward and consists of a curriculum vita, three-page summary of research interests and accomplishments, reprints and preprints of publications, and syllabi and teaching evaluations for courses
the candidate has taught. This package is sent to 10 outside reviewers, all of whom must hold tenure at a peer institution or better. Because of the diverse nature of biology and of our faculty, our department does not have rigid qualifications for tenure and promotion beyond what the university mandates. However, we give the greatest weight, by far, to research accomplishments, including publications, funding, and presentations at meetings and other institutions, and to the evaluations of the outside reviewers.

Assistant professors present a seminar in the fall of the year they are being considered for tenure and promotion. After the seminar, the annual review committee drafts an evaluation of the candidate’s accomplishments in research, teaching, and service. This document, tenure materials submitted by the candidate, and letters from outside reviewers are made available for the tenured faculty to review. The candidate’s case is then discussed at a meeting of all tenured professors (except the department head), and a vote is taken by secret ballot. The associate head for operations submits a written summary of the discussion and vote to the department head, who makes a recommendation concerning tenure and promotion to the dean. Promotion from associate to full professor follows a nearly identical process, except that there is no mandatory deadline for consideration.

FACULTY ANALYSIS

RESEARCH: The radar plot below (Figure 6) presents data from Academic Analytics that reflects the contributions of the current 38 core faculty members of the Department of Biology.

Figure 6. Overall Productivity Analyses. The chart shows TAMU Biology productivity measures of our core faculty compared to the national median (indicated by the 50th percentile mark) of 215 Ph.D. granting departments of Biology or Biological Sciences. 10 percentile increments are marked by concentric rings.
These data differ from those provided by the provost’s office as they do not include our research assistant professors nor the three faculty members we have lost in the past year. This is a more accurate indication of where we truly are as a department, with the exception that Academic Analytics does not include Dr. Garcia’s substantial HHMI funding (and possibly his associated award.) We are above the median for most measures of productivity when compared to all Ph.D. granting biology departments in the country, except for the number of publications per faculty member and the citations associated with these papers. However, we do not fare as well when compared to our peer group (biology departments at public land grant schools in the AAU; see Figures 3 and 5). Plans to improve performance in all of these categories are detailed in our strategic plan (Appendix B). We are also working with the university to resolve the issue of research assistant professors in our department so we can all have a more accurate record of our productivity.

TEACHING: The Department of Biology teaches the 4th highest number of student credit hours and the seventh highest number of weighted student credit hours on campus. Again, to put these numbers in perspective relative to other life science entities at Texas A&M, our department teaches over one-fourth of what the entire College of Agriculture and Life Sciences does and about 2.3 times what the entire College of Veterinary Medicine does. Our department is unusual among the most active teaching departments in that our high numbers stem from both a large number of undergraduate majors and from many large courses that mainly serve students from other life science majors. Most other large teaching departments have only one of these two factors.

We provide five options for the BS degree so that students can tailor their studies to their interests and aspirations, and we offer Ph.D. degrees in biology and in microbiology. Our faculty members play vital roles in many interdepartmental Ph.D. programs across campus, including Genetics, Neuroscience, Molecular and Environmental Plant Sciences, and the newly formed faculty of Evolution, Ecology, and Behavior.

The quantity and breadth of our teaching mission is daunting, and these combine to pose challenges to efforts to improve the quality of our teaching. Nevertheless, we are moving forward on several fronts, particularly with regard to establishing an honors program to recruit and retain the best undergraduates, and with reinvigorating our microbiology program at both undergraduate and graduate levels (see strategic plan for details). One of the largest challenges will be to figure out how we can teach relatively small sections of honors courses without increasing the size of our already large sections for other students.

SERVICE AND ENGAGEMENT: Nearly all core faculty members and many non-core faculty members are very active in service to our department, to professional societies, to professional review activities for funding agencies and journals. Our department is remarkable for the amount of administrative leadership it provides to the college and the university. Michael Benedik serves full-time as vice provost, Andreas Holzenburg is the director of the university’s Microscopy and Imaging Center, and Duncan MacKenzie is associate director of undergraduate research in the university’s honors program. Mark Zoran, Ginger Carney, and Michael Kemp are associate deans in the College of Science.

The faculty of the Department of Biology have partnered with the staff of Bryan Collegiate High School, a local dual-credit, dual-enrollment college prep school whose student body is composed of 69% minorities that are under-represented in the sciences, to provide two 35-minute lunchtime presentations each month to their
Entire freshman and sophomore classes. The topics of these presentations included the diversity of careers in biology (in addition to medical and dental school), “What is a Ph.D.? - What is graduate school?”, and informal research presentations on faculty research projects on a diversity of topics such circadian clocks, evolution and sex, rainforest ecology, and deadly pathogens. These activities also provided the opportunities for informal conversations between faculty ad BCHS and the Department of Biology.

We recently established a departmental outreach committee to coordinate, encourage, and expand our engagement activities within Texas A&M and beyond the campus. Their work will begin in the fall 2015 semester.
Student Profile

**DOCTORAL STUDENTS**

**ENROLLMENT:** Table 12 shows the total number of graduate students enrolled in biology at the beginning of each fall semester per major from 2008 to 2014. The number of doctoral students in our programs has consistently stayed around 100, with one exceptional year (2013), but the number of students in our labs from interdepartmental programs has declined.

<table>
<thead>
<tr>
<th>Year</th>
<th>PhD</th>
<th>MS</th>
<th>MAJORS</th>
<th>SUPPORT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>BIOL</td>
<td>MICR</td>
</tr>
<tr>
<td>2014</td>
<td>100</td>
<td>4</td>
<td>93</td>
<td>11</td>
</tr>
<tr>
<td>2013</td>
<td>82</td>
<td>2</td>
<td>55</td>
<td>29</td>
</tr>
<tr>
<td>2012</td>
<td>106</td>
<td>4</td>
<td>100</td>
<td>10</td>
</tr>
<tr>
<td>2011</td>
<td>97</td>
<td>4</td>
<td>91</td>
<td>10</td>
</tr>
<tr>
<td>2010</td>
<td>113</td>
<td>3</td>
<td>104</td>
<td>12</td>
</tr>
</tbody>
</table>

During the period of this review, from 2008 to 2014, the average number of graduate students admitted to the program per year was 16, for a total of 114. Of these, 100 were admitted as Ph.D. students, and 4 were admitted as M.S. students in 2009, the last year we accepted students applying for an M.S. degree. It should be noted that a number of students admitted to our Ph.D. program later decide to pursue an M.S. instead, so these numbers are based solely on status at time of enrollment. The breakdown of graduate enrollment by degree level for new students admitted during the last seven years can be seen in Table 13.

Our current graduate student body consists of 41% domestic (U.S. citizen) enrollees. This percentage has declined since the previous review when 57% were domestic. During the last seven years, the department annually admitted an average of 7.8 domestic and 8.4 international students. 59% of the graduate students in the Department of Biology are female. About 6% of the domestic students are classified as underrepresented minorities. A breakdown of new graduate students admitted per year by gender, degree sought, and domestic or international is displayed in Table 13.

All of our students are offered funding through teaching assistantships or research assistantships, but some of them have outside funding. For example, in 2014, 6 students in the Department of Biology had been awarded fellowships from NSF, EPA, or internal graduate fellowships (Table 12).

<table>
<thead>
<tr>
<th>Year</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>9</td>
<td>5</td>
<td>7</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>8</td>
</tr>
<tr>
<td>Females</td>
<td>9</td>
<td>9</td>
<td>13</td>
<td>10</td>
<td>5</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>Domestic</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>8</td>
<td>6</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>International</td>
<td>9</td>
<td>6</td>
<td>10</td>
<td>8</td>
<td>7</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>MS</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PhD</td>
<td>18</td>
<td>10</td>
<td>20</td>
<td>16</td>
<td>13</td>
<td>14</td>
<td>19</td>
</tr>
</tbody>
</table>
RETENTION AND GRADUATION RATES: Nearly all students entering our Ph.D. program graduate with either a Ph.D. or an M.S. degree. Typically, 10% to 30% of the students in any entering class change their degree objective from the Ph.D. to M.S., with or without a thesis. This rate has been consistent for the reporting period. We have awarded, on average, 16 degrees per year, the same as the number of our average entering class, confirming that nearly everyone who enters leaves with a degree (Table 14). The number of graduate degrees has increased since the previous review period ending in 2008, when we awarded about 12 degrees annually.

Table 14

<table>
<thead>
<tr>
<th>Year</th>
<th>M.S.</th>
<th>Ph.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>2013</td>
<td>2</td>
<td>17</td>
</tr>
<tr>
<td>2012</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>2011</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>2010</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>2009</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>2008</td>
<td>9</td>
<td>11</td>
</tr>
</tbody>
</table>

AVERAGE TIME TO DEGREE: This number is calculated as the average length of time to graduation for those students who graduate in the indicated year. Our graduation rates have remained consistently at just over 6 years (average 6.33 or 6.35), which may be slightly higher than the national average (national median time to degree in biological sciences represented in the Department is ~5.65 years as reported in the 2011 NRC report on the assessment of biomedical programs). We note that the average time to degree for M.S. students reflects their transition from the Ph.D. program to the M.S. degree plan, a decision which often comes after their second year in the program.

Table 15

<table>
<thead>
<tr>
<th>Year</th>
<th>BIOL Average</th>
<th>MICRO Average</th>
<th>BIOL Average</th>
<th>MICRO Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>5.75</td>
<td>6</td>
<td>4</td>
<td>N/A</td>
</tr>
<tr>
<td>2013</td>
<td>6.44</td>
<td>7</td>
<td>4.38</td>
<td>2.0</td>
</tr>
<tr>
<td>2012</td>
<td>6.79</td>
<td>6.75</td>
<td>2.75</td>
<td>2.50</td>
</tr>
<tr>
<td>2011</td>
<td>6.86</td>
<td>6.25</td>
<td>3.20</td>
<td>N/A</td>
</tr>
<tr>
<td>2010</td>
<td>6.0</td>
<td>N/A</td>
<td>2.0</td>
<td>2.5</td>
</tr>
<tr>
<td>2009</td>
<td>6.50</td>
<td>5</td>
<td>3.50</td>
<td>N/A</td>
</tr>
<tr>
<td>2008</td>
<td>6.17</td>
<td>7</td>
<td>3.17</td>
<td>N/A</td>
</tr>
<tr>
<td>Overall Average</td>
<td>6.35</td>
<td>6.33</td>
<td>3.28</td>
<td>2.33</td>
</tr>
</tbody>
</table>

GRADUATE STIPENDS AND PERCENTAGE OF STUDENTS WITH INSTITUTIONAL FINANCIAL SUPPORT: Graduate student stipends in the Department of Biology are linked to teaching budgets for our undergraduate teaching laboratories. Therefore, base stipends for newly admitted graduate students, are in large part, determined by our allocations for teaching. The current monthly stipend for biology students is $2,000, but this has not changed since 2011 (see Table 6, pg. 13). 100% of our students receive support in the form of either a teaching assistantship, a research assistantship from grants to their major professors, or fellowships. The stipend for both teaching and research assistantships is the same.
STUDENT PUBLICATIONS/ PRESENTATIONS: We began tracking student publications and presentations in the summer semester of 2010, but we have reliable data only for the past two years (Table 16). These numbers are based on a yearly Student Report Form that all graduate students are required to fill out and submit to the Department of Biology’s Graduate Advising Office. We are continuing to look for ways to increase student reporting and participation in the annual reporting process.

<table>
<thead>
<tr>
<th>Year</th>
<th>Year</th>
<th>Publications Submitted</th>
<th>Oral Presentations</th>
<th>Poster Presentations</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013-14</td>
<td>31</td>
<td>12</td>
<td>46</td>
<td>40</td>
</tr>
<tr>
<td>2012-13</td>
<td>21</td>
<td>8</td>
<td>19</td>
<td>37</td>
</tr>
</tbody>
</table>

EMPLOYMENT PROFILE: Data on post-graduation employment has been traditionally difficult to obtain, most often due to difficulties in maintaining communication with students more than one year after they graduate. Current efforts are underway to improve our data on post-graduation employment, with one-year and five-year time points being represented. While we do not yet have comprehensive data, we believe that social media will facilitate our efforts during the upcoming reporting period. Table 17 below shows current employment data, or the information we were able to obtain during the first year after graduation, for students who graduated during the indicated years. Thus, these data do not necessarily specify the post-graduation career trajectory for our graduates. The data we were able to obtain do show that the majority of graduates continue on to post-doctoral training positions or to positions in industry, with a consistent number obtaining faculty positions either in higher education or primary education.

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Number of Graduates</th>
<th>Faculty</th>
<th>Staff (University)</th>
<th>Industry</th>
<th>Post-Doc</th>
<th>Student (Continuing in Different Program)</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>13</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>2013</td>
<td>19</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>8</td>
</tr>
<tr>
<td>2012</td>
<td>20</td>
<td>2</td>
<td>0</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>16</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>2010</td>
<td>14</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>2009</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>2008</td>
<td>20</td>
<td>3</td>
<td>1</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

UNDERGRADUATE STUDENTS

STUDENT DIVERSITY/ DEMOGRAPHICS: Our department has no role in undergraduate admissions, nor do we have any restrictions for admission other than the university minimums for grades, SAT/ACT scores, etc. However, the diversity and demographics of our majors differ from that of the entire university in some important ways (Table 18). Our majors are 61% female vs. 49% for the entire university. The percentages of our majors who are Asian (14%), or Black (5%), or international (4%) are twice the university-wide percentage. This leads to a lower percentage of White students (48%) compared to the university-wide figure (66%). We also have more first-generation college students (30% vs. 24%) and more students who were not automatically admitted by virtue of graduating in the top 10% of their class (42% vs. 35%). These last two numbers may explain why the SAT scores for our entering freshmen are 40 to 60 points below the university average.
Table 18

<table>
<thead>
<tr>
<th>Student Diversity and Demographics (Graduate and Undergraduate)</th>
<th>Biology Headcount Fall 2014</th>
<th>Biology Percent Fall 2014</th>
<th>University Percent Fall 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>1,663</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><strong>Ethnic Origin</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>239</td>
<td>14.4</td>
<td>5.5</td>
</tr>
<tr>
<td>Black</td>
<td>78</td>
<td>4.7</td>
<td>2.8</td>
</tr>
<tr>
<td>Hispanic/Latino</td>
<td>435</td>
<td>26.2</td>
<td>20.6</td>
</tr>
<tr>
<td>International</td>
<td>64</td>
<td>3.8</td>
<td>1.6</td>
</tr>
<tr>
<td>American Indian</td>
<td>1</td>
<td>0.1</td>
<td>0.3</td>
</tr>
<tr>
<td>2 or more races</td>
<td>41</td>
<td>2.5</td>
<td>3</td>
</tr>
<tr>
<td>Native Hawaiian</td>
<td>1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Unknown or Not Reported</td>
<td>5</td>
<td>0.3</td>
<td>0.2</td>
</tr>
<tr>
<td>White</td>
<td>799</td>
<td>48.0</td>
<td>65.9</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>1,007</td>
<td>60.6</td>
<td>48.8</td>
</tr>
<tr>
<td>Male</td>
<td>656</td>
<td>39.4</td>
<td>51.2</td>
</tr>
<tr>
<td><strong>First Generation Student</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First Generation</td>
<td>499</td>
<td>30.0</td>
<td>24.1</td>
</tr>
<tr>
<td>Unknown</td>
<td>125</td>
<td>7.5</td>
<td>12.6</td>
</tr>
<tr>
<td>Not First Generation</td>
<td>1,039</td>
<td>62.5</td>
<td>63.3</td>
</tr>
<tr>
<td><strong>Top 10 Percent in High school</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not Top 10</td>
<td>703</td>
<td>42.3</td>
<td>35.4</td>
</tr>
<tr>
<td>Top 10</td>
<td>960</td>
<td>57.7</td>
<td>64.6</td>
</tr>
<tr>
<td><strong>Average SAT by Program</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIOL</td>
<td>1,149</td>
<td></td>
<td>1,189</td>
</tr>
<tr>
<td>BMCB</td>
<td>1,170</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MBIO</td>
<td>1,130</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZOOL</td>
<td>1,134</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RETENTION RATES:** As previously mentioned (page 18), we noted a recent trend in which some of our majors are leaving the department for less rigorous programs. We retain fewer than 50% of our majors after the first year, but this stabilizes at 30% retention by the third year (Table 19). Transfer students (~30% of our total) from other universities and from other programs at TAMU offset some of these losses when they enter our program in their second or third year. Other departments within the College of Science and the Department of Biochemistry and Biophysics in the College of Agriculture and Life Sciences have similar losses of majors in the first year and similar 4- and 6-year graduation rates. Nevertheless, we want to retain more of our freshmen for both pedagogical and financial reasons. To achieve this goal, we are focusing our efforts in two areas: 1) improve the academic success of students in our introductory courses (online homework, self-assessments, and learning communities), and 2) attract and retain the best students through the development of an honors program. Decreasing the sizes of our introductory courses to enhance learning is not possible without a large increase in faculty, classrooms, and teaching laboratories. We have considered eliminating the laboratory component of our introductory courses as a means to increase retention and overall throughput, but we have not done so because these labs fulfill state-mandated core curricula requirements for both majors and non-majors.
It is important to note that 4- and 6-year graduation rates at Texas A&M are among the best in the state for public universities at 51% and 80%, respectively. We assume that students who transfer out of Biology graduate from other programs on campus at these rates, but we do not have a method to track them after they leave our department.

**Table 19**

<table>
<thead>
<tr>
<th>Cohort Year</th>
<th>Initial cohort count</th>
<th>1 Yr. percent retained within department</th>
<th>2 Yr. percent retained within department</th>
<th>3 Yr. percent retained within department</th>
<th>4 Yr. percent graduated within department</th>
<th>5 Yr. percent graduated within department</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>516</td>
<td>61%</td>
<td>40%</td>
<td>32%</td>
<td>30%</td>
<td>34%</td>
</tr>
<tr>
<td>2009</td>
<td>510</td>
<td>56%</td>
<td>38%</td>
<td>33%</td>
<td>30%</td>
<td>34%</td>
</tr>
<tr>
<td>2010</td>
<td>504</td>
<td>53%</td>
<td>37%</td>
<td>31%</td>
<td>27%</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>489</td>
<td>56%</td>
<td>36%</td>
<td>31%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>594</td>
<td>47%</td>
<td>29%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>648</td>
<td>43%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GRADUATION RATES:** Graduation rates for majors in each of our degree options have been relatively constant since the last review (Table 20). This has been facilitated by a critical change to our curricula. Specifically, in 2012 we chose to eliminate the requirement for “directed” electives for the BA and BS Biology degrees (bulk of our majors). Directed electives were upper-level biology courses previously chosen by the faculty to ensure breadth of training within the major. Instead, students can now choose any upper-level biology course as an elective to complete their degree plan. Enrollment pressures in directed elective courses drove the need for greater curricular flexibility. Although this experiment is still unfolding, it is no longer necessary for a student to remain enrolled for an extra semester solely to gain entry into an over-subscribed, upper-level biology course or to obtain a waiver to meet graduation requirements.

**Table 20**

<table>
<thead>
<tr>
<th>Year</th>
<th>BIOL BA</th>
<th>BIOL BS</th>
<th>BMCB</th>
<th>MBIO</th>
<th>ZOOL</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>2011</td>
<td>4.29</td>
<td>4.16</td>
<td>4.04</td>
<td>4.15</td>
<td>4.00</td>
<td>4.15</td>
</tr>
<tr>
<td>2012</td>
<td>4.27</td>
<td>4.14</td>
<td>4.31</td>
<td>4.47</td>
<td>4.21</td>
<td>4.18</td>
</tr>
<tr>
<td>2014</td>
<td>4.08</td>
<td>4.11</td>
<td>3.92</td>
<td>4.28</td>
<td>4.14</td>
<td>4.10</td>
</tr>
</tbody>
</table>

**GRADUATE PLACEMENT/ EMPLOYMENT**
According to our survey of graduating seniors just before graduation in May 2015, 87% of them are continuing their education at either a professional school or graduate school. Most of the remaining 13% of our graduates plan to enter the workforce. 90% of our graduates report that because of their preparation here, they are confident or very confident about their success in the future.
Concluding Observations

Given our current resources, the Department of Biology at Texas A&M University is performing admirably with our massive undergraduate teaching mission, in terms of both quantity and quality. However, we would like to further enhance undergraduate education for our majors by reducing class sizes in upper-level courses. This would allow us to implement Socratic teaching methods in the classroom, provide increased opportunities to improve student critical thinking and writing skills, and allow for in-class discussion with immediate feedback. To create such smaller, more interactive classes, we need to hire additional tenure-track faculty members. The current demographics of our department indicate that we will have to hire two new professors each year just to maintain our core faculty at its current level of 38. It will take four hires per year, probably the maximum we can reasonably sustain, to reach a core faculty size of 48 by 2020. Even then, assuming our number of majors remains constant, our student: teacher ratio will be 32:1. This is still far from the ideal 20:1 ratio, but it would be a meaningful improvement over our current 42:1 ratio. To reach a core faculty of 48 in five years, we must be able to reallocate faculty salaries upon retirement and attrition to new faculty hires, and to use indirect cost returns to partially fund start-up packages. Additional funding from the university will likely be required to fully realize this goal.

Research by the Department of Biology faculty is leading to new therapeutics and innovative solutions to major questions. In addition to improving the quality of education, an appropriately sized core faculty will allow us to increase our research productivity and provide greater benefit to society. To increase and improve upon our current research programs, we must be able to fund exploratory work, provide bridge funding to productive faculty, and provide the equipment needed to generate preliminary data necessary for obtaining large federal and private research grants. We recently developed a strategic plan that prioritizes improving our research program. Much of this plan can be accomplished through changes made within our department, but it relies on the use of our indirect cost return. Unfortunately, due to ongoing budget constraints, we currently use a significant portion of our research funds, including IDC funds, to pay our teaching assistants. If, however, our teaching mission were fully funded, we could then reinvest all of the IDC to enhance our research enterprise.

Training graduate students is critical to the future of research needed to solve grand challenges confronting science and society. Our graduate program seems to be doing well, as many of our students go on to excellent postdocs or permanent positions demonstrating that they are well trained and poised for success, and that our continuous work to improve preparation is paying off. Nevertheless, we need to do a better job of not only tracking our students after they graduate, but also assessing progress along the way so that we can more precisely identify opportunities for further improvement. To accomplish this, we are expanding our undergraduate assessment program to our graduate program.

Now is the time to make the needed improvements to our teaching and research mission. We have a new president, and soon we will have a new dean in the College of Science. We look forward to working with them to help us achieve the goals and aspirations outlined in this document and detailed in our strategic plan.
APPENDICES

Appendix A: Academic Program Review 2008 Recommendations and Responses
Appendix B: Department of Biology Strategic Plan
Appendix C: Vision 2020 Executive Summary
Appendix D: Graduate Student Handbook
Appendix E: Graduate Course Descriptions
Appendix F: Undergraduate Degree Plans
Appendix G: Undergraduate Course Descriptions
Appendix H: Core Faculty Biographies
APPENDIX A

Results of the 2008 Departmental Review
Our review team spent Sunday evening, Monday, Tuesday and Wednesday morning (April 6-9, 2008) evaluating the Department of Biology. We toured the facilities, met with faculty, students (undergraduate as well as graduate), and staff of the department, the Dean of the College of Science, Chairmen of the Departments of Chemistry, Mathematics and Statistics and key University administrators. We felt that the schedule of our visit and the material supplied to us prior to and during our visit was sufficient for us to obtain a comprehensive review of the department.

Overall, we feel that the department has made great strides since the last review in improving its instructional role on campus and its research visibility nationally and internationally. We specifically commend Dr. Vincent Cassone on his excellent leadership in moving the department forward in its mission, while still maintaining an active research program. His departure will leave a major void in the department, not only as an administrator but also as a researcher that will be a challenge for the department and college to replace.

THE FACULTY

In the last five years the Department of Biology has hired 16 new faculty, including four senior members, bringing the total of tenure-track faculty to 42, a return to the levels of the pre-1990’s. As a result, the distribution of faculty by rank is more in line with similar departments in biology and the life sciences, i.e. 17 Professors, 11 Associates and 14 Assistants. By any standard, this represents an unprecedented rate of change when more than one-third of any departmental faculty is replaced. Furthermore, to include four senior hires in this same time frame is alone an unusual accomplishment. This was due to the Faculty Reinvestment Program whereby the University was committed to hire an additional 450 new faculty. This initiative was essential to cope with a significant increase in student numbers over the last several decades resulting in a concomitant requirement for more teaching faculty in the Department of Biology which today represents about 1500 undergraduate majors and 100 graduate students. We believe that the department should aim to reach a steady state level of 50 faculty in the next five years which is as many as it can support in terms of present space (see below). Any further growth will require careful planning and thought in terms of administration and construction of new space.

We believe that the junior hires represent an outstanding group of young faculty that all have great potential to contribute to the future of the Department. Furthermore, the tenured hires are all excellent scientists who will
be looked upon as a group of future leaders of the department and mentors for the large group of Assistant Professors. These faculty will also bring great new visibility to the department. In the next five years, this will translate to increased extramural research support generated by the department but will also require concomitant increases in university support for additional staff positions as these new faculty develop their research and training programs.

Faculty Mentoring
With this large influx of new untenured faculty and the arrival of a new department head, it is essential that a clear program for faculty mentoring be in place. There does not, however, appear to be a formal faculty mentoring program, a statement echoed by the pre-tenured faculty. This comment seems at odds with what we were told about a systematic effort to mentor junior faculty. Regardless, a program needs to be clearly outlined in which senior faculty are assigned to junior faculty for mentoring. The mentor should be assigned in consultation with the junior faculty member. The mentor should be available for regular consultation with the junior faculty member to provide advice and to monitor the faculty member’s progress. The mentor, and all the other mentors of junior faculty in the same cohort, might then be part of the promotion committee for these junior faculty when they come up for tenure. This arrangement would not supplant the current practice of a formal annual meeting with the department head in which progress towards tenure is discussed, but provides additional support for the young faculty during this critical time of their careers.

Future Faculty Recruitments
Because the total number of faculty within the department had fallen to 30, the lowest in over 20 years, the rebuilding strategy was not specifically targeted to any one or a few areas but rather to securing the best young talent in any area. Although we appreciate the value of this strategy at the time, it is critical in subsequent rounds of faculty hires that attention should be paid to target areas that not only build upon present strengths but that also create linkages that will develop new foci within the department and create new ones with other units in the university.

It is clear to us that one area of present strength within the department, the campus and nation is in chronobiology. In fact this group of about 10 faculty at Texas A&M is centered in biology and is clearly unique among universities in the U. S., as evidenced by its being awarded an NIH program project grant that is in place until 2011. The recent hiring of Paul Hardin contributed significantly to this strength, but over the next year or two we believe that additional hires in this area, perhaps in plant and vertebrate biology would result in even more competitive applications for renewal of training grants from NIH and additional ones from NSF (i.e., IGERT).

Another area of strength is in developmental neurobiology in which key hires at the assistant and full professor levels have led to a group that is capable of gaining further national recognition. There is a large group of neuroscientists across the campus, with an exceptionally strong group in Psychology as well as Biology, that would benefit with future hires, especially now with the departure of leadership of Dr. Cassone. The present search for a senior neurobiologist and space allocated to Biology in the new interdisciplinary Life Sciences Building are all excellent plans for the future of this strong area. In recruiting additional hires in this area and others it might be good to emphasize model systems such as C. elegans and mouse, to round out the expertise of the groups and take advantage of existing campus facilities.
It is clear that the Ecology, Evolution and Behavior (EEB) faculty attracts top quality graduate students for Ph.D. research. However, the EEB group also felt that there was a real lack of graduate courses in their discipline and some EEB faculty expressed a desire to spend more time teaching graduate courses, as opposed to undergraduate courses to help remedy this situation (see below). We feel, however, that the teaching void in ecology and a lack of senior leadership in evolution will require the addition of new EEB faculty in the very near future. Such searches can build or complement other areas at the same time, e.g., a plant ecologist/evolutionary biologist.

Although plant biology had much more of a presence in this department in the past, it is clear now that plant biology must be rebuilt with a view towards complementing existing departmental strengths, e.g. plant chronobiology, plant ecology, plant/microbe interaction. We do not believe that the Ph.D. in Botany is a viable program and should be eliminated. However, we believe that the department should be encouraged to build strengths in faculty and in course offerings in plant science to enhance the campus wide programs, e.g. at the Crop Biotechnology Center and in the Ph.D. program in Molecular and Environmental Plant Science (MEPS) program. This would definitely enhance the campus wide opportunities in plant science and involve the department in these cross campus programs. We comment further on other options for Ph.D. programs.

One of the future trends of science in general, and of biology in particular, is interdisciplinary research. We urge that there be serious consideration of hires with joint appointments between departments, even if these departments are in different colleges. The potential for such interactions are manifold as there are a number of natural matches between biology and math, chemistry, physics, biochemistry, wildlife and fisheries, crop science, etc. This might be efficiently accomplished through cluster hires in which a small group of researchers in one interdisciplinary theme could be hired simultaneously.

Texas A&M is fortunate to have a diversity of life sciences in a number of colleges across campus. The challenge, however, is to coordinate the life sciences to effectively educate undergraduates and graduate students and to promote the research of graduate students and faculty. We feel that there needs to be some oversight of the life sciences, at the minimum, to coordinate course offerings, reduce redundancy not only in courses but in majors, and to promote interdisciplinary interactions within biology and between biology and other fields of endeavors. The most effective and boldest measure would be to bring all of the life sciences together in a College of Life Sciences. At minimum there should be a committee appointed by the provost to consider how the life sciences on campus could be better coordinated. Given all the vested interests, this might be best done by an outside committee.

THE GRADUATE PROGRAM

Recruitment
There is a strong consensus that there are insufficient graduate applicants both in terms of quantity and quality. There were only 48 domestic applicants last year, ~135 total. This was a concern of most faculty, and was a serious concern for the pre-tenured faculty.

There are two issues here. One is increasing the size of the domestic applicant pool. It was pointed out that most faculty do not have their own lab web pages that can be accessed from the Department of Biology web
There was some discussion about possible impediments to doing so. Regardless of the cause, this is really inexcusable given that it is a low- or no-cost method to establish a presence on what might be the first means of attracting the attention of prospective graduate students. Other means of increasing recruitment were discussed; for example, having department faculty meet with promising undergrads when they present seminars at other universities. Of course, there is no substitute for faculty publishing often and as often as possible in high-profile journals to enhance their visibility, as many are doing.

Once students apply, the department needs to make an admission offer they can’t refuse. Having a few recruitment fellowships for the best and the brightest could make a serious difference in attracting outstanding students. We suggest offering several two-year fellowships with a 12-month stipend of $30,000. This is approximately the level of an NSF pre-doctoral fellowship.

The Biology Department now guarantees incoming graduate students support (in the form of a teaching assistantship) and waiver of tuition and fees (i.e., they will be paid by the program) for the first 12 months. The department has access to more than enough TA slots to support students for two long semesters each year and for the duration of their tenure in the program, if needed. Therefore, we suggest that upon admittance, the department inform each graduate student that in addition to full support for the first 12 months they will also be guaranteed TA or RA support for the next four years for the two long semesters each year as well as a waiver of tuition (but not fees). Since the department is doing this anyway, they should use it as a recruiting tool.

On the positive side, it should be noted that some faculty do quite well in attracting graduate students. Adam Jones, a pre-tenured faculty member, has five students. He feels these are all excellent, and he reports that he can get good students whenever space is available. This illustrates how improving the productivity, stature and visibility of the faculty, especially the junior faculty, is ultimately the most effective way to improve graduate student recruiting.

Stipends
Independent of recruitment issues, graduate student stipends here are not competitive, although the situation has changed for the better recently. The relatively low cost of living in Bryan-College Station offers an advantage in adding value to the stipends, but that advantage is not always appreciated by prospective graduate students. The graduate student stipends are approaching $20,000/two semesters. We suggest that stipend support be pushed to that amount immediately, and that the Department find some way to cover fees, as they are now covering tuition. PIs should be required to request funds to cover both fees and tuition of their RAs.

One mechanism to increase graduate student stipends even further would not require substantial new financial support from the university. At present, Biology employs a number of TAs from other departments. Many universities, and some programs at A&M, such as math, use exceptional undergraduates as TAs. This provides a special learning opportunity and scholastic recognition for these undergraduates. Moreover, since the remuneration for undergrad TAs would be considerably less than for graduate TAs, this would allow the department to apply the cost difference to increase the stipend of the graduate student TAs. In addition, some faculty suggested there needs to be some effort to retain some of the best and the brightest undergrads in grad programs here. This TA experience might contribute to such an end. There is a caveat here, however. As mentioned above, some of the strength in EEB and Plant Science derives from faculty and students in other
departments (e.g., Fisheries and Wildlife) as well as from other programs (e.g., MEPS). Many of the graduate students in these departments/programs often rely on Biology TAs for support at some time during their career. It would be counter-productive to implement this mechanism of reducing TAs if it would in turn harm some of the Biology or cross-campus programs.

Morale
The small sample of graduate students that we interviewed indicated that morale and camaraderie among the students could be improved. One method to begin to address this issue is to reserve one or two seminar dates each semester for graduate students to invite a speaker. This should be done with minimal input from the faculty aside from logistics—e.g., how to go about making an invitation, scheduling flights, making the schedule, etc. Perhaps an active graduate student club should be encouraged and allowed to invite speakers in alternative career paths for Ph.D.s in science. We would also like to note that in our meeting with graduate students we were not informed of the yearly retreat for faculty and graduate students, which, by all reports, is a very successful venue.

Graduate Programs
Some faculty raised the issue of having separate graduate degrees in Biology. There seem to be some advantages in doing so. The subject of Biology might be too large for a single degree. For example, we contemplated suggesting a single core course before we realized there is not a two-semester arrangement of topics that would be pertinent for the breadth of students in the program. That observation by itself might suggest some subdivision of the degree program. Some faculty have also pointed out that the life sciences at A&M suffer because there are no programs that match the categories in which the National Research Council ranks biology programs. From our vantage, we feel that the faculty should consider and discuss the option of having separate graduate programs within biology with faculty drawn from across the richness of life sciences in other departments in the University.

Graduate Curriculum
Again, we found the graduate curriculum to be basically sound although perhaps weak in some areas such as ecology and evolution. The lack of graduate courses in some areas appears to be due to excessive undergraduate teaching loads of the junior faculty. The recent emphasis on reducing section sizes in lower-division courses, an inefficient use of research-active faculty, needs to be re-evaluated. Combining just a few course sections would free up faculty members to develop and teach new graduate courses. It seems that a lack of suitably large lecture halls may be the only serious obstacle to implementing this change.

We thought the different choices of specialties within the curriculum to be reasonable and flexible enough to accommodate the various interests of graduate students in a department as broad as Biology. This also gives the department some visibility in these subspecialties. The downside is that it can also have the effect of lowering NRC and other rankings, if each of the sub-disciplines within the department has only a few participants. This problem can be alleviated by involving faculty from other departments in the sub-disciplines, for example, as is done with the interdepartmental Genetics Program and MEPS. As we discuss above, however, the optimum solution might be to grant separate degrees in these sub-disciplines in biology with faculty drawn from across departments.

Department of Biology, Texas A&M University
As it stands now, two years of formal course work, with approximately two courses per semester is sufficient. Also, leaving the choice of course work to the advisory committee, at least in the second year, is a good idea. We also thought it was wise to deemphasize the Master’s Program. We do think that it would be a good idea to move the preliminary exam up into the second year, before all of the more specialized coursework is completed, although we realize that there seem to be institutional restrictions to doing this. We should point out that some training programs require that the applicants already be admitted to candidacy, which may disadvantage some of your students.

Again many of our comments have to do with maintaining a sense of cohesiveness within the graduate students of the department. The graduate student orientation for incoming graduate students, that is now in place, helps. Another possibility is to provide money for a graduate student club to bring in outside speakers to discuss career opportunities for Ph.D.s in science such as in patent law, industry, publishing etc. (see above). This forum would not only bring the various graduate students together, but would also provide them with useful information about the diverse opportunities available.

Another possibility would be to offer a course to be taken by everyone, regardless of their interests, in their first year in the graduate program. A course in Bioethics might serve such a purpose and is required by some granting agencies for training grants, etc.

THE UNDERGRADUATE PROGRAM

We think that the undergraduate curriculum, while basically sound, could use some minor improvements. Some of these are cosmetic to improve the visibility of the Bachelor of Science in Biology major. It is important that potential undergraduate majors realize the breadth of disciplines within the Biology Department. The Bachelor of Arts Degree should probably be left as is, as it is designed to fulfill the broader needs of majors destined for careers mostly in Secondary Education. The Bachelor of Science Degree has been divided into tracks, which is a very good feature within a major as diverse as Biology, but the names of some of the tracks could perhaps be modernized to attract the attention of potential majors. The names of the tracks are now Biology, Microbiology, Molecular and Cellular Biology and Zoology. We realize the name Biology may appeal to some students applying to professional schools and the name Microbiology still has broad appeal to undergraduates pursuing careers in clinical laboratories and in industry, etc. For others, including those interested in pursuing scientific careers, the name Molecular and Cellular Biology is still attractive but Zoology could perhaps be changed to something like Evolution, Ecology and Integrative Biology.

The effort to maintain smaller class sizes within the undergraduate major has been heroic but may have to be partially retracted to allow more development of the graduate program. Offering so many sections of some second year courses may prevent the development of graduate courses, particularly by some of the junior faculty (see above). Once you have 100 students in a class you might as well have 200 or 300, as far as providing personal attention is concerned.

Advanced level laboratory courses may also have to be trimmed, as these are expensive and time consuming for the faculty and staff. This should be done with care because biology is, above all, an experimental science.
One part of the undergraduate program that we think needs improvement is the process by which undergraduates are chosen to be involved in research in faculty laboratories. One of the major advantages to a science student attending a large research university such as Texas A&M is the possibility of doing cutting-edge research in a well-equipped laboratory under the tutelage of an internationally recognized scientist. Such an opportunity can open paths leading to a distinguished career in science. Yet there doesn’t seem to be a process in place to assure that this opportunity is made available to those students who are most ready and capable of benefiting from it. With the large number of undergraduate majors in Biology, it is impossible to offer this opportunity to all of the majors without seriously detracting from the ability of the department to maintain its prominent position among comparable departments in major research universities. One possibility would be to create an undergraduate research program, coordinated by a faculty member, to advertise available research opportunities, to screen student applicants for research positions, to match the most qualified students with the most appropriate lab, and to oversee each student’s research progress. Applications for research positions should not be based solely on grade point average but also on a demonstrated interest in research and compatible career goals. One possibility would be to implement a formal application process whereby the student would submit a short application in which they would describe their accomplishments and give a brief description of their reasons for wishing to participate in research. Preparing such an application would be good training for preparing later applications, e.g. to graduate schools. We think a single faculty member with a good rapport with the students could coordinate such a program and help them find labs.

An active, centrally-coordinated undergraduate research program could also serve as the heart of an undergraduate Honors track in Biology. Students with a qualifying GPA and a year or more of research experience could be given the option of writing a senior thesis, in the form of a peer-reviewed journal article, for Honors consideration. Senior theses would be evaluated by a single faculty committee covering the various departmental disciplines. Students earning a Biology degree with "Research Honors" would be acknowledged at a graduation ceremony, ideally by their faculty research adviser.

Some undergraduates also feel that students majoring in Biology lack the cohesiveness shared by majors in some of the smaller departments. Again, some of this is inevitable, considering the large number of majors and the diversity of interests within the department. However, formation of a Biology Club, with outside speakers to discuss career opportunities for Biology Majors might help. Another possibility is to use undergraduates for teaching of lower level courses, which would not only save TA money for raising graduate student stipends (see above) but would also increase the involvement of some of the undergraduate majors in the department and provide an invaluable learning experience.

SPACE

The department’s current research-active faculty are mainly housed in three buildings: BSBE, BSBW, and Butler Hall. The support facilities, located in BSBE and BSBW (animal quarters, greenhouse, stockroom, electrical shop, etc.), seem to be in good condition, well-staffed and well managed, and entirely adequate to meet current research needs. Faculty labs and offices, particularly the recently renovated space, are in excellent condition and appropriately configured for modern experimental biology work.
Over the short term, the Biology Department can maintain or modestly increase current faculty numbers through retirement replacements and concomitant renovation of existing space, primarily in BSBW & BSBE. In this “approach to steady-state” scenario, each new faculty hire is likely to average about $1M in combined startup and renovation costs. It should be possible to reduce renovation costs somewhat by remodeling large blocks of space (e.g., a vacated imaging facility) in a single operation. It is vitally important that Biology research labs and faculty in the department not be scattered over too many buildings. Further attempts should continue to be made to form clusters of lab groups with common research interests and equipment needs to promote synergistic interactions among students, postdocs, and faculty.

There should be adequate space to accommodate as many as ten faculty hires over the next five years by renovating lab space in BSBW and BSBE, and (perhaps) Butler Hall that is freed up by faculty retirements, by a move of the imaging facility to the new Life Sciences building, and by judicious relocation of teaching labs. Several teaching labs are still in use on the third floor of BSBE, in the midst of faculty research space. These labs should be relocated or decommissioned in order to consolidate existing and new faculty research groups on this otherwise research-intensive floor. It would be a simple matter to relocate teaching labs if the teaching space currently occupied by Physics on the second floor of Heldenfels becomes available (by 2010?). The current Physics teaching space in Heldenfels would also provide expansion room to create additional, much needed teaching laboratories for lower- and upper-division Biology undergraduate courses. Finally, the Biology Department seems to have little scheduling control over large lecture halls and other classrooms needed for their many courses. This lack seriously disadvantages the department in meeting new enrollment pressures and in gaining flexibility in faculty teaching assignments. The research and laboratory teaching space in Butler Hall is at best antiquated and might be better converted to lecture classrooms over which Biology has primary scheduling control.

Over the long term, any further growth in the number of department faculty will probably require a new building.

**STAFF**

We found the existing staff of the department to be excellent and very capable of supporting the activities of the faculty. However, they have reached the limits of their ability to provide services, and the staff should be increased to meet the additional requirements as the junior faculty become more productive and more active faculty join the department.

Summary Recommendations (not prioritized)

1. Target new hires to existing strengths in research and not to perceived teaching needs. Emphasize hires in “Model Systems” to fill gaps in existing programs and take advantage of existing facilities. Aim for a steady-state size of ~50 faculty over the next five years or so.
2. Improve graduate student recruiting through improved faculty and departmental visibility and increased stipends.
3. Involve undergraduates in teaching to enhance their educational experience and to reduce the need for graduate TAs, thereby releasing money for use to increase stipends.
4. Implement mechanisms, e.g., offering fewer and larger sections of lower-division courses, to free junior faculty for graduate teaching.
5. Remodel subprime space, separate teaching and research areas, and keep faculty together who share common interests and support needs.
6. Consider offering graduate degrees within specialties of biology.
Departmental Responses to Specific Recommendations from the 2008 Review and Our Current Status

COLLEGE OF SCIENCE
Department of Biology

MEMORANDUM

30 May 2008

TO: Dr. Robert Webb, Interim Dean of Graduate Studies

THROUGH: Dr. H. Joseph Newton, Dean of Science
THROUGH: Dr. Vincent M. Cassone, Head of Biology
FROM: Dr. Thomas D. McKnight, Associate Head of Biology

SUBJECT: Departmental Response to the External Doctoral Review

An external committee comprised of four highly respected scientists reviewed the Department of Biology during April 6-9, 2008. On April 18, the external reviewers submitted their report to your Office of Graduate Studies. We feel that the final report of the external review team is a fair and accurate evaluation of the state of biological sciences and the Department of Biology at Texas A&M University.

Attached is our department’s response to each of the specific recommendations made in the external report.
1) **Recommendation:** Target new hires to existing strengths in research and not to perceived teaching needs. Emphasize hires in "Model Systems" to fill gaps in existing programs and take advantage of existing facilities. Aim for a steady-state size of ~50 faculty members over the next five years or so.

**Response:** We heartily agree that the department needs to expand to effectively meet the mission entrusted to us. Recent hires under the Faculty Reinvestment Program were essential to bring our department back to the size it was in the early 1990’s. However, increased enrollment at graduate and undergraduate levels, as well as an increased emphasis on research in the department in the last 15 years requires further expansion of our faculty. The reviewers were not enthusiastic about prospects for reaching the required 70 faculty members any time soon. Instead, they suggested that we focus on reaching 50 faculty members in the next five years. We currently have 42 faculty members, requiring a net gain of eight. Assuming loss of at least one faculty member per year due to retirement, failure to earn tenure, or moving to another institution, we should hire three new faculty members each year for the next five years to reach this goal.

We also agree that we should focus our hires to enhance currently strong research areas and fill in gaps in existing programs. We have not allowed teaching needs to drive hiring at the tenure-track level for at least the past 20 years, and we plan to continue this policy. One caveat is that we are responsible for microbiology degrees at both the undergraduate and graduate levels, and we do need to expand our faculty in this area.

One recommendation in the area of faculty hiring that is mentioned in the main text, but not in the summary of recommendations, is improved mentoring of beginning faculty. We have tried to institute informal mentoring mechanisms, with varying degrees of success. However, it is clear that a more formalized process is required in some cases. We will appoint a committee of pre-tenure and tenured faculty to develop a formal mentoring process to help improve the success of our newest faculty members.

**2015 Status:** We currently have 40 tenured and tenure-track faculty members, down from 42 at the time of the 2008 review and down from our peak of 45 in 2010. Since then, we have hired seven assistant professors: Mark Harlow (neurobiology), Steve Lockless (structural biology), Jim Smith (microbiology), Joe Sorg (microbiology), Jerome Menet (biological rhythms), Christine Merlin (biological rhythms), and Beiyan Nan (microbiology), and two professors: Richard Gomer (cell biology) and Wes Thompson (neurobiology). However, we lost five faculty members to other institutions during this time: Susan Golden (biological rhythms and microbiology), Jim Golden (microbiology), Brian Perkins (developmental biology), Keith Maggert (epigenetics), and Robyn Lints (developmental behavior). In addition, three assistant professors did not earn tenure, and four professors retired. Budget constraints during 2010 – 2012 prevented us from replacing many of these 12 faculty members in a timely fashion. With the worst of the state’s budget crisis behind us, we are hopeful we will be able to increase our tenure-track faculty numbers to 50 in the next 5 years.

We implemented a formal mentoring program for assistant professors in 2010, and we expanded it to cover associate professors in 2014.
2) **Recommendation:** Improve graduate student recruiting through improved faculty and departmental visibility and increased stipends.

**Response:** We have already increased stipends beginning in fall 2008 by -16% to $22,000 per year. Our increased stipend has already yielded dividends, as our incoming 2008 graduate class is the best (both quantity and quality) in many years. $22,000 is still not high enough to be fully competitive with peer institutions (the NSF standard is about $30K per year), so further increases will be required. One measure we will implement beginning in fall 2009 is to increase the stipends each year by at least 3%. Because our GAT/GANT budget rarely increases, we have maintained graduate stipends at one level for many years in the past. This leads to diminished competitiveness over a few years, and we return to a crisis point where we have to increase stipends dramatically. Over the next few years we will rapidly adjust our stipends to NSF-levels and increase them each year to maintain our competitiveness. We are also improving faculty and departmental visibility by reorganizing our website and website committee to focus on graduate recruiting.

**2015 Status:** Our graduate stipends were raised to $2,000 per month in 2009, but budget constraints have prevented us from raising them on a yearly basis as we had planned. Nevertheless, our current stipend is second highest on campus (only slightly behind the Department of Biochemistry), and it seems adequate for recruiting purposes.

We are still working on our on-line presence, and a major revamp of our website is underway.

3) **Recommendation:** Involve undergraduates in teaching to enhance their educational experience and to reduce the need for graduate teaching assistants, thereby releasing money for use to increase stipends.

**Response:** We occasionally use undergraduate TAs now, and we will explore the possibility of using more, but we cannot allow large numbers of undergraduates to displace graduate TAs, since this is a major source of support for our graduate program. We have already absorbed far too much of an increase in student credit hours and number of majors with little additional compensation from the university. Increasing graduate stipends is one of our highest priorities, and without financial support from the university this may mean cutting back on teaching lab sections, instead of using many undergraduate TAs.

One recommendation in the text, but not in the summary, is to institute a more formal undergraduate research program. The reviewers suggest that this program could be supervised by a faculty member who would initially screen applicants and help match them with appropriate laboratories. Such a program may encourage more of our majors to participate in research at an earlier stage of their undergraduate careers. The Undergraduate Program Committee will be asked to determine if and how this recommendation can be implemented.
2015 Status: We still do not use undergraduate teaching assistants, except in dire emergencies. During the budget crisis, we replaced nearly all graduate student TAs from other departments with full-time lab instructors. The lab instructors are paid only a little more than graduate TAs, but they teach 3 times as many students (6 lab sections per week, instead of 2 for the TAs). This move was a big blow to graduate programs in other departments, but it allowed us to maintain support for all of our own graduate students and to maintain close to our usual teaching load.

Our department made a concerted effort starting in 2010 to develop a large-scale undergraduate research program, based on two semesters of intensive bioinformatics and genomics instruction, followed by one semester of independent research and culminating in a capstone course where students wrote about their projects. The addition of these four courses rapidly proved to be unsustainable with decreasing faculty numbers. We have kept the fourth semester writing course as a capstone experience for students who have had a more traditional undergraduate research experience and want to learn to present their research orally and in writing.

4) Recommendation: Implement mechanisms, e.g., offering fewer and larger sections of lower-division courses, to free junior faculty for graduate teaching.

Response: We briefly tried to lower the student:teacher ratio in freshman sections for Biology Department majors by offering classes of 100 students in 2006 and 2007. Increased enrollment rapidly ended this experiment, and we are now back to 300 student sections for nearly all of our majors and non-majors freshman classes.

Almost all assistant professors already teach graduate classes, so it is not clear where this suggestion originated. It should be noted that teaching in our lower division program is the least demanding teaching assignment in the department because of the extensive infrastructure associated with it. Accordingly, such an assignment at least one semester per year is eminently suitable for junior (or senior) faculty with an active research program. Completely turning over our lower division classes to non-tenure-track lecturers, as some have suggested, runs counter to the culture of our department and the seriousness with which we take our teaching mission.

2015 Status: Despite the high-minded rhetoric above, a net loss of four core faculty members since 2008 (from 42 to 38) has forced us to rely extensively on non-tenure track lecturers for the bulk of our freshman biology lecture sections, and some upper-level biology courses.
5) **Recommendation:** Remodel subprime space, separate teaching and research areas, and keep faculty together who share common interests and support needs.

**Response:** We recently submitted a plan to the Council on the Built Environment to acquire the second floor of Heldenfels, once the Department of Physics moves out, so that we can relocate upper-level teaching labs from BSBE, Butler, and the Heep Laboratory Building. This would free up space in Butler and BSBE for additional research laboratories. We will have to request funds for renovation once this space becomes available. We already keep faculty with common research interests and support needs together as much as possible, and the space freed up by moving teaching labs to Heldenfels will help us continue this practice.

**2015 Status:** Our proposal to acquire additional teaching laboratory space in Heldenfels was declined, and we are still searching for ways to move teaching labs out of our research areas. We recently submitted a similar proposal to move teaching labs into the old Heep Building that will be vacated by the Department of Wildlife and Fisheries in 2016. However, this building is in part of campus where the College of Engineering is expanding, and we are not hopeful.

Since 2008 we have renovated one large laboratory complex and undertaken several smaller renovation projects. Most of our buildings are old, and there is a limit to how much renovations can achieve.

The Interdisciplinary Life Sciences Building opened in 2010, and six of our faculty members (three professors and three assistant professors) are located there. This building is several hundred yards from our other buildings, and some of the faculty members located there have expressed a desire to move into one of our main buildings.

6) **Recommendation:** Consider offering graduate degrees within specialties of biology.

**Response:** While we do offer a graduate degree in microbiology, we recently voted to eliminate our graduate degrees in botany and zoology. We agree that our graduate curricula could be updated to reflect modern divisions within biology. These divisions run along lines defined by biological problems, such as development, evolution, physiology, and genetics, rather than along lines defined by organisms such as botany and zoology. Because obtaining approval for a new degree will take some time, we will begin by advertising and offering tracks within our existing Biology degree. Developmental Biology, Neurobiology, and Integrative Biology are among the first tracks we will examine.

**2015 Status:** We currently offer Ph.D.’s in biology and microbiology. We are in the process of reinvigorating and expanding our microbiology Ph.D. to handle increased demand, and our faculty hiring in the next few years will focus on microbiology. Biology faculty members played major roles in establishing interdepartmental programs that offer Ph.D.s in Genetics, Neuroscience, and Ecology, Evolution, and Behavior.
APPENDIX B

Department of Biology Strategic Plan 2015-2020
5-YEAR STRATEGIC PLAN
Depart of Biology at Texas A&M University

VISION
The Department of Biology at Texas A&M University seeks to be an international leader in biological research and education, and a flagship for the life sciences at Texas A&M University and the State of Texas. Many of the grand challenges in science, including human health, energy supplies, and conservation of our environment, are deeply ingrained in basic biological research. A key strength of our department lies in its broad scope of fundamental research in the life sciences, from molecular and cellular biology, to organismal development and neurobiology, to the ecology and evolution of populations. We will build upon these strengths to provide excellent educational opportunities, recruit outstanding faculty, postdoctoral scientists, and graduate students, and through our research, impact the grand challenges in science.

MISSION
The Department of Biology conducts and disseminates innovative scientific research that is both disciplinary and interdisciplinary, provides service to the community, trains outstanding doctoral-level research scientists, and provides a high-impact undergraduate education that prepares students for life-long learning through the development of critical thinking skills, research experiences, and a broad intellectual perspective. Our students will be well prepared to further their education in graduate and professional schools or to pursue careers in biology, biotechnology, or health related fields.

DISCRIPTION OF THE BIOLOGY DEPARTMENT
The TAMU Biology Department is housed in the College of Science, along with departments of Chemistry, Mathematics, Statistics, and Physics. The Department currently has 39 tenured and tenure-track (T/TT) faculty (5 Assistant Professors, 15 Associate Professors, 18 Professors, and 1 Distinguished Professor), 1 Senior Distinguished Professor, 17 non-TT faculty, 36 support staff, and an annual budget of ~$9.6M. Departmental researchers generate approximately $5.5 million annually in sponsored projects ($2.5M NIH, $1M NSF, $1.5M other federal, state, and local funding), with research expenditures in 2014 of $5,510,113 (and $1,106,087 indirect costs). In 2014, 54% of the facult were funded externally. The department regularly serves approximately 1,600 undergraduate majors and 100 doctoral students enrolled in two doctoral programs (Biology and Microbiology). The Biology Department has the largest number of undergraduate majors in the College of Science, and the 3rd highest at Texas A&M University. We teach the 4th highest number of students of all departments on campus. Importantly, the number of T/TT faculty in our department (39) is significantly lower than that of our peer institutions, including Purdue (59) and Pennsylvania State (54), as well as our aspirational peers, including the University of Michigan (80) and Indiana University Bloomington (62).

Our previous strategic plan (2008-2013) focused on faculty hiring and graduate student support to position the department for outstanding research. While this plan had some success with regard to hiring young and energetic talent, over this same time several of our most successful faculty members were recruited to other universities. Thus, it is imperative that our new strategic plan focuses on hiring priorities, research productivity, and research infrastructure to significantly improve the impact of our research program, which in turn affects
our ability to recruit, train, and retain the best faculty, postdoctoral scientists, graduate students, and undergraduate students.

**DESCRIPTION OF STRATEGIC PLANNING PROCESS**

Significant changes have occurred since our last strategic plan was developed, including major budget cuts and loss of key faculty. Importantly, our department is ranked by US News and World Reports at about #75 of all Biology Departments. This ranking has remained constant for several consecutive years. Thus, a major objective in our plan is to increase this ranking to within the top 50 by 2025. To help the department accomplish this objective, the department head and associate heads generated this prioritized set of goals, strategies to achieve the goals, and measurable outcomes to assess progress toward the goals. A draft of the strategic plan was discussed with the executive committee and revised.

All of the goals outlined here align with the first three imperatives of the university’s strategic plan, Vision 2020, which are briefly described as (1) Elevating our faculty and their teaching, research and scholarship, (2) Strengthening our graduate programs, and (3) Enhancing the undergraduate academic experience.

**Summary of Goals**

Goal 1: Recruit, retain, and develop excellent faculty  
Goal 2: Increase extramural research funding  
Goal 3: Increase the number and impact of publications  
Goal 4: Improve the research infrastructure  
Goal 5: Enhance the visibility of our faculty’s contributions and accomplishments  
Goal 6: Develop and promote an internationally-recognized doctoral graduate program  
Goal 7: Enhance the undergraduate academic experience for our departmental majors
Strategies for Accomplishing Goal #1

RECRUIT, RETAIN, AND DEVELOP EXCELLENT FACULTY
Success in the research enterprise is measured by the impact we have in contributing new and impactful knowledge and technologies. Near- and long-term federal investments in the health sciences, energy sciences, and the environment are expected, and we should be well positioned to capitalize on opportunities. To this end, we need to establish and grow synergies developed within and between research focus areas to enhance productivity and prominence. As research focus areas converge, faculty members can define individual and multi-investigator funding opportunities and future hiring priorities. Based on funding potential, graduate student interest, and our plans to develop a master’s program in microbiology, we will prioritize hiring microbiologists over the next five years.

STRATEGIES:

A) Recruit excellent faculty

1. Recruit tenure-track faculty who significantly enhance and extend existing departmental strengths and who can develop sustainable and fundable research programs, with an initial focus on microbiology

2. Convert vacant non-TT positions to TT positions as they become available through retirement or other forms of attrition.

Measurable Outcome: We will hire two new faculty members each year and replace any of those who retire or leave the department, such that by 2020 we will increase our tenured and tenure-track faculty to 50.

Measurable Outcome: We will hire five microbiology faculty members by 2020. Additional hires will complement our current strengths, allowing us to build our microbiology program, while maintaining a healthy overall balance within the department.

B) Develop and retain excellent faculty

1. Promote faculty research programs through investment of resources in research groups organized around core strengths with a history of productivity or a high potential for future impact

2. Provide support for mid-career faculty to develop skills needed for continued engagement in their field

3. Foster an exciting intellectual environment by providing opportunities for dialogue and engagement

4. Aggressively pursue equity raises and other proactive retention measures

5. Implement a rigorous plan for annual reviews, promotion, tenure, and awards
6. Work with the College of Science and the Development Foundation to obtain endowed chairs
7. Hire, reward, and retain excellent staff to support our faculty

8. Expand our formal mentoring program to include mid-career faculty, and include mentoring as important service activity for successful senior faculty

9. Improve the quality of mentoring by providing a training program for effective mentoring of junior and midcareer faculty

10. Encourage retooling of research programs that are not funded through collaborations in core research areas and/or development leave

11. Cap the time spent on administrative tasks for faculty to participation on no more than 1 major departmental committee/year

Measurable Outcome: 80% of our assistant professors will be promoted to associate professor with tenure.

Measurable Outcome: 75% of our senior faculty will participate in departmental mentorship activities.

Measurable Outcome: At least one Associate Professor will be on development leave each year.

Measurable Outcome: Promote, on average, one Associate Professor to Professor each year.

Measurable Outcome: Departmental faculty will win at least one college- or university-level award each year.

Measurable Outcome: Departmental faculty will be nominated for at least one national or international award each year.

Measurable Outcome: We will correct salary inequities in every budget cycle and prevent future inequities.

Measurable Outcome: Support staff salaries will be in line with other departments in the College of Science.

Measurable Outcome: The number of endowed faculty positions in the department will increase.
Strategies for Accomplishing Goal #2

INCREASE EXTRAMURAL RESEARCH FUNDING
Synergies developed within and between established research focus areas can help enhance productivity, increase prominence, and provide unique opportunities for funding. New faculty members have brought fresh opportunities for productive interactions. Thus, we will work to align our faculty into groupings of at least 3 faculty members that reflect the current research portfolio and that align with the major thrusts of modern biology and global challenges. The expected outcomes are to increase the success rate of single-investigator proposals, write more collaborative proposals, increase opportunities for submitting training grant proposals, improve interactions through area-specific seminars and research presentations, market our strengths for graduate student recruiting, and maximize the availability of shared equipment.

STRATEGIES:

A) Define and establish research focus areas to optimize interactions for collaborative funding opportunities

B) Allocate bridge funds in a way to maximize return on the investment

C) Invest in development and training resources to support faculty grant writing

D) Identify mechanisms for non-traditional funding and encourage applications for non-traditional related grants and funding

E) Keep faculty better informed of the resources and activities within the Department and elsewhere

F) Encourage, support, and reward faculty for submitting large multi-PI grants and training grants

G) Encourage postdocs and graduate students to apply for fellowships

H) Encourage participation in limited-submission proposals

I) Encourage education and curriculum proposals

Measurable Outcome: All faculty members will participate in at least one research focus area.

Measurable Outcome: 75% of our faculty will participate in our established internal grant review process.

Measurable Outcome: 100% of T/TT faculty will submit an application for extramural research support in any three-year window.

Measurable Outcome: Multi-PI grant applications will increase by 25%.
Measurable Outcome: The percentage of T/TT faculty with an externally funded grant will increase from 54% to 80%.

Measurable Outcome: Research expenditures per T/TT faculty will double from an average of $125,000/year to $250,000/year.

Measurable Outcome: The number of postdocs and graduate students will increase by 25%.

Measurable Outcome: The percentage of graduate students supported on research grants or fellowships will increase from 35% to 50%.
Strategies for Accomplishing Goal #3

**INCREASE THE FREQUENCY AND IMPACT OF PUBLICATIONS**
While our department is at or above the mean of all Ph.D. granting biology departments in the nation by many objective measures, we lag behind in the number of publications and citations of these papers. This deficit is even more apparent when we are compared to biology departments at peer institutions (public land grant universities in the AAU). The number of publications and citations of these publications must be improved if we are to increase our overall rankings.

**STRATEGIES**

A) Consider the impact of publications in promotion and tenure decisions

B) Develop procedures that enable faculty to focus their time on being highly productive (e.g., hire additional staff; streamline administrative procedures; use technology to reduce administrative burdens)

C) Implement a policy for equitable workload that includes teaching load reductions for research productive faculty

D) Encourage approaches that improve writing productivity, such as keeping a log of time spent writing papers and scheduling time each day to write that is protected against encroachments

E) Establish a requirement that all Ph.D. candidates must have at least one primary first author publication to obtain a Ph.D.

Measurable Outcome: The department will reach the median of AAU Public Land-Grant Institutions in terms of journal publications and citations per T/TT faculty member by 2020.
Strategies for Accomplishing Goal #4

IMPROVE OUR RESEARCH INFRASTRUCTURE

A plan to grow the research enterprise must provide for facilities and instrumentation that allow researchers to collect data with rates that are competitive with those of peer institutions. Our current budget makes it difficult to rapidly improve the infrastructure in all areas, therefore we need to establish goals in each of the research focus areas and prioritize these for maximal impact. In addition, we will continue to support the University core facilities that are crucial to our research mission. Finally, the Biology Department is in dire need of a new building that can accommodate our research active faculty. Continuing to depend on renovations of BSBW, BSBE, and Butler Hall is not cost effective, and our current facilities hamper our ability to recruit new faculty members.

STRATEGIES:

A) Establish the clear near- and long-term physical needs and plans for the department

1. Faculty in each research focus area will develop a white paper describing current and future needs for successful grant applications, faculty recruitment and retention. The Department Executive Committee will prioritize the white papers for funding allocations.

2. We will work with the College and the University to encourage and maintain university support for core facilities (e.g., sequencing, bioinformatics, animal facilities, metabolomics, mass spectrometry, and microscopy) so that faculty have local access to modern instrumentation and methods of analysis at reasonable costs.

3. The department will continue to purchase and maintain common core equipment to facilitate faculty research.

4. The department will work with the College and the University toward the goal of obtaining a new Biology building that will house our entire department and serve as the flagship building for the life sciences on campus.

Measurable Outcome: The amount and capabilities of departmental common equipment will increase.

Measurable Outcome: Our department will have a new building that will facilitate faculty hiring and research collaborations between Biology faculty and faculty in other departments across campus.

B) Develop a financial plan that allows allocation of Departmental resources, leveraging of College and University resources, and opportunities through funding agencies and business partners.

1. The department administrators and executive committee will use the white papers to develop a long-term financial plan that prioritizes and allocates current and expected resources.

Measurable Outcome: There will be at least one substantial example each year where the use of discretionary funds positively affected initiatives that support department objectives.
ENHANCE THE VISIBILITY OF OUR FACULTY’S CONTRIBUTIONS AND ACCOMPLISHMENTS

Our faculty members have many accomplishments in research, teaching, and service, but these are often not known or appreciated beyond our department. Increasing the visibility of our work is necessary for increasing support for all of the missions entrusted to us. First, we will begin by improving our on-line presence to make our accomplishments more accessible to others outside our department. As our web site is our face to the world, we need to develop and maintain a presence that is engaging and intuitive, with strong visual impact. For many potential undergraduate or graduate students, the web site is their first contact with the department and plays a significant role in their decision to apply or not. Similarly, through our web site, we can create a strong first impression for prospective strategic partners. Second, because national academy membership, prestigious fellowships, distinguished professorships and national and international prizes serve as metrics by which research strength can be highlighted, we will work to identify and support individuals and interactions that may result in names being put forward for these awards. Finally, we will engage in meaningful outreach activities to enhance our visibility to the local community, and beyond.

STRATEGIES:

A) Promote the national and international reputation of the department

1. Build an online presence reflective of the department’s dynamic research and educational programs, with an initial focus on graduate student recruitment and training (see Goal 7)

2. Regularly engage college- and university-level media specialists to provide support to faculty in disseminating work

3. Establish a Biology Department Advisory Council, made up of successful alumni

4. Produce a department newsletter each year to maintain contact with alumni

5. Carefully examine the criteria used in national rankings, and evaluate how we could optimize our performance on these criteria

Measurable Outcome: 100% of T/TT faculty will have a web site that is updated each year.

Measurable Outcome: Our website committee will revise and oversee the web content to ensure it remains up to date.

Measurable Outcome: 25% of T/TT faculty will have their work covered in regional or national media outlets each year.

Measurable Outcome: We will have a 20% increase in alumni and external donations by 2020.
Programs in Biology

Measurable Outcome: We will be ranked among the top 50 biology departments by US News and World Report by 2025.

B) Seek and obtain professional recognition and awards, including appointment to editorial boards and grant review panels

1. Encourage a faculty-led awards committee to organize nominations

2. Continue to gather information about the organizations our faculty belong to, and which awards and recognitions are granted by those organizations

3. Consider recognitions and awards in promotion and tenure decisions and the distribution of resources within the department

4. Encourage our faculty to serve as editors and grant reviewers

Measurable Outcome: Our faculty will receive an average of 1 professional recognition or award (e.g., fellow status) per faculty member within a 5-year period.

Measurable Outcome: 50% of our faculty will serve on editorial boards of journals with 5-year impact factors over 2 or on grant review panels within a 5-year period.

Measurable Outcome: 25% of faculty will have leadership roles in their professional organizations within a 5-year period.

C) Increase faculty engagement in outreach activities

1. Make faculty aware of the range of programs and the benefits of outreach activities for the “broader impacts” in grant application

2. Identify resources to hold a yearly “Life Sciences Celebration” similar to the TAMU Physics Festival

3. Create a “community lab” as a resource for faculty-secondary school interactions that highlights aspects of our research, and that can be showcased during local football games

Measurable Outcome: 50% of our faculty members will be involved in outreach activities.
Strategies for Accomplishing Goal #6

DEVELOP AND PROMOTE INTERNATIONALLY RECOGNIZED GRADUATE PROGRAMS, BASED ON SIGNIFICANT SCHOLARLY CONTRIBUTIONS TO THE DISCIPLINE

The Biology PhD program currently has about 100 students, with ~35% supported on research grants and 65% supported as teaching assistants. As we increase the number of our faculty, we will also seek to increase the number of outstanding graduate students. There is a heightened interest in our Microbiology Ph.D. program. Therefore, one major goal is to strengthen and expand our existing faculty and courses in this area. There is also a need for a Master’s degree in Microbiology. Our plan is to develop this degree by expanding existing courses (with input from industry) with the goal of placing our students in internships and positions in industry. In addition, we will work to establish a 4+1 M.S. degree in Microbiology to provide additional preparation for students planning to apply to professional schools. The M.S. degree plans will be carefully instituted and assessed to ensure they enrich, rather than dilute, our existing Ph.D. program. Finally, while our graduate program is generally strong, the key to achieving excellence is to recruit, fund, and train students from the broadest possible pool of talent. To accomplish this, we will promote and support high quality research, emphasize graduate training on our web site, promote high quality mentoring, support student participation in departmental activities, and continue to develop a modern curriculum that provides students with opportunities for placement in prestigious positions.

STRATEGIES:

A) Generate high quality and impactful research

1. Prioritize research productivity in allocations of department funding to graduate students

2. Consider publication with students and placement of students in academic jobs in resource allocation to faculty

3. Promote development of training grants and fellowship support

4. Increase departmental participation in the student research-in-progress seminar series

5. Continue to provide support for students to attend and present their research at national and international meetings

Measurable Outcome: 90% of T/TT faculty will publish with graduate students in at least the past three years.

Measurable Outcome: 100% of Ph.D. students will attend at least 2 national or international meetings during their career.
B) Attract and retain more and better graduate students

1. Ensure competitive compensation for graduate students relative to aspirational peer institutions

2. Emphasize graduate student training on our departmental web site and social media

3. Promote broader participation of graduate students in department-wide activities (seminar series, outreach events, Biology Graduate Student Council, meetings with seminar speakers, and recruiting events)

4. Provide training for faculty on mentoring graduate students

5. Increase communication between graduate students and faculty

Measurable Outcome: Recruitment of better students should allow 75% of them to complete their degree within 5 years.

Measurable Outcome: The number of Ph.D. students in our department will increase by 25, in line with increased faculty numbers and resources.

Measurable Outcome: A graduate student representative will participate in each faculty meeting and report discussions to the Biology Graduate Student Council.

C) Improve and extend the graduate program in Microbiology

1. Hire microbiologists to take advantage of the current graduate student applicant pool (see Goal 1)

2. Implement the revised Microbiology Ph.D. degree plan

3. Develop a MS degree in Microbiology that includes an online component of our existing courses and internships (research in faculty labs or in industry), taking care not to negatively impact our Ph.D. program.

4. Develop a 4+1 MS degree in Microbiology at TAMU

Measurable Outcome: We will enroll 25 students in the M.S. degree program by 2020.

Measurable Outcome: We will hire five tenure-track Microbiology faculty by 2020.

Measurable Outcome: Implementation of the M.S. degree program will enhance, rather than diminish, our Biology Ph.D. program.
D) Place graduate students in prestigious positions

1. Develop a curriculum addressing key competencies for Ph.D. students to take in their first year

2. Support workshops designed to enhance productivity (e.g., grant writing) and prepare for the job market (e.g., vita preparation)

Measurable Outcome: We will maintain our 100% rate of placement of Ph.D. graduates in positions in academia, industry, or government that make use of their degree.
Programs in Biology

Strategies for Accomplishing Goal #7

ENHANCE THE UNDERGRADUATE ACADEMIC EXPERIENCE

Each year our faculty provides rigorous academic training to more than 10,000 undergraduate students, including approximately 1,600 departmental majors. To ensure that our students remain competitive for entry into careers and graduate/professional training programs, we need to judiciously manage growth of our student enrollment and to continue efforts to enhance the academic experience, especially for our majors.

STRATEGIES:

A) Deliver high-quality undergraduate education

1. Develop a Biology Honors program by 2016 to attract and retain the best students

2. Increase the number of high-impact learning opportunities by expanding enrollment in existing courses and carefully adding one or two new high-impact courses

3. Develop first-year learning communities to increase retention of our majors

4. Offer more, smaller sections of our upper-level courses

5. Offer courses required for graduation each semester

6. Maintain excellent undergraduate advising services

7. Increase outreach to selected high schools to make them aware of opportunities in our department

Measurable Outcome: At least 20 students will graduate through our honors program each year.

Measurable Outcome: 70% of our undergraduates will complete at least one high-impact learning experience, including research, inquiry-based course, Capstone course, or study abroad opportunity.

Measurable Outcome: Retention of departmental majors after the first year will increase from 50% to 60%.

Measurable Outcome: The student: faculty ratio will decrease in our upper-level courses.

Measurable Outcome: Average time to graduation will decrease.

Measurable Outcome: The number of undergraduate degrees granted by the Department of Biology will increase by 10%.
B) Place graduates in relevant and prestigious programs and jobs

1. Build upon the existing curriculum to develop courses and structures that prepare students interested in graduate school

2. Develop opportunities beyond the BS to prepare students for professional school

Measurable Outcome: Greater than 75% of our undergraduates will have been placed in a graduate or professional program at graduation.

Measurable Outcome: 25 students will be enrolled in the M.S. Microbiology degree program by 2020 (see Goal #6).
APPENDIX C

Vision 2020 Executive Summary
VISION 2020: CREATING A CULTURE OF EXCELLENCE

TEXAS A&M UNIVERSITY
DEAR READER

The work included in this document resulted from thousands of hours of effort from more than 250 people. It achieves the very difficult task of getting a sense of direction from many important and informed points of view. We believe it represents a convergence of some of the best thinking on higher education in many years. It is bold in its recognition of the progress required to continue to move Texas A&M University forward, a process that will add value to the degree of every former, current, and future student. It is sensitive in that it recognizes our heritage — as a land grant university, as a place where students are central, and as a place that inspires leadership. It is visionary in that it suggests many changes to the culture of Texas A&M University. The challenge it presents is addressing the interaction of tradition and change in a manner that strengthens Texas A&M University.

The process has been one of great intensity, debate, and deliberation. The work embodied in this document is available on the web at www.tamu.edu. Vision 2020: The Groundwork, which includes all of the reports from the many committees, and Vision 2020: The Baseline, which includes the benchmark data that helped start the process, are also both on the web. All of this work is testimony to the respect that so many have for this great institution.

We trust you will share our positive reflection on the process and the result. Both set a high standard for the next generation of faculty, students, and staff at Texas A&M University and challenge the state to recognize the value of having nationally eminent universities.

Sincerely,

Ray M. Bowen

Jon L. Hagler
Vision 2020 Co-Chairs
EXECUTIVE SUMMARY

THE IDEA
On October 10, 1997 President Ray Bowen placed a stake in the ground. He proposed that Texas A&M University strive to be recognized as one of the ten best public universities in the nation by the year 2020, while at the same time maintaining and enhancing our distinctiveness. This goal set in motion the efforts of more than 250 people on and off campus to determine where we are now and how to narrow the distance between the place we are now and the goal President Bowen has envisioned. This is the foundation of Vision 2020.

THE BEST
In order that a course might be charted to our goal, significant research was undertaken to ascertain which public universities are regarded as “the best” and why.

To identify qualitative and quantitative attributes of superior public institutions, two approaches were taken. The first was to consider the most prominent ranking systems and their results, as published by US News & World Report and the National Research Council. Six institutions are currently ranked among the nation’s ten best public universities by both of these sources: University of California – Berkeley, University of Michigan, University of California – Los Angeles, University of North Carolina – Chapel Hill, University of California – San Diego, and University of Wisconsin – Madison. Comparisons are drawn between Texas A&M University and these six institutions at many points throughout this document.

In addition, a number of other universities were deemed worthy of study, in order that all colleges and programs at Texas A&M University be accurately measured against leading academic counterparts. These institutions are Georgia Institute of Technology, University of California – Davis, University of Illinois – Champaign-Urbana, Pennsylvania State University, University of Minnesota, Ohio State University, Purdue University, University of Florida, and University of Texas – Austin.

OUR STRENGTH
Many characteristics distinguish us nationally. We fare well in our ability to attract National Merit Scholars. Some programs, such as our nautical archaeology unit and its affiliated Institute of Nautical Archeology, are the best in the entire world. Our chemistry program is consistently identified as outstanding, the more remarkable for the dramatic growth it has experienced in the last three decades. The colleges of Agriculture and Life Sciences, Business, Engineering, and Veterinary Medicine are frequently cited as among the very best in the nation. Education for leadership is a fundamental and distinctive part of our campus life. Our ability to engender an attitude of good stewardship marks us; we have the lowest ratio of administrative to general costs of any university in the State of Texas. An expansive physical plant reminds us of the intensity of our growth. We have many existing strengths in which we can and do take pride. Our greatest strength, however, is our desire to be even better.

THE NEED
The need to improve is real. We are good but not good enough. We do not provide the resources that the best public universities in America do to fuel quality teaching, research, and outreach. Our faculty, while excellent, as a whole is not the equal of those at the best institutions in the land, when measured by objective assessment. Many of our programs are very strong, as evidenced by their national recognition; few of our humanities and
social science programs, however, have reached real strength. As an institution, we have accomplished much, but we must not become complacent. We need to be better if we are to effectively serve our students, the State of Texas, and the nation.

Our Core Values
Our core values have been re-articulated and re-affirmed during the extensive process of reviewing our progress. We are dedicated to the search for truth. We hold the public trust sacred. We seek excellence in all we do. We welcome all people. We desire the enlightenment brought by true diversity and global interaction. We will manage ourselves to the highest standards of efficiency and productivity. These powerful values undergird every aspect of our plan.

Our Mission
Our mission also has been clarified and affirmed. We seek academic, research, and service excellence; teaching excellence; and leadership and citizenship development for our students and all associated with the university. We expect managerial and service excellence from ourselves. Our values and mission set high targets for the future of Texas A&M University.

Our Vision
A culture of excellence will be the hallmark of Texas A&M University in 2020. Our energy and boldness will distinguish us, guide our decision-making, and empower us to continue to improve. Our vision for 2020 addresses, through careful and honest analysis, our strengths and weaknesses. It reflects a steadfast determination to build on strengths, eliminate weaknesses, seek opportunities, and face threats creatively and energetically. We will create a culture of excellence that fulfills the need for an institution with quality of the first order. In 2020 Texas A&M University will be more distinctive than it is today. That distinctiveness will be created on a foundation of quality that is widely recognized and measured by world standards.

The Twelve Imperatives
The process of Vision 2020 produced hundreds of ideas supporting our goal. Almost all of these suggestions have merit, and most earn acknowledgment in the body of this report. The precepts, focused goals, and measures can be summarized in twelve overarching ideas. We call these the twelve imperatives.

Elevate Our Faculty and Their Teaching, Research, and Scholarship
The world today is knowledge-based and constantly changing. In such a world, the quality research university is “a creator, organizer, preserver, transmitter, and applier of knowledge.” The foundation of these functions is an excellent faculty in adequate numbers. We need to increase substantially the size of our faculty (perhaps by half), and we must attract and retain many more top scholars, teachers, and researchers. We will have to review and strengthen hiring and tenure policies, enhance compensation, focus our scholarship, and transform our administrative culture. We cannot achieve our goal without a nationally recognized faculty with a passion for teaching and an academic environment that values and rewards innovation, great ideas, and the search for the truth.
Strengthen Our Graduate Programs
We must have a shift in our thinking about the role of graduate education to attain the level of excellence we desire. A substantially expanded graduate studies effort is critical to our academic aspirations and to our effectiveness as a great research university. Outstanding professors attract superior graduate students and, in many instances, the money to help support their research. But these professors by themselves will not be enough. We must create a dynamic, exciting, discovery-driven intellectual environment that will draw superior graduate students, comparable to those in the nation’s best graduate programs.

Enhance the Undergraduate Academic Experience
The core of Texas A&M University must be a residential, learner-centered community that attracts excellent students and provides quality learning and mentoring experiences. We must better prepare learners for lives of discovery, innovation, leadership, and citizenship by better inculcation of writing, thinking, and self-expression skills. Texas A&M University is proud of its history of developing student leaders. Our co-curricular programs are already an area of true distinctiveness, but we must continue to strengthen their substance and reputation and extend their benefits to a greater percentage of the student body. While our retention rate is the highest in Texas, it is low relative to the best national institutions; we must make an institutional commitment to graduate those we enroll. We must emphasize education more than training and significantly improve our student-faculty ratio. We must provide more opportunity for intellectual exchange between distinguished faculty and undergraduates. Our recruiting should be more proactive and produce a more broadly representative student body. We need to expand our honors, study/live-abroad, interdisciplinary studies, and course-assistance programs.

Build the Letters, Arts, and Sciences Core
Texas A&M University has historically placed less emphasis on the letters and arts. While many of our basic science disciplines are nationally acclaimed, the best public universities have stronger and deeper liberal arts programs and a fuller range of such programs with a significantly higher institutional commitment. Such strengthening is necessary for the true, enduring education of our graduates and the enrichment of their lives. It is abundantly clear that we will never be seen as a premier institution nationally without a far stronger letters, arts, and sciences program.

Build on the Tradition of Professional Education
Undergraduate education in all areas, including professional education, has been our traditional strength at Texas A&M University. At the heart of Vision 2020 is a belief that we will not only sustain but also continually strengthen our professional programs at both the undergraduate and the graduate levels. We expect that these programs will be the first (as some already are) to represent Texas A&M University solidly and firmly in the top ten nationally. Our professional programs must also recognize the necessity to prepare their graduates more broadly for entry into a complex, changing, and unpredictable world.

Diversify and Globalize the A&M Community
The time has passed when the isolation of the Texas A&M University campus served a compelling utilitarian function. Information, communication, and travel technology have produced a highly connected global society. The ability to survive, much less succeed, is increasingly linked to the development of a more pluralistic, diverse,
and globally aware populace. It is essential that the faculty, students, and larger campus community embrace this more cosmopolitan environment. The university’s traditional core values will give us guidance and distinctiveness, while preparing us to interact with all people of the globe. Texas A&M University must attract and nurture a more ethnically, culturally, and geographically diverse faculty, staff, and student body.

**Increase Access to Knowledge Resources**

Despite recent progress, the intellectual assets represented by Texas A&M University library holdings are underdeveloped and must be increased. Coincidentally, we must recognize that the technology related to the storage, access, and distribution of knowledge resources has changed as much in the last decade as in the 550 years since the invention of movable type. Texas A&M University must invest rapidly, but wisely, to gain parity with its academic peers. It must lead, not just grow, in forcefully developing new methods and measures of success in this rapidly changing arena. The wedding of communications and computer technology will, no doubt, yield the most formidable change in academe by 2020. Texas A&M University must lead the adaptation.

**Enrich Our Campus**

The physical environment of our campus should be conducive to scholarly work and study. Texas A&M University has an efficient and well-maintained campus. However, during our rapid growth over the past four decades, the physical unity of the campus has been diminished by the presence of Wellborn Road and the railroad tracks. Innovative planning and bold leadership are needed to redress this division for reasons of safety and convenience as well as aesthetics. West Campus has not maintained the human scale that exists on the Main Campus. Through judicious planning we need to attain the same pedestrian-friendly scale and green space that gives the Main Campus its character. The use of large areas for surface parking needs to be reconsidered so that the unity of the campus is maintained as new building occurs to accommodate growth. As more of the university’s current land holdings are consumed by non-agricultural uses, acquisition of land on or near the Riverside Campus for agricultural development should be a high priority.

**Build Community and Metropolitan Connections**

The way that we relate to the local community, Houston, and other metropolitan areas of the state will have a powerful impact on Texas A&M University and the communities supporting and supported by the university. In addition, it is critical that the community in which we live provide opportunities for families to work and grow. Spouses need high-quality employment opportunities. Faculty and researchers need private-sector sponsorships and commercialization support. As we attract a wider range of people to Texas A&M University, the enrichment provided through our connection to a large metropolitan area becomes increasingly important. Correctly choreographed, such a connection gives us the best of both worlds.

**Demand Enlightened Governance and Leadership**

Great universities have a clearly articulated vision, a stimulating intellectual environment populated by great faculty and students, and resources adequate to support quality offerings. One other characteristic often contributes to greatness: enlightened leadership. Clear, cooperative relationships between the university and the System must be the norm. To achieve our aspirations, strong, enlightened, stable, and forward-thinking leadership focused on academic quality is essential. We have made progress, but we must guard it zealously. Regents must continue to take the policy high ground. The System administration must acknowledge and nurture Texas A&M University’s role as a comprehensive research university with national peers. The university
administration must be steadfast in its demand for quality in every decision. And finally, the university administration must make decisions through a process characterized by openness and appropriate faculty and staff participation. Our responsibility to the System as its flagship must be evidenced in all decision-making. Academic progress is fragile. Enlightened, shared governance and leadership are elemental to its achievement.

**Attain Resource Parity with the Best Public Universities**

The combination of rapid population growth, demand for government services, and difficult economic times has placed a strain on the Texas treasury in recent years. A good and widely dispersed university system has provided access to a growing college-aged population.

Access alone is no longer enough. Texas must have a few universities that offer opportunities equal to the best public universities, while taking complementary steps to maintain access.

Competitive peer states have long recognized the economic necessity of comprehensive research universities in meeting the knowledge demands of an information society. States with the best universities are currently investing twice as much funding per student as at Texas A&M University.

Texas A&M University and the University of Texas are ideally positioned to achieve recognition as top national institutions because of the state’s historical, constitutional financial commitment to them. Texas may also need additional institutions of this caliber. The institutions designated to fill this role must be acknowledged and supported in a way that is consistent with national competition. They must be provided the flexibility and exercise the wisdom and courage to price their offerings more in line with their value, while taking complementary steps to maintain access. Finally, they must use their historical strength to generate more private capital. Texas A&M University must attain resource parity with the best public institutions to better serve Texas.

**Meet Our Commitment to Texas**

Texas A&M University is a creation of the state and in its origin was designed to prepare educated problem-solvers to lead the state’s development. This fundamental mission, born out of the land grant heritage of service, remains today. Texas A&M University’s aspiration to be among the best public universities in the country resonates with this historical mandate. The diverse population of Texas should have access to the best public education in America without having to leave the state. Texas A&M University must also reach out even more to help solve the most difficult societal problems, including those related to public education, crime, and the environment, and must honor its heritage of enhancing the economic development of all regions of the state. Texas A&M University, if it aspires to national prominence, must first stay committed to Texas.
APPENDIX D

Graduate Student Handbook
DEPARTMENT OF BIOLOGY
GRADUATE POLICIES

The Graduate Program in the Department of Biology provides students with specialized training through coursework, research, and teaching. The Office of Graduate Studies (OGS) establishes the minimal University guidelines for all graduate degrees. The Biology Department has established additional requirements that all students must satisfy. It is your responsibility as a graduate student to ensure that you have met all departmental and university requirements for your degree. Please note that graduate students must fulfill the requirements of the catalog that is current during the semester they complete their degree requirements. This is the case for both University and Department of Biology requirements. It is the student’s responsibility to keep up with changes in requirements.

This book provides you with the Departmental and a summary of University requirements; a complete description can be found in the Graduate Catalog. Please keep this book and a copy of the Graduate Catalog handy and refer to them as you progress through your degree. Additional information can be obtained from the Office of Graduate Studies and the Biology Graduate Advising Office, located in Butler Hall Room 102.

DEADLINES for GRADUATE DEGREE REQUIREMENTS
The Department of Biology has established the following deadlines. The schedule is identical for all four degrees granted in the Department of Biology.

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<td>Degree Plan Filed with Department</td>
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<td>Final Examination</td>
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Note that the number of semesters does NOT include summer sessions.
ALL PAPERWORK SHOULD BE SUBMITTED THROUGH THE BIOLOGY GRADUATE ADVISING OFFICE
All paperwork to be filed with the Office of Graduate Studies (OGS) or other university offices must be routed through the Biology Graduate Advising Office. The Graduate Advising Office will review the document, obtain signatures from the Department Head or Graduate Advisor, log in the paperwork, make copies for your departmental file, and file the paperwork with OGS.

PROGRESS TOWARDS THE DEGREE
All graduate students must adhere to the requirements set forth by the department in order to remain in good standing. If a student has not met the required Departmental or University deadlines as specified in this handbook or the Graduate Catalog, they will no longer be in good standing with the department and may be blocked from registration the following semester. The block will not be lifted until the requirement is met. Requests for exemptions will be considered by the Graduate Advisor in consultation with the Graduate Programs Committee on a case-by-case basis.
THE FIRST YEAR

1. RESEARCH ROTATIONS
The Biology Department requires all incoming students to complete two seven-week laboratory rotations during their first semester. Rotations acquaint new students with research programs in their areas of interest, provide a perspective on approaches and procedures used in modern biology, as well as useful contacts in other labs. At the conclusion of rotations, a major professor is chosen by the mutual consent of the graduate faculty member and the student. Students have the option to do one or more additional seven-week rotations in the second semester.

2. REQUIRED COURSE WORK FOR 1st-YEAR STUDENTS
All Department of Biology graduate students are required to enroll in the following graduate courses during their first year.

a) First-year students are required to enroll in BIOL 697, Method of Teaching Biology Laboratory. BIOL 697 is a Department of Biology training program for teaching assistants (TAs). This training program is given as a workshop during New Graduate Student Orientation in August. Additionally, Texas A&M University provides a one-day mandatory TA training workshop. All new graduate students will be registered for these TA training programs during orientation and must attend, regardless of whether or what they teach during their first year.

b) First-year students are required to enroll in BIOL 681, Seminar in Graduate Orientation. This seminar meets one evening per week from 5:30-7:00 PM and will include discussions of requirements of the program, departmental resources, graduate funding, choosing a major professor, writing skills, oral presentations, and other topics important to new graduate students. Another objective of this seminar is to provide a setting for camaraderie to develop between members of the new class.

c) First-year students are required to enroll in BIOL 685, Directed Studies (Rotations), in order to receive credit hours for their participation in faculty-supervised laboratory rotations. Satisfactory/Unsatisfactory grades will be assigned by the Graduate Advisor based on faculty evaluation of a student’s performance in each rotation.

d) First-year students are required to enroll in for BIOL 689-601: Ethics and Responsible Conduct of Research. This one credit course meets in the spring and will include discussions of how to recognize, and avoid committing, fraud in science. Topics will include scientific ethics, negotiation techniques, plagiarism, record-keeping, data management, peer review, conflict management, and the regulations covering animal and human experiments.

e) All Biology graduate students are required to register for BIOL 681, Seminar in Departmental Colloquium, at least once. Most students fulfill this requirement during the first year of graduate study.

3. ADDITIONAL COURSE REQUIREMENTS
a) All graduate students are required to register for BIOL 682, Graduate Student Research Seminar, a course involving presentations of a student’s research results. Every scientific career step involves presentation of a...
research seminar, including the thesis defense. Therefore, the department requires a research seminar series for each of our graduate students. The graduate student research seminar is a one credit hour course that should be listed on the degree plan. For the MS degree, one hour of BIOL 682 should be listed as a required course. For the PhD degree, one hour of BIOL 682 should be listed as a required course, and one hour should be listed under Prerequisites and other courses. Regardless of whether registered or not, graduate students should attend the weekly Graduate Student Research seminar throughout their graduate careers, unless they have an unavoidable course or teaching conflict.

BIOL 682 will be offered each fall and spring semester. Students enrolled in this course will present a thirty-minute seminar on their specific research project. For Doctoral students one semester presentation will be devoted to their dissertation proposal and should be taken in the second year. The other semester presentation will be a progress report and should be taken in the third or fourth year of study.

b) All Ph.D candidate students are required to register for a journal club every semester. Biology Ph.D. graduate students that enter the department in the fall of 2010 and later will enroll in a formal one hour Journal Club every fall and spring semester, beginning in the fall of their second year and continuing until they graduate. Biology Masters graduate students are exempt from this requirement due to extensive formal course work needed for the Master’s degree. A graduate student can enroll in any journal club they want, as long as they have the consent of the instructor. Formal journal clubs taught outside the department will also fulfill this requirement.

c) Two additional hours of 681 Seminar are required for all M.S. These are usually journal clubs focusing on a specific topic. This is in addition to the requirement to enroll in the Seminar in Departmental Colloquium (BIOL 681) and the Seminar in Graduate Student Orientation (BIOL 681). All graduate students are encouraged to participate in and register for a 681 Seminar each semester, however Master’s students may only list a maximum of two credit hours of 681 on their degree plan..

d) All graduate students are required to fulfill the course requirements of the Biology Department. These graduate course requirements are listed on page 14. The purpose of this requirement is to ensure that students are broadly trained within their particular discipline. Courses selected to fulfill these requirements must appear on the degree plan.

4. REQUIRED TEACHING
The teaching requirement for the Master of Science degree is one semester. The requirement for the Doctor of Philosophy degree is two semesters. Previous teaching experience at the University level may be used to fulfill this requirement, at the discretion of the Graduate Advisor.

5. CHOICE OF MAJOR PROFESSOR
All students must identify a major professor by the end of their First year. The major professor must be a member of the Department of Biology Graduate Faculty. Students must inform the Graduate Advisor of their choice of major professor, and request that the major professor notify the Graduate Advisor of their agreement. A sample memo is included in Appendix I.
6. REQUIREMENTS FOR A CO-CHAired COMMITTEE

Occasionally, a student can best complete his/her graduate program by working under the direction of two faculty members. Under these circumstances, a student may elect to be co-chaired by two Texas A&M faculty members. In general, students should request a co-chaired committee only if necessary for their graduate training. The co-chairs should both provide ongoing intellectual contributions and be active mentors to the student. In the case of students resident in other academic departments, the Biology co-chair must be willing to act as a conduit to maintain lines of communication between the department, the advisory committee, and the student.

One of the co-chairs must be a member of the Department of Biology Graduate Faculty. The other co-chair may be a member of any other department on campus (including Biology). Students with co-chaired committees must satisfy all Biology requirements for degrees and must take at least 50% of their 691 research credit hours as Biology hours.

Guidelines for Requesting a Co-Chaired Advisory Committee

Requests for a co-chaired committee must be reviewed and approved by the Biology Department Graduate Program Committee (GPC) before the Graduate Advisor will approve a student’s Degree Plan.

Requests for a co-chaired committee should be submitted to the Biology Graduate Advising Office and must contain the following:

(1) Student Statement of Purpose:
This letter, from the requesting student, should outline the reasons for requesting the co-chaired committee and the reasons for designating the specific Biology faculty member as their choice of co-chair. The student should outline the role(s) each co-chair will take in guiding the students’ academic and research progress.

(2) Letters from Faculty Co Chairs:
A letter is required from each co-chair outlining his or her contribution to the student’s academic endeavors and/or research projects and confirming their approval of the shared duties as co-chairs of the student's advisory committee. The faculty co-chairs may be requested to meet with the GPC to discuss their contributions prior to approval of the request by the GPC.

7. ADVISORY COMMITTEE

An Advisory Committee supervises a student’s course work and research, examines a student’s progress, and approves all documents required for progress toward a degree. The Advisory Committee will approve the degree plan, read and critique the proposal and thesis or dissertation, and administer the oral exams. The Advisory Committee, chaired by the major professor, is a primary source of direction and intellectual support for a student’s research.

In order to provide the student with maximum input on course choices and research direction, the Advisory Committee should be constituted soon after the choice of major professor. Students should meet with their Advisory Committee before the end of their First year.
The University requires that a graduate student’s Advisory Committee must include a total of at least three (for M.S. students) or four (for Ph.D. students) members of the graduate faculty. In addition to the University requirements, a Biology graduate student’s Advisory Committee must include at least one (for M.S. students) or two (for Ph.D. students) tenured or tenure-track Biology graduate faculty. The University requires that one member of the Advisory Committee be from a department other than the student’s home department. Joint faculty members are considered Biology faculty, and cannot serve as the out-of-department member of a Biology graduate student’s Advisory Committee.

8. REQUIRED COMMITTEE MEETINGS
All graduate students are required to have at least one committee meeting each academic year. An Advisory Committee Meeting Report form must be submitted to the Graduate Advising Office no later than the end of summer term of each academic year. Failure to do so may result in a registration block for the Fall semester. The first committee meeting has a unique set of forms to be completed by the Advisory Committee, and subsequent meetings all use the standard Advisory Committee Meeting Report. These can be obtained from the Biology Graduate Advising Office or downloaded from the Biology Graduate Program web site; copies are included in the appendix of this manual.

9. FILING THE DEGREE PLAN
The Degree Plan lists the course work and research hours to be completed by a student during graduate study. The department or university cannot change the requirements for graduation once the Degree Plan is filed, and the student can only change the Degree Plan by filing a petition with OGS. The student, in consultation with the Major Professor and Advisory Committee, decides upon the courses included on the degree plan that are in addition to the departmentally required courses. The list of required courses starts on page 14, in addition a certain number of seminars, lab rotations and other required courses are listed on pages 6-7. The minimum total number of hours required on a Ph.D. degree plan is 96 hours, however for students entering with a M.S. degree awarded in the U.S. (or its equivalent as determined by the Office of International Admissions) the minimum number of hours is 64. A minimum of 32 semester hours is required for the thesis M.S. degree and 36 semester hours for the non-thesis M.S. degree.

It is important that students review the limitations on the use of undergraduate courses, seminar hours, research hours, and transfer courses (detailed in the Graduate Catalog) prior to submitting a degree plan. Sample degree plans can be found in the appendix.

The degree plan must be filed electronically https://ogspss.tamu.edu. Instructions can be found at the Office of Graduate Studies web site, http://ogs.tamu.edu/.
GENERAL INFORMATION

Petitions
During the course of a student’s career it may be necessary to make requests for changes to the Office of Graduate Studies. These petitions (for changes of committee, program, courses, etc.) must be submitted to the Biology Graduate Advising Office on the appropriate OGS form (forms can be downloaded from the OGS web site) and with sufficient time to accommodate approval decisions. Please note that it can take OGS up to 3 months to process some requests.

Ombudsperson for Graduate Education
The Ombudsperson for Graduate Education assists graduate students, faculty, staff, and administrators to solve conflicts informally. The ombudsperson serves as a neutral listener, information resource, advisor, intermediary, and mediator. The ombudsperson advocates for the processes of graduate education by being equally open and accessible to all parties.

Ombudsperson contact information:
Ombudsperson for Graduate Education
1113 TAMU
College Station, TX  77842-1113
(979) 845-3631
ombuds@tamu.edu

Minimum Credit Hour Requirements
All students must remain in continuous enrollment throughout their graduate careers regardless of their source of support. Graduate students must enroll for at least one credit hour during every regular semester (Fall and Spring) while working towards their degrees. Enrollment for a minimum of one credit hour also is required in the Summer semester for all students using university facilities.

There are higher enrollment requirements for students receiving a graduate assistantship. All graduate students receiving a graduate teaching or graduate research assistantship must register for a minimum of 9 semester credit hours during the Fall and Spring semester. In the Summer, students receiving a graduate assistantship must register for a minimum of 3 semester credit hours during the summer session in which they are employed or any combination of 6 semester credit hours during the entire Summer if they are employed for the entire summer. For example, 3 hours in SSI and 3 hours in SSII (total 6 hours) or 6 hours in the 10-week summer session.

Minimum GPR (Scholastic Deficiency)
A student’s Graduate GPR is expected to remain at or above 3.000 (on a 4.000 scale) during his or her graduate career. If a graduate student’s cumulative GPR falls below 3.000, he or she will be on scholastic probation and notified of this in writing by the Graduate Advisor. A copy of the memo will be sent to the student’s advisor. The student will meet with his or her advisor and advisory committee to develop a plan to overcome the scholastic deficiency. The plan should include the course(s) to be taken and the grade(s) the student must receive to return Department of Biology, Texas A&M University
to good standing with the department. A copy of the plan signed by the student and the advisory committee will be given to the Graduate Advising Office for the student’s file. If the student has not yet chosen a major professor, he or she will meet with the Graduate Advisor to develop such a plan, a copy of which will be put in the student’s file. The student will be given one semester (excluding summer terms) to raise his or her GPR above 3.000. If after one semester the student remains scholastically deficient, he or she will be informed of this in writing by the Graduate Advisor. The student may request the Graduate Program Committee for a second semester of academic probation. If the request is denied or if after two full semesters the student remains on scholastic probation, he or she may be asked to leave the graduate program and the GPC and Graduate Advisor will submit a request to the Office of Graduate Studies that the student be dismissed from the University for scholastic deficiency.

Financial Support
Graduate students in the Department of Biology can be supported by graduate teaching assistantships (GAT), graduate non-teaching assistantships (GANT), graduate research assistantships (GAR), or fellowships. GAR support is usually provided by individual faculty and is funded by research grants. Fellowship support may be provided by the University, Federal grants, or other sources and is awarded on a competitive basis.

In order to be eligible for support, students must be registered as full-time graduate students. In the Fall and Spring semesters, a minimum of 9 credit hours is required. For summer support, required registration is a minimum of 6 credit hours for the 10-week session or 3 credit hours per five-week summer session.

A&M Policy on the on maximum Doctoral (G8) Hours
A full-time doctoral student will be allowed to pursue his/her program for seven calendar years before a charge of out-of-state tuition is initiated. If a student is pursuing a doctoral degree on a part-time basis, he/she would have up to 99 semester hours before the university would begin to charge out-of-state tuition if they pass the seven year mark.

Students who exceed these time limits will be charged out-of-state tuition to compensate for this lack of state support. In the rare cases where a doctoral student requires more time to complete the degree, he/she can apply to the Department of Biology for funding to cover the out-of-state tuition penalty. These requests will be reviewed by the Graduate Program Committee and Graduate Advisor.

Graduate Students at TAMU-Galveston
Students undertaking research at the Galveston campus toward a Biology Degree are required to adhere to all requirements, deadlines, etc. of the Department of Biology. Residence on the Galveston campus will satisfy the residency requirement for graduate students.

Participation in Departmental Committees
Graduate students are encouraged to participate in departmental Committees. Regular elections are held to select graduate student representatives to the Graduate Programs, Graduate Recruiting and Admissions, and Frontiers committees. These elections are held under the auspices of the Biology Graduate Student Association (BGSA). Students are encouraged to join and become active in the BGSA, as it provides an organized means of
communicating student concerns to the faculty and administration. BGSA officer elections are held at the beginning of the fall semester.

**Travel, Travel Grants and Mini-Grants for Graduate Students**
The Department of Biology funds graduate student travel grants and mini-grants with Graduate Enhancement funds. Funds for these programs may not be available every year. All Biology graduate students may request funds to travel to scientific meetings to make presentations. Travel Mini-grants are limited to a maximum of $500 per trip. M.S. students may receive one Travel mini-grant; Ph.D. students may receive two. Research Mini-grants of up to $300 may also be requested by M.S. and Ph.D. students to assist in meeting unexpected research expenses.

Regardless of source of funding, or even if you pay your own costs, every graduate student making a professional trip to attend a meeting or conduct research must complete the "Request for Business Travel" form. These forms are essential to ensure that you will be appropriately covered by university insurance and your trip will be designated as professional business. The form can be found in the Biology office.
BIOLOGY GRADUATE COURSE REQUIREMENTS

Biology PhD graduate students are required to take a minimum of any 4 BIOL graduate courses from either or both Foundation and Specialization course listings. Exemptions will be considered by the GPC. Additional courses can be included to the student's degree plan by the student's individual committee; suggested courses from other departments are included in the supplementary list.

Foundation Biology courses (taught every year by 2 or more faculty members):

- BIOL 606  Bacterial Genetics
- BIOL 609  Molecular Tools
- BIOL 610  Evolution
- BIOL 611  Developmental Biology
- BIOL 613  Cell Biology
- BIOL 627  Principles of Neuroscience I
- BIOL 698  Behavior Genes and Evolution

Specialization Biology courses (taught every year or every other year):

- BIOL 601  Biological Clocks
- BIOL 602/603/604  TEM
- BIOL 608  Light Microscopy
- BIOL 615  Signaling in Development and Behavior
- BIOL 622  Advanced Microbiology Physiology
- BIOL 625  Structural and Molecular Biology
- BIOL 628  Principles of Neuroscience II
- BIOL 635  Plant Molecular Biology
- BIOL 636  Plant Cell Biology
- BIOL 644  Comparative and Developmental Neurobiology
- BIOL 649  Comparative Endocrinology
- BIOL 650  Genomics
- BIOL 651  Bioinformatics
- BIOL 652  Epigenetics
- GENE 612  Population Genetics (Taught by Biology faculty)

Supplementary courses:

- STAT 651/652  Statistics in Research I and II
- GEOL 651  Paleo Community Analysis (substitutes for STAT 651)
- GENE 603  Genetics
- BICH 603  General Biochemistry
- BICH 631  Biochemical Genetics

College Station, TX 100
MICROBIOLOGY GRADUATE COURSE REQUIREMENT

All Microbiology Ph.D. students are required to take a minimum of four 3 credit hour courses. Each student must take BIOL 606 Bacterial Genetics, and at least three additional 3 credit hour specialization courses relevant to the field of microbiology, which are selected in consultation with their dissertation committee.

Required Course:
BIOL 606 Bacterial Genetics

Specialization Courses (taught every year or every other year):
BIOL 609 Molecular Tools
BIOL 650 Genomics
BIOL 651 Bioinformatics
BIOL 613 Cell Biology
BIOL 611 Developmental Biology
BIOL 601 Biological Clocks
BIOL 602/603/604 TEM
BIOL 608 Light Microscopy
BIOL 615 Signaling in Development and Behavior
BIOL 622 Advanced Microbial Physiology
BIOL 625 Structural and Molecular Biology
BIOL 689 Digital Biology
STAT 651/652 Statistics in Research I and II
GENE 603 Genetics
BICH 601 Fundamentals of Biochemistry
BICH 603 General Biochemistry
BICH 631 Biochemical Genetics
MSCI 635 Basic Immunology
MPIM 601 Microbial Pathogenesis of Human Disease
MPIM602 Immunoregulation
MPIM 607 Applied Epidemiology
Special Topics courses:
These courses would cover current topics of interest and may or may not become permanent courses. Typically, they would be 1-3 credit literature-based courses and would be announced at the beginning of each semester. If these courses are well subscribed for 3 consecutive academic years then they could be moved up to the major course category and given a BIOL course number.

Undergraduate background courses:
If a graduate student enters the program without the background needed for a graduate course in a particular area, it may be appropriate for them to first take an undergraduate course. For example, graduate students who have not taken molecular biology, genetics, biochemistry, or neurobiology, we recommend that they take BICH 431 Molecular Genetics, GENE 302 Genetics (majors course), BICH 440/441 Biochemistry I/II (majors course), ZOOL 434/435.

Other current requirements:
- BIOL 682 Graduate Student Research Seminar (1cr) MS 1 hr, Ph.D. 2 hr
- BIOL 697 Method of Teaching Biology Laboratory (1cr) MS and Ph.D. 1 hr
- BIOL 681 Seminar in Graduate Orientation (1cr) MS and Ph.D. 1 hr
- BIOL 685 Rotations
- BIOL 681 Seminar in Departmental Colloquium (1cr) MS and Ph.D 1 hr
- 2 additional hours of 681 (prefix can be BIOL, BOTN, MICR, ZOOL)
Timeline for Graduate Studies
Doctor of Philosophy
Department of Biology

Year 1:
- Complete required courses/seminars
- Complete rotations
- Choose advisor
- Develop degree plan with advisor
- Set up advisory committee
- Hold first committee meeting
  - Outline research project
  - Discuss degree plan
  - Obtain committee approval for degree plan
- Submit degree plan to the Office of Graduate Studies (OGS)

Year 2:
- Complete yearly seminars
- Coursework should be completed
- PhD students submit draft of research proposal to their advisor by end of Spring semester

Year 3:
- Complete yearly seminars
- PhD students complete preliminary exam:
  - Submit research proposal to advisory committee (deadline: 3rd Monday in September)
  - Submit Preliminary Exam Checklist two weeks before preliminary exam commences (deadline: 3rd Monday in October)
  - Complete written and oral exams (deadline: Last working day of November)

Year 4 and beyond:
- Complete seminar course each year
- Hold committee meeting each year
- PhD students complete their final exam
  - Write dissertation
  - Submit completed Permission to Defend Thesis form to the OGS two weeks before defense
  - Distribute thesis to advisory committee two weeks before defense
  - Defend dissertation
  - Obtain committee approval for thesis
- Submit dissertation to the OGS
GRADUATE DEGREE REQUIREMENTS
DOCTOR OF PHILOSOPHY

To earn a Doctor of Philosophy degree a student must meet the requirements of both the University and the Department of Biology. The Department of Biology requirements are outlined below, along with a summary of the University requirements. Please refer to the Graduate Catalog for a complete description of University requirements and policies.

Please note that graduate students must fulfill the requirements of the catalog that is current during the semester they complete their degree requirements. This is the case for both University and Department of Biology requirements. It is the student’s responsibility to keep up with changes in requirements.

REQUIREMENTS

A. Residence
Students who enter the doctoral degree program with a bachelor’s degree must spend two academic years in resident study at College Station or Galveston. If a Master’s degree has been awarded, one academic year is required. One academic year may include two adjacent regular semesters or one regular semester and one adjacent 10-week summer semester. See the Graduate Catalog for additional information on residence requirements.

B. Identify a Major Professor
All Biology graduate students must identify a major professor by the end of their 2nd semester (excluding summer terms). Sponsorship by the Chair or Co-chair must be submitted in writing to the Graduate Advisor by the end of the 2nd semester.

The committee chair or one of the co-chairs must be a member of the Department of Biology graduate faculty. Requests for a co-chair from outside the Department of Biology must be approved by the Graduate Program Committee (see requirements on page 7).

C. Establish an Advisory Committee
The advisory committee, chaired by the major professor, is a primary source of direction and intellectual support for a student’s research. The advisory committee should be constituted soon after the choice of major professor in order to provide the student with maximum input on course choices and research direction. The advisory committee will approve the degree plan, read, critique, and approve the proposal and dissertation, and administer the preliminary exam and the final defense.

The University requires that a doctoral student’s advisory committee be composed of no fewer than 4 members of the graduate faculty who are representative of the student’s field of study and research. The chair or one of the co-chairs of the advisory committee must be from the student’s major department, and at least one of the members must be from a department other than the student’s department.
The Biology Department has established the following additional requirements for doctoral students. The advisory committee must contain at least 2 tenured or tenure-track members of the Biology graduate faculty. Faculty having joint appointments in the Department of Biology are considered Biology faculty and cannot serve as the out-of-department member of a Biology graduate student’s advisory committee.

**D. Degree Plan**
The degree plan should be developed in consultation with the student’s advisory committee and submitted to the Biology Department Graduate Advising Office prior to registering for the 3rd semester (excluding summer terms). This deadline was established to ensure that students consult with their advisory committees about course work before beginning the second year of study.

For Ph.D. students, a minimum of 96 credit hours beyond the baccalaureate degree or 64 credit hours beyond the Master’s degree is required. Some Master’s degrees awarded in countries other than the U.S. are not equivalent to a Master’s degree awarded in the U.S. In these instances, the student will be required to have 96 hours on their degree plan.

The degree plan should include the course work required by the Department of Biology. These requirements are described in the following section. For limitations regarding the use of certain graduate courses and transfer credit see the Graduate Catalog. All doctoral degree plans must carry a reasonable amount of 691 (Research) hours.

The Department of Biology Graduate Program Guide for the student’s particular degree must be submitted along with the degree plan (see section E, item 5).

**E. Departmental Course Requirements**
1) All Ph.D. students are required to take BIOL 681 Seminar in Graduate Student Orientation.
2) All Ph.D. students are required to take BIOL 697 Methods in Teaching Biology Laboratory.
3) All Ph.D. students are required to complete at least 3 additional hours of 681 (seminar). These must include 1 hour of Departmental Colloquium (BIOL 681).
4) All Ph.D. students are required to complete 2 hours of BIOL 682 (Graduate Student Research Seminar). On the degree plan, one hour of BIOL 682 should be entered as a required course, and the second hour should be listed under prerequisites and other courses. All graduate students should attend this seminar each week even when they are not registered for it as a class.
5) Graduate students are required to take a minimum of 4 courses, with at least 2 of the courses coming from the foundation course listing. Exemptions will be considered by the GPC. These courses are listed on page 14 at the beginning of this section.
6) Students with co-chairs from outside the Dept. of Biology must satisfy all Biology course requirements and must take at least 50% of their 691 research credit hours as Biology hours.

**F. Teaching requirement**
All Ph.D. students are required to teach for at least two semesters.
G. Foreign Language
No foreign language is required.

H. Research Proposal
The Ph.D. student must prepare a research proposal for approval by his or her Advisory Committee. The proposal describes the research that a student intends to undertake. The proposal is not a contract to perform the described research and significant research progress need not be completed at the time of proposal submission. The proposal is a mechanism to assist students in clarifying research goals early in their graduate program, to encourage students to become familiar with the primary literature in their field, to provide experience in scientific writing, and to facilitate research interactions between students and members of their Advisory Committee. In the proposal, the student describes the rationale for the research project, the objectives of the research to be performed, and outlines the methodologies to be used.

Students will prepare a proposal describing their planned research. The proposal format will be determined by the student’s advisory committee during their first committee meeting. Suggested formats include:
- NIH R01 applications (http://grants.nih.gov/grants/funding/phs398/phs398.html)
- NSF research proposals (http://www.nsf.gov/pubs/gpg/nsf04_23)
- NIH postdoctoral fellowships (http://grants1.nih.gov/grants/funding/416/phs416.htm)

A draft of the research proposal should be submitted to the students advisor by the end of the 4th semester. The proposal must be approved by the student’s advisor, then submitted to the entire advisory committee by the 3rd Monday in September of their 5th semester (excluding Summer). The advisory committee will evaluate the proposal and request any changes by the last business day in September. Students will complete any changes and gain approval by the committee to proceed with the preliminary exam by the 2nd Monday in October.

After revisions and approval by the advisory committee, the proposal should be submitted along with the signed official cover sheet to the Biology Graduate Advising Office. The official cover page is available on the OGS website. http://ogs.tamu.edu/OGS/pdf/prop.pdf

Students performing research involving human subjects, infectious biohazards, and/or recombinant DNA must attach a copy of the appropriate research compliance approval form to the proposal when proposal is submitted. Proposals that include research with vertebrate animals (including antibody generation in rabbits or mice) must include a copy of an approved Animal Use Protocol cover page. Information on Animal Use Protocols can be found at http://animal.tamu.edu/approval.html.

I. Preliminary Examination
The purpose of the preliminary examination is for the student’s advisory committee to determine whether the student has a mastery of the subject matter of all fields in the program, an adequate knowledge of the literature in these fields, and the ability to carry out bibliographical research. The preliminary examination is required.

Eligibility requirements for the preliminary exam:
• The student must be registered for at least 1 hour for the semester or 5-week summer term during which any portion of the preliminary exam may fall. If the entire exam falls between semesters, the student must be registered for the term immediately preceding the exam.

• An approved degree plan was on file with OGS at least 90 days prior to the first written examination.

• The student’s official GPR at the time of the examination must be at least 3.000.

• All English language proficiency requirements must have been satisfied.

• All committee members must have scheduled or waived the written portion and agree to attend the oral portion of the exam or have found a substitute. Only one substitution is allowed and it cannot be for the committee chair.

• At the end of the semester in which the exam is given, there are no more than 6 hours of course work remaining on the degree plan (except 681, 684, 690, 691, and 692). The head of the student’s department has the authority to approve a waiver of this criterion.

• The time span from the first written examination to the oral is no more than three weeks. (In cases of department-wide written examinations, this criterion is not applicable.) The head of the student’s department has the authority to approve a waiver of this criterion.

The preliminary examination includes both a written and an oral examination in which the student’s Advisory Committee tests a Ph.D. student’s mastery of his or her field of specialization. The preliminary examination will be administered, during the 5th semester (excluding Summer), by the student’s advisory committee. The Ph.D. preliminary examination will consist of the proposal described above, a written and an oral examination. During this exam, students are expected to demonstrate that they: 1) understand fundamental biological concepts; 2) have gained detailed knowledge of scientific literature in their research area and the ability to critically evaluate it; 3) are able to formulate specific, plausible and testable hypotheses; 4) are able to design controlled experiments that distinguish among competing hypotheses; 5) are familiar with techniques within their discipline; 6) understand the theory underlying the proposed techniques; and 7) can communicate effectively both in writing and in the oral presentation. Details of the exam format and requirements are as follows.

Preliminary examinations cannot be taken until all the course requirements of the Biology Department have been completed and less than six hours of formal course work remain to be completed on the degree plan.

1. The student and committee chair will complete the Preliminary Exam Checklist. The committee chair will bring the Preliminary Exam Checklist to the Biology Graduate Advising Office, which will then submit the form to the Office of Graduate Studies. This MUST be submitted and the Exam scheduled 2 weeks prior to taking the Preliminary Exam.

2. Written exams will be taken during the week starting with the last Monday in October. Each student will arrange a time to take the written exam from each advisory committee member. Exams will be evaluated and returned to the committee chair, who will then forward the exams to the student. Students will have the opportunity to discuss any deficiencies in their exams with advisory committee members during the first full week of November.
3. Oral exams will be taken during the second full week of November. Students are responsible for scheduling a mutually agreeable two hour block of time for the committee to give the oral exam. Students are expected to prepare a 20-40 minute presentation on their proposal and will be examined on their proposal and general knowledge of biology. The committee will meet at the end of the exam and evaluate student performance. The student passes the preliminary exam if there is no more than one dissenting vote among advisory committee members.

4. In the event of a failure, the advisory committee has the option to allow a retake of the preliminary exam. The written and oral portions of the exam, administered as described above, must be completed within a three week timeframe prior to Spring break. In the event of a second failure, no further retakes will be allowed. The student’s status in the Biology graduate program will then be determined by the student and the advisory committee.

The results of the examinations should be reported on the Report of the Preliminary Exam form. The chair will bring the completed Report form to the Biology Graduate Advising Office, which will submit the form to the Office of Graduate Studies. Failure to submit the form to OGS within 10 working days of the exam will result in the preliminary exam being recorded as a failure. Copies of the official forms can be downloaded from the Office of Graduate Studies web site: http://ogs.tamu.edu/OGS/currentExams.htm

After passing the preliminary examination, all degree requirements must be completed within four calendar years. Otherwise, the student will be required to repeat the preliminary exam.

J. Admission to Candidacy
For admission to candidacy for a doctoral degree, the student must have: (1) completed all formal course work on the degree plan with the exception of any remaining 681, 684, 690, and 691, (2) a 3.0 graduate GPR and a Degree Plan GPR of at least 3.0 with no grade lower than C in any course on the degree plan, (3) passed the written and oral portions of the preliminary exam, (4) submitted an approved dissertation proposal, and (5) met the residence requirements. The final examination will not be authorized for any doctoral student who has not been admitted to candidacy.

K. Continuous Registration
Once all course work on the degree plan other than 691 (Research) is completed, a doctoral student must be in continuous registration until all further requirements for the degree have been completed. See the Graduate Catalog for additional information on the continuous registration requirement.

L. Pre-Defense Publication of Dissertation Material
Students should be aware of the agreement that is signed when a journal (hard copy or electronic) accepts an article for publication. At that time, the student assigns rights to the journal as publisher. The student must obtain written permission from the copyright holder to include the material in the thesis, dissertation, or record of study. Some journals and publishers have previously granted TAMU such rights, these can be found on the thesis office website.

M. Dissertation
College Station, TX
The ability to perform independent research must be demonstrated by the dissertation, which must be the original work of the candidate. The dissertation describes the research performed by a student during graduate study and the unique contribution the student has made to advance the frontiers of knowledge. The student, in consultation with his or her Advisory Committee, determines the content of the dissertation. The dissertation must be approved by the student’s Advisory Committee. The dissertation should be submitted to the members of a student’s Advisory Committee at least two weeks prior to the Final Examination.

The dissertation must be original work, grammatically correct in a format consistent with that used in scholarly journals in the candidate’s field. The Office of Graduate Studies controls the format of the dissertation. Students must follow it exactly, or risk having it rejected by the Thesis Clerk. Instructions and the Thesis Manual is available on-line at http://thesis.tamu.edu/.

The student must submit an original copy of the dissertation in a form approved by the student’s Advisory Committee to the Graduate Advising Office in order to obtain the Department Head’s approval and signature a minimum of two weeks prior to the Office Graduate Studies deadline for submitting the dissertation to the Thesis Office. If the Department Head deems the dissertation unsatisfactory, it will be given to the Graduate Program Committee for review. The Graduate Program Committee will make a recommendation of action to the Department Head, student, and the members of the student’s Advisory Committee.

Students are required to submit an electronic thesis/dissertation (ETD) as a pdf file to the Thesis Office instead of using the traditional blue-line paper. Paper copies of these ETDs will not be sent to the library or to the departments. All electronically submitted manuscripts can be accessed from the Internet via http://etd.tamu.edu or through the library website, http://library.tamu.edu. Information on how to submit an electronic thesis/dissertation is available on the Thesis Office website: http://thesis.tamu.edu.

In addition, the Biology Dept. requires students to submit a copy of their dissertation printed on acid-free cotton bond paper to the Graduate Advising Office. Acid-free cotton bond paper can be obtained from the Biology Graduate Advising Office. The Biology Dept. will have this document bound for the departmental archives.

Deadlines for submission of manuscripts to the Office of Graduate Studies are published each semester in the Office of Graduate Studies calendar. A copy of this calendar can be found at: http://ogs.tamu.edu/OGS/currentCalendars.htm.

N. Time Limit
All graduate work must be completed within 10 consecutive calendar years. If within this time period a student does not complete all requirements for the degree sought, he or she cannot receive graduate credit for any course work that is more than 10 calendar years old at the time of the final examination.

O. Application for Degree
Graduate students who expect to complete their work at the end of a given semester must apply for graduation by submitting the electronic application for degree to the Office of the Registrar and by paying the required graduation fee at the Fiscal Department no later than the Friday of the second week of the fall or spring semester.
or the Friday of the first week of the first summer term. The electronic application for degree can be accessed via the website degreeapp.tamu.edu. Graduate students in interdisciplinary programs should attend the ceremony of their home academic department.

The Biology Graduate Advising Office should be notified when you apply to graduate so your file can be reviewed with time to identify and address any problems.

**P. Final Examination/Dissertation Defense**

In order to graduate at the end of a given semester the final exam for a doctoral degree must be passed by deadlines announced in the Office of Graduate Studies calendar. Students must be registered for at least one hour for the semester during the semester or summer term in which the final examination is held.

To be eligible to take the final examination, a student must be advanced to candidacy. The preliminary examination results and research proposal must have been submitted to the Office of Graduate Studies at least 14 weeks prior to the date of the defense. However the Final Examination must by held within three years of advancement to candidacy.

Request for permission to hold and announce the final oral examination must be submitted to the Office of Graduate Studies at least 10 working days before the requested exam date. This request must be approved by the student’s advisory committee, the Biology Dept. Graduate Advisor (or Department Head), and OGS. This announcement must be made on the official form, which can be downloaded from the OGS website. A sample form can be seen in Appendix II.

The student's advisory committee will conduct the final examination/dissertation defense. The final examination is not to be administered until the candidate’s dissertation in substantially final form is provided to the Advisory Committee, and all concerned have had adequate time to review the document. The Biology Department requires that the dissertation in substantially final form be submitted to the members of a student’s Advisory Committee at least two weeks prior to the Final Examination. In order to allow sufficient time for revisions and for Department Head approval, the Final Exam should be scheduled no later than 4 weeks prior to the OGS deadline for submission of the Dissertation.

All Ph.D. students receiving degrees through the Department of Biology will be required to present a Departmental Seminar covering their dissertation research, to be held immediately prior to the final examination. This seminar must be announced two weeks prior to the scheduled date and time (indicating that the student is a doctoral candidate), be advertised as a departmental seminar, and be open to all interested parties. Presentation of this seminar is to be followed by an open question period. Following the open question period, the student’s Advisory Committee will conduct the Final Examination.

Whereas the final examination may cover the broad field of the candidate's training, it is presumed that the major portion of the time will be devoted to the dissertation and closely allied topics. Persons other than members of the graduate faculty may, with mutual consent of the candidate and the major professor, be invited to attend a final examination for an advanced degree. Upon completion of the questioning of the candidate, all visitors must excuse themselves from the proceedings when the Advisory Committee begins its deliberation on the results of the examination.
A positive vote by all members of the graduate committee with at most one dissension is required to pass a student on his or her exam.
Timeline for Graduate Studies
Master of Science
Department of Biology

Year 1:
- Complete required courses/seminars
- Complete rotations
- Choose advisor
- Develop degree plan with advisor
- Set up advisory committee
- Hold first committee meeting
  - Outline research project
  - Discuss degree plan
  - Obtain committee approval for degree plan
- Submit degree plan to the Office of Graduate Studies (OGS)
- MS students submit draft of research proposal to their advisor by the end of the Summer

Year 2:
- Complete yearly seminars
- Coursework should be completed
- MS students submit research proposal to advisory committee by the end of the Fall semester

Year 3:
- Complete yearly seminars
- MS students complete their final exam
  - Write thesis
  - Submit completed Permission to Defend Thesis form to the OGS two weeks before defense
  - Distribute thesis to advisory committee two weeks before defense
  - Defend thesis
  - Obtain committee approval for thesis
- Submit thesis to the OGS
GRADUATE DEGREE REQUIREMENTS

MASTER OF SCIENCE
Thesis Option

To earn a Master of Science (thesis option) degree a student must meet the requirements of both the University and the Department of Biology. The Department of Biology requirements are outlined below, along with a summary of the University requirements. Please refer to the Graduate Catalog for a complete description of University requirements and policies.

Please note that graduate students must fulfill the requirements of the catalog that is current during the semester they complete their degree requirements. This is the case for both University and Department of Biology requirements. It is the student’s responsibility to keep up with changes in requirements.

REQUIREMENTS

A. Residence
In partial fulfillment of the residence requirement for the degree of Master of Science, the student must complete 9 residence credit hours during one regular semester or one 10-week summer semester. Upon recommendation of the student’s advisory committee and with approval of the Office of Graduate Studies, a student may be granted exemption from this requirement. However, such a petition must be approved prior to the student’s registration for the final 9 credit hours of required course work.

B. Identify a Major Professor
All Biology graduate students are required to identify a major professor by the end of the second full semester (excluding summer terms). M.S. candidates are encouraged to identify a major professor by the end of the first full semester. Sponsorship by the Chair or Co-chair must be submitted in writing to the Graduate Advisor by the end of the second semester.

The committee chair or one of the co-chairs must be a member of the Department of Biology graduate faculty. Requests for a co-chair from outside the Department of Biology must be approved by the Biology Department Graduate Program Committee (see requirements on page 7).

C. Establish an Advisory Committee
The advisory committee, chaired by the major professor, is a primary source of direction and intellectual support for a student’s research. The advisory committee should be constituted soon after the choice of major professor in order to provide the student with maximum input on course choices and research direction. The advisory committee will approve the degree plan, read and critique the proposal and thesis, and administer the final exam.

The University requires that a M.S. student’s advisory committee be composed of no fewer than 3 members of the graduate faculty who are representative of the student’s field of study and research. The chair or one of the

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co-chairs of the advisory committee must be from the student’s major department, and at least one of the members must be from a department other than the student’s department.

The Biology Department has established the following additional requirements. The advisory committee must contain at least one tenured or tenure-track member of the Biology graduate faculty. Faculty having joint appointments in the Department of Biology are considered Biology faculty and cannot serve as the out-of-department member of a Biology graduate student’s advisory committee.

**D. Degree Plan**

The degree plan should be developed in consultation with the student’s advisory committee and submitted to the Department of Biology Graduate Advisor prior to registering for the 3rd semester (excluding summer terms). This deadline was established to ensure that students consult with their advisory committees about course work before beginning the second year of study.

For M.S. Thesis students, the degree plan must contain a minimum 32 semester hours of approved courses and research hours. The Department of Biology course requirements are described in the following section. There are limitations regarding the use of certain graduate courses including 681, 685, 689, 690, 691, 694, and 695 courses, certain transfer course work, extension courses, advanced undergraduate courses, and certain courses offered by the College of Medicine. The student is referred to the Graduate Catalog for the details of these limitations.

The Department of Biology Graduate Program Guide for the student’s particular degree must be submitted along with the degree plan (see section E, item 5).

**E. Departmental Course Requirements**

1. All M.S. students are required to register for BIOL 681 Seminar in Graduate Student Orientation.
2. All M.S. students are required to complete BIOL 697 Methods in Teaching.
3. All M.S. students are required to complete 3 additional hours of 681 (seminar). These must include 1 hour of Departmental Colloquium (BIOL 681). Please note that the Office of Graduate Studies allows only 2 hours of 681 to be used on the degree program.
4. All M.S. students must register for one hour of BIOL 682 Graduate Student Research Seminar. All graduate students should attend this seminar each week even when they are not registered for it as a class.
5. Graduate students are required to take a minimum of 4 courses, with at least 2 of the courses coming from the foundation course listing. Exemptions will be considered by the GPC. These courses are listed on page 14 at the beginning of this section.
6. M.S. students with a co-chair from outside the Dept. of Biology must satisfy all Biology course requirements and must take at least 50% of their 691 research credit hours as Biology hours.

**F. Teaching Requirement**

All M.S. students are required to teach for at least one semester.
G. Foreign Language
No foreign language is required.

H. Research Proposal
The M.S. student must prepare a research proposal for approval by his or her Advisory Committee. The Proposal describes the research that a student intends to undertake. The proposal is not a contract to perform the described research and significant research progress need not be completed at the time of proposal submission. The proposal is a mechanism to assist students in clarifying research goals early in their graduate program, to encourage students to become familiar with the primary literature in their field, to provide experience in scientific writing, and to facilitate research interactions between students and members of their Advisory Committee. In the proposal, the student describes the rationale for the research project, the objectives of the research to be performed, and outlines the methodologies to be used.

Students will prepare a proposal describing their planned research. The proposal format will be determined by the student’s advisory committee during their first committee meeting. Suggested formats include:
- NIH R01 applications (http://grants.nih.gov/grants/funding/phs398/phs398.html)
- NSF research proposals (http://www.nsf.gov/pubs/gpg/nsf04_23)
- NIH postdoctoral fellowships (http://grants1.nih.gov/grants/funding/416/phs416.htm)

The proposal must first be approved the student’s advisor, then submitted to the advisory committee by the end of their 3rd semester (excluding summer). After revisions and approval by the advisory committee, the proposal should be submitted along with the signed official cover sheet to the Biology Graduate Advising Office. The official cover page is available on the OGS website: http://ogs.tamu.edu/OGS/pdf/prop.pdf

Students performing research involving human subjects, infectious biohazards, and/or recombinant DNA must attach a copy of the appropriate research compliance approval form to the proposal when proposal is submitted. Proposals that include research with vertebrate animals (including antibody generation in rabbits or mice) must include a copy of an approved Animal Use Protocol cover page. Information on Animal Use Protocols can be found at http://animal.tamu.edu/approval.html.

I. Pre-Defense Publication of Thesis Material.
Students should be aware of the agreement that is signed when a journal (hard copy or electronic) accepts an article for publication. At that time, the student assigns rights to the journal as publisher. The student must obtain written permission from the copyright holder to include the material in the thesis, dissertation, or record of study. Some journals and publishers have previously granted TAMU such rights, these can be found on the thesis office website.

J. Thesis
The thesis describes the research performed by a student during graduate study and the unique contribution the student has made to advance the frontiers of knowledge. The student, in consultation with the Advisory Committee, determines the content of the thesis. The thesis must be approved by the student’s Advisory
Committee. The thesis should be submitted to the members of a student’s Advisory Committee at least two weeks prior to the Final Examination.

The thesis must be original work, grammatically correct in a format consistent with that used in scholarly journals in the candidate’s field. The Office of Graduate Studies controls the format of the thesis. Students must follow it exactly, or risk having it rejected by the Thesis Clerk. Instructions and the Thesis Manual is available online at http://thesis.tamu.edu/.

After approval by the Advisory Committee an original of the thesis must be submitted to the Department of Biology Graduate Advising Office in order to obtain the Department Head’s approval and signature a minimum of two weeks prior to the Office Graduate Studies deadline for submitting the thesis to the Thesis Office. If the Department Head deems the thesis unsatisfactory, it will be given to the Graduate Program Committee for review. The Graduate Program Committee will make a recommendation of action to the Department Head, student, and the members of the student’s Advisory Committee.

Students are required to submit an electronic thesis/dissertation (ETD) as a pdf file to the Thesis Office instead of using the traditional blue-line paper. Paper copies of these ETDs will not be sent to the library or to the departments. All electronically submitted manuscripts can be accessed from the Internet via http://etd.tamu.edu or through the library website, http://library.tamu.edu. Information on how to submit an electronic thesis/dissertation is available on the Thesis Office website: http://thesis.tamu.edu.

In addition, the Biology Dept. requires students to submit a copy of their thesis printed on acid-free cotton bond paper to the Graduate Advising Office. The Biology Dept. will have this document bound for the departmental archives. Acid-free cotton bond paper is available in the Graduate Advising Office.

Deadlines for submission of manuscripts to the Office of Graduate Studies are published each semester in the Office of Graduate Studies calendar. A copy of this calendar can be found at: http://ogs.tamu.edu/OGS/currentCalendars.htm.

K. Time Limit
All requirements must be completed within seven consecutive calendar years. If a student does not complete all requirements for the degree sought by seven years, no course work will be applicable to the degree program that is more than seven calendar years old at the time of the final examination.

L. Application for Degree
Formal application for the degree must be filed in the Office of Graduate Studies not later than 90 days prior to the end of the semester (or 30 days in the summer term). Students must be registered in the semester in which the degree is conferred. If graduating at the end of the summer semester, the student must register during the first 5-week term of the summer session. There is a diploma fee that must be paid at the time formal application is submitted. The Biology Dept. Graduate Advising Office should be notified when the application for degree is filed so that the student’s file can be reviewed with time to address any problems.
M. Final Examination for M.S. students

1. The student should read the Graduate Catalog for a complete description of the University requirements.
2. The student must pass their final exam by deadline dates announced in the Office of Graduate Studies Calendar.
3. The student must be registered in the semester that the exam is taken.
4. The student’s GPR must be at least 3.000 for courses on the degree plan and for all courses completed at Texas A&M that are eligible to be applied to a graduate degree. There must be no un-absolved grades of D, F, or U in courses listed for credit on the degree plan. See the Graduate Catalog for information on how to absolve a deficient grade.
5. The student must have completed all course work on the degree plan with the exception of those hours for which the student is registered.
6. All English Language Proficiency requirements must be satisfied before the final examination is scheduled.
7. An approved research proposal must be on file with the Office of Graduate Studies by the published deadlines.
8. A request for permission to hold and announce the final examination must be submitted to the Office of Graduate Studies at least 10 working days in advance of the scheduled date for final examination.
9. The final examination covers the thesis and all course work on the degree plan. At the discretion of the Advisory Committee, the final examination may be written, oral, or both.
10. The final examination may not be administered until such time that the thesis is available to all members of the advisory committee in substantially final form and all members have had adequate time to review the document.
11. The final examination must be administered on campus (unless approved by the OGS).
12. There will be only one opportunity to retake the final examination. This must be accomplished within a time period that does not extend beyond the next regular semester (summer terms excluded).
GRADUATE DEGREE REQUIREMENTS

MASTER OF SCIENCE
Non-Thesis Option

To earn a Master of Science (non-thesis option) degree a student must meet the requirements of both the University and the Department of Biology. The Department of Biology requirements are outlined below, along with a summary of the University requirements. Please refer to the Graduate Catalog for a complete description of University requirements and policies.

Please note that graduate students must fulfill the requirements of the catalog that is current during the semester they complete their degree requirements. This is the case for both University and Department of Biology requirements. It is the student’s responsibility to keep up with changes in requirements.

REQUIREMENTS

All requirements for the non-thesis option Master of Science degree other than those specified below are the same as those for the thesis option degree.

Required course work:
A minimum of 36 semester hours is required. The degree plan must be approved by the student’s advisory committee and department head and is subject to the Limitations on the Use of Transfer, Extension and Certain Other Courses as described in the Graduate Catalog.

Students pursuing a non-thesis M.S. degree are not allowed to enroll in 691 (Research) for any reason and no 691 hours may be used for credit on the degree plan. A maximum of 4 credit hours of 684 (Professional Internship), 8 credit hours of 685 (Directed Studies), and up to 3 credit hours of 690 (Theory of Research) or 695 (Frontiers in Research) may be used toward the non-thesis option M.S. degree. In addition, any combination of 684, 685, 690, and 695 may not exceed 25% of the total credit hour requirement shown on the student’s degree plan.

Department of Biology course requirements for the non-thesis option Master of Science degree are same as those for the thesis option degree with the following exceptions: BIOL 682 Graduate Research Seminar is not required, there should be no more than 6 hours of non-science course work on the degree plan.

Thesis:
A thesis is not required. However, the Department of Biology requires non-thesis option students to prepare and submit a library research paper as described in the following section.

Library Research Paper:
Students pursuing the non-thesis option Master of Science Degree in the Department of Biology are required to prepare and submit a library research paper. The purpose of this paper is to demonstrate that the student can do library research and read, understand, and integrate information from the primary literature. In scope the paper is similar to the literature review that constitutes the first chapter of a thesis or dissertation. Typically, the paper is expected to be approximately twenty pages of double-spaced type, not including references and figures or tables.

The student’s Advisory Committee must approve this effort. An approved copy of this paper will be deposited with the Chair of the student’s advisory committee and a second soft bound copy will be deposited in the departmental file of non-thesis papers located in the Department of Biology Graduate Advising Office.

Final Exam
A final comprehensive examination is required for students seeking a non-thesis M.S. degree in the Department of Biology. No exemptions are allowed. The requirements as to level of courses and examinations are the same as for the thesis option M.S. degree.

The final examination may not be held prior to the mid-point of the semester or summer term in which a student will complete all remaining courses on the degree plan.
APPENDIX E

Graduate Course Descriptions
Graduate Course Descriptions

601. Biological Clocks. (3-0). Credit 3. Introduction to the formal properties of biological rhythms; cellular and molecular bases for rhythmicity; temporal adaptations of organisms using clocks. Prerequisite: Graduate classification or approval of instructor. Cross-listed with NRSC 635.

602. Fundamentals of Transmission Electron Microscopy. (2-6). Credit 3. State-of-the-art fundamentals in transmission electron microscopy (TEM); theoretical background supporting a strong hands-on course component comprising specimen preparation and image acquisition/interpretation; practical experience to attain a proficiency level permitting independent operation of transmission electron microscopes in the Microscopy and Imaging Center.

603. Advanced TEM Methodologies in Life and Material Sciences (TEM II). (1-6). Credit 3. Advanced TEM methodologies including specimen preparation and TEM imaging/analysis techniques as applicable to both biological and material samples; theory designed to support a strong hands-on component comprising specimen preparation, different imaging/diffraction/spectroscopic techniques and data interpretation. Prerequisites: BIOL 602; graduate classification.

604. Fundamentals of Scanning Electron Microscopy (SEM) and Environmental Scanning Electron Microscopy (ESEM). (1-3). Credit 2. Provides biologists, material scientists, and students from other disciplines with the techniques of operation of the scanning electron microscope (SEM) and the environmental SEM (ESEM) coupled with theoretical background knowledge; individual instruction in support of their research endeavors involving SEM/ESEM. Prerequisite: Graduate classification.

606. Microbial Genetics. (3-0). Credit 3. Basic understanding of microbial genetic systems and how genetic analyses can be used to investigate fundamental biological processes in bacteria. Prerequisite: Approval of instructor.

608. Theory and Applications of Light Microscopy. (2-3). Credit 3. Provides biologists, material scientists and students from other disciplines with the theoretical background and practical techniques of sample preparation, operation of light microscopes as well as image acquisition and processing; individual instruction which facilitates the completion of their research projects involving light microscopic techniques. Prerequisite: half-page write-up describing how their graduate work will benefit.

609. Molecular Tools in Biology. (3-0). Credit 3. Interactive lecture course in molecular biology for beginning graduate students; introduction to tools and methodologies used in prokaryotic and eukaryotic molecular labs; choosing the appropriate experimental technique for a given scientific question; virtual experiments will reinforce the applications and introduce useful bioinformatics tools. Prerequisite: Graduate classification.

610. Evolution. (3-0). Credit 3. Fundamentals of evolutionary biology with an emphasis on evolutionary theory. Prerequisite: Graduate classification or approval of instructor.

613. Cell Biology. (3-0). Credit 3. Consideration of the eukaryotic cell as a functional, integrated unit in living organisms: structure, composition, function and biogenesis of subcellular components; dynamic processes and interactions of cells, including division, communication, and death; experimental approaches in modern cell biology and selected applications of experimental cell biology to problems in medicine. Prerequisite: BICH 410 or BIOL 213. Concurrent enrollment in BIOL 213 or BICH 410 strongly discouraged.

615. Signaling in Behavior and Development. (3-0). Credit 3. Will focus on signaling pathways used in multicellular animals. In each lecture, major signaling pathways used in behavior, physiology, and development will be introduced at the molecular level, and then be discussed in the context of organismal biology. Prerequisite: Graduate classification. Cross-listed with NRSC 636.

622. Microbial Physiology. (3-0). Credit 3. An area of microbial physiology will be explored at the molecular, cellular, and genetic levels through reading and discussion of classic and current research literature. The area of focus may change from semester to semester. May be taken three times for credit with approval of instructor. Prerequisite: Graduate classification.

625. Structural and Molecular Biology. (3-0). Credit 3. Successfully integrate structural knowledge into areas of interest; literature examples used to integrate structural information from large macromolecular complexes to single proteins with functional information obtained through other methods. Prerequisite: Graduate classification or approval of instructor.

627. Principles of Neuroscience I. (3-0). Credit 3. Detailed introduction to the basic fundamentals of cellular and molecular neuroscience; topics include membrane potentials, action potential generation, and the mechanisms underlying synaptic transmission, as well as their molecular basis. Prerequisites: Graduate classification or approval of instructor. Cross-listed with NRSC 601.

628. Principles of Neuroscience II. (3-0). Credit 3. Fully integrated overview of nervous system organization and systems-level neurobiology; broad topics include sensory systems and sensory systems function, motor systems and neuromuscular function, central pattern generation and locomotion, homeostatic regulation, motivation, emotions, learning and memory, and circadian rhythms. Prerequisites: Graduate standing or permission of instructor. Cross-listed with NRSC 602.

634. Comparative Neurobiology. (3-0). Credit 3. Cellular, molecular and systems neurobiology, together with neuroethology. A comparative approach to subject matter is stressed. Topics include evolution of nervous systems and their diverse structure and complex functions. Cross-listed with NRSC 634.
635. Plant Molecular Biology. (3-0). Credit 3. Molecular aspects of plant growth, development, reproduction and evolution, emphasizing the structure, function, regulation, interaction and manipulation of plant genes; practical applications of plant molecular biology. Prerequisite: GENE 431.

644. Neural Development. (3-0). Credit 3. Classical and current research literature to explore the major events in the development of a nervous system, including topics ranging from neurogenesis to synapse information. Prerequisite: Graduate classification. Cross-listed with NRSC 644.

650. Genomics. (3-0). Credit 3. Modern genomics as a tool for understanding biological systems; review of gene structure and organization and the history of sequencing technologies; focus on transcriptional, translational and functional genomics. Prerequisite: Graduate classification or approval of instructor. Cross-listed with BICH 650.

651. Bioinformatics. (3-0). Credit 3. Introduction to applications related to information processing in biological research with practical training exercises; includes internet databases, sequence alignment, motif prediction, gene and promoter prediction, phylogenetic analysis, protein structure classification, analysis and prediction, genome annotation, assembly and comparative analysis, and proteomics analysis. Prerequisite: Graduate classification or approval of instructor.

652. Epigenetic Mechanisms. (3-0). Credit 3. Lectures and discussion of current research in epigenetic inheritance and its mechanisms in a variety of organisms. Structure of the course includes paper discussion and presentation, grant-writing, and grant-review. Prerequisite: BICH 631.

661. Antimicrobial Agents. (1-0). Credit 1. Understanding of microbial agents, limitations of use, biosynthesis and regulation, and challenges in development as new therapeutics. Prerequisite: Approval of instructor.

663. Biology of the Crustacea. (3-3). Credit 4. Classification, life history, morphology, physiology, ecology, diseases, parasites and predators of crustaceans; economic aspects of crustaceans; original literature emphasized. Prerequisite: BIOL 335 or equivalent, or approval of instructor.

665. Biology of Invertebrates. (3-3). Credit 4. Morphology, biology and phylogeny of invertebrates. Topics may be either detailed discussions of specific organisms or comparative information on a process. Prerequisite: BIOL 335 or equivalent.

681. Seminar. (1-0). Credit 1. Detailed reports on specific topics in field chosen. Students may register in up to but no more than three sections of this course in the same semester.

682. Research Seminar. (1-0). Credit 1. Seminars presented by students based upon their research projects. Prerequisite: Graduate classification.

685. Directed Studies. Credit 1 to 6 each semester. Limited investigations in fields other than those chosen for thesis or dissertation.
689. Special Topics in... Credit 1 to 4. Selected topics in an identified area of biology.

691. Research. Credit 1 or more each semester. Research for thesis or dissertation.

697. Methods in Teaching Biology Laboratory. (1-0). Credit 1. Introduction to teaching methods associated with the teaching of undergraduate biology laboratories; emphasis on effective preparation and delivery of laboratory course content, clear instructions for procedures and laboratory safety. Prerequisite: Graduate classification in a biological science.

698. Special Topics Behavior, Genes and Evolution. (3-0). Credit 3. This literature and lecture-based course will introduce an integrative approach to the study of animal behavior, complementing evolutionary and ecological perspectives with molecular and genetic approaches and methodologies. Prerequisite: Graduate classification. Cross-listed with NRSC 698.
APPENDIX F

Undergraduate Degree Plans
## Bachelor of Science-Biology

**Cat. 138 2015-2016**

Student ___________________________ UIN _______________ Lower Level complete (**) _______

### 6 Hours International and Cultural Diversity

900-level section #'s of BIOL 351, 388, 400, 401, 423, 491 (pre-approval),

### Two Writing Intensive Courses in Major

95, VIBS443; OCNG420; see advisor for other options

### Residency (300-400 level coursework, 36hrs required)

H.S. Foreign Language ______

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**Total Hours 120**

**Common Body of Knowledge courses. Freshmen: must complete before start of third year (5th full**
@ MATH147/148 alternative sequences: MATH151/152 or MATH171/172;
# See core.tamu.edu for options.
%Electives CANNOT be: 1-hr Intro courses (BIMS101, AGLS101, etc.); MATH102, 103; BIOL101, 107, 206;

Department of Biology, Texas A&M University
CAEN102; CORPS required courses (AERS, MILS, NVSC); CHEM106, 116; only one KINE199 may be used

**Bachelor of Arts-Biology**
Cat. 138 2015-2016

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6 Hours International and Cultural Diversity ______________________________________
900-level section #'s of BIOL 351, 388, 400, 401, 423, 491 (pre-approval)

Two Writing Intensive Courses in Major __________________________________________
495; OCNG420; see advisor for other options ______________________________________

Residency (300-400 level coursework, 36hrs required) ____________ H.S. Foreign Language ____________

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Total Hours 120

@MATH147/148 alternate sequences: MATH151/152 or MATH171/172; # See core.tamu.edu for options.

%Free Electives CANNOT be: One hour Intro classes (BIMS101, AGLS101, etc.); MATH102, 103, BIOL101, 107, 206; CAEN102; CORPS required courses (AERS, MILS, NVSC); CHEM106, 116; only one KINE199 can be used.
# Bachelor of Science-Microbiology

## Cat. 138 2015-2016

**Student_________________________ UIN________________**

**Lower Level complete (**) _______**

### 6 Hours International and Cultural Diversity

[900-level section #’s of BIOL 351, 388, 400, 401, 423, 491 (pre-approval)]

### Two Writing Intensive Courses in Major

495; OCNG420; see advisor for other options.

### Residency (300-400 level coursework, 36hrs required) __________ H.S. Foreign Language _________

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- POLS206 3
- POLS207 3

### Social Science (3)#

- BIOL352, 414, 430, 438, 450, 460; BESC401, 402

### Lang, Phil, Culture (3)#

- BIOL352, 430, 440, 460; SCSC405; BESC401, 402, 403

### Creative Arts(3)#

- BIOL352, 445, 454, 455, 456; VTPB452, 487

### Supporting Sciences (39)

- CHEM101** 3
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- CHEM102** 3
- CHEM112** 1
- CHEM227** 3
- CHEM237** 1
- CHEM228** 3
- CHEM238** 1
- PHYS201 4

### Biology Upper Level Requirements (11)

- BIOL351 4
- BIOL438 4
- BIOL406 3

### Other

- STAT302@ 3
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- BICH410 3
- BICH411 3
- BICH414 2
- GENE302/312 4

**Total Hours 120**

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**%Free Electives CANNOT be:** One hour Intro classes (BIMS101, AGLS101, etc.); MATH102, 103, BIOL101, 107; CAEN102; CORPS required courses (AERS, MILS, NVSC); CHEM106, 116

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**Common Body of Knowledge courses. Freshmen: must complete before start of third year (5th full semester); Transfers: must complete within two semesters.**

@MATH147/148 alternative sequences: MATH151/152 or MATH171/172;

@STAT302 alternate courses: STAT301 or STAT303

# See core.tamu.edu for options.
# Bachelor of Science-Molecular and Cell Biology

**Cat. 138 2015-2016**

**Student_________________________________ UIN________________**  **Lower Level complete (**) _______**

## 6 Hours International and Cultural Diversity
900-level section #'s of BIOL 351, 388, 400, 401, 423, 491 (pre-approval)

## Two Writing Intensive Courses in Major
- BIOL 495; VIBS443; OCNG420; see advisor for other options

## Residency (300-400 level coursework, 36 hrs required)__________  **H.S. Foreign Language _________**

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@MATH147/148 alternative sequences: MATH151/152 or MATH171/172;  
# See core.tamu.edu for options.  
%Free Electives CANNOT be: One hour Intro classes (BIMS101, AGLS101, etc.); MATH102, 103, BIOL101, 107; CAEN102; Corp required courses (AERS, MILS, NVSC); CHEM106, 116
### Bachelor of Science-Zoology
Cat. 138 2015-2016

**Student_________________________________ UIN________________**

**Lower Level complete (**) _______**

6 Hours International and Cultural Diversity___________________________________________

900-level section #’s of BIOL 351, 388, 400, 401, 423, 491 (pre-approval)

**Two Writing Intensive Courses in Major 495; OCNG420; see advisor for other options**

Residency (300-400 level coursework, 36 hrs required)____________ H.S. Foreign Language _________

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Department of Biology, Texas A&M University 133
APPENDIX G

Undergraduate Course Descriptions
UNDERGRADUATE COURSE DESCRIPTIONS

**BIOL 101 Botany.** Credits 4. 3 Lecture Hours. 3 Lab Hours. Structure, physiology and development of plants with an emphasis on seed plants. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113); includes laboratory that reinforces and provides supplemental information related to the lecture topics.

**BIOL 107 Zoology.** Credits 4. 3 Lecture Hours. 3 Lab Hours. Survey of animal life with respect to cell organization, genetics, evolution, diversity of invertebrates/vertebrates, anatomy/physiology, and interaction of animals with their environment; includes laboratory that reinforces and provides supplemental information related to lecture topics. (Not open to students who have taken BIOL 111 and BIOL 112 or BIOL 113).

**BIOL 111 Introductory Biology I.** Credits 4. 3 Lecture Hours. 3 Lab Hours. First half of an introductory two-semester survey of contemporary biology that covers the chemical basis of life, structure and biology of the cell, molecular biology and genetics; includes laboratory that reinforces and provides supplemental information related to the lecture topics.

**BIOL 112 Introductory Biology II.** Credits 4. 3 Lecture Hours. 3 Lab Hours. The second half of an introductory two-semester survey of contemporary biology that covers evolution, history of life, diversity and form and function of organisms; includes laboratory that reinforces and provides supplemental information related to the lecture topics. Prerequisite: BIOL 111.

**BIOL 113 Essentials in Biology.** Credits 4. 3 Lecture Hours. 3 Lab Hours. One-semester in introductory biology for non-majors; chemical basis of life, cellular and molecular biology, genetics, evolution, biodiversity and interaction of organisms with their environment; includes a laboratory to supplement and reinforce lecture topics.

**BIOL 206 Introductory Microbiology.** Credits 4. 3 Lecture Hours. 4 Lab Hours. Basic microbiology of prokaryotes and eukaryotes; main topics include morphology, physiology, genetics, taxonomy, ecology, medically important species and immunology; mandatory laboratory designed to give hands-on experience and to reinforce basic principles. Prerequisites: BIOL 101, BIOL 107, BIOL 111, or BIOL 113; CHEM 101 and CHEM 111 or CHEM 103 and CHEM 113. May not be used for credit by biology, molecular and cell biology, microbiology, zoology, pre-dentistry or pre-medicine majors.

**BIOL 213 Molecular Cell Biology.** Credits 3. 3 Lecture Hours. Explores the molecular basis of cell structure, function and evolution; gene regulation, cell division cycle, cancer, immunity, differentiation, multicellularity and photosynthesis; may not take concurrently with, or after the completion of, BIOL 413. Prerequisites: BIOL 112; CHEM 227 or concurrent enrollment.

**BIOL 214 Genes, Ecology and Evolution.** Credits 3. 3 Lecture Hours. A genetically-based introduction to the study of ecology and evolution; emphasis on the interactions of organisms with each other and with their environment. Prerequisite: BIOL 112.
BIOL 285 Directed Studies. Credits 1 to 4. 1 to 4 Other Hours. Problems in various phases of plant, animal and microbial science. Prerequisites: Freshman or sophomore classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

BIOL 289 Special Topics in... Credits 1 to 4. 1 to 4 Lecture Hours. Selected topics in an identified area of biology. May be repeated for credit. Prerequisite: Approval of instructor.

BIOL 291 Research. Credits 0 to 4. 0 to 4 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be repeated for credit. Prerequisites: Freshman or sophomore classification and approval of faculty member.

BIOL 300 Research Seminar: Tropical Ecology in Costa Rica. Credit 1. 1 Lecture Hour. Advanced instruction in research activities for Costa Rica; critical planning and writing skills essential in conducting research and communicating results using scientific methods and formatting. Prerequisites: Junior or senior classification; approval of instructor.

BIOL 318 Chordate Anatomy. Credits 4. 3 Lecture Hours. 3 Lab Hours. Classification, phylogeny, comparative anatomy, and biology of chordates; diversity, protochordates, vertebrate skeletons, shark and cat anatomy studied in laboratory. Prerequisite: BIOL 112.

BIOL 319 Integrated Human Anatomy and Physiology I. Credits 4. 3 Lecture Hours. 3 Lab Hours. Integrated approach to cellular, neural, skeletal, muscular anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. Prerequisite: BIOL 111 and BIOL 112, or BIOL 107.

BIOL 320 Integrated Human Anatomy and Physiology II. Credits 4. 3 Lecture Hours. 3 Lab Hours. Continuation of BIOL 319. Integrated approach to endocrine, cardiovascular, respiratory, digestive, urinary, reproductive and developmental anatomy and physiology; includes some histology, histopathology, radiology and clinical correlations. Prerequisite: BIOL 111 and BIOL 112, or BIOL 107; BIOL 319 or approval of instructor.

BIOL 335 Invertebrate Zoology. Credits 4. 3 Lecture Hours. 3 Lab Hours. Morphology, taxonomy, natural history and phylogeny of invertebrate animals, with emphasis on biodiversity; class includes both lecture and lab. Labs include study of preserved material and demonstration of living animals in aquaria and terraria. Prerequisite: BIOL 112 or approval of instructor.

BIOL 344 Embryology. Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to general and comparative embryology; molecular and cellular mechanisms of development; genetics and early development of selected invertebrates (C. elegans, Drosophila and sea urchin) and emphasis on vertebrates (frog, fish, chick and mouse). Prerequisite: BIOL 213 or GENE 302.

BIOL 350 Computational Genomics. Credits 3. 2 Lecture Hours. 2 Lab Hours. Hands-on approach to obtaining, organizing and analyzing genome-related data; emphasis on asking and answering biologically relevant questions by designing and performing experiments using computers; understanding biology from a
computational perspective. Prerequisite: Junior or senior classification in life sciences, engineering, mathematics, chemistry.

**BIOL 351 Fundamentals of Microbiology.** Credits 4. 3 Lecture Hours. 4 Lab Hours. Introduction to modern microbiology with emphasis on prokaryotes; includes microbial cell structure, function, and physiology; genetics, evolution, and taxonomy; bacteriophage and viruses; pathogenesis and immunity; and ecology and biotechnology; includes laboratory experience with microbial growth and identification. Prerequisites: BIOL 112; CHEM 227, and CHEM 237 or CHEM 231; or approval of instructor.

**BIOL 352 Diagnostic Bacteriology.** Credits 4. 2 Lecture Hours. 6 Lab Hours. Practical experience in handling, isolation and identification of pathogenic microorganisms using biochemical tests and rapid identification techniques. Prerequisite: BIOL 206 or BIOL 351.

**BIOL 357 Ecology.** Credits 3. 3 Lecture Hours. Analysis of ecosystems at organismal, population, interspecific and community levels. BIOL 358 is the laboratory for this lecture course. Prerequisite: BIOL 112 or approval of instructor.

**BIOL 358 Ecology Laboratory.** Credit 1. 3 Lab Hours. Quantitative analyses of freshwater and terrestrial ecosystems; includes data sampling and presentation of results in written and oral formats; required fieldtrips; analysis of competition and predator-prey interactions using ecological models. Prerequisite: BIOL 357 or concurrent enrollment; junior or senior classification.

**BIOL 388 Principles of Animal Physiology.** Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to how animals function, including basics of neurophysiology, endocrinology, muscular, cardiovascular, respiratory, osmoregulatory, and metabolic physiology; broadly comparative in scope and encompassing adaptation of physiological systems to diverse environments; the laboratory stresses techniques used for monitoring and investigating physiological mechanisms and responses to environmental changes. Prerequisites: BIOL 112; CHEM 228.

**BIOL 400 Tropical Ecology Costa Rica.** Credits 6. 2 Lecture Hours. 12 Lab Hours. Advanced field course taught at multiple field stations in Costa Rica; emphasis on biological, ecological, natural history and philosophical attributes of tropical ecosystems; includes planning and conducting a field-oriented research project, and presentation of results. Prerequisites: BIOL 300 and approval of instructor; junior or senior classification.

**BIOL 401 Critical Writing in Biology.** Credit 1. 1 Lecture Hour. Reading scientific papers and writing short synopses of papers with a focus on learning how to think and write like a scientist; fills the current Writing Intensive "W" course requirement for biology. Prerequisites: BIOL 213 and BIOL 214; junior or senior classification.

**BIOL 405 Comparative Endocrinology.** Credits 3. 3 Lecture Hours. Basic principles of endocrinology including structure and functions of hormones in vertebrates; hormonal control of growth, metabolism, osmoregulation,
and reproduction; endocrine techniques and mechanism of hormone action. Prerequisites: BIOL 213 and CHEM 227; BIOL 320 or BIOL 388 strongly recommended.

**BIOL 406/GENE 406 Bacterial Genetics.** Credits 3. 3 Lecture Hours. A problem oriented course surveying the manipulation and mechanisms of genetic systems in bacteria; recombination, structure and regulation of bacterial genes, plasmids and phages. Prerequisites: BIOL 351; GENE 302. Cross Listing: GENE 406/BIOL 406.

**BIOL 413 Cell Biology.** Credits 3. 3 Lecture Hours. Structure, function, and biogenesis of cells and their components; interpretation of dynamic processes of cells, including protein trafficking, motility, signaling and proliferation. Prerequisites: BIOL 213 and BICH 410.

**BIOL 414 Developmental Biology.** Credits 3. 3 Lecture Hours. Concepts of development in systems ranging from bacteriophage to the mammalian embryo; use of recombinant DNA technology and embryo engineering to unravel the relationships between growth and differentiation, morphogenesis and commitment, aging and cancer. Prerequisite: BIOL 413 or concurrent enrollment or approval of instructor.

**BIOL 423 Cell Biology Laboratory.** Credit 1. 3 Lab Hours. Modern methods of study of cell structure and cell function. Prerequisites: BIOL 413 and BICH 412 or registration therein; approval of instructor.

**BIOL 430 Biological Imaging.** Credits 4. 3 Lecture Hours. 3 Lab Hours. Still and video photography and photomicrography, computer based digital image analysis and processing of biological images; theory and principles of light and electron microscopy including transmission and scanning electron microscopy; optical contrast methods for light microscopy including phase contrast, DIC, polarizing light and confocal laser scanning microscopy. Prerequisite: Junior classification or approval of instructor.

**BIOL 434/NRSC 434 Regulatory and Behavioral Neuroscience.** Credits 3. 3 Lecture Hours. Cell biology and biophysics of neurons; functional organization of the vertebrate nervous system; physiological basis of behavior. Prerequisites: BIOL 319 or BIOL 388 or PSYC 335/NRSC 335; BIOL 213 strongly recommended. Cross Listing: NRSC 434/BIOL 434.

**BIOL 435 Laboratory for Regulatory and Behavioral Neuroscience.** Credit 1. 3 Lab Hours. Study of modern methods and tools used to investigate nervous system structure and function. Prerequisite: Approval of instructor.

**BIOL 437 Molecular and Human Medical Mycology.** Credits 3. 3 Lecture Hours. Principles of fungal pathogenesis, diagnosis and antifungal therapies, and relevant genetic and molecular tools for studying human pathogens and drug delivery. Prerequisites: BIOL 351; junior or senior classification; or approval of instructor.

**BIOL 438 Bacterial Physiology.** Credits 4. 4 Lecture Hours. Structure and function of prokaryotic cells, with emphasis on evolutionary adaptations to different environmental, developmental, and pathogenic selections pressures; formation of teams and preparation of presentations on specific topics in microbiology. Prerequisites: BIOL 351 and BIOL 406/GENE 406; BICH 410, BICH 431/GENE 431 and GENE 302 strongly recommended.
BIOL 440 Marine Biology. Credits 4. 3 Lecture Hours. 3 Lab Hours. Introduction to biology of common organisms inhabiting bays, beaches and near-shore oceanic waters with special reference to Gulf of Mexico biota; emphasis on classification, distribution, history, ecology, physiology, mutualism, predation, major community types and economic aspects of marine organisms. Prerequisite: BIOL 112 or approval of instructor.

BIOL 445 Biology of Viruses. Credits 3. 3 Lecture Hours. Structure, composition and life cycles of viruses; methods used to study viruses; their interaction with host cells; mechanisms of pathogenicity and cellular transformation; responses of the host to viral infection, and vaccine applications; in-depth study of the life cycles of the major classes of viruses and discussion of emerging viruses. Prerequisite: BIOL 213 or BIOL 351 or approval of instructor.

BIOL 450/BICH 450 Genomics. Credits 4. 3 Lecture Hours. 3 Lab Hours. The study of genomic data includes consideration of the logic behind the most important genomic approaches, as well as their capabilities and limitations in investigating biological processes; the science of accessing and manipulating genomic data; and practical applications, including development of an hypotheses-driven data mining experiment. Prerequisites: BIOL 213, GENE 301 or GENE 302, BICH 431/GENE 431 or GENE 431/BICH 431, or BIOL 351; junior or senior classification or approval of instructor. Cross Listing: BICH 450/BIOL 450.

BIOL 451 Bioinformatics. Credits 3. 3 Lecture Hours. Introduction to the entire field of bioinformatics; theoretical background of computational algorithms, with an emphasis on application of computational tools related to modern molecular biological research. Prerequisite: Junior or senior classification, or approval of instructor.

BIOL 452 Fungal Functional Genomics. Credits 4. 3 Lecture Hours. 4 Lab Hours. Extensive research experience in eukaryotic molecular genetics using the fungus Neurospora crassa as the primary model system; analysis of Neurospora gene-deletion strain collection to examine the effects of genes on the organism's traits; introduction of molecular techniques for genome manipulation and analysis. Prerequisite: Junior or senior classification in any life science major or approval of instructor.

BIOL 454 Immunology. Credits 3. 3 Lecture Hours. Introduction to basic immunological concepts and principles of serology. Prerequisite: BIOL 351 or equivalent or approval of instructor.

BIOL 455 Laboratory in Immunology. Credits 2. 6 Lab Hours. Practical application of serological principles which include precipitation, agglutination and blood banking principles; techniques in tissue culture and hybridoma technology also included. Prerequisite: BIOL 454 or registration therein.

BIOL 456 Medical Microbiology. Credits 4. 4 Lecture Hours. Microbiology, epidemiology and pathology of human pathogens with an emphasis on bacterial agents. Prerequisite: BIOL 351 or approval of instructor.

BIOL 461 Antimicrobial Agents. Credit 1. 1 Lecture Hour. Understanding of antimicrobial agents, limitations of use, biosynthesis and regulation, and challenges in development as new therapeutics. Prerequisites: BICH 410 or BICH 440 and BIOL 351 or VTPB 405.

Department of Biology, Texas A&M University
Programs in Biology

**BIOL 463 Epigenetic Mechanisms and Inheritance.** Credits 3. 3 Lecture Hours. Knowledge of chromatin structure, the mechanisms of chromatin inheritance and the consequences of heritable chromatin structures on gene expression; phenomenology, molecular underpinnings and evolutionary implications. Prerequisite: Junior or senior classification or approval of instructor.

**BIOL 466 Principles of Evolution.** Credits 3. 3 Lecture Hours. Evolutionary patterns, mechanisms and processes at the organismal, chromosomal and molecular levels; modes of adaptation and the behavior of genes in populations. Prerequisite: GENE 302 or approval of instructor.

**BIOL 467 Integrative Animal Behavior.** Credits 3. 3 Lecture Hours. Examines how behavior contributes to survival and reproduction, and how evolutionary history and ecological circumstance interact to shape the expression of behavior; focus on integrative nature of behavior: how the interaction of evolutionary processes, mechanistic constraints, and ecological demands determine behavioral strategies. Prerequisite: Any one of the following: BIOL 214, BIOL 357, BIOL 388, BIOL 405, BIOL 434/NRSC 434, BIOL 466, or approval of instructor.

**BIOL 481 Seminar in Biology.** Credit 1. 1 Lecture Hour. Recent advances. Restricted to senior undergraduate majors in biology, microbiology, botany or zoology.

**BIOL 484 Internship.** Credits 0 to 4. 0-1 Other Hours. Directed internship in a private firm or public agency to provide research experience appropriate to the student's degree program and career objectives. May be taken two times. Prerequisite: Approval of internship agency and advising office.

**BIOL 485 Directed Studies.** Credits 1 to 12. 1 to 12 Other Hours. Problems in various phases of plant, animal and bacteriological science. Prerequisites: Junior classification; approval of ranking professor in field chosen and Undergraduate Advising Office.

**BIOL 487/VTPB 487 Biomedical Parasitology.** Credits 4. 3 Lecture Hours. 2 Lab Hours. Helminth and protozoan parasites of medical and veterinary importance; life cycles, morphology, taxonomic classification, economic and public health aspects and current topics in parasitic diseases. Prerequisites: BIOL 107 or BIOL 112; junior or senior classification or approval of instructor. Cross Listing: VTPB 487/BIOL 487.

**BIOL 489 Special Topics in...** Credits 1 to 4. 1 to 4 Lecture Hours. 0 to 10 Lab Hours. Selected topics in an identified area of biology. May be repeated once for credit.

**BIOL 491 Research.** Credits 0 to 4. 0-1 Other Hours. Active research of basic nature under the supervision of a Department of Biology faculty member. May be taken two times. Registration in multiple sections of this course is possible within a given semester provided that the per semester credit hour limit is not exceeded. Prerequisite: Approval of departmental faculty member.

**BIOL 495 Biology Capstone: Research Communication in the Life Sciences.** Credits 2. 2 Lecture Hours. Culmination of capstone research experience; formalization of research results in written and oral forms; introduction to primary genres or scientific writing; apply principles of rhetoric and composition to diverse methods of professional communication. Prerequisite: BIOL 452, BICH 464, BIOL 400, BIOL 493 or BIOL 491 or approval of instructor.
APPENDIX H

Core Faculty Biographies
Rodolfo Aramayo
Associate Professor

BIOGRAPHY
Dr. Rodolfo Aramayo joined the Department of Biology at Texas A&M University in 1997 and was tenured and promoted to Associate Professor in 2004. He obtained his Ph.D. in Genetics at the University of Georgia. His postdoctoral work in the laboratory of Dr. Robert L. Metzenberg at the University of Wisconsin and at Stanford University focused on studying the ascus-dominant behavior of a gene coding for a transcription factor. These studies resulted in the discovery of a novel meiotic silencing behavior dubbed Meiotic Silencing. Dr. Aramayo is a member of the Faculty of Genetics, the Program for the Biology of Filamentous Fungi (PBoFF), Graduate Faculty of the Health Science Center and Whole Systems Genomics Computational Advisory Group. He is a member of Aggie Research Scholars and Faculty Honors Program. He developed a course called "Genomics" in 1999, which he teaches at both undergraduate and graduate levels. He also developed a new graduate course called "Digital Biology" in 2013. He is responsible for the Campus-wide training in Genomics and Computational Biology and his team deployed "Galaxy," a web-based interface to Computational Genomics software, both in the Department of Biology and the TAMU Supercomputer "Ada."

RESEARCH
Dr. Aramayo's laboratory is centered on understanding the function(s) of RNAs, especially non-coding RNAs in all aspects of Biology. While the initial work was based on studying Meiotic Silencing in Neurospora, it became immediately clear that the RNA silencing mechanism invoked by this very unusual genetic phenomenon had been adapted and evolved to fulfill key highly-related roles in all eukaryotic cells. The complexity of the problem demanded the use of the most sophisticated molecular tools, especially Next Generation DNA Sequencing and the manipulation of the emerging information. In the process of mastering these computational tools and techniques, the Aramayo lab branched into studying the Computational Genomics aspect of these problems. The expertise thus generated could clearly be applied to all organisms and/or other systems. The Aramayo laboratory thus established active collaborations with researchers studying the biology of RNAs in Neurobiology, Muscular Dystrophy and Cell Cycle. The computational expertise of this laboratory has also generated an active collaboration with Materials Sciences. The wet-lab aspect of this laboratory is still centered on understanding Meiotic Silencing, one of the most amazing and intriguing mechanisms observed in meiotic cells of eukaryotic organisms. If a segment of DNA is not present on the opposite homologous chromosome in meiosis in Neurospora, the resulting "unpaired" DNA segment is targeted for silencing. This situation occurs when a DNA element gets inserted at a particular chromosomal position (e.g., a situation akin to the "invasion" of a genome by transposable DNA elements). It can also occur when a normal region gets deleted. In both situations, the resulting loop of "unpaired" DNA activates a genome-wide "alert" system that results in the silencing not only of the genes present in the "unpaired" DNA segment, but also of those same genes if present elsewhere in
the genome, even if they are in the paired condition. Although meiotic silencing and was originally described in *Neurospora crassa*, it has since been observed in nematodes and mammals. In all these organisms, "unpaired or unsynapped" regions (or chromosomes) are targeted for gene silencing. The working hypothesis is that meiotic silencing is a two-step process. First meiotic trans-sensing compares the chromosomes from each parent and identifies significant differences as unpaired DNA. Second, if unpaired DNA is identified, a process called meiotic silencing silences expression of genes within the unpaired region and regions sharing sequence identity. The lab is using a combination of genetics, molecular biology and biochemistry aimed at identifying all the molecular players of the process and at understanding how they work together. The long term objective of our work is to understand meiotic silencing in Neurospora and to map its connections with the meiotic silencing observed in other organisms.

**PUBLICATIONS**


Li, H., C. Wu, R. Aramayo, M. S. Sachs and M. L. Harlow (2015). "Synaptic vesicles contain small ribonucleic acids (sRNAs) including transfer RNA fragments (trfRNA) and microRNAs (miRNA)." Submitted.


**SUPPORT**

**VPR Seed Grant**

*Materials Genome Project*

01 May 2014 – 30 April 2016
Karl Aufderheide
Associate Professor

BIOGRAPHY
Dr. Karl Aufderheide joined the Department of Biology at Texas A&M University in 1979, and he was tenured and promoted to Associate Professor in 1986. He obtained his Ph.D. in Cell Biology from the University of Minnesota, under the guidance of Dr. Ross Johnson. His postdoctoral work, in the laboratory of Dr. Tracy Sonneborn at Indiana University and in the laboratory of Dr. Joseph Frankel at the University of Iowa, focused on the genetics and cellular and developmental biology of various species of ciliate protozoa. Dr. Aufderheide teaches Introductory Biology, Molecular Cell Biology, and Cell Biology at the undergraduate level and assists with a graduate Light Microscopy course.

RESEARCH
The protozoa *Paramecium tetraurelia* and *Tetrahymena thermophila* possess many characteristics which make them both especially useful for a wide range of cellular and developmental investigations. This lab has studied several important biological problems using species of paramecia as research organisms.

A major project in the laboratory is the study of intracellular pattern formation in *Paramecium*. The cell cortex is an extremely elaborate array of cytoskeletal and membrane components. This complex array must be duplicated each cell cycle. We are investigating the genetic and epigenetic contributions to the formation and maintenance of this complex patterned array. Current specific projects include a detailed investigation of morphogenetic activity in cells bearing cortical inversions and also a quantitative/mathematical study of the relation of swimming behavior in cells with inversions to the number of altered ciliary rows in the cell.

In *Tetrahymena*, we discovered a novel transient organelle, the conjusome, which appears uniquely during conjugation. This organelle appears to be a critical signaling and determining center for macronuclear development, and likely contributes to many of the epigenetic phenomena that occur in this species. Several manuscripts further characterizing the conjusome are in preparation in an ongoing collaboration with Dr. Chris Janetopoulos at the University of the Sciences in Philadelphia.

Also, in collaboration with Dr. Janetopoulos, we have developed and refined devices that will non-destructively and reversibly immobilize cells and small organisms for high resolution microscopic examination. These devices have been adapted to permit their use on either upright or inverted light microscopes, and also have added microfluidics so that fresh media can be supplied to an immobilized specimen, or solution content can be changed while the specimen is being observed, assessing response to a new stimulus or drug.
PUBLICATIONS


SUPPORT

**Frank R. Lillie Research Innovation Award Program**

*Mechanical micro-compressors for the immobilization and imaging of cells and specimens.* Co-Investigator, 1 June 2013 – 31 August 2013

$125,000
Academic Program Review 2015

Deborah Bell-Pedersen
Professor and Associate Department Head for Operations

BIOGRAPHY
Dr. Deborah Bell-Pedersen joined the Department of Biology at Texas A&M University in 1997, rising to Professor in 2007. She obtained her Ph.D. in Molecular Biology from the State University of New York at Albany, under the guidance of Dr. Marlene Belfort. Her postdoctoral work in the laboratories of Drs. Jay Dunlap and Jennifer Loros at Dartmouth Medical School focused on molecular studies of the circadian biological clock in Neurospora crassa. She was appointed Associate Department Head for Operations in 2014 and is a member of the Genetics Faculty, Program for the Biology of Filamentous Fungi (PBoFF), and Center for Research on Biological Clocks. Dr. Bell-Pedersen teaches Biology of Viruses at the undergraduate level. She currently serves as an Associate Editor for Fungal Genetics and Biology, Journal of Biological Rhythms, and Eukaryotic Cell. She has won several awards, including the TAMU Jo Ann Treat Award for Excellence in Research, the Davidson Award Lecture (Baylor College), the TAMU Women Former Students’ Network Eminent Scholar Award, and most recently, the 2015 Association of Former Students’ Distinguished Achievement for Research. She was elected into the American Academy of Microbiology in 2014.

RESEARCH
Dr. Bell-Pedersen’s research focuses on understanding how the circadian clock functions in organisms to regulate daily rhythms in gene expression. Defects of the human clock are associated with several important human diseases, and daily changes in metabolism and cell division rates influence the efficacy and toxicity of many pharmaceuticals, including cancer drugs. Therefore, knowing what clocks regulate at the molecular level is important for the development of new treatments.

Her research uses Neurospora crassa as a model system for understanding the human clock. She recently discovered that the clock regulates the activity of highly conserved MAPK signaling pathways involved in stress responses, protein translation elongation, and the control of cell growth and division. This finding provides a rationale for observations that deregulation of the clock in humans contributes to cancer, and suggests new approaches for treatment of circadian disorders. In addition, she is working on a collaborative project that combines computational and experimental studies to determine how transcription factor networks regulate the phase of rhythmic gene expression. By defining the molecular rules that govern rhythmic gene expression, which in turn controls overt biological processes, this work has the potential for developing interventions to diminish the serious effects of disruption of the clock on human disease, such as metabolic syndrome associated with circadian misalignment during shift work. Lastly, she is investigating a universal property of the circadian clock called temperature compensation. Using whole genome ribosome profiling
coupled with transcriptome analyses, she is testing the hypothesis that a physiological temperature increase specifically affects translation efficiency of the clock components.

**PUBLICATIONS**


SUPPORT

NIH/NIGMS
Molecular Genetics of Fungal Circadian Rhythms
1 August 2014 – 31 July 2018
$1,339,608

NIH/NIGMS
Systems Biology of the Circadian Clock Output Network
15 January 2015 – 31 December 2018

NIH-NIGMS R01
Determining the Mechanism of Temperature Compensation of the Circadian Clock
1 July 2013 – 30 April 2017
$1,094,166

NSF/UBM
UBM Integrated Undergraduate Research Experiences in Biological and Mathematical Sciences
1 September 2010 – 31 August 2015
$1,667,506

JGI/EMSL Collaborative Science Initiative
Specialized Ribosomes: A New Frontier in Gene Regulation
1 October 2015 – 31 September 2017
Value $250,000
Programs in Biology
Michael J. Benedik
Vice Provost and Regents Professor of Biology

BIOGRAPHY

Dr. Mike Benedik joined the Department of Biology at Texas A&M University in 2004 as a tenured professor. He had previously served as an Assistant Professor of Biology at Texas A&M University from 1985 to 1989, before he accepted a position at the University of Houston in the Department of Biology and Biochemistry. He obtained his Ph.D. in Molecular Genetics from Stanford University in 1982, under the guidance of Dr. Allan M. Campbell. Dr. Benedik was appointed Vice-Provost on July 1, 2015 after having served as the Dean of Faculties and Associate Provost since 2013. He served on the TAMU Faculty Senate from 2005-2012 and was the speaker-elect from 2011-2012. He was appointed as the first-ever faculty ombuds officer for TAMU in 2010.

RESEARCH

My laboratory studies basic biological problems using molecular genetic methods with simple microbial systems. Additionally we are developing novel microbial approaches for biotechnological applications.

**Biotechnology/Bioremediation - Cyanide**

The aim of this project is better enzymes for degrading cyanide in waste streams and contaminated sites. The industrial uses of cyanide have resulted in contamination at many sites, especially the water and soil of metal plating plants and as the result of ore extraction in mining operations. Especially in light of recent highly-publicized incidents of cyanide contamination (e.g., in Houston-area plating facilities as well as the recent cyanide release in Eastern Europe) there is a need to develop lower-cost, efficient methods to detoxify these sites. Cyanide is a common constituent of biological systems and is actually produced by a variety of organisms, especially plants. Due to the toxicity of cyanide, nature has evolved numerous biochemical pathways for its conversion to innocuous byproducts. There is previous work on biodegradation of cyanide, either by enzymes or metabolically-active whole cells, using a variety of different pathways. The most interesting for our project are those cyanide-degrading enzymes which can function without the need for active cellular metabolism, and can be used under conditions which would kill microorganisms.

We hope to apply modern molecular biology to improve the cost, stability, and metal-tolerance of cyanidases, enzymes which convert cyanide directly to formate and ammonia. These end products are vastly less toxic than cyanide, and they can also be directly metabolized by indigenous microorganisms to cell mass, CO2, and water. Like other enzymes, cyanidases are capable of scavenging and destroying their substrate (i.e., cyanide) down to extremely low levels (< 0.01 ppm). Cyanidases have already been applied to cyanide removal, but the commercial technology is relatively old, and has not taken advantage of: (1) the ability to overexpress enzyme activities in alternative hosts, (2) opportunities for functional
improvement by protein engineering, and (3) the discovery and cloning (by others in the literature) of new forms of this enzyme with potentially superior properties.

Our work is leading to further insights on the structural biology of this important branch of nitrilase enzymes as well as in the development of novel enzymes for industrial applications in bioremedation.

**Bacterial Persistence and Antibiotic Tolerance**

Antibiotics are effective at killing most bacteria, however for any large population there are always a small number of survivors no matter how long the treatment is administered. These bacterial cells that survive antibiotic treatment are called persisters and the phenomenon of bacterial persistence is long-standing. The project aims to elucidate the molecular mechanisms of dormancy in bacteria where bacteria are not killed by antibiotics but rather persist throughout treatment and awaken after the antibiotic therapy ceases. This leads to disease recurrence as well as increased antimicrobial resistance. The project aims to understand the signals that lead to the dormant state and eventually to develop therapeutic interventions that can “wake” these bacteria before antibiotic therapy ceases.

**PUBLICATIONS**


**SUPPORT**

Cyanide Remediation: Enzyme Modification and Immobilization. 
Texas Hazardous Waste Research Center. $27,000 (9/2008-8/2009)

Cyanide Remediation: Enzyme Modification and Immobilization. 
Texas Hazardous Waste Research Center. $28,000, (9/2010-8/2011)

Engineering Improved Microbial Nitrilases 
Robert A. Welch Foundation. $150,000 (2008-11)

Cyanide Remediation: Evolving Improved Enzymes. 
Texas Hazardous Waste Research Center. $25,000 (9/2012-8/2013)

Cyanide Remediation: Evolving Improved Enzymes. 
Texas Hazardous Waste Research Center. $40,000 (9/2013-8/2015)
Ginger E. Carney
Associate Professor and Associate Dean for Undergraduate Research and College Climate

BIOGRAPHY
Dr. Ginger Carney joined the Department of Biology at Texas A&M University in 2004 and was tenured and promoted to Associate Professor in 2009. She obtained her Ph.D. in Genetics at the University of Georgia in 1998, under the guidance of Dr. Michael Bender. Her postdoctoral work in the laboratory of Dr. Barbara J. Taylor at Oregon State University focused on molecular genetic studies of neural factors controlling reproductive behaviors in Drosophila melanogaster. Dr. Carney teaches Critical Writing in Biology at the undergraduate level and Behavior, Genes, and Evolution at the graduate level. She was appointed Associate Dean for Undergraduate Research and College Climate in 2013 and 2014, respectively, and is a member of the Faculty of Neuroscience and Faculty of Ecology and Evolutionary Biology. Dr. Carney has won several awards, including the Women’s Faculty Network Outstanding Service and Leadership Award, the College of Science and Association of Former Students Distinguished Teaching Award, and the Center for Teaching Excellence 25th Anniversary W Course Teaching Award. Most recently, she was named an SEC Academic Leadership Development Program Fellow (2015-2016). Dr. Carney serves on grant review panels for the NSF and NIH and also serves as an ad hoc reviewer for NSF and numerous journals, including Proc. Nat. Acad. Sci. USA, PLoS Biology, J. Insect Physiol., and Proc. R. Soc.

RESEARCH
Sensing and responding appropriately to changing environments is of utmost importance for animal survival and reproductive success. In multi-cellular organisms, environmental information is ultimately processed by the nervous system, which then signals an appropriate behavioral response. Our laboratory uses a tractable genetic and developmental model, the fruit fly Drosophila melanogaster, to identify and characterize genes that regulate sex-specific reproductive behaviors. We use cutting-edge molecular and genetic techniques to study the effects of mutations on fly reproductive behaviors. There are currently 3 main projects underway in our laboratory:

- Identifying and characterizing genes that are important for reproductive behaviors
- Understanding how signals from adipose tissue modulate neural signaling and behavior
- Determining how diet affects gene expression and behavior

PUBLICATIONS


**SUPPORT**

**NSF**

*His fat made him do it: modulation of Drosophila courtship behavior by an adipose-expressed gene product*

15 August 2011 – 31 July 2016

$540,250
Charles D. **Criscione**  
Associate Professor

**BIOGRAPHY**  
Dr. Criscione joined the Department of Biology at Texas A&M University in 2008 and was tenured and promoted to Associate Professor in 2014.

**RESEARCH**  
I examine fundamental ecological and evolutionary questions in parasite systems and consider my research to be at the interface of ecology, evolution, and genetics. Parasitology provides a rich subject area for studies of ecology and evolutionary biology. Numerous topics such as ecosystem dynamics, mating systems, or coevolution can be addressed because parasites are extremely diverse. By diversity, I include not only the myriad of taxa that have independently evolved a parasitic lifestyle, but also the diversity in life cycles, modes of reproduction, host species, and ecosystems utilized by parasites. This diversity also allows for comparative studies to address theories or unifying principles that span ecosystems or taxonomic groups. Furthermore, there are many practical applications such as studying the evolution of drug resistance, or using parasite community structure to assess “ecosystem health”. My research interests address both basic and applied questions, and span three overlapping subject areas: 1) Evolution: Population Genetics, Mating Systems, and Molecular Epidemiology, 2) Ecology: Biodiversity, Conservation, and Natural History, and 3) Genetics and Ecological Genomics.

**PUBLICATIONS**  


SUPPORT

NSF
Biodiversity in the parasitic fluke genus Alloglossidium: Evolutionary origins of changes in life cycle complexity
1 August 2012 – 31 July 2016
$716,455

Texas Parks and Wildlife
Post de-listing demographic and genetic monitoring of the Concho water snake (Nerodia paucimaculata).
2012 – 2015
$149,513
James W. Erickson
Associate Professor

BIOGRAPHY  Dr. Erickson joined the Department of Biology at Texas A&M University in 2003 as an Associate Professor. He obtained his Ph.D. in bacteriology at the University of Wisconsin, under the guidance of Dr. Carol Gross. His postdoctoral work in the laboratory of Dr. Thomas Cline at the University of California – Berkeley focused on molecular characterization of *Drosophila* primary sex determination.

RESEARCH  Alternative developmental fates are often determined by small differences in the concentrations of signaling molecules. In many cases, cells respond to these signals within narrowly defined temporal windows and are unresponsive to the same signal molecules at other times in development. A number of aspects of *Drosophila* sex determination make it an ideal experimental system to study how strict temporal controls and small quantitative differences in protein concentration can elicit different developmental fates.

Sex is determined in *Drosophila* by the number of X chromosomes, with one X specifying male development and two specifying female. The dose of X chromosomes controls sex determination through its effects on the establishment promoter, SxlPe, of the regulatory gene *Sex-lethal*. Female development occurs as a consequence of Sxl being turned on in diplo-X animals while male development occurs in haplo-X animals because Sxl is left inactive. Although Sxl protein is required at all times to direct female differentiation, X chromosome dose affects Sxl expression only during a 30-40 min period in the pre-cellular embryo. After this time, Pe shuts off and Sxl is transcribed from a maintenance promoter, Pm, that operates in both sexes.

Genetic experiments have identified five elements on the X chromosome whose relative dose (one vs. two) is used to determine sex. These include the genes sisterlessA and -B, -C, runt, as well as Sxl itself. The sisA sisB and runt genes encode transcriptional activators of the bZIP, bHLH, and runt/AML class. The dose of these "counted" elements is measured with respect to a number of maternal and zygotically expressed proteins, some of which function as activators and some as inhibitors. We are studying the molecular interactions between the positively acting and inhibitory protein factors and their SxlPe promoter target. Our approach combines biochemistry with classical and molecular genetic analyses to identify novel molecules, and to characterize the protein/protein and protein/DNA interactions that regulate SxlPe. Given the ability to identify the key regulatory molecules, to study their expression, and to manipulate their levels and activity, in vitro, and in vivo; studies on *Drosophila* sex determination should prove ideal for understanding how transcriptional regulators of different classes can cooperate to generate sharp threshold responses.
**PUBLICATIONS**


**Erickson JW** & Cline TW (1998) Key aspects of the primary sex determination mechanism are conserved across the genus Drosophila. *Development* 125:3259-68


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**SUPPORT**

**National Science Foundation**

*Chromosome Counting Mechanisms in Primary Sex Determination*

01 March 2011 – 01 March 2015

$550,000
L. Rene Garcia

**Professor**

**BIOGRAPHY**

L. Rene Garcia was hired into the Department of Biology at Texas A&M University in 2002, and promoted to Professor in 2014. He earned his Ph.D. in Microbiology at the University of Texas at Austin under the supervision of Dr. Ian Molineux. His dissertation thesis concerned how the biophysical mechanisms of bacterial virus nucleic acid translocation through the host's lipid bilayers are coupled to the regulation of gene expression. For his postdoctoral work, he changed fields and studied neuro-genetics, post-embryonic development and the regulation of motivated behaviors in the nematode *C. elegans* with Dr. Paul Sternberg at Caltech. At Texas A&M he is a joint member of the Health Science Center Department of Molecular Medicine, a member of the Genetics Faculty and a member of the Neuroscience Faculty. He has taught Introductory Biology, Molecular Signal Transduction, Molecular Tools and the Undergraduate Seminar Colloquium. He was also a Searle Scholar, a recipient of the Presidential Early Career Award for Scientists and Engineers and a Howard Hughes Medical Institute Investigator.

**RESEARCH**

I am interested in understanding how behavioral states are regulated at the molecular and genetic level. My lab addresses this complex question in the well-studied nematode Caenorhabditis elegans. Several physical aspects of this worm make it convenient for integrating whole organism system biology studies with genetic/molecular analysis of neurobiology and behavior. *C. elegans* is an anatomically simple organism; it is 1mm in size, and it contains ~ 1000 somatic cells, a third of which are neurons. The worm is also transparent, and thus every cell can be visualized by light microscopy. Behavioral mutants can be efficiently generated through standard chemical mutagenesis. In addition, gene functions involved in motivational and behavioral regulation can be determined by transgenic techniques.

My lab investigates the interplay between feeding and sex-specific mating behavior to understand how chemo/mechano-sensory and motor outputs are controlled under various physiological conditions. We study male mating by using genetics to de-construct this behavior into its fundamental sensory-motor components. We then use a combination of transgenics, pharmacology, classical genetics and laser microsurgery to understand how individual motor sub-behaviors are coordinated to produce gross behaviors during periods when the animal is food deprived, and when it is food satiated.

We focus on how food-related sensory signaling through sensory neurons and insulin growth factor-like receptor signaling regulates sensory-motor mating circuits. We have generated mutations in UNC-103/ERG K+ channels and UNC-43/CaMKII kinase that cause spontaneous firing of the mating circuitry in well-fed males. In normal males, these molecules act to attenuate neurons and muscles until proper stimulation by a mate. When ERG K+ channels
and CaMKII kinase are mutated, males constitutively display mating-like behaviors that superficially resemble seizures. Depriving ERG K+ channel mutants of food can attenuate spontaneous firing of the mating circuit. This suggests that signaling pathways involved in nutritional physiology can regulate excitability of behavioral circuits.

Through multiple approaches, we determined that the chemosensory neuron AWC senses the absence of food. Under food deprivation conditions, the neuron acts with mating circuitry-expressed insulin growth factor-like receptors to stimulate calcium-regulated CaMKII kinases and EGL-2/EAG K+ channel activity. These downstream molecules then reduce the excitability of neurons and muscles, so that in ERG K+ channel mutants, they do not spontaneously display seizure behaviors; and in wild-type animals, males do not efficiently respond to mating cues. We are currently trying to understand other physiological changes that occur in the mating circuit under food deprivation conditions, and how those changes are molecularly reversed when the animal becomes food satiated.

My lab is also investigating how in food-satiated males, molecular mechanisms involved in executing motor programs are modulated, during prolonged mating attempts, to maintain behavioral persistence. Prior to ejaculation, the male must first breach his mate’s vulva with his copulatory spicules. During mating, young adult hermaphrodites are not behaviorally receptive to mating. To achieve mating success, the male uses a network of cloacal cholinergic sensory/motor neurons to maintain his position over the vulva, as he repetitively attempts to penetrate the tightly closed vulval slit. He maintains this behavior until ejaculation is accomplished. The efficacy of these sensory motor neurons to stain their output is facilitated by the GAR-3/G-protein-coupled M1/M3/M5-like muscarinic ACh receptor (mAChR). The GAR-3 receptor promotes persistence in executing behavioral programs, since males mutant in the gar-3 gene frequently cease spicule insertion attempts and move off the vulval area, if they do not immediately penetrate their mates. We are currently trying to understand how downstream effectors of GAR-3 receptor signaling integrate with nicotinic acetylcholine receptor signaling in various muscle and neuronal components of the mating circuit.

PUBLICATIONS


Guo, X and García, LR. 2014. SIR-2.1 integrates metabolic homeostasis with the reproductive neuromuscular excitability in aging male C. elegans. eLife:3:e01730


SUPPORT

Howard Hughes Medical Institute (2008-2016). Role PI
Environmental and Genetic Regulation of Motivated Behavior
FY2008-FY2016 ($570,000 per year)

Purpose of the study is to identify how changes in metabolic status of young and aging animals affects the excitable properties of the neural muscular circuitry that regulates motivated behavior.
Richard H. **Gomer**

**Professor**

**BIOGRAPHY**
Dr. Richard Gomer joined the Department of Biology at Texas A&M University as a Professor in 2010 and is a member of the Genetics Faculty and Center for Research on Biological Clocks. He obtained his Ph.D. at Caltech in 1983 under the guidance of Dr. Elias Lazarides. His postdoctoral work in the laboratory of Dr. Rick Firtel at UC San Diego focused on understanding how a population of *Dictyostelium* cells breaks symmetry to differentiate into stalk or spore cells. In 1988 he joined the Biochemistry and Cell Biology department at Rice University as an Assistant Professor, rising to Associate Professor and then Professor in 2000. He was a HHMI assistant, then associate, then full Investigator from 1990 to 2005 and was also an Adjunct Assistant Professor of Cell Biology at Baylor College of Medicine. Dr. Gomer co-teaches Molecular Cell Biology at the undergraduate level and Ethics and Responsible Conduct of Research at the graduate level. He serves on the editorial board of four journals, is the co-founder of two biotechnology companies, is a Member of the Global Fibrosis Foundation Medical Advisory Council, and was named an Inventor of the Year by the State Bar of Texas in 2011.

**RESEARCH**
Our laboratory is working on two areas of biomedicine. First, we are studying how the sizes of tissues and tumors are regulated, and how this can be manipulated for therapeutic purposes. As a model system, we are using the simple eukaryote *Dictyostelium discoideum*, which allows us to combine techniques such as biochemistry, genetics, computer modeling, and cell biology to study tissue size regulation. We have found that a secreted protein and an unknown small molecule are signals in negative feedback loops that inhibit *Dictyostelium* cell proliferation, and we are studying the signal transduction pathways to understand similar mechanisms in humans.

Second, we found that a human blood protein called Serum Amyloid P (SAP) regulates a key step in the formation of scar tissue as well as the formation of the scar-like lesions in fibrosing diseases such as end-stage kidney disease and pulmonary fibrosis. We are studying this mechanism, and a biotechnology company that we co-founded (Promedior) has shown that SAP improves patient symptoms in a Phase 1b trial for pulmonary fibrosis as well as a Phase 2 trial for myelofibrosis, a bone marrow fibrosis. We have also found a potential therapeutic for neutrophil-driven diseases such as acute respiratory distress syndrome, and two second-generation potential anti-fibrotics based on our elucidation of the SAP signal transduction pathway.

**PUBLICATIONS**


Pilling D, Crawford JR, Verbeek JS & Gomer RH (2014) Inhibition of murine fibrocyte differentiation by cross-linked IgG is dependent on FcγRI. J Leukoc Biol 96:275-282


**SUPPORT**

R01 GM102280  Gomer (PI)  09/01/2012 - 08/31/2016
NIH/ NIGMS
Elucidation of a *Dictyostelium* chalone
The major goals of this project are to determine the nature of, and the signal transduction pathway used by, an unknown small molecule factor secreted by *Dictyostelium* cells that stops mitosis and cell division (but not the accumulation of mass and protein by cells) when the cells reach a high cell density and are about to starve. Aim 1 is a collaboration with Ted Molinski, a chemist at UC San Diego, to purify the factor and determine its chemical structure. Aim 2 is to elucidate the signal transduction used by the factor. Aim 3 is to elucidate the effect of the factor on the cell cycle machinery, focusing on the regulation of Cdc2/ Cyclin B.

R01 HL118507  Gomer (PI)  04/01/2014 - 03/31/2018
NIH/NHLBI
Pentraxin regulation of macrophage differentiation
The major goals of this project are to elucidate how human pentraxin proteins such as Serum Amyloid P and C-reactive protein (CRP) affect monocyte and macrophage differentiation, elucidate which receptors on mouse and human monocytes and macrophages mediate the effects of the pentraxins, and then determine if small molecule drugs can block the effect of the pentraxins on macrophage phenotypes, thus providing a novel way to alter macrophage phenotype.
Ira F. Greenbaum
Professor and Director of Lower Division Instruction

**BIOGRAPHY**

**ADMINISTRATION**
The primary goal of the Biology Lower Division is to provide a high quality educational experience to our students. To this end my role as Director is to facilitate and optimize the effectiveness and efficiency of all aspects of the Biology Lower Division. This requires the wisdom and experience to make decisions and implement policies that facilitate the effectiveness and efficiency of the Lower Division and to recognize and act appropriately when decisions or policies are not optimal. As Director I actively seek and consider the council of individuals representing all levels of the program.
Lawrence R. Griffing
Associate Professor

**BIOGRAPHY**

Dr. Lawrence Griffing joined the Department of Biology at Texas A&M University in 1986. He was tenured and promoted to Associate Professor in 1991. He obtained his Ph.D. in Biology at Stanford University, and he did his postdoctoral work at Oregon State University, University of Saskatchewan, and at the Plant Biotechnology Institute in Canada.

**RESEARCH**

I am testing the theory that the endoplasmic reticulum, ER, is the circulatory network of the cell, connecting different organelles to each other, allowing them to share signals, lipids, and proteins.

I am particularly interested in how the cytoskeletal system of plants regulates the movement of the ER network. In interphase, the actinomyosin network drives movement of the ER, just as it drives the movement of organelles through the cytoplasm in a process called cytoplasmic streaming, a phenomenon in plants, but not animal cells. Of the seventeen different myosin forms in plants, only six are involved in active cytoplasmic streaming. We are sorting out which of those six guide the different movements of the endoplasmic reticulum.

I am also interested in the nature of the nexus between the ER and other organelles, including the chloroplast, plasma membrane, and Golgi. I have recently shown that by photo-stimulating the nexus between the chloroplast and the ER, the directional flow within the ER can be reversibly altered. This ability to generate very localized ER stress may have application in a wide variety of fields - from finding cures for neurodegenerative diseases such as Alzheimer's syndrome to developing crops that can better-tolerate physiological heat stress and drought.

Looking at flow in the ER is complicated because the organelle has a very complicated structure. I am collaborating with computational scientists in San Diego, California and Zurich, Switzerland to computationally model how flow can occur in a directional manner in such a complicated web of membrane tubules.

My research and teaching in a variety of imaging fields has motivated me to write a book, called Imaging Life, which will be published in 2012/2013 by Wiley. It is an undergraduate textbook in digital imaging of trans-dimensional events in biology - from photography of Grizzly bears to imaging single molecules with the light microscope.

My teaching is now completely directed to inquiry-based instruction. I have developed a module for PlantingScience.org on the genetics of Arabidopsis thaliana, the first plant to have
its genome completely sequenced. I also teach junior and senior-level undergraduate labs that allow students to do authentic science research.

**PUBLICATIONS**


**Griffing LR** (2011) Laser stimulation of the chloroplast/endoplasmic reticulum nexus in tobacco transiently produces protein aggregates (boluses) within the endoplasmic reticulum and stimulates local ER remodeling. *Mol Plant* 4:886-95


Dr. Paul Hardin joined the Department of Biology at Texas A&M University in 2005 as a tenured professor and the inaugural holder of the John W. Lyons Jr. ’59 Endowed Chair in Biology. He obtained his Ph.D. in Genetics from Indiana University in 1987. His postdoctoral work in the laboratory of Dr. Michael Rosbash at Brandeis University focused on the molecular basis of circadian clock function in Drosophila. He is currently the Director of the Center for Biological Clocks Research and a member of the Genetics and Neuroscience faculties at TAMU, as well as being the President of the Society for Research on Biological Rhythms, a 400-plus member international society that promotes basic and applied research on biological rhythms. Dr. Hardin teaches Introductory Biology and Molecular Cell Biology at the undergraduate level and Biological Clocks at the graduate level. Dr. Hardin is credited with being the first to define the feedback loop in gene expression that comprises the core "circadian," or 24-hour, timekeeping mechanism in fruit flies. His subsequent work identified the so-called "E-box" in the promotor region of the period gene that governs its rhythmic transcription and interlocked feedback loops that control rhythmic transcription in different phases of the daily cycle -- work that formed the basis for a large body of research into the molecular nature of circadian timekeeping in both Drosophila and mammals. He has authored many research journal articles and numerous conference presentations, earning the international Aschoff-Honma Prize in Chronobiology in 2003 and named Distinguished Professor in 2008.

The long-term objectives of his research program are to define, in molecular terms, the feedback loop in gene expression that comprises the core circadian timekeeping mechanism in Drosophila, to determine how environmental factors modulate the feedback loop, and to determine how this feedback loop activates rhythmic outputs. The circadian feedback loop was initially characterized in Drosophila, but the discovery of similar feedback loops in organisms ranging from microbes to mammals suggest that feedback loops in gene expression are a general mechanism for keeping circadian time. Identifying feedback loop components and defining their roles within the feedback loop mechanism has been a major focus of molecular clock research since 1990. Understanding how feedback loops accurately keep circadian time and activate outputs at specific times, represents significant challenges for future molecular clocks research.

In Drosophila, feedback loop oscillators operate autonomously in many different neuronal and non-neuronal tissues. The functions of these oscillators is, by in large, a mystery since few rhythmic phenomena have been measured in Drosophila. Another aspect of my research is to identify rhythmic physiological and behavioral phenomena emanating from the various oscillators. A comprehensive understanding of these rhythms will enable us to determine the
biological functions of the clock and to define the pathways through which the feedback loops activate these rhythms.

**PUBLICATIONS**


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**SUPPORT**

**National Institute of Neurological Disorders and Stroke R21 NS094807**  
*Circadian Clock Activation and Tissue Specificity in Drosophila*  
15 August 2015 – 31 July 2017  
$391,242

**National Institute of Neurological Disorders and Stroke R21 NS080638**  
*Developing Cell Lines from Clock Neurons in Drosophila*  
1 July 2012 – 31 May 2015  
$393,728

**National Institute of Neurological Disorders and Stroke R01 NS052854**  
*Regulation of Circadian Transcription*  
16 August 2010 – 31 July 2016  
$1,580,528

**National Institute of Neurological Disorders and Stroke R01 NS052854**  
*Regulation of Circadian Transcription*  
1 April 2006 – 15 August 2010  
$1,178,552

**National Institute of Neurological Disorders and Stroke R01 NS051280**  
*Circadian Regulatory Circuits in Drosophila*  
1 January 2005 – 31 December 2009  
$1,236,264
Mark L. Harlow
Assistant Professor

BIOGRAPHY Dr. Mark Harlow joined the Department of Biology at Texas A&M University in 2009 as an Assistant Professor. He obtained his Ph.D. in Neuroscience at Stanford University in 2001, under the guidance of Dr. U. Jack McMahan. His postdoctoral work in the Laboratory of U. Jack McMahan focused on the molecular structure of the neuronal synapse. He is a Member of the Texas A&M Institute for Neuroscience. Dr. Harlow teaches Neuroscience at the undergraduate level, and Structural Biology at the graduate level.

RESEARCH Dr. Harlow has a long-standing interest in understanding the molecular mechanisms that underlie neurotransmission at the synapse. Currently there are two main research topics in the laboratory.

The first area of research in the Harlow laboratory deals with how synapses regulate protein synthesis. The regulation of protein synthesis at the chemical synapse is critical for learning and memory in healthy individuals, and is disrupted in a number of diseases such as Alzheimer’s diseases, schizophrenia, and autism. It has long been appreciated that protein synthesis is necessary for both the consolidation of new memories and the reconsolidation of existent memories. In neurons, much of the protein synthesis occurs away from the cell body at specialized regions within the dendritic arbor and postsynaptic boutons, and is referred to as local protein synthesis. Local protein synthesis at the synapse is regulated by the presynaptic activity of synaptic vesicles (SVs), and requires a host of translation factors, ribosomes, mRNAs, and small non-coding RNAs (sRNAs; 20-50 nucleotides [nt] in length). The laboratory has recently discovered a novel class of sRNAs conserved across vertebrate synapses. Although these sRNAs have been implicated in different aspects of post-transcriptional control of protein translation in other tissues, their precise role at the neuronal synapse is still a mystery. In order to understand the normal regulation of local protein synthesis in the CNS, the Harlow lab is investigating the function of these sRNAs at the synapse. In the long-term, the laboratory believes these studies will contribute meaningfully to a framework whereby the detailed mechanisms of normal synaptic physiology can inform future investigation into the causes of numerous neurological disorders.

The second area of research in the Harlow laboratory deals with how energy is regulated at the synapse. The disruption of energy at the synapse, or more broadly any cell or organ, can lead to metabolic syndrome. Metabolic syndrome is a broad clinical term. It describes a cluster of risk factors that include diabetes and obesity, cardio-metabolic imbalance, and inflammation. Metabolic syndrome is linked to Alzheimer’s, Parkinson’s, and heart disease. At the cellular level, metabolism is controlled by the mitochondria, and each cell’s mitochondria are custom built to use a unique balance of energetic molecules that will ultimately be
coupled with oxygen to produce energy, metabolites, and carbon dioxide. Energetic cells, such as cardiac muscle cells, dopaminergic and cholinergic neurons, possess mitochondria that are designed to tightly couple oxygen with energetic molecules such as triglycerides in order to produce energy. Any disruption of this coupling can lead to the production of radical oxygen species that are damaging to the mitochondria, and can ultimately trigger premature cell death. The Harlow laboratory has recently discovered a novel pathway, conserved across species, in the nervous and heart cells most susceptible to metabolic syndrome disease, that offers new insight into the unique metabolic circuit of these cells. The laboratory is studying this unique metabolic circuit in order to understand how energy is regulated at the synapse. The long-term goal of the Harlow laboratory is to expand on these findings in order to provide potential preventive or therapeutic agents for the treatment of metabolic syndrome.

**PUBLICATIONS**


BIOGRAPHY
Dr. Andreas Holzenburg joined the Department of Biology at Texas A&M University as Professor in 2000 together with an appointment as the Director of the Microscopy and Imaging Center serving the entire campus as well as extramural clients and leveraging research funding in excess of $50Mio. annually. He obtained his Ph.D. in Microbiology, Botany and Organic Chemistry from the University of Goettingen (Germany) under the guidance of Dr. Frank Mayer working on the structure-function relationships of the key enzyme of the Calvin cycle Ribulose-1,5-Bisphosphate Carboxylase/Oxygenase from the chemolithoautotrophic soil bacterium *Ralstonia eutropha* (formerly known as *Alcaligenes eutrophus*). His postdoctoral work in the laboratory of Drs. Ueli Aebi and Andreas Engel at the Biocenter of the University of Basel (Switzerland) focused on structural studies of membrane proteins such as OmpF porin (*E. coli*), photosystem I (*Phormidium laminosum*) and the nuclear pore complex (*Xenopus laevis*) prior to receiving a Feodor Lynen-Fellowship by the Alexander von Humboldt Foundation to work with Dr. Lars Ljungdahl at the UGA (Athens, GA) on the conversion of waste paper into chemical feedstock. After that, he was appointed to his first faculty position at the University of Leeds rising through the ranks to Senior Lecturer with tenure (equivalent to Associate Professor in the USA) and working on transmembrane membrane and membrane-associated proteins such as photosystem II, ion channels and blood coagulation factors. During this time (1994) he was also awarded the Biology Prize of the German Academy of Sciences in Göttingen. Since his arrival at Texas A&M University, Dr. Holzenburg’s expertise has been called upon by several entities on campus. Since April 2001 he is a joint Professor of Biochemistry and Biophysics, since August 2002 a faculty member in Materials Sciences and Engineering, from 2005 to 2010 he directed the Materials Characterization Facility, since December 2005 he joined the faculty of the Health Science Center Graduate School and since February 2010 the Interdisciplinary Faculty of Toxicology. He has been a consultant for the design and academic integration of imaging and other core facilities on the national and international level and is a Fellow of the Royal Microscopical Society. He has been a member of several editorial boards and more recently co-founded a new journal aiming at interdisciplinary imaging efforts (Advanced Structural and Chemical Imaging (Springer)).

RESEARCH
The Holzenburg lab is interested in elucidating structure-function relationships of proteins and protein complexes. Focus points are the following projects:

1) Assembly and turnover dynamics of the cytoskeletal tubulin-like FtsZ protein in plant chloroplasts. FtsZ plays a pivotal role in the division of prokaryotic cells as well as chloroplasts. One of the functional characteristics of FtsZ is its auto-assembly into a ring-like macromolecular complex called the Z-ring. During cell division, the Z-ring undergoes continuous and rapid remodeling via subunit exchange and constricts at the leading edge of
the septum with the simultaneous loss of subunits. Consistent with the endosymbiotic origin of chloroplasts, plants possess nuclear-encoded, plastid-targeted homologues of bacterial FtsZ. However, whereas most prokaryotes, including the cyanobacterial relatives of chloroplasts, have a single form of FtsZ, two structurally distinct FtsZ protein families, FtsZ1 and FtsZ2. Experimental evidence suggests that FtsZ1 and FtsZ2 function in a complex and that their roles are functionally distinct. They are both localized in the stromal compartment of the chloroplast and are always tightly colocalized in immuno-fluorescence labeling experiments. In addition, FtsZ1 seems unable to form long polymers in planta without FtsZ2. Overall, the molecular mechanism of FtsZ filament assembly and its regulation, the structures of assembled protofilaments, and the structure of the in vivo FtsZ ring in chloroplasts remain poorly understood. Our overall goal is to expand the current model for FtsZ assembly and investigate and define the molecular structure and assembly dynamics of FtsZ rings in chloroplasts of Arabidopsis thaliana with the view to understand chloroplast size control. Modulation of the size of storage plastids (amyloplasts) and the starch granule size by changing the levels of FtsZ expression is of considerable interest to the starch and biofuel industry, since increased starch granule size improves the wet-milling efficiency and thus the starch yield in staple crops.

2) A second project is in the area of optimizing photovoltaics using a biomimetic approach. The most effective circumnavigation of the challenges arising from responding to the economics and politics of climate change is achieved by utilizing non-fossil sustained energy sources. Sunlight is a huge source of energy, amounting to 120,000 TW/year. Tapping into this energy resource means being able to effectively use it. Currently, the most advanced low-cost organic solar cells have a quantum efficiency of approximately 10%. This is in stark contrast to plant/bacterial light-harvesting systems which offer a quantum efficiency of approx. 95%. To this end, the biomimetic project is concerned with how one could make use of the underlying principal components of photosynthesis to develop highly efficient photovoltaic devices from man-made materials. Of particular interest in this regard is the highly effective quantum coherence-enabled energy transfer. Noting that quantum coherence is promoted by charged residues and local dielectrics, classical atomistic simulations and time-dependent density functional theory (DFT) are used to identify charge/dielectric patterns and electronic coupling at energy transfer interfaces. These interfaces have to be accurately defined both in terms of their chemistry and their locale. The latter is particularly critical as locations, distances, orientations matter across the scales and vary in response to the environment. The calculations make use of structural information obtained on photosynthetic protein-pigment complexes while still in the native membrane. This way it may be possible to establish a link between supramolecular organization and quantum coherence in terms of what length scales enable fast energy transport and prevent quenching. Calculating energy transfer efficiencies between components based on different proximities will permit the search for patterns that enable defining material properties suitable for advanced photovoltaics. This project is in collaboration with Dr. Lisa Perez (Laboratory for Molecular Simulation, Dept. Chemistry).

3) Paving the way for cold microwave technology (CMT)-enhanced diagnostics
Aim: To further optimize CMT-enhanced antibody-antigen recognition and binding. Commercial ELISAs are very time consuming; using CMT could revolutionize clinical routines in human and veterinary diagnostic laboratories. Recent CMTe ELISA test results suggest that this may become a high impact technology for more readily sustained screening.

4) Enabling phage-based therapies aims at developing a thorough understanding of phage-induced bacterial lysis. When bacteria are attacked by bacteriophages, the biggest challenge for the phage is about egress in order to set its progeny free. So far, using microscopy in conjunction with biochemical and molecular biology approaches, it became clear that the inner membrane is lysed by holins, the peptidoglycan by endolysins, and the outer membrane likely by spanins. The latter step still remains to be further elucidated. Understanding the entire process at the molecular level will aid the development of new antibiotics in the age of ever-increasing resistances. This project is a long-term collaboration with Dr. Ryland Young (Dept. Biochemistry and Biophysics).

**PUBLICATIONS**


SUPPORT

IUMRI, Texas A&M University
Center for Phage Technology
09/01/11 – 08/31/16
$3,160,000
PI: R. Young
Co-PIs: C. Gonzalez and A. Holzenburg
Applications Faculty: R. Alaniz, N. Cohen, A. Honeyman, R. Lane, and J. Sturino
Adam G. Jones

Professor

BIOGRAPHY
Dr. Adam Jones joined the Department of Biology in 2004. He was promoted to Associate Professor in 2009 and Full Professor in 2013. He received a B. A. in Environmental, Population and Organismic Biology from the University of Colorado in 1998. Dr. Jones earned a Ph. D. in Genetics at the University of Georgia, where he was mentored by Dr. John C. Avise. Dr. Jones worked as a postdoctoral fellow under the guidance of Dr. Stevan J. Arnold at Oregon State University from 1998-2002, after which he accepted a tenure-track appointment at Georgia Institute of Technology in Atlanta, Georgia. After two years at Georgia Tech, Dr. Jones moved to his current appointment at Texas A&M University. He serves on the executive committee and as the curriculum chair of the Ecology and Evolutionary Biology Interdepartmental Doctoral Program. In addition to reviewing for dozens of journals and numerous funding agencies, he is a contributing member of the Faculty of 1000 and was recently elected to the Council of the American Genetics Association.

RESEARCH
Molecular Ecology and Evolutionary Biology
Research in the Jones Lab is concerned with the mechanisms of phenotypic change in evolutionary lineages. Most of the research effort in the lab is directed at (1) the use of molecular techniques to resolve unanswered questions in sexual selection, (2) theoretical studies of quantitative genetics and behavior, (3) the evolution of major morphological innovations, and (4) evolutionary genomics. Other research projects in the lab involve population genetics, conservation genetics, speciation and molecular evolution.

PUBLICATIONS [2009 to Present]


SUPPORT NSF Grant (DEB-1119261; $620,000; 9/1/2011-8/31/2016):
The molecular evolution of reproductive genes in seahorses and pipefishes
NSF Grant (with Sarah Flanagan; DEB-1401688; $18,915; 6/1/2014-5/31/2016):
DISSERTATION RESEARCH: Elucidating the genomic signature of mate competition in a pipefish using a population genomics approach
W. Michael Kemp

Professor

BIOGRAPHY  Dr. W. Michael Kemp joined the Department of Biology at Texas A&M University in 1975. He obtained his Ph.D. in Biology from Tulane University, specializing in field of parasite immunology. His postdoctoral experience was in the laboratory of Dr. Raymond T. Damian at the Southwest Foundation for Research and Education in San Antonio, Texas. His research focused on elucidating the biological mechanisms by which parasites avoid the host’s immune response, using the African trypanosomes (African Sleeping Sickness) and schistosomes (bilharzia or Snail Fever) as model systems. Dr. Kemp has taught courses in introductory biology, histology, parasitology and immunology both at the undergraduate and graduate levels. He has received teaching awards from Abilene Christian University and Texas A&M University. His research has been acknowledged by the receipt of the Henry Baldwin Ward Medal from the American Society of Parasitologists and the Faculty Distinguished Achievement Award in Research from the Association of Former Students of Texas A&M University. He served as a member of the Tropical Medicine and Parasitology Study Section of the National Institutes from 1981 – 1985 and chaired that Study Section from 1983 – 1985. He chaired an average of four ad hoc study sections per year in the NIH SBIR program until 1997. Dr. Kemp has served as the acting head of the Department of Biology, interim dean of the College of Science and executive director for research at Texas A&M University main campus in College Station and vice president and CEO of Texas A&M University at Galveston and dean and CEO of Texas A&M University at Qatar.

TEACHING  Dr. Kemp has dedicated his teaching activities to meeting students where they are in their knowledge of biology and taking them where they need to be to establish and maintain successful careers in the life sciences. He subscribes to the philosophy that the classroom teacher cannot force students to learn but must create a context in which the students choose to learn. The assimilation of biological knowledge should be as painless and inspiring as possible, drawing on the innate interest students have in the processes that support and characterize the phenomenon we call life.
Arne C. Lekven
Associate Professor and Graduate Advisor

BIOGRAPHY
Dr. Arne Lekven joined the Department of Biology at Texas A&M University in 2001 and was tenured and promoted to Associate Professor in 2007. He obtained his Ph.D. in Molecular, Cell, and Developmental Biology at the University of California – Los Angeles in 1996. His postdoctoral work in the laboratory of Dr. Randall Moon at the University of Washington – School of Medicine focused on Wnt regulation of vertebrate development. He was appointed Graduate Advisor for the Department of Biology in 2012. Dr. Lekven teaches Developmental Biology at the undergraduate level and Signaling in Behavior and Development at the graduate level.

RESEARCH
The Lekven Lab uses the zebrafish as a model organism to understand the link between cell signaling and vertebrate embryonic axis patterning. More specifically, lab projects dissect how the Wnt signal transduction pathway, a conserved cell signaling pathway implicated in many human diseases, regulates neural plate patterning, mesodermal patterning and tissue growth. Projects in the lab use an array of molecular genetic methods to study the regulation and output of Wnt ligands involved in early steps of axis patterning, with a particular emphasis on understanding how Wnt signaling in the early gastrula controls the allocation of progenitor cells to brain divisions in the anteroposterior axis.

PUBLICATIONS


**SUPPORT**

**National Institutes of Health**

*Imaging Dynamics and Interactions of Developmental Lineages in the Early Embryo*

1 April 2015-31 March 2019

$1,242,141

**American Heart Association**

*Regulation of Wnt Signaling and Mesoderm Development by MicroRNAs*

1 July 2012 – 30 June 2015

$140,000

**Texas A&M Genomics and Bioinformatics Service**

*NGS Approach to Identify Genes Involved in Early Vertebrate Nervous System Development*

May 2014 – September 2015

$16,933

**American Heart Association**

*Wnt8 Cis-Regulatory Analysis to Study Vertebrate Mesoderm Progenitor Specification*

01 July 2010 – 30 June 2012

$140,000

**American Cancer Society**

*Wnt Regulation of Vertebrate Mesoderm Differentiation*

01 July 2006 – 30 June 2011

$736,000
BIOGRAPHY

Dr. Xiaorong Lin joined the Department of Biology at Texas A&M University in 2008 and was tenured and promoted to Associate Professor in 2013. She obtained her Ph.D. in fungal biology at the University of Georgia in 2003, under the guidance of Dr. Michelle Momany. Her postdoctoral work in the laboratory of Dr. Joseph Heitman at Duke University Medical Center focused on the novel life cycle of the human fungal pathogen Cryptococcus neoformans. Dr. Lin teaches Fundamentals of Microbiology and Molecular Medical Mycology at the undergraduate level and Eukaryotic Microbiology journal club (with Dr. Matt Sachs) at the graduate level. She is a member of Program for the Biology of Filamentous Fungi and also a faculty member of F1000. She currently serves as an Associate Editor for Fungal Genetics and Biology, Eukaryotic Cell, and PLoS Pathogens. She has won several awards, including two teaching awards from TAMU, a Young Investigator Award from Eukaryotic Cell, an ICAAC Young Investigator Award from American Society for Microbiology (ASM), and an Investigator Award in the Pathogenesis of Infectious Disease from the Burroughs Wellcome Fund (BWF). She currently serves as a course director for the Molecular Mycology Summer Course at Marine Biological Labs (MBL).

RESEARCH

About 100,000 fungal species have been identified so far and 1.5 million are estimated to exist. Yet only few fungi are known to cause severe systemic infection in humans and most of them are environmental pathogens that do not require animal hosts to complete their life cycle. Dr. Lin’s research interests concern: (1) how do these few fungi evolve to be pathogenic, (2) what are the molecular mechanisms governing their virulence, and (3) how morphological differentiation impacts on fungal virulence.

Dr. Lin’s laboratory studies two environmental pathogens that represent the two major phyla in the fungal kingdom: Aspergillus fumigatus, an ascomycetous filamentous fungus causing allergies and invasive aspergillosis, and Cryptococcus neoformans, a basidiomycetous dimorphic yeast causing pneumonia and cryptococcal meningitis. Both pathogens infect mostly immunocomprised individuals and cause diseases with high mortality rates even with aggressive current antifungal treatment. For instance, Cryptococcus neoformans alone claims ~600,000 people’s lives each year. Late diagnosis, limited options of antifungals, and the lack of vaccines to prevent any systemic human infections underscore our woefully inadequate knowledge about these eukaryotic pathogens. Her group uses a combination of microscopic, genetic, biochemical, and molecular biology approaches to gain insights into the molecular bases of fungal virulence and differentiation, with the goals of seeking better approach for the management of fungal diseases and of advancing eukaryotic biology.
PUBLICATIONS


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**SUPPORT**

1012445 BWF Investigators in Pathogenesis of Infectious Disease Award (Lin: PI)
The Burroughs Wellcome Fund
Total direct cost: $500,000
Title: Fungal communication and pathogenicity

1R01AI097599 (Lin: PI) NIH/NIAID
Total direct cost: $1,200,000
The link between dimorphism and virulence in Cryptococcus

1R21AI107138 (Lin: PI) NIH/NIAID
Total direct cost: $266,000
Investigate the multifunctional adhesins in Cryptococcus
Steve W. Lockless
Assistant Professor

BIOGRAPHY
Dr. Steve Lockless joined the Department of Biology at Texas A&M University in 2009. He obtained his Ph.D. in Molecular Biophysics from The University of Texas Southwestern Medical Center at Dallas, under the guidance of Dr. Rama Ranganathan. His graduate work focused on identifying and validating novel, functionally important interactions between residues in signaling and metabolic proteins. His postdoctoral work in the laboratory of Drs. Roderick MacKinnon and Tom Muir at The Rockefeller University focused on ion channel selectivity and the use of chemical biology to interrogate protein function. He is a member of the Texas A&M Institute for Neuroscience and a member of the Ecology & Evolutionary Biology Faculty. Dr. Lockless teaches Molecular & Cellular Biology at the undergraduate level and Structure & Molecular Biology at the graduate level. He is currently the Chair for the 2016 Texas Protein Folders and Function Meeting, the local American Chemical Society Treasurer and serves as an ad hoc reviewer for various journals, including Analytical Biochemistry, Biochemistry, Biophysical Journal, Biotechnology and Bioengineering, Cell, Chemical Science, Journal of Bacteriology, Journal of General Physiology, Molecular Biology & Evolution, Nature, Nature Communications, PLoS Computational Biology, PLoS One, and Protein Science.

RESEARCH

Ion channel gating and selectivity
All cells use selective transport of molecules across their membranes to maintain nutrient homeostasis and to support cellular signaling. Ion channels are found in all three domains of life and are used to modulate the cellular membrane potential and the proton-motive force. The largest family of channels is the tetrameric cation channels, including those for Na⁺, K⁺ and Ca²⁺ ions, which have two basic functional properties. They selectively conduct particular ions and they gate open or closed in response to stimuli. Together, these two processes control how rapidly the membrane potential changes, driving a wide-range of physiological processes. The overarching goal of this research project is to determine molecular mechanisms by which ion selectivity and gating are integrated into a concerted output, representing the sum total ion conduction across the membrane.

Mapping regulatory sites in networks of signaling and metabolic proteins
Genetics, site-directed mutagenesis and/or structure determination has been the primary means to identify regulatory molecules and their targets, but these approaches are each severely limited by practical considerations, e.g., observable phenotypes, functional assays, and protein expression. We overcame many of these problems by developing an approach to use compensatory mutations discovered within and between proteins in the exploding genome databases. The basic principle is that sites that influence each other are co-constrained throughout the evolution of the protein family. This approach not only identifies known allosteric sites in proteins, but also was used previously to predict novel regulatory
sites that we validated as important for the protein’s function. When the same approach was employed to examine co-evolution between proteins, we identified proteins known to interact with one another in both stable and transient complexes. The overarching goal of this research project is to learn the rules that underlie the complex network of functional connections between signaling and metabolic proteins in cells, with one goal being to identify novel connections between cellular components.

**PUBLICATIONS**


**SUPPORT**

**CURRENT GRANTS HERE**

*The structural basis for lipid regulation of membrane protein function*

The Welch Foundation (Lockless, PI) 6/1/13 – 5/31/16

*Mechanisms of C. difficile spore germination*

NIH R01 (Sorg, PI; Lockless, collaborator) 8/1/15 – 3/31/20

*Mechanisms of Gating and Permeation in the TrkH K+ Channels*

NIH R01 (Ming Zhou, PI; Lockless, collaborator) 1/1/15 – 11/30/18
BIOGRAPHY

Duncan MacKenzie received a B.S. in Zoology from the University of California at Davis in 1975 and a Ph.D. in Zoology from the University of California at Berkeley in 1980 working on comparative pituitary physiology with Paul Licht. Following a three year postdoctoral fellowship in the laboratory of Richard Peter at the University of Alberta he joined the Texas A&M faculty in 1983. He is currently an Associate Professor of Biology and serves a two thirds time appointment as Associate Director for Undergraduate Research in Honors and Undergraduate Research, where he oversees initiatives to promote and support undergraduate research across campus. He is also Co-Chair of the graduate Interdisciplinary Degree Program in Marine Biology and a member of the Interdisciplinary Faculty of Reproductive Biology. He has previously served as Graduate Advisor in Biology, Chair of the University Laboratory Animal Care Committee and Director of the Biology Department’s BioAquatics Facility. He has taught introductory biology, human anatomy and physiology, animal physiology, and endocrinology at the undergraduate level, and comparative physiology and endocrinology at the graduate level. His research interests are in the evolution of endocrine systems, particularly related to regulation of growth, reproduction, and metabolism in reptiles, amphibians, and fish.

RESEARCH

Hormones secreted by the thyroid gland are of primary importance in the regulation of such fundamental physiological processes as growth, nutrient utilization, and reproduction. In my laboratory we examine the regulation of the secretion of thyroid hormones and their actions in poikilothermic vertebrates in order to understand the evolution of thyroid function. We are presently focusing on the regulation on thyroid hormone secretion and the mechanisms of iodine transport in commercially-important fish species such as the red drum (Sciaenops ocellatus), the channel catfish (Ictalurus punctatus), and even the zebrafish (Danio rerio).

We have discovered that blood thyroxine levels undergo robust daily cycles in the red drum, supporting a role for an endogenous clock in the central control of thyroid hormone production. Current studies are directed towards examining the regulation of thyroid hormone cycles and determining their physiological significance. I am also interested in the specific mechanisms through which nutrient intake influences thyroid hormone secretion and the manner in which thyroid hormone delivery to target tissues is influenced by circulatory factors unique to poikilotherms. Thyroid hormone studies have led us to an examination of the mechanisms through which euryhaline fish obtain iodine from their environment. We are currently examining the physiology of iodide transport in fish and hope to integrate it into a...
better understanding of the maintenance of thyroid homeostasis in variable marine environments.

A comparative perspective is always maintained in my research. Because of their position at the transition to endothermy, reptiles remain an interesting model for the examination of thyroid hormone action. For this reason, I also direct research on endocrine function in reptiles, such as sea turtles, desert tortoises, and alligators. From these animals we gain a broader perspective of the relationship between nutrient intake, temperature, and thyroid hormone production.

This research is aimed at providing new insights into the potentially ancient role of thyroid hormones in nutrient assimilation, as well as elucidating evolutionary trends in the regulation of thyroid function. These studies may serve identify ways in which the pituitary-thyroid axis may be manipulated to enhance aquaculture production or endangered species conservation.

**PUBLICATIONS**

Pasupuleti S, Sule N, Cohn WB, **MacKenzie DS**, Jayaraman A & Manson MD (2014) Chemotaxis of *Escherichia coli* to norepinephrine (NE) requires conversion of NE to 3,4-dihydroxymandelic acid. *J Bacteriol* 196:3992-4000


Michael D. Manson
Professor

BIOGRAPHY
Dr. Michael Manson joined the Department of Biology at Texas A&M University in 1987 as an Associate Professor, rising to full Professor in 1996. He obtained his Ph.D. in Biology at Stanford University. He did his postdoctoral work at the University of Colorado and the California Institute of Technology.

RESEARCH
Bacteria have a limited behavioral repertoire. The well-known Gram-negative enteric species Escherichia coli swims after nutrients that the cells smell. The simplicity of bacterial motility and chemotaxis, and the amenability of E. coli to genetic, biochemical and physiological manipulation, has facilitated rapid advances in understanding the molecular mechanisms of biological energy conversion and signal transduction.

Our laboratory studies the inputs and outputs of chemotaxis. Ligands interact with the periplasmic receptor domain of a chemotactic signal transducer that spans the cytoplasmic membrane. This interaction is converted into an intracellular signal that is communicated to the flagella. Our most detailed analysis has been made with the aspartate/maltose receptor, which binds aspartate directly. In contrast, maltose first binds to a soluble periplasmic protein, which then interacts with the receptor domain of the transducer. Thus, an acidic amino acid and a moderately large protein each evokes an attractant signal from the same receptor.

We know to a fairly high degree of molecular detail how these ligands bind. We are now extending our investigations to probe the conformational changes in the transducer that accompany transmembrane signaling. We are also working to determine the mechanism of repellent sensing.

We also want to know how transmembrane H+ current is converted into flagellar rotation. We find that certain missense mutations affecting mobility proteins are suppressed by mutations in genes encoding other motility or flagellar proteins. This analysis is being extended to reveal protein interactions in the flagellum that drive this, the world's tiniest, rotary motor. Co-expression of specific combinations of mutant motility proteins in large amounts is lethal. We have found that mutation in a region we call the “plug” of MotB lead to a constitutively open proton channel. The plug consists of an amphipathic helix that we think interacts with the cell membrane to block the channel. We are trying to work out the molecular mechanisms that trigger the opening and closing of the channel. We are also studying the role of a protein "hinge" in switching the direction of flagellar rotation and determining how the stator element of the motor is anchored to the cell wall.
Programs in Biology

PUBLICATIONS


SUPPORT

National Science Foundation, MCB-1121916
AI-2 Chemotaxis and Biofilm Foundation (PI)
01 December 2011 – 30 November 2014
$645,851

National Institutes of Health
Structural Basis of Signaling between Bacterial Chemoreceptors and Flagella (co-PI)
01 November 2014 – 31 October 2018
Thomas D. McKnight
Professor and Department Head of Biology

**BIOGRAPHY**
Dr. Tom McKnight joined the Department of Biology at Texas A&M University in 1985, rising to Professor in 2002. He obtained his Ph.D. in Molecular and Population Genetics from the University of Georgia in 1983. During his postdoctoral work at the Atlantic Richfield Plant Cell Research Institute he developed some of the first plant transformation systems using *Agrobacterium tumefaciens* and *A. rhizogenes*. He became Associate Head of the Department of Biology in 2003, and he continued serving in that capacity until he was appointed Head in 2014. Dr. McKnight has taught numerous courses, from freshman biology to graduate-level courses in plant molecular biology. An accomplished educator, he is the 2009-2010 National Academy of Sciences Education Fellow and was honored with a Texas A&M Association of Former Students Distinguished Achievement Award in Teaching in 1994.

**RESEARCH**
The McKnight lab has always had very broad interests in plant molecular biology, and over the years we have worked on areas as diverse as transformation systems, structure and evolution of the cotton genome, anti-cancer alkaloids, plant telomere biology, and now, biofuels. There are two main themes running through these disparate projects; how do plants function, and how can we alter their functions to improve life for humans.

The current focus of the lab is investigation of *Solanum pennellii*, a wild Peruvian tomato species that directs up to 25% of its fixed carbon into a glycolipid that coats the leaves, as a potential feedstock for biofuel. This compound has three short-chain fatty acids (with 4 to 10 carbons) esterified to three of carbons on glucose, and it can be removed easily from the plant with a quick ethanol wash. A simple transesterification reaction (the same reaction used to convert vegetable oil to biodiesel) produces methyl esters, which could substitute for gasoline. We have cloned genes encoding the first two enzymes in the short pathway that makes the glycolipid, and we are using comparative transcriptomics and genetic approaches to identify genes encoding the remaining steps. Our ultimate goal is to transfer this biosynthetic pathway to more agronomically tractable plants.

**PUBLICATIONS**

Robinson WD, Park J, Tran HT, Del Vecchio HA, Ying S, Zins JL, Patel K, McKnight TD, Plaxton WC. (2012) The secreted purple acid phosphatase isozymes AtPAP12 and AtPAP26 play a


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PENDING SUPPORT

NSF
NRT-IGE: Smart Buildings: A Vertically Integrated Multidisciplinary Graduate Educational Program
1 January 2016 – 31 December 2018
$499,554 requested

RECENT SUPPORT

USDA
Solanum pennellii, a Potential Feedstock for Bio-Gasoline Production
1 February 2012 – 31 January 2015
$99,995

NIH-NIGMS 1RC2GM902521
Advancing Drug Development in Medicinal Plants with Transcriptomics and Metabolomics
30 September 2009 – 29 September 2012
$96,706
U. J. McMahan

Professor

**BIOGRAPHY**
Dr. U. J. McMahan joined the Department of Biology at Texas A&M University as Professor and Department Head in 2008. He obtained his Ph.D. in anatomy at the University of Tennessee Medial Units in Memphis. He is a world renowned neurobiologist, and is a Professor of Neurobiology and of Structural Biology Emeritus at Stanford.

**RESEARCH**
For more than three decades this laboratory has been concerned with understanding how the nervous system’s synapses function, how they develop and how they regenerate after trauma. Such information is essential for a comprehensive understanding of the factors that bring about certain diseases of the nervous system and for developing ways of improving recovery after trauma.

We have done most experiments on vertebrate neuromuscular junctions, particularly those of frog, because they are the best understood of all synapses, but we have also studied neuron-to-neuron synapses in the brains of both vertebrates and invertebrates.

Over the years our experimental approaches have included in vivo microsurgery, tissue culture, light and electron microscopy, immunocytochemistry, protein purification, molecular genetics, in situ hydridization, and electrophysiology.

We are currently using the nascent technology of high-resolution electron microscope tomography to study at 2-3 nm spatial resolution the organization and behavior of macromolecules at synapses. The information that is obtained provides unique insights about the molecular mechanisms involved in synaptic impulse transmission and in synapse formation. To augment these studies we are exploring methods for localizing synaptic proteins characterized by biochemistry to specific macromolecules observed by electron microscope tomography.

We are also developing software, called EM3D, a unified application designed specifically for structural cell biologists that allows a user to proceed from an electron microscope tomography data set of a specimen to a collection of 3D surface models of structures within the specimen. EM3D also includes computational tools that quantify spatial characteristics on a vertex-by-vertex basis upon the surface models. These technologies can be used to examine how macromolecular organization regulates cell function in any tissue.

**PUBLICATIONS**


Jerome S. Menet
Assistant Professor

**BIOGRAPHY** Dr. Jerome S Menet joined the Department of Biology at Texas A&M University in 2013 as a tenure-tracked Assistant Professor. He obtained his Ph.D. in Neuroscience from the Louis Pasteur University of Strasbourg, France, in 2003 under the guidance of Dr. Paul Pevet. His postdoctoral work in the laboratory of Dr. Michael Rosbash at Brandeis University, Massachusetts focused on the molecular characterization of the circadian clock in *Drosophila* and the mouse. He is a member of the Genetics Faculty, the Texas A&M Institute for Neuroscience, and Center for Research on Biological Clocks. Dr. Menet teaches Molecular Cell Biology at the undergraduate level, and Molecular Tools in Biology at the graduate level. He is an ad hoc reviewer for NSF and NIH grant proposal and various journals, including *PLoS One, Nucleic Acids Res, Biochemistry, BMC Biology, Journal of Biological Rhythms* and *Molecular Cell Biology*.

**RESEARCH** Most organisms from bacteria to humans exhibit 24-hours rhythms in their biochemistry, physiology and behavior. Best exemplified by the sleep/wake cycle, these rhythms are remarkably widespread and include in humans hormonal (e.g., melatonin, insulin, cortisol), metabolic (e.g., glucose, cholesterol), physiological and behavioral oscillations. In fact, most biological functions are rhythmic and are set to perform optimally at the most appropriate time of the day. For example, the human digestion process performs better during the day when we are supposed to eat.

These circadian rhythms are generated by “molecular clocks”, which consist of a few “clock genes” interacting in feedback loops, and which drive the rhythmic expression of a large number of genes, i.e. ~10% of the transcriptome in any tissues. This wide impact of clock genes in regulating gene expression is underscored by the surprisingly large number of pathologies developed by clock-deficient mice. In addition to being arrhythmic, these mice indeed develop pathologies as diverse as mania-like behaviors, learning and memory defects, depression, drug addiction, insomnia, metabolic diseases, arthropathy, hematopoiesis defects and cancers.

Research in our lab aims at characterizing how circadian clocks and clock genes regulate gene expression to provide insights into how and why clock dysfunction leads to a wide spectra of pathologies. To this end, we are using a wide-range of molecular and biochemical techniques to investigate the circadian clock function at the genome-wide level (e.g., next-generation sequencing). We are currently extending some of our recent results and focus on how clock genes rhythmically regulate chromatin environment to drive rhythmic gene expression.
PUBLICATIONS


SUPPORT

2015: Texas A&M University and CONACYT Collaborative Research Grant Program
“Molecular characterization of the adverse effects of shift work on metabolic and cardiovascular functions”
PI: Jerome Menet; co-PIs: Ruud Buijs
Award period: September 2015-August 2016. Total direct costs: $24,000.

2014: Texas A&M Center for Biological Clock Research Seed Fund
“Role of the daily food intake rhythm in the synchronization of circadian clocks”
PI: Jerome Menet; co-PIs: David Earnest, Chaodong Wu
Award period: January 2014-December 2015. Total direct costs: $14,000.
Christine Merlin
Assistant Professor

**BIOGRAPHY**
Dr. Christine Merlin joined the Department of Biology at Texas A&M University in 2013. She obtained her Ph.D in Insect Physiology in 2006 from the University Pierre and Marie Curie in France, under the guidance of Dr. Emmanuelle Jacquin-Joly and Martine Maibeche-Coisne. Her postdoctoral work in the laboratory of Dr. Steven Reppert at the University of Massachusetts Medical School focused on integrative studies of the biological circadian clock in monarch butterflies and their role in insect migration. She is a member of the Genetics Faculty, Texas A&M Institute for Neuroscience, and Center for Research on Biological Clocks. Dr. Merlin teaches Genes, Ecology and Evolution at the undergraduate level, and Molecular Tools at the graduate level. She has served as an NSF panelist and currently serves as a Review Editor for Frontiers in Ecology and Evolutionary Biology, Chemical Ecology, as well as being a reviewer for various journals, including *Journal of Biological Rhythms, Molecular Ecology, Scientific Reports, European Journal of Neuroscience, Insect Molecular Biology* and *PloS one*.

**RESEARCH**
Dr. Merlin’s research program reflects our broad interests in understanding how organisms respond and adapt to changing environments. The Merlin laboratory uses the eastern North American migratory monarch butterfly (*Danaus plexippus*) as a model system to study animal clock mechanisms and the role of circadian clocks and clock genes in a fascinating biological output - animal long-distance migration. Research in the Merlin lab combines integrative approaches that include molecular, genetic, genome-wide profiling approaches, and behavior to more specifically address: 1) how the circadian clock and clock genes govern the photoperiodic seasonal migratory switch, 2) the genetic and cellular bases underlying migratory behavior, and 3) the evolution of insect clockwork mechanisms. The Merlin lab continues to develop innovative gene-targeting approaches to knock-in reporter tags into clock genes loci to gain insights into the clock circuitry involved in both seasonal responses and navigation.

**PUBLICATIONS**
Reppert SM, Guerra PA and Merlin C. (*In press*) Neurobiology of Monarch Butterfly Migration. *Annual Reviews of Entomology*.


SUPPORT

NSF IOS #1456985 (PI) (05/01/2015-04/30/2018)
Circadian clock control of seasonal migration
Total costs: $550,683
Beiyan Nan
Assistant Professor

BIOGRAPHY
Dr. Beiyan Nan joined the Department of Biology at Texas A&M University in 2015. He obtained his Ph.D. in Biochemistry and Molecular Biology at Peking University, China, in 2008. His postdoctoral work in the laboratory of Dr. David Zusman at the University of California, Berkeley focused on the molecular mechanism of bacterial motility. Dr. Nan has been using the super resolution photo-activated localization microscopy (PALM) to track single molecule dynamics of proteins in live cells.

RESEARCH
Dr. Nan’s lab is interested in understanding the mechanisms of fundamental biological processes in bacteria. His lab uses soil bacterium Myxococcus xanthus as the model organism. Several aspects of M. xanthus make it an ideal model for understanding bacterial physiology. First, M. xanthus cells utilize sophisticated systems to move on solid surfaces, which involve cytoplasmic and periplasmic proteins, filamentous cytoskeletons, membrane channels, cell wall, and cell surface components. Second, cells constantly communicate with each other and with their environment. Cells usually move in coordinated groups but also as isolated “adventurous” individuals, which allows this bacterium to feed on soil detritus and prey on other microorganisms. Third, when the availability of nutrients or prey decreases in the environment, most cells exhibit behaviors that include aggregation into fruiting bodies and conversion of individual cells into spores. Dr. Nan has been studying protein dynamics in bacteria using the super resolution photo-activated localization microscopy (PALM). Due to the diffraction of light, the resolution of conventional fluorescence microscopy techniques (including confocal, deconvolution, etc.) is limited to 200-250 nm. This resolution is often insufficient because bacterial cells are usually only 500-1,000 nm in diameter. With PALM, Dr. Nan has achieved 10-millisecond time resolution and 80-nm spatial resolution in live cells, which break the resolution barrier of the conventional fluorescence microscopy techniques. The research of the Nan lab covers a broad range of topics including motility, development (fruiting body formation and biofilm formation), cytoskeleton, and cell wall assembly.

PUBLICATIONS


Alan E. Pepper
Associate Professor

**BIOGRAPHY**

Dr. Pepper joined the Department of Biology at Texas A&M University in 1995, and was promoted to Associate Professor in 2002. He obtained his Bachelor’s degree in Biochemistry from the University of California at Berkeley, and a Ph.D in genetics from U.C. Davis. He did his postdoctoral work on developmental responses to light in the model plant *Arabidopsis thaliana* in the laboratory of Dr. Joanne Chory at the Salk Institute for Biological studies where he was an NSF postdoctoral fellow in Plant Biology. Dr. Pepper is active in the interdepartmental Faculty of Genetics (FOG), the Ph.D. program in Molecular and Environmental Plant Sciences (MEPS) and the new interdisciplinary program in Ecology and Evolutionary Biology (EEB). He developed and now teaches a sophomore-level interdisciplinary course entitled “Genes, Ecology and Evolution” as well as a graduate course in Plant Molecular Biology. He was the recipient of the TAMU Association of Former Students Distinguished Achievement Award in teaching in 2003. Dr. Pepper has served both as *ad hoc* reviewer and on grant review panels for the USDA and NSF, and has reviewed manuscripts for a large number of journals in disciplines as diverse as systematics, development, conservation biology, genomics, ecology, and cell biology.

**RESEARCH**

Dr. Pepper’s laboratory uses genetic, molecular and genomic tools to study how terrestrial plants adapt, to the vast diversity of environments found on our planet.

The Pepper lab investigating the genetic mechanisms of plant adaptation to the stresses of extreme environments such as drought, low mineral nutrients (N,P,K) and heavy metals, in wild relatives of Arabidopsis, such as the rare endemic plant *Caulanthus amplexicaulis* (Brassicaceae). This work has led The Pepper lab to become more broadly interested in the conservation and ecological genetics of rare plants, particularly geoendemics. At the other end of the biological spectrum, the Pepper lab is also investigating the ecological and evolutionary genomics of highly successful invasive plants, such as cogongrass (*Imperata cylindrica*) and giant reed (*Arundo donax*) (Poaceae). Finally, the lab is using comparative genomics to investigate the genetic basis of the evolution-under-domestication of developmental processes in cultivated cottons (*Gossypium* spp.) and their wild relatives (Malvaceae).

**PUBLICATIONS**


Ryan DE, Pepper AE & Campbell L (2014) De novo assembly and characterization of the transcriptome of the toxic dinoflagellate Karenia brevis. BMC Genomics 15:888


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**SUPPORT**

**NSF**
Genomic Analysis of Adaptation to an Extreme Terrestrial Environment  
01 February 2014 – 31 January 2017  
$700,000  
PI

**USDA-NIFA**
An Experiential Learning Program at Two Hispanic Serving Institutions for Underrepresented Students Focused on Food Safety and Security  
01 June 2014 – 31 August 2015  
$25,000  
Sub-awardee

**USDA-ARS**
De Novo SNP Discovery and GBS-Based Cotton Genome Map Development  
01 November 2012 – 31 October 2015  
$160,000  
PI
Dr. Hongmin Qin received her Ph.D. (Genetics) from the Institute of Microbiology, Chinese Academy of Sciences in 1999. She joined the Department of Biology at Texas A&M University as an Assistant Professor in 2006. Dr. Qin teaches courses in cell and molecular biology. Her teaching emphasizes the fundamental concepts of cell biology and encourages students to apply what they have learned in the classroom to solve biological questions. She, together with another faculty, developed and implemented a graduate level cell biology course, which is now an integral part of the Department of Biology’s graduate curriculum, and attracts students from departments across campus. Dr. Qin’s research is focused on the mechanism of intraflagellar transport (IFT), an evolutionarily conserved motility process that has been implicated in a wide spectrum of human diseases and disorders. Her work has identified novel components of IFT system and provided new insights into the mechanistic functions of the individual IFT proteins. She has coauthored 16 peer-reviewed research articles and received grant funding from Polycystic Kidney Disease Foundation, American Heart Association and National Science Foundation for her work on IFT.

Cilia/flagella are evolutionarily conserved organelles extending from surfaces of almost all eukaryote cells. Motile cilia/flagella, such as sperm flagella and airway tract epithelial cell cilia, are responsible for movement or generation of fluid flow. The non-motile primary cilia are critically involved in visual, olfactory, and auditory signal transduction, and play key roles in regulation of gene expression, development, and behavior (see figure). Consistent with their nearly ubiquitous distribution and essential role in cellular physiology and organ development, cilia dysfunction has been implicated in a wide spectrum of human diseases and disorders collectively known as ciliopathies, including cystic kidney diseases, retinal degeneration, hydrocephaly, polydactyly, situs inversus, and obesity.

Dr. Qin is a cell biologist and her research is to understand the biogenesis of a flagellum/cilium using the model organism *Chlamydomonas reinhardtii*. This single cellular system is suited for flagellar research due to the ease of flagellar isolation, microscopic analysis, and a large collection of flagellar mutants. More importantly, the process of intraflagellar transport (IFT) (see figure), the discovery of which provided the first link between ciliogenesis and human disease and afforded opportunities for ciliopathy research, was first observed and remains best characterized in *Chlamydomonas*. The mechanisms and molecules involved in ciliogenesis and IFT are conserved between human and *Chlamydomonas*; therefore, the knowledge learned about flagella and IFT in *Chlamydomonas* can be leveraged to address ciliopathies arising from dysfunction of homologous systems in humans. However, how the IFT functions is still unknown, nor have all of the components of the IFT been identified. Using a combination...
of genetic and biochemical approaches, the Qin lab seeks to address these important questions.

To understand the mechanism of IFT, it is essential to define the molecular composition of the IFT system. Organized into complexes A and B based on biochemical purification, IFT particles are composed of about 18 subunits. By utilizing the experimental advantages of *Chlamydomonas*, and combining it with the Qin group’s expertise in biochemical analysis of IFT complexes, several novel IFT particle subunits have been identified. Through these efforts, the protein composition of the IFT particle is near completion, providing new opportunities for functional and structural analysis of the IFT particle.

While identification of the components of the IFT particle is nearly complete, the mechanistic functions of the individual IFT proteins are not known. The Qin group’s recent work provides insight into the *in vivo* step-wise assembly process of complex B and reveals for the first time that IFT complex B first localizes to the proximal end of the centrioles and then translocates onto the transition fibers via an IFT88 dependent mechanism. One prediction from this work is that IFT88 itself, or one of the complex B peripheral proteins that failed to attach to the complex, is responsible for the translocation of complex B from the proximal end of basal bodies onto the transition fibers. Future work will test this idea by examining the assembly status and the localization pattern of complex B proteins in mutants of peripheral complex B proteins.

Despite the fact that IFT is observed inside flagella and functions to build flagella, the majority of IFT particles are within the cell body and are closely associated with the basal body transition fibers. Because all flagellar proteins are synthesized in the cell body, and because the transition zone imposes a physical barrier between the cell body and the flagellar compartment, the entry of precursors is thought to be a critical step during flagellar assembly. The small, active fraction of IFT particles that are undergoing IFT movement is directly responsible for ferrying flagellar precursors from the cell body to the flagellar compartment. Therefore, the number of IFT particles present in a flagellum is important for flagellar assembly, as well as for maintenance of a constant flagellar length. However, little is known about how the number of IFT particles allocated to IFT is regulated. The Qin group has demonstrated that IFT22 plays a key regulatory role in controlling the cellular amount of IFT particles. Knock-down and overexpression of IFT22 both produced cells containing more IFT particles, but not IFT-dynein, in the flagella, indicating that aberrant amounts of IFT22 disrupt the balance of anterograde and retrograde IFT. These results revealed that IFT22 regulates the balance among IFT particle complexes and motors, and controls the amount of IFT particles distributed to the flagellar compartment. The key questions arising from these studies are: 1) what is the mechanism by which IFT22 controls the motility and function of IFT; 2) how does the nucleotide state of IFT22 control these steps. We will continue mutant analysis and biochemical purification to pursue the regulatory properties of IFT22. Additionally, we are isolating new mutants defective in IFT regulation. The Qin group has been generating and screening phototaxis defective mutants, and to date identified >200 mutants. The mutants
with defective IFT, in particular the ones with over-expression or reduced levels of IFT proteins will be investigated. The results from analyzing these mutants will likely provide information on the mechanism of IFT regulation.

**PUBLICATIONS**


SUPPORT

Agency: National Science Foundation (NSF)
Title: Small GTPase regulators of Intraflagellar Transport (IFT)
Funding period: 02/01/2010 - 01/31/2016, No cost extension
Role: Principle Investigator
Bruce B. Riley
Professor

BIOGRAPHY Dr. Bruce Riley obtained his Ph.D. in molecular biology at the University of Wisconsin-Madison. He joined the Department of Biology at Texas A&M University in 1995, rising to Professor in 2007.

RESEARCH My lab studies inner ear development in zebrafish. A prominent feature of our research is to investigate how cell-cell signaling and downstream gene-interactions control development. One project in the lab focuses on how cell signaling regulates ectodermal patterning during gastrulation to establish the otic placode, the precursor of the inner ear. Our recent work shows that localized Fgf signaling is especially critical for inducing formation of the otic placode, and members of the Pax2/5/8 family of transcription factors are important mediators of Fgf signaling. During later stages of inner ear development, we are exploring how sensory hair cells and neurons are regulated. Our studies address how these cells initially form, how they are genetically maintained, and how they become specialized for hearing vs. balance. We are also investigating how zebrafish can replace dead and damaged hair cells, an ability that mammals have lost. The inability to regenerate hair cells explains why humans show progressive irreversible hearing loss as we age. It is hoped that activating or augmenting human homologs of genes shown to operate in zebrafish might help restore hearing and balance in humans.


Sweet EM, Vemaraju S & Riley BB (2011) Sox2 and Fgf interact with Atoh1 to promote sensory competence throughout the zebrafish inner ear. *Dev Biol* 358:113-21


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**SUPPORT**

**National Institutes of Health, NIDCD R01 DC003806**

*Genetic Analysis of Inner Ear Development in Zebrafish*

1 March 2013 – 28 February 2018

$1,062,500 (direct)
BIOGRAPHY

Dr. Gil Rosenthal obtained his Ph.D. in zoology at the University of Texas at Austin. His work focused on the behavioral ecology of visual signaling in swordtails. He did his postdoctoral work at the University of California – San Diego. He joined the Department of Biology at Texas A&M University in 2006, rising to full Professor in 2013.

RESEARCH

My lab’s research focuses broadly on the mechanisms, evolution, and consequences of mate choice. The heart of our research program is animal behavior, and we enjoy collaborating with other labs with complementary areas of specialization. The lab’s main study system is natural hybrid zones of swordtail fish, centered at our CICHAZ research station, in the Sierra Madre Oriental of Hidalgo, Mexico.

Hybrids between Xiphophorus malinche and X. birchmanni represent a ‘genomic collision’ between two species with divergent suites of male traits and female preferences, and provide a terrific opportunity to understand both the genomic architecture underlying mate choice and the fitness consequences of novel sexual phenotypes in the wild. Ongoing research centers on a long-term study of natural and experimental hybrid populations, combining evolutionary genetics with morphological, behavioral, and neurobiological approaches to sexual communication. Social and environmental effects on chemical signaling also play a major role in this system. In conjunction with efforts to characterize the genetics of multivariate female mating preferences, we have developed and support anyFish, a new tool for the creation of synthetic animated stimuli for studying visual signals.

I am also involved in a collaborative project on mate choice, life-history evolution, and ecology in the annual killifish genus Austrolebias. Like swordtails, these remarkable little Uruguayan fishes lend themselves well to both field and laboratory work. They are restricted to seasonal bodies of water, where they grow rapidly, reproduce, and die within the space of a few winter months, leaving their eggs to estivate in diapause. These closed systems should allow us to gain a comprehensive picture of the biotic and abiotic environment, and, in concert with behavioral studies of mate choice, how sexual selection changes over space and time.

PUBLICATIONS


**SUPPORT**

National Science Foundation, IOS, “Long-term Research in Environmental Biology (LTREB): Social, environmental, and evolutionary dynamics of replicated hybrid zones in swordtails
(Teleostei: Xiphophorus) of Mexico’s Sierra Madre Oriental”, April 2014-April 2019 (renewable through 2024). $447,948
Cancer Prevention and Research Institute of Texas, “Screening for melanoma genes using natural hybrid incompatibilities “, September 2014-August 2015. $200,000

National Science Foundation, IOS, “Planning Grant: Developing a Strategic Plan and Infrastructure Needs Assessment for the CICHAZ Field Station”, August 2014-August 2015. $25,000

Matthew S. Sachs
Professor

BIOGRAPHY
Dr. Matthew S Sachs joined the Department of Biology at Texas A&M University in 2007 as Professor. He obtained his Ph.D. in Biology from the Massachusetts Institute of Technology under the mentorship of Dr. Uttam L. RajBhandary. His postdoctoral work in the laboratory of Dr. Charles Yanofsky at Stanford University focused on the molecular biology and genetics of mRNA expression in Neurospora crassa. Prior to moving to Texas A&M he was faculty at Oregon Health & Sciences University in the Department of Biomolecular Systems and the Department of Molecular Microbiology and Immunology. He is a member of the Program for the Biology of Filamentous Fungi (PBoFF) and the Genetics Faculty. He is now teaching Fundamentals of Microbiology and Research Communication in the Life Sciences at the undergraduate level. He currently serves as Associate Editor for Eukaryotic Cell, Faculty of 1000, Fungal Genetics and Biology, Genes, Genomes, Genetics (G3) and Translation. He won the Association of Former Students of Texas A&M University Distinguished Achievement Award for Teaching in the College of Science and the Student Recognition Award for Teaching Excellence in 2011. He was elected American Association for the Advancement of Science Fellow in 2013 and to the American Academy of Microbiology in 2014.

RESEARCH
My laboratory’s research focuses primarily on understanding post-transcriptional control mechanisms using filamentous fungi as models. We have probed the functions of upstream open reading frames (uORFs) important in controlling gene expression. We discovered that the nascent arginine attenuator peptide (AAP), encoded by an evolutionarily conserved uORF in fungal mRNA specifying an arginine biosynthetic enzyme, stalls ribosomes in response to arginine, reducing gene expression. As a result of these efforts, AAP is currently the best understood eukaryotic ribosome arrest peptide. We are currently using in vivo and in vitro approaches to understand mechanisms governing translation initiation at canonical and noncanonical start codons, since we have identified evolutionarily conserved noncanonical start codons that serve potential regulatory roles, and to understand how translation initiation, elongation and termination processes are regulated by endogenous and environmental signals.

We discovered that when the uORF-encoded AAP causes stalling at the uORF termination codon, it results in degradation of the mRNA on which the ribosome is stalled through the nonsense mediated mRNA decay (NMD) pathway. Analyses of this process led us to find that, in the fungus Neurospora crassa, there are two distinct branches of NMD, one of which requires exon junction complex (EJC) and mRNA cap binding complex (CBC) factors in addition to NMD factors. We are studying the different mechanisms by which these distinct branches of NMD operate.
The Neurospora crassa cell free translation system is a powerful tool for gaining insight into translational processes. In collaboration with Dr. Yi Liu, UT Southwestern, we are using this system to understand the roles of optimal versus nonoptimal codons in modulating translation elongation. In collaboration with Dr. James Sacchettini, Texas A&M, we are using this system to develop a high throughput screening platform for finding novel compounds that impact translation. In collaboration with Dr. Xiaorong Lin, (Biology, Texas A&M), we are using cell free systems from pathogenic fungi to find and characterize new antifungal agents that act at the level of translation.

In collaboration with Dr. Deb Bell-Pedersen (Biology, Texas A&M) and others, we are using systems-based approaches to understand transcriptional and translational control mechanisms helping underpin the cellular responses to light and for establishing circadian rhythms in gene expression.

PUBLICATIONS


**SUPPORT**

R01GM113673 (Bell-Pedersen, Galagan coPI) 1/31/2015 – 12/31/2018

Role: Collaborator

*Systems Biology of the Circadian Clock Output Network*

The goal of this grant is to combine computational and experimental work to model the upstream and downstream circadian transcription factor network controlling rhythms in the transcription factor ADV-1 and its target genes. The relationship of ADV-1 to clock control of metabolism will be explored and used to test the idea that we can manipulate the timing of key metabolic processes in the cell.
Deborah A. Siegele
Associate Professor

BIOGRAPHY
Dr. Deborah Siegele joined the Department of Biology at Texas A&M University in 1992, rising to Associate Professor in 1997. She obtained her Ph.D. in Molecular and Cell Biology from the University of Wisconsin at Madison, under the guidance of Dr. Carol Gross. Her postdoctoral work in the laboratory of Dr. Roberto Kolter at Harvard Medical School focused on regulation of the starvation response in *Escherichia coli*. She is a member of the Faculty of Genetics and the Professional Program in Biotechnology. She served as the Dept. of Biology Graduate Advisor from 2003-2006 and served on the TAMU Graduate Appeals Panel from 2007-2012, serving as chair of the panel from 2010-2012. She was elected to a 3-year term on the Genetics Society of America Board of Directors in 2012. Dr. Siegele teaches Fundamentals of Microbiology at the undergraduate level and Microbial Physiology at the graduate level.

RESEARCH
Phenotypes are the observable characteristics of an organism that result from the expression of a particular genotype in a particular environment. For example, eye color, number of seeds per pod, and coat color are phenotypic traits that can be observed in flies, legumes, and cats, respectively. Phenotype-genotype associations in well-studied model organisms can be a powerful tool for predicting biological function in less well-studied organisms. However, to use known phenotypic information in one organism to predict possible phenotypes in other organisms requires that phenotype information is stored in a consistent, computable format for ease of data integration and mining.

Until recently, phenotypic information has largely been captured as free text descriptions in primary research papers. The ambiguities in natural language confound attempts to retrieve information across sources. For example, “serotype” and “serovar” both refer to the same phenotype, but a simple text-based computer query with either word alone would miss the other. Or, a single term may be used to refer to more than one biological process.

Controlled vocabularies, such as ontologies, are commonly used to provide both consistent terminology and a structured data format for the capture of biological information. An ontology consists of a controlled vocabulary of defined terms with unique identifiers and precise relationships to each other. Currently, there are phenotype and anatomy ontologies in common use for many eukaryotic organisms, including fungi. However, none of the existing ontologies is appropriate to comprehensively capture phenotypes for Bacteria or Archaea or for comparisons across microbial species.

Dr. Siegele’s lab, in conjunction with collaborators at TAMU and the Institute for Genome Sciences at the University of Maryland, is developing a general Ontology of Microbial Phenotypes (OMP). Efforts in the Siegele lab are focused on term development and annotating...
Phenotypes of the model bacterium *Escherichia coli*. OMP can be accessed via a wiki-based ontology browser: microbialphenotypes.org.

**PUBLICATIONS**


College Station, TX

246
SUPPPPORT  
NIH-NIGMS  
An Ontology for Microbial Phenotype  
9/18/2014 – 6/30/2017  
Co-PI’s: James C. Hu (TAMU, Biochemistry and Biophysics) and Michelle Giglio and Marcus Chibucos (Institute for Genome Sciences, University of Maryland Medical School)
James L. Smith
Associate Professor

BIOGRAPHY
Dr. James L. Smith joined the Department of Biology at Texas A&M University in 2009 as an Assistant Professor and was tenured and promoted to Associate Professor in 2013. He obtained his Ph.D. in Biochemistry from the College of Medicine at University of Florida in 2003, under the guidance of Dr. Arthur Edison. His postdoctoral work in the laboratory of Dr. Jeffrey Hillman at Oragenics Inc. focused on the isolation and characterization of natural products. Oragenics Inc. had a significant interested in peptide antibiotics, which Dr. Smith developed. Dr. Smith teaches Microbiology at the undergraduate level and Antimicrobial Agents at the undergraduate and graduate level. He currently serves on the editorial board of Applied and Environmental, as well as being an ad hoc reviewer for various Biochemistry, Microbiology and Cell Biology focused journals.

RESEARCH
The discovery of novel antimicrobials and the study of antimicrobial function have significant relevance towards the development of therapeutics aimed at treating life threatening diseases. However, much of what we have learned about protein synthesis, DNA replication, enzyme function, as well as membrane physiology comes from the study of antimicrobials. Our knowledge of cellular and membrane physiology is still limited and there is much we need to learn. The discovery and structural and functional characterization of new antimicrobial agents will provide new insights into cellular and membrane function, as well as provide means to intellectually design new analogs that target microbial function. The discovery of new enzymes involved in natural product synthesis also provides invaluable information in understanding the complexity of microorganisms and provides tools for synthetic chemistry applications.

PUBLICATIONS


Escano J, Stauffer B, Brennan J, Bullock M, and Smith L. The leader peptide of mutacin 1140 has distinct structural components compared to related class I lantibiotics. MicrobiologyOpen 3(6), 961–972. (2014)


Smith L., and Hillman J.D., Therapeutic Potential of Type A (I) Lantibiotics, a Group of Cationic Peptide Antibiotics, Current Opinion in Microbiology, 11, 401-408. (2008).

SUPPORT Award RP121002 (P.I.) 06/01/2012 – 10/31/2015
Cancer Prevention Research Institute of Texas (CPRIT)
Examination of the Pharmacological Properties of a Novel Antifungal Named Occidiofungin
This proposal involves the pharmacokinetic and pharmacodynamic evaluation of a novel
antifungal compound, named occidiofungin, for the treatment of a systemic Candida albicans infection.
Role: Principal Investigator
Amount $777,884
Michael S. Smotherman
Associate Professor

BIOGRAPHY
Dr. Michael Smotherman joined the Department of Biology at Texas A&M University in 2004 and was promoted to associate professor in 2011. He earned an MS in Zoology from the University of Maine in 1992 and his Ph.D. in Physiology from UCLA in 1998, where he studied ion channel biophysics in the auditory system under the guidance of Dr. Peter Narins. He was a post-doctoral research fellow in Dr. Walter Metzner’s lab at UCLA from 1999 to 2004, where he began studying mechanisms of sensorimotor integration in the mammalian brain. Dr. Smotherman was a Grass Fellow at MBL in 2002. He currently serves the university as an IACUC member and as chair of the interdisciplinary graduate program in Neuroscience.

RESEARCH
Communication is an essential part of sociality, and an animal’s vocal communications provide a window into their cognitive capabilities, motivations, and behavioral ecology. Communication is also an important model of sensorimotor neurobiology because vocalizations are the motor output of a sophisticated suite of brain pathways that integrate across multiple sensory modalities and time scales. Vocal communication systems are highly diverse because they have been shaped by intense natural and sexual selection. Studying the evolution of communication networks in the brain provides important insight into how environment and ecology molded the social brain.

Our lab studies bats because of their biosonar capabilities and their unusually broad repertoire of communication calls and songs.

Echolocation provides an exciting model system for exploring how multiple brain pathways interact to control behavior on a millisecond time scale. Our neural studies investigate the neurocircuits that guide delicate changes in sonar pulse acoustics. Our behavioral studies of bats echolocating in groups has shed light on how they coordinate their sonar systems to minimize interference with one another. This research has direct relevance to man-made sonar and wireless communications systems.

Singing by bats offers exiting new opportunities to young investigators to explore how mammals and birds converged upon a similar behavior via different neural mechanisms. Identifying and characterizing the functional neurocircuitry of the bat’s song production network is a major component of our research.

PUBLICATIONS


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**SUPPORT**

Dr. Smotherman’s lab is currently funded by grants from the NSF, DOE, and Bat Conservation International.
Joseph A. Sorg
Assistant Professor

**BIOGRAPHY**

Dr. Joseph Sorg joined the Department of Biology at Texas A&M University in 2010 as an Assistant Professor. Dr. Sorg earned his bachelors of science degree from Purdue University before moving on to graduate studies at The University of Chicago under the mentorship of Dr. Olaf Schneewind. Upon obtaining his Ph.D. in microbiology in 2006, Dr. Sorg began postdoctoral studies on *Clostridium difficile* spore germination with Dr. Linc Sonenshein at Tufts University School of Medicine. In his own lab, he is focused on elucidating the mechanisms of spore germination in *C. difficile*. Dr. Sorg teaches Fundamentals of Microbiology at the undergraduate level and Bacterial Genetics at both the undergraduate and graduate levels and he has been recognized for his teaching efforts the by the Texas A&M University Center for Teaching Excellence as a Montague – CTE Scholar. Dr. Sorg is actively involved in student mentorship at both the undergraduate and graduate levels, serves as a reviewer for several journal and granting agencies within his field.

**RESEARCH**

Dr. Sorg’s lab is focused on the mechanisms of spore germination and bile acid resistance in *Clostridium difficile*. *C. difficile* is a Gram-positive, spore forming, anaerobe that causes infections in people who have undergone antibiotic regimens. Previously, we had shown that certain bile acids promote *C. difficile* spore germination while others inhibit germination. Bile acids are small molecules made by the liver that help the absorption of fat and cholesterol in the GI tract while also serving as a protective barrier against invading pathogens. Because *C. difficile* spores use the ratios of bile acids as cues for germination, the actively growing bacteria must have adapted means to avoid their toxic properties. We are currently focused on identifying these factors and the mechanisms by which *C. difficile* spores germinate.

**PUBLICATIONS**


**Sorg JA** (2014) Microbial bile acid metabolic clusters: the bouncers at the bar. *Cell Host Microbe* 16:551-2


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**SUPPORT**

NIH / NIAID: RO1

*Mechanisms of Clostridium difficile spore germination.*

04/01/15 – 03/31/20. (1R01AI116895-01; Role: PI)
Terry L. Thomas

Professor

BIOGRAPHY

Dr. Terry L. Thomas joined the Department of Biology at Texas A&M University in 1983, rising to Professor in 1992. He obtained his Ph.D. in Molecular Genetics (Zoology) from the University of Georgia. His postdoctoral work in the laboratory of Dr. Eric Davidson at the California Institute of Technology led to the discovery of numerous genes involved in sea urchin embryogenesis. At Texas A&M, Dr. Thomas has used genomics and bioinformatics tools to understand the molecular basis of numerous processes in animals, plants and fungi. He served as Head of the Biology Department (1992-2003) and has served in numerous leadership roles at TAMU. Currently he is Special Advisor to the Vice President for Research and is Chair of the PI Advisory Committee for the TAMU Shared Research Services. He is a member of the Program for the Biology of Filamentous Fungi (PBoFF) and the Center for Research on Biological Clocks. Dr. Thomas teaches Bioinformatics at the undergraduate and graduate level. He has served as a reviewer for numerous high profile journals and grant agencies. He has also functioned as a consultant to multiple biotech companies, and he has given many invited presentations.

RESEARCH

My interests are evolutionarily broad and include animals, plants and fungi. A major focus of the lab is the genomic analysis of gene expression programs during plant gene expression programs, particularly during embryogenesis and seed development, and the underlying regulatory mechanisms required for the initiation and maintenance of these programs. This work has illustrated the combinatorial interactions of cis and trans-acting factors that result in specific gene regulatory events. We are also using genomics tools to study the interaction of the rice blast fungus, Magnaporthe grisea, with plant hosts; the circadian control of gene expression; and the development of the vertebrate retina. An additional focal area is the utilization of molecular and cellular approaches for crop improvement. As part of these research activities, we have developed or adapted high throughput genomics approaches to accelerate the gene discovery process and subsequent analysis of gene expression and function.

PUBLICATIONS


Wesley J. Thompson
Professor

BIOGRAPHY
Wesley Thompson joined the Department of Biology in 2012 as a Professor. He obtained his Ph.D. in 1975 in molecular biology from the University of California, Berkeley. After postdoctoral work in Norway (Institute of Physiology, University of Oslo) and in St. Louis (Washington University School of Medicine), he joined the faculty at the University of Texas, Austin in 1979 where he remained until 2012. He studied neuronal circuits in invertebrates as a graduate student and development of synapses as a postdoctoral fellow. He continued this last work as an independent investigator. His most notable honors include being named a Searle Scholar and a recipient of a Jacob Javits award from NIH. He presently teaches in the introductory Principles of Neuroscience I and II class for beginning graduate students in the Institute for Neuroscience which runs the interdisciplinary program in which a number of biology faculty participate.

RESEARCH
All neuroscientists agree that the brain functions by virtue of the way its neurons are wired together into intricate circuits. I study how these connections between neurons, i.e. synapses, are formed and maintained. I study the simplest of all vertebrate synapses, the neuromuscular junction (NMJ). This synapse, the connection between a motor neuron and a skeletal muscle fiber, offers a number of advantages for the types of questions that interest me. The synapse is huge, easily accessible, and easily manipulated. There is only a single “pre-synaptic” input and the target cell is very large. This is in contrast to most synapses in the central nervous system where the pre- and post-synaptic elements are very small and the numbers of synapses and cells closely packed together are enormous. There are a number of neurological disorders that affect the integrity of this synapse or its components.

The specific issue that I pursue is the role of the glial cells that are present at this synapse. At the NMJ there are several Schwann cells (the glial cells of the peripheral nervous system) that are in intimate contact with the terminal branches of each motor neuron. If a muscle is denervated by crushing the muscle nerve, the Schwann cells react to the degeneration of the axons and nerve terminals by growing long, elaborate processes that extend away from the synaptic site. Motor axons regenerate quite readily and Schwann cell processes serve as substrates for the regrowing axons. In this way, the Schwann cells apparently determine where in the muscle regenerating axons grow.

In my lab we image Schwann cells and axons in living mice to determine the relationships between axons and Schwann cells at normal NMJs as well as during reinnervation and sprouting. For this purpose, we have made transgenic mice in which green fluorescent protein (GFP) is expressed in Schwann cells. We have mated these animals to animals obtained from...
Programs in Biology

collaborators in which cyan fluorescent protein (CFP), is expressed in axons. In this way we produce mice bearing two transgenes. We can stain the acetylcholine receptors with small concentrations of a snake toxin, bungarotoxin, that is conjugated to a red fluorochrome, rhodamine. Thus, we can insert a microscope objective into a small lesion in the skin of a mouse and observe green Schwann cells, blue axons and axon terminals, and red acetylcholine receptors. Moreover, each site bears a “fingerprint” that one can easily use to identify this same synaptic site hours, days, weeks, months, or even years later. Thus, it is possible to identify the synaptic components at individual synapses and see how they change with time. We are investigating how motor neurons regenerate and sprout in the muscle in response to nerve injury. In this way, we are learning exactly the relationships between axons and their glial cells as synapses reform. We also examine these components in aging muscle and in muscles in animals with muscular dystrophy.

We are also trying to manipulate the molecules involved in this relationship between glia and nerve terminals. We have made transgenic mice in which a target gene in Schwann cells can be turned on at the will of the investigator by simply giving the mouse an oral antibiotic. The system works well and we are now embarking on experiments to express proteins that we believe are crucial for the function of these cells.

In summary, research in my lab uses imaging and mouse transgenic technology to explore mechanisms involved in synaptic maintenance and in repair of neuronal lesions.

PUBLICATIONS

Lee, Y-L, Li, Y., Mikesh, M, Smith, I, Nave, K-A, Schwab, M, and Thompson, WJ. Neuregulin 1 displayed on motor axons regulates Schwann cell-mediated synapse elimination at developing neuromuscular junctions (under review)


SUPPORT

My current grant support in a one year bridge grant for my NIH grant NS20480-24. I have an grant awaiting council review by the National Institutes of Aging, but I am told it is unlikely to be funded. I am actively applying for additional funding.
Wayne K. Versaw
Associate Professor and Associate Department Head for Academic Affairs

BIOGRAPHY
Dr. Wayne Versaw joined the Department of Biology at Texas A&M University in 2003 and was tenured and promoted to Associate Professor in 2009. He obtained his Ph.D. in Biomolecular Chemistry at the University of Wisconsin – Madison in 1995, under the guidance of Dr. Robert L. Metzenburg. His postdoctoral work in the laboratory of Dr. Maria Harrison at the Samuel Roberts Noble Foundation focused on phosphate transport in plants. He was appointed Associate Department Head for Academic Affairs in 2014 and is a member of the Molecular and Environmental Plant Science Faculty. Dr. Versaw teaches Introductory Biology and Molecular Cell Biology at the undergraduate level and Plant Molecular Biology at the graduate level. He currently serves on the editorial board of Plant Signaling & Behavior and Frontiers in Plant Science, as well as being an ad hoc reviewer for NSF grant proposals and various journals, including Plant Physiology, Plant Cell, Functional Plant Biology, Eukaryotic Cell, and Journal of Bacteriology.

RESEARCH
Compartmentalization of metabolic pathways and other cellular functions is a hallmark of eukaryotic cells. This feature is extreme in plants due to the presence of organelles not found in most other eukaryotes - plastids. Plastids are a diverse group of interrelated organelles that perform a wide range of metabolic functions including photosynthesis, nitrogen and sulfur assimilation and the synthesis of amino acids, starch and fatty acids. These functions are coordinated with metabolic processes in the cytosol through dynamic exchange of metabolites and ions across the plastid inner envelope membrane.

My lab is studying phosphate (Pi) transport processes that link the metabolic pathways in the plastid and cytosol. The concentrations of Pi in the cytosol and plastid stroma influence photosynthesis and the partitioning and storage of fixed carbon. Transporters involved in the movement of Pi across the plastid inner membrane include members of the pPT, PHT2, and PHT4 families. We are using genetics, cell biology, biochemistry and molecular physiology to investigate the function and physiological roles of these transporters. We have also recently developed a series of genetically encoded FRET-based biosensors for Pi. These sensors allow us to monitor Pi concentrations in different subcellular compartments within live plants (and animals) in real time.

PUBLICATIONS

Mukherjee P, Banerjee S, Wheeler A, Ratliff LA, Irigoyen S, Garcia LR, Lockless SW, and


**SUPPORT**

DOE DE-SC0014037
Development of biosensors to measure the spatial and temporal concentration profiles of inorganic phosphate in plants during arbuscular mycorrhizal symbiosis
1 July 2015 – 30 June 2018
$1,217,923 total; $652,222 to TAMU

TAMU
*Development of On-Line Tools to Enhance Learning in Introductory Biology*
25 January 2014 – 31 August 2015
$72,838
Mary Wicksten
Professor

**BIOGRAPHY**

Dr. Mary Wicksten joined the Department of Biology at Texas A&M University in 1980, rising to Professor in 1994. She obtained her Ph.D. in Biology from the University of Southern California under the guidance of Dr. John Garth, a noted crustacean biologist who was among the first to write extensively on the marine fauna of the Galapagos Islands. She held a postdoctoral fellowship of the Allan Hancock Foundation of the University of Southern California, where she completed the first major work on carideans shrimps of the Gulf of California and participated in large-scale environmental impact studies of coastal to deep-sea ecosystems in southern California. She is the author or co-author of over 130 publications on marine invertebrates and ecosystems, and has in press a book on the biology of oil and gas platforms. She was recognized as a National Fellow of the Explorers Club for her participation and publication on marine biota of isolated and mostly unexplored reefs of the eastern and western Pacific. Since coming to Texas A&M University, she was one of the senior investigators on the Deep Gulf of Mexico Benthic Project, a four-year study of the biota living at depths of 200-3000 m. She currently is assisting in interpretation of live video feed from remotely operated vehicles at 150-4000 m in the Gulf of Mexico and the central Pacific, describing symbioses between poorly-known deep-water corals and crustaceans. Dr. Wicksten teaches Invertebrate Zoology and Marine Biology at the undergraduate level, and Biology of the Invertebrates at the Graduate Level. She has received a Distinguished Teaching Award. Her classes make use of the Marine Invertebrates Collection of the Texas A&M University Biodiversity, Research and Teaching Collection, of which she is curator. An enthusiastic aquarist, she incorporates observation and demonstration of local marine fishes and invertebrates into her classes. She also participates in the Scientific Diving Program and has logged over 1350 hours underwater.

**RESEARCH**

Decapods are among the best-known crustaceans, ranging from tiny shrimp to crabs with a leg span of up to nearly 4 m. Major predators, disturbers of sediments, and elements of food chains, these animals are found in almost all marine habitats. New species continue to be found. Of those already known to science, often the descriptions are very old and lack details needed for more modern comparative work. Genetic studies are in their infancy.

Decapods can range in color from brilliantly marked to dull, white or transparent. Color patterns can function in camouflage, courtship, or aggressive displays, but may differ within a single species according to age, diet, or sex. The consistency of color patterns within a species is unknown in many, if not most, decapods. Pigmentation may be a function not only of visual communication but also serve in physiological processes such as intermediary metabolism and strengthening of the integument. Some crabs add to their camouflage by carrying foreign
objects or attaching sponges, shells, algae, etc. to their bodies. Studies on adaptive coloration and camouflage must integrate laboratory work under controlled conditions with observations and photography in the natural habitat. My own current work on spider crabs and hippolytid shrimp indicates phylogenetic trends in behavior and coloration within certain clades and marked differences within others. Do these differences reflect problems with the currently accepted systematic arrangement?

To publish anything worthwhile on behavior of a species, one must be able to identify that species. I am studying the Thoridae, a family of small-sized marine shrimp that are remarkably diverse in the cold waters of the North Pacific. Evidence suggests that these shrimp may be losing range due to global warming. They may be replaced by members of a different family, the Palaemonidae, a group of more aggressive predatory shrimp. But to study such a replacement, one must identify the shrimp. The last major study was in 1906. All previous work has been morphological. Evidence from my own work and that of Greg Jensen, University of Washington, suggests that not only have species been confused (one species is actually two, three species actually are only one) but the generic designation may depend on temperature-dependent features. With a small start-up grant from the Arctic Biodiversity Study, I am collaborating with Luis Hurtado, Department of Wildlife and Fisheries Science, to obtain some molecular data on genetic affinities within the Thoridae and potentially allied shrimp taxa. These data may at least indicate which of the supposed genera are distinct or even if the Thoridae is indeed a natural group.

**PUBLICATIONS**


Wicksten, M. 2000. The species of Lysmata (Caridea: Hippolytidae) from the eastern Pacific Ocean. Amphipacifica 2: 3-22
Mark J. Zoran
Professor and Associate Dean for Graduate Studies and Faculty Affairs

BIOGRAPHY
Dr. Mark Zoran joined the Department of Biology at Texas A&M University in 1991, rising to Professor in 2011. He obtained his Ph.D. in Zoology from Iowa State University, under the guidance of Dr. Charles Drewes. His postdoctoral work in the neurobiology laboratory of Dr. Philip Haydon, also at Iowa State, focused on cellular regulation of specific synapse formation between neurons. After five years as the Graduate Advisor in Biology, he was appointed Associate Dean for Graduate Studies in the College of Science in 2003 and since 2014 also oversees Faculty Affairs for the college. He is a member of the Interdisciplinary Faculty of Neuroscience, which he chaired from 2001-2007, and the Center for Biological Clocks Research. Dr. Zoran teaches Principles of Animal Physiology at the undergraduate level and Comparative and Developmental Neurobiology courses for graduate students. He has won several awards, including the Association of Former Students’ Distinguished Achievement for Teaching and service awards from Sigma Xi Scientific Research Society and Texas A&M Institute for Neuroscience.

RESEARCH
Dr. Zoran’s laboratory studies cellular and molecular mechanisms governing communication among brain cells, both neurons and glia. Since these interactions mediate most neural integration and behavioral outputs, an understanding of their development and plasticity is crucial to an ultimate appreciation of brain function. Dr. Zoran studies neural cell communication in several behavioral contexts and in multiple animal systems. One of his projects is focused on a form of nervous system regeneration called neural morphallaxis in the annelid worm, *Lumbriculus variegatus*, where synaptic connections rapidly change as neurons take on new positional identities. Another project centers on biological clock regulation of neural cell communication in the mammalian brain. His circadian neuroscience studies investigate the role of adenosine triphosphate (ATP) signaling as an important output of the mouse biological clock of specific brain cells called astrocytes. His lab aims to determine the role of this clock-controlled signaling in normal brain function and in various neurological disorders. Dr. Zoran is also co-investigator on a research project studying the role of glycosylation of neuronal proteins in nervous system function.

PUBLICATIONS


**SUPPORT**

NIH Grant, NINDS R01 NS075534-01 (Co-PI with V. Panin, Biochemistry and Biophysics)

*The Control of Neural Transmission by Glycosylation*

Award Period: 8/01/2011 - 7/31/2016; Total costs: $1,567,970