Program Proposal
Form B

Academic Group (College): NSM
Date of Submission to College Dean: September 29, 2008

Academic Organization (Department): Biological Sciences
Requested Effective: Fall X, Spring__, 2009.

Department Chair: Rose Leigh Vines
Contact if not Department Chair: Shannon Datwyler or Thomas Peavy

Title of the Program: Master of Arts in Biological Sciences

Type of Program Proposal:

___ Modification in Existing Program:
   ___ Substantive Change
   ___ Non-Substantive Change
   ___ Deletion of Existing Program

___X___ New Programs
   ___ Initiation (Projection) of New Program on to Master Plan
      ___X___ New Degree Programs
      ___X___ Fast Track Process
      ___ Pilot Process
      ___ New Minor, Concentration, Option, Specialization, Emphasis
      ___ New Certificate Program

PLEASE NOTE: Form B is to be used only as a Cover Form. Additional information is requested for each of the above as noted in the corresponding procedure in the Policies and Procedures for Initiation, Modification, Review and Approval of Courses and Academic Programs found at http://www.csus.edu/acaf/univmanual/index.htm

Briefly describe the program proposal (new or change) and provide a justification.
In an effort to sustain and strengthen our graduate program in the Department of Biological Sciences,

We propose to expand our graduate program offerings within the Department of Biological Sciences at CSUS by adding a Master of Arts (MA) non-thesis degree to our pre-existing Master of Science (MS) thesis degree. One of our main goals is to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the MA and MS programs will be identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the MA program will be a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the MA program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our proposed MA program will serve an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.
Approvals:

Department Chair: Ron Zigler Vice Date: 10/16/08

College Dean: Laurel Jefferson Date: 10/20/08

University Committee: Date:

Associate Vice President and Dean for Academic Affairs: Date:

8/27/07
PROPOSAL FOR THE MASTER OF ARTS DEGREE IN BIOLOGICAL SCIENCES
Thomas R. Peavy, PhD
Biological Sciences Department
Fall 2008

1. **Complete Form B** – see attached

2. **Definition of the Proposed Degree Major Program**

   a. **Campus:** Sacramento
      
      **Degree Terminology:** Master of Arts in Biological Sciences
      **Intended implementation:** Fall 2009

   b. **Department:** Biological Sciences
      
      **Contact:** Dept. Chair Rose Leigh Vines or Thomas Peavy

   c. **Proposer:** Thomas R. Peavy, PhD, Assistant Professor of Biological Sciences and Chair of the Graduate Task Force subcommittee.

   d. **Objectives:**
      
      The main objective of the MA program is to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems without a thesis requirement. We currently offer a Master of Science thesis degree based on original research in biology; however, not all individuals that would like to pursue graduate education need a thesis-based degree for their career development. We are thus proposing that in lieu of thesis research, students in the MA program would be required to complete a written project based on a research problem in biology under the supervision of a Biological Sciences faculty advisor.

   e. **Total number of units required for the major:** 30 (note: same as the Master of Science thesis degree program in the Biological Sciences)

   List of required courses (note: No new core courses are proposed, however a new culminating requirement (BIO 502) is needed since it is a project rather than a thesis)

   **Required Core Courses (7 units)**
   
   (2) BIO 220 Research Methods in Biological Sciences
   
   (1) BIO 294 Seminar
   
   (2) BIO 299 Problems in Biological Sciences (normally, up to 4 units may be applied to meet coursework requirements, however up to 8 units of 299 may be counted for students pursuing internship-based research in departmentally approved placements)

   Select one of the following:
   
   (2) BIO 221A Cell & Molecular Methods and Techniques
   OR
   
   (2) BIO 221B Methods in Ecology, Evolution and Conservation
Culminating Requirement (2 units)
(2) BIO 502 Master’s Project.
Catalog description: Completion of a written project based on a research problem in biology approved for the Master of Arts degree. Should be taken in final semester prior to the completion of all requirements for the degree. 2 units.

f. List of Elective Courses: (21 units; also up to six units of undergraduate upper division coursework taken as a graduate student may be applied to the MA degree if approved by advisory committee)
(3) BIO 214 Advanced Plant Ecology (BIO 160)
(3) BIO 222 Molecular Biology (BIO 184, CHEM 161)
(3) BIO 223 Human Molecular Genetics (BIO 139, BIO 184, CHEM 161)
(3) BIO 224 Genomics, Proteomics, and Bioinformatics (BIO 184, BIO 222 or instructor permission)
(2) BIO 233 Review of Human Gross Anatomy (BIO 22, BIO 122)
(3) BIO 245 Host/Pathogen Interactions (BIO 121, BIO 139, BIO 184)
(2) BIO 247 Contemporary Topics in Immunology (BIO 149A or instructor permission)
(3) BIO 260 Population and Community Ecology (BIO 160)
(3) BIO 269 Behavioral Ecology (BIO 160 or instructor permission)
(2) BIO 270 Conservation Policy and Administration (BIO 118, BIO 173 or BIO 179)
(3) BIO 273 Advanced Fishery Biology and Management (BIO 173 or instructor permission)
(3) BIO 279 Conservation Biology and Wildlife Management (BIO 160, BIO 179 or instructor permission)
(3) BIO 282 Evolution
(3) BIO 283 Biogeography
(3) BIO 292 Biological Concepts
(2) BIO 293 Research Conference (instructor permission)
(1-3) BIO 296 Experimental Offerings in Biological Sciences
(1) BIO 297A Teaching Biology Seminar (acceptance in GTA program or instructor permission)
(1) BIO 297B Laboratory Teaching (acceptance in GTA program or instructor permission)

g. Formal options, concentrations, or special emphases: none proposed

h. Course prerequisites and criteria for admission or continuation in the proposed program:

Prerequisites for individual courses are listed above in parentheses.

Admission criteria:
• a baccalaureate degree;
• completion of a major in biological sciences or closely related field; or completion of 24 units of upper division biological science courses or courses in closely related fields, each of which must be passed with a “C-“ or better;
• a minimum GPA of 2.75 in all biology courses and a minimum GPA of 3.0 in upper
division biology courses
• GRE General Test scores;
• GRE Subject Test scores (either Biology, Biochemistry, or Cell and Molecular Biology
scores are acceptable);
• two letters of recommendation from persons qualified to judge the applicant’s potential
for successful graduate study; and
• a statement of purpose

Continuation in proposed program is contingent upon the following:
• minimum grade point average of 3.0 is required for all courses used to meet degree
requirement (courses in which a student earns a grade of C- or less may not be used to
meet degree requirements)
• Student removes admission deficiencies identified by the admission committee (e.g.
undergraduate upper division coursework) by the end of their second semester
• A biology faculty member has agreed to serve as their faculty advisor
• Student passes the Writing Proficiency Examination (WPE) or secured approval for a
WPE waiver
• Student advances to candidacy prior to enrolling in BIO 502 (culminating requirement)

i. **Explanation of special characteristics:** not applicable

j. **Articulation with community college programs:** not applicable

k. **Provision for meeting accreditation requirements:**
Biology programs are not accredited by any outside agencies or organizations.

3. **Need for Proposed Degree Major Program**

a. **List of CSU campuses and nearby institutions offering a non-thesis masters degree in
the Biological Sciences:**
   i. CSU San Bernardino (MS, non-thesis program plan II)
   ii. San Jose State University (MA, coursework master’s degree)
   iii. CSU East Bay (MS, Plan B, non-thesis)
   iv. Cal Poly San Luis Obispo (Plan 2, non-thesis “Course Work Plan”)
   v. CSU Bakersfield (MS non-thesis option)
   vi. CSU Channel Islands (MS non-thesis programs)

b. **Differences between the proposed program and those listed above:**
Description of other non-thesis masters degree programs:
   i. CSU San Bernardino (MS, non-thesis program plan II)
      In addition to 45 units of coursework (same for their MS thesis program plan I), non-thesis
      students are required to pass a comprehensive exam administered by the Biology department.

   ii. San Jose State University (MA, coursework master’s degree)
In addition to 30 units of coursework (same as their MS thesis program), MA students are required to pass both written and oral examinations administered by the biological sciences faculty.

iii. CSU East Bay (MS, Plan B, non-thesis)
In addition to 45 units of coursework (same for their MS thesis program, Plan A), MA students are required to complete a review paper based on “intensive study and analysis of the scientific literature” on a topic approved by the major professor and advisory committee. The student also needs to pass an oral defense centered on their chosen review topic.

iv. Cal Poly San Luis Obispo (Plan 2, non-thesis “Course Work Plan”)
Additional coursework is required in place of the thesis units (9 units) for a total of 45 units (same total units as for their MS thesis option). Non-thesis students are also required to complete two comprehensive exams (the GRE biology subject test with score >650, and an essay exam covering three general areas of biology), and a written report on an “Independent study” project that is to be approved by the student’s advisor.

v. CSU Bakersfield (MS non-thesis option)
In addition to 45 units of coursework (same for their MS thesis option), students are required to complete a project on a topic that is approved by the Graduate Committee (presented at time of advancement to candidacy).

vi. CSU Channel Islands (MS non-thesis programs)
The biology program has no thesis options but rather has two non-thesis degree offerings. The first is a MS degree in Biotechnology and Bioinformatics which is in essence simply coursework (33-34 units) with no culminating requirement. This track is designed to “prepare students with analytical, business and managerial skills along with sophisticated expertise in biotechnology and computational sciences for a diverse set of vocations.” The second is a MS degree in Biotechnology & MBA Dual Degree (71 units) which requires a capstone project. This track is targeted for individuals interested in business-related careers within the biotechnology industry.

Comparison of our proposed non-thesis master’s program to other programs:
Our program proposal is for 30 coursework units which is most similar to San Jose State University’s MA coursework requirements. It should be noted that CSU Sacramento and San Jose State University are both on the semester system, whereas all of the campuses listed above that require 45 coursework units are on the quarter system. Our culminating requirement is a written project which is most similar to CSU East Bay but differs significantly. Students in our program will have two options for their written report. One option is to write a grant proposal that incorporates a literature review for background information (similar to CSU East Bay), but then goes a step beyond by challenging the student to apply the scientific process to identify a biological problem within this topic area and propose a means to experimentally solve it. Alternatively, a student can perform short-term internship-based research in departmentally approved placements, and then provide a formal written report on the project (i.e. Lab Project Report). Most other non-thesis programs require students to pass an exam for the culminating requirement.
c. List of other related curricula (at CSUS):
MS degree in Biological Sciences (thesis)

d. Results of formal survey:

An online survey was performed during the summer of 2008 to assess the demand for a non-thesis master’s degree in the biological sciences to a population of K-12 teachers (one of the main target audiences for this degree program). The teacher database was created and generously shared by the Center for Mathematics & Science Education (MASE). The teachers in their database are local, credentialed, and have participated in the MASE center’s professional development activities. The survey was constructed using the software within the web-site SurveyMonkey.com (http://www.surveymonkey.com/) so as to enable anonymous responses and automatic tabulation of results. Although 100 responses were collected and analyzed, even more responses could have been collected had it not been for the collection number limitation within the free version of the online software (as evidenced by teacher emails and phone calls received after the survey was closed).

Within the survey, the target audience was provided with an overview of our non-thesis program with respect to its goals, admission requirements, and degree requirements prior to answering four questions. The results of the survey are summarized below.

Question 1: Would it be of interest to you to have a Master’s degree in the biological sciences for your professional development?
All 100 individuals responded with 50 of them stating Yes (50%) and the other 50 stating No (50%).

Question 2: If so, would you consider applying for admission into our proposed non-thesis MA degree program?
Of the 80 respondents to this question (the non-responding 20 individuals were from the No category above), 48 stated Yes (60%) and 32 stated No (40%).

Question 3: What is your current occupation? (Note: teachers, please specify which grade level you teach)
Elementary school level: 42 respondents (34 of these responded to question #2 and 15 replied Yes which is 44%)
Middle school level: 29 respondents (21 of these responded to question #2 and 18 replied Yes which is 86%)  
High school level: 23 respondents (16 of these responded to question #2 and 11 replied Yes which is 69%)
The remaining 6 respondents were comprised of administrators connected to curriculum development or implementation (e.g. coordinators or program directors) of which 3 of the 6 responded Yes to question #2.

Question 4: Would you be willing to be contacted by a faculty member (by email or phone) to provide us with valuable feedback so as to fine tune the program to match your needs? If so, please provide your contact information.
Thirty-seven individuals responded yes.
Analysis:

It seems evident that there is a significant amount of interest within the teacher population to warrant such a non-thesis program in the biological sciences in the Sacramento region. A thesis program does not seem to be the highest priority for a teacher’s professional development. When teachers of different grade levels were subdivided and analyzed separately to assess their interest in our program within their subgroups (yes response to question 2), middle and high school teachers tended to have more interest (elementary 44%; middle school 86%, high school 69%). Since the focus of our program is on advanced coursework in the biological sciences, we anticipated that teachers of upper grade levels would likely have professional development goals more aligned with our program.

In addition to those surveyed above, one local law student attending McGeorge School of Law expressed a desire to join our non-thesis master’s program. The law student stated that their career goal is to become a patent lawyer specializing in the biological sciences and that a master’s degree in the biological sciences would augment their credentials and credibility in this profession. In addition, they stated a preference for a non-thesis program since a thesis was not necessary for their professional development.

e. Number of declared undergraduate majors and the degree production over the preceding years for the corresponding baccalaureate program:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Department Total</td>
<td>674</td>
<td>763</td>
<td>881</td>
<td>916</td>
<td>910</td>
</tr>
<tr>
<td>College Total</td>
<td>1,169</td>
<td>1,323</td>
<td>1,531</td>
<td>1,603</td>
<td>1,588</td>
</tr>
<tr>
<td>% of College</td>
<td>57.7%</td>
<td>57.7%</td>
<td>57.5%</td>
<td>57.1%</td>
<td>57.3%</td>
</tr>
</tbody>
</table>

Degree Production:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Bachelor’s</td>
<td>96</td>
<td>99</td>
<td>134</td>
<td>150</td>
<td>136</td>
<td>123</td>
</tr>
<tr>
<td>Second Bachelor’s</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Master’s</td>
<td>6</td>
<td>16</td>
<td>13</td>
<td>15</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>115</td>
<td>148</td>
<td>165</td>
<td>149</td>
<td>136</td>
</tr>
</tbody>
</table>

f. Professional uses of the proposed degree major program:

- K-12 teachers: professional advancement
- Lawyers: enrich credentials for biological applications (e.g. patent law, environmental law, medical law, genetic privacy)
- Biotechnology: enhance job opportunities and professional advancement
- State agencies: enhance job opportunities and professional advancement
- Students: additional preparation to increase student opportunities for admission into Ph.D programs, medical school, and other biology-related and health professional schools (e.g. pharmacy, dentistry, etc)
• Alternative careers: preparation for other biology-related careers (e.g. scientific journalism, health/medical reporting, scientific illustration, hospital administration, etc)

g. Expected number of majors in years 1, 3, and 5 and expected number of graduates in years 1, 3, 5:
   We anticipate accepting anywhere between 10-25 applicants per year depending on the quality of applicants, availability of major advisors, and space in classes. It is to be noted that we would also be simultaneously accepting applicants into our MS thesis program which has similar limitations. We anticipate that applicants accepted into our MA program will be able to graduate at the end of 4 semesters of full time student status (at least 8 units enrolled per semester).

4. Existing Support Resources for the Proposed Degree Major Program:

a. Faculty:
   All of the faculty in the Biological Sciences department are considered potential faculty advisor candidates for MA students (see table 1). In addition, faculty from other biology-related departments can serve as one of the three advisory committee members if approved by the department’s graduate committee that oversees graduate affairs. MA students will be required to organize an advisory committee comprised of three faculty members of which two must be within the Biological Sciences department.

b. Space and facilities:
   The Department of Biological Sciences is located in Sequoia Hall and Humboldt Hall. Lecture and laboratory courses are usually taught in these two buildings, but depending on course size and classroom demand, lectures can be taught in other buildings on campus. Since we are not proposing to expand our course offerings for our MA degree, we expect to be able to accommodate the MA students within our existing graduate course structure which is currently not impacted by over-enrollment.

c. Library resources:
   The campus library has adequate access to biology-related journals and books for graduate coursework and preparation for the MA project. In the event that the campus does not have a subscription to the desired journal or does not have the particular book in their collection, our interlibrary service is committed to procuring copies of articles and book loans for full student access.

d. Equipment and other specialized materials currently available:
   As previously stated, the Department of Biological Sciences has a MS thesis program and has thus acquired all the essential equipment and materials to teach our graduate level (and undergraduate) courses listed in our curriculum (listed in section 2e and 2f). In addition, last year we added two new graduate courses to our curriculum (BIO 221A Cell & Molecular Methods and Techniques; and BIO 221B Methods in Ecology, Evolution and Conservation) that are to be implemented this spring semester 2009. Two Curriculum & Infrastructure grants from the CSU Program for Education and Research in Biotechnology (CSUPERB) were awarded (PI Thomas Peavy, Co-PI Thomas Landerholm; 2005-06 yr $12,805; 2007-08 yr $14,155) for
equipment and supplies to facilitate the creation of our BIO 221A “Cell and Molecular Methods and Techniques” course. In addition, we will be submitting a Course, Curriculum and Laboratory Improvement (CCLI) grant proposal to NSF this coming spring to further update our equipment to improve our cutting-edge training for our students. Although we do strive to update, it should be re-emphasized that we currently have all the equipment and resources to teach our courses.

5. Additional Support Sources
a. Form C (not completed; optional for fast track proposals)

b. Special characteristics of additional faculty or staff support positions: none needed

c. Amount of additional lecture or laboratory space for the next five years: none needed.

d. Additional library resources needed: none

6. Abstract of the Proposal and Proposed Catalog Description.

ABSTRACT

We propose to expand our graduate program offerings within the Department of Biological Sciences at CSUS by adding a Master of Arts (MA) non-thesis degree to our pre-existing Master of Science (MS) thesis degree. One of our main goals is to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the MA and MS programs will be identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the MA program will be a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the MA program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our proposed MA program will serve an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.

CATALOG DESCRIPTION

Program Description: The graduate program in Biological Sciences leads to a Master of Science (MS) or a Master of Arts (MA) degree. The program is designed to provide opportunities for students to pursue advanced training in particular fields of biology, to advance their professional goals in fields such as teaching, state agencies, or biotechnology, or to increase their preparation for entry into doctoral or health professional programs. The MS degree requires completion of a thesis and has concentrations in “Biological Conservation” and “Molecular and Cellular Biology.” This degree emphasizes advanced training and research
experience in these fields. The MA degree is a non-thesis degree that combines advanced coursework and completion of a written project based on a research problem in biology.
<table>
<thead>
<tr>
<th>Name</th>
<th>Title</th>
<th>Affiliation</th>
</tr>
</thead>
<tbody>
<tr>
<td>William E. Avery, Ph.D.</td>
<td>Associate Professor</td>
<td>(hired Fall 1998)</td>
</tr>
<tr>
<td></td>
<td>Research: Ecology, Invertebrate Zoology, and Marine Biology</td>
<td></td>
</tr>
<tr>
<td>Ruth E. Ballard, Ph.D.</td>
<td>Full Professor</td>
<td>(hired Fall 1998)</td>
</tr>
<tr>
<td></td>
<td>Research: Human Molecular Genetics and Forensics</td>
<td></td>
</tr>
<tr>
<td>Juanita Barrena, Ph.D.</td>
<td>Full Professor</td>
<td>(hired Fall 1975)</td>
</tr>
<tr>
<td></td>
<td>Research: Vertebrate and Reproductive Physiology</td>
<td></td>
</tr>
<tr>
<td>James W. Baxter, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2003)</td>
</tr>
<tr>
<td></td>
<td>Research: Plant Ecology, Mycorrhizal Ecology, Biodiversity-functioning</td>
<td></td>
</tr>
<tr>
<td>Rosalee C. Carter, Ph.D.</td>
<td>Full Professor</td>
<td>(hired Fall 1995)</td>
</tr>
<tr>
<td></td>
<td>Research: Human Anatomy, Electron Microscopy, Neuroscience</td>
<td></td>
</tr>
<tr>
<td>Ronald M. Coleman, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2001)</td>
</tr>
<tr>
<td></td>
<td>Research: Evolutionary Ecology, Behavior, and Fishes</td>
<td></td>
</tr>
<tr>
<td>Shannon Datwyler, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2004)</td>
</tr>
<tr>
<td></td>
<td>Research: Reproductive Biology of Plants</td>
<td></td>
</tr>
<tr>
<td>Nick Ewing, Ph.D.</td>
<td>Full Professor</td>
<td>(hired Fall 1994)</td>
</tr>
<tr>
<td></td>
<td>Research: Plant Molecular Biology and Plant Physiology</td>
<td></td>
</tr>
<tr>
<td>Enid Gonzalez, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2008)</td>
</tr>
<tr>
<td></td>
<td>Research: Microbial Genetics</td>
<td></td>
</tr>
<tr>
<td>Sarah Greenleaf, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2007)</td>
</tr>
<tr>
<td></td>
<td>Research: Conservation, agro-systems, ecology, biodiversity</td>
<td></td>
</tr>
<tr>
<td>Brett Holland, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2003)</td>
</tr>
<tr>
<td></td>
<td>Research: Evolutionary genetics, Social Evolution, Sexual Selection</td>
<td></td>
</tr>
<tr>
<td>Christine Kirvan, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2003)</td>
</tr>
<tr>
<td></td>
<td>Research: Infectious disease, Autoimmunity, and Molecular mimicry</td>
<td></td>
</tr>
<tr>
<td>Jamie Kneitel, Ph.D.</td>
<td>Assistant Professor</td>
<td>(hired Fall 2004)</td>
</tr>
<tr>
<td></td>
<td>Research: Community Ecology, Food Webs, Conservation Biology</td>
<td></td>
</tr>
<tr>
<td>Winston Lancaster, Ph.D.</td>
<td>Associate Professor</td>
<td>(hired Fall 2002)</td>
</tr>
<tr>
<td></td>
<td>Research: Human Anatomy, Biosonar in Bats, Functional Morphology</td>
<td></td>
</tr>
<tr>
<td>Tom Landerholm, Ph.D.</td>
<td>Associate Professor</td>
<td>(hired Fall 2002)</td>
</tr>
<tr>
<td></td>
<td>Research: Cell and Developmental Biology</td>
<td></td>
</tr>
<tr>
<td>Susanne Lindgren, Ph.D.</td>
<td>Full Professor</td>
<td>(hired Fall 1997)</td>
</tr>
<tr>
<td></td>
<td>Research: Pathogenic Bacteriology</td>
<td></td>
</tr>
</tbody>
</table>
Melanie Loo, Ph.D., Full Professor (hired Fall 1977)
  Research: Molecular and Developmental Genetics

Jennifer Lundmark, Ph.D., Associate Professor (hired Fall 1996)
  Research: Cardiovascular Physiology

Robert R. Metcalf, Ph.D., Full Professor (hired Fall 1970)
  Research: General Microbiology

Hao Nguyen, Ph.D., Associate Professor (hired Fall 2002)
  Research: Cell and Molecular Biology; Colon Carcinogenesis

Tom Peavy, Ph.D., Assistant Professor (hired Fall 2004)
  Research: Molecular Genetics

Adam Rechs, Ph.D., Assistant Professor (hired Fall 2003)
  Research: Neurophysiology, Digestive Physiology

Ben Sacks, Ph.D., Assistant Professor (hired Fall 2007)
  Research: Evolution, ecology and conservation of vertebrates

Chris Sullivan, Ph.D., Assistant Professor (hired Fall 2006)
  Research: Physiology/Anatomy, Vascular Biology, Angiogenesis

Rose Leigh Vines, Ph.D., Full Professor (hired Spring 1979)
  Research: Anatomy, Clinical Hematology, Clinical Laboratory Science
PROPOSAL FOR THE MASTER OF ARTS DEGREE IN BIOLOGICAL SCIENCES
Thomas R. Peavy, PhD
Biological Sciences Department
Fall 2008

1. Complete Form B – see attached

2. State the purpose of the program
The purpose of the Master of Arts (MA) degree program is to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems without the requirement of a thesis. One of our main goals is to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). Thus, we propose to expand our graduate program offerings within the Department of Biological Sciences at CSUS by adding a Master of Arts (MA) non-thesis degree to our pre-existing Master of Science (MS) thesis degree so as to address this educational need in the Sacramento region.

3. How does the proposed program fit into the mission of the University and the program responsibility of the College and the academic unit that will offer the program?
The University is committed to teaching and learning and “providing an excellent education to all eligible applicants who aspire to expand their knowledge and prepare themselves for meaningful lives, careers, and service to their community”. Our proposed MA program is a good fit with the University’s mission to provide quality post-baccalaureate/graduate degree programs to prepare individuals for successful careers. In addition, our program also advances the mission of our Department of Biological Sciences within the College of Natural Sciences and Mathematics to “offer a high quality graduate program that provides advanced academic and research training in biology”.

4. Describe the need for the program with respect to student interest, interest in the community and the demand within our service area for graduates of the program.

a. Student interest
Although we did not survey our undergraduate biology students, many of our own graduates apply to our MS thesis program. Some of these students expressed interest (verbal communication) in the concept of a non-thesis graduate program since their career objectives often do not require a thesis degree but rather advanced coursework preparation. For example, some students would like to increase their chances for admission into Ph.D. programs, medical school, and other biology-related and health professional schools (e.g. pharmacy, dentistry, etc). Other students could use the graduate course training to assist them in attaining jobs in the biotechnology sector, laboratories, and state agencies (e.g. Department of Fish and Game).

b. Community interest and demand within area
An online survey was performed during the summer of 2008 to assess the demand for a non-thesis master’s degree in the biological sciences to a population of K-12 teachers (one of the main target audiences for this degree program). The teacher database was created and
generously shared by the Center for Mathematics & Science Education (MASE). The teachers in their database are local, credentialed, and have participated in the MASE center’s professional development activities. The survey was constructed using the software within the web-site SurveyMonkey.com (http://www.surveymonkey.com/) so as to enable anonymous responses and automatic tabulation of results. Although 100 responses were collected and analyzed, even more responses could have been collected had it not been for the collection number limitation within the free version of the online software (as evidenced by teacher emails and phone calls received after the survey was closed).

Within the survey, the target audience was provided with an overview of our non-thesis program with respect to its goals, admission requirements, and degree requirements prior to answering four questions. The results of the survey are summarized below.

Question 1: Would it be of interest to you to have a Master’s degree in the biological sciences for your professional development?
All 100 individuals responded with 50 of them stating Yes (50%) and the other 50 stating No (50%).

Question 2: If so, would you consider applying for admission into our proposed non-thesis MA degree program?
Of the 80 respondents to this question (the non-responding 20 individuals were from the No category above), 48 stated Yes (60%) and 32 stated No (40%).

Question 3: What is your current occupation? (Note: teachers, please specify which grade level you teach)
Elementary school level: 42 respondents (34 of these responded to question #2 and 15 replied Yes which is 44%)
   Middle school level: 29 respondents (21 of these responded to question #2 and 18 replied Yes which is 86%)
   High school level: 23 respondents (16 of these responded to question #2 and 11 replied Yes which is 69%)
   The remaining 6 respondents were comprised of administrators connected to curriculum development or implementation (e.g. coordinators or program directors) of which 3 of the 6 responded Yes to question #2.

Question 4: Would you be willing to be contacted by a faculty member (by email or phone) to provide us with valuable feedback so as to fine tune the program to match your needs? If so, please provide your contact information.
Thirty-seven individuals responded yes.

Analysis:
It seems evident that there is a significant amount of interest within the teacher population to warrant such a non-thesis program in the biological sciences in our Sacramento region. A thesis program does not seem to be the highest priority for a teacher’s professional development. When teachers of different grade levels were subdivided and analyzed separately to assess their interest in our program within their subgroups (yes response to question 2), middle and high school teachers tended to have more interest (elementary 44%; middle school 86%, high school
69%). Since the focus of our program is on advanced coursework in the biological sciences, we anticipated that teachers of upper grade levels would likely have professional development goals more aligned with our program.

In addition to those surveyed above, one local law student attending McGeorge School of Law expressed a desire to join our non-thesis master’s program. The law student stated that their career goal is to become a patent lawyer specializing in the biological sciences and that a master’s degree in the biological sciences would augment their credentials and credibility in this profession. In addition, they stated a preference for a non-thesis program since a thesis was not necessary for their professional development.

5. Indicate the anticipated student demand for the program. Upon what basis were these estimates derived?

We anticipate receiving enough applications from K-12 teachers involved in science education as well as from students and professionals that desire graduate-level training in biology to warrant accepting anywhere between 10-25 applicants per year. The exact number we accept will depend on the quality of applicants, availability of major advisors, and space in classes. The basis of this estimate is from our survey of K-12 teachers that participated in science and mathematics professional development programs (48 out of 100 responded that they were interested in our program). As mentioned above, graduates from biology-related bachelor's programs that require additional educational preparation for admission into other programs would also be prime candidates for our non-thesis degree program. Although we do not know exactly how many applicants we would receive from individuals in non-teaching careers, we feel confident that there will be applicants from other walks of life (e.g. one law student intends to apply to the program). Unfortunately, we did not have access to a database of individuals that we could have easily surveyed the demand from other non-teaching careers.

6. Describe the general scope and content of the proposed program.

The MA degree is a non-thesis degree that combines advanced coursework with a culminating project that is a written project based on a research problem in biology under the supervision of a faculty advisor. Acceptance into the MA program is contingent upon meeting our graduate admission requirements (see Graduate Admission Requirements section) and available space in the program. MA students must have a faculty advisor before enrolling in their third semester and prior to advancing to candidacy.

Graduate Admission Requirements
Admission as a fully classified graduate student to the MS or MA program requires:

- a baccalaureate degree;
- completion of a major in biological sciences or closely related field; or completion of 24 units of upper division biological science courses or courses in closely related fields, each of which must be passed with a "C-" or better;
- a minimum GPA of 2.75 in all biology courses and a minimum GPA of 3.0 in upper division biology courses
- GRE General Test scores;
• GRE Subject Test scores (either Biology, Biochemistry, or Cell and Molecular Biology scores are acceptable);
• a faculty member who has agreed to serve as their faculty advisor;
• two letters of recommendation from persons qualified to judge the applicant’s potential for successful graduate study; and
• a statement of purpose

MA Degree Requirements
The MA degree requires completion of 30 units of course work with a minimum GPA of 3.0. The 30 units must include a minimum of 18 units of 200-level courses.

Each student who receives an MA degree from the Department of Biological Sciences must submit a written project based on a research problem in biology under the supervision of a Biological Sciences faculty advisor. Students in our program will have two options for their written report. One option is to write a grant proposal that incorporates a literature review for background information, but then challenges the student to apply the scientific process to identify a biological problem within this topic area and propose a means to experimentally solve it. Alternatively, a student can perform short-term internship-based research in departmentally approved placements, and then complete a formal written report on the project (i.e. Lab Project Report).

All MA degree requirements must be completed within seven years starting from the time the first course is used to meet the Master’s degree requirements.

List of required courses
(note: No new core courses are proposed, however a new culminating requirement (BIO 502) is needed since it is a project rather than a thesis)

Required Core Courses (7 units)
(2) BIO 220 Research Methods in Biological Sciences
(1) BIO 294 Seminar
(2) BIO 299 Problems in Biological Sciences (normally, up to 4 units may be applied to meet coursework requirements, however up to 8 units of 299 may be counted for students pursuing internship-based research in departmentally approved placements)

Select one of the following:
(2) BIO 221A Cell & Molecular Methods and Techniques
OR
(2) BIO 221B Methods in Ecology, Evolution and Conservation

Culminating Requirement (2 units)
(2) BIO 502 Master’s Project
Catalog description: Completion of a written project based on a research problem in biology approved for the Master of Arts degree. Should be taken in final semester prior to the completion of all requirements for the degree. 2 units.
List of Elective Courses: (21 units; also up to six units of undergraduate upper division coursework taken as a graduate student may be applied to the MA degree if approved by advisory committee)

(3) BIO 214 Advanced Plant Ecology (BIO 160)
(3) BIO 222 Molecular Biology (BIO 184, CHEM 161)
(3) BIO 223 Human Molecular Genetics (BIO 139, BIO 184, CHEM 161)
(3) BIO 224 Genomics, Proteomics, and Bioinformatics (BIO 184, BIO 222 or instructor permission)
(2) BIO 233 Review of Human Gross Anatomy (BIO 22, BIO 122)
(3) BIO 245 Host/Pathogen Interactions (BIO 121, BIO 139, BIO 184)
(2) BIO 247 Contemporary Topics in Immunology (BIO 149A or instructor permission)
(3) BIO 260 Population and Community Ecology (BIO 160)
(3) BIO 269 Behavioral Ecology (BIO 160 or instructor permission)
(2) BIO 270 Conservation Policy and Administration (BIO 118, BIO 173 or BIO 179)
(3) BIO 273 Advanced Fishery Biology and Management (BIO 173 or instructor permission)
(3) BIO 279 Conservation Biology and Wildlife Management (BIO 160, BIO 179 or instructor permission)
(3) BIO 282 Evolution
(3) BIO 283 Biogeography
(3) BIO 292 Biological Concepts
(2) BIO 293 Research Conference (instructor permission)
(1-3) BIO 296 Experimental Offerings in Biological Sciences
(1) BIO 297A Teaching Biology Seminar (acceptance in GTA program or instructor permission)
(1) BIO 297B Laboratory Teaching (acceptance in GTA program or instructor permission)

Continuation in program:

- minimum grade point average of 3.0 is required for all courses used to meet degree requirement (courses in which a student earns a grade of C- or less may not be used to meet degree requirements)
- Student removes admission deficiencies identified by the admission committee (e.g. undergraduate upper division coursework) by the end of their second semester
- A biology faculty member has agreed to serve as their faculty advisor
- Student passes the Writing Proficiency Examination (WPE) or secured approval for a WPE waiver
- Student advances to candidacy prior to enrolling in BIO 502 (culminating requirement)

7. Estimate the resources (existing and new) required to operate the proposed program.

Existing Support Resources for the Proposed Degree Major Program:

a. Faculty
All of the faculty in the Biological Sciences department are considered potential faculty advisor candidates for MA students (see table 1). In addition, faculty from other biology-related departments can serve as one of the three advisory committee members if approved by the department’s graduate committee that oversees graduate affairs. MA students will be required to organize an advisory committee comprised of three faculty members of which two must be within the Biological Sciences department.

b. Space and facilities:
The Department of Biological Sciences is located in Sequoia Hall and Humbolt Hall. Lecture and laboratory courses are usually taught in these two buildings, but depending on course size and classroom demand, lectures can be taught in other buildings on campus. Since we are not proposing to expand our course offerings for our MA degree, we expect to be able to accommodate the MA students within our existing graduate course structure which is currently not impacted by over-enrollment.

c. Library resources:
The campus library has adequate access to biology-related journals and books for graduate coursework and preparation for the MA project. In the event that the campus does not have a subscription to the desired journal or does not have the particular book in their collection, our interlibrary service is committed to procuring copies of articles and book loans for full student access.

d. Equipment and other specialized materials currently available:
As previously stated, the Department of Biological Sciences has a MS thesis program and has thus acquired all the essential equipment and materials to teach our graduate level (and undergraduate) courses listed in our curriculum (listed in section 6 above). In addition, last year we added two new graduate courses to our curriculum (BIO 221A Cell & Molecular Methods and Techniques; and BIO 221B Methods in Ecology, Evolution and Conservation) that are to be implemented this spring semester 2009. Two Curriculum & Infrastructure grants from the CSU Program for Education and Research in Biotechnology (CSUPERB) were awarded (PI Thomas Peavy, Co-PI Thomas Landeholm; 2005-06 yr $12,805; 2007-08 yr $14,155) for equipment and supplies to facilitate the creation of our BIO 221A “Cell and Molecular Methods and Techniques” course. At the end of last year (spring 2007), our Dean of the College of Natural Science and Mathematics provided us with the funding to purchase a Real Time PCR instrument which is a state-of-the-art technology that will be used in the BIO 221A course. In addition, we will be submitting a Course, Curriculum and Laboratory Improvement (CCLI) grant proposal to NSF this coming spring to further update our equipment to improve our cutting-edge training for our students. Although we do strive to update, it should be re-emphasized that we currently have all the equipment and resources to teach our courses.

8. What is the proposed source of funding for the additional resource needs?
As stated above, we do not require additional funding since the existing course structure will be utilized. However, we will be applying for outside funding to continue to improve our laboratory courses and incorporate more state-of-the art technologies.
9. What programmatic or fiscal impact will the proposed program have on the sponsoring unit’s programs and other academic units within and outside the host College?

The expansion of our graduate program to incorporate a MA non-thesis program will add more students into the graduate program, however we will not need to increase our course offerings since we have space in our graduate classes to accommodate these students. Thus, no negative fiscal impact is expected. Also, we do not anticipate any negative fiscal impact on other academic units within and outside the college either.

10. Summary Statement for Submission to Chancellor’s Office

We propose to expand our graduate program offerings within the Department of Biological Sciences at CSUS by adding a Master of Arts (MA) non-thesis degree to our pre-existing Master of Science (MS) thesis degree. One of our main goals is to serve individuals whose primary motive is for professional career advancement in a biology-related field that do not need a thesis degree program (e.g. teaching, patent law, science journalism, biotechnology, and state agency positions). There is a demand for such non-thesis graduate degree programs as evidenced by our survey of K-12 teachers in the region and the establishment of similar programs by biology departments at six other CSU campuses. The coursework requirements for both the MA and MS programs will be identical so as to provide rigorous advanced course preparation (total of 30 units). However, in lieu of a research thesis, the culminating requirement for students in the MA program will be a written project based on a research problem in biology under the supervision of a faculty advisor. The primary objectives of the MA program are to produce students with an advanced understanding of biology and the ability to apply the scientific process to biological problems. Our proposed MA program will serve an unaddressed need in the Sacramento region by providing graduate education in biology for individuals who do not need a thesis degree for their professional development.
**Table 1 – Department of Biological Sciences Faculty & Interests**

**William E. Avery, Ph.D.**, Associate Professor (hired Fall 1998)  
Research: Ecology, Invertebrate Zoology, and Marine Biology

**Ruth E. Ballard, Ph.D.**, Full Professor (hired Fall 1998)  
Research: Human Molecular Genetics and Forensics

**Juanita Barrena, Ph.D.**, Full Professor (hired Fall 1975)  
Research: Vertebrate and Reproductive Physiology

**James W. Baxter, Ph.D.**, Assistant Professor (hired Fall 2003)  
Research: Plant Ecology, Mycorrhizal Ecology, Biodiversity-functioning

**Rosalee C. Carter, Ph.D.**, Full Professor (hired Fall 1995)  
Research: Human Anatomy, Electron Microscopy, Neuroscience

**Ronald M. Coleman, Ph.D.**, Assistant Professor (hired Fall 2001)  
Research: Evolutionary Ecology, Behavior, and Fishes

**Shannon Datwyler, Ph.D.**, Assistant Professor (hired Fall 2004)  
Research: Reproductive Biology of Plants

**Nick Ewing, Ph.D.**, Full Professor (hired Fall 1994)  
Research: Plant Molecular Biology and Plant Physiology

**Enid Gonzalez, Ph.D.**, Assistant Professor (hired Fall 2008)  
Research: Microbial Genetics

**Sarah Greenleaf, Ph.D.**, Assistant Professor (hired Fall 2007)  
Research: Conservation, agro-systems, ecology, biodiversity

**Brett Holland, Ph.D.**, Assistant Professor (hired Fall 2003)  
Research: Evolutionary genetics, Social Evolution, Sexual Selection

**Christine Kirvan, Ph.D.**, Assistant Professor (hired Fall 2003)  
Research: Infectious disease, Autoimmunity, and Molecular mimicry

**Jamie kneitel, Ph.D.**, Assistant Professor (hired Fall 2004)  
Research: Community Ecology, Food Webs, Conservation Biology

**Winston Lancaster, Ph.D.**, Associate Professor (hired Fall 2002)  
Research: Human Anatomy, Biosonar in Bats, Functional Morphology

**Tom Landenholm, Ph.D.**, Associate Professor (hired Fall 2002)  
Research: Cell and Developmental Biology

**Susanne Lindgren, Ph.D.**, Full Professor (hired Fall 1997)  
Research: Pathogenic Bacteriology
Melanie Loo, Ph.D., Full Professor (hired Fall 1977)
Research: Molecular and Developmental Genetics

Jennifer Lundmark, Ph.D., Associate Professor (hired Fall 1996)
Research: Cardiovascular Physiology

Robert R. Metcalf, Ph.D., Full Professor (hired Fall 1970)
Research: General Microbiology

Hao Nguyen, Ph.D., Associate Professor (hired Fall 2002)
Research: Cell and Molecular Biology; Colon Carcinogenesis

Tom Peavy, Ph.D., Assistant Professor (hired Fall 2004)
Research: Molecular Genetics

Adam Rechs, Ph.D., Assistant Professor (hired Fall 2003)
Research: Neurophysiology, Digestive Physiology

Ben Sacks, Ph.D., Assistant Professor (hired Fall 2007)
Research: Evolution, ecology and conservation of vertebrates

Chris Sullivan, Ph.D., Assistant Professor (hired Fall 2006)
Research: Physiology/Anatomy, Vascular Biology, Angiogenesis

Rose Leigh Vines, Ph.D., Full Professor (hired Spring 1979)
Research: Anatomy, Clinical Hematology, Clinical Laboratory Science