

College of Natural Sciences

Context: We are recommending several disruptive changes in the College that we believe will have great benefit to the university, including the movement of three different academic programs to other colleges and IfA, and a radical change in the way that we administer the university's academic programs related to Life Sciences.

Department of Chemistry

Summary Recommendations

- Continue addressing low success rates in gateway courses and Organic Chemistry.
- Review the BA/BS in Chemistry to address declining majors and retention issues.
- Ensure graduate students have access to the courses needed in identified sub-disciplines.
- Collaborate with faculty outside of Chemistry on research and a faculty-hiring plan.
- Encourage faculty with grant funding to provide research rather than teaching assistantships to support students.

Details

- The Department is home to the BA/BS in Chemistry, BA/BS in Biochemistry, and MS and PhD programs in Chemistry.
- Undergraduate enrollment in the Chemistry BA/BS has decreased from 156 in 2012 to 64 in 2019. The BA/BS in Biochemistry (approved in 2012) has since grown to 146 majors. Graduate enrollment has held steady at 41 (14 Master's, 27 PhDs). Overall, enrollment in the department is up considerably since 2012, from 171 to 251, owing to the Biochemistry degrees. Faculty FTE has increased from 9.93 FTE in 2014 to 11.23 in 2019.
- Enrollment in the professionally accredited BS in Chemistry dropped from 100 (2012) to 48 majors (2019), and the BA is approaching the low-enrollment threshold at 16 majors. Both programs need attention. The 2014 review team discussed the low success rate in gateway Chemistry courses, which should be examined to determine any relationship to the decrease in enrollment.
- Recently there have been efforts to incorporate learning assistants into Organic Chemistry, a challenging course for undergraduates across campus (which affects campus retention rates). The success of these efforts should be assessed regularly.
- In 2014, graduate students raised concerns about access to courses needed, particularly in the sub-disciplines. The review team recommended the following:

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The department should acknowledge its responsibility to ensure that every admitted graduate student has access to an appropriate set of courses. If students in a certain sub-discipline won't have access to necessary courses, especially including those that provide essential preparation for the qualifying examinations, then the department should either modify its requirements or suspend admissions into the program until requirements can be met. – 2014 Natural Sciences External Review, page 19

- The review team also questioned the use of teaching assistants rather than research assistantships for graduate students.

Even senior graduate students appear to be generally supported as teaching assistants during the academic year; the department should consider whether faculty with grant funding should be encouraged and perhaps incentivized to provide academic year research assistantships. – Page 19

- The review team encouraged the Department to collaborate with faculty outside of Chemistry on hiring and research opportunities. Per the review team:

Rethink the current departmentally focused hiring plan and consider whether an emphasis on broad “grand challenge” areas involving multiple departments and colleges might be a better route to success than standard disciplinary hiring. There are unrealized opportunities for collaboration within and outside the department. The ability to compete for large multi-investigator grants, to recruit top graduate students, and to grow the department’s stature will require the development of a more collaborative and entrepreneurial faculty culture. – Page 20

School of Life Sciences (Biology, Botany, Microbiology)

Summary Recommendations

- Stop-out the MS and PhD programs in Microbiology.
- Consider stopping out the MS and PhD programs in Botany.
- Strongly encourage collaboration with life sciences units across campus. Pursue joint hires to facilitate collaboration on research and instruction.
- Support ways to accelerate the curricular changes needed to eliminate the duplication of courses, and possibly, to consolidate degrees. Consider hiring a consultant to facilitate this work.
- Consider joint JABSOM/Life Sciences (and perhaps CTAHR and SOEST/HIMB/PBRC) administration of the life sciences graduate programs.

Details

- The School of Life Sciences, approved in 2019, was created through the merger of the Departments of Biology, Botany, and Microbiology. The new structure includes a Director and three Associate Directors for Curriculum, Instruction, and Research.

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- The School offers the BA/BS in Biology; BS in Marine Biology, and the MS/PhD in Marine Biology in collaboration with SOEST; BA/BS, MS and PhD in Botany; BA/BS, MS and PhD in Microbiology; BS in Molecular Cell Biology; and the MS and PhD in Zoology. A BA in Marine Biology is in the proposal phase (ATP approved). Admission to the BA/BS in Zoology is stopped out.
- Undergraduate enrollment is as follows: BA Biology: 227; BS Biology: 536; BS Marine Biology: 382; BA Botany: 18; BS Botany: 27; BA Microbiology: 15; BS Microbiology: 31; BS Molecular Cell Biology: 48.
- Graduate enrollment: MS Botany: 13; PhD Botany: 18; MS Microbiology: 4; PhD Microbiology: 8; MS Zoology: 8; PhD Zoology: 27. The MS and PhD in Marine Biology are jointly administered with SOEST, however through an arrangement with IRO, students are allocated to Natural Sciences or SOEST. Per IRO data, the CNS MB enrollment is 9 and the CNS PhD enrollment is 11. (SOEST enrollment is larger at 16 for the MS and 33 for the PhD.)
- There are 34.34 tenure-track faculty FTE in the School.
- One of the goals of the Life Sciences reorganization is to address course redundancy across the departments. The faculty expressed openness to exploring the consolidation of degree programs with the goal of providing more interdisciplinary training.

Course redundancy among undergraduate programs in the life sciences. The three departments currently offer seven undergraduate programs. A number of basic life science courses represent 'variations on a theme' taught in different programs (e.g. ecology and evolution courses within the Biology and Botany programs). Merging the life science departments within CNS will provide increased opportunity to examine whether improved offerings can be developed that draw on the expertise of multiple faculty. Faculty in some of these programs are interested in exploring reducing the overall number of degrees offered, and instead establishing tracks within more general degrees as a means of offering more specialized opportunities to students. --Life Sciences Reorganization Proposal, page 12

- Per the reorganization proposal, "the drivers for this merger include a desire for increased collaborative opportunities in research and instruction, and to overcome the artificial barriers that remain in place with the maintenance of "silos" as three separate departments." Recommend that the faculty collaborate on research and instruction with life sciences units outside of the School as well, including with faculty in JABSOM, CTAHR, SOEST, and in the organized research units.
- External reviewers identified several issues with the Microbiology and Botany graduate programs. Both programs are challenged with providing the courses that students need to prepare for the qualifying exam and to make progress towards graduation. Neither program has a defined curriculum. The Microbiology program, which is small, has a retention problem (25% leave or transfer to another program). Neither program has been revised in the last 10 years (per records of approved program modifications). Given the plans outlined in the reorganization proposal, addressing the issues with these programs should be a priority as well.

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Recommend stopping out admission to the graduate programs in Microbiology, and possibly Botany, to facilitate review and modification or termination of these programs.

- JABSOM offers graduate degrees in the life sciences that could be jointly administered with the School of Life Sciences. CTAHR and SOEST also have very relevant programs and research activities that could be strong contributors. Recommend that a group be assembled to begin discussing possibilities.

Department of Mathematics

Summary Recommendations

- Improve innovations in undergraduate courses such as those already made by M. Chyba.
- Review faculty workload, adjusting for research productivity.
- Think strategically about hiring, collaborating with units outside of the Math Department.

Details

- Enrollment in the undergraduate program has increased slightly from 83 in 2012 to 97 in 2019. Graduate enrollment has remained fairly stable at 42. Faculty FTE is 21.79, back to levels in 2015.
- The Department continues to provide required Math courses to support general education and STEM majors, though SSH has declined.
- Faculty have been innovative in using of learning assistants to meet the quantitative reasoning hallmark of 30:1.
- The 2014 program review recommendations focused mainly on faculty hiring, research, and workload. On hiring, the review team encouraged collaboration with units outside of the Math Department.

The Department should think strategically about how to approach the large number of current and expected recruitments. Ideally, the plan should identify areas in which the Department might like to establish or enhance its reputation. The plan should also integrate collaborations with other departments in the college and relevant units outside CNS. – 2014 Natural Sciences External Review, page 26

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Department of Physics & Astronomy

Summary Recommendations

- Reorganize the Astronomy degree program into the Institute for Astronomy OR (based on discussion with unit) explore a collaborative administration of the program between IfA and Physics.
- Reduce inequities in the level of graduate student support.
- Review the BA/BS to address declining majors.
- Consider developing a capstone experience or partnering with UROP to develop and expand faculty-mentored research experiences.

Details

- The Department of Physics & Astronomy serves as the academic home for the BS in Astrophysics; the BA, MS and PhD in Astronomy; and the BA, BS, MS, and PhD in Physics.
- There are 53 students enrolled in the BS in Astrophysics, and 15 in the BA in Astronomy. Both lag enrollment projections (80 and 48, respectively). Enrollment in the MS in Astronomy is low at 6 students. Enrollment in the PhD program is 39.
- There are 11 enrolled in the BA in Physics (up from 5 in 2012), 27 enrolled in the BS (down from 60 in 2012), 4 enrolled in the MS (no direct admittance), and 35 enrolled in the PhD.
- Tenure-track FTE is 16.92, down from 21.50 in 2014.
- The undergraduate programs in Astronomy and Astrophysics (approved in 2014) are still provisional. While the Department serves as the home for the academic programs, IFA faculty are primarily responsible for the Astronomy degree program. A complicated MOA facilitates the administration of this degree program across these units. Recommend moving the BA, MS, and PhD in Astronomy into the Institute for Astronomy, or seek a new organization to better support this collaborative program. The previous IFA Director recommended that the Department of Physics & Astronomy and IFA collaborate to create a School of Astronomy and Astrophysics. The proposed model was similar to how Natural Sciences and SOEST collaborate to administer the graduate degrees in Marine Biology.
- Moving the Astronomy program into IFA could help address issues with inequitable support of graduate students. The 2014 program review team found the following.

The department should carefully examine its current policies and practices regarding the graduate program...the department needs to develop a way to address the extreme resentment felt by some graduate students regarding the graduate students support levels offered by IFA. – 2014 College of Natural Sciences External Review Report, page 35.

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The Physics undergraduate programs, particularly the BA, are consistently on the “small programs” list. While enrollment in the BA has increased, the BS enrollment has dropped considerably since 2012. Per the 2014 review, there is little interaction between the faculty and undergraduate students, and surprisingly, few opportunities for undergraduate research.

One area of widespread agreement is that some faculty members are perceived as being “too busy with research” to interact meaningfully with undergraduates. Students described a generally low level of interaction with faculty members outside of the classroom. There did not appear to be a high level of camaraderie among students. Students reported that the physics club is small and weak, and that it is not supported financially by the department or have an involved faculty advisor. Students also reported that they were not informed about undergraduate research experiences on and away from campus, and that they felt at sea in thinking about whether and how to apply to graduate school. – Page 35

Recommend that the department consider developing a capstone experience or partnering with UROP to develop and expand faculty-mentored research experiences.

Department of Information & Computer Sciences

Summary Recommendations

- Reorganize the Computer Science faculty and programs into the College of Engineering.
- Reorganize the Master of Library & Information Science program and faculty into the School of Communications (Social Sciences).
- House the PhD in Communication & Information Science in the School of Communications. Continue collaboration with Information & Technology Management (Shidler) and Computer Science.

Details

- The Department of Information and Computer Sciences offers the BA in Information and Computer Sciences; BS, MS, and PhD in Computer Science; and the Master of Library and Information Science. The Department collaborates with the College of Social Sciences and the Shidler College of Business on the PhD in Communication & Information Science.
- There are 93 students enrolled in the BA in ICS, 420 in the BS in Computer Science (up from 223 in 2012), 35 in the MS, and 18 in the PhD program. There are 47 enrolled in the Library & Information Science program (down from 97 in 2012).

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- Moving Computer Science to Engineering was included in 2 of the options recommended by the external team charged with reviewing the Computer Science and Computer Engineering programs.
- Selected recommendations for the undergraduate programs (per the external review) are provided below.
 - *Modify the content of courses so that the undergraduate program produces students who are prepared to work as software developers.*
 - *Merge ICS courses with corresponding Computer Engineering courses – courses such as algorithms and operating systems – so that there is a single course, taught in the same way alternately by faculty from each program. Adopt the Computer Engineering approach to these courses.*
 - *Establish an Advisory Board which periodically reviews the program curriculum, among other things, and identifies gaps and recommends changes to ensure graduates meet the needs of employers. Members of the Advisory Board could come from local industrial as well as non-industrial employers.*
 - *Ensure that all tenure-track faculty feel responsibility for the undergraduate program, so that the courses fit together to address the educational objectives, and so that a fair and appropriate balance of teaching responsibility across all faculty is achieved. -- 2019 Program Review of Computing Related Programs, pages 5-6*
- The Library & Information Science program needs a home with the move of Computer Science to Engineering. With the addition of this degree program, along with the interdisciplinary PhD in Communication & Information Science, recommend naming the unit the School of Communication and Information Sciences (in the College of Social Sciences).

DRAFT