Response of the Academic Program Review Council to the Review of Natural Sciences, 2018-19

APRC notes that units that experienced suspensions during the review period did not know how to address them within the context of the Program Review. The Council notes that future reviews may necessitate that the department address a paragraph or so to suspensions. APRC notes the need to continue Physics courses to support other areas beyond the continued support to students affected by suspensions as they are 'taught out' (minor suspended/teaching minor). Similarly, several new initiatives have been approved, but have not yet existed long enough to undergo Program Review. Pre-engineering is approved for the Associates degree (first appearing in the 2016-17 catalog) and should in future receive similar treatment to Environmental Science, which was recently approved. Brief discussion of the development and initial response to these programs should be given. The manner in which initial trends are being evaluated will provide a stronger formal review after the first 4-5 years.

APRC Executive Summary of Findings

Strengths of the Department:

APRC finds that overall the Department of Natural Sciences continues to be strong. The Department demonstrates a robust commitment to a broad foundational education, embracing the concept of a liberal arts education through scientific inquiry and close ties to the University Mission. A deep commitment to high impact practices is evident in all programs of the Department and is reflected in high student participation in research, as well as in the Department's strong connections in the community and region. Although some programs are marginally successful in maintaining System enrollment minimums, their active development of articulation agreements, exploration of means to deploy resident expertise of existing faculty, and their overall ability to stand as a Department under a singular mission supports the need to sustain each of its component parts.

As the most developed programs within the department, Biology and Chemistry provide able leadership in developing measurable outcomes and adjusting curricula in response to emerging needs. APRC commends the Department for its active collaborations internally to the Department, across academic units of the campus, and with the broader community. It is especially noteworthy for the ways in which it integrates and exploits the close relationships with the Research Institutes of LSNERR and LSRI.

The department is highly active in service across campus and beyond, participating in numerous public events and presentations, from Preview Days to Posters in the Rotunda and participation in System URSCA. Members are active in many committees and councils, and participate at high levels in funded research.

Opportunities:

APRC encourages the Department and its programs to actively work with Administration to set criteria for determining how and when programs may be released from a status of "under review." APRC also notes a challenge claimed by Natural Sciences regarding underprepared students has been expressed by

many programs across campus as increasing pressure to recruit students has led to UW-Superior's acceptance of more students with lower high school rankings. As part of the current Strategic Plan and Academic Plan initiatives, academic and non-academic units should participate in a campus-wide discussion of ways to support such students and enable them to succeed. Initiatives such as supplemental instruction labs and study groups in Chemistry appear to yield promising results.

Conclusions:

The Department of Natural Sciences is highly creative in developing means to support the ongoing needs of all its programs, including reliance on Differential Tuition and external fund-raising initiatives. It is particularly creative in sharing all types of resources with the Research Institutes. Care must be taken not to become over-reliant on the relationship between funded research projects and the academic arm of the Department.

All programs in Natural Sciences share common classrooms and laboratories, and its facilities support not only departmental needs but those of USP courses and other majors across the University. APRC recommends the Administration should explore multiple means of meeting departmental needs, including developing a broader conceptual model for financing efforts to maintain and support the structural/facility improvements, equipment and technological upgrades, and on-going needs for disposable supplies (p. 11).

Biology

(Biology major/minor. Biology Teaching major; minor suspended; Broad Field Science/Broad Field Science Teaching majors, suspended)

Strengths:

Biology makes effective use of URSCA and AS-L high impact practices and demonstrates a strong commitment to SURF (p. 4). Biology shows a creative response to concerns about program decline by developing collaborations with other departments, including HHP, HBJD, and M-CSci (p. 1-3). They actively and intentionally integrate with the Research Institutes of the NERR and LSRI and maintain extensive and consistent grant funding that supports student involvement in research. They have made extensive efforts with CCEL and Foundation to increase outreach and draw in new students. With the entire department they actively engage with the community through Science Fest, Preview Days, SOAR, and target the Pre-Health concentration for deliberate recruitment efforts through expanded transfer agreements.

The Biology program uses its data to provide a strong and reflective report. In particular, APRC finds measurable learning outcomes and deliberate scaffolding within its curriculum, demonstrating gains in student learning through its various assessments. Deliberate evaluation criteria developed for the Senior Year Experience course and presentation provide opportunity to celebrate student success (p. 3-7). Additionally, the use of a standard student evaluation tool across all programs in the department provides consistent examination of overall department offerings (p. 7, Appendices).

The Biology program engages in a wide array of outside consultation with industry, comparison to peers, and matching on national standards, as well as aligning its assessment to national standard for better

comparison of program strengths (p. 6-7). Students and faculty participate in significant research, with local/regional and global foci. In collaboration with other departments, Biology has developed new emphases in Pre-Health and Environmental Science, coupling program strengths to cross-disciplinary needs. They continue to enroll a strong number of majors, which raises the question of whether numbers have remained stable, or have even increased relative to the overall number of students enrolled across campus. Enrollment appears stable and they maintain a high rate of graduation compared to the campus average.

Opportunities:

While careful examination of individual courses has identified specific areas of redundancy between its offerings and those of HHP, Biology acknowledges and APRC supports continued clarification of means to reduce or eliminate overlaps (p. 4).

An inconsistent approach in campus hiring practices for Instructional Academic Staff versus Adjunct appointments has compromised the integrity of Biology and Natural Sciences. Re-assignments throughout the program and department, as well as mandated effort towards funded grants, creates uneven deployment of staffing from year to year. Additionally, ability to provide for laboratory and green house support has fluctuated. Careful monitoring of true distribution of effort to these areas based on anticipated research and ongoing curricular changes may result in both stabilization and cost savings (p. 8).

Biology examined their data closely and reflected on challenges in the face of overall declining enrollment numbers (p. 13). They acknowledge and express concern of retention rates and an inability to stabilize the Biology minor, but believe that the infusion of new students in new areas of Environmental Science and Pre-Health may strengthen enrollments. They have developed a deliberate approach to address decreases in the minor. However, APRC cautions they carefully monitor trends over the next few years that may threaten the continuation of the minor in the long term. APRC also encourages Biology to continue to develop plans to address changes to the minor in light of outside factors. As noted in its last review, Biology continues to struggle with changes in licensures for K-12 teachers as approved by the WI Department of Public Instruction while also balancing the requirements for Minnesota teachers (p. 2).

Biology has gathered information on students who leave the program and finds no single or predominant reason for leaving (p. 12-13). APRC encourages the program to utilize more aggressive methods to solve stabilization of the traditional minor, rather than relying only on the strength of new majors to support the minor program.

Recommendations:

Overall, APRC strongly supports the work of the Biology program, who demonstrate willingness for self-examination both for their own program and their department to strengthen the entire campus.

Financial means to support the role for Animal Care need to be addressed (See UW System Policy: https://www.wisconsin.edu/regents/policies/criteria-for-use-of-animals-for-research/).

Chemistry

(major, comprehensive; Chemistry major comprehensive concentration for Pre-med/Pre-pharmacy; Chemistry, Secondary Education major; Chemistry, Forensic, suspended. Chemistry minor. Note: Physics/Physics Teaching minors, suspended)

Strengths:

APRC commends Chemistry for faculty who are deeply involved in research that also engages students. The Chemistry programs sustain direct and indirect collaborations with other units, from Biology and HHP's Pre-Health, to Sustainable Management and Global Studies. Chemistry has also worked with Math and Writing to develop cross-disciplinary support for the needs of all the sciences. Data from evaluations and surveys has led to the incorporation of Supplemental Instruction sessions to strengthen student outcomes and the development of the non-comprehensive Chemistry major with reduced math and Chemistry requirements.

Chemistry collaborates with Research Institutes (LSRI, LSNERR) to provide student research opportunities and provide enrichment events for the broader Twin Ports community.

Chemistry demonstrates clear growth and participation in development of program outcomes (p. 33). APRC finds the structure of Chemistry's curriculum and SLOs well explained and encourages the program to continue review of and integration with ACS standards (p. 34). APRC especially marks changes made to student learning outcomes and curriculum as the result of assessment. In addition to performance on ACS standardized tests Chemistry considers individual level and overall class performance to determine their overall learning outcomes, and has developed a standard rubric for the capstone (p. 35-36). The programs make effective use of evaluations, which are considered by the entire department (p. 38).

Chemistry makes full use of its physical and financial resources, maximizing opportunities for professional development offered by the campus and System. They examine library resources to maintain instructional currency, and receive Classroom and Lab Mod, as well as exploiting partnership with LSRI, to maintain quality equipment and facilities (p. 39-40).

Opportunities:

APRC encourages Chemistry to actively pursue relationship with the Alumni Association (p. 32). Chemistry noted they were "interested in developing" better documentation of student activities post-graduation. The program should partner with the Alumni Association to develop and distribute a survey to collect feedback from recent graduates of the program (p. 36). We commend the success of the 'Periodic Table' outreach and recommend consideration of means by which they may build on established relationships to support recruitment and retention. Providing the percentage of students and graduates who receive Swenson and other scholarships might also be a valuable means of promoting the programs.

A more nuanced reflection of low enrolling courses should be considered. APRC wondered whether the low numbers were associated with inconsistent rotation, insufficient communication with other departments regarding student numbers and requirements, or a combination of these and other seemingly unrelated factors. For example, Chem 381 is offered as needed rather than on a set rotation, which confounds students in course sequencing a 4-year plan. This may lead to greater numbers of independent study offering in order to assist students in meeting graduation deadlines. Understanding

of more factors affecting course enrollments may allow for adjustments in planning that could result in improved course rotation and retention.

While plans may not yet be fully developed regarding individual courses, the program should be prepared to explain decisions regarding course elimination and/or replacement regarding development of the non-comprehensive major. In a related matter, APRC notes reference to *Thermodynamics of Physics* whereas Physics is no longer reviewed as a separate entitlement. If Physics is now combined with Chemistry, the program may wish to demonstrate its interdisciplinary nature throughout the curriculum, as APRC now has no way of assessing its impact. They may wish to emphasize its importance via integration across all Natural Sciences as well as to the well-being of all students through USP (p. 35 #4).

The program assessments have proved to be a strength. However, further discussion of what the data showed, what trends were revealed, and how the information is being used to make changes or further strengthen the program would be helpful in future reviews (p.36).

Recommendations:

APRC recommends that the Chemistry program work closely with other programs to monitor trends in enrollments that affect Chemistry, such as Sustainable Management and Pre-Health, in order to maintain a tight rotation of necessary courses.

Chemistry and the entire department should continue to work closely to support needs across all programs as well as involving researchers from the non-academic research institutes by collaborating and sharing equipment and laboratory supplies. Administration should open discussions on how best to support the need for a designated laboratory manager as soon as feasible.

APRC acknowledges Chemistry and the department continue to be challenged by the lack of adjacent computing areas that meet the capacity needs of USP. Current laboratory space either is not designed for, or does not have sufficient capacity, for multi-purpose space-use to both perform lab functions and meet other instructional needs. Additional lab needs include expansion of health and safety required fume hoods for both the Research Institutes and to support all Natural Science majors in required Chemistry courses. Programs will need campus support to identify and deploy differential tuition, external grant funds and other financial support (p. 40).

APRC recognizes that Chemistry and other programs across campus have engaged in efforts to recruit new students by developing career tracks and specialties that lead to familiar career opportunities (for example, Forensic Chemistry). However, these tracks, when evaluated by Administration, may be viewed as separate entitlements rather than recruiting tools, resulting in suspension when the enrollments required for separate entitlements cannot be achieved in spite of ‘no cost’ overlap of all curricula. APRC encourages the programs to press Administration for direction by which they may successfully meet both the expectation to increase recruitment, and simultaneously count the numbers of graduates as ‘entitlement by discipline’.

Environmental Science

(major, comprehensive)

Strengths:

The Environmental Science major is a cross-disciplinary major, managed within Natural Sciences and overseen by a team of faculty across multiple Departments and Programs (p. 56). The Environmental Science major began instruction in the 2017-18 academic year after receiving approval by the Board of Regents and is therefore not required to undergo review (p. 57). However, baseline information and planning are already underway. The Program makes the most of current faculty strengths by partnering across Departments and through its unique collaborations with the Research Institutes in order to provide new opportunities to students (p. 63).

Opportunities:
APRC commends faculty work in identifying modifications for Environmental Science, including distinguishing course focus of lab and field work from analytical thinking in order to emphasize strengths of science and social science courses (p. 58-59). The Program was originally conceived as two programs, Environmental Science and Environmental Studies, derived from strengths of current faculty and employing courses that already existed across multiple disciplines. Faculty have identified that the current program leans heavily on biology at the current time, and plan to encourage hires that will allow increased offerings in environmental policy, remediation, and sustainability (p. 68). Program participants are encouraged to continue to push for certificates or a minor with more emphasis in the social sciences. Growth may also lead to more frequent offering of Econ 335 (p. 66). APRC recommends close monitoring of UW-Milwaukee's proposed Freshwater Initiative for future collaboration.

Recommendations:
APRC notes success will rely on continued flexibility in course scheduling across the cooperating departments (p. 67). Consideration of faculty strengths among new hires will be imperative to the continued growth and success of the program (p. 62). The ability to provide streamlined advising will remain a challenge due to complications derived from transfer credits and late declaration of major (p. 64).

APRC encourages continued expansion of communication among partners. Common support, rather than reliance on each department (pg. 61-62), and common space in the form of a dedicated lab (p. 62) should be considered as a means of fostering closer integration, rather than teaching out of disparate disciplinary 'homes' (p. 67; 69).

GIS – Applied Geographic Information Systems

(minor)

Strengths:

The Geographic information Systems (GIS) program provides a unique niche on campus by providing students across multiple disciplines to learn methods of geographic representation of data in support of local and regionally focused projects (p. 71). APRC notes that Transportation & Logistics students have particularly benefited from these offerings.

Opportunities:

GIS anticipates the introduction of the Environmental Science major will lead to an increase in students in the 3-course GIS sequence. Adequate lab accommodations will be necessary as numbers increase.

APRC would like to see a more robust explanation of growth and change in the GIS courses over time (p. 75). APRC notes that, while faculty are clearly active in the field, the Review does not refer to how knowledge is integrated into courses. Demonstration of consideration of current understanding gained from conferences and scholarly activity would be welcomed. The Council encourages faculty to explicitly emphasize cross-disciplinary thinking. For example, critical thinking could be expanded by examining ways geographic representation of information can clarify understanding of societal issues among the general population.

Similarly, growth of the program could be stimulated by providing examples of the evolution of student progress, detailing the numbers of students employing GIS within senior projects, or demonstrations of student success via comments of satisfied community partners.

Recommendations:

APRC encourages further collaboration with less obvious partners who could benefit from understanding of GIS concepts, including Psychology, Health & Human Performance, Individually Designed Majors, and Environmental Studies, if that major is eventually approved.

As with other areas of Natural Sciences, GIS struggles with adequate access to specialized laboratories or software updates (p. 77). It is unclear whether GIS has received Classroom or Lab Modification in the past. APRC encourages the department to assist the program in outreach to other departments to learn how they confronted similar technology challenges. Discussion should also be initiated with Technology Services to examine what flexibility might exist with updated software. Newer iterations may offer potential for adjustments in software licensing to expand availability to students outside of class or on limited machines.