

## **Division of Natural Sciences and Mathematics Spring 2010 Internal Environmental Scan (Draft 1)**

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March 22, 2010

### **1. INTRODUCTION**

The following report represents a Draft 1 summary of an environmental scan for the Division of Natural Sciences and Mathematics (NSM) at Western Oregon University. NSM is comprised of four departmental units: Biology, Chemistry, Earth and Physical Science, Mathematics. The departments collectively offer BS/BA degrees in Biology, Chemistry, Earth Science, and Mathematics; with minors in Biology, Chemistry, Forensic Science, Geology, Earth System Science, Physical Science, and Mathematics. Physics is a service program and offers a minor as part of the Earth and Physical Science Department. In addition, the Biology and Chemistry programs support the pre-health and pre-professional tracks at WOU. All NSM Division programs support teacher preparation in the College of Education.

The summary presented below is derived from the 2007 program accreditation report and year-end departmental reports submitted over the past two years (2007-2008; 2008-2009). The internal environmental scan is presented “bullet-style” and is organized in five main sections: Program Mission, Strengths, Opportunities, Challenges, and Vulnerabilities. Individual program evaluations are listed as subsections, presented in alphabetical order.

*Note: this is a draft 1 analysis prepared by the division chair. The reporting deadline and academic scheduling is such that review by faculty stakeholders was not possible prior to submission. Additional faculty review and compilation of supporting data will need to be completed at a later date. This document should be considered as a first-cut summary based on existing reports and internal assessment data.*

### **2. PROGRAM MISSION**

#### ***A. Biology***

The Biology Department prepares students for careers in biology and science education, and admission to graduate and professional schools in the life and health sciences. We also promote the understanding of biology as an essential part of a liberal arts education and of global citizenship.

#### ***B. Chemistry***

The Chemistry Department provides preparation for professional work in chemistry or forensic science; graduate work in chemistry or forensic science; or pre-professional training in the health sciences or secondary education. Coupling the program with an appropriate minor, prepares students to enter related fields such as biochemistry, oceanography, pharmacy, toxicology and

the environmental or atmospheric sciences. Through the study of general, organic, analytical and physical chemistry, students gain an understanding of the world around them.

### ***C. Earth Science***

The Earth Science program provides a liberal arts core education in geoscience with an emphasis on the scientific method, problem solving, and interdisciplinary science education. A key objective of the program is to prepare undergraduates for careers as professional geoscientists and educators. The program also promotes the development of an informed citizenry for wise decision-making on issues related to natural resources, environmental quality, and sustainability in Oregon and beyond.

### ***D. Mathematics***

The Mathematics Department is committed to the teaching of mathematics and the communication of mathematical ideas. Faculty members believe that both the assimilation of mathematical knowledge and the enhancement of one's capacity for mathematical reasoning are essential outcomes of a liberal arts education.

### ***E. Physics***

The Physics program fosters a small-group active learning environment in which students explore and discover the laws of physics in a state-of-the-art laboratory. Students develop connections that link fundamental concepts in physics with phenomena covered in their Biology, Chemistry and Earth Science classes. The program provides out-of-classroom experiences in space science and teacher training through membership in the NASA Oregon Space Grant Consortium.

## **3. STRENGTHS**

*(Key words: capabilities, resources, assets, marketing, innovative aspects, value, quality)*

### ***A. Biology***

The strengths of the Biology program are summarized as follows:

- Biology faculty provide personal contact with students via small class sizes, labs, and independent research opportunities.
- Biology majors complete a broad, thorough set of core classes featuring meaningful lab experiences designed and taught by Biology faculty.
- The program fulfills important service to non-majors via a rigorous lab-based liberal arts foundation series and advanced coursework for pre-nursing and pre-education students.
- A two to three-fold increase in graduating majors has been achieved along with improved retention in post-200 series courses over the past decade. The implementation of Peer-

Led Team Learning (PLTL) represents a significant investment in retention efforts at both the majors, and non-majors levels.

- A 100-series assessment has been employed since 2001 and the utilization of the Educational Testing Service's Major Field Examination in Biology since 1996 have been major efforts to secure meaningful data about our students.
- Significant budget increases have allowed increased spending on modern laboratory equipment and computer resources for instructional spaces. These improvements have provided greater opportunities for the infusion of technology-based curricula into many of our courses.
- The Biology Department strongly supports undergraduate research opportunities and is a key stakeholder in the WOU Program for Undergraduate Research (PURE). Support includes both stipend-based and volunteer activities that involve tenured and tenure-track faculty.
- The Biology advising processes are structured to proactively ensure that students make progress both in the major and toward pre-professional requirements. Each student is matched with the appropriate advisor, and in turn, each advisor maintains an expertise in a subset of pre-professional schools and career pathways.

### ***B. Chemistry***

The strengths of the Chemistry program are summarized as follows:

- The chemistry program offers close student-faculty interaction through small upper-division class sizes and research opportunities.
- All classes are taught by specialists or faculty members holding terminal degrees in their field of expertise.
- A strong communication component is part of the major and enhances our students marketability in the chemical industry.
- The chemistry program affords students the opportunity to gain direct hands-on experience using specialized techniques and instrumentation.
- The Chemistry program collaborates with the Oregon State Police crime lab which provides instructors for Forensic Science courses and internships allowing students to gain professional experience in a working forensic environment.

### ***C. Earth Science***

The strengths of the Earth Science program are summarized as follows:

- The Earth Science program has a faculty:student ratio that is conducive to one-on-one contact, personalized instruction, and promotion of undergraduate research.
- The Earth Science program is one of the campus leaders with respect to service contributions to the Liberal Arts Core Curriculum and pre-education programs. The ES100 sequence (ES 104-105-106) that serves approximately 1400 students per year, is a common first destination for entering freshman, and has a notably high retention rate between fall, winter, and spring terms. ES100 encourages real-world problem solving and is appealing to non-science majors.
- Earth Science faculty members embrace a technology-based curriculum and are working to implement standardized program assessment tools.
- Earth Science faculty members actively serve as leaders on a number of campus-wide committees and serve in a variety of professional capacities.
- Earth Science faculty members are enthusiastically engaged in a wide spectrum of peer-reviewed research, publications, and related professional development.

#### ***D. Mathematics***

The strengths of the Mathematics program are summarized as follows:

- Math majors have research-like experiences via small group presentations and individual capstone projects, all of which involve significant independent study guided by faculty, oral presentations, and a written paper.
- Middle school mathematics and elementary mathematics education courses exceed national recommendations for content, breadth and pedagogical approach.
- Seven tenure-track faculty, new to WOU since 1997, are all dedicated to student success in the areas of mathematics and mathematics education and all very active professionally.

#### ***E. Physics***

The strengths of the Physics program are summarized as follows:

- The physics program offers small class size with opportunities for close student-faculty interaction. Upper level students engage in personalized independent studies.
- The physics laboratory represents a state-of-the-art active learning environment.
- Students have opportunities to participate in a wide range of activities through our affiliation with the NASA Oregon Space Grant Consortium.

## 4. OPPORTUNITIES

*(Key words: market developments, industry trends, nice markets, innovation, partnerships)*

### ***A. Biology***

Key opportunities for the Biology program include the following:

- As a result of marketing and demand in the health care professions, there is increasing attractiveness of our program for Biology majors. Our enrollment in the Bi 200 sequence is at an all-time high. For example, our enrollment in Bi 211 is 144 students for Fall 2009, up from approximately 100 five years ago. One reason for this may be our restructuring of the major that occurred approximately two years ago. The new format offers students a range of emphases, allowing them to tailor their biology degree to their interests and needs. Through adaptive program management, faculty not only hope to better serve our significantly expanding pre-health science professional majors, but also to attract and better prepare a more diverse array of majors in specific sub-disciplines (e.g. zoology, botany, molecular/cell biology etc.).
- A key opportunity lies in human resources and integrating our recent tenure-line hires (Kristin Latham, Erin Baumgartner) in such a way to strengthen our program. We anticipate that Dr. Latham will contribute especially to our major's offerings and undergraduate research program, while Dr. Baumgartner will help us assess and improve our non-majors biology sequence.

### ***B. Chemistry***

Key opportunities for the Chemistry program include the following:

- The Chemistry program has developed a strong collaboration with the Oregon State Police forensics program, and there is significant enrollment growth associated with the health science-related service courses.
- The Chemistry program graduated six students at the end of the 2008-2009 academic year. In contrast to past years where more students followed the forensic option, four of the graduating students completed the requirements for the traditional option and two the forensic option. This did not indicate a decline in the popularity of the forensic chemistry program, but rather, showed student interest in merging the two options through combining a traditional major with a forensic minor. There seems to be increasing interest among our students in the traditional major.
- The Chemistry Department had notable growth in the Ch100 (Ch104-105-106) sequence for 2008-2009 which necessitated the addition of lecture seats and two laboratory sections. The increase in enrollment was a consequence of the new nursing program. We expect to see continued growth in this area for the near future.

### ***C. Earth Science***

Key opportunities for the Earth Science program include the following:

- Lower-division Earth Science enrollments have been increasing over the past 3 academic years (2006-2009). Total student credit hour production increased by 15% and ES100 enrollments by 11%. The upper-division population remains steady with a consistent number of degrees awarded. The program is economical and efficient, with a high annual credit-hour production per faculty-staff member (~400 SCH per faculty-staff) and a low salary:SCH ratio.
- A key aspect of the program is the close alliance with faculty in physics, chemistry, biology, and education. Faculty members from different disciplines work directly together on a daily basis and cultivate a multi-disciplinary, collegial atmosphere that is unique compared to other institutions. The cross-disciplinary alliance in NSM provides a superb opportunity for faculty and students with diverse interests to interact in a rich and stimulating academic environment. Earth Science plays an important role by providing a nexus for studies in the biological and physical sciences. In this regard, Earth Science faculty are instrumental in supporting a growing alliance of NSM faculty and programs that provide integrated, interdisciplinary field-based courses and research opportunities in Natural Science disciplines. In addition, there is a common linkage between majors and minors in Earth Science, Geography, and Environmental Studies. As such, a significant number of students share common classes in each of these programs.

### ***D. Mathematics***

Key opportunities for the Mathematics program include the following:

- The Mathematics Department is nationally recognized as one of the top 10 programs in the area of teacher education. A recent study by the National Council on Teacher Quality (Greenberg and Walsh, 2008) determined that the WOU math education program is highly robust and making significant contributions in the area of teacher preparation. This recognition combined with strong enrollment numbers attest to a positive trajectory with respect to mathematics education at WOU.
- There has been a significant increase over the years of students in the lower-level service courses. Because of this and the desire for students to take mathematics their freshman or sophomore year, the number of sections of MTH 70, MTH 95, and MTH 111 has increased greatly in the past couple of years. As a result of changes in degree requirements for students in the Natural Sciences, the enrollment in the calculus sequence has increased as well. There are also increasing linkages between mathematics and the OHSU Nursing Program, particularly with respect to MTH243 Statistics.

### ***E. Physics***

Key opportunities for the Physics program include the following:

- The Physics program is actively engaged in K-12 community outreach and improving science teacher training in the State of Oregon. Linkages with NASA-based grants programs provides WOU student scholarships and supports teacher training opportunities with a focus on global climate change in the Earth system. The application of Physics to real-world problems in Earth Science represents an innovative opportunity for cross-collaboration between faculty and students.

## 5. CHALLENGES

*(Key words: market demand, sustainability, obstacles, weaknesses)*

### ***A. Biology***

Biology program challenges include the following:

- Retention of students beyond the freshman year is the most serious and ongoing challenge for the program. The attrition of students during the Bi 200 series is significant, with a loss of approximately half of the students over the course of the year-long sequence. This rate has remained relatively stable over the past several years. We also see attrition of student numbers in the Bi 100 series. The causes of this situation are multifaceted and include insufficient resources for ongoing retention efforts and poor high school preparation of incoming students. Despite poor retention in the 100- and 200-level series, retention in upper-division courses remains high with a growing number of degrees awarded annually.
- High growth in pre-health and pre-professional tracks: an increasing majority of students recruited and retained as Biology majors are highly focused on pre-health professional training (e.g. medicine, nursing), putting pressure on the array of classes offered in the form of both over-enrollment (e.g. Anatomy and Physiology) and under-enrollment in other areas (e.g. Plant Ecology). Related issues include cancellation of low enrollment courses that adversely impact timely graduation, retention of adjuncts, and diversity of course offerings.
- Biology faculty are increasingly over-burdened with demands involving recruitment and retention-based remediation efforts. This is all in addition to full-time teaching schedules, curriculum development and assessment activities, research expectations, and advising.
- Space limitations are another obstacle facing the Department of Biology. In terms of lecture facilities in the Natural Sciences Building, scheduling classrooms, especially for classes that exceed 50 students, is challenging and will continue to be problematic as student numbers increase in our program. Core courses like Genetics, Evolution, and Cell Biology are currently at or just beyond 50 students, the maximum number of seats in the medium-sized lecture rooms in the building; at this time, it is not possible to schedule core courses in the largest lecture rooms because of other courses (including 100- and 200-level biology, and Human Anatomy and Physiology) requiring the use of these rooms. Although the Division is looking at synchronizing schedules to remedy some of

these issues, the Biology Department anticipates that new building projects on campus (e.g., the Wellness Center) will alleviate pressure on these spaces.

- In terms of laboratory space for teaching, most rooms are sufficient but legacy effects and their poor design makes them very inefficient in terms of serving students, housing equipment, and preparing labs. For example, most classroom laboratories were originally designed by a now-retired chemistry faculty member, resulting in unnecessary sinks in the center of each lab bench, and holes in all the laboratory tables (for the assembly of metal frameworks to hold chemistry equipment), both of which reduce bench space that could be used for additional set-up materials and equipment. Although efforts to create smart lab classrooms have positively resulted in the installation of computers at most benches in teaching labs, the poor design of bench space makes it difficult to incorporate computer-based programming efficiently into the laboratories. Finally, even though many large, modern pieces of equipment have been recently acquired for teaching (e.g., cell biology tissue culture hood, specialty incubators, fluorescence microscope), current lab layouts cannot accommodate these items because of space and / or infrastructure issues. Adjoining lab preparation and storage rooms are likewise poorly designed, filled to capacity with equipment, and – most problematically – contain equipment (e.g., dishwashers and stoves) that are not working and / or out-dated. Major remodels of the laboratories would alleviate many of these issues and would lead to more efficient use of laboratory space.
- In terms of faculty office space (including, in some cases, back room research space), the Natural Science Building is filled to capacity, which obviously poses a major challenge to housing new faculty. Given that it is unlikely a new science building (the most logical long-term solution) will be built in the near future, office and research space problems need to be addressed through existing building renovations to create office space. Specifically, cleaning up and redesigning storage and lab preparation rooms could add new office space for existing lab preparators, thus freeing up offices for faculty. Additionally, such renovations would allow for better equipment management and storage, including the development of shared research spaces that would provide a better alternative to back room research space.

### ***B. Chemistry***

Chemistry program challenges include the following:

- Although a goal of the Chemistry program is to produce students who are able to operate a variety of instruments, many of our instruments are aging and in need of upgrades. We also do not possess one major instrument routinely used by practicing chemists, the nuclear magnetic resonance spectrometer (NMR). Departmental budgets are insufficient for the purchase of new, modern instrumentation and are stretched to maintain aging instrumentation.
- The level of Chemistry Department service provided to other programs has increased. At the time of the 1997 report, approximately 60 students enrolled in CH 104-106 (Introductory Chemistry) annually. This course services the LACC, pre-nursing students and is used by those students needing an introductory chemistry course before entering



the more intense chemistry offerings. The enrollment in the CH 104-105-106 sequence has doubled since 1997. The CH 221-222-223 sequence (General Chemistry for science majors) has increased from a cap of 72 students in 1997 to its current cap of 96 students annually. CH 334-335-336 (Organic Chemistry) serves as both a core course in the Chemistry program as well as a service course for the Biology major. This course has increased in size from an enrollment of 30-35 students at the time of the last report to a starting enrollment of 50 in 2005-2006. It was noted in the 1997 self-study report that the large size of General Chemistry courses made student participation and class discussion difficult. This has been exacerbated by the continued growth of these courses.

### *C. Earth Science*

Three primary challenges to advancing the Earth Science program at WOU include: (1) over-dependence on adjunct faculty and lack of tenure-line positions, (2) limited faculty time available for scholarly activities, program assessment, and faculty development, and (3) student enrollment and retention.

- The primary challenge facing the Department of Earth and Physical Sciences is the over-dependence on adjunct faculty and lack of tenure-line positions compared to other departments in the division. The adjunct faculty ratio in Earth Science ranges up to 65%, almost double that of other NSM Division programs. The Earth Science program is currently in need of at least one tenure-track faculty position. Adjunct pay levels, teaching loads, and contract procedures at WOU are such that there is relatively high turnover in these positions, which ultimately destabilizes curricular programs and inhibits long-term development. Institutional stability, continuity, and future growth are dependent upon the stock of tenure-line faculty. Adjuncts represent short term investments with high turnover rate and curricular instability. Not only do tenure-track faculty members add to the vitality of individual courses and program curricula, they also represent an institutional investment in advanced levels of service, scholarship, and grant writing that is not typically possible for adjunct instructors. The Earth Science program is challenged by this instability.
- An ongoing challenge is also associated with the teaching load required of faculty. The standard teaching assignment requires 12 contact hours per week (36 FTE contact hours per academic year), with lecture hours counting for 1 FTE contact and lab hours counting for 0.66. The teaching load combined with maximum-capacity class sizes results in little time available for other faculty duties such as scholarly research, program planning / assessment, and professional service. As such, the bulk of the latter activities must be conducted after hours, on weekends, and during the summer. An additional challenge presented by the relatively high teaching load is that associated with depletion of creative energy and “teacher burnout”.
- Student enrollment and retention is an ongoing challenge at all levels of the University, including the Earth Science program. While Earth Science 100-level course enrollments are increasing, the numbers of majors have been relatively steady, and growth has been slower than expected. The 100-level enrollment trends in large part mirror that of the university as a whole. The most significant challenge to growth of the Earth Science program results from the general lack of geology/Earth Science in the high school

curriculum at the state level. In the state of Oregon, K-12 Students are only required to take Earth Science in 8th grade. Geology-related course offerings at the high school level occur sporadically on a district-by-district (teacher to teacher) basis, and are not prominently required in the same way as chemistry, biology, or physics. This deficiency is notable given the prominent role that the geosciences are currently playing in the state and national dialogue about oil and gas resources, energy production, water supplies, sustainability, and global climate change. The lack of an advanced placement (AP) test in Earth Science and absence of an explicit Oregon teaching endorsement are exacerbating factors. The net result is that students receive minimal exposure to Earth Science or Geology in high school, with little understanding of career options or the importance of Earth Science to natural resources issues in the state of Oregon. This deficiency propagates as students enter college, thus stagnating opportunities for freshman enrollment growth.

#### ***D. Mathematics***

Four challenges in the Mathematics program include:

- Incoming WOU students are unprepared for college level mathematics courses and there is a high campus need for remedial classes (e.g. MTH70, MTH95, MTH111).
- There is an over-reliance on adjunct instructors to cover MTH70, MTH95, and MTH-100 courses.
- There are limited recruitment opportunities for Mathematics majors at WOU, as related back to poor high mathematics preparation listed above.
- Space limitations: the main issue the Mathematics Department is running into is the lack of office and classroom space. The non-tenure-track faculty offices in MNB are very small, and two of the NTTFs in the department will be sharing an office next year. Classroom space is also an issue, as it is across campus. The department has begun to schedule more classes at 4p.m., but we struggle finding faculty members willing to teach later than this. The classroom space issue is getting worse with the ever increasing number of students enrolled at the university, especially those requiring remedial mathematics courses.

#### ***E. Physics***

Physics program challenges include the following:

- The most urgent challenge faced by the physics program is the lack of a second tenure line which limits the ability to offer upper division courses and to plan for programmatic upgrades. The physics program is caught in a classic “Catch-22” predicament. Low enrollment in upper level physics courses ensures departmental and division discussions for future hires go to disciplines other than physics. The lack of a major in physics, and regular upper level course offerings prevent the already small number of interested students from actually choosing physics. Student enrollment numbers in physics courses

outside of require engineering coursework across the country have been low for many years now, and is likewise manifested at WOU.

- A high number of weekly student contact hours (typically 15-16) prevents faculty from fully engaging in scholarly and professional activities.
- Another challenge involves entering students who are ill-prepared for the quantitative problem solving demands that a university level physics class thrusts upon them.

#### ***F. NSM Division-Wide Challenge***

- A significant challenge for all NSM programs is that of poorly-prepared incoming freshman, relatively low levels of science and math proficiency, and deficient study skills. Low scores on math placement tests are an endemic problem that disrupt scheduling sequences and create an immediate barrier for students who are interested in math and science disciplines. The net result is reduced retention and diversion of otherwise interested math/science students to other disciplines or universities. Currently all NSM program-related students at WOU (including majors and pre-professionals) amount to a persistent 8% of the total university population. A significant portion of the problem lies within the K-12 education system and is beyond our immediate control. NSM faculty are aware of these problems with no easy answers. Continued work with the Office of Admissions and Student Enrichment Program are the current avenues being utilized to address this issue. More discussion, problem solving, and work is needed.

## **6. VULNERABILITIES**

*(Key words: gaps in capabilities, financials, cash flow, supply chain, disadvantages)*

### ***A. Biology***

Vulnerabilities for the Biology program are summarized as follows:

- While the growth in student enrollment is widespread across the biology curriculum, two areas have shown significant increases. First, enrollment in our majors level introductory series (Biology 211 – 213) has shown a rapid rise in the last five years, with the number of students enrolled in the sequence increasing from just over 200 students during the 2004 – 2005 academic year to approximately 350 students during the 2008 – 2009 academic year (Figure 2). Currently, we are no longer able to find available FTE and space for individuals actively seeking the introductory sequence, having already opened several new laboratories and lecture sections over the past several years.
- Given that 300 – level core courses are currently only designed to serve 24 – 48 students / year (again based on both FTE and space constraints), the implications for observed entry level growth of this magnitude is significant. Indeed, in the Spring of 2009, we found it necessary to increase the enrollment for our Introductory Genetics course (BI 311) and our Advanced Human Anatomy and Physiology course (BI 334) for the Fall of 2009 to meet these demands. We fear that this may simply represent the ‘tip of the iceberg’ regarding future enrollment numbers for upper division courses.

- Enrollment in our non-major health professional service courses, primarily Human Anatomy and Physiology (BI 234 – 236) and Microbiology for Health Sciences (BI 318), have shown a rapid increase in the last three years (e.g., Figure 3), coinciding with the development of the OHSU Nursing Program – Monmouth Campus. Despite efforts to keep lecture sections for these courses at or under 72 students per section (including developing multiple sections (e.g., BI 318) and / or trailer sequences (e.g., BI 234 – 236)), most of these classes have reached capacity. The Human Anatomy and Physiology series has grown in a particularly dramatic manner, with multiple faculty now teaching multiple sections during multiple terms. This growth has been so rapid there are limited times available for the development of common standards among the faculty, a necessity if this series is to successfully incorporate new curricular practices in this field.
- Due to FTE demands in lower-division courses described above, the department is able to offer only a relatively small number of upper-division electives each year. This means that students must carefully plan their schedules with their advisors, or they risk missing a critical course. This scheduling crunch is due, in part, to increasing FTE devoted to our Principles of Biology and Anatomy and Physiology sequences. Also, while the biology faculty has a breadth of knowledge that is impressive for its size, some specialties are outside our collective areas of expertise.
- Consistent funding lines for equipment and materials, especially for major lab equipment and technology, continue to be restricted. While the department has made significant improvements in supply budget, technology, and assessment, the challenges of retention and increasing expectations on faculty for non-teaching service all represent long-term themes that continue to impact our ability to prioritize and implement broader planning. Strong faculty commitment to novel curriculum development, retention and remediation programs like PLTL, and research and outreach activities represent intrinsic capabilities for both fulfilling basic mission objectives and larger visions for the future. However, the degree to which faculty can successfully execute these goals is directly related to a number of extrinsic factors that can only be addressed through administrative financial allocations.

### ***B. Chemistry***

Vulnerabilities for the Chemistry program are summarized as follows:

- Many chemistry courses are offered on either an alternating year or less regular schedule. The alternating schedule includes not only elective offerings but also courses that are required core courses in the program, capstone courses or courses students select as part of their programs to fulfill the required limited electives. The Ch 440-442 (Physical Chemistry required for the traditional chemistry major), Ch 340 (Elementary Physical Chemistry required for the Forensic major), Ch 420 (Forensic Chemistry required for the Forensic major) and GS 161 (Technical Photography required for the Forensic major) are offered in alternate years. Ch 461, 462 (Experimental Chemistry), one of our capstone courses required of all majors, is also only offered in alternating years. Students are required to choose two courses from a limited list of electives as part of their degree requirement. Ch 411, 412 (Advanced Inorganic Chemistry), Ch 354 (Computational

Chemistry) and Ch 471 (Chemical Instrumentation), four of the six courses from which they can choose, are offered on a non-regular schedule often with 3-4 years between delivery. The only limited elective that is offered on an annual basis is Ch 430, 431 (Biochemistry) which is also a core course for the Forensic option and a service course for Biology students. A number of chemistry courses have either never been offered or have been offered on a very limited basis.

### ***C. Earth Science***

Vulnerabilities for the Earth Science program are summarized as follows:

- The Earth Science program, along with others in the division, lacks a consistent source of funding for large-scale instrumentation and facility infrastructure. While we have worked diligently to upgrade and support laboratory infrastructure, the Earth Science program still lags behind other science program areas in terms of modern laboratory equipment and resources.
- While the need is clearly documented by staffing and enrollment data, there is a notable lack of institutional commitment to securing a long overdue tenure-line addition of an Earth and Physical Science education specialist, comparable to that recently added to the Biology faculty complement.

### ***D. Mathematics***

- The primary vulnerability for the Mathematics program is lack of adequate tenure-line staffing levels, commensurate with growth and need in the lower-division remedial areas.

### ***E. Physics***

- The primary vulnerability for the Physics program is lack of office space, course-load equivalency and adequate long-term funding for a second tenure-line physicist.