

# Snow College

## Physical Sciences Program Review

submitted to the Snow College Board of Trustees  
October 2015

**Reviewed spring semester 2015 with the rating of recommended for the following programs:**

- Chemistry
- Engineering & Computer Science
- Geology
- Physics

### **Reviewers:**

- Dr. Daniel Horns, Associate Dean, College of Science & Health, Utah Valley University.
- Danni Larsen, Instructor, Home and Family Studies Department, Snow College.

### **Chemistry Program Description:**

Chemistry is the study of matter and its changes. Chemistry is a very broad discipline that is considered essential training for engineers, physicians, pharmacists, dentists, nurses, and science teachers as well as for all those pursuing any program in life or physical science. Chemistry broadly includes the study of inorganic, organic, and biologically important compounds as well as the physical and analytical characterization of these materials. Snow College has had excellent success providing exceptional preparation for those desiring to continue in chemistry, chemical engineering, pharmacy, and other premedical and science programs. The Chemistry Department offers general education courses to teach basic principles of scientific thought as it applies to matter and its properties and transformations. General Education students also are able to engage in laboratory experiences. Laboratories are an integral part of chemistry studies at Snow College and provide hands-on experience with the concepts discussed in classes.

### *Mission Statement:*

The mission of Snow College Chemistry Department is to provide a foundation for students who have a wide variety of career goals in the sciences and allied health fields. Faculty strives to teach chemistry in ways that help students become life-long learners and explorers of the relationship of chemistry to other fields. We encourage scientific inquiry in the classroom and laboratory by posing questions that require hands-on experiences with modern scientific equipment, and also challenge students to think critically about chemical principles.

The following departmental goals serve as guides toward mission fulfillment and are aligned with Snow College's mission and core themes (indicated in parentheses).

- To maintain close working relationships between students and faculty in order to provide wide-ranging and real-world experiences to students both in and out of the classroom (Core Theme 3: Atmosphere of Engagement).
- To provide an enriching and well-functioning curriculum such that student that leave the chemistry department continue to succeed at their transfer institutions (Core Theme 1: Tradition of Excellence).
- To support faculty development.
- To work together as faculty, staff, and administration to provide clean, safe, and well-functioning classrooms and laboratories.
- To maintain and improve our equipment and instrumentation to meet industry standards so that students are exposed to the most up-to-date trends/equipment and understand that science is a center for innovation (Core Theme 2: Culture of Innovation)
- To foster and maintain relationships with regional high school faculty and students.

### **Faculty and Staff:**

The faculty of the Chemistry Program is comprised of six full-time faculty and two adjunct instructors who represent various specialties in chemical engineering, inorganic chemistry, organic chemistry, and general chemical education. Faculty members are committed to providing quality instruction not only in their specific discipline but in all areas of chemistry. All full-time faculty members maintain at least 30 annual credit hour teaching assignments while also providing administrative support to the program, the division, and the college. Please see the datasheet for an inventory of chemistry faculty and their credentials.

### **Student Learning Outcomes:**

Students who complete an emphasis in chemistry at Snow College will be expected to demonstrate that they

- understand the principles of chemistry and the scientific method;
- understand the impact of chemistry in their lives;
- realize that chemistry is fundamental in understanding other natural sciences;
- can apply chemical principles to solve problems;
- can use chemical laboratory equipment and instruments;
- appreciate the usefulness of chemistry as a tool for solving problems;
- appreciate the way scientific research is done and the importance of the scientific method;
- appreciate medical, industrial and technological innovations resulting from the study of chemistry

The general advising of students attending Snow College is conducted through the Student Success Center. The Center employs many advisors who are trained to help with schedules, consult about major and career options, and find financial aid resources to pay for school. However, faculty members and part-time instructors in the chemistry department often meet with students to discuss their current academic and/or performance needs as well as their future goals. The program also hosts individuals from various

institutions who come to Snow College to recruit students for their programs. The University of Utah and University of Southern Nevada Colleges of Pharmacy make annual visits to the college to answer pre-pharmacy students' questions regarding their programs. For allied health majors, representatives from the Utah Rural Scholars Program at Southern Utah University have visited Snow College to address their needs. Annual visits from Utah State University are also held for those students interested in general chemistry science degrees.

**Data Form:**

| <b>Faculty Headcount (Academic Year)</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|--|-------------|-------------|-------------|-------------|-------------|
| <b>With Doctoral Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 1           | 1           | 1           | 1           | 1           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 1           | 3           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
|  |             |             |             |             |             |
| <b>With Master's Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 1           | 1           |
| Full-Time Non-Tenured                    | 1           | 1           | 1           | 1           | 1           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
|  |             |             |             |             |             |
| <b>With Bachelor's Degrees</b>           |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 3           | 3           | 3           | 3           | 2           |
|  |             |             |             |             |             |
| <b>Other</b>                             |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
|  |             |             |             |             |             |
| <b>Total Headcount Faculty</b>           | <b>5</b>    | <b>5</b>    | <b>5</b>    | <b>7</b>    | <b>8</b>    |
| <b>Full-Time Tenured</b>                 | <b>1</b>    | <b>1</b>    | <b>1</b>    | <b>2</b>    | <b>2</b>    |
| <b>Full-Time Non-Tenured</b>             | <b>1</b>    | <b>1</b>    | <b>1</b>    | <b>2</b>    | <b>4</b>    |
| <b>Part-Time</b>                         | <b>3</b>    | <b>3</b>    | <b>3</b>    | <b>3</b>    | <b>2</b>    |
|  |             |             |             |             |             |
| <b>FTE</b>                               |             |             |             |             |             |
| Full Time                                | 3.3         | 3.7         | 3.9         | 4.3         | 6.2         |
| Teaching Assistants                      | NA          | NA          | NA          | NA          | NA          |
| Part-Time                                | 0.5         | 0.9         | 1           | 0.5         | 0.3         |
| <b>Total Faculty FTE (Academic Year)</b> | <b>3.8</b>  | <b>4.6</b>  | <b>4.9</b>  | <b>4.8</b>  | <b>6.5</b>  |

| <b>Graduating Class</b>                         | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|---|-------------|-------------|-------------|-------------|-------------|
| <b>Number of Graduates</b>                      | 3           | 2           | 3           | 1           | 1           |
| Certificates                                    | 0           | 0           | 0           | 0           | 0           |
| Associate Degrees                               | 3           | 2           | 3           | 1           | 1           |
| Bachelor's Degrees                              | NA          | NA          | NA          | NA          | NA          |
| Master's Degrees                                | NA          | NA          | NA          | NA          | NA          |
| Doctoral Degrees                                | NA          | NA          | NA          | NA          | NA          |
|   |             |             |             |             |             |
| <b>Number of Students (as of Fall Semester)</b> | 662         | 715         | 738         | 707         | 742         |
| Total Declared Majors                           | 42          | 44          | 41          | 32          | 33          |
| Total Department FTE                            | 88.27       | 95.33       | 98.40       | 94.27       | 98.93       |
| Total Department SCH                            | 2648        | 2860        | 2952        | 2828        | 2968        |
| Student FTE/Faculty FTE                         | 23.2        | 20.7        | 20.1        | 19.6        | 17.4        |
| <b>Cost (based on Fiscal Year-Cost Study)</b>   | <b>FY10</b> | <b>FY11</b> | <b>FY12</b> | <b>FY13</b> | <b>FY14</b> |
| Direct Institutional Expenditures               | \$279,534   | \$245,743   | \$241,003   | \$264,788   | \$312,123   |
| Cost per Student FTE                            | \$3,443     | \$2,519     | \$2,257     | \$2,472     | \$3,072     |
|   |             |             |             |             |             |
| <b>Funding:</b>                                 |             |             |             |             |             |
| Appropriated Fund                               | NA          | NA          | NA          | NA          | NA          |
| <b>Other:</b>                                   |             |             |             |             |             |
| Special Legislative Appropriation               | NA          | NA          | NA          | NA          | NA          |
| Grants of Contracts                             | NA          | NA          | NA          | NA          | NA          |
| Special Fees/Differential Tuition               | NA          | NA          | NA          | NA          | NA          |

**Conclusion:**

Chemistry plays a significant role in many Snow College major programs. We work closely with those departments to establish and maintain standards that sufficiently meet their needs.

We have also worked with departments outside of our division. Fall 2013 and 2014 the Chemistry department sponsored a ceviche night on our Richfield campus. Brandon Burnett led this effort in conjunction with the Bill Jensen from the Spanish department. Students and community members were invited to attend a brief lecture on the chemistry behind preparing fish using acids (ceviche) and the cultural significance of ceviche.

We also continue to work with the CTE departments in Richfield and have developed an online chemistry course designed to meet their needs, including a Math and Science Day implemented on the Richfield campus this last year. Local high school students were invited to campus to learn more about opportunities in the STEM fields. We continue to explore interdisciplinary courses such as with the art department on a "Chemistry of Art" class and the English department on a collaborative "Murder Mystery" class.

## **Engineering and Computer Science Program Description**

Jim Luster formalized the Engineering Program at Snow College after joining the faculty in the early 70s. The Engineering Department was created in the late 80s. These developments were driven by an increasing demand by industry for engineers and student requests to study engineering at Snow College. Engineering has grown over the last century and continues to be an essential backbone to society. The number of engineering disciplines has continued to expand beyond the traditional four: civil, chemical, electrical, and mechanical. Snow College trains students well in these four disciplines, as well as their variations. We also are able to reasonably support newer disciplines such as computer engineering or biological engineering.

### *Mission Statement:*

The mission of the engineering department is to successfully prepare engineering students to transfer into a B.S. program at the junior level and then continue to completion. Our mission supports the greater societal goal of improving the quality of life for everyone.

The B.S. engineering requirements at the universities have become a continually moving target. The first two years of engineering education used to be uniform for all engineering disciplines. In the last two decades, that uniformity has transformed into discipline-specific curricula. We have worked and continue to work with the many engineering departments at the universities in the state to provide a collection of courses that articulate appropriately. The pattern of curriculum specialization makes it challenging for Snow College to provide all the necessary classes for all the variations at all of the local universities.

### **Faculty and Staff:**

The faculty of the Engineering and Computer Science Program is comprised of three full-time faculty, three contributing faculty from other programs, and two adjunct faculty (see data form).

### **Student Learning Outcomes:**

Students who complete the recommended Computer Science curriculum at Snow College will be expected to demonstrate that they:

- know the elements of high-level and low-level programming languages and the vocabulary used to describe them;
- know the common data structures and various implementations of each;
- understand the basics of digital circuits and how a central processing unit works;
- understand number systems; specifically base-2, base-16, and base-10;
- can design and implement a program in a high-level language and low-level language;
- can analyze and synthesize a digital circuit;
- appreciate the social and ethical responsibilities of a computer professional;
- believe that they are capable of participating in the systematic study of algorithmic processes.

Students who complete an emphasis in engineering at Snow College will be expected to demonstrate that they:

- have a working knowledge of the theories and principles of physics in the areas of Newtonian mechanics, gravitation, electricity and magnetism, wave motion and physical optics;
- are acquainted with standard methods of mathematical analysis including trigonometry and analytic geometry, differential and integral calculus, matrices and linear algebra, and the solution to differential equations;
- understand the role of chemistry in our physical and biological environment as it pertains to atomic and molecular structure, the laws of thermodynamics and how energy is exchanged between systems;
- can work effectively in a group to accomplish an objective, and make a significant contribution to its outcome;
- can combine the knowledge of physics and chemistry, together with the analytical skills of mathematics to find solutions to technical problems that benefit society;
- can use the computer to store and process technical data, to access information remotely over the internet, and as a computational tool related to the engineering process;
- appreciate our understanding of the physical world and the laws that govern it;
- recognize the beauty of mathematics and elegance of physical theories;
- inculcate the importance of professional ethics as practiced by engineers as they apply knowledge and skills to serve society.

Students who complete an emphasis in engineering at Snow College and transfer to a university have the following outcomes:

- be able to transfer into a university engineering program at the junior level and continue their studies without loss of time or credits;
- have gained a sufficiently broad and rigorous background in the physical sciences, mathematics, and engineering methods that they will be successful and perform well in comparison to their fellow students at the university.

Students who complete an emphasis in engineering at Snow College and complete any additional needed training usually should be eligible for employment in the following occupations:

- oil refining, environmental remediation, composite materials, and nuclear waste management;
- design and construction of transportation systems, structural projects, water systems, agricultural facilities, and mining projects;
- design and manufacture of mechanical systems in the auto industry, aerospace vehicles, farm machinery, and heating and air conditioning systems;
- computer design and manufacturing, electric power production, microwave and radio communications, and signal processing.

The general advising of students attending Snow College is conducted through the Student Success Center. The Center employs many advisors who are trained to help with schedules, consult about major and career options, and find financial aid resources to pay for school. Although skilled, the advisors do not give students specific advice in engineering related coursework. Advisors help students with their general education choices, give general advice about engineering related coursework, and then explicitly explain to students that they must see an engineering faculty for detailed program counseling.

This policy has minimized student confusion and helped students avoid choices that would delay their progression toward their degree goal. This policy has come with significant costs. A conservative estimate is that engineering faculty advise students specifically about coursework over 200 times per semester.

Engineering and/or Computer Science students transfer to four-year institutions with the intent of earning a B.S. degree. Most transfer to Utah State University with smaller numbers transferring to the University of Utah and other schools. Many of our students have earned the honor of valedictorian or outstanding senior in their respective colleges/programs at those transfer institutions.

Our students are not only being accepted, but they are being sought out. They are not only completing B.S. degrees, but they are performing at least as well, usually better, than the university's own freshman and sophomore students. Our students regularly report back that they were better prepared in the junior level courses than those students who started at the respective university. A long-time engineering advisor at USU continues to commend us for the quality of student transferring from Snow College. Three years ago the Civil Engineering Department Chair at USU simply stated that Snow College students are better prepared than their own students.

We are also succeeding in our mission with students who start out as marginal students. With the extra care provided here at Snow College, they are able to get a stable foundation and continue to completion of a B.S. degree. Most of these students would certainly not persevere in the extra-large and non-personal freshman and sophomore engineering courses at the university.

The Engineering and Computer Science Program develops student learning and leadership through involvement with various external organizations. For example, the GIS and Surveying courses allow student to provide regular surveying service to Ephraim City and other local communities.

**Data Form:**

| <b>Faculty Headcount (Academic Year)</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|--|-------------|-------------|-------------|-------------|-------------|
| <b>With Doctoral Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 1           | 1           | 1           | 2           | 2           |
| Full-Time Non-Tenured                    | 1           | 1           | 1           | 0           | 0           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
| <b>With Master's Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 3           | 3           | 3           | 3           | 3           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 1           |
| Part-Time                                | 0           | 1           | 2           | 1           | 0           |

|  |          |            |            |          |            |
|--|----------|------------|------------|----------|------------|
| <b>With Bachelor's Degrees</b>           |          |            |            |          |            |
| Full-Time Tenured                        | 0        | 0          | 0          | 0        | 0          |
| Full-Time Non-Tenured                    | 0        | 0          | 0          | 0        | 0          |
| Part-Time                                | 0        | 0          | 0          | 0        | 0          |
| <b>Other</b>                             |          |            |            |          |            |
| Full-Time Tenured                        | 0        | 0          | 0          | 0        | 0          |
| Full-Time Non-Tenured                    | 0        | 0          | 0          | 0        | 0          |
| Part-Time                                | 0        | 0          | 0          | 0        | 0          |
| <b>Total Headcount Faculty</b>           | <b>5</b> | <b>6</b>   | <b>7</b>   | <b>6</b> | <b>6</b>   |
| <b>Full-Time Tenured</b>                 | <b>4</b> | <b>4</b>   | <b>4</b>   | <b>5</b> | <b>5</b>   |
| <b>Full-Time Non-Tenured</b>             | <b>1</b> | <b>1</b>   | <b>1</b>   | <b>0</b> | <b>1</b>   |
| <b>Part-Time</b>                         | <b>0</b> | <b>1</b>   | <b>2</b>   | <b>1</b> | <b>0</b>   |
| <b>FTE</b>                               |          |            |            |          |            |
| Full Time                                | 2        | 2.1        | 1.5        | 1.5      | 1.9        |
| Teaching Assistants                      | NA       | NA         | NA         | NA       | NA         |
| Part-Time                                | 0        | 0.3        | 0.6        | 0.5      | 0.2        |
| <b>Total Faculty FTE (Academic Year)</b> | <b>2</b> | <b>2.4</b> | <b>2.1</b> | <b>2</b> | <b>2.1</b> |

| <b>Graduating Class</b>                       | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|---|-------------|-------------|-------------|-------------|-------------|
| <b>Number of Graduates</b>                    | 17          | 14          | 15          | 15          | 3           |
| Certificates                                  | 0           | 0           | 0           | 0           | 0           |
| Associate Degrees                             | 17          | 14          | 15          | 15          | 3           |
| Bachelor's Degrees                            | NA          | NA          | NA          | NA          | NA          |
| Master's Degrees                              | NA          | NA          | NA          | NA          | NA          |
| Doctoral Degrees                              | NA          | NA          | NA          | NA          | NA          |
| <b>Number of Students (Academic Year)</b>     | <b>194</b>  | <b>230</b>  | <b>239</b>  | <b>228</b>  | <b>257</b>  |
| Total Declared Majors                         | 62          | 46          | 14          | 4           | 5           |
| Total Department FTE                          | 25.2        | 32.6        | 34.9        | 29.9        | 36.8        |
| Total Department SCH                          | 756         | 979         | 1047        | 898         | 1103        |
| Student FTE/Faculty FTE                       | 12.6        | 13.6        | 16.6        | 15.0        | 17.5        |
| <b>Cost (based on Fiscal Year-Cost Study)</b> | <b>FY10</b> | <b>FY11</b> | <b>FY12</b> | <b>FY13</b> | <b>FY14</b> |
| Direct Institutional Expenditures             | \$226,708   | \$216,712   | \$228,252   | \$254,038   | \$263,483   |
| Cost per Student FTE                          | \$8,996     | \$6,641     | \$6,540     | \$8,487     | \$7,166     |
| <b>Funding:</b>                               |             |             |             |             |             |
| Appropriated Fund                             | NA          | NA          | NA          | NA          | NA          |
| <b>Other:</b>                                 |             |             |             |             |             |
| Special Legislative Appropriation             | NA          | NA          | NA          | NA          | NA          |
| Grants of Contracts                           | NA          | NA          | NA          | NA          | NA          |
| Special Fees/Differential Tuition             | NA          | NA          | NA          | NA          | NA          |



**Conclusion:**

On a college campus, most recognize that engineering students are bright and they work extremely hard, and long, to graduate with their degrees. Historically, incoming freshman intent on studying engineering are in the 80<sup>th</sup> percentile of academic skill in comparison to their peers. Unfortunately across the country, approximately 80% never earn a bachelor's degree in engineering. The process of becoming an engineer is difficult. It requires learning challenging material, but more difficult is the process of changing how a student thinks. An engineering student becomes a problem-solver. It is that ability that the market values. If engineering educators could find a way to develop problem-solvers in an easier, quicker way, we'd have more engineers. But the axiom "anything of value comes with a price" is immutable. Students must pay that price, but engineering teachers' pay a portion of that price also with hard work and immutable dedication to their students.

## **Geology Program Description:**

The geology program has always been part of the Natural Science Division. Before the 90s, the geology program had one faculty with 2/3 load in geology and 1/3 in math. Since that time the demand for geology courses has increased with increasing student numbers so that there is enough work for one full time and some adjuncts. The department is committed to providing geology majors and others interested with early exposure to geology in the field. The department is also committed to the laboratory experience. While many four-year institutions in Utah have eliminated the laboratory requirements for general education courses (for funding reasons), Snow College geology courses carry a co-requisite laboratory course. These two aspects of the Geology Program at Snow College, and the small class sizes make us unique. These field and lab experiences give geology majors a significant advantage when transferring to four-year institutions.

Over the years, the geology program has adapted and changed in many ways. For example, the variety of courses offered for GE credit have expanded to include Environmental Geology, Oceanography and Honors geology. In the fall of 2014 a new course called Survey of Hydrology was added to fill the needs of the Natural Resource AAS program. This course is 2/3 time in the field and 1/3 time lecture. Students leave this class prepared to work as watershed technicians. The courses for majors have been expanded to include field studies courses. The courses have morphed into courses that are more inquiry based, more experiential and more field-- based over time. Our department offers tradition face to face courses as well as online, hybrid and IVC.

### *Mission Statement:*

The mission of the geology program has always been primarily geared towards teaching general education science courses in geology and physical geography in order to produce citizens that are geologically literate and understand the nature of science as a method of inquiry about the world. In addition, the program's mission is to provide an exemplary first two years for geology majors in preparation for transfer to four-year programs. The geology program also offers courses required of civil engineering, education and natural resource majors.

The goal of the Geology Department is to teach students to love learning about geology, and learn to serve others. The small class sizes, commitment to service learning and to laboratory and field experiences give our students a unique advantage. Many courses in the department carry the "SL" suffix indicating that service learning is a portion of the curriculum in this course. In addition to students providing service to the community in the context of geology courses, the department is committed to providing service to the community by providing expertise and materials to local schools, scout groups, civic groups, etc.

An additional departmental goal is to recruit geology majors from GE courses. According to agiweb.org about 30% of students decide to major in geology as the result of an undergraduate course. At Snow College, the percentage of majors who come from our GE courses is greater than this – closer to 50%. A large percentage of these majors are young women.

In addition to preparing geology majors for successful transfer, a new push has been to seek out and provide internship and research opportunities for majors while they are at Snow College. We have been successful in developing partnerships with the local watershed and coal mines that provide our students with internships.

### **Faculty and Staff:**

Geology program faculty consists of one full-time faculty member and several adjunct instructors. The full-time faculty member was originally hired at 1/3 math instruction and 2/3 geology instruction. As overall student enrollments grew in addition to math program development, geology instruction was adjusted to 100% of the faculty member's load (see Data Form).

### **Student Learning Outcomes:**

Students who complete the recommended Geology curriculum at Snow College will be expected to demonstrate that they

- know the common materials of which the earth is composed;
- know the processes that create the different types of rocks;
- know the principal chemical and physical processes at work both on and below the earth's surface;
- know the major events in the geologic evolution of the earth, especially North America and Utah;
- know the significant events in the development of geology as a science;
- can identify common rocks and minerals;
- can read and interpret topographic and geologic maps and aerial photographs;
- can identify common fossils;
- can construct a geologic map from field data;
- can interpret geology in the field;
- can write a scientific style research paper;
- can deliver a professional talk on an area of geologic research;
- can make informed personal and political decisions in the area concerning earth processes;
- appreciate the methods of science as a means of inquiry in the world;
- appreciate the difference between science and pseudo-science;

All geology majors are encouraged to seek advisement from the faculty in the geology department instead of the general advising center. As soon as geology majors are declared, the faculty meet with them to create a plan for both Snow College and transfer.

Data Form:

| <b>Faculty Headcount (Academic Year)</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|--|-------------|-------------|-------------|-------------|-------------|
| <b>With Doctoral Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
| <b>With Master's Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 1           | 1           | 1           | 1           | 1           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 2           | 2           | 1           | 0           | 0           |
| <b>With Bachelor's Degrees</b>           |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
| <b>Other</b>                             |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 0           | 0           | 0           | 0           | 0           |
| <b>Total Headcount Faculty</b>           | <b>3</b>    | <b>3</b>    | <b>2</b>    | <b>1</b>    | <b>1</b>    |
| <b>Full-Time Tenured</b>                 | <b>1</b>    | <b>1</b>    | <b>1</b>    | <b>1</b>    | <b>1</b>    |
| <b>Full-Time Non-Tenured</b>             | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    |
| <b>Part-Time</b>                         | <b>2</b>    | <b>2</b>    | <b>1</b>    | <b>0</b>    | <b>0</b>    |
| <b>FTE</b>                               |             |             |             |             |             |
| Full Time                                | 0.9         | 1           | 1           | 0.7         | 1           |
| Teaching Assistants                      | NA          | NA          | NA          | NA          | NA          |
| Part-Time                                | 0.5         | 0.3         | 0.5         | 0           | 0           |
| <b>Total Faculty FTE (Academic Year)</b> | <b>1.4</b>  | <b>1.3</b>  | <b>1.5</b>  | <b>0.7</b>  | <b>1</b>    |

| <b>Graduating Class</b>                   | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|---|-------------|-------------|-------------|-------------|-------------|
| <b>Number of Graduates</b>                | <b>1</b>    | <b>0</b>    | <b>1</b>    | <b>0</b>    | <b>0</b>    |
| Certificates                              | 0           | 0           | 0           | 0           | 0           |
| Associate Degrees                         | 1           | 0           | 1           | 0           | 0           |
| Bachelor's Degrees                        | NA          | NA          | NA          | NA          | NA          |
| Master's Degrees                          | NA          | NA          | NA          | NA          | NA          |
| Doctoral Degrees                          | NA          | NA          | NA          | NA          | NA          |
| <b>Number of Students (Academic Year)</b> | <b>225</b>  | <b>219</b>  | <b>203</b>  | <b>153</b>  | <b>187</b>  |
| Total Declared Majors                     | 1           | 2           | 0           | 1           | 2           |

|                         |       |       |       |       |       |
|-------------------------|-------|-------|-------|-------|-------|
| Total Department FTE    | 28.60 | 26.52 | 24.67 | 19.20 | 22.97 |
| Total Department SCH    | 858   | 795.5 | 740   | 576   | 689   |
| Student FTE/Faculty FTE | 20.4  | 20.4  | 16.4  | 27.4  | 23.0  |

| Cost (based on Fiscal Year-Cost Study) | FY10     | FY11      | FY12     | FY13     | FY14     |
|--|----------|-----------|----------|----------|----------|
| Direct Institutional Expenditures      | \$74,504 | \$108,798 | \$95,837 | \$97,619 | \$84,500 |
| Cost per Student FTE                   | \$2,696  | \$3,484   | \$3,090  | \$3,716  | \$4,055  |
|  |          |           |          |          |          |
| <b>Funding:</b>                        |          |           |          |          |          |
| Appropriated Fund                      | NA       | NA        | NA       | NA       | NA       |
| <b>Other:</b>                          |          |           |          |          |          |
| Special Legislative Appropriation      | NA       | NA        | NA       | NA       | NA       |
| Grants of Contracts                    | NA       | NA        | NA       | NA       | NA       |
| Special Fees/Differential Tuition      | NA       | NA        | NA       | NA       | NA       |

### Conclusion:

The geology program is a great deal. One full-time faculty member offers quality teaching in all venues -- face to face, IVC, online and hybrid. One full-time faculty member has a proven history of high impact practices in the classroom and embraces more changes going forward. One faculty member is committed to and loves teaching a wide variety geology courses to general education students. One faculty member serves the community by teaching teachers, providing lessons and material to local schools, coaching Science Olympiad students. Our department has a proven record of seamless transfer for geology majors and an exemplary record of preparing such majors for success after transfer.

Geology is a subject that is beloved by people of Utah. We are surrounded by the beauty and wonder of it. Our students love learning about it. They love the experiential field based learning. When we educate students in geology we create, with few exceptions, lifelong learners. They can't keep their eyes on the road because their eyes have been opened to the wonders of geology. They choose window seats on planes. They look at liquefaction potential maps before they buy property. And they never forget their geology field trip!

## **Physics Program Description:**

Physics is the study and application of the fundamental laws of nature that include motion, gravity, astronomy, thermodynamics, electromagnetics, and microscopic interaction. Studying the laws of nature is traditionally a core part of a college education. Most all other areas of science are supported and understood by a thorough understanding of the laws of nature. Students who are majors in engineering, computer science, chemistry, geology, mathematics, and the life sciences take physics classes at Snow College. Individuals who work in these fields are essentially applied physicists. In addition, problem solving skills and understanding the science behind new technologies are necessary for all people to be successful, regardless of career choice. The physics, physical science, meteorology, and astronomy courses offered by Snow College are designed to meet these needs.

### *Mission Statement:*

The mission of the physics department fits tightly into the College's mission statement in that it provides a "vibrant learning environment...empowers students to achieve their educational goals---creates dynamic learning experiences." Specifically, a student completing physics courses should be able to reason scientifically, be prepared to succeed at the next level of courses, and have in general an increased knowledge of physical science.

As student preparation and interest in science has decreased over the last several years, we have incorporated many "gee whiz" demonstrations. These demos have helped rekindle some science excitement in many of our classes. Due to lack of funding, we used to crowd 5 or 6 people around one set of equipment in the lab. Now with the lab fees and selling of lab manuals through the Majock Bookstore, we have been able to increase the number of complete sets of equipment to 8 units per lab for most experiments. This places 2 to 3 students on each set of equipment. We have added Modern Physics (required for physics majors, and strongly recommended for chemistry and electrical engineering majors), astronomy, and a meteorology course to the curriculum to give students more options and in depth knowledge. As per the recommendations in the American Association of Physics Teachers "Guidelines for Two-Year-College Physics Programs", the Physics for Scientists and Engineers class has had its lab lengthened from 2 hours to 3 hours per week to give a more thorough experience in gathering and interpreting scientific data.

### **Faculty and Staff:**

All physics faculty are part time in the department and have assignments in other departments such as mathematics, chemistry, engineering, etc. Below is a list the faculty with their highest attained degree, approximate years of experience, and an additional responsibility they may have.

### **Student Learning Outcomes:**

Students who complete the recommended physics curriculum at Snow College will be expected to demonstrate that they

- know how to approach a problem and solve it;
- know how to apply physics to everyday situations;
- know about the basic laws that govern the universe and the world around us;
- understand that physics is useful in many areas of life;
- understand that physics is a fundamental science that underlies the other natural sciences;
- understand the methods scientists use to discover and learn scientific principals;
- can do elementary problems in mechanics, electricity & magnetism, gravitation, optics, waves, etc.;
- can set up an experiment to test an idea;
- can work with various kinds of physical and electrical equipment including computers comfortably;
- appreciate the pervasiveness of physics in the world;
- appreciate the role of physics in history as well as its role in modern life;
- appreciate technological innovations that result from applied physics;
- feel confident in their abilities to deal with the world.

A major factor in Physics growth has been the lack of available adjunct personnel. The pressure for additional physical science seats has been assumed largely by Chemistry as they have available adjuncts. If we offer additional classes we have to do it ourselves as a night class, overload, or as a gift. The departure of Dr. James Luster and Dr. Ron Thurgood has increased the workload of the physics and engineering faculty. This may be efficient, but it does not boost the quality of instruction. This year we were successful in attracting and hiring a new faculty member, Professor Kyle Rowley. Although his primary assignment is in engineering, he does teach a physics class each semester. The availability of the Physics lab also narrows what we can offer. The numbers below have been compiled by the office of institutional research. To our knowledge, we have had about 1 physics major, and a clientele of 25 – 50 students needing the 2000 level courses each year.

The general advising of students attending Snow College is conducted through the Student Success Center. The Center employs many advisors who are trained to help with schedules, consult about major and career options, and find financial aid resources to pay for school. In addition, faculty members and part-time instructors in the physics department often meet with students to discuss their current academic and/or transfer needs as well as their future goals. Many times the advisement office will classify students as “general ed” rather than the specific major that would be a physics related field.

**Data Form:**

| <b>Faculty Headcount (Academic Year)</b> | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
|--|-------------|-------------|-------------|-------------|-------------|
| <b>With Doctoral Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 2           | 2           | 2           | 2           | 2           |
| Full-Time Non-Tenured                    | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                | 2           | 2           | 2           | 2           | 1           |
| <b>With Master's Degrees</b>             |             |             |             |             |             |
| Full-Time Tenured                        | 0           | 0           | 0           | 0           | 0           |

|   |             |             |             |             |             |
|---|-------------|-------------|-------------|-------------|-------------|
| Full-Time Non-Tenured                         | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                     | 1           | 1           | 1           | 1           | 2           |
| <b>With Bachelor's Degrees</b>                |             |             |             |             |             |
| Full-Time Tenured                             | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                         | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                     | 0           | 0           | 0           | 0           | 0           |
| <b>Other</b>                                  |             |             |             |             |             |
| Full-Time Tenured                             | 0           | 0           | 0           | 0           | 0           |
| Full-Time Non-Tenured                         | 0           | 0           | 0           | 0           | 0           |
| Part-Time                                     | 0           | 0           | 0           | 0           | 0           |
| <b>Total Headcount Faculty</b>                | <b>5</b>    | <b>5</b>    | <b>5</b>    | <b>5</b>    | <b>5</b>    |
| <b>Full-Time Tenured</b>                      | <b>2</b>    | <b>2</b>    | <b>2</b>    | <b>2</b>    | <b>2</b>    |
| <b>Full-Time Non-Tenured</b>                  | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    |
| <b>Part-Time</b>                              | <b>3</b>    | <b>3</b>    | <b>3</b>    | <b>3</b>    | <b>3</b>    |
|   |             |             |             |             |             |
| <b>FTE</b>                                    |             |             |             |             |             |
| Full Time                                     | 1.1         | 1.5         | 1.2         | 1.3         | 1.7         |
| Teaching Assistants                           | NA          | NA          | NA          | NA          | NA          |
| Part-Time                                     | 1.3         | 0.9         | 0.9         | 0.9         | 0.9         |
| <b>Total Faculty FTE (Academic Year)</b>      | <b>2.4</b>  | <b>2.4</b>  | <b>2.1</b>  | <b>2.2</b>  | <b>2.6</b>  |
| <b>Graduating Class</b>                       | <b>2010</b> | <b>2011</b> | <b>2012</b> | <b>2013</b> | <b>2014</b> |
| <b>Number of Graduates</b>                    | <b>0</b>    | <b>1</b>    | <b>0</b>    | <b>0</b>    | <b>0</b>    |
| Certificates                                  | 0           | 0           | 0           | 0           | 0           |
| Associate Degrees                             | 0           | 1           | 0           | 0           | 0           |
| Bachelor's Degrees                            | NA          | NA          | NA          | NA          | NA          |
| Master's Degrees                              | NA          | NA          | NA          | NA          | NA          |
| Doctoral Degrees                              | NA          | NA          | NA          | NA          | NA          |
|   |             |             |             |             |             |
| <b>Number of Students (Academic Year)</b>     | <b>337</b>  | <b>376</b>  | <b>312</b>  | <b>359</b>  | <b>432</b>  |
| Total Declared Majors                         | 34          | 42          | 24          | 23          | 27          |
| Total Department FTE                          | 44.93       | 50.13       | 41.60       | 47.87       | 57.60       |
| Total Department SCH                          | 1348        | 1504        | 1248        | 1436        | 1728        |
| Student FTE/Faculty FTE                       | 18.7        | 20.9        | 19.8        | 21.8        | 22.2        |
| <b>Cost (based on Fiscal Year-Cost Study)</b> | <b>FY10</b> | <b>FY11</b> | <b>FY12</b> | <b>FY13</b> | <b>FY14</b> |
| Direct Institutional Expenditures             | \$246,445   | \$217,917   | \$203,897   | \$126,623   | \$157,200   |
| Cost per Student FTE                          | \$5,749     | \$6,274     | \$4,901     | \$3,469     | \$3,850     |
| <b>Funding:</b>                               |             |             |             |             |             |
| Appropriated Fund                             | NA          | NA          | NA          | NA          | NA          |
| Other:  |             |             |             |             |             |



|                                   |    |    |    |    |    |
|-----------------------------------|----|----|----|----|----|
| Special Legislative Appropriation | NA | NA | NA | NA | NA |
| Grants of Contracts               | NA | NA | NA | NA | NA |
| Special Fees/Differential Tuition | NA | NA | NA | NA | NA |

**Conclusion:**

The department is productive, austere, and share in the committee/administrative responsibilities of the school. The faculty are professional in every way. They have excellent credentials and experience and are up to date in the profession. The department is totally committed to the success of the students. The faculty contribute to the community in many acts of service. The free advertising for Snow through the weather station is a big bang for little money spent. We feel that we contribute to the mission of the school, love our jobs and want the best for the students.

The department has encouraged the strategic planning committee to look critically at not just the instructional programs, but support staff and administration. Taking administrative budgets and dividing by the total number of students would produce a meaningful piece of data that would help us see how much we spend for no FTE generated.

The faculty have assumed additional responsibilities in the last few years, such as doing accounting, purchasing, additional assessment of student learning objectives, and other roles in the governance of the school.

**Comprehensive Program Assessment:**

In accordance with Utah State Board of Regents’ policy R411 on the periodic review of educational programs, an on-site visit of Snow College’s Physical Science programs was conducted on April 24, 2015. This visit included a comprehensive tour of educational facilities, conversations with students, class visits, and faculty interviews. This review represents strengths/commendations, weaknesses, and recommendations for all natural science programs: Chemistry, Computer Science & Engineering, Geology, and Physics.

**Program Strengths/Commendations:**

- The programs are commended for the enthusiasm faculty possess toward teaching. Consistently, faculty members expressed their love for working with students in the classroom with a great many knowing their students by name, having given particular attention to each students’ success. The program holds weekly lunchtime teaching workshops which are attended by a few dozen faculty members, which is further indicative of their dedication to teaching and improvement.
- All respective program faculty are commended for the significant amount of hours dedicated to teaching, lab prep, and field trips—with or without overload compensation.

- The faculty among the four natural science programs are commended for their camaraderie and willingness to cross departmental lines to help one another.
- The programs are commended for their cross-disciplinary teaching efforts. Several faculty members teach in more than one program. Such teaching helps those faculty members stay informed in more than one field, encourages innovative curriculum development, and mitigates burn-out that typically occurs by teaching the same courses over and over. This type of teaching also provides students with an understanding of the inter-relatedness of science disciplines.
- Each program is commended for its efforts toward student success. Transfer students from the Chemistry, Computer Science & Engineering, Geology, and Physics programs (respectively) are well-prepared when they enter four-year degree programs.

### **Program Weaknesses:**

- Lack of laboratory managers: The heavy teaching load of faculty, including frequent overload teaching, is worsened by a complete lack of support in the form of laboratory managers. Faculty members are responsible for the purchase, storage, and maintenance of laboratory supplies; tracking of laboratory inventory; the preparation and cleaning of lab spaces; and the preparation and instruction of all laboratory classes. This is of greatest concern in chemistry. A significant safety concern is created by having over-worked faculty members placed in charge of storing and maintaining supplies of hazardous chemicals. This increases the chances of hazardous chemicals being stored improperly, kept on-site for longer than is safe, and indicates the dire need for the hiring of laboratory managers.
- Overworked faculty: While it is clear that faculty members greatly enjoy their jobs, it is also clear that they work very hard, including frequently teaching overload and maintaining laboratory supplies.
- Insufficient Advising: Several students indicated that they received bad advice from general advisors working in the college's Student Success Center. This stemmed from the fact that the advisors are generalists and lack the proper knowledge to help students with specific natural science majors. Many students work around this issue by seeking advice from faculty members in their major departments. While this offers a partial solution, it creates an ineffective and often conflicting advising system in which students must go to more than one place for academic solutions.
- Lack of reliable data: It is noted that the commendation and concern regarding faculty workload are both based on purely anecdotal evidence. Several faculty members stated that the available data on students numbers (e.g. numbers of majors in each department) are not reliable. Any requests for additional resources (e.g. hiring laboratory managers) should be based on documented faculty workloads and student demand.

## Reviewer's Recommendations:

- **It is recommended that the physical science programs hire at least one laboratory manager.** Particularly, the lack of a chemistry laboratory manager creates an unsafe situation for students making this a top priority. A full-time chemistry lab manager could oversee the purchase of chemical supplies, the safe storage of chemicals, and the safe disposal of chemicals. In addition, this full-time person could teach chemistry lab classes and/or manage laboratory supplies for the other natural science departments. The existing full-time workload/overload physical science programs could likely justify hiring a second laboratory manager. This second lab manager could be responsible for purchasing and storing lab supplies for engineering, geology, physics, and could teach classes—lab classes—in those areas.
- **It is recommended that the centralized advising system be de-centralized.** Centralized advising is effective in helping undecided students choose majors, and in advising students who do not want to focus on a major. Once a student has chosen a major, however, that student is best served by working with an advisor specific to that major. This model of de-centralized advising is best achieved at Snow College by (1) assigning each advisor in central advising to be in charge of one or more academic disciplines with faculty providing specific discipline information, or (2) allowing departments or related departments to hire their own advisor(s). While the first option is the least expensive, the second option could also be called upon to conduct recruitment and outreach activities or care for some laboratory management tasks.
- **It is recommended that data collect faculty workloads, student numbers, and student success.** Lobbying for funds to hire laboratory managers or advisors would be made more effective by having sound data that documents the need for the manager or advisor. Among the types of data that would be useful are
  - A table showing the teaching load for each full-time faculty member for the past several years.
  - A table showing the numbers of majors in each department over the past several years. The usefulness of this table, however, would be compromised by the fact that a great many students at Snow College never declare a major, even if they are clearly focused on one field of study. If meaningful numbers on majors is not available, this table could be replaced by a table showing numbers of students in discipline core courses over the past several years.
  - A report on the numbers and success of students who transfer to physical science programs at four-year universities. Since the faculty members at Snow College seem to be quite familiar with their students, they likely know the transfer location of their former students. It may be possible to get information on students who have transferred to other schools and it may be possible to obtain information on their success at those schools

(e.g. GPA, graduation status, etc.). This could be one aspect of a part-time or full-time physical science advisor.

### **Institutional Response:**

The physical science area is grateful for the insight and the suggestions of the external evaluators associated with the Natural Science and Mathematics Division program review. Their insight is both helpful and useful as we make strategic plans for the program. We very much appreciate and agree with the commendations provided in evaluation. Many of the recommendation and commendation we agree with. The way we plan to address the recommendations are as follows:

- **Laboratory Managers:** As a division we will strive to address this serious concern. As part of the strategic plan, there have been monies allocated to use to address part of this problem in the area of life science. A number of proposals have been submitted to address the chemistry area, but none have matched current resources yet. As a department, we will continue to strive to obtain a position to address this concern. Until possible, we will continue to use faculty to ensure that the stock rooms and equipment remain in good order as mentioned in the recommendation.
- **Faculty Load/Overload:** We agree that the workload issue is of concern. Currently the institution is undergoing an evaluation of salary and workload to help understand and address this concern. The institution has hired a consulting firm to address the area of salary. The Dean's council has taken up the task of examining the current workload of each faculty. We hope to have most of these issues addressed in the next few years.
- **Central/De-Centralized Advising:** In general, we do not believe this to be as large a problem as the evaluators indicate. We have improved our relationship with central advising over the last few years. They have been excellent at advising students in a general fashion and they have been diligent at trying to get students to talk with a faculty advisor in the area of their major. Yes, there are times when this breaks down and there are times when a student is advised in a problematic direction. In most cases, it can be determined that the student didn't follow up on the advice to check with a faculty member in the area. Our plan is to work toward better communication with central advising. We also plan to utilize major preference information to help give students better advice. One of the largest problems in poor advising happens before students come to college. High Schools are trying to help students obtain so many college credits before enrolling that students are not science ready when they come. We have started offering more substantial science courses for high school students to help curb this problem.
- **Lack of reliable data:** We agree with this assessment and need to address it. Part of the information will come from the salary and workload studies mentioned above. Data on students is something that we desire as well. The ability to obtain this data is becoming available and we hope to include more of this in our studies in the future. We will implement a data collection, review and analysis process to help us understand success of our students and workload.