UTAH STATE UNIVERSITY

DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY
College of Science

SELF-STUDY REPORT

Departmental Review
2011
SUMMARY

Ours is a combined Department of Chemistry and Biochemistry, offering undergraduate and graduate degrees in both disciplines. Our faculty numbers presently stand at 14 tenured or tenure-track faculty members and one lecturer. Historically there have been 17.4 faculty lines in the department; the attrition has arisen from university-wide budget cuts that resulted in the pullback of some vacant positions, and recent unsuccessful searches. There is one current search for a regular faculty member, and two other searches in more specialized areas (Chemical Biology and USTAR); these are described in the next section. The distribution of faculty among the classical teaching divisions of chemistry and biochemistry is presented in the Faculty section.

Departmental Staff include an Administrative Assistant and another staff assistant in the main office, with part time student worker help; a Business Manager who monitors departmental financial affairs and assists with individual faculty grants; the manager for Chem Stores, a stockroom that serves the entire campus community; an Electronics Specialist; and an NMR/EPR facility director. The job descriptions for these positions are in section III on Staff. Except for the student workers these are all full-time positions. The Department had an undergraduate laboratory manager as well, but this position was lost to budget cuts in 2008.

The department currently has six adjunct faculty members, none of whom teach courses but who contribute to the department in various ways that are described in the Faculty section.

At the undergraduate level the Chemistry and Biochemistry Department offers BS and BA degrees in Chemistry and a BS Biochemistry. Minors include Chemistry and Chemistry teaching. Graduate degrees are offered at both the MS and PhD levels. The most current enrollment figures show 247 undergraduates who have declared an undergraduate major in our department, about 45% in chemistry and 55% biochemistry. The graduate student body as of Spring semester 2011 includes 1 MS candidate and 28 PhD candidates. The number of undergraduate majors has increased in recent years, while graduate numbers have declined. The number of degrees awarded annually over the past five years has varied within the following ranges: 16-25 BS, 3-4 MS, and 2-10 PhD. More information on our undergraduate and graduate student bodies is presented in the Students section (Section IV) of this report. The Department awards more PhD degrees than any other Department in the College of Science.

The Department teaches a large number of service courses, and the number of student credit hours has been steadily increasing in recent years, from 12,130 in 2006-07 to 13,334 in 2008-09. The student/faculty ratio (taking into account student FTE and faculty FTE) rose from 24.6 in 2006 to 31 in AY2010. The undergraduate student-faculty ratio was 43.4 in 2008-09. Both figures are the highest in the College of Science. The cost per student credit hour is $192, the same as the Biology Department; in the College of Science, only Mathematics & Statistics is lower at $127. Computer Science is highest at $511.

This Department is heavily involved in research and in the training of graduate and undergraduate students in this regard. Historically, total Departmental annual contracts and grants funds were in the $1.9 - 2.2 M range from the 1990’s through 2005 then gradually declined, but rebounded strongly to >$3 M in 2009-10. Our faculty members submitted 27 proposals to external funding agencies for new funding in 2009-10. The Department also publishes well in peer-reviewed journals. The total of 129 for the period 2008-2010 amounts to
just over 9 papers/faculty member. Undergraduate students in our department are not required, but are encouraged, to pursue research in a faculty lab prior to graduation. Indeed, many of our undergraduates are listed as coauthors on published papers. Many of these students go on to graduate or professional schools.

The success of the Department in training undergraduate and graduate students, as well as substantial contributions to the scientific literature and securing external research funding, stands in marked contrast to our low number of faculty. Even the historical high of 17.4 faculty lines in the Department placed us smaller than any similar Department of the ten institutions chosen by the University as USU’s peer group. These “peer institutions” are the following: UC Davis, Colorado State, Iowa State, New Mexico State, North Carolina State, Oregon State, Penn State, Texas A&M, Virginia Polytech, and Washington State. Most of these schools have from three to four times the number of faculty in Chemistry and Biochemistry as our Department. The smallest “peer” department is New Mexico State’s Chemistry and Biochemistry Department, which numbers 23 faculty.

The inadequacy of our faculty numbers profoundly affects several of our missions, particularly our research and graduate programs. It is a major hurdle in our attempts to recruit graduate students. Our success in securing external funding has provided an ample number of openings for graduate students to serve as research assistants. However, we have not been able to recruit the number of students needed to fulfill the goals of the funded research projects in this Department. According to surveys taken of graduate students who consider enrolling, students repeatedly cited the small number of faculty and the accompanying limited choices of research groups as a major reason for choosing to go elsewhere for graduate studies. The deficiency has additional repercussions on our instructional program. With our present faculty, our teaching capacity is stretched to fill the lower-level and service courses, and we are severely limited in our ability to teach upper-level specialty courses, both at the undergraduate and graduate levels.

Another roadblock in this Department’s attempts to compete in the national arena is a weak research infrastructure, both in this Department and on the campus generally, in both major equipment and, even more severely, in support personnel. Some important equipment is simply absent, and other equipment lacks the expertise to properly utilize it; for example, an advanced LC-MS system obtained by a congressional earmark and housed in a center elsewhere on campus is underutilized because no LC-MS expert is in residence. The absence of such expertise was an obstacle in the Department’s efforts to obtain NSF funding for our own instrument, and the absence of a sufficiently large user base was a weakness cited by reviewers in another proposal to obtain a 500 MHz NMR. Our small user base is a constant challenge to our efforts to obtain extramural funding for instrumentation.

In summary, the Department has a sound track record in successfully training both undergraduate and graduate students, and in establishing a recognized and well-funded research program. The Department is limited in moving to the next level principally by a shortage of faculty and a weak research infrastructure.

This report is organized as follows. Section I consists of a profile of our Department, summarizing its mission within the University, degrees and programs, courses offered, and a faculty listing by research area. Section II describes the faculty, giving a short profile of each
(full CVs are contained in an appendix) and summaries of research, scholarly activity, and teaching loads. A description of the Staff positions and responsibilities is contained in Section III. A profile of our student body is presented in Section IV, along with numbers of degrees awarded and enrollments in different courses. Section V summarizes the Department’s budget, lab fees, and F&A return. The resources and facilities available for support of the instructional and teaching program and for professional development of faculty are summarized in Section VI. This section includes procedures for the evaluation and mentoring of new faculty, and the recruitment of faculty and graduate students. Program assessment is the topic of Section VII, which includes a brief discussion of ongoing methods of assessment of both specific courses as well as the program as a whole.

The final section is reflective. The Department’s resources, human, fiscal, and physical, are critically evaluated in Section VIII and our own perceptions of our current strengths and weaknesses, along with current efforts directed toward overcoming some of the latter, are described.
I. Department Profile

Mission and goals

The principles of chemistry lie at the heart of the properties and behavior of molecules, and how they react with one another. Molecular science underlies not only the chemical sciences, including nanotechnology, but also the biological sciences, such as genomics, evolution, and behavior, and the medical sciences. Members of this Department share a commitment to uncover and elucidate the principles underlying molecular behavior, and to probe their relation to other lines of inquiry. Equally important, members of this Department share a commitment to the sharing of their knowledge with students at all levels, and imparting to both graduate and undergraduate students a sense of wonder about the molecular world around them.

The stated mission of the University is to “be one of the nation's premier student-centered land-grant and space-grant universities by fostering the principle that academics come first, by cultivating diversity of thought and culture, and by serving the public through learning, discovery, and engagement.”

In fulfilling its part in the pursuit of this mission, the Department of Chemistry & Biochemistry:

i) creates and disseminates new knowledge,
ii) teaches courses in chemistry and biochemistry at the graduate and undergraduate levels that will help prepare students for professional careers in science, technology, and health care, iii) teaches courses that help promote public awareness and understanding of science.

In addition, members of the Department of Chemistry & Biochemistry contribute to the vitality of the University by serving on College and University committees, on the Faculty Senate and Graduate Council, and by representing the University on regional, national, and international review panels, professional societies, and editorial boards.

Degree Program descriptions

a. Undergraduate
The Department offers the following undergraduate degree options:

• BS in Chemistry with following emphases:
  o Professional chemistry, biochemistry, environmental, chemical education, life science
• BA in Chemistry
• BS in Biochemistry
• BS and BA in Chemistry Teaching
• BS and BA in Composite Teaching - Physical Science (Chem)

Minors are offered in Chemistry, as well as a Chemistry Teaching Minor

All of the above BS and BA Chemistry degrees require a common core consisting of:
• one year of general chemistry, with labs
• one year of organic chemistry, with labs
• one semester quantitative analysis, with lab
• one semester inorganic chemistry, with lab
• one year of physical chemistry (calculus-based), with labs
• one semester biochemistry, with lab
• one semester undergraduate seminar (reading, writing, and oral delivery of papers)
• mathematics:
  o calculus I and II, multivariable calculus
  o linear algebra & differential equations OR scientific statistics
• two semesters of introductory calculus-based physics

Professional Chemistry Emphasis includes also:
• one semester advanced inorganic chemistry with lab
• one semester instrumental analysis with lab
• two semesters of advanced electives

Biochemistry Emphasis includes also:
• one semester instrumental analysis with lab
• one additional semester of biochemistry with lab
• biology 1
• four credits of advanced biology electives

Environmental Chemistry Emphasis includes also:
• one semester intermediate environmental chemistry
• one semester environmental chemistry laboratory

Life Science Emphasis includes also:
• one additional semester of biochemistry with lab
• biology 1
• biology 2 OR human physiology
• genetics OR general microbiology

Chemical Education Emphasis includes also:
  one semester advanced inorganic chemistry, with lab
  OR
  one semester instrumental analysis, with lab
  OR
  one additional semester of biochemistry, with lab
  as well as teacher licensure courses and teaching minor from another Department
BA in Chemistry includes also:
- one semester advanced inorganic chemistry OR one semester instrumental analysis
- completion of at least one foreign language

Chemistry Teaching Major includes also:
- teacher licensure courses and teaching minor from another Department

Chemistry Minor:
- one year of general chemistry, with labs
- 10 credits chosen from organic chemistry, inorganic, biochemistry, etc.

Chemistry Teaching Minor:
- one year of general chemistry, with labs
- at least one semester of organic chemistry
- 3-4 credits of electives

The Department maintains a formal Honors Degree in Chemistry program, which requires
- 3.50 GPA in chemistry courses
- 3.30 overall GPA
- at least one semester of undergraduate research
- registration in several of the regular chemistry courses as an “honors” option, which requires a certain amount of extra work, as agreed upon by the student and instructor

Please refer to the Chemistry Major sheet, Appendix 1A for more detailed information about required courses for each of these degrees and emphasis areas.

The BS in Biochemistry degree requires a common core consisting of:
- one year of general chemistry, with labs
- one year of organic chemistry, with labs
- one semester quantitative analysis, with lab
- one year of biology
- one year of biochemistry
- one semester of biochemistry lab
- one semester of biophysical chemistry
- one semester undergraduate seminar (reading, writing, and oral delivery of papers)
- two semesters of either general or calculus-based physics
- calculus I and II, multivariable calculus

Please refer to the Biochemistry Major sheet, Appendix 1B for more detailed information about required courses.

b. Graduate
The Department offers the following graduate degree options:

MS and PhD in Chemistry
specialties in analytical, inorganic, organic, or physical chemistry
Each division has established a list of core courses for students in their area; these are listed below under Graduate Courses.

Entering graduate students must demonstrate proficiency in 3 of these 4 areas by passing the respective ACS standardized exams, which are administered to all new graduate students given during orientation week. For areas in which this is not achieved, a student must either:
 a) earn a grade of B or better in the appropriate undergraduate class the ensuing semester, or
 b) pursue independent study, then retake another version of the ACS exam.

30 credit hours are required for the MS, 90 for the PhD. At least 15 of these must be coursework, the rest being research (6970 or 7970).
Students attend regular (weekly) seminars, both Departmental (usually outside speakers) and Divisional. Students are required to present a seminar at least once each year in their respective divisional seminar series.

A GPA of 3.0 is required to maintain academic status, and only one grade below B is permitted.

Please refer to Information for Graduate Studies in Chemistry, Appendix 1C, for more detailed information.

MS and PhD in Biochemistry
30 credit hours are required for the MS, 90 for the PhD. At least 15 of these must be coursework, the rest being research (6970 or 7970).
The biochemistry core courses consist of 6730, 6740, 6750, 6760.

Students attend regular (weekly) seminars, both Departmental (usually outside speakers) and Divisional. Students are required to present their own seminar at least once each year.
A GPA of 3.0 is required to maintain academic status, and only one grade below B is permitted.

Please refer to Information for Graduate Studies in Biochemistry, Appendix 1D, for more detailed information.
Undergraduate Courses

The table below lists our undergraduate courses (excluding labs) with texts used.

<table>
<thead>
<tr>
<th>NUMBER</th>
<th>BRIEF TITLE</th>
<th>AUTHOR</th>
<th>TITLE</th>
<th>CREDIT HOURS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1010</td>
<td>Chemistry for Non-Science Majors</td>
<td>Suchocki</td>
<td><em>Conceptual Chemistry, 4th ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>1120</td>
<td>Chemistry for Non-Chem Majors Part II</td>
<td>Timberlake</td>
<td><em>General, Organic &amp; Biochemistry Structures of Life, 3rd ed.</em></td>
<td>4</td>
</tr>
<tr>
<td>1210</td>
<td>General Chemistry for Chem Majors Part I</td>
<td>Brown et al</td>
<td><em>Chemistry, the Central Science, 9th ed.</em></td>
<td>4</td>
</tr>
<tr>
<td>1220</td>
<td>General Chemistry for Chem Majors Part II</td>
<td>Brown et al</td>
<td><em>Chemistry, the Central Science, 9th ed.</em></td>
<td>4</td>
</tr>
<tr>
<td>2320</td>
<td>Organic Chemistry for Chem Majors Part II</td>
<td>Bruice</td>
<td><em>Organic Chemistry 5th ed.</em></td>
<td>4</td>
</tr>
<tr>
<td>3000</td>
<td>Quantitative Analysis</td>
<td>Harris</td>
<td><em>Quantitative Chemical Analysis 7th ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>3060</td>
<td>Physical Chemistry Part I</td>
<td>Engel and Read</td>
<td><em>Physical Chemistry 2nd ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>3070</td>
<td>Physical Chemistry Part II</td>
<td>Engel and Read</td>
<td><em>Physical Chemistry 2nd ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>3650</td>
<td>Environmental Chemistry</td>
<td>Girard</td>
<td><em>Principles of Environmental Chemistry, 2nd ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>3700</td>
<td>Biochemistry</td>
<td>Pratt</td>
<td><em>Essential Biochemistry, 2nd ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>5070</td>
<td>Biophysical Chemistry</td>
<td>Allen</td>
<td><em>Biophysical Chemistry</em></td>
<td>3</td>
</tr>
<tr>
<td>5640</td>
<td>Instrumental Analysis</td>
<td>Skoog et al</td>
<td><em>Principles of Instrumental Chemistry, 6th ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>5700</td>
<td>Biochemistry Part I</td>
<td>Nelson</td>
<td><em>Lehninger Principles of Biochemistry, 5th ed.</em></td>
<td>3</td>
</tr>
<tr>
<td>5710</td>
<td>Biochemistry Part II</td>
<td>Nelson</td>
<td><em>Lehninger Principles of Biochemistry, 5th ed.</em></td>
<td>3</td>
</tr>
</tbody>
</table>
**Graduate Courses**

The Chemistry and Biochemistry graduate courses are listed below. The majority of these are core courses, offered on a regular basis and required by all graduate students in the respective area. Courses that are only periodically offered are indicated with asterisks:

**Physical**
- 6010 Quantum Chemistry
- 6020 Molecular Spectroscopy
- 7020 Statistical Mechanics

**Organic**
- 6300 Advanced Organic Chemistry (a course in physical organic chemistry)
- 7300 Reactions and Synthesis
- 7310 Structure and Spectroscopy

**Inorganic**
- 6500 Reactivity and Mechanisms
- 6510 Group Theory
- 7500 Coordination Chemistry*
- 7510 Bioorganic*

**Analytical**
- 7600 Analytical Spectroscopy
- 7610 Chemical Separations
- 7620 Electrochemistry*

**Biochemistry**
- 6730 Principles of Enzymology
- 6740 Cellular Communication by Small Molecules and Proteins
- 6750 Principles of Structural Biology
- 6760 Principles of Bioenergetics

**Research Programs**

Most faculty members in the Department have an independent research program. There is synergy between a number of them, and several direct collaborations exist between faculty members in our department, as well as with faculty in other departments. A majority of the faculty members carry out research in either biochemistry *per se*, or in chemistry that has a connection to the life sciences.

Listed by the formal divisions, the tenure-track faculty members are listed in the table below. Short faculty profiles describing their research are given in the Faculty section.
Multidisciplinary research areas involving other units.

This Department has historically been organized around the classical divisions shown above. Even before budget cuts reduced our faculty numbers we lacked the numbers necessary to achieve critical mass in these divisions. The faculty made the decision three years ago to focus future hires in the Department around a number of research focus areas. This was a difficult process on which to reach consensus, without leaving some faculty members feeling marginalized. After a series of faculty meetings, six research focus areas were identified that both encompass the research interests of current faculty and are Directions that the department would like to focus growth on in the future: Energy and the Environment; Catalysis and Mechanism; Bioorganic & Inorganic/Medicinal/Synthetic; Macromolecular Structure and Function; Theoretical/Computational; and Eukaryotic Biochemistry.

Further focus seems appropriate, as some of these categories more resemble umbrellas than focus areas. However, one benefit of this categorization is that these descriptions more accurately describe the types of research going on in the Department than the classical divisional names. There are also a number of faculty members in other departments who were trained as either chemists or in a closely related field, and who are doing research related to that in our own department.

In the past year, the Department initiated monthly meetings with extended groups of scientists across campus with shared research interests in some of these areas. The groups are listed in Appendix 1E; these have allowed the members of our Department to interact on a regular basis with faculty with common interests in other departments. The meetings have consisted in part of get-to-know one another sessions where people took turns one or two each month giving short presentations on their work, also exploring future interests for which collaboration would be needed.

USTAR

USTAR stands for the Utah Science Technology And Research initiative. It is an initiative of the Utah State legislature to bolster Utah’s high-tech economy by investing in recruiting new, high caliber faculty and university research programs. With the state USTAR board, administrators and faculty at both Utah State University and the University of Utah have identified research focus areas and assembled teams of existing faculty and provided funds for the recruitment of established researchers to provide new expertise to enhance research and commercialization efforts in these selected areas. A number of USTAR teams have been formed at USU (see ustar.usu.edu for a complete description).

Two USTAR teams involve this Department. The Biofuels team has as its primary goal the development of lipid-rich algae for use in alternative fuels. Lance Seefeldt in this Department was one of the founding members of this team along with several faculty members from Engineering, and he is currently the Director of Science for the USU Biofuels Center. There
have been no faculty hired in our Department from this team, but USTAR funds have supported graduate students in the Seefeldt lab, and this research has led to a number of federally funded projects in his laboratory.

The Veterinary Diagnostics and Infectious Disease team was founded to conduct interdisciplinary research that will lead to commercial opportunities in the areas of infectious disease and diagnostics. Its founding members were Ken White of the Animal, Dairy and Veterinary Sciences department and Alvan Hengge of this Department. Other faculty in this Department who are associated with VDID are Tom Chang, Brad Davidson and Sean Johnson. One of the faculty lines budgeted for the VDID team is designated for this Department and this search is underway, focusing on either a bioanalytical chemist or a medicinal/synthetic chemist. This faculty position is funded entirely by USTAR funds for startup and for the first five years of salary, after which the College becomes responsible for 1/3 of the ongoing salary line. This person will be integrated with the rest of the Department, but will have a reduced teaching load for the first five years.

**Chemical Biology**

In 2009 we proposed to the College of Science a PhD emphasis area in the field of Chemical Biology jointly between the departments of Chemistry and Biochemistry and Biology. Students in the Chemical Biology emphasis area would choose a home department from which to obtain their degree in Chemistry, Biochemistry, or Biology. The course requirements would be modified from the standard ones to permit these students to take a combination of courses from each department, and supervisory committees would have substantial representation from both departments. Goals of this initiative were to foster more collaborative research between the two departments by (1) identifying new areas among existing investigators for potential projects and extramural proposals, and (2) identifying strategic hires with areas of expertise that will foster new opportunities for collaborative research. Two positions, one in Chemistry & Biochemistry and one in Biology, were sought to provide new areas of expertise and offer new opportunities for collaborative projects with existing faculty. Participating faculty in this Department are Berreau, Brown, Chang, Davidson, Ensign, Hengge, Hevel, Johnson, and Seefeldt. A similar number of interested faculty reside in Biology.

This proposal was looked upon favorably by the administration, funding from a University central strategic investment pool for the first faculty position was received this fiscal year, and a bi-departmental joint search is currently underway for a faculty position in support of this initiative. The new hire will reside in the department that best suits their research and teaching expertise.

The other concrete manifestation of the Chemical Biology program so far is an overview methods survey course aimed at beginning graduate students, with the intention to familiarize students with a wide variety of methodologies common to chemistry, biochemistry and biology. This course (two semesters, one credit each term) is team taught by a number of faculty members from both departments, and is co-listed in both.
II. Faculty

Composition of Faculty by Category and Credentials

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Tenure</th>
<th>Contract only</th>
<th>Research only</th>
<th>Emeritus</th>
<th>Adjunct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number with Doctoral degrees</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Number with Master's Degree</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Number with Bachelor's degrees</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

Our faculty numbers currently stand at 14 tenured or tenure-track faculty members and one lecturer. Historically there have been 17.4 tenure-track faculty lines in the Department; the attrition has resulted from a combination of budget cuts that resulted in the pullback of vacant positions that arose from departing and retired faculty, and recent unsuccessful searches. There is one current search for a regular faculty member, and two other searches in more specialized areas (Chemical Biology and USTAR, described previously) that may add faculty members to the Department.

In addition to the tenure-track faculty, the Department includes:
1. Full-time lecturer
2. Research Assistant Professor, funded entirely off research grants, in the physical division
3. Emeritus Professors with active research programs (1 in biochemistry, 1 organic).
4. Emeritus Professor who teaches Physical Chemistry laboratory; he will depart at the end of the 2010-2011 academic year
5. Adjuncts; these individuals do not teach or carry out research in the department, but include collaborators, and other facilitators as described below.

While hiring in the future will be centered around development of the research focus areas, for teaching purposes faculty members in the Department identify with the classical divisions. Each of these divisions is tiny, barely sufficient to offer a balanced education to our students. Even when the Department was at what has traditionally been considered full strength, none of the divisions had what could be called a critical mass.

The balance between junior and senior ranks has become top-heavy with 8 full Professors, 5 Associate Professors, and 1 Assistant Professor.

<table>
<thead>
<tr>
<th>Division</th>
<th>Full</th>
<th>Associate</th>
<th>Assistant</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analytical</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Inorganic</td>
<td>0</td>
<td>2(^a)</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Organic</td>
<td>1(^b)</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Physical</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Biochemistry</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>8</strong></td>
<td><strong>5</strong></td>
<td><strong>1</strong></td>
<td><strong>12</strong></td>
<td><strong>2</strong></td>
</tr>
</tbody>
</table>

\(^a\)Includes one Associate Dean (25% administrative role statement)  \(^b\) Dept Head
Teaching faculty

The Department has one full time lecturer, Doug Harris, who earned his doctorate in biochemistry from BYU. Dr. Harris teaches several of our general chemistry courses (1010 and 1110) as well as the biochemistry laboratory (3710). After the loss of the laboratory manager position in 2008, he took over supervision of the general chemistry and organic chemistry laboratories. This includes TA supervision and curriculum development. Dr. Harris has made substantial contributions to revising both the general and organic laboratory curricula and bringing them into better alignment with the lectures.

Two of our tenured faculty members contribute more than most to our General Chemistry teaching mission. John Hubbard contributes significantly in this area, as well as to undergraduate inorganic chemistry. In addition, beginning in Fall of 2010 he voluntarily initiated the offering of a majors-only section of General Chemistry 1210 that was very well received by students. Scott Ensign also contributes significantly to General Chemistry, and has been at the forefront of our faculty in embracing new technology for the delivery of instructional materials to his students. Brad Davidson has a larger teaching responsibility than the other organic chemists, and has experimented with a number of innovative methods in his teaching including POGIL methods and novel examination approaches.

Research faculty program summaries by division

The short summaries below include contributions by regular faculty and research-active emeritus professors, as well as the research assistant professor who is funded entirely from grants. Faculty CVs are included in an appendix.

Biochemistry:

Scott Ensign, Professor, investigates microbial pathways of short-chain hydrocarbon oxidation and the biochemical, mechanistic, and spectroscopic properties of the enzymes involved in these pathways, and bacterial acetone metabolism.

Lance Seefeldt, Professor, studies the mechanism of the metalloenzyme nitrogenase, using a multidisciplinary approach, including genetics, kinetics, spectroscopy, and X-ray crystallography. In addition, he has a very active research endeavor in the pursuit of the development of biofuels from algae. Seefeldt is a member of the Biofuels USTAR team, and in this capacity is involved in collaborative research with several faculty in the College of Engineering. The USTAR program is described above.

Joan Hevel, Associate Professor, studies the post-translational modification of proteins. Her major research effort centers around the methylation of arginine by protein arginine methyl transferases (PRMTs).

Sean Johnson, Hansen Assistant Professor, is a protein crystallographer interested in the interactions between proteins and nucleic acids. He has a number of collaborative projects with faculty members within and outside the department; his own project studies the structure and function of the helicases Mtr4 and Ski2.

Steven Aust, Emeritus professor, maintains a laboratory with industrial funding to study the generation and fate of free radicals generated in the eye by instruments used to treat cataracts. He does not take graduate students but employs undergraduates. Historically, he worked in the enzymology of mixed-function oxidases of liver endoplasmic reticulum, toxicology, and the role of iron and active oxygen in lipid peroxidation, ischemia, and toxicity.
**Inorganic Chemistry:**
Lisa Berreau, Associate Professor and Associate Dean in the College of Science, is concerned with the mechanisms of metal center-catalyzed reactions, and obtaining insights from model studies regarding metalloenzyme systems. The group’s current work involves CO-releasing reactions involving metals; metal-flavonolate chemistry; and metal-promoted catalysis in biological pathways.

John Hubbard, Associate Professor, studied the fundamental molecular interactions between metal complexes and small molecule substrates such as CO, NO, unsaturated hydrocarbons, and carbohydrates. He has not been research active in recent years, but contributes in a major way to the teaching mission of the department.

**Physical Chemistry:** The Department’s physical chemists all work in the area of computational chemistry.

Alexander Boldyrev, Professor, works in a number of areas including aromaticity and antiaromaticity in all-metal systems, nonstoichiometric molecules, and tetracoordinated planar carbon. The group is also developing models for the chemical bonding of sub-nanoparticles aimed toward the rational design of nanocatalysts, nanomaterials with tailored properties, nanoscale electronic devices, etc.

David Farrelly, Professor, studies the dynamics of microscopic and mesoscopic systems (e.g., quantum dots) in the classical limit of quantum mechanics, i.e., when \( h \) is small. Examples of such systems are ultrahigh atomic and molecular Rydberg states and electrons in quantum dots.

Steve Scheiner, Professor, is concerned with intermolecular interactions, chiefly hydrogen bonds and proton transfer reactions. These calculations are aimed at achieving a fundamental understanding of biochemical processes.

Tapas Kar, Research Assistant Professor, attempts to determine the structure and electrical, chemical and mechanical properties of hybrid BCN nanomaterials. He is also involved in understanding and improving the quality of Li-nano-batteries. He does not currently have students but is eligible to supervise graduate students, if he were to obtain extramural funding.

**Organic Chemistry:**
Brad Davidson, Associate Professor, works in two areas: 1) the discovery of new biologically-active naturally natural products, and 2) the synthesis of biologically-active natural products and their structural analogs.

Tom Chang, Associate Professor, focuses on utilizing modern synthetic methodologies such as asymmetric catalysis and combinatorial synthesis for the development of novel carbohydrate-containing molecules with biological activities and practical applications. Several new compounds with significant antifungal activity have been discovered and are in various stages of patent applications and biological testing.

Alvan Hengge, Professor and Department Head, is interested in characterizing the mechanistic details of chemical reactions, especially those of biological interest, and comparing enzyme-catalyzed reactions with the respective uncatalyzed reactions in solution. The group uses a variety of techniques to study enzymatic and nonenzymatic catalysis, particularly phosphoryl and sulfuryl transfer.

Vernon Parker, Emeritus Professor, works on electron transfer reactions and the reactions of reactive intermediates. The experiments provide thermodynamic as well as kinetic and mechanistic information, and depend heavily on physical measurements, including stopped-flow
kinetics. Two graduate students are currently completing their doctorates in this lab, which also employs undergraduates.

**Analytical Chemistry:**

Stephen Bialkowski, Professor, works in the areas of fluorocarbon analysis, soil physics, photothermal spectroscopy, white light spectrometry, and digital filtering. He also has an interest in environmental chemistry.

Robert Brown, Associate Professor, is concerned with studies aimed at improving the analysis of large, nonvolatile molecules by mass spectrometry. The principle analysis technique involves the use of high powered pulsed lasers (laser desorption) to effect ionization of biologically relevant molecules such as peptides, proteins and glycoproteins, oligonucleotides, DNA fragments and synthetic commercial polymers.

**Scholarly Activities**

The research accomplishments of our faculty members are reflected by a continuous stream of publications and extramural funding. The connection between research and teaching is demonstrated by the fact that nearly all of the papers published by faculty in this Department contain graduate and undergraduate coauthors. Several faculty members hold appointments on committees of national and international scientific organizations, and review panels of external funding agencies. More details are provided below.

**Publications and Funding**

The table below summarizes peer-reviewed publications of all faculty members in the past three calendar years.

Most faculty members in the Department are the recipients of external funding, generally national in origin, e.g. NIH and NSF. Some faculty members have corporate funding, as well as some from USTAR sources (the USTAR program is described in a previous section). Research awards to faculty members in this Department in FY 2010 amounted to $3,199,503 from data compiled by the Sponsored Programs Office (see Appendix 2A for a table of sources, amounts, and project titles). Current extramural sources of funding are also noted below for each faculty member. There are a few differences between these data sets; two faculty members, Scheiner and Boldyrev, obtained NSF funding after the end of FY2010. It is also noted that Farrelly has an NSF submission under review; he recently reached the end of an NSF award and has a good history of NSF funding.

A number of faculty members have internal funding, primarily from the USU VPR “seed” grant programs. There are two such programs, the Research Catalyst (RC) and the Seed Program to Advance Research Collaborations (SPARC). The latter program provides up to $35K for one year to “to catalyze development of large interdisciplinary research teams and projects that involve scholarly research in more than one department, research center, college or institution.” The RC program provides 1 year of funding up to $20K to “help applicants develop new initiatives or directions in their discipline that will lead to new externally funded grants.” Both awards come with the stipulation that recipients must agree submit a major external grant proposal within 6 months of the completion of the award to be eligible for the program in the future. For 2011 Hevel and Johnson are co-PIs on a SPARC award, and Berreau holds an RC. Chang has two awards in the neighborhood of $50K each from the Technology Commercialization Office, and Davidson has a small seed grant from USTAR.
Peer-reviewed publications for each faculty member, and funding status

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>current extramural funding</th>
<th>proposals submitted 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Analytical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bialkowski, Prof</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>Kestrel corp.</td>
<td>2</td>
</tr>
<tr>
<td>Brown, Assoc</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>NSF</td>
<td>0</td>
</tr>
<tr>
<td><strong>Inorganic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Berreau, Assoc</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>NSF</td>
<td>0</td>
</tr>
<tr>
<td>Hubbard, Assoc</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td><strong>Organic</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chang, Assoc</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>Baicor L.C., NIH</td>
<td>4</td>
</tr>
<tr>
<td>Davidson, Assoc</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Hengge, Prof, Dept Head</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>NIH</td>
<td>3</td>
</tr>
<tr>
<td>Parker, Emeritus</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>NSF</td>
<td>0</td>
</tr>
<tr>
<td><strong>Physical</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boldyrev, Prof</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>NSF</td>
<td>3</td>
</tr>
<tr>
<td>Farrelly, Prof</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><em>Kar, Res. Asst. Prof.</em></td>
<td>6</td>
<td>2</td>
<td>3</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>Scheiner, Prof</td>
<td>9</td>
<td>6</td>
<td>5</td>
<td>NSF</td>
<td>4</td>
</tr>
<tr>
<td><strong>Biochemistry</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aust, S, Emeritus</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>Alcon manuf.</td>
<td>2</td>
</tr>
<tr>
<td>Ensign, Prof</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>Seefeldt, Prof</td>
<td>2</td>
<td>5</td>
<td>4</td>
<td>NIH, NSF, DOE</td>
<td>5</td>
</tr>
<tr>
<td>Hevel, Assoc</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>NSF</td>
<td>1</td>
</tr>
<tr>
<td>Johnson, Assistant</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>NSF</td>
<td>2</td>
</tr>
</tbody>
</table>

**Critical Mass Considerations**

As will be obvious from the data above, the faculty numbers in this Department are nowhere near the threshold of critical mass required to effectively support research in the traditional divisions. These numbers provide limited options for graduate students in any particular division, which presents a major obstacle in the recruiting of graduate students. The small numbers further complicate the Department’s ability to fulfill its teaching obligations during faculty sabbaticals. In physical chemistry, a further problem is that all three faculty are theoreticians, without with the expertise to teach physical chemistry laboratory. For a number of years an emeritus experimental physical chemist who is retiring after the present academic year, has taught this course. The most qualified faculty member to take over this assignment is Stephen Bialkowski, who, although he received his PhD in experimental physical chemistry, has been conducting research primarily in the analytical chemistry area for many years.
National Recognition

Many members of our faculty have achieved national recognition. Full CVs of all faculty are included as a separate appendix. Some excerpted bits of information regarding national recognition follow.

Lisa Berreau was the recipient of an NSF CAREER award in 2001-2006, served on the editorial advisory boards for Inorganic Chemistry (2007-2010) and Dalton Transactions (2005-2010) and currently serves in this capacity for the Journal of Coordination Chemistry (2005-2011). She chaired the NIH Graduate fellowship panel from 2008 to 2009.

Stephen Bialkowski was a Fulbright Fellow to the University of Nova Gorica in Slovenia in 2006, and recently created a Study Abroad program in environmental chemistry for USU students using his contacts there.

Within the past 12 months Alex Boldyrev’s work has been highlighted twice in Chemical & Engineering News, the weekly newsletter of the American Chemical Society. Boldyrev was awarded the American Chemical Society Utah Award for 2008, and also was the recipient of the D. Wynne Thorne Award in 2009. Named after USU’s first vice president for research, the D. Wynne Thorne Career Research Award is given to an individual on the USU campus who has completed outstanding research in his or her career. Boldyrev has been a member of the editorial board of Physical Chemistry: an Indian Journal since 2006, and for the European Journal of Chemistry since 2010.

Scott Ensign was invited to give the opening plenary lecture at the West Coast Bacterial Physiologists Meeting at Asilomar in 2009, and has been invited to speak at an international symposium on “Biological transformations of hydrocarbons without oxygen” in Hersching, Germany in March 2011. He also developed a series of problem-solving videos published as a CD that accompany the widely used text, “Principles of Biochemistry” by Lehninger.

David Farrelly was a Visiting Professor at the Universidad de Madrid during the summers of 2009 and 2010.

Joanie Hevel is a co-chair of the American Heart Association Student Review Board (serving a term from 2009-2012) and is also a member of the AHA Research Review Board.

Sean Johnson recently received a CAREER award from the NSF (2010-2015) for the study of Ski-2-type RNA helicases. He was an invited speaker in 2008 at the FASEB summer research conference on Mechanisms of mRNA Decay in Lucca, Italy, and also spoke at a 2009 EMBO Conference in Switzerland.

Steve Scheiner was a discussion leader at the 2009 Gordon Conference on Biomolecules in the Gas Phase and in Solution, and an invited plenary speaker at the 50th Annual Sanibel Symposium in March 2010. He was a member of the editorial board of the Journal of Molecular Structure (Theochem) from 1991-2010, and is currently serving a term on the board for the International Journal of Quantum Chemistry (2006-2015). Scheiner received the D. Wynne Thorne Career Research Award at USU in 2010.

Lance Seefeldt was an invited speaker and session chair at the International Conference on Biological Inorganic Chemistry in Nagoya, Japan, in 2009, and an invited speaker at the 2010 Gordon Conference on FeS Proteins. He has served as a grant review panel member and program reviewer for the USDA, and on several NIH study sections in recent years. He is also the Director of Science for the USU Biofuels Center USTAR team.
Faculty teaching loads

Faculty members with less active or inactive research programs have larger teaching roles, and their contributions are critical in allowing the Department to meet its educational obligations both to our own majors, both graduate and undergraduate, as well as to the large numbers of students in other departments who take our service courses in general, organic, and biochemistry.

Most regular faculty members participate in active, externally funded research programs. These faculty balance efforts in both teaching and research, sustaining a formal course load of approximately one full course each semester. Faculty members with less active research programs have larger teaching loads. All faculty exhibit a strong dedication to the instructional program. Teaching plays a large part in the evaluation of each faculty member, including the consideration of junior faculty for tenure and promotion. The Department prides itself on the ability and willingness of all faculty members to teach not only in their area of research specialization, but also in large service classes. For Organic chemists this means yearly teaching in undergraduate Organic Chemistry, and for the rest of the faculty, occasional participation in General Chemistry by all and yearly participation by a few.

The appendices contain more detailed information about teaching assignments. Appendix 2B lists teaching assignments during the three most recent academic years, including the current one. Appendix 2C gives more detailed information including head counts, number of sections, and credits, listed alphabetically by faculty member.

In addition to their Departmental teaching assignments, several faculty members teach for the Regional Campus and Distance Education (RCDE) office in delivering classes online or by broadcast to one of the regional campuses in the USU network. Faculty members receive extra compensation from RCDE for these courses and such teaching is voluntary, outside the faculty role statement, and is not considered in their Departmental teaching load or in making teaching assignments. Recent RCDE teaching activity is reported in Appendix 2D.

Note that the RCDE teaching reports include a number of individuals who are not located on the Logan campus, but at regional campus sites. Some of these individuals are high school teachers authorized by the Department to teach concurrent enrollment CHEM 1010. Others are lecturers hired to teach one or two particular classes at one of the USU regional campuses in Brigham City, Tooele, or the Uintah Basin. All of these instructors are subject to approval and periodic review by this Department. Their students, using the same evaluation form used for Logan campus courses, evaluate all RCDE courses and instructors each semester. The regional campuses in Blanding and in Price, and the Uintah Basin (in Vernal, UT) are the only ones with full-time Chemistry positions; the latter is the subject of a current search.

Adjunct Faculty

The Departmental policy on adjunct faculty as approved by the faculty is as follows: Adjunct Faculty have unpaid “courtesy” status to facilitate and enhance interdepartmental interactions. Usually involves some service to department, e.g., unpaid teaching, service on graduate committees or search committees. Appointment is governed by the following guidelines:

1. Nominations, which include a candidate’s CV and other relevant credentials, along with a statement describing the reason for the request, will be considered by the Departmental Advisory Committee and forwarded to the faculty for a vote.
2. The term of appointment will be 3 years
3. The appointment is non-salaried and nonvoting
4. The appointee cannot serve as the major professor on a graduate supervisory committee
5. The appointee can serve on graduate supervisory committees, with a limit of no more than one regular committee member having adjunct status.
6. A request for an Adjunct Faculty appointment renewal will be reviewed by the Departmental Advisory committee and forwarded to the faculty for a vote.

Current adjunct faculty include the following, all of whom hold doctorate degrees in either chemistry or biochemistry):
1. Christopher Hill, Biochemist, faculty member at University of Utah (collaborator with Sean Johnson and member of the supervisory committee for one of his students)
2. Phil Silva (environmental chemist, former member of this department, currently works with USDA; collaborator with Bob Brown on an NSF-funded project)
3. David Ward (biochemist at U. of Hawaii; involved in USTAR, has assisted two of our faculty members in obtaining seed funding from this source)
4. Ned Weinshenker (organic chemist, USU VP for Strategic Ventures and Economic Development) meets with our undergraduate majors to discuss chemistry career options, has assisted faculty members in obtaining funding from the Technology Commercialization Office.
5. Michael Wojcik (environmental chemist, works at the USU Environmental Dynamics Laboratory) collaborator and co-PI with Stephen Bialkowski on past and present grant proposals.
6. William Doucette (environmental chemist, department of Civil & Environmental Engineering at USU) has served on several graduate committees, employs chemistry majors in his laboratory, working with the department on development of the Environmental Chemistry emphasis area.

Involvement of Faculty in Departmental Decisions
Most policy decisions affecting the Department emanate from votes at regular faculty meetings. Issues are discussed, motions made, and votes taken. Minutes are recorded and distributed following each faculty meeting.

The organizational structure of the Department is heavily based upon faculty committees. As described in the Department’s Bylaws (Appendix 2E), there are certain major committees that address important issues. The Committee structure for 2010-11 is appended as an example of the constitution of these committees (Appendix 2F). The major standing committees are as follows:

- **Advisory** addresses overarching policies that are not covered by regular committees, makes recommendations to Department Head
- **Curriculum/Assessment** curricular issues/revisions, assessment, course articulation
- **Graduate Studies** policies regarding graduate student education
- **Graduate Recruiting** responsible for recruiting and selection of graduate students
- **General Chem Steering** policies related to the General Chemistry (series 1xxx) courses
- **Advising** group of faculty that advise undergraduates
III. Staff

The Department is administered by a Department Head, with help from an Associate Department Head. The Associate Department Head has responsibilities to Chair the Graduate Recruiting Committee, Graduate Studies, and the Advisory Committee. The Associate Head also makes Teaching Assistant assignments each semester, is expected to seek out new grant opportunities for departmental proposals and faculty teams, aggressively organize graduate recruiting efforts, has signing authority for faculty proposals and other official departmental documents, and assists with other administrative duties as needed. The Department has had an Associate Head on and off over the years, and the current arrangement was temporarily funded (partial summer salary) by the College as part of a recent change (Fall 2009) in Department Head. This funding and arrangement will end after the current fiscal year and the duties and continuation of the position will be reevaluated.

Administrative Assistant, Ms. Geraldine Child. The Administrative Assistant has the assistance of one other full-time staff in the Office, plus one or two part-time student workers. Ms. Child handles most of the official documents, whether paperwork or online forms, that go through the Department Office. The Administrative Assistant also acts as the primary contact in undergraduate student advising.

Other job duties:
- Prepare contracts for faculty, professional employees, and classified employees.
- Department Leave Reports.
- Schedule meetings for Tenure and Promotion Committees and Department Committees.
- Assist Advising Committee by maintaining undergraduate advisor list and helping undergraduate students as needed.
- Maintain faculty and staff personnel files.
- Publish Department newsletter and submit department news to College of Science.
- Organize the Departmental Awards and Alumni Achievement Awards reception.
- Staff Training.
- Access the Alumni Database as requested by Dept Head.
- Coordinate submission of textbook adoptions with course schedules.
- Assist invited visitors with travel.

The other office staff member, Ms. Margaret Dobrowolska, takes primary responsibility for graduate student business. This includes working closely with the graduate Recruiting Committee tracking applications, as well as tracking graduate students’ progress assisting the Graduate Studies Committee.

Other job duties:
- Processes student employment including Teaching and Research Assistants
- Tuition waivers for graduate students.
- Maintains the Department web site.

Historically the Department had a third full-time staff assistant, but as a result of budget considerations this position was replaced a number of years ago by part-time student workers who are hired, trained, and supervised by the Administrative Assistant.
These assignments of these workers include:

- Front desk reception duties.
- Daily preparation of FedEx shipping.
- Coordinates departmental seminar program and set-up refreshments.
- Maintain stock of supplies in department.
- Maintain office machines.
- Copying and scanning for all faculty and department.
- Sort mail, and assign student mailboxes.
- Coordinates requests for textbook adoptions.

For more information and greater detail, see Appendix 3A.

The Department’s Business Manager is responsible for financial record-keeping, accounting, and ordering, as well as monitoring lab and office facilities. Ms. LuAnn Stocking generates and approves most financial documents, faculty and visitor Travel Authorizations, and tracks Departmental accounts. She also tracks expenditures on research grant accounts held by faculty PIs and sends monthly account updates. This position also coordinates with Facilities on issues of maintenance, repairs, and construction and serves on the Departmental Safety Committee.

Jim Albee, Manager of Chemistry Stores, a Service Enterprise of USU serving the entire campus community with scientific teaching and research supplies. The manager hires, trains, supervises, and schedules Chem Stores personnel.

Until 2009 the Department had a Laboratory Manager, whose responsibilities included stocking of student drawers, maintaining laboratory stockrooms and inventories including small equipment, ordering of all the required supplies for all laboratories, preparation of all reagents needed for the weekly general and organic chemistry laboratories, testing equipment to be sure it is functional, running all experiments to be sure they work properly, and preparation and assistance in the presentation of demonstrations for lecture courses and outreach programs. This position was lost due to budget cuts. The Department’s lecturer, Doug Harris, took on many of these duties for the 1xxx- and 2xxx-level laboratories in exchange for a salary increase equal to about 60% of the line that was lost; presently the department funds this internally, partially from lab fees. Labs above the 2xxx level lost Laboratory Manager support and those duties have fallen back on the respective faculty and Teaching Assistants.

The Department has a part-time Glassblower, Richard Logsdon. Logsdon retired from Los Alamos several years ago and works on an as-needed basis, is paid by the hour, and is typically in the Department one day per week. He is also used on a part-time basis to help with preparation of solutions for the general chemistry labs.

Mr. Buckley Banham serves as the Department’s Electronics Specialist. Mr. Banham is responsible for maintaining College of Science equipment, such as centrifuges, autoclaves, spectrophotometers, and incubators, locating replacement parts, and consulting with manufacturers about technical support. With regard to computers, he does software installation, file maintenance, networking, upgrades, and backup. He also assists the NMR/EPR manager in
maintaining and repairing those instruments, avoiding the need for service contracts. The Department also plans to send him to Rigaku for special training to maintain the X-ray equipment used by our protein crystallographer.

Dr. Simon Sham is the Department’s NMR/EPR director. His duties are to manage the department’s magnetic resonance facility, which houses 300 & 400 MHz NMRs and a low-temperature EPR; operation and maintenance of the instruments; collaboration in research projects; training of users; assistance with utilization of the instruments in teaching; and support of efforts for instrument upgrades or new instrument purchases.

Teaching Assistants.
Teaching Assistants do not teach lecture classes, nor do they have primary responsibility for laboratory courses. Laboratory TAs supervise laboratory sections under the direction of a faculty member who drafts the curriculum and creates experiments, and assigns final grades. Other TAs run recitation sections associated with the General Chemistry 1210 and 1220 courses. The recitation sections meet once/week and the TAs give quizzes, review homework and give other supplemental instruction.

In a typical academic year the Department utilizes approximately 18.5 full time equivalent TA positions in fall semester, and 19 in spring. The majority of these are in the laboratories (14.5 to 15.5 FTE positions), the remainder having recitation assignments. Graduate students are given priority in TA assignments, but in recent years the Department has needed to use some undergraduate students to meet our TA needs.

A typical laboratory TA assignment involves supervision of three instructional laboratory sections each week, plus grading of lab reports and administering and grading pre-lab quizzes. General chemistry recitation TA assignments involve 6 to 7 recitation sections each week, and these also involve administering and grading quizzes. Both types of TA assignment include meetings with the instructor and other class preparation.

Teaching Assistant assignments for the current academic year may be found as Appendix 3B.
IV. Students

Faculty-student ratios and FTE per faculty.

Recent total headcounts of graduate plus undergraduate students in this Department, and full-time equivalents (FTE) of students and faculty are shown below.

<table>
<thead>
<tr>
<th>AY</th>
<th># of Majors</th>
<th>Undergrad Students FTE</th>
<th>Graduate Student FTE</th>
<th># of Faculty</th>
<th>FTE-to-Faculty Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005-06</td>
<td>163</td>
<td>382.27</td>
<td>33.45</td>
<td>16.90</td>
<td>24.60</td>
</tr>
<tr>
<td>2006-07</td>
<td>177</td>
<td>387.10</td>
<td>25.85</td>
<td>17.47</td>
<td>23.64</td>
</tr>
<tr>
<td>2007-08</td>
<td>195</td>
<td>406.37</td>
<td>27.75</td>
<td>17.37</td>
<td>24.99</td>
</tr>
<tr>
<td>2008-09</td>
<td>207</td>
<td>426.73</td>
<td>26.60</td>
<td>15.54</td>
<td>29.17</td>
</tr>
<tr>
<td>2009-10</td>
<td>237</td>
<td>449.07</td>
<td>22.80</td>
<td>15.23</td>
<td>30.98</td>
</tr>
</tbody>
</table>

1 The number of students (undergraduate + graduate) in the department, as of Fall semester each academic year.
2 Actual E&G Academic Year FTE Faculty. This is not a headcount, but a figure the budget office arrives at by dividing academic year payments by faculty members’ base salary.
3 Source: USU Budget Office

Total Degrees Awarded

Below is a report of the number of degrees that have been awarded in all categories by our Department over the last five years. The total number of BS degrees has continued to rise since the late 1990’s. Graduate degrees have fluctuated, with total graduate degrees hovering in the range between 8 and 13.

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>BS</td>
<td>16</td>
<td>19</td>
<td>25</td>
<td>25</td>
<td>21</td>
</tr>
<tr>
<td>BA</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>MS</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>PhD</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

Undergraduates

At present we have 247 undergraduate students who are declared chemistry or biochemistry majors, up significantly from the 120 majors reported in our previous department review in 2003.
The Department’s Biochemistry BS program began in the 2005-26 academic year. There were concerns that this major program might simply cannibalize the Chemistry major. The enrollment data below show that while there was a decline of about 10% initially, the Chemistry numbers have rebounded to where they were before the Biochemistry major began. Most of the Biochemistry majors are pre-medical students who would otherwise have been biology majors.

### Undergraduate Major Enrollment Data*

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Biochemistry</td>
<td>14</td>
<td>46</td>
<td>71</td>
<td>78</td>
<td>98</td>
<td>134</td>
</tr>
<tr>
<td>Chemistry</td>
<td>109</td>
<td>98</td>
<td>96</td>
<td>99</td>
<td>108</td>
<td>113</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>123</strong></td>
<td><strong>144</strong></td>
<td><strong>167</strong></td>
<td><strong>177</strong></td>
<td><strong>206</strong></td>
<td><strong>247</strong></td>
</tr>
</tbody>
</table>

*based on fall enrollment each year.

Of our current majors, 30% are women, though the distribution is dominated by the Senior class, which is only 25% female. The majority (80%) of our majors are Utah residents, approximately 18% from out of state, and a bit less than 2% from abroad. The breakdown by student class year is shown below.

The unusually small number of freshmen majors results from the fact that a large number of students begin USU studies with a sufficient number of concurrent enrollment and/or AP credits to be counted as sophomores rather than freshmen. The class year standings reflect a designated number of credits rather than progress within our degree program. Also, a number of students leave for 2-year LDS missions before their junior or senior years.

### Class Year Breakdown

<table>
<thead>
<tr>
<th>Class Year</th>
<th>Total</th>
<th>Origin</th>
<th>US Students</th>
<th>Sex</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>US</td>
<td>In State</td>
<td>Out of State</td>
</tr>
<tr>
<td>Freshman</td>
<td>42</td>
<td>40</td>
<td>32</td>
<td>8</td>
</tr>
<tr>
<td>Sophomore</td>
<td>50</td>
<td>50</td>
<td>41</td>
<td>9</td>
</tr>
<tr>
<td>Junior</td>
<td>54</td>
<td>54</td>
<td>48</td>
<td>6</td>
</tr>
<tr>
<td>Senior</td>
<td>101</td>
<td>99</td>
<td>77</td>
<td>22</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>247</strong></td>
<td><strong>243</strong></td>
<td><strong>198</strong></td>
<td><strong>45</strong></td>
</tr>
</tbody>
</table>

*Data from Fall 2010.
Analysis of grade point average data by group is shown below. The upperclassmen (juniors and seniors) have a demonstrably higher average GPA than those in their first two years. The combined mean GPA for all students listed as chemistry or biochemistry majors is 3.28.

<table>
<thead>
<tr>
<th>Year</th>
<th>Average GPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>2.72</td>
</tr>
<tr>
<td>Sophomore</td>
<td>2.94</td>
</tr>
<tr>
<td>Junior</td>
<td>3.21</td>
</tr>
<tr>
<td>Senior</td>
<td>3.43</td>
</tr>
<tr>
<td>Cumulative</td>
<td>3.28</td>
</tr>
</tbody>
</table>

The following table reports where our graduates have gone upon receiving their BS degree in recent years.

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continued Education</td>
<td>9</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Employment</td>
<td>3</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>4</td>
<td>12</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>17</td>
<td>20</td>
<td>26</td>
<td>25</td>
<td>21</td>
</tr>
</tbody>
</table>

The following table provides greater detail about destination for the past three years:

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graduate School</td>
<td>4</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>Professional School:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical</td>
<td>4</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>3</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Veterinary</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industry</td>
<td>2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Teaching</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>12</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
<td>25</td>
<td>21</td>
</tr>
</tbody>
</table>
The Department supplies a large number of service classes; the table below shows student credit hour numbers for the last five academic years.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>6,133</td>
<td>6,358</td>
<td>6,741</td>
<td>6,840</td>
<td>7,314</td>
</tr>
<tr>
<td>Spring</td>
<td>6,004</td>
<td>5,772</td>
<td>6,005</td>
<td>6,494</td>
<td>6,614</td>
</tr>
<tr>
<td>Total</td>
<td>12,137</td>
<td>12,130</td>
<td>12,746</td>
<td>13,334</td>
<td>13,928</td>
</tr>
</tbody>
</table>

Enrollments in our various undergraduate classes over the past five academic years are reported below, separately for Fall and Spring semesters. Service class enrollments have seen considerable increases in recent years. Chem 1010 (for nonscientists) has reached the lecture hall cap each semester and approximately 25 students were left on the waiting list in Fall of 2010. Likewise, Chem 1110, chemistry for non-chemistry majors, reached the cap of 180 students, and saw 30 students waitlisted in Fall 2010. (These final enrollments were a bit under 180 due to a few students who dropped the course after the start of the semester.) Its succeeding course 1120 has a smaller enrollment, and is offered only during the Spring semester.

### Enrollments in Chemistry Courses

<table>
<thead>
<tr>
<th>CHEM</th>
<th>F06</th>
<th>S07</th>
<th>F07</th>
<th>S08</th>
<th>F08</th>
<th>S09</th>
<th>F09</th>
<th>S10</th>
<th>F10</th>
<th>S11</th>
</tr>
</thead>
<tbody>
<tr>
<td>1010</td>
<td>163</td>
<td>138</td>
<td>174</td>
<td>177</td>
<td>166</td>
<td>178</td>
<td>179</td>
<td>179</td>
<td>179</td>
<td>180</td>
</tr>
<tr>
<td>1110</td>
<td>173</td>
<td>111</td>
<td>172</td>
<td>124</td>
<td>174</td>
<td>132</td>
<td>180</td>
<td>177</td>
<td>174</td>
<td>170</td>
</tr>
<tr>
<td>1120</td>
<td>-</td>
<td>88</td>
<td>-</td>
<td>54</td>
<td>-</td>
<td>87</td>
<td>-</td>
<td>79</td>
<td>-</td>
<td>110</td>
</tr>
<tr>
<td>1210</td>
<td>557</td>
<td>264</td>
<td>642</td>
<td>289</td>
<td>598</td>
<td>269</td>
<td>695</td>
<td>276</td>
<td>703</td>
<td>300</td>
</tr>
<tr>
<td>1220</td>
<td>93</td>
<td>257</td>
<td>88</td>
<td>298</td>
<td>85</td>
<td>326</td>
<td>109</td>
<td>342</td>
<td>121</td>
<td>389</td>
</tr>
<tr>
<td>2300</td>
<td>86</td>
<td>-</td>
<td>82</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>116</td>
<td>-</td>
<td>101</td>
<td>-</td>
</tr>
<tr>
<td>2310</td>
<td>199</td>
<td>-</td>
<td>198</td>
<td>-</td>
<td>219</td>
<td>-</td>
<td>205</td>
<td>-</td>
<td>257</td>
<td>-</td>
</tr>
<tr>
<td>2320</td>
<td>-</td>
<td>156</td>
<td>-</td>
<td>165</td>
<td>-</td>
<td>190</td>
<td>-</td>
<td>185</td>
<td>-</td>
<td>214</td>
</tr>
<tr>
<td>3000</td>
<td>42</td>
<td>-</td>
<td>32</td>
<td>-</td>
<td>55</td>
<td>-</td>
<td>46</td>
<td>-</td>
<td>48</td>
<td>-</td>
</tr>
<tr>
<td>3510</td>
<td>-</td>
<td>11</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>18</td>
<td>-</td>
<td>19</td>
<td>-</td>
<td>9</td>
</tr>
<tr>
<td>3060</td>
<td>11</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>10</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>8</td>
<td>-</td>
</tr>
<tr>
<td>3070</td>
<td>-</td>
<td>14</td>
<td>-</td>
<td>5</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>14</td>
<td>-</td>
<td>7</td>
</tr>
<tr>
<td>3650</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>27</td>
<td>-</td>
</tr>
<tr>
<td>3700</td>
<td>-</td>
<td>186</td>
<td>-</td>
<td>148</td>
<td>-</td>
<td>183</td>
<td>-</td>
<td>174</td>
<td>-</td>
<td>200</td>
</tr>
<tr>
<td>5070</td>
<td>18</td>
<td>-</td>
<td>20</td>
<td>-</td>
<td>22</td>
<td>-</td>
<td>13</td>
<td>-</td>
<td>23</td>
<td>-</td>
</tr>
<tr>
<td>5520</td>
<td>8</td>
<td>-</td>
<td>6</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>12</td>
<td>-</td>
<td>11</td>
<td>-</td>
</tr>
<tr>
<td>5670</td>
<td>-</td>
<td>-</td>
<td>7</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5680</td>
<td>-</td>
<td>-</td>
<td>4</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5640</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>8</td>
<td>-</td>
<td>6</td>
</tr>
<tr>
<td>5700</td>
<td>61</td>
<td>-</td>
<td>54</td>
<td>-</td>
<td>49</td>
<td>-</td>
<td>61</td>
<td>-</td>
<td>58</td>
<td>-</td>
</tr>
<tr>
<td>5710</td>
<td>-</td>
<td>39</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>36</td>
<td>-</td>
<td>35</td>
<td>-</td>
<td>45</td>
</tr>
</tbody>
</table>

Summer Enrollments: Summer 2007 – CHEM 1220, 30 students
No face-to-face Summer classes have been taught since 2007, although several (1010, 1220 and 3650) are offered online. Headcount information for these can be found in the Faculty section under Teaching in Appendix 2D. A section of Chem 1210 and the lab 1210 will be offered in Summer of 2011.
The Chem 1210/20 General Chemistry sequence for chemistry majors, engineers, and premeds has grown by roughly 100 students over the past five years. Two sections of Chem 1210 have been offered in the Fall when demand is highest. The one-semester Organic survey (2300) enrolls just over 100 students. The first semester of Organic (2310) has a high enrollment increasing from around 200 to over 250 students this past Fall. Organic II (2320) has increased, similarly, though there is usually a 10-15% reduction from the preceding 2310 section.

The upper level courses, 3000 and above, are populated primarily by chemistry majors and have consequently lower enrollments. The prime exception is 3700, our one-semester biochemistry survey, which is used by various other majors around campus, and enrolls between 150 and 180.

The Department of Chemistry and Biochemistry provides lower division courses that are required by several other departments. These requirements are summarized in Appendix 4A.

In addition to courses that are specifically required by other majors, the Department of Chemistry and Biochemistry participates fully in the University’s general education program-University Studies. Chemistry courses that satisfy specific University Studies requirements include:

For the physical science breadth requirement
- CHEM 1010 - Introduction to Chemistry (3 cr)
- CHEM 1110 - General Chemistry I (4 cr)
- CHEM 1120 - General Chemistry II (4 cr)
- CHEM 1220 - Principles of Chemistry II (4 cr)

For the life and physical science depth requirement
- CHEM 3650 - Environmental Chemistry (3 cr)

For the communications intensive requirement
- CHEM 3080 - Physical Chemistry Laboratory I (1cr)
- CHEM 3090 - Physical Chemistry Laboratory II (1 cr)
- CHEM 4800 - Research Problems (1-2 cr)
- CHEM 4890 – Undergraduate Biochemistry Seminar (2 cr)
- CHEM 4990 - Undergraduate Seminar (2 cr)

For the quantitative intensive requirement
- CHEM 3600 - Quantitative Analysis (3 cr)
- CHEM 3060 - Physical Chemistry I (3 cr)
- CHEM 3070 - Physical Chemistry II (3 cr)

Graduate Students
A summary of the graduate students enrolled in our program as of the end of Fall semester 2010 is reported below. Two doctoral students successfully completed their dissertation defenses during Fall semester and do not appear on this summary. As of Spring semester 2011 we have 29 students enrolled graduate students in the Department. This number has been declining gradually in recent years. For comparison, in 2003 the numbers of graduate
students stood at 23 Chemistry and 29 Biochemistry students. A complete table of present students by name and major area is in Appendix 4B. Demographic information appears in the tables below.

### Chemistry Graduate Students

<table>
<thead>
<tr>
<th></th>
<th>US Students</th>
<th>International Students</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utah</td>
<td>Other States</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>MS degree</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>PhD degree</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Biochemistry Graduate Students

<table>
<thead>
<tr>
<th></th>
<th>US Students</th>
<th>International Students</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Utah</td>
<td>Other States</td>
<td></td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>F</td>
<td>M</td>
</tr>
<tr>
<td>MS degree</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>PhD degree</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
</tbody>
</table>

Of the 16 chemistry students, 13 are international students. A major Departmental goal is to increase the number of domestic graduate students. The ratio in the biochemistry program is quite different, with only 3 of 13 students originating from outside the U.S. The international contingent is diverse, coming from countries such as Russia, Poland, India, Cameroon, New Zealand, Belarus, Mexico, Jordan, and China. Of the graduate students, 47% are female overall.

### Student Recognition

As we believe we have some fine students in our program, we go to great pains to recognize their achievements. Each spring the Department hosts a reception for students and their parents and family, at which time Department awards are announced. See Appendix 4C for a list of such awards from April, 2010.

### Student Advisement

#### a. Undergraduate

Historically, until about 2000 the advisement of all of the Department’s undergraduate majors lay on the shoulders of a single faculty member. Although the quality of the advisement was excellent and the advisor won an award as the College of Science Advisor of the Year, this burden grew too heavy for a single faculty member. Currently the Department has a total number of majors slightly in excess of 200, roughly equally divided between chemistry and
biochemistry. Advising is divided alphabetically among three faculty advisors in each of the two majors such that each advisor has roughly the same clientele. These six faculty advisors are assisted by one of the Department Office staff, Ms. Geri Child, who handles most of the clerical chores associated with advising. Ms. Child is able to competently handle some of the more routine questions asked by students, keeps track of the list of chemistry majors, and does an initial check of chemistry minors. When students need an appointment with their faculty advisor, Ms. Child schedules this appointment and sees that the student’s file is updated prior to the meeting. The advising appointment can thus focus first upon the student’s progress, and then discussions about career options can ensue, along with fitting the proper emphasis for each student. The faculty advisors, led by Dr. Scheiner, confer when the need arises about policy issues.

In the most recent graduating senior survey, advising was less highly rated than other aspects of our program. We have also noticed a tendency of our students to seldom, or in some cases never, meet with their faculty advisor, instead relying on other advising sources. To address this, in the past year the Department instituted mandatory yearly meetings of our majors with their faculty advisors (the biochemistry advisors had recently initiated this requirement on their own). To facilitate, in the fall two mass meetings are scheduled for each major at which advisors are present. Students can satisfy the yearly meeting requirement by attending one of these; students who do not attend are asked to schedule an individual appointment with their advisor. At the mass meetings advisors review frequently asked questions, review timelines for completion of graduation requirements, cover commonly encountered obstacles, and inform students about opportunities for undergraduate research.

Another aspect of advisement is the supervision of undergraduates in research. One of the Department’s faculty members, Joanie Hevel, serves as our coordinator for undergraduate research. Students looking for opportunities meet with her, and Dr. Hevel endeavors to match students up with a faculty member either in our department or in another department. To provide information to our students, Dr. Hevel developed a web page that is linked to from our Departmental web site that gives undergraduates advice on how to find a laboratory, describes the benefits of undergraduate research, and provides links to a number of other sites with regarding funding, internship opportunities, and other information. Dr. Hevel recently obtained funding from the Associate Vice President for Research in charge of undergraduate research to pay a student to renovate the undergraduate research web site, using input from students involved in undergraduate research in our Department. The new site will be designed to deliver the content that students desire the most in the way they will find both attractive and informative.

b. Graduate

New graduate students participate in a week-long orientation to the department that is organized by the Graduate Recruiting Committee, that occurs several weeks before the start of classes in the fall. Students receive advisement on registering for their first courses, information about TA responsibilities, safety training, are introduced to services provided the USU library system, and participate in a TA Workshop run by the Graduate School. During their first semester of residence, students typically rotate through three research groups that students request after discussions with faculty members whose research aligns with the student’s interests. By the end of their first semester, students meet with the Department Head to discuss their preferences for research advisor. Based upon those faculty members’ interest in the particular
student, their level of funding and availability of research slots in their lab, the student is assigned a research advisor by the Department Head. This is usually, but not always, the student’s first choice. Graduate students are permitted to directly join a research group without rotating by mutual consent of the student, the faculty member, and Department Head.

Soon after selection of a major professor, the student sets up a supervisory committee. For doctoral students this is composed of four faculty members from within the Department and one from another department, with the consent of the Department Head and Graduate School. This committee approves the set of courses for the student, monitors the student’s academic and research progress, and eventually administers oral exams and the final dissertation defense. Students are required to call annual meetings of the committee and present a report of their research progress, at which the student’s academic progress is also discussed. The expectations of these meetings is described in the Graduate Program documents found in Appendices 1C and 1D for Chemistry and Biochemistry, respectively. After each meeting, a memo is prepared summarizing the findings of the committee, problems or deficiencies are noted, and the student is asked to sign the memo to verify they have received the committee’s evaluation and recommendations. The large majority of the Department’s doctoral students progress well through their programs and obtain their degrees in an average of about 5 years, close to the national average.

The Graduate Studies Committee, assisted by one of the office staff (Margaret Dobrowolska) monitors the compliance of students in scheduling their annual meetings and assists students in room scheduling.
V. PROGRAM COSTS

Budget Management

The Department Head is responsible for managing the Department budget with the assistance of the Business manager LuAnn Stocking. Each fall a report is made to the entire faculty on expenditures during the preceding fiscal year (fiscal years run from July 1 – June 30).

Operating budget. The state funds budgeted to this Department for OTS (other than salary) purposes for 2010-2011 amounted to $70,900, a level that has been steady since the 2008-09 FY. This total is meant to cover equipment, maintenance and repair of Departmental teaching infrastructure, travel, support of the seminar program, and general operating (monthly phone and networking fees, photocopying/printing, office supplies, chemicals, etc, etc.). This amount is too small to operate a chemistry & biochemistry department, so the Department must frequently cannibalize our TA budget to avoid going into the red. The domino effect is a smaller number of TAs to cover our laboratory and recitation sections, resulting in a higher load for each student than at most universities.

Lab fees. The other primary source of income is the laboratory fee account. Each student registering for a chemistry laboratory course is assessed a fee of $55. During the last fiscal year, the Department was credited a total of $115,552 from this source. University rules require that these funds be spent solely on the teaching laboratories. Strangely, the Executive Memorandum governing the use of lab fees takes the position that certain expenditures are to be met by permanent budget lines, and may be covered by lab fees only as a temporary measure until a permanent funding source can be found. These temporary only uses include:

- Computer usage, including software
- Purchase, repair, and replacement of equipment
- Laboratory supervision (fees may not be assessed to pay for faculty, teaching or research assistants)
- Expendable supplies

The Memorandum goes on to say that fees may be used to pay for “consumables” which can be construed to include chemical reagents, but it will be clear to any laboratory scientist that the vast majority of the costs associated with our teaching laboratories fall under categories intended to be covered by a permanent budget line. In the last academic year 1,229 students were enrolled in our general chemistry labs, 424 in organic labs, and 134 in the introductory biochemistry lab, plus smaller numbers in upper division laboratories in inorganic, analytical, physical, biochemistry, and advanced synthesis.

Since the Department budget is ludicrously small to support this teaching laboratory enterprise in addition to operating the Department, lab fees must be used to cover costs that include chemicals, glassware, personnel (part-time student employees) to man the student lab stockrooms, and the purchase of new equipment and the replacement of obsolete and nonfunctional equipment. The Department also obtained permission of the Provost’s Office to temporarily use a portion of the lab fees (about $10,000) to help cover the cost of the salary increase for the Lecturer to take over the Lab Manager duties when the latter position was lost to budget cuts, until a permanent funding solution is found.
**F&A Return.** The University’s currently negotiated overhead rate is 40%. The distribution of F&A generated by research grants is 70% to the Vice President for Research (VPR), 25% to the Department, and 5% to the Dean’s Office of the College of Science. The Department’s share is held centrally.

The Department and Dean’s Office are together typically responsible for 50% of the startup costs of new faculty, and the remainder is funded by the VPR’s Office. These costs typically run on the order of $400-500 K; for example, in the most recent search the startup offer to a prospective biochemist totaled $550,000, of which the Department’s share would have been $188,245. To put this in perspective, the Department’s allotment of F&A receipts was $69,682 in FY2009-2010. Not all startup packages are this large, and the total varies depending on the particular field of research. According data compiled by the Council for Chemical Research from a survey of its >125 member universities, startup costs range from ~$300K to $600K for chemistry faculty at university departments in the second and third NRC quartiles, with top quartile institutions offering $800K and above.

The Department is also responsible for a major share of any matching funds that are required when applying for major research or instructional instrumentation. An example was a recent NSF proposal for funds to obtain an LC-MS, which included a commitment of approximately $30 K from the Department.

Another commitment of F&A funds is for temporary, “bridge” funding for faculty who have had a history of successful funding and are not currently funded but are aggressively seeking it. This has averaged approximately $30 K annually in the most recent four fiscal years but varies considerably, from a high of $69 K to a low of $12 K in the most recent year. F&A funds are also used to pay for the services of the grant writer described elsewhere.

**TA Budget.** The Department’s TA budget line is $393,929 and has not increased for several years. The Department utilizes 18.5 to 19 FTE TA positions each semester; the number of TAs and their duties were discussed in more detail in Section III on Staff. The current graduate TA stipend is $20,500 per year, and health insurance adds an additional $1 K per student. As discussed in the next Section VI under the subheading Assistantship and Fellowship Resources, the stipend level is low and negatively affects recruiting. Most, but not all, of the graduate students who serve as TA’s during the academic year are put on RA support via their major professor’s grants for summer semesters.
VI. Program Support

Resources and Facilities
The Department is housed in two adjoining buildings on campus. Widtsoe Hall was occupied in 2000 and contains modern laboratory facilities within the context of 54,000 nsf. Supplementary space (35,000 nsf) is provided by the Maeser Building, originally constructed in 1970 and renovated with new fume hoods in 1999. There is adequate space for offices and research labs for current faculty and several empty laboratories. The chemistry buildings also furnish adequate instructional laboratory space; Widtsoe Hall in particular has excellent instructional laboratories that are used for general and organic chemistry.

Adjoining the two chemistry buildings is the newly completed Eccles Science Learning Center (ESLC), which provides classroom facilities of various sizes, up to the 480-seat Emert Auditorium. ESLC is not assigned to the Chemistry Department, but is a general campus building whose classrooms are assigned by the central scheduling office. The Emert Auditorium was designed with the assistance of Chemistry faculty to be able to support chemical demonstrations. As a result of the dearth of large lecture rooms on campus, only a single section of general chemistry is taught in this space. One other room was designed for chemical demonstrations, in the basement of the Widtsoe building; this room has a capacity of 180, too small to house general chemistry or organic chemistry classes. As a result, most chemistry lectures are scheduled in more remote buildings on campus, which makes the presentation of lecture demonstrations impractical.

New Faculty Development
New faculty members are assigned a Tenure & Promotion Committee, consisting of a group of four tenured Departmental faculty plus one outside faculty member from another department. The four internal members are selected to provide mentors who have been successful in teaching and research in the new hire’s area, and the outside member is chosen from a department related to their area of research.

Development of the research programs of new faculty members is assisted in a number of ways. This Department, the Vice President for Research Office, with the assistance of the Dean of the College of Science, all contribute to startup funds for new faculty. Typically the VPR office covers half, and the other half is split between the Department and College. The teaching loads and service assignments of new faculty are kept as low as possible so that they may concentrate on development of their research program and on development of courses they will teach. Specifically, new faculty members are usually given a half-load in their first year. The Department actively encourages new faculty to apply for national awards set aside for new faculty. For example, an assistant professor in the Department was recently awarded an NSF CAREER award, as was another faculty member who is presently an associate professor.

The Vice President for Research office funds a program called the New Investigator Grant-writing Experience through Mentorship (GEM), which provides up to $5,000 to establish active collaboration between a new USU investigator and a more established colleague willing to serve as a research and proposal writing mentor. These funds are intended to be utilized primarily by the new investigator to develop preliminary data, or to support travel to access specialized resources not available at USU or meet with potential collaborators or funding sponsors/agencies. Up to $1000 of the total award may be allocated to the mentor to support time and effort or research-related contributions to the project. One of the expectations of this
program is that each funded GEM project will result in the development and submission of at least one proposal to an external funding agency.

During the past year the Provost’s office held workshops to train a selected number of faculty members on campus to assist faculty in the development of their teaching expertise, and the documentation of this growth in a “teaching portfolio.” This is a document that is intended to demonstrate the evolution and development of the pedagogy skills of faculty members, and will form an important part of the tenure and promotion document in the future. Within the past year Brad Davidson, a faculty member in our Department, was chosen as one of the College of Science trainees in this area. Assistant Professors will work with him on a yearly basis to receive mentoring on utilizing these best practices to improve their instructional skills, and to document them in a manner that the administration expects for successful tenure packages.

**Faculty Recruitment and Retention**

Faculty searches in the Department are conducted nationally. Ads are placed in C&E News and the associated ACS web site, Science magazine, the Chronicle of Higher Education, HigherEdJobs.com, and Academikeys.com. These are supplemented by letters to other departments and personal contacts. This Department has had high standards for hiring, and it is typical to deem about half of interviewed candidates unacceptable after their visit. Our requirements demand the qualities of a highly competent instructor, coupled with the promise of a dynamic, fundable and nationally recognized research program.

Retention of faculty has been good, but not excellent. Recent years have witnessed the loss of several faculty members. In 2005 a bioinorganic chemist left for Loyola University to become the department head. An assistant professor in analytical chemistry left academia for the USDA in 2008 just before his tenure year. Steve Aust, a biochemist who had a 40% departmental appointment, retired and became emeritus in 2008; and Vernon Parker, an organic chemist, did the same in 2010.

None of these have been replaced, although searches for a biochemist were held in 2008 and in 2009. Incredibly, both searches were seemingly successful only to collapse unexpectedly. The 2008 search yielded a candidate who gave a verbal acceptance that was retracted several weeks later when, it was claimed, he received a better offer from another institution including a startup package of $1,000,000. The 2009 search ended with a candidate giving written acceptance of an offer, followed by Skype interviews he conducted a month later with prospective graduate students for his laboratory, and providing us a web page describing his lab for the Departmental web site. This candidate then reneged a month before he was to report in fall of 2010, citing personal family-related reasons.

As of this writing, several searches are underway: a more general Departmental search that has generated a large applicant pool of >200; the Chemical Biology search described earlier that may produce a faculty member in this Department; and the USTAR VDID search for a bioanalytical or a medicinal/synthetic chemist.

**Evaluation of Tenured and Non-Tenured Faculty**

The Department follows the University’s codes and procedures with regard to tenure and promotion evaluations. In summary, each tenure-track faculty member is assigned an advisory “T&P” committee of five tenured faculty, approved by the Department Head and Dean. One of these committee members is selected from another Department. This committee serves in part as a “mentoring” group, to offer the junior faculty member advice and direction. It also is meant to provide clear feedback on performance, and to make the tenure criteria explicitly clear, in
writing. This Committee meets once each year with the candidate, and produces a letter to the
Department Head concerning progress toward tenure, including a recommendation as to whether
the candidate should be continued for another year. These letters give explicit advice on what
areas, if any, need improvement. After receipt of the letter the Department Head meets with the
candidate, and offers his own opinions in person and in written form. The Department Head’s
letter and that of the T&P Committee are forwarded to the Dean, who writes his own summation
letter. Copies of all correspondence are furnished to the candidate.

In the tenure year, a full binder is assembled by the candidate with assistance from the
T&P Committee and guidance from the College of Science, which has examples of successful
binders (shorn of identifying material). This packet includes evaluation letters from at least four,
but more typically 6-7, external referees. The T&P Committee makes a recommendation for or
against tenure to the Department Head, who makes his own recommendation to the Dean.

The Department Head meets individually with all tenured faculty each year. These
annual meetings are designed to discuss teaching effectiveness and research productivity over the
past several years. They are also designed to result in goals for the upcoming year, and for the
faculty member’s long-term career particularly for those seeking promotion. A supplementary
purpose is for each faculty member to have an opportunity to provide feedback to the
Department Head about the current state of the Department. Written summaries of these
meetings are jointly approved by the Department Head and the individual faculty member.

The Department follows the University requirement for post-tenure reviews of all tenured
faculty once every five years. These reviews are conducted by a three-member committee
composed of faculty of equal or higher rank, with one member from outside the Department.

Student Recruitment
The number of graduate students in the Department has declined in recent years. We will
have 29 graduate students as of Spring semester 2011. At the time of the last Departmental
review in 2003 this number was 51. The final section of this report discusses several ideas the
Department is pursuing in an effort to reverse this trend. The Department does several things to
enhance recruiting:

• accepted domestic applicants are invited to campus for a visit at Departmental expense
• a web-based pre-application process was instituted; students who meet departmental criteria
  are assisted in making a full application to the School for Graduate Studies and the
  application fee is paid by the Department
• the financial incentive of a $1000 “signing bonus” was instituted for all new graduate
  students attempts have been made to identify and cultivate “feeder” schools that might be
  interested in encouraging their best undergraduates to attend USU
• the Department guarantees payment of any tuition costs that are not covered by Graduate
  School tuition awards
• 80% subsidy of student health insurance by the Department
• this year, a number of faculty members scheduled visits to potential feeder schools and the
  Department plans to systematically continue this for several years and then evaluate

To assist in recruitment of foreign students several initiatives have been undertaken:

• several of our faculty members have visited particular universities in China and Poland
  that we have connections with, so as to encourage applications for our graduate program.
• one of our faculty, originally from Taiwan, assists in evaluating applications from Chinese students and telephones promising applicants to assess their proficiency with spoken English, before the student is offered a TA.
• one of our faculty members who is from Russia has used personal contacts at two universities in Moscow to recruit graduate students for his group.

Resources for Faculty and Student Development

The Department’s small budget makes setting aside funds for faculty development difficult, but some means are available from the department to supplement activities by the University as a whole in this area.

The Department is able to assist faculty with travel to meetings on a case-by-case basis. Within the past year the Department also offered paid lodging costs for one faculty member to attend the regional POGIL workshop in Salt Lake City in the summer of 2010, and for lodging at an NSF grant workshop in fall of 2010 also in SLC. The Department matches up to $300 travel funds that any student (grad or undergrad) obtains from other university sources for travel to meetings to present their research. The Department also matches $500 undergraduate research awards made through the VPR office to undergraduates through the URCC program (Undergraduate Research and Creative Opportunities).

All faculty offices are equipped with personal computers, either PC or Mac. Faculty with significant grant funding typically provide their own computers and critical software, and the Department assists in this for the Instructor, and for faculty who have significant teaching duties and lack their own funding. Chemistry students have access to a computer lab maintained by the Department in the Widtsoe building, containing 12 PCs where students taking chemistry classes may use the facility to help them prepare their chemistry coursework and lab reports. These computers are networked and have installed software including Microsoft Office and ChemDraw. A Department server houses the Chemistry website. While Department staff can handle routine maintenance and updates to this website, we do not have a true IT expert or anyone with web design experience on the staff.

Beginning in the fall of 2010, the Department covers costs for faculty members to use the services of an experienced Grant Writer, Kay Hegemann, who has worked extensively with faculty in Engineering and at the Space Dynamics Laboratory. She is an accomplished technical writer, who is also experienced at insuring that the elements of a proposal match effectively with the expectations of particular RFPs. Faculty wishing to use her services must obtain approval from the Department Head; the requirements for this are that the proposal budget must be significant (>300K), result in F&A return to the Department, and a clear summary of the proposed research must be in place. Faculty members already have the assistance of Kellie Hedin from the Sponsored Programs Office to assist them in the formulation of budgets (and proper completion of associated budget forms) and thus the Grant Writer can be used to focus on improving the technical writing aspects of the proposal. This will be especially helpful for those faculty members for whom English is a second language.

Seminar Series. The Department maintains a robust weekly seminar series; copies of recent seminar schedules can be found in Appendix 6A. These are generally held weekly, although during searches when there is a large number of seminars scheduled by faculty candidates we try to leave open weeks in this schedule. The Department also hosts two named
lecture series funded by donors. One of these is the Olsen Lecture, named for former faculty member Richard Olsen, an organic chemist who retired in 1997. The other is the Hansen Lecture, named for R. Gaurth Hansen, a Cache Valley native who obtained his education at the University of Wisconsin and later came to USU as an Academic Vice President, and Distinguished Professor of Nutrition and Food Sciences and Chemistry & Biochemistry. Both of these lectureships allow the Department to host a high profile researcher to visit the department and deliver a talk that is advertised widely, and attended by faculty and students from other departments besides our own. Appendix 6B lists the names of the Olsen and Hansen lecturers to date. The 2011 Olsen lecturer is Jon Clardy of Harvard University, scheduled for April 27. The 2011 Hansen lecturer will be Robert Tabita from Ohio State on October 12.

Gifts and Endowments. The Department has a number of small endowment funds from alumni as well as a small influx of development funds including donations from current faculty members. The income from nearly all of these funds is earmarked for student awards and scholarships. One of the two notable exceptions is an endowment from Richard Olsen, mentioned above, which funds a stipend and other costs associated with the annual Olsen lectureship. The other endowment consists of funds donated by William Rutter, and members of the Hansen family, in memory of R. Gaurth Hansen. It was originally hoped that this endowment would be of sufficient size to permit the establishment of a permanent faculty position. This did not prove to be the case, but this fund has been used to provide startup funds for promising assistant professors in Biochemistry who are designated as Hansen Assistant Professors, until the title is relinquished upon tenure. Hansen Assistant Professors also receive an additional $10K/year for use in their research from these funds. The Department has had two such faculty members to date: Joanie Hevel, who is now an Associate Professor; and Sean Johnson, who is presently a Hansen Assistant Professor.

Instructional Laboratory Equipment

Appendix 6C contains tables showing the major equipment in the teaching laboratories. These tables were created in the Fall of 2010 for the purpose of coordinating the use of major equipment among the faculty members who teach laboratory courses. It will be noted from these tables that a good deal of the equipment is old, and gradual replacement and upgrades are planned. Toward this end, within the past year a number of new balances, stirrer/hotplates, and melting point devices were purchased for the lower division laboratory courses, which include Chem 1115 (General Chemistry Laboratory), Chem 1215/1225 (Principles of Chemistry Laboratory I and II) and Chem 2315/2325 (Organic Chemistry Laboratory I and II). Shortages of working balances and spectrophotometers in some of the upper division laboratories will be addressed in the present year, with an eye toward maximizing sharing of such equipment across laboratory courses as much as possible. Several computers were purchased within the past year, which, along with the computer lab in Widtsoe Hall, will permit the addition of a computational modeling experience in conformational analysis to the organic laboratory curriculum.

In addition to the equipment on the matrix, the organic laboratory instrumentation includes a very old gas chromatograph that needs to be replaced. It will be seen from the equipment tables that a number of the upper division laboratories are using other aging equipment that will either need to be replaced, or should be, in the interest of modernization. This year the Department has begun to systematically collect student feedback about their laboratory experience (the form used is in Appendix 6D). This information is being used to
address bottlenecks (such as shortage of balances) and to replace or repair equipment that
students find to be repeatedly prone to malfunction.

Research equipment
Common equipment in the Department available to all faculty includes the following:

- Bruker ARX-400 MHz and JEOL 300 MHz NMR.
- Bruker ESP-300 X-band EPR spectrometer, with dual-mode ER-4116 DM-X-band
device.
- Shimadzu gradient HPLC system with autosampler, diode array and fluorescence
detection
- Shimadzu model QP-5000 GC-MS
- Shimadzu dual-beam scanning UV-Vis spectrophotometer
- Two Shimadzu single-beam UV-Vis spectrophotometers
- Nano 2G ITC Microcalorimeter
- CS model 136 peptide synthesizer
- 2 Sorvall RC-5B high-speed centrifuges
- The department maintains two coldrooms, and an autoclave room for shared use.
- A shared biochemistry instrumentation room for community use contains a NanoDrop
ND-1000 spectrophotometer, Fujifilm LAS-3000 imager, Beckman LS 6500 scintillation
counter, and several centrifuges.

The USU Center for Integrated Biosystems (CIB), located near the Department, houses a protein
production facility with protein and DNA sequencing services, and mass spec instrumentation
(GC/MS and LC/MS). These are available on a fee per sample system.

A major roadblock in this Department’s attempts to compete in the national arena is a weak
research infrastructure, both in this Department and on the campus generally, in both major
equipment and, even more severely, support personnel. Some important equipment is simply
absent, and other equipment lacks the expertise to properly utilize it. For example, the advanced
LC-MS system listed above housed in the CIB was obtained by a congressional earmark and is
woefully underutilized because no LC-MS expert is in residence. The absence of such expertise
was the major (and only significant) weakness cited in reviews for the Department’s recent
application to the NSF MRI program to obtain funding for our own instrument.

Library Holdings
The Merrill-Cazier Library, opened in 2005, has more than 305,000 square feet of usable
space and seating for more than 2,000 people. The Library is open 101 hours per week when
classes are in session and is accessible throughout the year (except during designated University
closures). It incorporates several desirable technological features, such as ubiquitous wireless
computing; an automated storage system (called “the BARN”) with capacity for more than 1.5
million volumes; an information commons with 150 computers from which students may use a
wide variety of software, including word processing and statistical analysis packages; and more
than 35 group study rooms with computer and projection equipment.

The University Library currently subscribes to electronic access to the ACS, Royal
Society of Chemistry, Wiley, and Elsevier journals in chemistry and biochemistry; Science,
PNAS, Cell and Nature; along with others relevant for interdisciplinary research, such as titles in
agriculture, biology, environmental science, nutrition, physics, or engineering. The Library
provides online access to the Web of Science and the SciFinder Scholar (Chemical Abstracts) databases, though the latter package that USU has purchased lacks substructure searching capability.

The Library is a member of several consortia, which expands access to materials for the USU community through cooperative circulation agreements. The Merrill-Cazier Library belongs to the Utah Academic Library Consortium (UALC), comprised of 24 academic libraries throughout Utah and Nevada; the Greater Western Library Alliance (GWLA), a group of 32 major, Western research libraries; and the Center for Research Libraries (CRL), an international consortium of research libraries with headquarters in Chicago. Recently, the Library also became the 31st partner in the HathiTrust, an international cooperative dedicated to building a comprehensive digital archive of library materials (converted from print) that is co-owned and managed by the partner institutions. These Interlibrary Services at USU permit rapid access to journal articles from titles to which the local Library does not subscribe, and most are scanned by the lending library and delivered to researchers' online accounts. Interlibrary loan also borrows physical materials for Utah State Univ. students and faculty, such as books, conference proceedings, and other publications that are not locally available.

Assistantship and Fellowship Resources

The current Departmental graduate TA stipend is $20,500 per year. The Departmental TA budget supplied by the University has been flat for the past three years. For comparison, according to data from the Council for Chemical Research departments in the third to fourth NRC quartiles have average stipends of $21,600 rising to $23,000 for second-quartile programs. The department also subsidizes the cost of health insurance for graduate students, paying 80% of their cost; currently the Department’s share is $1,016/year per student.

It is customary for all first-year graduate students to serve as TA’s their first full year. In subsequent years most graduate students are moved to Research Assistantships and TA only part time, if at all. Departmental policy permits faculty members with grants to pay their Research Assistants a higher rate, up to 120% of the departmental TA level. The School of Graduate Studies provides tuition awards to doctoral students for the first 70 credits of the 90 that are required for the doctoral degree if a student enters the program with a BS. (Students who enter with the MS only need to complete 60 credits) The Department promises entering students they will not be responsible for tuition up to the 90 (or 60) credits needed for their doctorate. The 20 credits not covered by tuition awards from the Graduate School are expected to be covered by PIs from grant funds, and faculty are regularly reminded to factor in this cost when preparing budgets.

There are few fellowships available to incoming students. The College of Science has an Eccles Fellowship available that this is spread around to all six of the Departments, and the Chemistry Department is successful in this regard only infrequently. The Department has been offering entering graduate students a first-year Departmental Fellowship of $1K to $1.5K as an added enticement.
VII. Program Assessment

Learning Goals
Each of the five divisions in the Department, and the general chemistry steering committee, has identified a set of learning goals for each course. These objectives are included in course syllabi. Students can access the syllabi for all of our courses from the Departmental web site. The Department has also identified a "higher-level" set of learning objectives for our undergraduate degree programs, which are summarized in a matrix that shows how each course in the Department contributes to these broader goals. This matrix is posted on the Assessment section of the Departmental web site, and is reproduced in Appendix 7A.

Teaching Assessment of Faculty
Members of their Tenure & Promotion Committees are asked to observe untenured faculty members in their classrooms. After each visit the observer will normally discuss their findings with the instructor, and modifications might be recommended.

All courses are evaluated at the end of the semester on University forms (see Appendix 7B). The student scoring on these forms are compiled and derived in a number of categories including overall instruction effectiveness and course quality. The forms also ask students to write in comments about parts of the course they liked, and for suggested changes. The Department Head reads all of these comments for each course every semester, and are provided to the instructors following each course.

The Department’s evaluation scores of lecture classes are good, comparing favorably with averages in the College and in the University. These scores range from a maximum of 6, to 1 being the lowest. Average scores compiled over the last four years are reported below, where each value corresponds to the average of the two principal categories, overall instruction effectiveness and course quality. For comparison purposes the same data are reported from a report prepared in 2003. With the exception of 1210 and 1220, which have dipped somewhat, the scores for the majority of courses have risen in this time period.
### Averages for Student Evaluations of Courses

<table>
<thead>
<tr>
<th>Course number</th>
<th>General title</th>
<th>Typical enrollment(^a)</th>
<th>Average rating(^b) as of 2003</th>
<th>Average rating(^b) as of 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>1010</td>
<td>Introduction to Chemistry</td>
<td>~ 180</td>
<td>4.2</td>
<td>4.8</td>
</tr>
<tr>
<td>1110</td>
<td>General Chem for non-science majors</td>
<td>130-180</td>
<td>4.4</td>
<td>5.0</td>
</tr>
<tr>
<td>1120</td>
<td>2(^{nd}) semester of above</td>
<td>60-85</td>
<td>4.1</td>
<td>4.5</td>
</tr>
<tr>
<td>1210</td>
<td>General Chem for science majors</td>
<td>275-700</td>
<td>4.6</td>
<td>4.3</td>
</tr>
<tr>
<td>1220</td>
<td>2(^{nd}) semester of above</td>
<td>85-340</td>
<td>4.4</td>
<td>4.0</td>
</tr>
<tr>
<td>2300</td>
<td>Principles of Organic Chemistry</td>
<td>100-115</td>
<td>4.2</td>
<td>4.9</td>
</tr>
<tr>
<td>2310</td>
<td>Organic I (for science majors)</td>
<td>200-250</td>
<td>4.6</td>
<td>4.9</td>
</tr>
<tr>
<td>2320</td>
<td>Organic II (for science majors)</td>
<td>165-200</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>3000</td>
<td>Quantitative analysis</td>
<td>30-55</td>
<td>4.3</td>
<td>4.3</td>
</tr>
<tr>
<td>3060</td>
<td>Physical chemistry I</td>
<td>8-20</td>
<td>4.6</td>
<td>5.5</td>
</tr>
<tr>
<td>3070</td>
<td>Physical chemistry II</td>
<td>8-14</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>3510</td>
<td>Intermediate inorganic</td>
<td>10-19</td>
<td>4.9</td>
<td>5.4</td>
</tr>
<tr>
<td>3700</td>
<td>Introductory Biochemistry</td>
<td>150-185</td>
<td>5.0</td>
<td>5.5</td>
</tr>
<tr>
<td>5520</td>
<td>Advanced inorganic</td>
<td>6-12</td>
<td>5.2</td>
<td>4.9</td>
</tr>
<tr>
<td>5640</td>
<td>Instrumental analysis</td>
<td>8</td>
<td>4.8</td>
<td>4.8</td>
</tr>
<tr>
<td>5700</td>
<td>Biochemistry I</td>
<td>49-61</td>
<td>5.0</td>
<td>5.2</td>
</tr>
<tr>
<td>5710</td>
<td>Biochemistry II</td>
<td>35-39</td>
<td>4.6</td>
<td>5.3</td>
</tr>
</tbody>
</table>

\(^a^\)Range of enrollments seen during the past three years. With the exception of 1120 the general chemistry courses are offered both semesters, and the lower enrollments are seen in the off-sequence or “trailer” sections. In recent years the on-sequence General Chemistry courses (1010, 1110 and 1210) have been filled to capacity.

\(^b^\)Average of the two principal categories, overall instructor effectiveness and course quality. The form completed by students can be found in Appendix 7B.

### Course Level Objectives and Assessment

In several core courses "gain-score" tests are administered at the start and the end of the semester (or course sequence). These tests consist of questions designed not only to determine how well students have understood the information in the course but also their ability to apply, analyze, and synthesize that information. Examples of gain-score tests and a comparison of results at the start and end of the course are available in the Assessment section of the Department web site. The results are analyzed by the faculty to identify areas of weakness, and to gauge the effectiveness of remedial measures.

Comparison of student knowledge to national level is achieved in certain core courses through the use of ACS standard examinations as the actual final examinations in these courses. Performance on these examinations is monitored on a question by question basis so as to identify areas where improvement is needed. Outcomes data are compiled and utilized by individual faculty, and some historical data listed by course and compared with our stated learning objectives can be found in the assessment section of the departmental web site, although this data has not been collected centrally in the department since 2007.

In another assessment measure of the overall program, senior chemistry majors taking our “capstone” seminar course (Chem 4990) take an exam, designed by faculty several years
ago, composed of 60 questions taken from standardized ACS exams in the subject areas of
general chemistry, organic, inorganic, physical, analytical, and biochemistry. An advantage of
this approach is the availability of national norms for purposes of comparison using published
ACS test bank data, though it must be remembered that the national percentile norms come from
ACS exams that are typically administered to students at the end of the respective courses, when
the material is fresh in their minds, in contrast to our senior exams. Nonetheless, the most recent
results yielded good outcomes: averages of the 70th percentile in general chemistry, 60th
percentile in organic, 59th percentile in analytical, and 56th in biochemistry. Physical was lowest
at the 41st percentile. Currently these exams are only administered to chemistry majors;
biochemistry majors are not evaluated in this way.

Graduating seniors meet separately with the Department Head and the Dean to discuss
their retrospective opinions of their educational program. Part of the interview process in the
Dean’s office involves completion of an exit interview form that asks students for their feedback
on a number of topics including their coursework. Annual summaries of these comments, along
with the written comments themselves, are distributed to departments and are considered for
areas of improvement. Appendix 7C shows the tabulated results from the first part of the most
recent survey. This section of the survey consists of a series of 19 questions asking students to
agree or disagree with statements intended to evaluate aspects of their educational experience.
The results for the Department compare favorably with data from other departments in the
College of Science.

Two specific moves have been taken within the past year arising from findings of the
graduating seniors survey.

(a) Several majors had indicated dissatisfaction with the quality of advising in general,
and some specifically asked for more information about professional opportunities and
information about the chemistry profession. This past year with the retirement of one of the
former Chemistry advisors, the Department Head asked John Hubbard to return to advising.
Hubbard is an outstanding advisor, and is a past winner of the College of Science Advisor of the
Year. A Departmental requirement that all majors meet with their faculty advisor yearly was
instituted (the Biochemistry advisors already had such a requirement on their own) and to
facilitate this, the opportunity to satisfy this requirement by attend one of two mass meetings
over lunch (provided by the department) were organized. To provide more professional
information to seniors, one of our Adjunct faculty members with a long career in the chemical
and pharmaceutical industries (Weinshenker) participated in two sessions of the senior capstone
course to share his knowledge. In one of these he invited a guest from the Business School to
provide another perspective.

(b) It was also noted that a number of students expressed disappointment with obsolete
and malfunctioning equipment in upper division laboratory courses. While the university has
long conducted student evaluations of lecture courses, for laboratory courses, only evaluations of
TA performance have historically been conducted. In order to collect better data on student
satisfaction in our laboratory courses, beginning this academic year the department instituted
short laboratory surveys of students (this was mentioned in the previous section, and the survey
form appears as Appendix 6D). These surveys give us information that is being used to guide
equipment upgrades, and also informs instructors about experiments in the curriculum that
students found either particularly problematic, or rewarding.
VIII. STRENGTHS AND WEAKNESSES
We describe below our own perceptions of our strengths and weaknesses at this point in time.

Strengths

• The faculty members of this Department are strongly committed to both research and teaching. This dedication is exemplified by the willingness with which all of our faculty members teach large undergraduate service classes. Another indication of this commitment lies in the involvement of undergraduates in research.

• The quality of the undergraduate instructional program is high, as rated by graduating students as well as course evaluations.

• The vast majority of our faculty members are research active, as measured by successful grantsmanship and regular publication, and their papers are well-cited in the literature.

• The Department is housed in a modern and attractive facility, with adequate space for chemistry teaching and research.

• The University is situated in an attractive mountain setting that offers a myriad of recreational opportunities, which assists in recruitment of both faculty and students. The Logan area has one of the lowest crime rates of any such area in the country.

• The quality of undergraduate majors is very high. These students consistently score very well on nationally standardized exams upon nearing graduation, and perform competitively with graduate students in graduate level courses.

• The Department has been able to fund a robust seminar program, attracting weekly visits from active researchers around the country and the world.

Weaknesses

Below we list what we perceive to be the major weaknesses of the Department. Following this is a summary of steps we are taking to address these issues.

• The biggest weakness of the Department is its small number of faculty. Even when the department was at what has historically been considered full strength, with a total of 4.4 positions in biochemistry and 13 in chemistry, the critical mass needed to sustain graduate programs in biochemistry and chemistry and to justify extramural investment in infrastructure was lacking. The small number of positions puts severe strains on faculty time, which must be divided into research, teaching, and service. In recent years trailer courses in some of our general chemistry and in organic chemistry had to be eliminated, creating inconvenience for students and enlarging class sizes. This shortage of faculty positions, and their associated research groups, also hinders recruiting graduate students.

• The Department’s number of graduate students has been declining; our success at recruiting graduate students, particularly domestic students, has been less successful than needed to sustain our graduate program at the level needed by our funded research grants.
• The research infrastructure in the Department and the University as a whole is weak. This weakness encompasses several different areas. One major unmet need is for a mass spectrometry facility. While the Center for Integrated Biosystems houses some such instrumentation, including high-end MS equipment that was obtained by congressional earmarks, no staff support positions were created to support the instrumentation. These instruments are under the nominal supervision of faculty members with the usual duties associated with full time regular faculty appointments, and only BS-level technicians with minimal training run samples on a fee per sample basis. The absence of bona fide MS expertise hampers a number of PI’s around campus, including several in this department. In other areas the low faculty numbers present a challenge in demonstrating the presence of a large enough user base to support convincing grant proposals to NSF to fund instrument purchases. This is a particular concern for our protein crystallographer, who will need funds to upgrade his capabilities in the near future.

• Faculty salaries are low, by comparison with comparable Chemistry/Biochemistry Departments. According to the University’s overall compensation figures (Source: USU Bluebook for 2010), using AAUP survey data, USU lags 21% in salary behind peer institutions, although the deficit is only 12% when total compensation is considered. This adversely impacts faculty morale, as well as retention and recruiting.

Several efforts have been made to address these weaknesses; some have been described earlier in this document.

Small number of faculty. The positions of faculty members who have left the University in recent years have reverted to the College, and those budget lines were sacrificed to meet State budget cuts. While restoration of some of these positions to departments that are strapped to meet their teaching obligations is expected, there is no expectation of an automatic return to our historical 17.4 tenure-track lines (inadequate as these were) even when and if budget conditions permit it. It is likely that the University, and the College, will also favor investment of faculty lines in ways that strategically build research areas, particularly that will consolidate “teams” of researchers in areas that cut across departments, in areas that are promising avenues for future funding and development.

In response to a call by the Dean in fall of 2009 for proposals along these lines the Department submitted two proposals, one the Chemical Biology program discussed earlier, and another in Environmental Chemistry. The latter proposed emphasis area in our graduate program would also be interdepartmental, with participation by two adjunct faculty, one in Engineering and the other at the Energy Dynamics Lab. The Chemical Biology proposal, which asked for funding for a faculty position in both our department and in Biology, was approved for funding of one position out of a special reinvestment fund this year.

The growth of our undergraduate major program, which has largely resulted from the establishment of the biochemistry major in 2005, should also position the Department to justify the reclamation of lost faculty lines.

The Department has taken steps in the past year and a half to give our faculty the opportunity to increase our interactions with faculty members in other departments who are doing chemistry and biochemistry-related research. Monthly gatherings of faculty with shared
research interests in some of our research focus areas (described earlier) were initiated, and have moved to the stage of trying to identify particular collaborative grant proposals by new teams of researchers. It is hoped that the Chemical Biology group will move in a similar direction. The success of these efforts will depend on the degree to which faculty find these opportunities fruitful, and are desirous of pursuing them.

Probably no other investment would be as fruitful as an increase in the number of faculty positions in this Department. Two dominant trends in the federally funded sciences are a growing number of collaborative projects, and ever-stiffer competition for major funding. Adding faculty members with expertise in our research focus areas would enable us to identify and pursue more collaborative and multi-departmental grant opportunities, in addition to the individual grants these faculty would garner individually. Their presence would add to the user base and enhance our competitiveness for major instrumentation grants, an area in which the Department already has proven success. Finally, such expansion would help greatly to reverse the decline in graduate student numbers; as discussed earlier, the limited number of research laboratory options is a major reason that potential graduate students decide to go elsewhere.

**Recruitment of graduate students.** The decline in graduate student numbers must be reversed; this is a critical priority. The College of Science agreed to contribute $20 K per year for two years as part of the Department Head change in the fall of 2009. Some of these funds were used to offer enhanced first-year stipends to recruits in the past year. In the present year, beginning this fall, these funds will help pay for a number of faculty in both chemistry and biochemistry to visit a number of feeder programs. A number of 4-year or MS program schools were chosen as targets based either on their geographical proximity, or because they have USU graduate alumni on their faculty; several of them have been the source of graduate students in the past. Faculty who visit give a combination research/recruiting talk, and the Graduate Recruiting Committee prepared a portfolio of recruiting slides that faculty who make such visits can choose from for the recruiting portion of their talk. Six such visits have been made or are planned for the present recruiting season. We plan to continue this program using Departmental funds for several years and then assess its productivity, in the form of numbers of applications to our graduate program from these schools.

At a summer faculty retreat, interest was expressed in instituting a program that would offer future prospective applicants the opportunity to visit a particular research group in the Department for a month. We are also investigating the feasibility of inviting a faculty member for a similar visit from these feeder schools, who is conducting research that has collaborative possibilities with one of our own faculty. Summer campus housing is relatively inexpensive, and it is estimated that lodging and travel costs will be at or under $1K per person.

Several other, ongoing efforts will be continued:

- The Department provides each new graduate student a lump-sum payment of $1300, as an incentive signing bonus.
- To help evaluate applications from China and to assure that they have adequate language skills, one of our faculty, originally from Taiwan, phones them and assesses their level of spoken English.
- The Department instituted a pre-application process and pays the application fees for all who pass this bar.
• One of our faculty, originally from Russia, has developed relationships with his home country that provide excellent graduate students, although to date these have only joined his group.
• All domestic applicants who are accepted are invited to campus for a visit and interview at Departmental expense.
• Faculty have visited several particular Universities abroad, in China and Poland, so as to foster strengthened relations that will hopefully lead to graduate applications.

Weak research infrastructure. The Department Head has initiated meetings with a number of other heads and several other faculty in Science, as well as other colleges (Engineering; Animal, Dairy and Vet Sciences; and Nutrition and Food Science) to seek to identify a core set of common needs that have a large potential user base. The ultimate goal is to increase the level of central investment in both equipment and, critically, in support personnel. A recent compilation by the VPR office of the major research equipment on the USU campus (see Appendix 8A) shows that nearly all has been obtained either via earmarks or faculty-initiated grant proposals. The vast majority of this equipment is under the supervision of full-time faculty members with other responsibilities that do not include the administration of core services to other investigators. The only exceptions are the NMR/EPR director in this Department, and, a faculty member in Geology with a modified role statement to include the administration of a luminescence dating instrument.

The Department has been aggressive in submitting proposals to the NSF CRIF and MRI programs. In recent years we have been successful in obtaining funds for the purchase of a JEOL 300 MHz NMR, and subsequently, for a significant upgrade to the EPR. In recent cycles the Department has submitted proposals to CRIF for funds to purchase a 500-MHz NMR, and to the MRI program for an LC-MS. As mentioned earlier, the LC-MS proposal received reviews of excellent (1) and very good (2) with the major weakness cited being the absence of a PI with extensive LC-MS expertise. If a central MS director position along the lines of our NMR/EPR director can be created, we anticipate a greater likelihood of success in a subsequent proposal. The NMR proposal evaluations cited a lack of sufficient user base. We are investigating the addition of additional users to a follow-up proposal. Since the submission of the original one, we have learned that several Engineering faculty associated with USTAR teams need NMR for their research programs and we will have our NMR/EPR director meet with them to determine whether those will enhance a subsequent proposal.

Low faculty salaries. No effective means of incrementing faculty salaries exists; there are no research-based named professorships or chairs that can be used to enhance the compensation of existing faculty. In the past there has been the opportunity to earn certain University honors, such as a Trustee Professorship though the Provost’s office. One of these came to the department in 2000 to a faculty member who has since retired. This honor came with a $2000 annual salary increment but according to the Provost’s web site no Trustee Professors have been named since 2002. Small one-time awards of $500 are connected to College of Science Researchers of the Year (an award that has been bestowed on a number of faculty members in this Department).