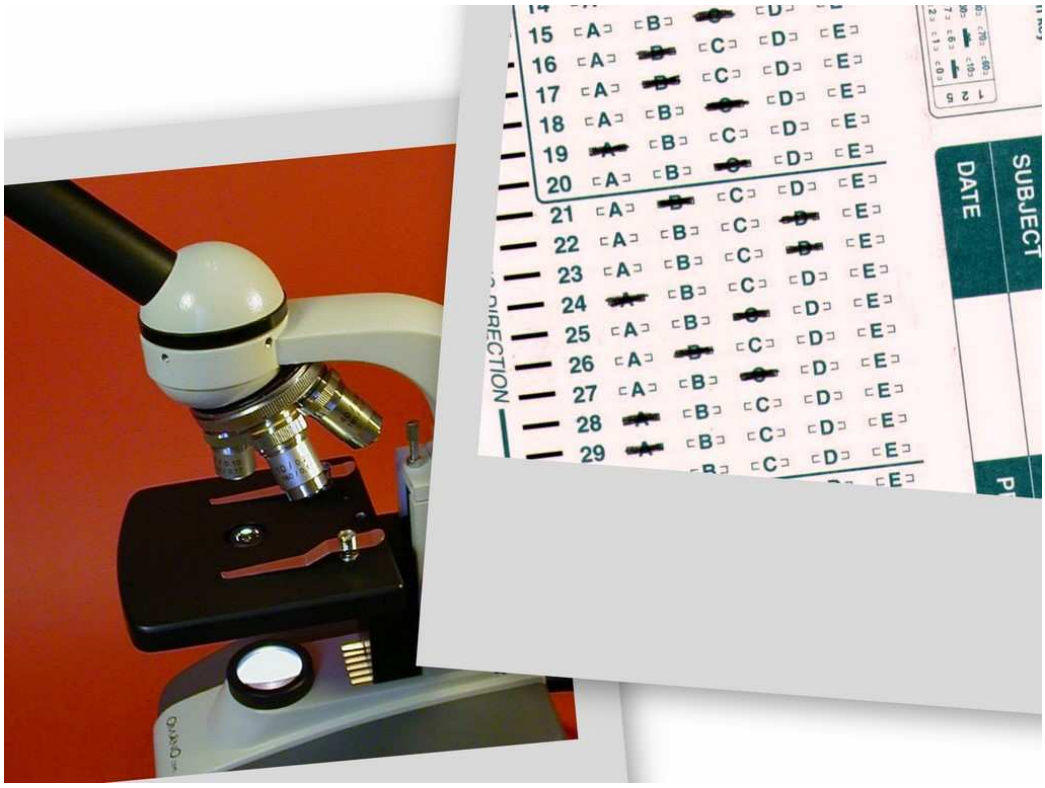
Assessment Practices and Procedures in a Salt Lake Community College Entry-Level Biology Course

BIOL 1170 a case study

Spring 2007



Introduction

Recent trends in accreditation requirements and national accountability mandates have solidified the role of assessment in the delivery of post-secondary education. Higher Education institutions are now required to establish very specific Student Learning Outcomes (SLO's) and to incorporate the measurement and monitoring of those SLO's into their practice. Although "assessment" is relatively new to Salt Lake Community College (SLCC) as a formalized practice, many SLCC departments have, of course, been carefully monitoring student achievement through less formalized evaluation systems for a long time. Sadly, in the rush to answer accreditation concerns and the confusion over new terminology and practices, some of the more established assessment systems have been overlooked and/or forgotten. Indeed, it should be noted that many courses exist only due to departmental concerns over student achievement. One such course is Foundations of Biology (BIOL 1170).

The process of assessment in BIOL 1170 has been ongoing since it's inception in 1998 when it was originally called Introduction to Cell Biology. This report describes the origin, evolution and current state of assessment in this entry-level Biology course at SLCC.

BIOL 1170 Foundations of Biology

The SLCC Biology Department has a unique course called BIOL 1170 (Foundations of Biology). This course has been designed as the entry point for students desiring to earn degrees or certification in one of the many Health Science fields. SLCC students wanting to matriculate into Health Science areas such as Nursing, Dental Hygiene, Medical Laboratory Technician, Physical Therapy Assistant, Radiological Technician and Surgical Technician must first complete a rigorous series of Biology courses which may include Human Anatomy, Human Physiology and Microbiology (see Table 1).

Table 1

Health Science Prerequisite Biology Courses

Course Number	Course Title	Credits	Students[1]	HS Program Requirements[2]					
				DH	MLT	Nrs	PTA	RT	ST
BIOL 1170	Foundations of Biology	4	1886	n/r[3]	C	C+	n/r[3]	C	n/r[3]
BIOL 1210	General Biology	4	489						
BIOL 2060	Microbiology	4	273	B	n/r	n/r	n/r	n/r	n/r
BIOL 2320	Human Anatomy	4	1687	B	n/r	C+	B	B-	B
BIOL 2420	Human Physiology	4	1068	B	C	C+	n/r	n/r	n/r
		Total	**5403**						

1. Total course enrollment for Summer 2006, Fall 2006 and Spring 2007

2. Abreviations are: DH = Dental Hygiene, MLT = Medical Laboratory Technician, Nrs = Nursing, PTA = Physical Therapy Assistant, RT = Radiological Technician and ST = Surgical Technician.

3. Although not specifically required by these prorgams, a grade of C or better in BIOL 1170 or BIOL 1210 is the required prerequisite to higher level Biology courses.

Historically, these 2000 level Biology courses have been among the most difficult of all college classes. It is not uncommon to see failure rates as high as fifty percent for these courses and, with the SLCC open enrollment policy, an unacceptable number of NEW students were failing these courses. To help improve the success rate for our students in their Health Science prerequisite courses, the SLCC Biology Department created BIOL 1170 as a required prerequisite. This course is designed to provide students with a basic knowledge of cell structure and chemistry as well as a basic understanding of how living organisms work. Information mastered in BIOL 1170 helps our students understand the fundamental concepts built upon in Human Anatomy, Human Physiology and Microbiology. Indeed, the value of BIOL 1170 has been recognized by the Health Science programs themselves as many of them have come to require it for admision.

Importantly, successful BIOL 1170 students have also mastered the fast pace of a rigorous college-level biology course taught over a single semester. They have learned appropriate study habits and demonstrated that they are ready for the fast and furious life of a Health Science student. Of particular note, reports from the SLCC Institutional Research Office show that since the advent of BIOL 1170 and its prerequisite status, we have seen a measurable improvement in the percentage of students who are successful in the higher courses.

BIOL 1170 Standardization Task Force

While the Institutional Research reports clearly showed that BIOL 1170 was helping improve student's success, they also revealed an underlying problem with the course. Specifically, the many sections of BIOL 1170 (often more than 3 dozen per semester) were not all achieving the same level of student preparedness. Grade distributions from one instructor to another were unacceptably variable and BIOL 1170 grades were not predicting further success as accurately as would be expected. Additionally, reports had started filtering downward from the faculty members in the higher-level Biology courses that some students were still not mastering their basic understanding and skills.

In 2004 a group of SLCC Biology instructors formed the BIOL 1170 Standardization Task Force. The purpose of this task force and the recommendations they arrived at are shown in Table 2.

Table 2

Biology 1170 Standardization Task Force Recommendations
Toward the goal of standardizing Biology 1170 instruction and ensuring adequate preparation for higher-level Biology courses for Health Science students, the TASK FORCE recommends:
That ALL Biology 1170 Instructors operate from exactly the same course outline. The outline has a total of 98 outlined topics and a list of required vocabulary words. Each instructor is responsible for teaching AT LEAST these items. The outline and vocabulary words will be made available to students via the Biology Department website.
That ALL Biology 1170 Instructors give a final exam containing a departmental portion. This portion will consist of 50 multiple choice questions, generated from 50 randomly selected objectives. This portion of the final exam may account for the entire cumulative portion of the final exam. The final exam may contain other portions provided by the instructor.
That the grades for ALL Biology 1170 students include 20 percentage points from the laboratory and 10 percentage points from the standardized departmental portion of the final exam. The remaining 70 percentage points should be designated by the instructor. This information will be included on ALL course syllabi.
That each Biology 1170 instructor be provided with a formative assessment of their students' performance on the standardized departmental portion of the final exam. This report shall include, by objective topic, results for ALL Biology 1170 students and results for the students from that instructor. These results will ONLY be used by individual instructors to improve the delivery of the Biology 1170 curriculum.

BIOL 1170 Objectives

The list of objectives for BIOL 1170, established by the BIOL 1170 Standardization Task Force originally contained 98 topics that students would be expected to master. The list has subsequently been narrowed to 75. This list represents the minimum amount of biological understanding the task force thought students would need in order to facilitate success in higher-level Biology courses. The numbering system is based on the chapter structure of the textbook used for the course during the 2006-2007 academic year (Biology 7th Edition by Campbell et al.,)

Foundations of Biology - BIOL1170 Course Objectives

Chapter 1: Exploring Life
Students should understand:
1.1 The Hierarchy of **Biological Organization** and the concept of **Emergent Properties**.
1.2 The **Diversity** and **Classification** of Living Organisms.
1.3 The **Cell Theory**, the **Principle of Evolution** and Continuity Requires **Inheritance**.
1.4 The method and practice of **Scientific Inquiry**.

Chapter 2: The Chemical Context of Life
Students should understand:
2.1 The **Elements** that make up Living Matter.
2.2 The Structure and Chemical Properties of **Atoms**.
2.3 The **Periodic Table** of the Elements, Electron **Energy Levels** and **Valence**.
2.4 The different types of **Chemical Bonds**.

Chapter 3: Water and the Fitness of the Environment
Students should understand:
3.1 The **Structure** and **Unique Properties** of Water.
3.2 The use of **Molarity** in Aqueous Solutions.
3.3 The **Dissociation** of Water, the **pH Scale** and **Buffers**.

Chapter 4: Carbon and the Molecular Diversity of Life
Students should understand:
4.1 The Atomic Structure and Chemical Properties of **Carbon** Atoms.
4.2 The Structural Formulas, Shapes and Diversity of **Organic Molecules**.
4.3 The **Functional Groups** that are found in Organic Molecules.

Chapter 5: The Structure and Function of Macromolecules
Students should understand:
5.1 The Synthesis and Breakdown of **Polymers**.
5.2 The four types of **Biological Macromolecules**.
5.3 The four Levels of **Protein Folding**.

Chapter 6: A Tour of the Cell.
Students should understand:
6.1 The different **Sizes** and **Types** of Cells and how **Cells are Studied**.
6.2 The basic structures found in **Prokaryotic** and **Eukaryotic** Cells.
6.3 The **Endomembrane System** and Intracellular Trafficking.
6.4 The **Cytoskeleton**, **Extracellular Matrix**, **Cell Wall** and **Intercellular Junctions**.

Chapter 7: Membrane Structure and Function.
Students should understand:
7.1 The Structure and **Amphipathic** Property of **Phospholipids**.
7.2 The **Fluid Mosaic Model** and the concepts of **Osmosis** and **Selective Permeability**.
7.3 The Structures and Functions of **Membrane Proteins**.
7.4 The different types of **Passive**, **Active** and **Bulk Transport** across membranes.

Chapter 8: An Introduction to Metabolism.
Students should understand:
8.1 The bioenergetics of **Anabolic** and **Catabolic** pathways.
8.2 The Laws that govern **Energy Transformations**.
8.3 The use of **Free Energy Profiles**, **delta G** and **Energy of Activation**.
8.4 The Structure and Cycle of Adenosine Triphosphate (**ATP**).
8.5 The basic concepts of **Enzyme Catalysis**, **Allosterics** and **Feedback Inhibition**.

Chapter 9: Cellular Respiration: Harvesting Chemical Energy.
Students should understand:
9.1 The energetics of **Oxidation**, **Reduction** and **Electron Carriers**.
9.2 The three **Stages of Cellular Respiration** and their relative **ATP Yields**.
9.3 The distinction between **Substrate-Level** and **Oxidative Phosphorylation**.
9.4 The types of Anaerobic Respiration (**Fermentation**).
9.5 The **Regulation** and **Connection** of Metabolic Pathways.

Chapter 11: Cell Communication.
Students should understand:
11.1 The difference between Local and Long-Distance **Signaling**.
11.2 The types of **Target Cell Receptors** and how they Function.
11.3 The concepts of **Signal Transduction** and **Phosphorylation Cascades**.
11.4 The distinction between **Cytoplasmic** and **Nuclear Responses**.

Chapter 12: The Cell Cycle.
Students should understand:
12.1 The Roles and Types of **Cell Division**.
12.2 The Phases of the **Eukaryotic Cell Cycle** and the Behavior of **Chromosomes**.
12.3 The role of the **Cytoskeleton** in Eukaryotic Cell Division.
12.4 The basic concepts of **Cell Cycle Regulation** and **Cancer**

Chapter 13: Meiosis and Sexual Life Cycles.
Students should understand:
13.1 The meaning of **Asexual** and **Sexual** Reproduction as well as **Somatic** and **Germ** Cells.
13.2 The concepts of **Autosomes**, **Sex** Chromosomes and **Homologous** Chromosomes.
13.3 The behavior of Chromosomes during **Meiosis I** and **Meiosis II**.
13.4 The **Comparison** of Mitosis and Meiosis including **Crossing Over**.

Chapter 14: Mendel and the Gene Idea.
Students should understand:
14.1 The Terminology and Description of **Mendelian Genetics**.
14.2 The use of **Monohybrid** and **Dihybrid** Crosses and **Punnett Squares**.
14.3 The significance of the **Test Cross**.
14.4 The Laws of **Segregation** and **Independent Assortment**.
14.5 The more Complex Patterns of **Non-Mendelian** Genetics.
14.6 The use of **Pedigree Analysis** in **Human Genetics**.

Chapter 15: The Chromosomal Basis of Inheritance.
Students should understand:
15.1 The connection between Mendelian Genetics and **Chromosome Behavior**.
15.2 The concepts of **Linkage** and **Recombination** as they pertain to **Gene Mapping.**
15.3 The patterns of **Sex-Linked Inheritance**.
15.4 The consequences of **Human Chromosomal Abnormalities**.

Chapter 16: The Molecular Basis of Inheritance.
Students should understand:
16.1 The experiments that established **DNA** as **The Genetic Material**.
16.2 The **Complementary** and **Anti-Parallel** structure of the DNA **Double Helix**.
16.3 The **Semi-Conservative** Mechanism of **DNA Replication**.
16.4 The concepts of **DNA Repair** and **Telomere Replication**.

Chapter 17: From Gene to Protein
Students should understand:
17.1 The Flow of Genetic Information in **The Central Dogma of Biology**.
17.2 The Mechanism and Stages of **Transcription**.
17.3 The **Processing** of Eukaryotic **mRNA's**.
17.4 The Mechanism and Stages of **Translation**.
17.5 The use of the **Genetic Code** and the affects of various types of **Mutations**.

Chapter 18: The Genetics of Viruses and Bacteria.
Students should understand:
18.1 The **Structure** and Genomic **Classification** of **Viruses**
18.2 The Reproductive Cycles of **Bacteriophages**, **Enveloped Viruses** and **Retroviruses**.
18.3 The Structure and Replication of **Bacterial Chromosomes**.
18.4 The Mechanisms of **Gene Transfer** in Bacteria.
18.5 The Regulation of **Bacterial Operons**.

Chapter 20: DNA Technology and Genomics
Students should understand:
20.1 The methods of **DNA Cloning** and the concept of **Libraries**.
20.2 The techniques of **PCR**, **Electrophoresis** and **DNA Sequencing**.
20.3 The Science of **Genomics** and The Human Genome Project.
20.4 The Practical **Applications** of DNA Technology.

BIOL 1170 Departmental Final Exam

Near the end of each semester, the lead instructor for BIOL 1170 randomly chooses 50 objectives from the course list to be assessed. The lead instructor then assigns a set of the chosen objectives to each of the full time BIOL 1170 instructors (Table 3). These instructors write multiple choice test items to be incorporated into the departmental final exam for the objectives that they have been assigned. The lead instructor then assembles the initial draft of the departmental final exam by combining the test items from each instructor and standardizing the format of the items. Once the initial draft is complete, it is sent back to the instructors, in its entirety, for review and revision. Finally, the lead instructor makes any necessary changes and delivers the final exam to all BIOL 1170 instructors for assessment.

Table 3

Item Assignments BIOL 1170 Departmental Final Exam Fall 2006

Question	Selected Objectives	Item Writer
1	1.1 The Hierarchy of Biological Organization and the concept of Emergent Properties.	Bill Speer
6	3.1 The Structure and Unique Properties of Water.	Bill Speer
11	5.3 The four Levels of Protein Folding.	Bill Speer
16	7.3 The Structures and Functions of Membrane Proteins.	Bill Speer
21	9.1 The energetics of Oxidation, Reduction and Electron Carriers.	Bill Speer
26	11.3 The concepts of Signal Transduction and Phosphorylation Cascades.	Bill Speer
31	13.3 The behavior of Chromosomes during Meiosis I and Meiosis II.	Bill Speer
36	14.5 The more Complex Patterns of Non-Mendelian Genetics.	Bill Speer
41	16.3 The Semi-Conservative Mechanism of DNA Replication.	Bill Speer
46	18.1 The Structure and Genomic Classification of Viruses	Bill Speer
2	1.3 The Cell Theory, the Principle of Evolution and Continuity Requires Inheritance.	Jane Keleher
7	3.3 The Dissociation of Water, the pH Scale and Buffers.	Jane Keleher
12	6.1 The different Sizes and Types of Cells and how Cells are Studied.	Jane Keleher
17	7.4 The different types of Passive, Active and Bulk Transport across membranes.	Jane Keleher
22	9.2 The three Stages of Cellular Respiration and their relative ATP Yields.	Jane Keleher
27	12.1 The Roles and Types of Cell Division.	Jane Keleher
32	13.4 The Comparison of Mitosis and Meiosis including Crossing Over.	Jane Keleher
37	15.1 The connection between Mendelian Genetics and Chromosome Behavior.	Jane Keleher
42	17.1 The Flow of Genetic Information in The Central Dogma of Biology.	Jane Keleher
47	18.2 The Reproductive Cycles of Bacteriophages, Enveloped Viruses and Retroviruses.	Jane Keleher
3	2.1 The Elements that make up Living Matter.	Jim Blevins
8	4.2 The Structural Formulas, Shapes and Diversity of Organic Molecules.	Jim Blevins
13	6.2 The basic structures found in Prokaryotic and Eukaryotic Cells.	Jim Blevins
18	8.2 The Laws that govern Energy Transformations.	Jim Blevins
23	9.3 The distinction between Substrate-Level and Oxidative Phosphorylation.	Jim Blevins
28	12.2 The Phases of the Eukaryotic Cell Cycle and the Behavior of Chromosomes.	Jim Blevins
33	14.1 The Terminology and Description of Mendelian Genetics.	Jim Blevins
38	15.3 The patterns of Sex-Linked Inheritance.	Jim Blevins
43	17.3 The Processing of Eukaryotic mRNA's.	Jim Blevins
48	18.4 The Mechanisms of Gene Transfer in Bacteria.	Jim Blevins
4	2.2 The Structure and Chemical Properties of Atoms.	Melissa Tillack
9	4.3 The Functional Groups that are found in Organic Molecules.	Melissa Tillack
14	6.4 The Cytoskeleton, Extracellular Matrix, Cell Wall and Intercellular Junctions.	Melissa Tillack
19	8.3 The use of Free Energy Profiles, delta G and Energy of Activation.	Melissa Tillack
24	9.5 The Regulation and Connection of Metabolic Pathways.	Melissa Tillack
29	12.3 The role of the Cytoskeleton in Eukaryotic Cell Division.	Melissa Tillack
34	14.2 The use of Monohybrid and Dihybrid Crosses and Punnett Squares.	Melissa Tillack
39	15.4 The consequences of Human Chromosomal Abnormalities.	Melissa Tillack
44	17.4 The Mechanism and Stages of Translation.	Melissa Tillack
49	20.1 The methods of DNA Cloning and the concept of Libraries.	Melissa Tillack
5	2.4 The different types of Chemical Bonds.	Tim Beagley
10	5.2 The four types of Biological Macromolecules.	Tim Beagley
15	7.2 The Fluid Mosaic Model and the concepts of Osmosis and Selective Permeability.	Tim Beagley
20	8.5 The basic concepts of Enzyme Catalysis, Allosterics and Feedback Inhibition.	Tim Beagley
25	11.1 The difference between Local and Long-Distance Signaling.	Tim Beagley
30	13.1 The meaning of Asexual and Sexual Reproduction as well as Somatic and Germ Cells.	Tim Beagley
35	14.4 The Laws of Segregation and Independent Assortment.	Tim Beagley
40	16.2 The Complementary and Anti-Parallel structure of the DNA Double Helix.	Tim Beagley
45	17.5 The use of the Genetic Code and the affects of various types of Mutations.	Tim Beagley
50	20.2 The techniques of PCR, Electrophoresis and DNA Sequencing.	Tim Beagley

Collection and Dissemination of Departmental Final Exam Results

Using Scantron test grading equipment and supplies, each BIOL 1170 instructor reports their students results to the lead instructor. These data are incorporated into a spreadsheet which tallys the average performance for each objective for all BIOL 1170 students and reports back to the instructor the relative perfomance of their students (see Table 4 below). From the results received, each instructor can identify areas where their students may be struggling and redirect instructional time and resources accordingly.

Table 4

Percent Correct for BIOL 1170 Departmental Final Exam Fall 2006			
Selected Objectives	**Std Dev.**	**Dept. Ave**	**Instructor A**
1.1 The Hierarchy of Biological Organization and the concept of Emergent Properties.	8.8%	71.6%	77.8%
1.3 The Cell Theory, the Principle of Evolution and Continuity Requires Inheritance.	7.8%	22.3%	22.2%
2.1 The Elements that make up Living Matter.	2.7%	96.4%	97.8%
2.2 The Structure and Chemical Properties of Atoms.	7.9%	75.4%	64.4%
2.4 The different types of Chemical Bonds.	10.1%	40.8%	20.0%
3.1 The Structure and Unique Properties of Water.	4.4%	87.4%	93.3%
3.3 The Dissociation of Water, the pH Scale and Buffers.	6.6%	68.7%	71.1%
4.2 The Structural Formulas, Shapes and Diversity of Organic Molecules.	14.1%	54.3%	66.7%
4.3 The Functional Groups that are found in Organic Molecules.	15.3%	62.2%	51.1%
5.2 The four types of Biological Macromolecules.	15.2%	30.1%	31.1%
5.3 The four Levels of Protein Folding.	13.2%	45.4%	31.1%
6.1 The different Sizes and Types of Cells and how Cells are Studied.	10.8%	72.0%	64.4%
6.2 The basic structures found in Prokaryotic and Eukaryotic Cells.	11.4%	39.6%	40.0%
6.4 The Cytoskeleton, Extracellular Matrix, Cell Wall and Intercellular Junctions.	9.5%	41.4%	64.4%
7.2 The Fluid Mosaic Model and the concepts of Osmosis and Selective Permeability.	7.4%	50.1%	51.1%
7.3 The Structures and Functions of Membrane Proteins.	8.9%	62.3%	46.7%
7.4 The different types of Passive, Active and Bulk Transport across membranes.	7.1%	67.5%	71.1%
8.2 The Laws that govern Energy Transformations.	10.3%	69.0%	55.6%
8.3 The use of Free Energy Profiles, delta G and Energy of Activation.	9.7%	84.8%	57.8%
8.5 The basic concepts of Enzyme Catalysis, Allosterics and Feedback Inhibition.	8.3%	25.9%	17.8%
9.1 The energetics of Oxidation, Reduction and Electron Carriers.	11.9%	32.1%	40.0%
9.2 The three Stages of Cellular Respiration and their relative ATP Yields.	7.5%	76.5%	75.6%
9.3 The distinction between Substrate-Level and Oxidative Phosphorylation.	10.6%	51.7%	44.4%
9.5 The Regulation and Connection of Metabolic Pathways.	9.5%	30.5%	24.4%
11.1 The difference between Local and Long-Distance Signaling.	10.4%	58.8%	46.7%
11.3 The concepts of Signal Transduction and Phosphorylation Cascades.	11.3%	33.8%	20.0%
12.1 The Roles and Types of Cell Division.	7.1%	76.1%	73.3%
12.2 The Phases of the Eukaryotic Cell Cycle and the Behavior of Chromosomes.	18.3%	56.9%	75.6%
12.3 The role of the Cytoskeleton in Eukaryotic Cell Division.	9.0%	25.4%	17.8%
13.1 The meaning of Asexual and Sexual Reproduction as well as Somatic and Germ Cells.	8.1%	84.9%	84.4%
13.3 The behavior of Chromosomes during Meiosis I and Meiosis II.	9.2%	42.2%	51.1%
13.4 The Comparison of Mitosis and Meiosis including Crossing Over.	6.6%	54.5%	44.4%
14.1 The Terminology and Description of Mendelian Genetics.	4.7%	90.0%	93.3%
14.2 The use of Monohybrid and Dihybrid Crosses and Punnett Squares.	6.0%	70.4%	68.9%
14.4 The Laws of Segregation and Independent Assortment.	8.6%	75.7%	71.1%
14.5 The more Complex Patterns of Non-Mendelian Genetics.	8.6%	64.2%	73.3%
15.1 The connection between Mendelian Genetics and Chromosome Behavior.	12.2%	31.2%	28.9%
15.3 The patterns of Sex-Linked Inheritance.	15.5%	49.7%	24.4%
15.4 The consequences of Human Chromosomal Abnormalities.	9.4%	85.6%	91.1%
16.2 The Complementary and Anti-Parallel structure of the DNA Double Helix.	12.7%	38.6%	31.1%
16.3 The Semi-Conservative Mechanism of DNA Replication.	13.0%	66.3%	73.3%
17.1 The Flow of Genetic Information in The Central Dogma of Biology.	22.2%	44.0%	51.1%
17.3 The Processing of Eukaryotic mRNA's.	13.5%	47.6%	62.2%
17.4 The Mechanism and Stages of Translation.	17.3%	64.4%	77.8%
17.5 The use of the Genetic Code and the affects of various types of Mutations.	12.3%	23.3%	24.4%
18.1 The Structure and Genomic Classification of Viruses	10.3%	76.5%	80.0%
18.2 The Reproductive Cycles of Bacteriophages, Enveloped Viruses and Retroviruses.	11.6%	56.5%	80.0%
18.4 The Mechanisms of Gene Transfer in Bacteria.	7.8%	21.5%	28.9%
20.1 The methods of DNA Cloning and the concept of Libraries.	14.9%	67.6%	48.9%
20.2 The techniques of PCR, Electrophoresis and DNA Sequencing.	17.0%	53.8%	51.1%

Examination of the results from the Fall 2006 Departmental Final revealed two types of concerns. First of all, some objectives/questions had low overall department performance, highlighting areas where the department as a whole can improve instruction. Indeed, 18 of the objectives had less than 50 percent of the students show understanding (Table 5).

Objectives with Below 50 Percent Departmental Mastery	
Objective	**Percent**
18.4 The Mechanisms of Gene Transfer in Bacteria.	21%
1.3 The Cell Theory, the Principle of Evolution and Continuity Requires Inheritance.	22%
17.5 The use of the Genetic Code and the affects of various types of Mutations.	23%
12.3 The role of the Cytoskeleton in Eukaryotic Cell Division.	25%
8.5 The basic concepts of Enzyme Catalysis, Allosterics and Feedback Inhibition.	26%
5.2 The four types of Biological Macromolecules.	30%
9.5 The Regulation and Connection of Metabolic Pathways.	30%
15.1 The connection between Mendelian Genetics and Chromosome Behavior.	31%
9.1 The energetics of Oxidation, Reduction and Electron Carriers.	32%
11.3 The concepts of Signal Transduction and Phosphorylation Cascades.	34%
16.2 The Complementary and Anti-Parallel structure of the DNA Double Helix.	39%
6.2 The basic structures found in Prokaryotic and Eukaryotic Cells.	40%
2.4 The different types of Chemical Bonds.	41%
6.4 The Cytoskeleton, Extracellular Matrix, Cell Wall and Intercellular Junctions.	41%
13.3 The behavior of Chromosomes during Meiosis I and Meiosis II.	42%
17.1 The Flow of Genetic Information in The Central Dogma of Biology.	44%
5.3 The four Levels of Protein Folding.	45%
17.3 The Processing of Eukaryotic mRNA's.	48%

Table 5

Secondly, when compared to the departmental average, the performance on some objectives/questions showed a high standard deviation from instructor to instructor (Table 6). This shows a need for communication and professional development throughout the BIOL 1170 instructor ranks.

Objectives with Wide Performance Variability	
Selected Objectives	**Std Deviation**
17.1 The Flow of Genetic Information in The Central Dogma of Biology.	22%
12.2 The Phases of the Eukaryotic Cell Cycle and the Behavior of Chromosomes.	18%
17.4 The Mechanism and Stages of Translation.	17%
20.2 The techniques of PCR, Electrophoresis and DNA Sequencing.	17%
15.3 The patterns of Sex-Linked Inheritance.	15%
4.3 The Functional Groups that are found in Organic Molecules.	15%
5.2 The four types of Biological Macromolecules.	15%
20.1 The methods of DNA Cloning and the concept of Libraries.	15%
4.2 The Structural Formulas, Shapes and Diversity of Organic Molecules.	14%
17.3 The Processing of Eukaryotic mRNA's.	14%
5.3 The four Levels of Protein Folding.	13%
16.3 The Semi-Conservative Mechanism of DNA Replication.	13%
16.2 The Complementary and Anti-Parallel structure of the DNA Double Helix.	13%
17.5 The use of the Genetic Code and the affects of various types of Mutations.	12%
15.1 The connection between Mendelian Genetics and Chromosome Behavior.	12%
9.1 The energetics of Oxidation, Reduction and Electron Carriers.	12%
18.2 The Reproductive Cycles of Bacteriophages, Enveloped Viruses and Retroviruses.	12%
6.2 The basic structures found in Prokaryotic and Eukaryotic Cells.	11%
11.3 The concepts of Signal Transduction and Phosphorylation Cascades.	11%
6.1 The different Sizes and Types of Cells and how Cells are Studied.	11%
9.3 The distinction between Substrate-Level and Oxidative Phosphorylation.	11%
11.1 The difference between Local and Long-Distance Signaling.	10%
18.1 The Structure and Genomic Classification of Viruses	10%
8.2 The Laws that govern Energy Transformations.	10%
2.4 The different types of Chemical Bonds.	10%
8.3 The use of Free Energy Profiles, delta G and Energy of Activation.	10%
6.4 The Cytoskeleton, Extracellular Matrix, Cell Wall and Intercellular Junctions.	10%

Table 6

Future Direction and Data Usage

Starting in the Fall of 2007, BIOL 1170 will merge with BIOL 1210 (General Biology) into a newly numbered course called BIOL 1610 (College Biology I). This change is in response to a state mandate that moves all public colleges and universities toward a common course numbering system and improves the transferability of courses. The new course will become the entry point for ALL SLCC students needing higher-level Biology courses.

The precise assessment scheme for BIOL 1610 has not yet been established but it is expected to build upon the work of the BIOL 1170 Standardization Task Force and the assessment scheme they established. Indeed, the data acquired through the BIOL 1170 protocol will be used to provide direction to two new Biology Department initiatives.

1) BIOL 1617 is an approved new course that begins operation in Fall 2007. It is called College Biology I Workshop. This one credit hour course is designed for BIOL 1610 students who self-identify as needing supplemental instruction for the semester. Two sections of this course will be offered during Fall Semester and students will meet for two hours per week. This course is strictly graded on a pass/fail basis as students work on problem sets and worksheets designed to help them in the BIOL 1610 course itself. Importantly, the instruction in this supplemental course will be guided by the data obtained through the BIOL 1170 assessments. The instructor for BIOL 1617 will be able to use the combined results from the BIOL 1170 Departmental Final Exams to determine the most likely areas of need for extra instruction and time.

2) In addition to the BIOL 1617 course mentioned above, a less formal series of workshops will be established for Fall Semester 2007. Using the BIOL 1170 assessment data, a collection of Biology instructors will advertise and offer one hour workshops focusing on topics known to be difficult for students to master. These workshops will be free to students and the topics will follow the anticpated trajectory of the BIOL 1610 course outline. The free workshops will differ from the BIOL 1617 course in that students will only come to the workshop(s) that help them in the area(s) in which they are struggling. They will be a sort of large scale drop in tutoring/help session.