CORE CURRICULUM COMPONENT APPLICATION
Sam Houston State University

Revised October, 2012

PART I – Course Information

Course Type
☒ Existing/Restructured
☐ New Course Proposed Fall 2013
If new, have you submitted a Form B to the SHSU Curriculum Committee? ☐ Yes ☐ No

Course Prefix & Number: BIOL 1308 to become BIOL 1408

Texas Common Course Number (TCCN Matrix)**:** BIOL 1308 (BIOL 1408)

Course Title: Contemporary Biology

Course Catalog Description (Copy and paste from online catalog for existing courses):
OLD: Presentation for the non-science major of biological concepts and topical subjects related to science methods, embryological development, reproduction, genetics, evolution, human organ systems, disease, and environmental biology. Ethical considerations of reproduction and birth control, genetic engineering, environmental pollution and population control will be included. Credit in BIO 134 <BIOL 1308> as a laboratory science is contingent upon completion of BIO 114 <BIOL 1108>. This course is designed for non-science majors to help them meet their General Education science requirement and cannot be applied to either a major or a minor in Biology.

NEW*: Presentation for the non-science major of contemporary hypotheses and the unifying principles of biology, including but not limited to: scientific method and hypothesis testing, the definition of life, cell theory, the central dogma of biology (transcription of DNA to RNA to protein), genetic regulation and heredity, metabolism and homeostasis, organismal evolution, biodiversity, and ecology. The class builds scientific literacy and critical thinking skills for use in everyday life. Credit in BIO 134 <BIOL 1308> as a laboratory science is contingent upon completion of BIO 114 <BIOL 1108>. This course is designed for non-science majors to help them meet their General Education science requirement and cannot be applied to either a major or a minor in Biology. Fall, Spring, Summer. Credit 3. **Note: Fall 2013 , 2 courses (BIOL 1308 and BIOL 1108) become 1 course (BIOL 1408).

*process to change course description has been initiated.

Course Prerequisites: none

Available Online?
☒ Yes, currently developed in online delivery mode
☐ Anticipated development in online delivery mode (Semester, Year:)
☐ No

Number of Sections to be Offered per Academic Year: 8 - 12

Estimated Enrollment per Section: 50-120

Course Level (freshman, sophomore): freshman

Designated Contact Person (for follow-up communication purposes): Sibyl Bucheli

E-Mail Address: bucheli@shsu.edu

Phone: 4-1550

Approvals		
Department Chair:	Signature	18 OCT 2012 Date
Academic Dean:	Signature	10/18/12 Date

Submit completed, signed form to Core Curriculum Committee - Box 2478 or Fax 4-1271

PART II – THECB Foundational Component Areas

See Appendix for full description of each component area.

Select Component Area: III. Life and Physical Sciences

In one paragraph, describe how the proposed course will fulfill the core and skill objectives of the component area: This is a non-majors course designed to present a synopsis of the contemporary views of major hypotheses and unifying principles of biology, including but not limited to: the definition of life, cell theory, the central dogma of biology (transcription of DNA to RNA to protein), genetic control and heredity, metabolism and homeostasis, evolution, biodiversity, and ecology. The lecture and laboratory structure of BIOL1408 Contemporary Biology is in-line with a call from The National Science Foundation and The American Association for the Advancement of Science to support needed changes in undergraduate biology education by focusing on core concepts outlined in their 2009 action plan: evolution; structure and function; information exchange and storage; and systems, pathways, and transformations of energy and matter. These outlined core concepts form the basis of our Objective and Student Learning Objectives (SLO) 1 - 3. BIOL1408 Contemporary Biology introduces and regularly reinforces the scientific method hypothesis testing. It includes components of scientific literacy and critical thinking skills and demonstrates how they pertain to everyday experiences. Laboratory exercises focus on group work, problem solving skills, quantitative biology, and hypothesis testing while reinforcing unifying principles and providing hands-on exposure to a broad diversity of organisms.

PART III – Course Objectives & Student Learning Outcomes (SLO)

Insert the applicable course objectives stated as student learning outcomes (e.g., Students completing the course will be able to…) that support the core component area objectives. Please reference the component rubric for additional information on core component area objectives.

Objective/SLO 1: The Scientific Method: It This SLO focuses on the scientific method and how it can be used to describe, explain, and predict natural phenomena. This SLO demonstrates how students may apply the scientific method to their daily experiences to improve critical thinking skills; the differences between observation, hypothesis, and theory will be described; the difference between hypothesis driven science and pseudoscience will be described; the importance of scientific literacy and critical thinking skills will be described.

How will the objective be addressed (including strategies and techniques)?
In lecture, at the beginning of the course, critical thinking skills and application of the scientific method are introduced. Terms essential to this objective such as hypothesis, theory, and law are discussed. These important topics are reinforced throughout the course in lecture as an overarching theme of biology and science in general. In laboratory, the topic is usually discussed as the first unit (See Appendix 1: Laboratory Syllabus).

Describe how the objective will be assessed: This material is covered in depth at the beginning of the course and is continually are reinforced in both the lecture and lab components via quizzes, exams, and homework. Regular laboratory and/or lecture homework assignments and quizzes point out strengths and weaknesses the student may have and guide them in their studies. Lecture exams generally consist of multiple choice questions and are designed to test the student's ability to think critically, their comprehension of the scientific method, and their understanding of related terminology. Laboratory exams generally consist of written and multiple choice formats that also examine the student's ability to think critically, their comprehension of the scientific method, and their understanding of related terminology. Sample lecture questions can be found in Appendix 2: Sample Questions for Lecture; Sample laboratory questions can be found in Appendix 3: Sample Questions for Laboratory.
An agreed upon series of questions will be administered in laboratory via blackboard for all students at the beginning and the end of the course. Questions administered will address the objectives of SLO 1 and will serve as a gauge of the student's progression throughout the semester. Sample questions can be found in Appendix 4: Pre and Post BIOL 1408 Assessment Questions for SLO 1 – 3.

Objective/SLO 2: Evolution: This SLO focuses on understanding the interactions among natural phenomena. There are approximately 3-30 million unique species alive on Earth today, with most still not described, and millions more that have gone extinct. Evolution by means of descent with modification via Darwinian natural selection from a universal common ancestor accounts for this staggering diversity as well as the unity of: (a) the genetic code, (b) the production of amino acids, and (c) the generation of proteins among all living beings. Genetic inheritance, phenotypic change, and adaptation are themes that recur throughout lecture and laboratory and are supported by evidence from developmental biology, molecular genetics, biochemistry, medicine, biodiversity, zoology, botany, and ecology.

How will the objective be addressed (including strategies and techniques)?
In lecture, at the beginning and throughout the course, the topic of evolution by means of descent with modification via Darwinian natural selection is defined and described as a way to understand natural phenomena. As it is a core theory of biology hardly a topic can be covered in BIOL 1308 that does not incorporate this topic. Terms essential to this objective such as the Linnaean Hierarchy (Domain, Kingdom, Phylum, Class, Order, Family, Genus and Species), adaptation, natural selection, traits, homology, fitness, phylogeny, and mutation are defined and discussed. The importance of these topics is constantly reinforced as the unifying theory in biology; they are essential to describing biodiversity, genetics and heredity, and ecosystems biology. In laboratory units 3, 4, 8, and 9 focus on evolution (See Appendix 1: Laboratory Syllabus).

Describe how the objective will be assessed: This material is covered in depth throughout the entire course as it is the central unifying theme of biology. It is continually reinforced in both the lecture and lab components via quizzes, exams, and homework. Regular laboratory and/or lecture homework assignments and quizzes point out strengths and weaknesses the student may have to guide them in their studies. Lecture exams generally consist of multiple choice questions designed to test the student's ability to think critically regarding the major unifying theory of biology, common ancestry and descent with modification, and their understanding of related terminology. Laboratory assessment generally consists of exams in written and multiple choice formats that also examine the student's ability to think critically, their comprehension of the evolution, and their understanding of related terminology. Sample lecture questions can be found in Appendix 2: Sample Questions for Lecture; Sample laboratory questions can be found in Appendix 3: Sample Questions for Laboratory.

An agreed upon series of questions will be administered in laboratory via blackboard for all students at the beginning and the end of the course. Questions administered will address the objectives of SLO 1 and will serve as a gauge of the student's progression throughout the semester. Sample questions can be found in Appendix 4: Pre and Post BIOL 1408 Assessment Questions for SLO 1 – 3.

Objective/SLO 3: Information exchange and storage: The growth and behavior of organisms is dependent on storage and transmission of genetic information across generations. Information exchange forms the basis of cellular reproduction, cellular recognition, organization of communities, and the responses of organisms to various stimuli. Students are taught that that all levels of biological organization depend on specific interactions and information transfer and they are required to understand the implications of these scientific principles on the physical world and on human experiences. Gene expression networks, physiological mechanisms of organismal regulation, cellular homeostasis, and biogeochemical cycling all may be understood in terms of the storage, transmission, and processing of biological information.

How will the objective be addressed (including strategies and techniques)?
In lecture, the genetic code and the rules that govern how the information encoded within is transferred within a cell, as well as between generations of both cell and organisms, are defined and described. Terms essential to this objective such as DNA, RNA, protein, transcription, and translation are introduced. The idea of structural and ancestral hierarchy is reinforced. Students are required to understand the implications of these scientific principles on the physical world and on human experiences. In laboratory, the topic is usually discussed in units 3, 5, 6, 7, and 9 (See Appendix 1: Laboratory Syllabus).

Describe how the objective will be assessed: This material is covered in depth at the beginning of the course and is continually are reinforced in both the lecture and lab components via quizzes, exams, and homework. Regular laboratory and/or lecture homework assignments and quizzes point out strengths and weaknesses the student may have and guide them in their studies. Lecture exams generally consist of multiple choice questions and are designed to test the student's understanding of the genetic code and information transfer with in and across generations and their understanding of related terminology. Laboratory exams generally consist of written and multiple choice formats that also examine the student's understanding of cellular and organismal information transfer and their understanding of related terminology. Sample lecture questions can be found in Appendix 2: Sample Questions for Lecture; Sample laboratory questions can be found in Appendix 3: Sample Questions for Laboratory.
An agreed upon series of questions will be administered in laboratory via blackboard for all students at the beginning and the end of the course. Questions administered will address the objectives of SLO 1 and will serve as a gauge of the student's progression throughout the semester. Sample questions can be found in Appendix 4: Pre and Post BIOL 1408 Assessment Questions for SLO 1 – 3.

Objective/SLO 4:

How will the objective be addressed (including strategies and techniques)?

Describe how the objective will be assessed:

Objective/SLO 5:

How will the objective be addressed (including strategies and techniques)?

Describe how the objective will be assessed:

PART IV – THECB Skill Objectives

Address each of the THECB skill objectives required within the component area. Explain how the skill is addressed, including specific strategies to address the skill(s). *Address ALL skill objectives associated with the selected Component Area. (See Appendix)*

1. Critical Thinking Skills: to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information

How will the skill be addressed (including specific strategies, activities, and techniques)?
Critical thinking is a fundamental aspect of BIOL1408. In lecture, at the beginning of the course, critical thinking skills and application of the scientific method are introduced. Examples of research according to the scientific method are presented. Pseudoscience and anecdotal evidence are debunked. Laboratory exercises will provide students with the opportunity to generate and examine multiple working hypotheses through discussion and experimentation. The concepts of scientific theory and hypothesis testing are repeatedly addressed throughout the semester. Students are asked to examine evidence that may or may not support their proposed hypothesis and are then encouraged to critically evaluate and adjust the hypothesis. Post-lab quizzes, mid-term and final exams include questions designed to assess students' understanding of science as a process and principles covered during laboratory exercises.

2. Communication Skills: to include effective development, interpretation and expression of ideas through written, oral and visual communication

How will the skill be addressed (including specific strategies, activities, and techniques)?
In laboratory, students are grouped into permanent learning teams for the semester. Learning teams work together to complete and process laboratory exercises as well as group post-lab quizzes. Most of the lab exercises not only involve oral sharing of ideas among team members, but also require teams to report out to the entire lab class and prepare a brief written report to be graded by the lab instructor. The lab exercise examining stem cell research requires students to assume the role of one "stake holder" in the stem cell debate. Once the students have answered a series of questions, along with other students having the same role as theirs, they return to their learning team to discuss the same series of questions in a now very heterogeneous group (a mix of stake holders); this gives the students an opportunity to examine the questions from differing viewpoints and perspectives and provides practice in appropriate self-expression. Each student's ability to communicate is reflected by their peer evaluation scores assigned by fellow team members as well as the lab instructor's evaluations of team presentations. Successful completion of the lab exercises requires effective written, oral and visual communication as well as the interpretation of data and ideas.

3. Empirical and Quantitative Skills: to include the manipulation and analysis of numerical data or observable facts resulting in informed conclusions

How will the skill be addressed (including specific strategies, activities, and techniques)?
Original data in the form of graphs and tables are presented during lecture as appropriate. This provides the students with an example of how scientists communicate with one another. Select laboratory exercises require construction of one or more graphs and a written discussion of the results. The population genetics lab requires students to calculate changes in frequencies of alleles and genotypes using the Hardy-Weinberg Equation while completing an interactive exercise designed to increase student understanding of the Hardy-Weinberg model. Additionally, learning to work through genetics problems and case studies enhances students' abilities to process empirical information as it applies to the human experiences.

4. Teamwork: to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

How will the skill be addressed (including specific strategies, activities, and techniques)?
In laboratory, as previously mentioned, students are placed in permanent learning teams and required to successfully complete lab exercises. Teams are encouraged to establish mutual goals (students are responsible for their own learning and the learning of all other group members) and positive interdependence of individual members. Cooperation/collaboration between teams is also encouraged. Each student is also encouraged to feel responsible for doing their share of the work and helping other group members. Methods to ensure accountability include frequent oral quizzes of group members picked at random, individual pre-lab quizzes and major exams, and group post-lab quizzes as well as weekly completion of peer evaluations. Individual student ability to work as a team member is directly assessed through a peer evaluation system. Team members evaluate each other using a peer evaluation form and guidelines provided at the beginning of (and repeated throughout) the semester.

5. Personal Responsibility: to include the ability to connect choices, actions and consequences to ethical decision-making

How will the skill be addressed (including specific strategies, activities, and techniques)?

6. Social Responsibility: to include intercultural competence, knowledge of civic responsibility, and the ability to engage effectively in regional, national, and global communities

How will the skill be addressed (including specific strategies, activities, and techniques)?

PART V – SHSU Core Curriculum Committee Requirements

1. Using a 15-week class schedule, identify the topics to be covered during each week of the semester. Provide sufficient detail to allow readers to understand the scope and sequence of topics covered.

Week 1	What is Life? – Life is defined in terms of characteristics shared by all living systems and includes metabolism, homeostasis, reproduction and growth, adaptation and evolution, hierarchical organization, and emergent properties.
Week 2	Nature of Science – Science is based in critical thinking and allows us to understand the natural world. The scientific method is presented as a philosophical and operational tool that allows us interpret the world around us via observation, critical thinking, experimenting, and validating. It introduces the idea that science is recursive and peer evaluation. Superstition, pseudoscience, and anecdotal evidence are discussed and eliminated as reasonable ways of knowing the natural world.
Week 3	Archaea, Bacteria – The idea of phylogenetics as a method of interpreting relationships is introduced. The Linnaean Hierarchy is introduced. The antiquity of the Earth is introduced. The idea of a common ancestor and descent with modification is introduced. The similarities and differences between prokaryotes and eukaryotes are introduced. The similarities and differences between Archaea and Bacteria are introduced. Life history traits (reproduction, metabolism, cellular systems) of Archaea and bacteria are discussed. The diversity of Bacteria and Archaea and their impact on human societies is explored.
Week 4	Protista and Plant - The Linnaean Hierarchy is reinforced. The antiquity of the Earth is reinforced. The idea of a common ancestor and descent with modification is reinforced. The similarities and differences between prokaryotes and eukaryotes are reinforced. The Kingdom(s) "Protista" is introduced. Life history traits (reproduction, metabolism, cellular systems) of protists are discussed. The diversity of protists and their impact on human societies is explored. Similarities between photosynthetic green algae and the Kingdom Plantae are introduced. The Kingdom Plantae is introduced. Life history traits (reproduction, metabolism, cellular systems) of plants are discussed. The diversity of plants and their impact on human societies is explored.
Week 5	Fungi and Animals - The Linnaean Hierarchy is reinforced. The antiquity of the Earth is reinforced. The idea of a common ancestor and descent with modification is reinforced. The similarities and differences between prokaryotes and eukaryotes are reinforced. The Kingdom Fungi is introduced. Life history traits (reproduction, metabolism, cellular systems) of fungi are discussed. The diversity of fungi and their impact on human societies is explored. Similarities between fungi and the

	Kingdom Plantae are introduced (heterotrophy and chitin). The Kingdom Animalia is introduced. Life history traits (reproduction, metabolism, cellular systems) of animals are discussed. The diversity of animals and their impact on human societies is explored.
Week 6	Chemistry – Matter, elements and atomic structure are introduced. Water as a fundamental unit of life in introduced. The macromolecules of life (carbohydrates, proteins, lipids, and nucleic acids) are described. Their roles as building blocks are defined. Enzymes are discussed. The pH scale and the significance of buffers are introduced. The idea of surface area to volume ration is introduced. The idea of emergent properties and common ancestry are reinforced.
Week 7	Cells – Cells, the fundamental unit of life, are discussed in detail. The similarities and differences between prokaryotes and eukaryotes are reinforced. The plasma membrane, cell wall, organelles and compartmentalization and efficiency are described. Cellular transport of molecules and water are described. Cellular communication is described. Cellular "eating" and "drinking" are described. The evolution of eukaryotic cells from prokaryotic cells is introduced in terms of symbiosis, phagocytosis, and membrane infolding.
Week 8	Metabolism, Respiration and Photosynthesis – Energy flow is described. Potential and kinetic energy are defined. Entropy and energy are defined. The generation, maintenance, and necessity of ATP as a cellular "battery" are described. Photosynthesis is defined and described. The significance of the sun and primary producers is stated. Respiration is defined and described. The connection between the generation of oxygen in photosynthesis, its consumption during respiration, the generation of carbon dioxide during respiration, and its consumption during photosynthesis is stressed.
Week 9	Cell Division – The necessity of cellular division and the cellular cycle of DNA replication and separation is described. Chromosomal organization of genetic material is described. Mitosis is illustrated and described. Meiosis is illustrated and described included a discussion of the essential stage of crossing over as a new source of genetic material. Sexual reproduction and fertilization are discussed for several organismal models.
Week 10	Stem Cells and Cancer – Aging and apoptosis are discussed. Cell differentiation during embryogenesis is discussed. The idea of cell fate and totipotency and pluripotency are discussed. Stem cells are discussed. Ethics associated with stem cell research are discussed. The idea is discussed that interference of the cellular cycle may lead to cells which do not stop divided. This continual cell division is frequently associated with cancer. Types of cancers ad treatments are discussed. The link between stem cell research and cancer is made.
Week 11	Genetics – The idea of genes, or coding DNA, is introduced. The organization of DNA, genes, and chromosomes is reinforced. Basic patterns of inheritance are discussed. The idea of alternate alleles is introduced. Mendel's Law of Heredity is described. Extensions of Mendel's Law of Heredity under a modern paradigm are discussed. Human genetics are discussed including reasons for individual similarities and differences. Human genetic disorders are discussed.
Week 12	DNA and Genes – Details of the three dimensional structure of DNA are discussed. Rules of DNA replication are discussed. Methods of DNA repair are discussed. Errors in replication and mutations at the DNA level are discussed. Genomics is discussed. Epigenetics is introduced.
Week 13	From Genes to Proteins – The relationship between genes and proteins is discussed. Details of the three dimensional structure of RNA are discussed. Rules of RNA replication are discussed. Details of the three dimensional structure of proteins are discussed. Rules of protein synthesis are discussed. The idea of alternate alleles is reinforced. The similarity and uniqueness of life and the idea of a universal common ancestor is reinforced.
Week 14	Evolution – How evolution works is detailed. Descent with modification via natural selection is reinforced. Adaptations are defined. Fitness is defined. Mechanisms of evolution are discussed

	(mutations, population movement and size, and nonrandom mating). Evidence for evolution is discussed (homologies) and the similarity and uniqueness of life and the idea of a universal common ancestor is reinforced. Species are defined and speciation is discussed. The impact of evolution is discussed.
Week 15	Ecology – The biosphere is defined and interactions between organisms and the Earth are discussed. Biomes are defined. Population growth is discussed. Human population growth is discussed. Species interactions are discussed. Ecosystems, energy flow, and elemental cycling are discussed. Global change is discussed.

2. Attachments (Syllabus Required)

Syllabus Attached? ☒ Yes ☐ No

Other Attached? ☒ Yes ☐ No If yes, specify: Appendix 1: Laboratory Syllabus; Appendix 2: Sample Questions for Lecture; Sample laboratory; Appendix 3: Sample Questions for laboratory; Appendix 4: Pre and Post BIOL 1308 Assessment Questions for SLO 1 - 5.

Appendix 1
Laboratory Syllabus

BIOL 1108, CONTEMPORARY BIOLOGY LAB
FALL 2012

The Syllabus is Subject to Change for Logistical and/or Pedagogical Reasons at the Discretion of the Lab Coordinator!

LAB DATES	LAB EXERCISES TO BE READ *BEFORE* COMING TO LAB
3-7 September	NO LABS THIS WEEK due to the Labor Day Holiday on Monday!
10-14 September	1. Introduction to Biology Also Read Chapter 1 in *Discover Biology* **Phelan 1st Ed. Chapter 1, pgs. 1-33** **Phelan 2nd Ed. Chapter 1, pgs. 1-36**
14 September	**12th CLASS DAY, Last day to change lab schedule!**
17-21 September	2. Using the Microscope to Investigate the Diversity of Life Also Read Chapter 6, Sect. 2, pgs. 144-146 in *Discover Biology* **Phelan 1st Ed. Chapter 10: 368-405, 13: 406-499** **Phelan 2nd Ed. Chapter 10: 387-426, 13: 511-528**
24-28 September	3. Investigating the Diversity of Life by Examining Eukaryotic Cells Also Read Chapter 6, Sect. 2-5 in *Discover Biology* Also Read the Prologue from *The Immortal Life of Henrietta Lacks* by Rebecca Skloot (This is the 2012-2013 SHSU Freshman Reader.) **Phelan 1st Ed. Chapter 3: 76-102, 13: 500-513** **Phelan 2nd Ed. Chapter 3: 82-122, 13: 529-545**
1-5 October	4. "What Happened to Alice Newfield?": An Investigative Case Study to Review the Diversity of Life and the Nature of Science Also Read Chapter 1-4 in *Discover Biology* **Phelan – Review all readings from above**
8-12 October	5. Stems Cells and Development Also Read Chapter 11, Sect. 1, pgs. 252-260 & 272 in *Discover Biology* **Phelan 1st Ed. pgs. 186-188** **Phelan 2nd Ed. pgs. 207-210** **& Review everything prior to this date for the mid-term.**
15-19 October 2012	**Mid-Term Exam** given during your regular lab time. Chapters 1-5. Multiple-choice! ***Taken and scored as individuals – this is NOT a GROUP test!***

Appendix 1
Laboratory Syllabus

19 October 2012	**Check-Point Peer Evaluation Due This Week!** **Mid-term Make-up Exam,** LDB 305, 12:00 p.m. You MUST notify Mrs. Rose (294-1542) before 9:00 a.m. on Friday, 19 October 2012. You *must* bring appropriate *documentation* for your *totally unavoidable* absence from a major exam!
22-26 October	6. Genetic Engineering Also Read Chapter 16 – DNA Technology in *Discover Biology* **Phelan 1st Ed. pgs. 179-195** **Phelan 2nd Ed. pgs. 194-207**
29 October – 2 November	7. Introduction to Meiosis and Genetics Also Read Chapter 10, Sect. 5 & Chapters 12-13 in *Discover Biology* **Phelan 1st Ed. Chpt. 6: 208-216 & 225-247, 7: 248-281** **Phelan 2nd Ed. Chpt. 6: 222-228 & 237-262, 7: 263-299**
5-9 November	8. Evolutionary Processes Also Read Chapters 17-19 in *Discover Biology* **Phelan 1st Ed. Chpt. 8: 282-327, 10: 368-405** **Phelan 2nd Ed. Chpt. 8: 299-346, 10: 387-426**
12-16 November	9. Population Genetics and Evolution Also Read Chapters 18 & 22 in *Discover Biology* **Phelan 1st Ed. Chpt. 8: 282-327, 10: 368-405** **Phelan 2nd Ed. Chpt. 8: 299-346, 10: 387-426**
19-23 November	No regular lab meetings this week due to the Thanksgiving Holiday! Make sure you are ready for your final exam!
26-30 November	"In Sickness and In Health" A **Graded** Case Study **Review** for Final Exam Also Read Chapter 11, Sect. 2 in *Discover Biology* **Phelan: Review everything since the mid-term.**
30 November 2012	**Last Day for BIOL 1108 Lab Students to obtain the Lab Coordinator's signature to drop the course.** You must see Mrs. Rose in LDB 300-F by 3:00 p.m. All BIOL 1108 drops **must** be in the Registrar's Office by 9:00 a.m. on Monday, 3 December 2012.
3-7 December 2012	**Final Exam** given during your regular lab time. Chapters 6-9. Multiple-choice, essay and pedigree construction. ***Taken and scored as individuals – this is NOT a GROUP test!***

Appendix 1
Laboratory Syllabus

7 December 2012	**Final Peer Evaluation Due This Week!** **Make-up Final Exam**, LDB 305, 12:00 p.m. You MUST notify Mrs. Rose (294-1542) before 9:00 a.m. on Friday, 7 December 2012. You *must* bring appropriate *documentation* for your *totally unavoidable* absence from a major exam!

Laboratory Coordinator: Mrs. Rose
LDB 300-F
(936) 294-1542
bio_lab@shsu.edu

Appendix 2
Sample Questions for Lecture

1. Somatic cell nuclear transfer currently involves all of the following choices except
   a. a surrogate mother.
   b. harvesting of stem cells from the embryo.
   c. human reproduction.
   d. a nucleus from an adult body cell
   e. reprogramming of a body cell to produce an embryo.

2. The oxygen released in photosynthesis comes from
   a. carbon dioxide.
   b. glucose.
   c. ribulose bisphosphate.
   d. water
   e. atmospheric oxygen.

3. The formal definition of Natural Selection is:
   a. Differential survival and reproductive success of individuals in a population based on genetic differences among them.
   b. Survival of the fittest.
   c. Only the fittest live to reproduce.
   d. (a) and (b)
   e. (a) and (c)

4. Movement of a molecule against a concentration gradient occurs in
   a. active transport.
   b. osmosis.
   c. facilitated diffusion.
   d. simple diffusion.
   e. passive transport.

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Use the following answers (a -e) for the three questions below (one answer per question; each may be used more than once or not al all).

a. monosaccharide
b. fatty acid
c. nucleotide
d. glycerol
e. amino acid

5. Which is a "building block" of proteins?

6. Which is a "building block" of nucleic acids?

7. Which is a "building block" of carbohydrates?

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8. A human karyotype showing 22 pairs of autosomes and two X chromosomes would be

a. an abnormal female.
b. a normal female.
c. an abnormal male.
d. a normal male.
e. none of these.

9. After chromosomes are duplicated, each of the new copies is called a _____.
   a. centromere
   b. nucleosome
   c. sister chromosome
   d. clone
   e. sister chromatid

10. Oils are
   a. both liquid at room temperature and unsaturated.
   b. unsaturated.
   c. complex carbohydrates.
   d. liquid at room temperature.
   e. found only in animals.

11. ATP acts as what type of agent in almost all metabolic pathways?
   a. transfer
   b. allosteric
   c. catalytic
   d. enzymatic
   e. feedback

12. Plants produce which of the following as a productof photosynthesis?
   a. CO_2
   b. both CO_2 and H_2O
   c. H_2O
   d. O_2
   e. both CO_2 and O_2

13. What causes mutations?

   a. Mistakes that occur during DNA replication
   b. Transposable elements can cause insertion mutations
   c. All of the above can cause mutations.
   d. Natural or synthetic chemicals can cause mutations
   e. Environmental agents (UV light) can damage DNA

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Use the following answers (a -e) for the two questions below (one answer per question; each may be used more than once or not al all).

a. the Krebs cycle

b. glycolysis
c. electron transport
d. glycolysis and electron transport
e. glycolysis and the Krebs cycle

14. When proteins are used as energy sources, their breakdown subunits usually enter

15. When fats are used as energy sources, their breakdown subunits usually enter
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16. When glucose is used as the energy source, the largest amount of ATP is produced is in
    a. the Krebs cycle
    b. substrate-level phosphorylation
    c. electron transfer phosphorylation
    d. acetyl CoA formation
    e. glycolysis.

17. What is formed when an atom loses or gains an electron?
    a. isotope
    b. ion
    c. a new element
    d. bond
    e. molecule

18. HeLa cells were originally derived from
    a. Henrietta Lacks' cervical cancer.
    b. Henry Larson's skin cancer.
    c. Hamster ovary cells.
    d. Heather Lamb's liver cancer.
    e. none of these.

19. If a population is not evolving, _____ of its members will express the recessive genotype.
    a. 100 percent
    b. 50 percent
    c. 25 percent
    d. 0 percent
    e. 75 percent

20. Science is self-correcting. This means that:
    a. when scientists make mistakes in their statistical analyses, their statistical software always catches those mistakes.
    b. scientists have impeccable manners.
    c. science actively seeks to disprove its own theories and hypotheses.
    d. scientists correct their own biases before engaging in scientific study.
    e. science is incapable of producing mistaken beliefs if its studies are carefully done.

Appendix 2
Sample Questions for Lecture

21. Strictly speaking, mitosis is a division of the
    a. nucleus.
    b. cytoplasm.
    c. nucleus, cytoplasm, and chromosomes.
    d. only nucleus and chromosomes.
    e. chromosomes.

22. Unlike eukaryotic cells, bacterial cells _____.
    a. have no plasma membrane
    b. have two nuclei
    c. have no plasma membrane and have no nucleus
    d. have no nucleus
    e. have RNA but not DNA

23. The place Darwin visited on his trip around the world that had the greatest impact on his thinking was
    a. Brazil.
    b. the Canary Islands.
    c. the Galapagos Islands.
    d. Africa.
    e. the Hawaiian Islands.

24. Which of the following is(are) frameshift mutations?
    a. one base addition
    b. one base addition and one base substitution
    c. one base addition and two base deletion
    d. one base substitution
    e. two base deletion

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Use the following answers (a -e) for the two questions below (one answer per question; each may be used more than once or not al all).
a. community
b. population
c. organism
d. biosphere
e. ecosystem

25. Which of the following is defined as "all populations of all species living in the same area?"

26. All of the coyotes (*Canis latrans*) living in the Mojave Desert constitute a(an)
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27. Four of the five answers listed below are characteristics of water. Select the exception.
    a. common solvent
    b. cohesion and surface tension

c. produces salts
d. stabilizes temperature
e. less dense when solid

28. Transcription
a. is catalyzed by DNA polymerase.
b. occurs on the surface of the ribosome.
c. is the synthesis of RNA from a DNA template.
d. is the final process in the assembly of a protein.
e. is all of these.

29. When ATP releases its energy, it forms
a. ADP.
b. AMP.
c. both AMP and Phosphorous.
d. Phosphorous.
e. both ADP and Phosphorous.

30. The synthesis of an RNA molecule from a DNA template strand is called
a. translation.
b. DNA synthesis.
c. transcription.
d. replication.
e. metabolism.

31. Which of the following needs a transport protein to cross the cell membrane?
a. oxygen
b. carbon dioxide
c. water
d. glucose
e. carbon dioxide and water

32. The longest part of the cell cycle is usually
a. telophase.
b. prophase.
c. interphase.
d. anaphase.
e. metaphase.

33. Bacteriophages are
a. viruses.
b. protistans.
c. pathogens (disease-producing bacteria).
d. large bacteria.
e. cellular components.

Appendix 2
Sample Questions for Lecture

34. Rosalind Franklin used which technique to determine many of the physical characteristics of DNA?
    a. density-gradient centrifugation
    b. transmission electron microscopy
    c. transformation
    d. X-ray diffraction
    e. all of these

35. The chromosomes are moving to opposite poles during
    a. prophase.
    b. interphase.
    c. telophase.
    d. metaphase.
    e. anaphase.

36. Every cell is descended from another cell. This idea is part of _____.
    a. hereditary evolution
    b. evolution
    c. the theory of heredity
    d. cell biology
    e. the cell theory

37. Light excites ____ in photosynthetic pigments.
    a. electrons
    b. protons
    c. protons and neutrons
    d. electrons and protons
    e. neutrons

38. Darwin was influenced by which of the following concepts attributable to Charles Lyell?
    a. Acquired characteristics can be inherited.
    b. The geologic forces in Earth's history show predictable uniformity.
    c. All life forms a part of a great Chain of Being.
    d. The geological history of Earth is a series of catastrophes.
    e. Natural selection operates on the tremendous variation found in nature.

+++

Use the following answers (a -e) for the three questions below (one answer per question; each may be used more than once or not al all).

a. neutron.
b. proton.
c. electron.
d. neutron and proton.
e. proton and electron.

39. The neutral subatomic particle is the ______.

40. The negative subatomic particle is the _____.

41. The positive subatomic particle is the _____.
++

42. Mutations can be
    a. harmful.
    b. beneficial.
    c. heritable.
    d. random.
    e. all of these.

43. Critical thinking is the process of
    a. unconditionally accepting information from a trusted source.
    b. judging the quality of information before accepting it.
    c. designing a scientific experiment.
    d. finding fault in others.
    e. making a hypothesis.

44. In asexual reproduction, new combinations of genes arise by
    a. random segregation of chromosomes into gametes.
    b. random assortment of gametes.
    c. crossing over.
    d. mutation.
    e. all of these.

45. During interphase of the cell cycle, most of the cell's activity is directed toward
    a. DNA replication.
    b. resting for the next step.
    c. sorting the chromosomes.
    d. making the proteins that drive mitosis.
    e. membrane synthesis.

46. The portion of the DNA molecule that is translated is composed of
    a. both exons and transcriptons but not introns or anticodons.
    b. exons.
    c. transcriptons.
    d. introns.
    e. anticodons.

47. When O_2 accepts electrons in aerobic respiration, it is converted to
    a. O_3
    b. CO
    c. CO_2
    d. H_2O

e. OH

48. If a population is not evolving, _____ of its members will express the dominant phenotype.
    a. 25 percent
    b. 0 percent
    c. 50 percent
    d. 75 percent
    e. 100 percent

49. The ultimate source of energy for living things is
    a. aerobic respiration
    b. fossil fuels
    c. the sun
    d. glycolysis
    e. the Krebs cycle

50. In simple diffusion
    a. the rate of movement of molecules is controlled by temperature and pressure.
    b. the movement of molecules of one substance is independent of the movement of any other substance.
    c. the net movement is away from the region of highest concentration.
    d. the movement of individual molecules is random.
    e. is all of these.

51. According to Darwin, natural selection is based on the ____ found in populations.
    a. weakest members
    b. noncompetitors
    c. similarities
    d. acquired characters
    e. variations

52. Aerobes use ____ as the final electron acceptor in electron transport phosphorylation.
    a. hydrogen
    b. H_2O
    c. carbon
    d. NAD^+
    e. oxygen

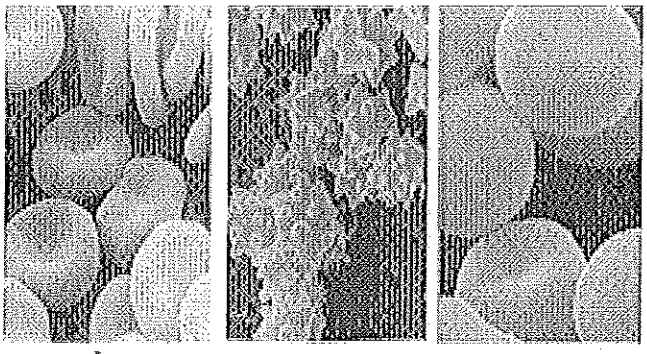
53. White blood cells use ____ to get rid of foreign particles in the blood.
    a. facilitated diffusion
    b. osmosis
    c. phagocytosis
    d. simple diffusion
    e. bulk flow

54. ATP contains
    a. guanine.
    b. cytosine.
    c. uracil.
    d. thymine.
    e. adenine.

55. Each of the cells formed during telophase I is
    a. haploid.
    b. in synapsis.
    c. tetraploid.
    d. diploid.
    e. ready to be fertilized.

56. Four of the five answers listed below are related by a common phase of mitosis. Select the exception.
    a. Shortening and condensation of a visible chromosome.
    b. Disappearance of nuclear membrane.
    c. Microtubules start to assemble outside the nucleus.
    d. Division of centromere.
    e. Disappearance of nucleolus.

++



A B C

Pictured are red blood cells immersed in fluids of different tonicity. Refer to this image to answer the following three questions.
    a. hypertonic
    b. hypotonic
    c. isotonic

57. The red blood cells in micrograph A are immersed in a(n) _____ solution.

58. The red blood cells in micrograph C are immersed in a(n) _____ solution.

59. The red blood cells in micrograph B are immersed in a(n) _____ solution.
++

60. Yeast fermentation produces

Appendix 3
Sample Questions for laboratory

1. It is possible for ***scientists*** to study events that happened or animals/plants that lived millions of years ago by which of the following methods?
    a. Comparing plant fossils to modern plant structures and their function.
    b. Observe modern animal behavior, structure and function, compare them to the structures of fossilized animals and deduce the function of the fossilized structures.
    c. Apply the laws of physics and nature, that we know exist today, to evaluate the evidence of past events.
    d. All of the above are methods employed by scientists seeking to understand the natural events of the past.
    e. None of the above, there is no way to determine what has happened in the past.

2. After looking at the "fossil" in today's lab exercise and the resource manual, what could you say about how and where this animal lived?
    a. The animal most likely lived in an aquatic or marine environment.
    b. The animal most likely lived on land, eating grasses and always stayed on the ground.
    c. The animal most likely lived on land, may have fed on other animals and may have had the ability to fly.
    d. There's really no way to figure this out.
    e. There is no evidence to suggest any of the above scenarios is even close.

3. If the "Fossil Find" scenario is typical of the work of scientists, what features of the nature of science does it demonstrate?
    a. Formulating a hypothesis
    b. Amending a hypothesis when new evidence is presented and suggests adjustments are needed
    c. Collaboration among researchers
    d. The production of a finalized theory
    e. a, b, and c but not d

4. Regarding the "hand washing and disinfectant experiment," which of the following could be considered an independent variable in the experiment?
    a. The number of micro-organisms present on the person's hands at the beginning of the experiment.
    b. The kind of hand soap used.
    c. The kind of disinfectant used.
    d. The amount of time the person washed their hands.
    e. There were no independent variables.

5. Regarding the "hand washing and disinfectant experiment," which of the following were variables that you controlled?
    a. The kind of hand soap used.
    b. The kind of disinfectant used.
    c. The amount of time the person washed their hands.
    d. a, b, and c
    e. a, b but not c

Appendix 3
Sample Questions for laboratory

6. Regarding the "hand washing and disinfectant experiment," how could redesign the experiment to eliminate or determine the cause of any inconsistencies in results?
   a. Thoroughly disinfect the faucet and handles.
   b. Sterilize the soap and soap containers before the experiment.
   c. Use sterile water for the experiment.
   d. Use sterile paper towels for drying hands during the experiment.
   e. All of the above could help eliminate or determine the cause of any inconsistencies in the results of the experiment.

7. Which of the following would be a reasonable hypothesis for the "hand washing and disinfectant experiment?"
   a. The longer one washes their hands with soap, the fewer micro-organisms remain on their hands.
   b. Soap sterilizes skin.
   c. Washing hands is a good thing.
   d. All disinfectants are good.

8. What was the reason you were asked to compare your results in the "hand washing and disinfectant experiment" to those of other groups and/or lab sections?
   a. Well designed experiments are repeatable and the results should also be repeatable.
   b. Bigger sample sizes typically yield more accurate results.
   c. Both a and b
   d. None of the above

9. Which of the following are advantages of membrane-enclosed internal cellular compartments?
   a. This partitioning of the cytoplasm into a variety of highly specialized membrane-enclosed compartments confers speed and efficiency through an intracellular division of labor.
   b. Unique chemical environments can be maintained within a membrane-enclosed compartment.
   c. Some cellular chemical reactions produce by-products that could interfere with other vital reactions or even poison the cell; locking such substances into special compartments avoids "collateral damage."
   d. a, b, and c are all advantages of membrane-enclosed internal cellular compartments.

10. Which of the following statements is a scientific rationale for why most cells are small?
   a. As a cell's width increases, its volume decreases vastly more than its surface area, so a larger cell has proportionately less plasma membrane area to import and export substances but must support a much larger cytoplasmic volume.

b. As a cell's width increases, its volume increases vastly more than its surface area, so a larger cell has proportionately less plasma membrane area to import and export substances.
c. Because God made them that way.
d. Both a and c are appropriate scientific rationale for why most cells are small.

11. Without data from a scientific experiment, is it either reasonable/wise to state that Bt-containing crops are definitely responsible for the loss of honeybees or that Bt crops are absolutely not responsible for honeybee loss?
    a. Yes, because there's no evidence suggesting that anything else might be responsible?
    b. No, because the perceived correlation between the use of Bt-containing crops and the decline of honeybees may be only correlation and not a cause-and-effect relationship; a controlled experiment will help determine if this is a cause-and-effect relationship.
    c. No, because we do not yet know if there is any evidence suggesting that some other phenomenon may be causing the decline of honeybees.
    d. a and c are the most scientifically reasonable responses
    e. b and c are the most scientifically reasonable responses

12. The inability to roll your tongue is a homozygous recessive trait. If 49% of the individuals at SHSU cannot roll their tongues, what would be the predicted percent of the population heterozygous for the tongue rolling gene?
    a. 70%
    b. 30%
    c. 49%
    d. 9%
    e. 42%

13. Still considering the information in question above, what would be the predicted percent of the population homozygous dominant for the tongue rolling gene?
    a. 9%
    b. 42%
    c. 30%
    d. 70%
    e. 49%

"A Sickeningly Sweet Baby Boy"

Exam question adapted from a case study by Jacqueline Washington and Anne Zayaitz

Emma and Jacob Miller were so excited at the birth of their baby Matthew.

"Jacob, he's just so perfect! Just one problem though, it looks like he has your hairline!" Emma teased her husband who, though only 32, was balding.

Appendix 3
Sample Questions for laboratory

"Emma, I spent all that time painting the baby's room and I just hope that he's not color blind like your father or he won't be able to see it!" Jacob responded.

Both the pregnancy and delivery had been uneventful. But in the back of their minds, they really were worried because their first child, Samuel, died at the age of nine days.

By the fifth day after birth, Matthew began to have trouble nursing and by the seventh day he had completely stopped feeding. Emma and Jacob were frantic because it seemed to them that Matthew might also die.

"What is going on with our family? Another sick baby?" Jacob thought to himself.

Emma and Jacob rushed Matthew to the emergency room. Although Matthew's limbs were rigid and he had had a seizure, the examination showed no infection and his x-rays were normal. The doctor also did routine lab tests on his blood and urine.

"Doctor, do you think that this funny smell in Matthew's diapers has anything to do with his problem?" Emma asked. " I brought one along so that you could smell it too."

Matthew's urine did have a sweet, maple syrup smell and lab results revealed elevated levels of the branched chain amino acids (BCAA) – valine, isoleucine, and leucine.

Skin biopsies from the baby and his parents were taken and cultured. The ability of the cultured skin fibroblasts to metabolize BCAA was determined. While his parents' enzyme activity levels were nearly normal, Matthew's was 200 times lower than normal.

"Given the medical information and the smell of the urine, Matthew has Maple Syrup Urine Disease (MSUD)," reported Dr. Morton of the Clinic for Special Children. "He will not be able to breast feed or drink regular formula. What is really important is that Matthew eats a low protein diet. This diet must continue for the rest of his life or else the amino acids will accumulate in the body creating a situation that leads to brain swelling, neurological damage, and death. In spite of dietary intervention, the disease may cause several complications, the most notable being mental retardation. You need to know that dietary intervention does not cure the disease."

Emma and Jacob were Mennonites and their family history revealed that Emma's mother had two sisters who died in their first year of life; no one knew why. Emma's maternal grandparents are still alive and well. Jacob's father had a sister who died at seven months of age from unknown causes; Jacob's paternal grandparents are still alive and running the family farm.

Appendix 3
Sample Questions for laboratory

The genetics counselor used a pedigree chart to look for the (possible) incidence of disease within multiple generations of Emma and Jacob's family.

Use the information given about Emma and Jacob and their families (and the following figure) to **construct a pedigree showing four generations of their family.** Be sure to correctly include and represent Emma, Jacob, Samuel, Matthew, Emma's father, Emma's mother, Emma's aunts, Emma's maternal grandparents, Jacob's mother, Jacob's father, Jacob's aunt and Jacob's paternal grandparents.

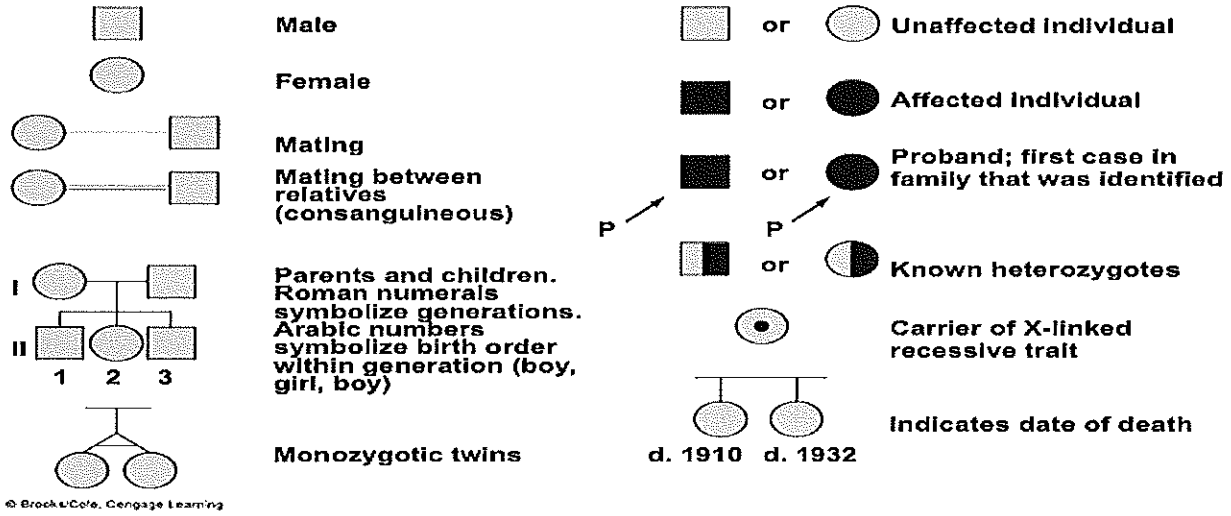


Fig. 3-16a, p. 60

ON THE SAME SHEET OF PAPER, ANSWER THE FOLLOWING QUESTIONS:

1. Explain how MSUD must be inherited and what the genotype of the parents (Emma and Jacob) must be. **(3 points possible)**

2. What is the probability that Emma and Jacob could have a third child affected by MSUD? **(2 points possible)**

3. Could Emma and Jacob have children who do not have MSUD (i.e. phenotypically normal)? Explain. What is the probability? **(3 points possible)**

4. If MSUD were a dominant disorder, what would be the probability that Matthew would inherit the disease? **(2 points possible)**

Appendix 4

Pre and Post BIOL 1408 Assessment Questions for SLO 1 - 3

SLO 1: The Scientific Method

Q1: What is a hypothesis? What is a theory?

Q2: How do you test a hypothesis? How do you test a theory?

Q3: Are scientific theories fallible?

SLO 2: Evolution

Q1: Is there scientific evidence to support the notion that all life evolved from a common ancestor?

Q2: Do all living organisms use the same fundamental processes to transmit their genetic material to their descendants?

Q3: What laws govern the fundamental processes necessary to carry on life?

SLO 3: Structure and Function and Systems

Q1: Are cells capable of adjusting to their environment?

Q2: Can you describe how living things are interconnected and continuously interacting with each other?

Q3: Can you describe two different ways in which we can arrange life into hierarchical units?

Q4: What is the building block of life?

Q5: How is the information contained within our genes decoded and put into action?

Q6: How does the similarity in information storage and transfer unify life?