

Kolbe Academy Home School

HIGH SCHOOL BIOLOGY WITH LAB (HONORS)

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COURSE TITLE: Biology (Honors)**COURSE DESCRIPTION:**

This course is designed to give students an appreciation of creation and of the order and complexity of living things. The course plan outlines a track for a Kolbe Academy honors course (H) in Biology. The “Honors Biology” track will outline the more in-depth processes of life systems.

The science of biology presents the student with some of the bioethical issues that exist in today’s world, such as stem cell research, genetic engineering, and cloning. It is the role of the parent to discuss these issues with the student and instruct the student in Church teaching. We have done our best to point out these controversial issues and to provide guidance on how to address them. For example, the topic of evolution is studied alongside the Church’s teaching in *Humani Generis*. Miller and Levine’s *Biology* book periodically includes a “Biology & Society” segment which should be used as points of discussion between the student and parent. It is important to bring in the Church’s teaching on moral and bioethical issues during these discussions. Projects have been assigned during some weeks so that the student can explore the Church’s teachings on controversial topics on their own.

The honors track, although up to the parent’s discretion, is aimed for students who have a solid background in physical science. A student who still wishes to pursue this course as an honors course that did not follow the recommended course of study for physical science, may find the pace of the course challenging. These students should be sure to allot extra time for their studies.

COURSE TEXTS AND MATERIALS:

- ❖ Miller, Kenneth R. and Joseph S. Levine. *Biology*. Boston: Pearson Education, 2017.
- ❖ *Virtual Biology Lab*. Labster. (digital)
- ❖ Hoxie, Elizabeth. *Biology: Quizzes (Kolbe Core)*. Napa, CA: Kolbe Academy Press, 2016. (digital, recommended)
- ❖ Hoxie, Elizabeth. *Biology Answer Key*. Napa, CA: Kolbe Academy Press, 2019. (optional)
- ❖ *Lab Report Writing Guide*. Napa, CA: Kolbe Academy Press, 2008. (optional)

Church Teaching Materials:

- ❖ Pope Pius XII. *Humani Generis*. Vatican: The Holy See, 1950. (online library at www.ewtn.com)
- ❖ Christoph, Cardinal Schonbörn. *Chance or Purpose?: Creation, Evolution and a Rational Faith*. Hubert Philip Weber, ed. Henry Taylor, trans. San Francisco: Ignatius Press, 2007.
- ❖ *Catechism of the Catholic Church*. 2nd edition revised. Vatican: Libreria Editrice Vaticana, 2000.

SCOPE AND SEQUENCE:

1. The Nature of Life
2. Cells
3. Genetics
4. Evolution
5. Ecology
6. From Microorganisms to Plants
7. Animals
8. The Human Body

COURSE PLAN “AT A GLANCE” OUTLINE:**Semester 1 Material Covered:**

Week 1	Chapter 1: 1.1 through 1.3
Week 2	Chapter 2: 2.1 through 2.4
Week 3	Chapter 7: 7.1 through 7.4
Week 4	Chapter 8: 8.1 through 8.3
Week 5	Chapter 9/10: 9.1 through 9.3 and 10.1 through 10.2
Week 6	Chapter 10: 10.3 through 10.4
Week 7	Review Ch. 1, 2, 7 through 10/ Ch. 11: 11.1 through 11.2
Week 8	Chapter 11/12: 11.3 through 11.4 and 12.1 through 12.3
Week 9	Chapter 13/14: 13.1, 13.2, 13.4 and 14.1 through 14.3
Week 10	Review Chapters 11 through 14
Week 11	Chapter 15: 15.1 through 15.4
Week 12	Chapter 16: 16.1 through 16.4
Week 13	Chapter 17: 17.1 through 17.4
Week 14	Chapter 18: 18.1 through 18.3
Week 15	Chapter 3: 3.1 through 3.4
Week 16	Chapter 4: 4.1 through 4.4
Week 17	Chapter 5: 5.1 through 5.3
Week 18	Review Chapters 15 through 18 and 3 through 5

Exam Schedule:

Exam I: Chapters 1, 2, 7-10

Exam II: Chapters 11-14

Exam III: Chapters 15-18, 3-5

Semester 2 Material Covered:

Week 1	Chapter 19/20: 19.1 through 19.3 and 20.1 through 20.3
Week 2	Chapter 21: 21.1 through 21.4
Week 3	Chapter 22: 22.1 through 22.4
Week 4	Chapter 23: 23.1 through 23.5
Week 5	Chapter 24: 24.1 through 24.2
Week 6	Review Chapters 19 through 24
Week 7	Chapter 25: 25.1 through 25.2
Week 8	Chapter 27: 27.1 through 27.4
Week 9	Chapter 28: 28.1 through 28.4
Week 10	Chapter 29: 29.1 through 29.2
Week 11	Review Chapters 25, and 27 through 29
Week 12	Chapter 30: 30.1 through 30.4
Week 13	Chapter 31: 31.1 through 31.4
Week 14	Chapter 32: 32.1 through 32.3
Week 15	Chapter 33: 33.1 through 33.3
Week 16	Chapter 34: 34.1 through 34.4
Week 17	Chapter 35: 35.1 through 35.4
Week 18	Review Chapters 30 through 35

Exam Schedule:

Exam IV: Chapters 19-24

Exam V: Chapters 25, 27-29

Exam VI: Chapters 30-35

COURSE PLAN METHODOLOGY:

There are 6 exams incorporated into the biology course. These exams reflect the content of what was assigned in the weekly course plans. If students do the work assigned during the week, they should be adequately prepared for any question that arrives on the exams. The exams consist of many different types of questions including matching, multiple choice, and essays. Students may not skip or alter questions on the exams except when specified by the directions within the exam itself if they wish to receive the (H) designation for this course. As parents are the primary educator, they may alter the course plan or exams as needed if the student does not desire a designation on the transcript.

Short quizzes are provided for each chapter in a separate publication. While not mandatory, completing the quizzes will help student prepare for the exams. They are available as a digital download. Please see the course text list.

Lab work is suggested throughout the lesson plan through the use of the Virtual Lab and labs in the textbook that do not require extensive materials. To qualify the course as a lab science, students should spend an average of one hour per week doing some type of lab work. This may include field observation, dissection, work with a microscope, or using the Labster program. Students may receive lab credit by other means than following the course plan suggestions such as a home school co-op, hands-on lab at home, college lab course etc. A separate grade should NOT be given for the lab work, but should be incorporated into the overall grade given for the course. Parents may determine the weight the lab component will have on the final grade, but typical values ranges from 15-25% of the total grade. Two written, formal lab reports are needed per semester for lab credit on the transcript; however, students are encouraged to write an informal lab report for the majority of the labs in this course.

If this text is being used in preparation for the AP Biology exam, students should complete the Honors Biology level of this course. Since this book is NOT a college text, it is important to study for the AP with an AP specified study guide for Biology. Most of the topics needed to be successful on the Biology AP exam are covered in the honors course of study. To see the AP biology requirements, go to www.collegeboard.com. AP is a registered trademark of the College Board.

The following key will help the parent and student understand how each week's assignments are laid out.

Reading: Includes pages from the specified chapter in the Pearson *Biology* textbook or other specified outside reading.

Section Assessment: Suggested questions from the text at the end of each section. The suggested questions will help the student prepare well for each exam provided by Kolbe Academy. Answers to these questions are provided in the Kolbe Academy Answer Key to the Pearson Biology text.

Chapter Assessment: Suggested questions from the text at the end of each chapter. The suggested questions will help the student prepare well for each exam provided by Kolbe Academy. Answers to these questions are provided in the Kolbe Academy Answer Key to the Pearson Biology text.

Resources: The etext (www.pearsonrealize.com) has a collection of supplemental materials intended to reinforce concepts presented in the text. Materials assigned in the “Resources” are meant to complement the textbook lessons and are not necessary to do well on the exams. However, the activities and videos do provide additional assessment and demonstration of the concepts in the text. Students also have access to workbook pages for each section through the etext.

Lab Work: The lab work assignments come from either the Labster labs or from the *Biology* text itself. The labs chosen from the text need little or no equipment to be completed at home (like the Quick Labs or Inquiry activities), and all Labster assignments use just computer software. Any Quick Labs or Inquiry activities listed in the course plan are optional for lab credit but do allow students using the Labster software to get some occasional hands-on lab experience. If you have equipment available to complete the more complex labs that are outlined in the book, these could be done in lieu of the virtual lab, and is a superior way to fulfill the lab requirement. Note that virtual labs have been placed in the most relevant week possible, but sometimes a lab covering a certain topic is postponed to a later week so as not to overwhelm the student. To gain experience with science writing, it is recommended that students complete a lab worksheet (in the appendix of this course plan) for each Labster simulation except for those they choose for full lab reports.

Project: Several project ideas are suggested for each semester. Some deal with moral or ethical concepts which the student may wish to understand better. The projects may be submitted to fulfill the “written work” requirement.

Key Terms: This is a list of important vocabulary terms to look out for as the student reads the chapter.

Biological Issues & Church Teaching: References that can be used to incorporate Church Teaching alongside the study of biology are provided in this section. Many of the references are to documents easily found on the Internet, such as *Fides et Ratio*, *Humani Generis*, and the *Summa Theologica*. These references are by no means exhaustive and not every chapter will have references to Church Teaching, depending on the subject matter being covered.

Important Concepts: The most important concepts for the student to understand are described in this section.

GUIDELINES FOR WRITTEN LAB REPORT SAMPLES:

Honors (H) guidelines: Students seeking the Honors designation for a lab credit with this science course should complete a lab worksheet or keep other comparably detailed, organized notes for each lab completed. They must also submit 2 formal lab reports each semester.

General guidelines: Students not seeking any designation for a lab credit with this science course are encouraged to complete a Lab Report Worksheet or keep other comparably detailed, organized notes for each lab completed. They must submit 2 written lab samples each semester (any sample of lab work will suffice).

The **Kolbe Lab Report Writing Guide**, which is available in the Kolbe Academy Bookstore, explains how to write a formal lab report. This guide is optional, however, you should seek out a reputable source on writing lab reports if you do not have access to it.

DIPLOMA REQUIREMENTS:

Summa Cum Laude diploma candidates are required to follow either the Kolbe Core course (K) or Kolbe Honors course (H) track course plan, and are required to fulfill the laboratory component with this biology course. **Magna Cum Laude** and **Standard** diploma candidates may choose to pursue the (H) or (K) designation, but are not required to do so, and instead have the option of altering the course plan as they choose. **Summa** students must complete 4 years of science during their high school course of study including Biology with Lab, Chemistry with Lab, Physics with Lab, and a pre-approved science elective. **Magna** students must complete 3 years of science during their high school course of study including Biology, Chemistry, and a physical science. **Standard** diploma students must complete 2 years of science including a biological and physical science. For a student pursuing the **Magna Cum Laude** diploma, the science requirement dictates that lab work is incorporated into Biology and Chemistry or Physics. There is no lab requirement for the **Standard** diploma. Please see below for specific course titles, semester reporting requirements and transcript designations for biology.

SEMESTER REPORTING REQUIREMENTS:

Designation*	No Designation		K (Kolbe Core)	H (Honors)
Course Title	Biology	Biology w/ Lab		Biology w/ Lab
Semester 1	1. Any two written, graded samples.	1. Any two written, graded samples. 2. Any two graded lab reports.	Please use the Kolbe Core version of the Pearson Biology course plan if you would like to seek the Kolbe Core (K) designation.	1. Honors Exam I 2. Honors Exam II 3. Honors Exam III Each completed fully and graded. 4. Any two graded lab reports. 5. Any two graded projects
Semester 2	1. Any two written, graded samples.	1. Any two written, graded samples. 2. Any two graded lab reports.		1. Honors Exam IV 2. Honors Exam V 3. Honors Exam VI Each completed fully and graded. 4. Any two graded lab reports. 5. Any two graded projects.

*Designation refers to designation type on transcript. K designates a Kolbe Academy Core course. H designates a Kolbe Academy Honors course.

If the student wishes to have the course distinguished on the transcript with an (H) as a Kolbe Academy Honors course, please be sure to send the correct exams and components each semester for verification as specified above. **If no designation on the transcript is desired, parents may alter the lesson plan and any written sample work is acceptable to receive credit for the course each semester.** If you have any questions regarding what is required for the (K) or (H) designations or diploma type status, please contact the academic advisory department at 707-255-6499 or by email at advisors@kolbe.org.

◆◆◆ FIRST SEMESTER ◆◆◆

KOLBE ACADEMY ORIENTATION WEEK

This week will be strictly dedicated to learning about the set-up of the course and textbook, the virtual lab software, and all supplemental online materials.

- **Read pages 1 – 7** of the Kolbe Academy **Syllabus** for biology. Open the textbook to the table of contents. Pay special attention to the key in the Course Plan Methodology that explains how each week's assignments are laid out.
- If you are using the virtual lab, **make sure you have been given access**. Login is at www.labster.com. A username and password must be generated by Kolbe and emailed to you.
- Login to Labster. Go over the Help Tutorials located in the virtual lab environment.
- Pay special attention to the key that explains how each week's assignments are laid out. Compare the key with a few weeks in the course-plan since not every component appears in each week. Look ahead to Week 1. Take stock of the material you will be covering. Make sure you understand what each assignment is and whether it pertains to the course of study you will be following. You are now ready to begin your biology adventure!

WEEK 1		
Chapter 1: The Science of Biology		
Reading	Chapter 1	Sections 1-3
Section Assessment	1.1 Assessment 1(a), 2(a)(b) 1.2 Assessment 1(b), 2(a), 3(a), 4(b) 1.3 Assessment 1(a)(b), 2(b), 4(a)	
Chapter Assessment	1-5, 9, 10, 15-17, 19, 23-24	
Quiz	Chapter 1 Quiz	
Resources	Disproving Spontaneous Generation Flipped Video for Science (1.2) Adventures in Measurement (1.3)	
Lab Work	Students should familiarize themselves with the scientific method and the basics of science writing. This can be done independently or using <i>The Kolbe Academy Lab Report Guide</i> .	
	Labster	Complete the "Lab Safety" simulation and record the total quiz score. The student does not need to complete a lab worksheet for this simulation.
	Optional	Quick Lab, page 13
Key Terms	1.1 science, observation, inference, hypothesis, controlled experiment, independent variable, dependent variable, control group, data 1.2 theory, bias 1.3 biology, DNA, stimulus, sexual reproduction, asexual reproduction, homeostasis, metabolism, biosphere	
Biological Issues & Church Teaching	The Catechism states that: "Though faith is above reason, there can never be any real discrepancy between faith and reason. Since the same God who reveals mysteries and infuses faith has bestowed the light of reason on the human mind, God cannot deny himself, nor can truth ever contradict truth." ³⁷ "Consequently, methodical research in all branches of knowledge, provided it is carried out in a truly scientific manner and does not override moral laws, can never conflict with the faith, because the things of the world and the things of faith derive from the same God. The humble and persevering investigator of the secrets of nature is being led, as it were, by the hand of God in spite of himself, for it is God, the conservator of all things, who made them what they are" (para 159). Chapter 1 discusses what science is and is not. The authors state that "Scientific endeavors never concern, in any way, supernatural phenomena of any kind." Science looks for natural explanations based on evidence, not belief. Although science is concerned only with the natural world, the pursuit of scientific truth will not create any conflict for the believer. As the Catechism explains, a scientist who submits himself to the boundaries of morality, will discover nothing that opposes the truth of faith because faith and the natural world have the same Divine origin.	
Important Concepts	Biology is the study of life. In this course, we will explore what living things are made of, how they function and relate to each other, and how they change over time. It is important that students understand the scientific method and how to design a controlled experiment before proceeding to the next chapter.	

WEEK 2		
Chapter 2: The Chemistry of Life		
Reading	Chapter 2	Sections 1-4
Section Assessment	2.1 Assessment 1(a)(b), 2(b), 3(a), 4(a)(b) 2.2 Assessment 1(b)(c), 2(b), 3(a)(c) 2.3 Assessment 1(a)(b), 2(b), 3(a)(b) 2.4 Assessment 1(b), 2(a)(b), 3(b)	
Chapter Assessment	1-3, 10-12, 13, 15, 18-20, 25-28	
Quiz	Chapter 2 Quiz	
Resources	Chemistry of Durian Fruits Untamed Science Video (2.3) The Role of Enzymes Flipped Video for Science (2.4)	
Lab Work	No lab assignment this week	
Key Terms	2.1 atom, nucleus, electron, element, isotope, compound, ionic bond, ion, covalent bond, molecule, van der Waals force 2.2 hydrogen bond, cohesion, adhesion, mixture, solution, solute, solvent, suspension, pH scale, acid, base, buffer 2.3 monomer, polymer, carbohydrate, monosaccharide, lipid, nucleic acid, nucleotide, protein, amino acid 2.4 chemical reaction, reactant, product, activation energy, catalyst, enzyme, substrate	
Important Concepts	<p>Since millions of chemical reactions happen in the cells and body of living organisms, understanding the fundamentals of chemistry is critical for success in biology. Chapter 2 discusses the nature of matter, the primary types of chemical bonds, and the pH scale. Students should understand the chemical properties of water that make it necessary for life on Earth. The four macromolecules – the “stuff” of which living things are made – are introduced in this chapter.</p> <p>Students should know the monomers of each of the four macromolecules, but is not required to understand the levels of organization for proteins (page 49). They should understand the importance of enzymes as biological catalysts and should be able to describe the enzyme substrate complex and factors which affect enzyme function (pages 52-53).</p>	

WEEK 3		
Chapter 7: Cell Structure and Function		
Reading	Chapter 7	Sections 1-4
Section Assessment	7.1 Assessment 1(b), 3(a)(b), 4 7.2 Assessment 1(a), 2(a), 3(b), 4(b), 5(a) 7.3 Assessment 1(a)(b)(c), 2(a)(b)(c) 7.4 Assessment 1(c), 2(a)(b)(c)	
Chapter Assessment	1-4, 6-10, 15, 16, 19, 23-26	
Quiz	Chapter 7 Quiz	
Resources	Prokaryotic and Eukaryotic Cells Flipped Video for Science (7.1) Labelling Cell Structures (7.2) Rehydrating Athletes STEM Activity (7.3) Maximizing Mitochondria (7.4)	
Lab Work	Labster	Perform the “Microscopy Lab” simulation and complete a lab worksheet.
	Optional: Quick Lab (page 203)	
Key Terms	7.1 cell, cell theory, cell membrane, nucleus, eukaryote, prokaryote 7.2 cytoplasm, organelle, vacuole, lysosome, cytoskeleton, centriole, ribosome, endoplasmic reticulum, Golgi apparatus, chloroplast, mitochondrion, cell wall, lipid bilayer, selectively permeable 7.3 diffusion, facilitate diffusion, aquaporin, osmosis, isotonic, hypertonic, hypotonic, osmotic pressure 7.4 homeostasis, tissue, organ, organ system, receptor	
Biological Issues & Church Teaching	Watch the “Inner Life of the Cell” animations created by Harvard University (http://multimedia.mcb.harvard.edu/). Studying the intricacy of cell structure is an opportunity to meditate on the way in which the complexity and orderliness of the natural world reflects the glory of God. In the <i>Summa Theologica</i> (First part, Question 2, Article 3), St. Thomas Aquinas presents five proofs for God’s existence – all of which involve observations about the natural world.	
Important Concepts	The cell is the basic unit of life. Differentiate between prokaryotic and eukaryotic cells. Draw and label diagrams of plant and animal cells and describe the function of each organelle. Refer to the chart on page 207. Cells need to move nutrients, waste, and other materials in and out to maintain homeostasis. Review the types of cell transport described in section 3. Finally, discuss the relationship between homeostasis, cell specialization, and the organization of multicellular bodies. Draw and label a diagram of the nucleus (page 197). Differentiate between microtubules and microfilaments and give examples of how each are used (page 199). Explain how cells “talk” to each other (page 217).	