Course Outline SBI100

Course	Biology
Course Code	SBI100
Times and Location	Mondays 20h00/8:00pm – 21h00/9:00pm EST; online
Instructor	Philippe D'Onofrio, Ph.D., M.Sc.
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Required Text
Goodenough, Judith, McGuire,Betty. "Biology of Humans; Concepts, Applications and Issues" (online edition)

Supplemental texts and readings
Any first-year university or introductory biology or physiology text will provide a useful reference. Lecture slides and recordings will be posted in Moodle along with any additional content.

Course Description
Human Biology (SBI100) is a 3-credit, 14-week introductory course that will provide students with a solid core foundation in basic and applied human biology. Through on-line self-study modules, tutorials, quizzes, and an assignment, students will learn to use relevant terminology and concepts in a biological context. The course will cover the molecular and cellular basis of life, biochemical processes, and how these coalesce to form organ systems and, ultimately, the full human organism.

Students will have complete weekly on-line self-study modules and will interact online with the course instructor one evening a week in an on-line tutorial session. Students are expected to be prepared for these tutorial sessions (i.e. have completed the on-line modules).

The application of biology fundamentals to naturopathic medicine is integrated throughout the course, providing students with a unique opportunity to learn biology within the context of medical practice.

Prerequisites:
There are no prerequisites for this course.

Course Format:
The course is delivered in a **blended learning style** which combines online self-study modules with weekly live interactive **online tutorial sessions from 20h00 (8p.m.) - 21h00 (9 p.m.) EST** on Monday evenings with the course instructor. The passing grade is 60%, and evaluations/assessments will consist of **a participation grade (10%)**, **one quiz per module (10%), one assignment (10%), one midterm test (30%), and a final exam (40%)**. Both the

midterm test and the final exam are delivered via Examity and invigilated via Zoom by the CCNM.

Course Outcomes:
This course is designed to:
• A core foundation for their knowledge of cellular and molecular biology
• The basis for applying biological concepts to the human body
• Use the relevant vocabulary and concepts correctly in a biological and clinical context
• Acquire an understanding of the known mechanisms by which the cells and organisms function and achieve homeostasis
• Challenge and engage the student where he/she may independently work to enrich their learning.
• Equip students with the necessary knowledge to enter the ND program. Where applicable, apply human biology to Naturopathic principles.

Plagiarism and Cheating
Plagiarism and cheating are academic offenses and will be treated seriously by the College. Students should refer to the College's policies on academic misconduct posted on in the Academic Calendar.

Course Schedule

Week	Textbook chapter	Topics	Activities	Date
1	22	Evolution and our Heritage	Quiz 1	4 May
2	2 + 3	Chemistry Comes to Life + The Cell	Quiz 2 + 3	12 May
3	19 + 20	Chromosomes and Cell Division + Genetics and Human Inheritance	Quiz 4 + 5	19 May
4	21	DNA and Biotechnology	Quiz 6	26 May
5	17	Reproductive Systems	Quiz 7	2 June
6	18	Development Throughout Life	Quiz 8	9 June
7		**Midterm Exam**		**16 June**
8	7	Neurons: Matter of the Mind	Quiz 9	23 June
9	8 + 9	The Nervous System + Sensory Systems	Quizzes 10 + 11	30 June
10	10	The Endocrine System	Quiz 12	7 July
11	12	The Cardiovascular and Lymphatic Systems	Quiz 13	14 July
12	13	Body Defense Mechanisms	Quiz 14	21 July
13	13a	Infectious Disease	Quiz 15	28 July
14		**Final Exam**		**4 August**

Learning objectives:

Chapter 22: Evolution and our Heritage

- Describe the early Earth and how those conditions lead to the formation of organic molecules, genetic material, prokaryotic cells, and eukaryotic cells.
- Differentiate between the processes of microevolution and macroevolution using the following terms: *population, gene pool, mutation, genetic drift, bottleneck effect, founder effect, gene flow,* and *species*.
- Explain how each of the following provides evidence for evolution: the fossil record, geographic distributions, comparative anatomy and embryology, and comparative molecular biology, including the use of the molecular clock.
- Trace human evolution from primates to *Homo sapiens*, noting distinguishing characteristics of early hominins. Be able to refute common misconceptions.

Chapter 2: Chemistry Comes to Life

- Describe the characteristics of the subatomic particles (protons, neutrons, and electrons) and explain the structure of an isotope.
- Differentiate between covalent, ionic, and hydrogen bonds in terms of strength and the actions of the electrons.
- List the unique properties of water that make it valuable to biological systems.
- Predict what happens when an acid or a base is added to water.
- Define *pH,* explain the range of the pH scale, and tell which values indicate acid and which values indicate base.
- Describe the structure of a polymer, including its formation through dehydration synthesis and its breakdown through hydrolysis.
- Describe the structure and biological purpose of carbohydrates, lipids, proteins, and nucleotides and give an example of each.
- Describe ATP as the energy currency of the cell.

Chapter 3: The Cell

- Compare prokaryotic and eukaryotic cells.
- Relate the surface-to-volume ratio to maximum cell size.
- Provide examples that show the relationship between the structure and function of a cell.
- Explain how the structure of the plasma membrane regulates the movement of materials in and out of the cell.
- Describe the function and structural features of each of the following organelles: nucleus, endoplasmic reticulum, Golgi complex, lysosomes, and mitochondria.
- Compare the structure and function of the three fibers that make up the cytoskeleton.

- Summarize the efficiency of cellular respiration and fermentation as methods to harvest cellular energy from the food we eat.

Chapter 19: Chromosomes and Cell Division

- Compare the role of meiosis and mitosis in the cell cycle.
- Differentiate between chromosomes and genes, autosomes and sex chromosomes, and diploid and haploid cells.
- Draw the cell cycle, label each phase of mitosis and interphase, and describe the events and significance of each phase.
- List the events of interphase, prophase, metaphase, anaphase, and telophase as completed in mitosis.
- Define *cytokinesis* and explain its role in cell division.
- Explain the diagnostic uses of karyotypes.
- Diagram and describe how haploid cells result from meiosis and highlight the opportunities for crossing over and the independent assortment of chromosomes.
- Describe how nondisjunction results in an abnormal number of chromosomes in the daughter cells resulting in Down, Turner, and Klinefelter syndromes.

Chapter 20: Genetics and Human Inheritance

- Define, give an example, and use the terms *homozygous, heterozygous, dominant, recessive, genotype, phenotype, pleiotropy, multiple alleles*, and *polygenic*.
- Explain the relationship between the dominant and recessive alleles in cases of complete dominance, codominance, incomplete dominance, and sex-linked inheritance patterns.
- Use a Punnett square to show inheritance patterns.
- Describe how chromosome deletions and duplications affect the production of proteins and then describe common genetic disorders in humans and their causes.
- Compare the methods and advantages of prenatal, newborn, and adult genetic testing.

Chapter 21: DNA and Biotechnology

- Draw the structure of a DNA molecule and explain why complementary base pairing ensures reliable replication of the genetic code.
- Describe the purpose and mechanism of DNA expression.
- Compare the structure and function of DNA and RNA and then describe the details of protein synthesis including transcription, translation, and the genetic code.
- Differentiate between chromosomal and point mutations.
- Describe the various types of point mutations and their relative impact on protein synthesis.
- Explain the mechanisms used to control gene activity.

- List the steps involved in making recombinant DNA and then describe the value of genetic engineering and give examples of how it has been applied to plant, animal, and environmental science.
- Describe the purpose and value of the Human Genome Project, microarray analysis, and comparing the genomes of different species.

Chapter 17: Reproductive Systems

- State the function of the gonads.
- Compare and contrast the roles of the male and female in reproduction.
- Describe the function of each organ of the male reproductive system, the development of sperm, the formation of semen, and hormonal control of male reproduction.
- Describe the function of each organ of the female reproductive system; the ovarian and uterine cycles and the interplay between them; and the hormonal control of the female reproductive system.
- Explain the causes and symptoms of health problems of the female reproductive system.
- List the stages involved in the human sexual response and the physiological changes that accompany them.
- Name each method of birth control presented in the chapter and explain how it works, why it prevents pregnancy, and its relative effectiveness.

Chapter 18: Development Throughout Life

- Differentiate between prenatal and postnatal periods of development.
- Use correctly the following terms to describe prenatal development: fertilization by one sperm, zygote, cleavage, morula, blastocyst, inner cell mass, trophoblast, placenta, implantation, gastrulation, germ layers, and neural tube development.
- List in order the stages of labor and describe the birthing process.
- Relate the prenatal developmental timeline to the seriousness of the birth defect and describe potential causes of birth defects.
- Explain control over milk production and letdown.
- Describe postnatal growth and development and the factors that influence aging and high quality of life through old age.

Chapter 7: Neurons - Matter of the Mind

- Differentiate between a neuron and neuroglial cells.
- Explain the role each of the following plays in the conduction of a nerve impulse: cell body, dendrite, axon, myelin sheath, Schwann cell, and node of Ranvier.

- Describe how a nerve cell maintains a resting potential using the sodium-potassium pump and changes that occur as an action potential moves along the axon.
- Summarize the events that occur at the synapse as an impulse is transmitted from one neuron to the next.

Chapter 8: The Nervous System

- Compare the functions of the central and peripheral, somatic and autonomic, and parasympathetic and sympathetic divisions of the nervous system.
- Identify the location and list the function of each component of the central nervous system.
- Describe the function of the somatic and autonomic nervous systems and the sympathetic and parasympathetic nervous systems.
- Explain the cause and seriousness of common health problems and injuries of the nervous system.

Chapter 9: Sensory Systems

- Explain the term *sensory receptors*.
- List the five classes of sensory receptors and their stimuli.
- Differentiate between general senses and special senses.
- Label the parts of the eye and explain the function of each part in the perception of sight.
- Label the parts of the ear and describe the role of each part in hearing.
- Explain how we perceive and maintain balance.
- Describe the mechanism of taste buds and olfactory receptors.

Chapter 10: The Endocrine System

- Explain the role of hormones as chemical messengers and give an example of hormone regulation.
- List the effect of each of the six anterior pituitary hormones and the two posterior pituitary hormones.
- Describe the effect of thyroid hormone, including oversecretion and undersecretion.
- Explain the regulation of blood calcium by calcitonin and parathyroid hormone.
- Name and describe the effects of the hormones produced by the adrenal gland.
- Compare the effects of the two pancreatic hormones, glucagon and insulin, on the regulation of glucose blood level.
- Describe the effect of the thymus gland on the health of the immune system.

- Relate the production of melatonin to seasonal affective disorder and name the gland that is involved.
- Define *prostaglandins* and describe their mechanism of action as compared with endocrine hormones.

Chapter 12: Cardiovascular and Lymphatic Systems

- List the functions of the cardiovascular system.
- Compare the structure of arteries, veins, and capillaries and explain how the structure facilitates the function of each type of vessel.
- Contrast the exchange of gas in the pulmonary and systemic circuits.
- Describe the internal conduction system of the heart and the resulting cardiac cycle.
- Define blood pressure and differentiate between systolic and diastolic pressure.
- Describe the functions and structures of the lymphatic system.

Chapter 13: Body Defense Mechanisms

- Use the word *pathogen* to explain why our body needs a defense mechanism.
- Describe in detail each of the three lines of defense.
- Define *antigen* and *MHC markers* and explain their role in cell identity.
- Compare an antibody-mediated immune response with a cell-mediated immune response.
- List the steps in an adaptive immune response, the cells that are involved, and the mechanism of defense.
- Differentiate between active and passive immunity.
- Describe monoclonal antibodies and list some of their uses.
- Explain the cause of autoimmune disorders and the development of an allergic reaction.

Chapter 13a: Infectious Disease

- Define *pathogen,* list the pathogens discussed in the chapter, and provide an example of each.
- List the mechanisms by which disease can be spread.
- Define:
    - *epidemiology*
    - *sporadic diseases*
    - *endemic diseases*
    - *epidemic disease*
    - *pandemic*