COURSE OUTLINE
2018/2019

COURSE NAME: Biology 30
COURSE CODE: BIO30

COURSE DESCRIPTION
Course topics covered include: Chromosomes, DNA, and cell division, human nervous system, endocrine system, human reproduction system and embryonic/fetal development and classical and population genetics. Biology 20 recommended

Course Credits: 5.00
Equivalent Courses: BSS291, CPB130

LEARNING OUTCOMES

<table>
<thead>
<tr>
<th>OUTCOME</th>
<th>Upon successful completion of this course, you will be able to</th>
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<tbody>
<tr>
<td>1</td>
<td>Describe the components and functioning of eukaryotic cells</td>
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<tr>
<td></td>
<td>The following concepts, skills, and issues are used to support this Outcome:</td>
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<td>• describe the components of cell theory and the general features of all cells</td>
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<td>• compare the features of eukaryotic cells to prokaryotic cells</td>
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<td>• describe the components and organelles of eukaryotic cells, i.e., cytoplasm, plasma (cell) membrane, cell wall, chloroplasts, mitochondria, ribosomes, endoplasmic reticulum (smooth and rough), Golgi apparatus, lysosomes, vacuoles, vesicles, centrioles, cytoskeleton, cilia, flagella, DNA, chromosomes, nucleus, nuclear envelope, nucleolus</td>
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</tbody>
</table>
| 2 | Describe how the components of eukaryotic cells carry out the processes of mitosis, meiosis, and DNA replication

The following concepts, skills, and issues are used to support this Outcome:

- define and explain the significance of chromosome number in somatic and sex cells; i.e., haploidy, diplodiay and polyploidy
- explain, in general terms, the events of the cell cycle; i.e., interphase, mitosis and cytokinesis
- describe the process of meiosis (spermatogenesis and oogenesis) and the necessity for the reduction of chromosome number
- compare the processes of mitosis and meiosis
- describe the processes of crossing over and nondisjunction and evaluate their significance to organism inheritance and development
- compare the formation of fraternal and identical offspring in a single birthing event
- describe, in general, how genetic information is contained in the sequence of bases in DNA molecules in chromosomes and how the DNA molecules replicate themselves
- explain, in general, how restriction enzymes cut DNA molecules into smaller fragments and how ligases reassemble them
- explain, in general, how cells may be transformed by inserting new DNA sequences into their genomes
- explain how base sequences in nucleic acids contained in the nucleus, mitochondrion and chloroplast give evidence for the relationships among organisms of different species

| 3 | Explain the basic rules and processes associated with the transmission of genetic characteristics using classical genetics and molecular biology

The following concepts, skills, and issues are used to support this Outcome:

- describe, in general, how genetic information is transcribed into sequences of bases in RNA molecules and is finally translated into sequences of amino acids in proteins
- explain how a random change (mutation) in the sequence of bases results in abnormalities or provides a source of genetic variability
- describe the evidence for dominance, segregation and the independent assortment of genes on different chromosomes, as investigated by Mendel
- compare ratios and probabilities of genotypes and phenotypes for dominant and recessive, multiple, incompletely dominant, and codominant alleles
- explain the influence of gene linkage and crossing over on variability
- explain the relationship between variability and the number of genes controlling a trait
- compare the pattern of inheritance produced by genes on the sex chromosomes to that produced by genes on autosomes, as investigated by Morgan and others
4. Describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time.

The following concepts, skills, and issues are used to support this Outcome:
- **describe the Hardy-Weinberg principle and explain its significance in population gene-pool stability and nonequilibrium values**
- **describe the factors that cause the diversity in the gene pool to change; i.e., natural selection, genetic drift, gene flow, nonrandom mating, bottleneck effect, founder effect, migration, mutation**
- **apply, quantitatively, the Hardy-Weinberg principle to observed and published data to determine allele and genotype frequencies, using the equations \( p + q = 1 \) and \( p^2 + 2pq + q^2 = 1 \)
- **describe the molecular basis of gene-pool change and the significance of these changes over time; i.e., mutations and natural selection, drug-resistant bacteria, herbicide-resistant plants**

5. Explain human reproduction in terms of survival of the human species and its regulation by chemical control systems

The following concepts, skills, and issues are used to support this Outcome:
- **identify the structures in the human female reproductive system and describe their functions; i.e., ovaries, Fallopian tubes, uterus, endometrium, cervix, vagina**
- **identify the structures in the human male reproductive system and describe their functions; i.e., testes, seminiferous tubules, interstitial cells, Sertoli cells, epididymides, vasa (ductus) deferentia, Cowper’s glands, seminal vesicles, prostate gland, ejaculatory duct, urethra, penis**
- **distinguish sperm and egg from their supporting structures; i.e., seminiferous tubules, interstitial cells, Sertoli cells, follicle, corpus luteum**
- **describe the chromosomal factors and hormonal influence on the formation of the gonads and reproductive organs in the female and male embryo and fetus; i.e., Y chromosome and role of testosterone**
- **explain how sexually transmitted infections (STIs) can interfere with fertility and reproduction**
- **describe the role of hormones, i.e., gonadotropic-releasing hormone (GnRH), follicle-stimulating hormone (FSH), luteinizing hormone (LH), estrogen, progesterone, testosterone, in the regulation of primary and secondary sex characteristics in females and males**
- **identify the principal reproductive hormones in the female and explain their interactions in the maintenance of the menstrual cycle; i.e., estrogen, progesterone, FSH, LH**
- **identify the principal reproductive hormones in the male and explain their interactions in the maintenance and functioning of the male reproductive system; i.e., testosterone, FSH, LH**
Explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine and environmental factors

The following concepts, skills, and issues are used to support this Outcome:

- trace the processes of fertilization, implantation and extra-embryonic membrane formation, i.e., placenta, amnion, chorion, allantois, followed by embryonic and fetal development, parturition and lactation, and describe the control mechanisms of these events, i.e., progesterone, LH, human chorionic gonadotropin (hCG), prostaglandins, oxytocin, prolactin
- describe development from fertilization to parturition in the context of the main physiological events that occur in the development of organ systems during each major stage (trimester); i.e., zygote, blastocyst, gastrulation, general morphogenesis
- identify major tissues and organs that arise from differentiation and morphological development of the ectoderm (i.e., nervous system, epidermis), mesoderm (i.e., skeleton, muscles, reproductive structures), and endoderm (i.e., lining of the digestive and respiratory systems, endocrine glands) in the embryo
- describe the influence of environmental factors on embryonic and fetal development; e.g., maternal lifestyle, teratogens such as alcohol, drugs, viral infections and radiation
- describe the physiological or mechanical basis of different reproductive technologies; i.e., conception control, in vitro fertilization, infertility reversal

Explain how the nervous system controls physiological processes

The following concepts, skills, and issues are used to support this Outcome:

- describe the general structure and function of a neuron and myelin sheath, explaining the formation and transmission of an action potential, including all-or-none response and intensity of response; the transmission of a signal across a synapse; and the main chemicals and transmitters involved, i.e., norepinephrine, acetylcholine and cholinesterase
- identify the principal structures of the central and peripheral nervous systems and explain their functions in regulating the voluntary (somatic) and involuntary (autonomic) systems of the human organism; i.e., cerebral hemispheres and lobes, cerebellum, pons, medulla oblongata, hypothalamus, spinal cord, sympathetic and parasympathetic nervous systems, and the sensory-somatic nervous system
- describe, using an example, the organization of neurons into nerves and the composition and function of reflex arcs
- describe the structure and function of the parts of the human eye; i.e., the cornea, lens, sclera, choroid, retina, rods and cones, fovea centralis, pupil, iris and optic nerve
- describe the structure and function of the parts of the human ear, including the pinna, auditory canal, tympanum, ossicles, cochlea, organ of Corti, auditory nerve, semicircular canals and Eustachian tube
- explain other ways that humans sense their environment and their spatial orientation in it, i.e., olfactory receptors, proprioceptors, taste receptors, receptors in the skin
Explain how the endocrine system contributes to homeostasis

The following concepts, skills, and issues are used to support this Outcome:

• identify the principal endocrine glands of humans; i.e., the hypothalamus/pituitary complex, thyroid, parathyroid, adrenal glands and islet cells of the pancreas
• describe the function of the hormones of the principal endocrine glands, i.e., thyroid-stimulating hormone (TSH)/thyroxine, calcitonin/parathyroid hormone (PTH), adrenocorticotropic hormone (ACTH)/cortisol, glucagon/insulin, human growth hormone (hGH), antidiuretic hormone (ADH), epinephrine, aldosterone, and describe how they maintain homeostasis through feedback
• explain the metabolic roles hormones may play in homeostasis; i.e., thyroxine in metabolism; insulin, glucagon and cortisol in blood sugar regulation; hGH in growth; ADH in water regulation; aldosterone in sodium ion regulation
• explain how the endocrine system allows humans to sense their internal environment and respond appropriately; e.g., calcium balance, osmotic pressure of the blood
• compare the endocrine and nervous control systems and explain how they act together; e.g., stress and the adrenal gland
• describe, using an example, the physiological consequences of hormone imbalances; i.e., diabetes mellitus, diabetes insipidus, gigantism, goitre, cretinism, Graves’ disease

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<thead>
<tr>
<th>OUTCOME</th>
<th>ACTIVITY DESCRIPTION</th>
<th>MARK DISTRIBUTION</th>
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</thead>
<tbody>
<tr>
<td>1, 2, 3, 4, 5, 6, 7 and 8</td>
<td>Assignments and quizzes</td>
<td>15%</td>
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<tr>
<td>1, 2, 3, 4, 5, 6, 7 and 8</td>
<td>Lab Reports</td>
<td>15%</td>
</tr>
<tr>
<td>1, 2, 3, 4, 5, 6, 7 and 8</td>
<td>Unit Exams (4 @ 10% each)</td>
<td>40%</td>
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<tr>
<td>1, 2, 3, 4, 5, 6, 7 and 8</td>
<td>Final Exam</td>
<td>30%</td>
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<td>TOTAL</td>
<td>100%</td>
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**COURSE COMPLETION REQUIREMENTS**

No less than 50%.

**STUDENT EQUIPMENT AND SUPPLIES**

Lab coat and safety glasses are required for laboratory work.
**DELIVERY METHOD**

This course will be taught using a variety of delivery methods which may include face-to-face, online, or blended teaching platforms. Activities such as collaborative exercises/assignments, seminars, labs, discussion, audio/visual presentations, case studies, and practicums may be used to support learning.

**ADDITIONAL INFORMATION**

Lab Attendance Expectation: If a student does not attend a lab, they may not submit a lab report. An excused absence with valid documentation will receive an omit for that lab and an unexcused absence will receive a zero.

The learning outcomes for Biology 30 are from the Biology 30 Curriculum from Alberta Education:


**STUDENT RESPONSIBILITY**

Enrolment at NAIT assumes that the student will become a responsible citizen of the Institute. As such, each student will display a positive work ethic, assist in the preservation of Institute property, and assume responsibility for his/her education by researching academic requirements and policies; demonstrating courtesy and respect toward others; and respecting expectations concerning attendance, assignments, deadlines, and appointments.

**EQUITY STATEMENT**

NAIT is committed to providing an environment of equality and respect for all people within the learning community, and to educating faculty, staff, and students in developing inclusive teaching and learning contexts that are welcoming to all.

Leadership Review Date: November 06, 2017  
Curriculum Committee Review Date: November 06, 2017

Changes to This Course Outline: Every effort has been made to ensure that information in this course outline is accurate at the time of publication. The Institute reserves the right to change courses if it becomes necessary so that course content remains relevant. In such cases, the instructor will give the students clear and timely notice of the changes.

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