DEPARTMENT OF ACADEMIC UPGRADING

COURSE OUTLINE BI0130 A3 W15

BI 0130 - Biology Grade 12 Equivalent 5 (5-0-1.5) HS – Winter 2015

INSTRUCTOR: Sheryl Heikel **PHONE:** Office: 780–539–2059
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OFFICE HOURS: Mondays 11:00am – 12:00 pm
Wednesdays 11:30 – 12: 30 (if no Department meeting scheduled)
Fridays 11:30am – 12:30 pm Or by appointment

DELIVERY MODE(S): Classroom instruction and lab. Use of Moodle required.

PREREQUISITE(S)/COREQUISITE:

BI0120 (Biology 20); EN0120 (English 20-1 or 20-2) or EN0130 placement; MA0110 (Math 10C) or MA0123 (Math 20-3) or MA0120 placement. See also Academic Upgrading Science Requirements.

REQUIRED TEXT/RESOURCE MATERIALS:

Inquiry into Biology - McGraw-Hill Ryerson
NOTE: There are approximately 300 pages of recommended printing for this course.

CALENDAR DESCRIPTION:

BI 0130 - Biology Grade 12 Equivalent 5 (5-0-1.5) HS
The concepts in this course include nervous and endocrine systems; cell division; genetics and molecular biology; populations and community dynamics.

COURSE OBJECTIVES: As stated by Alberta Education, upon successful completion of this course the student will be able to:

- explain how the nervous system controls physiological processes
- explain how the endocrine system contributes to homeostasis.
- explain how survival of the human species is ensured through reproduction
- explain how human reproduction is regulated by chemical control systems
- explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine and environmental factors.
- describe the processes of mitosis and meiosis
- explain the basic rules and processes associated with the transmission of genetic characteristics
- explain classical genetics at the molecular level.
- describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time
- explain the interaction of individuals in a population with one another and with members of other populations explain, in quantitative terms, the change in populations over time.
- Lab Skill objectives (focus on scientific inquiry) Initiate, plan, perform record, analyze, interprete, communicate and work in a team

LEARNING OUTCOMES: Please see detailed Course outline which follows (p 4 – 8).

COURSE SCHEDULE/TENTATIVE TIMELINE:

Biology 0130 consists of four units — **Tentative** Exam Dates

Unit 1:	The Nervous and Endocrine Systems (4 weeks)	10%	February 3
Unit 2:	Reproduction and Development (2 weeks)	5%	February 13
	Midterm (Unit 1 + 2)	25%	February 24
Unit 3:	Cell Division, Genetics, & Molecular Biology (5 weeks)	10%	March 23
Unit 4:	Populations and Community Dynamics (2 weeks)	5%	April 10

EVALUATION: Course final grade will be based on the following components.

Moodle Quizzes	5%	
Labs, Quizzes, Assignments	10%	**Late penalty 20% per day for 2 days.**
Unit Exams	30%	
Midterm (covers Unit 1 + 2)	25%	
Final (covers Unit 3 + 4)	30%	

All tests and exams MUST be written at the scheduled times unless **PRIOR** arrangements have been made with the instructor. A missed test (exam) will result in a score of ZERO on that test (exam). Only in very specific cases may student be given an opportunity to make up a missed exam (student will be presented with a different version of the exam). Doctor, lawyer or police documentation may be required. The final exam is 3 hours long and is scheduled by the registrars' office during GPRC Exam weeks.

GRADING CRITERIA: Final Grades will be assigned on the Letter Grading System.

GRANDE PRAIRIE REGIONAL COLLEGE			
GRADING CONVERSION CHART			
Alpha Grade	*4-point Equivalent*	*Percentage Guidelines*	*Designation*
A+	*4.0*	*90 – 100*	*EXCELLENT*
A	*4.0*	*85 – 89*	
A–	*3.7*	*80 – 84*	*FIRST CLASS STANDING*
B+	*3.3*	*77 – 79*	
B	*3.0*	*73 – 76*	*GOOD*
B–	*2.7*	*70 – 72*	
C+	*2.3*	*67 – 69*	*SATISFACTORY*
C	*2.0*	*63 – 66*	
C–	*1.7*	*60 – 62*	
D+	*1.3*	*55 – 59*	*MINIMAL PASS*
D	*1.0*	*50 – 54*	
F	*0.0*	*0 – 49*	*FAIL*
WF	*0.0*	*0*	*FAIL, withdrawal after the deadline*

STUDENT RESPONSIBILITIES:

Refer to the College Policy on Student Rights and Responsibilities at
https://www.gprc.ab.ca/files/forms_documents/StudentRightsandResponsibilities.pdf

STATEMENT ON PLAGIARISM AND CHEATING:

Refer to the College Policy on Student Misconduct: Plagarism and Cheating at
https://www.gprc.ab.ca/files/forms_documents/Student_Misconduct.pdf

**Note: all Academic and Administrative policies are available at
https://www.gprc.ab.ca/about/administration/policies/

TRANSFERABILITY: Grade of D or D+ may not be acceptable for transfer to other post-secondary institutions. Students are cautioned that it is their responsibility to contact the receiving institutions to ensure transferability. Please refer to the Alberta Transfer Guide for current transfer agreements.

AUD Student Classroom Deportment Guidelines

The Academic Upgrading Department is an adult education environment. Students are expected to show respect for each other as well as faculty and staff. Students are expected to participate fully in achieving their educational goals.

Attendance: Regular attendance is expected of all students and is crucial to good performance in the course. Class interruption due to late arrival or leaving early will **NOT** be permitted. You may be debarred from the final exam if your absences exceed 15% of class days (10 lecture classes).

Certain activities are disruptive and not conducive to an atmosphere of learning. In addition to the *Student Rights and Responsibilities* as set out in the College calendar, the following guidelines will maintain an effective learning environment for everyone. We ask the cooperation of all students in the following areas of classroom deportment.

1. Students are expected to turn off cell phones during class time or in labs.
   No unspecified electronic devices will be allowed in exams.
2. Refrain from disruptive talking or socializing during class time.
3. Be respectful of others regarding food or beverages in the classroom. Clean up after yourself.
4. Recycle paper, bottles and cans in the appropriate containers.
5. Students are expected to **arrive on time and to remain for the duration of scheduled class**.
6. Children are not permitted in the classrooms.
7. Students are expected to notify his/her instructor of any extenuating circumstances.

Labs:

- Attendance is compulsory in all labs.
- Missed labs result in a score of zero. **There are NO make-up labs.**
- If you are late and have missed the lab safety discussion, you will be excluded from participating in the lab and will receive a mark of zero. The lab is certified as a biohazard zone and the regulations that apply will be given to you during your first lab
- **Lab reports are due noon FRIDAY following the lab**. Late lab reports will result in a penalty of 20% per day. Labs over two days late will not be graded without PRIOR approval.
- Download the lab sheets and complete any Pre-lab assignment before the lab period, data tables are completed during the lab and analysis and questions after the lab.

Lab Schedule Thursdays L1 8:00 – 9:20 am J130
L2 11:00 am – 12:50 pm J130

Date		Room	Biology 0130 LABS
Jan 6			No lab
Jan 13		J130	Safety
Jan 20	Lab 1	J130	Nervous System
Jan 27	Lab 2	J130	Fetal Pig
Feb 3		classroom	Unit 1 Exam 8:00am – 9:50am
Feb 10		classroom	STI report 8:30 am
Feb 17			**Reading Week**
Feb 24		classroom	**Midterm (Units 1 + 2) 8:00 am – 9:50**
Mar 3	Lab 3	J130	Mitosis Part 1
Mar 10	Lab 4	J130	Mitosis Part 2
Mar 17	Lab 5	J130	Unit 3 Quiz / Genetics
Mar 24			No lab
Mar 31	Lab 6		Breeding Bunnies (take home lab)
April 7	Lab 7	J130	Yeast
April 14			No lab (perhaps class)

Biology 0130 Learning Outcomes (adapted from Alberta Learning Physics 30 curriculum http://education.alberta.ca/media/654841/bio203007.pdf)

Unit A: Nervous and Endocrine Systems

Overview: This unit examines the biological processes that mediate the interactions between humans and their environment to maintain equilibrium. The nervous system contributes to homeostasis through its response to internal and external stimuli. Endocrine glands help to maintain homeostasis through the hormones they release into the blood. A study of the interactions between the nervous and endocrine systems leads to an examination of the functioning of the central and peripheral nervous systems and their ability to sense the environment and respond to it.

Key Concepts:

- neuron
- nerve impulse transmission
- central and peripheral nervous systems
- reflex arcs
- sensory receptors
- endocrine system and hormones
- homeostasis and feedback systems
- endocrine and nervous system interactions

Learning Outcomes

1. explain how the nervous system controls physiological processes

Students will:

- 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; *e.g., the patellar reflex, the pupillary reflex*
- 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; *e.g., olfactory receptors, proprioceptors, taste receptors, receptors in the skin.*

2. explain how the endocrine system contributes to homeostasis.

Students will:

- 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., thyroidstimulating 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 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 *(e.g., diabetes insipidus, gigantism, goitre, cretinism, Graves' disease).*

Unit B: Reproduction and Development

Overview: This unit investigates the human reproductive system as a representative mammalian system responsible for propagating the organism and perpetuating the species. The processes associated with human reproduction and development, as well as the regulation of these processes by hormones, are reviewed. The influence of environmental factors on embryonic and fetal development is examined, as are various reproductive technologies.

Key Concepts:

- male and female reproductive systems
- reproductive hormones
- reproductive technologies
- embryonic and fetal development
- parturition
- lactation

Learning Outcomes

1. explain how survival of the human species is ensured through reproduction

Students will:

- 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; *e.g., chlamydia, gonorrhea, human papilloma virus*

2. explain how human reproduction is regulated by chemical control systems

Students will:

- describe the role of hormones, i.e., gonadotropic-releasing hormone (GnRH), folliclestimulating 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.

3. explain how cell differentiation and development in the human organism are regulated by a combination of genetic, endocrine and environmental factors.

- 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, mesoderm and endoderm in the embryo; i.e.,
    - ectoderm: nervous system, epidermis
    - mesoderm: skeleton, muscles, reproductive structures
    - endoderm: lining of the digestive and respiratory systems, endocrine glands
- 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.

Unit C: Cell Division, Genetics and Molecular Biology

Overview: This unit examines the two types of cell division, mitosis and meiosis. Students learn about chromosomal behaviour during cell division and expand their knowledge of chromosomes by studying classical genetics. Classical genetics is further extended to a molecular level by exploring the basic structure of deoxyribonucleic acid (DNA), its role in protein synthesis and the impact of mutation.

Key Concepts:

- cell cycle
- mitosis and meiosis
- chromosome number
- karyotype
- alternation of generations
- Mendel's laws of heredity
- probability
- monohybrid, dihybrid and sex-linked inheritance
- incomplete dominance and codominance
- polygenic and multiple allelic traits
- gene linkage
- model of DNA
- replication
- transcription
- translation
- mutation
- genetic engineering

Learning Outcomes

1. describe the processes of mitosis and meiosis

Students will:

- define and explain the significance of chromosome number in somatic and sex cells; i.e., haploidy, diploidy and polyploidy
- explain, in general terms, the events of the cell cycle; i.e., interphase, mitosi 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 the diversity of reproductive strategies by comparing the alternation of generations in a range of organisms; *e.g., Daphnia*, *sea anemone, moss, pine.*

2. explain the basic rules and processes associated with the transmission of genetic characteristics

Students will:

- 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; *e.g., one pair of genes, as for Rh factor, versus two or more pairs of genes, as for skin colour and height*
- 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.

3. explain classical genetics at the molecular level.

Students will:

- summarize the historical events that led to the discovery of the structure of the DNA molecule, including the work of Franklin and Watson and Crick
- 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
- 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, 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 a random change (mutation) in the sequence of bases results in abnormalities or provides a source of genetic variability
- explain how base sequences in nucleic acids contained in the nucleus, mitochondrion and chloroplast give evidence for the relationships among organisms of different species.

Unit D: Population and Community Dynamics

Overview: Population change over time can be examined through a study of population genetics (Hardy-Weinberg principle) and population growth. Both of these can be expressed quantitatively. Individual members of populations interact with each other as well as with members of other populations, which can have an impact on the populations involved. Communities are a sum of all the different populations living together. Communities may change over time as a result of natural or artificial events.

Key Concepts:

- Hardy-Weinberg principle
- gene pool
- natural selection
- symbiotic relationships and other interactions
- succession
- determiners of population size: natality, mortality, immigration, emigration
- population growth rate and population growth curves
- *r*- and *K*-selected reproductive strategies

Learning Outcomes

1. describe a community as a composite of populations in which individuals contribute to a gene pool that can change over time

Students will:

- 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 *(e.g., drug-resistant bacteria, herbicideresistant plants)*.

2. explain the interaction of individuals in a population with one another and with members of other populations

Students will:

- describe the basis of species interactions and symbiotic relationships and describe the influence of these interactions on population changes; i.e.,
  - predator-prey and producer-consumer relationships
  - symbiotic relationships: commensalism, mutualism and parasitism
  - interspecific and intraspecific competition
- explain the role of defence mechanisms in predation and competition; *e.g., mimicry, protective coloration, toxins, behaviour*
- explain how mixtures of populations that define communities may change over time or remain as a climax community; i.e., primary succession, secondary succession.

3. explain, in quantitative terms, the change in populations over time.

Students will:

- describe and explain, quantitatively, factors that influence population growth; i.e.,
  - mortality, natality, immigration, emigration
  - change in population size, ΔN = [natality + immigration] – [mortality + emigration]
- describe the growth of populations in terms of the mathematical relationship among carrying capacity, biotic potential, environmental resistance and the number of individuals in the population; i.e.,
  - growth rate, $gr = \Delta N / \Delta t$,
    where ΔN is the change in number of individuals in a population and Δt is change in time
  - per capita growth rate, $cgr = \Delta N / N$,
    where ΔN is the change in number of individuals in a population relative to N, the original number of individuals
  - population density, $D_p = N / A$ or $D_p = N / V$,
    where N is the number of individuals in a given space, A is the area, and V is the volume
- explain the different population growth patterns; i.e.,
  - logistic growth pattern (S-shaped curve) and exponential growth pattern (J-shaped curve)
  - open and closed populations
- describe the characteristics and reproductive strategies of *r*-selected and *K*-selected organisms.

Lab Skills and objectives are included in labs and assignments in each unit of the course.

Specific Outcomes for Skills (focus on scientific inquiry)

Initiating and Planning

Students will :

- identify, define and delimit questions to investigate
- design an experiment, identifying and controlling major variables
- state a prediction and a hypothesis based on available evidence or background information or on a theory
- evaluate and select appropriate procedures, including appropriate sampling procedures, and instruments for collecting evidence and information

Performing and Recording

Students will :

- research, integrate and synthesize information from various print and electronic sources regarding a scientific question
- select and use appropriate instruments for collecting data effectively, safely and accurately
- carry out procedures, controlling the major variables, and adapt or extend procedures where required
- compile and organize findings and data by hand or computer, using appropriate formats such as diagrams, flowcharts, tables and graphs
- apply Workplace Hazardous Materials Information System (WHMIS) standards to handle and dispose of materials

Analyzing and Interpreting

Students will :

- apply appropriate terminology, classification systems and nomenclature used in the sciences
- interpret patterns and trends in data and predict the value of a variable by interpolating or extrapolating from graphical data or from a line of best fit
- estimate and calculate the value of variables, compare theoretical and empirical values, and account for discrepancies
- identify limitations of data or measurements; explain sources of error; and evaluate the relevance, reliability and adequacy of data and data collection methods
- identify new questions or problems that arise from what was learned
- state a conclusion, based on data obtained from investigations, and explain how evidence gathered supports or refutes a hypothesis, prediction or theory

Communication and Teamwork

Students will :

- work collaboratively to develop and carry out investigations
- select and use appropriate numeric, symbolic, graphical and linguistic modes of representation to communicate findings and conclusions
- evaluate individual and group processes used in planning and carrying out investigative tasks