

# Bio 30 Outcome Checklist

## Unit 1: Nervous System

### *Knowledge*

\_\_\_\_\_ I can describe in general terms the structure and function of a neuron and myelin sheath.

\_\_\_\_\_ I can explain how an action potential is formed by electrochemical gradients and how it is transmitted along a neuron.

\_\_\_\_\_ I can explain how a nerve impulse can cross a synapse using neurotransmitters such as norepinephrine, acetylcholine, and enzymes such as cholinesterase.

\_\_\_\_\_ I can differentiate between the somatic and autonomic nervous systems.

\_\_\_\_\_ I can describe the function of the 4 lobes of the cerebrum, the pons, the cerebellum, the medulla oblongata, the hypothalamus, and the spinal cord.

\_\_\_\_\_ I can list several functions of both the parasympathetic and sympathetic nervous systems.

\_\_\_\_\_ I can explain how a reflex works, including the sensory receptor, sensory neuron, interneuron, motor neuron, and effector.

\_\_\_\_\_ I can describe the structure and function of the human eye, including the cornea, lens, sclera, choroids, retina, rods, and cones, fovea centralis, pupil, iris, and optic nerve.

\_\_\_\_\_ I can describe the structure and function of the auditory parts of the ear including the pinna, auditory canal, tympanic membrane, ossicles, cochlea, organ of Corti, and auditory nerve.

\_\_\_\_\_ I can describe the structure and function of the balance related parts of the ear including the semicircular canals, utricle, saccule.

\_\_\_\_\_ I can describe the function of the Eustachian tube.

## **Science, Technology, & Society**

The following do not form part of the required program but are shown merely as examples of science, technology, and society connections to this topic.

\_\_\_\_\_ I can describe in general terms the causes of Alzheimer's and Parkinson's as it relates to the nervous system.

\_\_\_\_\_ I can describe technologies available to correct eye defects such as myopia, hyperopia, and astigmatism

\_\_\_\_\_ I can describe technologies to correct ear defects such as hearing loss and tinnitus

\_\_\_\_\_ I can explain the effect of neurotoxins from snakes, jellyfish etc as they relate to our nervous system

\_\_\_\_\_ I can describe the use of neurotoxins by indigenous peoples

\_\_\_\_\_ I can describe ways in which science has contributed technologies such as electron microscopes, or infrared cameras that increase access to the world beyond normal human sensory limits.

## Unit 2: Endocrine System

### *Knowledge*

\_\_\_\_\_ I understand that the role of the endocrine system is to maintain a constant internal environment in the body (homeostasis)

\_\_\_\_\_ I can identify the location of the principal human endocrine glands including the hypothalamus/pituitary complex, thyroid, parathyroid, adrenal glands, and islet cells of the pancreas.

\_\_\_\_\_ I can describe the function of the following hormones:

- \_\_\_\_\_ Thyroid Stimulating Hormone (TSH) & Thyroxine
- \_\_\_\_\_ Calcitonin & Parathyroid Hormone (PTH)
- \_\_\_\_\_ Adrenocorticotrophic Hormone (ACTH) & Cortisol
- \_\_\_\_\_ Glucagon & Insulin
- \_\_\_\_\_ Human Growth Hormone (hGH)
- \_\_\_\_\_ Antidiuretic Hormone (ADH)
- \_\_\_\_\_ Epinephrine / Adrenaline
- \_\_\_\_\_ Aldosterone
- \_\_\_\_\_ Follicle Stimulating Hormone (FSH)
- \_\_\_\_\_ Leutinizing Hormone (LH)
- \_\_\_\_\_ Prolactin & Oxytocin

\_\_\_\_\_ I can describe how each of the hormones above could be or are controlled through negative feedback.

\_\_\_\_\_ I can describe the role that thyroxine plays in metabolism.

\_\_\_\_\_ I can describe the role that glucagon and cortisol play in blood sugar regulation.

\_\_\_\_\_ I can describe the role hGH has in growth.

\_\_\_\_\_ I can describe the role ADH has in water regulation and the role aldosterone has in sodium ion and water regulation.

\_\_\_\_\_ I can explain how both ADH and Aldosterone can alter the body's blood pressure.

\_\_\_\_\_ I can explain the relationship between the nervous system and the endocrine system and how they can sometimes act together.

*Ex. stress and the adrenal gland – adrenal gland is stimulated by sympathetic nervous system*  
*Ex. Hypothalamus / Pituitary complex*

\_\_\_\_\_ I can describe the physiological consequences of hormone imbalances including:

- \_\_\_\_\_ Diabetes mellitus
- \_\_\_\_\_ *Diabetes insipidus*
- \_\_\_\_\_ *Gigantism / Acromegaly*
- \_\_\_\_\_ *Dwarfism*
- \_\_\_\_\_ *Goitre*
- \_\_\_\_\_ *Cretinism*
- \_\_\_\_\_ *Graves' Disease*

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*The following do not form part of the required program but are shown merely as examples of science, technology, and society connections to this topic.*

\_\_\_\_\_ *I understand that hormones such as Prolactin, HGH, and Insulin can be synthesized to solve medical problems or increase productivity (i.e. more milk from cows), and can evaluate the advantages and disadvantages of these practices*

## Unit 3: Human Reproduction and Development

### *Knowledge*

\_\_\_\_\_ I can identify the structures in the human female reproductive system and describe their function:

- \_\_\_ Ovaries
- \_\_\_ Fallopian Tubes
- \_\_\_ Uterus
- \_\_\_ Endometrium
- \_\_\_ Cervix
- \_\_\_ Vagina

\_\_\_\_\_ I can identify the structure in the male reproductive system and describe their functions:

- \_\_\_ Testes
- \_\_\_ Seminiferous tubules
- \_\_\_ Interstitial Cells
- \_\_\_ Sertoli Cells
- \_\_\_ Epididymides
- \_\_\_ Vasa (ductus) deferentia (vas deferens)
- \_\_\_ Cowper's Glands
- \_\_\_ Seminal Vesicles
- \_\_\_ Prostate Gland
- \_\_\_ Ejaculatory Duct
- \_\_\_ Urethra
- \_\_\_ Penis

\_\_\_\_\_ I can differentiate between sperm and eggs in terms of their supporting structures such as seminiferous tubules, interstitial cells, sertoli cells, follicle, and corpus luteum.

\_\_\_\_\_ I can describe how the Y chromosome causes testosterone to be produced leading to male organ formation, whereas it's absence results in female organ development.

\_\_\_\_\_ I can explain how STI's like Chlamydia, gonorrhea, human papilloma virus etc can interfere with fertility and reproduction.

\_\_\_\_\_ I can describe the role of GnRH, FSH, LH, Estrogen, Progesterone, and testosterone in the regulation of primary and secondary sex characteristics in females and in males.

\_\_\_\_\_ I can identify the principal reproductive hormones involved in the female menstrual cycle and explain how FSH, LH, Estrogen, and Progesterone work together to maintain the menstrual cycle.

\_\_\_\_\_ I can graph the changes in Estrogen, Progesterone, FSH, and LH throughout the menstrual cycle.

\_\_\_\_\_ I can Identify and describe the function of Testosterone, LH, and FSH in human males.

\_\_\_\_\_ I can trace the process from conception to birth including:

- \_\_\_ Fertilization → zygote, gastrulation, blastulation
- \_\_\_ Implantation
- \_\_\_ Extra-embryonic membrane formation
  - \_\_\_ placenta
  - \_\_\_ amnion
  - \_\_\_ chorion
  - \_\_\_ allantois
- \_\_\_ parturition / childbirth & oxytocin

\_\_\_\_\_ I can describe the roles of progesterone, LH, hCG, prostaglandins, and oxytocin in human development (i.e. in the steps above)

\_\_\_\_\_ I can describe the general mechanisms of lactation in human females after childbirth and the role of oxytocin and prolactin.

\_\_\_\_\_ I can describe the main physiological events in human pre-natal development such as neural tube / nervous system development, heart formation, limb formation, sex differentiation as it relates to each trimester.

\_\_\_\_\_ I can identify the major tissues and organs that arise from the ectoderm (nervous system, skin), the mesoderm (skeleton, muscles, reproductive system), and the endoderm (digestive and respiratory systems, endocrine glands)

\_\_\_\_\_ I can describe the influence environmental factors such as maternal lifestyle, alcohol, drugs, and infections can have on embryonic and fetal development – i.e. teratogens

\_\_\_\_\_ I can describe medical technologies such as in vitro fertilization, vasectomy, and infertility drugs.

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\_\_\_\_\_ *I can describe reproductive technologies such as in-vitro fertilization, artificial insemination (animals), and cloning.*

\_\_\_\_\_ *I can describe the use of reproductive hormones in fertility drugs.*

\_\_\_\_\_ *I can describe technologies such as ultrasound, chorionic villus sampling (CVS), amniocentesis, and fetal heart monitoring.*

\_\_\_\_\_ *I understand that certain environmental pollutants such as second hand smoke, PCB's, heavy metals, etc can act as teratogens and lower fertility.*

## Unit 4: Molecular Biology

### *Knowledge*

\_\_\_\_\_ I can describe the contributions that were made by James Watson and Francis Crick to the field of genetics.

\_\_\_\_\_ I can describe the structure of DNA, including the three components of nucleotides, the two families of nitrogen bases, and how the two strands are bonded together.

\_\_\_\_\_ I can describe how a DNA molecule is able to replicate itself semi-conservatively using molecules such as helicase & DNA polymerase.

\_\_\_\_\_ I can describe the differences in DNA synthesis by polymerase in the leading and lagging strands of DNA replication.

\_\_\_\_\_ I understand how a DNA sequence is transcribed into an mRNA sequence of bases using RNA polymerase.

\_\_\_\_\_ I understand how rRNA, tRNA, and mRNA interact to synthesize a polypeptide / protein based on the nucleotide sequence of an mRNA molecule.

\_\_\_\_\_ Given a DNA sequence, I can use the mRNA codon table to identify the amino acid sequence for which it codes.

\_\_\_\_\_ I can demonstrate how a random change (mutation) in the DNA sequence can result in abnormalities and provide a source of genetic variability (good or bad).

\_\_\_\_\_ I understand and can demonstrate the range of consequences of genetic mutations (severe, moderate, silent, advantageous).

\_\_\_\_\_ I can explain how, in general, restriction enzymes cut DNA molecules into smaller fragments based on a specific nucleotide sequence, leaving "sticky ends".

\_\_\_\_\_ I understand the purpose and function of ligases.

\_\_\_\_\_ I can explain how restriction enzymes, ligases, and other DNA technology can be used to transform cells by inserting new DNA or genes into their genome.

\_\_\_\_\_ I can explain how the sequence of nitrogen bases in DNA can give evidence for the relationships among organisms of different species.

\_\_\_\_\_ I understand that very small amounts of DNA are found in chloroplasts and mitochondria and can be used to help trace inheritance.

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\_\_\_\_\_ *I can identify and assess human and environmental concerns that may arise from genetic biotechnology.*

- ex. corporations patenting genes for herbicide resistance*
- ex. the use of transgenic organisms like "golden rice", insulin producing bacteria, or goats producing silk in their milk!*
- ex. cloning trees for replantation in the forest industry*

\_\_\_\_\_ *I can give examples and explain how scientific research and the progression of technology can benefit humans, the economy, and the environment.*

- ex. Benefits of gene replacement therapy for human genetic disorders*
- ex. Transformation of agricultural crops & animals*
- ex. Using DNA to identify relationships between or within species (i.e to study evolution, identify biological parents, or match suspects to DNA left at a crime scene)*



## Unit 5: Cell Division & Classical Genetics

### ***Knowledge***

\_\_\_\_\_ I can explain the meaning of haploidy, diploidy, and polyploidy

\_\_\_\_\_ I can explain the steps of the cell cycle including interphase, prophase, metaphase, anaphase, and telophase / cytokinesis

\_\_\_\_\_ I can differentiate and compare the processes of mitosis and meiosis in terms of their purpose, as well as the major steps involved in each.

\_\_\_\_\_ I can describe the difference between metaphase of mitosis, and metaphase of meiosis I.

\_\_\_\_\_ I can describe the process of crossing over and evaluate its significance to organisms inheritance.

\_\_\_\_\_ I can describe the process of nondisjunction and identify disorders such as Turner & Down Syndrome that occur as a result.

\_\_\_\_\_ I can explain how both fraternal and identical offspring are formed in a single birthing event.

\_\_\_\_\_ I can identify and describe some of the diversity of reproductive strategies by comparing the alternation of generations in organisms such as *Daphnia*, *sea anemones*, *moss*, *pine trees* etc.

\_\_\_\_\_ I can describe the evidence Mendel obtained for dominance, segregation, and the independent assortment of genes on different chromosomes.

\_\_\_\_\_ I can calculate & compare ratios and probabilities of genotypes and phenotypes for genetic crosses with the following inheritance patterns:

- \_\_\_\_\_ Dominant / Recessive
- \_\_\_\_\_ Multiple Dominance
- \_\_\_\_\_ Incomplete Dominance
- \_\_\_\_\_ Codominance
- \_\_\_\_\_ Sex-Linked (Morgan)
- \_\_\_\_\_ Multihybrid

\_\_\_\_\_ I can describe the effect that linked genes have on crossing over have on the variability of organisms.

\_\_\_\_\_ I understand that traits can be controlled by one pair of genes (*Rh factor*), or they may be controlled by many genes (ex. *skin colour, height*)

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\_\_\_\_\_ *I understand that mitosis & biotechnology can be used to regenerate whole, damaged, or missing parts or organisms (stem cells, skin tissue)*

\_\_\_\_\_ *I can describe how errors in the cell cycle can lead to cancer.*

\_\_\_\_\_ *I understand how genetic counseling can be helpful in family planning and preparation by identifying and possibly treating disorders such as phenylketonuria, cystic fibrosis etc through germ cell modification.*

\_\_\_\_\_ *I can identify advantages, disadvantages and examples of the use of genetic crosses to develop specific plant hybrids (wheat, corn etc)*

## Unit 6: Populations and Community Dynamics

### *Knowledge*

\_\_\_\_\_ I can describe what is meant by "gene pool"

\_\_\_\_\_ I can list the 5 conditions that are required for a Hardy-Weinberg equilibrium and can explain how the gene pool changes if each condition is not met.

\_\_\_\_\_ I understand the meaning of, and can describe factors that cause the gene pool to change:

- \_\_\_\_\_ Natural Selection
- \_\_\_\_\_ Genetic Drift
- \_\_\_\_\_ Gene Flow
- \_\_\_\_\_ Nonrandom mating
- \_\_\_\_\_ Bottleneck effect
- \_\_\_\_\_ Founder effect
- \_\_\_\_\_ Migration
- \_\_\_\_\_ Mutation

\_\_\_\_\_ I can use the HW equation to determine allele and genotype frequencies using  $p+q=1$  and  $p^2 + 2pq+q^2=1$

\_\_\_\_\_ I can describe how interactions between predators and prey and between producers and consumers can alter populations.

\_\_\_\_\_ I can describe commensalisms, mutualism, and parasitism.

\_\_\_\_\_ I understand the difference between interspecific and intraspecific competition and can predict how both will affect populations.

\_\_\_\_\_ I can explain how organisms defend themselves from competition using mimicry, protective coloration, toxins, and modified behaviours.

\_\_\_\_\_ I can explain how / why mixtures of populations may change over time from a climax community through different stages of succession.

\_\_\_\_\_ I know what the terms mortality, natality, immigration, and emigration mean in terms of population size / growth.

\_\_\_\_\_ I can describe a population's size & growth using the following terms: carrying capacity, biotic potential, environmental resistance

\_\_\_\_\_ I can calculate a population's growth rate ( $gr$ ), per capita growth rate ( $cgr$ ) and population density ( $Dp$ ).

\_\_\_\_\_ I can explain the differences between a logistic growth pattern (S curve) and an exponential growth pattern (J curve)

\_\_\_\_\_ I can explain the difference between an open and closed populations.

\_\_\_\_\_ I can list some of the major differences between r-selected and k-selected organisms.

## **Science, Technology, & Society**

*The following do not form part of the required program but are shown merely as examples of science, technology, and society connections to this topic.*

\_\_\_\_\_ *I can describe examples where human technology and development has both positive and negative consequences:*

*Ex. Introduction of exotic species into new ecosystems*

*Ex. Ecological reserves to preserve gene pool (chickens)*

*Ex. Suggest strategies to counteract the bottleneck effect in whooping cranes or swift foxes*

*Ex. Use of gene banks for plants – why have them?*

*Ex. Assess habitat loss & human responsibility*

\_\_\_\_\_ *I can explain why Canadian society supports scientific research and technological development to facilitate a sustainable society, economy, and environment:*

*Ex. public funding & support for wildlife research & management*

*Ex. public funding for national park research*

*Ex. Wildlife management techniques used by aboriginals*

*Ex. Fire control / prevention implications*