Connecticut Science 9-10 & Biology
Contents Standards Mapping

BIOLOGY	Boardworks High School Biology Presentation
Grade 10 - Strand IV: Cell Chemistry and Biotechnology	
10.1 - Fundamental life processes depend on the physical structure and the chemical activities of the cell.	
i) Most of the chemical activities of the cell are catalyzed by enzymes that function only in a narrow range of temperature and acidity conditions.	Body Temperature Enzymes Homeostasis
ii) The cellular processes of photosynthesis and respiration involve transformation of matter and energy.	Aerobic Respiration Anaerobic Respiration Carbon Cycle Nitrogen Cycle Photosynthesis 1 Photosynthesis 2
10.2 - Microorganisms have an essential role in life processes and cycles on Earth.	
i) Understanding the growth and spread patterns of viruses and bacteria enables the development of methods to prevent and treat infectious diseases.	Antibodies and Vaccination HIV and AIDS Infectious Diseases Tuberculosis
10.3 - Similarities in the chemical and structural properties of DNA in all living organisms allow the transfer of genes from one organism to another.	
i) The principles of genetics and cellular chemistry can be used to produce new foods and medicines in biotechnological processes.	Genetic Engineering Genetic Engineering for Health Care GM Organisms
Strand V: Genetics, Evolution and Biodiversity	
10.4. - **In sexually reproducing organisms, each offspring contains a mix of characteristics inherited from both parents.**	
i) Genetic information is stored in genes that are located on chromosomes inside the cell nucleus.	DNA Genes and Alleles Nucleic Acids
ii) Most organisms have two genes for each trait, one on each of the homologous chromosomes in the cell nucleus.	Genes and Alleles

10.5 - Evolution and biodiversity are the result of genetic changes that occur over time in constantly changing environments.	
i) Mutations and recombination of genes create genetic variability in populations.	Genetic Mutations Genetic Variation Meiosis Population Genetics
ii) Changes in the environment may result in the selection of organisms that are better able to survive and reproduce.	Environmental Variation Evolution The Process of Evolution
10.6 - Living organisms have the capability of producing populations of unlimited size, but the environment can support only a limited number of individuals from each species.	
i) Human populations grow due to advances in agriculture, medicine, construction and the use of energy.	Describing Populations Human Populations Human Impact on the Environment
ii) Humans modify ecosystems as a result of rapid population growth, use of technology and consumption of resources.	Human Impact on the Environment Loss of Diversity

HIGH SCHOOL BIOLOGY	
Cell Biology	
a) The fundamental life processes of plants and animals depend on a variety of chemical reactions that occur in specialized areas of the organism's cells.	
i) Cells are enclosed within semipermeable membranes that regulate their interaction with their surroundings.	Organelles The Fluid Mosaic Model
ii) Enzymes are proteins that catalyze biochemical reactions without altering the reaction equilibrium and the activities of enzymes depend on the temperature, ionic conditions and the pH of the surroundings.	Enzymes
iii) Prokaryotic cells, eukaryotic cells (including those from plants and animals), and viruses differ in complexity and general structure.	Prokaryotic Cells Eukaryotic Cells HIV and AIDS
iv) The central dogma of molecular biology outlines the flow of information from transcription of ribonucleic acid (RNA) in the nucleus to translation of proteins on ribosomes in the cytoplasm.	Controlling Protein Synthesis Transcription and Translation
v) The endoplasmic reticulum and Golgi apparatus have a role in the secretion of proteins.	Eukaryotic Cells Organelles Prokaryotic Cells
vi) Usable energy is captured from sunlight by chloroplasts and is stored through the synthesis of sugar from carbon dioxide.	Photosynthesis 2

vii) The role of the mitochondria is to make stored chemical-bond energy available to cells by completing the breakdown of glucose to carbon dioxide.	Aerobic Respiration Eukaryotic Cells
viii) Most macromolecules (polysaccharides, nucleic acids, proteins, lipids) in cells and organisms are synthesized from a small collection of simple precursors.	Lipids Nucleic Acids Polysaccharides Proteins
Genetics	
a) Mutation and sexual reproduction lead to genetic variation in a population.	
i)Meiosis is an early step in sexual reproduction in which the pairs of chromosomes separate and segregate randomly during cell division to produce gametes containing one chromosome of each type.	Meiosis The Stages of Meiosis
ii) Only certain cells in a multicellular organism undergo meiosis.	Meiosis
iii) Random chromosome segregation explains the probability that a particular allele will be in a gamete.	Genetic Variation Meiosis The Stages of Meiosis
iv) New combinations of alleles may be generated in a zygote through the fusion of male and female gametes (fertilization).	Genetic Variation Meiosis
v) Approximately half of an individual's DNA sequence comes from each parent.	Genetic Variation
vi) Genes on specific chromosomes determine an individual's sex.	Boy or Girl
vii) Possible combinations of alleles in a zygote can be predicted from the genetic makeup of the parents.	Genes and Alleles Genetic Variation Patterns of Inheritance
b) A multicellular organism develops from a single zygote, and its phenotype depends on its genotype, which is established at fertilization.	
i) The probable outcome of phenotypes in a genetic cross can be predicted from the genotypes of the parents and mode of inheritance (autosomal or X-linked, dominant or recessive).	Genes and Alleles Incomplete Dominance and Co-Dominance Patterns of Inheritance
ii) Mendel's laws of segregation and independent assortment are the basis of genetics.	Gregor Mendel
iii) The probable mode of inheritance can be predicted from a pedigree diagram showing phenotypes.	Patterns of Inheritance
iv) Data on frequency of recombination at meiosis can be used to estimate genetic distances between loci and to interpret genetic maps of chromosomes.	–
c) Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.	
i) Ribosomes synthesize proteins, using tRNAs to translate genetic information in the mRNA.	Controlling Protein Synthesis Transcription and Translation

ii) The sequence of amino acids in a protein can be predicted from the sequence of codons in the RNA, by applying universal genetic coding rules.	Controlling Protein Synthesis Protein Synthesis Transcription and Translation
iii) Mutations in the DNA sequence of a gene may or may not affect the expression of the gene or the sequence of amino acids in an encoded protein.	DNA Replication 2 Genetic Mutations
iv) Specialization of cells in multicellular organisms is usually due to different patterns of gene expression rather than to differences of the genes themselves.	Controlling Protein Synthesis Cell Differentiation
v) Proteins can differ from one another in the number and sequence of amino acids.	Proteins
vi) Proteins having different amino acid sequences typically have different shapes and chemical properties.	Proteins
d) The genetic composition of cells can be altered by incorporation of exogenous DNA into the cells.	
i) Base-pairing rules are used to explain the precise copying of DNA during semiconservative replication and transcription of information from DNA into mRNA.	Controlling Protein Synthesis DNA Replication 2 Transcription and Translation
ii) Genetic engineering (biotechnology) is used to produce novel biomedical and agricultural products.	Genetic Engineering Genetic Engineering for Health Care GM Organisms
iii) DNA technology (restriction digestion by endonucleases, gel electrophoresis, ligation and transformation) is used to construct recombinant DNA molecules.	Genetic Engineering
iv) Exogenous DNA can be inserted into bacterial cells to alter their genetic makeup and support expression of new protein products.	Genetic Engineering
Ecology	
a) Stability in an ecosystem is a balance between competing effects.	
i) Biodiversity is the sum total of different kinds of organisms and is affected by alterations of habitats.	Introduction to Biodiversity
ii) Changes in an ecosystem can result from changes in climate, human activity, introduction of nonnative species, or changes in population size.	Ecosystems Loss of Diversity Human Impact on the Environment
iii) Fluctuations in population size in an ecosystem are determined by the relative rates of birth, immigration, emigration and death.	Describing Populations
iv) Water, carbon and nitrogen cycle between abiotic resources and organic matter in the ecosystem and oxygen cycles through photosynthesis and respiration.	Aerobic Respiration Carbon Cycle Nitrogen Cycle Photosynthesis 2 Water Cycle
v) A vital part of an ecosystem is the stability of its producers and decomposers.	Food Webs Decomposers

vi) At each link in a food web some energy is stored in newly made structures, but much energy is dissipated into the environment as heat.	Energy Transfer in Food Chains Energy Loss in Food Chains
vii) The accommodation of an individual organism to its environment is different from the gradual adaptation of a lineage of organisms through genetic change.	Animal Adaptations Evolution The Process of Evolution
Evolution	
a) The frequency of an allele in a gene pool of a population depends on many factors and may be stable or unstable over time.	
i) Natural selection acts on the phenotype rather than the genotype of an organism.	Evolution The Process of Evolution
ii) Alleles that are lethal in a homozygous individual may be carried in a heterozygote and thus maintained in a gene pool.	Inherited Diseases
iii) New mutations are constantly being generated in a gene pool.	Genetic Mutations
iv) Variation within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.	The Process of Evolution
b) Evolution is the result of genetic changes that occur in constantly changing environments.	
i) Natural selection determines the differential survival of groups of organisms.	Evolution The Process of Evolution
ii) A great diversity of species increases the chance that at least some organisms survive major changes in the environment.	The Process of Evolution
iii) Genetic drift affects the diversity of organisms in a population.	Population Genetics
iv) Reproductive or geographic isolation affects speciation.	Population Genetics
v) Fossil evidence contributes to our understanding of biological diversity, episodic speciation and mass extinction.	Fossil Record
vi) Several independent molecular clocks, calibrated against each other and combined with evidence from the fossil record, can help to estimate how long ago various groups of organisms diverged evolutionarily from one another.	–
Physiology	
a) As a result of the coordinated structures and functions of organ systems, the internal environment of the human body remains relatively stable (homeostatic) despite changes in the outside environment.	
i) The complementary activity of major body systems provides cells with oxygen and nutrients and removes toxic waste products such as carbon dioxide.	Blood and Blood Vessels Digestion The Respiratory System Ventilation

ii) The nervous system mediates communication between different parts of the body and the body's interactions with the environment.	Controlling Movement Nerve Impulses The Brain The Nervous System
iii) Feedback loops in the nervous and endocrine systems regulate conditions in the body.	Homeostasis The Endocrine System
iv) The neurons transmit electrochemical impulses.	Nerve Impulses The Nervous System
v) Sensory neurons, interneurons and motor neurons all have a role in sensation, thought and response.	Nerve Impulses The Nervous System
vi) Digestion includes the secretion of stomach acid, digestive enzymes (amylases, proteases, nucleases, lipases) and bile salts into the digestion system.	Digestion
vii) The kidneys have a homeostatic role in the removal of nitrogenous wastes from the blood.	The Kidneys
viii) The liver has a homeostatic role in detoxification and keeping the blood glucose balance.	Glucoregulation
ix) Actin, myosin, Ca_2 and ATP have a role in the cellular and molecular basis of muscle contraction.	Sliding Filament Theory
x) Hormones (including digestive, reproductive, osmoregulatory) provide internal feedback mechanisms for homeostasis at the cellular level and in whole organisms.	Female Reproductive System Glucoregulation Hormones Homeostasis The Endocrine System The Kidneys
b) Organisms have a variety of mechanisms to combat disease.	
i) The skin provides nonspecific defenses against infection.	Infectious Diseases
ii) Antibodies have a role in the body's response to infection.	Antibodies and Vaccination
iii) Vaccination protects an individual from infectious diseases.	Antibodies and Vaccination Vaccinations
iv) There are important differences between bacteria and viruses with respect to their requirements for growth and replication, the body's primary defenses against bacterial and viral infections, and effective treatments of these infections.	HIV and AIDS Immune Responses Immune System Tuberculosis
v) An individual with a compromised immune system (for example, a person with AIDS) may be unable to fight off and survive infections by microorganisms that are usually benign.	HIV and AIDS
vi) Phagocytes, B-lymphocytes and T-lymphocytes have a role in the immune system.	Immune Responses