GREAT NECK PUBLIC SCHOOLS

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Honors Biology Profile

Department	Science		
Course Name	Honors Biology		
Course Length	1 year		
High School Credits	1 unit of credit		
Description	An enriched and more quantitatively oriented course emphasizing the molecular, anatomical and ecological aspects of Biology. The course is designed for those students who are going to pursue careers in science, or qualified students who wish for an intellectual challenge. All students will be expected to take the Biology Regents examination in June. Class daily plus lab alternate days.		
Target/eligible students	Great Neck South: 9th-grade students meeting the following criteria: Earth Science Regents greater than or equal to 95-course average, Earth Science Regents Exam score must be greater than or equal to 94, and must receive a recommendation by Middle School Science Department Great Neck North: Any student who has completed Honors Chemistry with strong marks and strong student behaviors can be recommended for Honors Biology. Students who have shown exemplary performance in Chemistry Regents can also be recommended for Honors Biology.		
State Learning Standards Link(s)	NYS Science Learning Standards HS. Structure and Properties of Matter HS. Chemical Reactions H.S. Energy HS. Waves and Electromagnetic Radiation H.S Structure and Function H.S Matter and Energy in Organisms and Ecosystems HS. Interdependent Relationships in Ecosystems HS. Inheritance and Variation of Traits HS. Natural Selection and Evolution HS. Earth's Systems H.S Weather and Climate HS. Human Sustainability HS. Engineering Design		 pg 54 pg 56 pg 60 pg 62 pg 64 pg 65 pg 67 pg 69 pg 71 pg 77 pg 79 pg 81 pg 83
Primary texts and materials	Campbell Biology Concepts & Connections by Reece, Taylor, et al.		
Scope/Sequence			
Unit 1: Exploring Life and Scientific Method	LS1.A, LS2.B Science and Engineering Practices: Developing and Using Models, Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Engaging in Argument from Evidence, Obtaining,	In order to study life, one should begin by defining "life" at the scientific level. This includes utilizing the cell theory to find the basic functions of all life on the planet - reducing traits to include all life on Earth - universal life functions. To substantiate the list, the scientific method/experimental design will be studied/used. ● characteristics of life ● life functions ● cell types and classification (kingdoms of life)	pg 64 pg 65 pg 54-83

	Evaluating, and Communicating Information	● the process of science and testing hypotheses ● structure/function as it relates to natural selection	
Unit 2: Chemistry of Life	PS1.A, PS1.B, LS1.C LS3.A, ESS2.C	Dynamic matter is life - a look at how atoms make up the basic unit of life (the cell) will be introduced. The importance of the structure and functions of particular molecules will be studied. This will be followed by a look at the four organic molecules that keep a cell functioning. ● Atomic Structure (Bohr Model) ● Periodic Table (basic organization/use) ● Bonding (covalent/ionic/hydrogen) ● Properties of Water ● Acids/Bases/pH ● 4 Organic Compounds: carbohydrates, proteins, lipids, nucleic acids (structure/function/properties) ● Enzymes, factors affecting enzyme reaction rates ● Dehydration/Hydrolytic Reactions	pg 54 pg 56 pg 65 pg 69 pg 77
Unit 3: Life of the Cell	LS1.A	Students will explore the structures that make up the basic unit of life, the cell. Incorporating dynamic processes - active and passive transport - students will learn how the cell maintains homeostasis on a cellular level by maintaining life functions using materials from the environment. From the simple cell (prokaryote) to the eukaryote, universal knowns will be identified and their differences will be explored ● Microscope structure and function ● Prokaryote v. Eukaryote ● Cell Structures/Organelles and functions ● Plant v. Animal Cell Differentiation ● Cell Membrane: role/function ● Transport in/out/around the cell	pg 64

Unit 4 :Energy	PS3.A, PS3.B, PS4.B, LS1.C,LS2.B, PS3.D	Defining energy and explanation of energy transformations
		● Endergonic vs exergonic reactions
		● Kinetic vs. potential energy (chemical)
		● ATP synthesis
		● Photosynthesis
		  ○ chemical equation, light dependent vs. independent reactions, leaf structure, pigments, wavelengths of light, environmental adaptations
		● Cellular Respiration
		  ○ chemical equation, three steps of aerobic respiration: Glycolysis, Kreb's Cycle, Oxidative Phosphorylation; aerobic vs. anaerobic respiration
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Unit 5: Cell Reproduction and Genetics	LS1.A, LS1.B, LS3.A, LS3.B	The perpetuation of life is controlled through the dividing cell using two distinct pathways: mitosis and meiosis. The role and general mechanism of each is studied. ● Mitosis: purpose and overall purpose of the phases will be studied ● Meiosis: purpose and overall purpose of the phases will be studied ● Human Life Cycle Diagram	pg 64 pg 69 pg 70

		● Differentiate terms: chromatin, chromosome, chromatid, homologous chromosomes, centrosome, centromere, haploid, diploid ● Utilizing mathematical applications, students will predict outcomes given certain Mendelian principles. Exceptions to those principles will also be studied. Using such principles can be applied to problem-solving techniques by way of biotechnology and selective breeding. ● Mendelian Genetics: using Punnett squares and probability to make predictions, laws of dominance, segregation, independent assortment ● Other key terms: allele, dominant, recessive, cross, homo/heterozygous, homologous, karyotype ● Exceptions to Mendel: codominance, incomplete dominance, multiple alleles, polygenic, pleiotropy, briefly touched upon: epigenetics ● Nature v. Nurture: role of environment on genetic expression The central dogma of biology - DNA to RNA to Protein - will be described and modeled. Its application to current biotechnological techniques will also be discussed. ● DNA: structure/function ● RNA: structure/function/types ● Transcription ● Translation ● Protein building revisited (see unit 3) ● Mutations types/effects: missense, nonsense, frameshifts, chromosomal ● Biotechnology: applying our knowledge to solve problems ○ Gel electrophoresis: purpose, set up, hands-on application ○ PCR: purpose and uses ○ Recombinant DNA ○ Restriction Enzymes	
<u>Unit 6: Concepts of Evolution</u>	LS2.D; LS4.D; LS3.B; LS4.A; LS4.B; LS4.C	The concept of structure and function is solidified here as students learn why populations appear to show higher frequencies of one trait over another. Misconceptions and modes of evolution will be discussed with a focus on adaptation by means of natural selection. ● Evolution: building a definition using history ● Evidence for Evolution ● Modes of Evolution ○ Mutations and sexual reproduction produce genetic variations ● Building and reading evolutionary trees ● Misconceptions and the nuisance within terminology ● Physical, Chemical, Behavioral Adaptations ● Resistance as evidence of Natural Selection	pg 67 pg 69 pg 71 pg 72
<u>Unit 7: Ecology</u>	LS2.B; PS3.D; LS2.A:	Cells arise and are dependent upon other cells to exist. At the macro level, this interdependency can be witnessed by studying food chains, nutrient cycling and the calamity caused	pg 65 pg 66 pg 67

	LS2.C; LS4.D; ETS1.B;
	ESS2.D;
	ESS3.D; ESS3.A; ESS3.C;
	ETS1.A;
	ETS1.C
		by unchecked species. The dynamics of competition, niche, and symbiotic relationships are covered.
		● Population: limiting factors (density indep/dep.), growth models, human population through time, carrying capacity
		● Community: food chain/web, inter/intra-competition, niche, symbiosis,predator-prey, keystone species, energy flow, nutrient cycling, biomagnification, trophic pyramid (10% rule)
		● Ecosystem/Biosphere: ecological succession, climate change, ozone, types of pollution
		  ○ Nuclear Energy, renewable and non-renewable energy
		  ○ Viable solutions to ecological problems: cost/benefit/trade-off
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<u>Unit 8: Human Body</u>	LS1.A; LS1.B; LS3.B	Humans are complex organisms. They require multiple systems to interact to perform life functions. If there is a disruption in any human system, there may be a corresponding imbalance in homeostasis. Alongside the structure and function, various diseases/disorders will be discussed/researched in each of the following human body systems:
		● digestive system
		  ○ Pathway of nutrients from ingestion, absorption, to elimination, digestive organs vs. accessory organs, specific enzymes involved, mechanical vs. chemical digestion
		● circulatory system
		  ○ Pathway of blood through the heart, role of blood vessels (veins, arteries and capillaries), components of blood, explanation of blood pressure, heart rate, and blood types
		● respiratory system
		  ○ Pathway of air containing oxygen from the environment to the alveoli, gas exchange, effect of exercise/altitude on breathing rate, function of the diaphragm and concept of negative pressure breathing
		● excretory system
		  ○ Function of the lungs, skin, and urinary system in removal of metabolic waste, emphasis of the nephron as the functional unit of the kidney
		● immune system
		  ○ Role of the first, second and third lines of defense in protecting against foreign invaders, antibodies, antigens, types of white blood cells, blood clotting, active vs. passive immunity, vaccines, allergies
		● nervous system
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		○ Central vs. peripheral nervous system, structure and function of a neuron, role of neurotransmitters, reflex arc ● endocrine system ○ Endocrine glands of the human body and function of corresponding hormones, role of the hypothalamus in connection to the nervous system, role of receptors in cell communication, role of hormones in regulating the reproductive system, positive vs. negative feedback ● reproductive system & development ○ Structures and functions of the male and female reproduce systems, pathway of sperm from production to fertilization, pathway of egg from production to fertilization, location of fertilization and implantation, phases of the menstrual cycle, stages of embryonic and fetal development, cell division and differentiation, structure and function of the placenta and umbilical cord, effect of drugs and alcohol on fetal development	
<u>Additional Notes</u>	NYSED: "Critical to understanding science concepts is the use of scientific inquiry to develop explanations of natural phenomena. Therefore, as a prerequisite for admission to the Regents examination in the Living Environment, students must have successfully completed 1200 minutes of laboratory experience with satisfactory written reports for each laboratory investigation." *The sequence of units may vary.		