

Center for Talented Youth
Fast Paced High School Biology
 Course Outline and Lab Activity Form

Session	Topics (including activities and demonstrations)	Equipment Needs
Sunday, July 18th		
Evening	Pre-Test	
Monday, July 19th: Biochemistry		
Morning	<p><u>Introduction</u></p> <ul style="list-style-type: none"> ▪ Endangered Species Icebreaker ▪ Classroom Culture <ul style="list-style-type: none"> ○ Safety First ○ On-task Freedom ○ Respect ▪ Supplies <ul style="list-style-type: none"> ○ Binder for Portfolio <ul style="list-style-type: none"> ▪ Notes (and lecture handouts) ▪ Lab Write Ups ▪ Quizzes ▪ Assessments <ul style="list-style-type: none"> ○ Pre/Post Tests ○ Mastery Learning (The 20 Quizzes) <p><u>Lecture: The Octet Model of Bonding</u></p> <ul style="list-style-type: none"> ▪ <i>Activity:</i> The Sticky Tape (Ben Franklin's positives and negatives) ▪ Structure of the Atom (Ben Franklin applied to atoms) <ul style="list-style-type: none"> ○ An atom's quest to be "happy" ○ Shells ▪ Periodic Trends in Bonding <ul style="list-style-type: none"> ○ Electronegativity ○ Ionic, Polar, Non-polar, Covalent ▪ The Lewis Model of Bonding <p><u>Cluster group: Design these molecules</u></p> <p><u>Lecture: The Story of Judith Taylor (Structure & Fxn of Macromolecules)</u></p> <ul style="list-style-type: none"> ▪ <i>Demonstration:</i> Hydrophobic Sand ▪ Reactions: Dehydration Synthesis and Hydrolysis ▪ <i>Demonstration:</i> Like dissolves like (acetone and packing peanuts) 	<p><u>The Sticky Tape</u> Two pieces of scotch tape (about a foot long) stuck together with a "tab". Each piece is labeled "top" or "bottom".</p> <p><u>Hydrophobic Sand</u> (65694-00) One 2 L beaker of water</p> <p><u>Like Dissolves Like</u> Every station should have 1 50mL beaker of water and 1 50mL beaker of acetone. In addition, a pile of Styrofoam packing peanuts at each station.</p>
Afternoon	<p><u>The Scientific Method</u></p> <ul style="list-style-type: none"> ▪ Scientific Thinking ▪ <i>Demonstration:</i> Food coloring in milk ▪ Introduce the concept of experimental design (IV, DV, control, constants, hypothesis) through the <i>Paper Airplane Lab</i> <p><u>Building Macromolecules</u></p>	<p>Whole milk Food coloring Beaker (500mL) Ethanol (250 mL) (95064-05:) Ice cubes Macromolecule building set (45381-50:)</p>

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Evening	<p><u>Mastery Quiz #1*</u></p> <ul style="list-style-type: none"> Chapter 2: The Chemistry of Life (except 2-4) (pg 57 #1-25 and pg 59 #1-10) Above lecture <p><u>Mastery Quiz #2*</u></p> <ul style="list-style-type: none"> Chapter 7: Cell Structure and Function (except 7-3) <p><u>Demonstration Preparation:</u></p> <ul style="list-style-type: none"> Cucumbers in Salt Water and Distilled Water 	<p>Cucumbers</p> <p>Salt Water</p> <p>Distilled Water</p>
Tuesday, July 20th: The Cell		
Morning	<p><u>Discussion: The Cell</u></p> <ul style="list-style-type: none"> Prokaryotes vs. Eukaryotes Plant cells vs. Animal Cells Endo-membrane System <p><u>Lecture: Structure & Function of the Cell Membrane</u></p> <ul style="list-style-type: none"> <i>Demonstration:</i> Cologne Diffusion Passive vs. Active Transport <i>Demonstration:</i> Osmosis with Cucumbers (Introduce hypertonic and hypotonic) Water Potential $\Psi = \Psi_p + \Psi_s$ (-iCRT) <p><u>Set-Up Lab: Osmosis and Water Potential</u></p> <ul style="list-style-type: none"> What effect does increasing the concentration of solution in a dialysis tube have on the percent change in mass of the tube? Using 6 prepared solutions, determine the water potential of a potato. Lab will be analyzed tomorrow afternoon <p><u>Chapter 10: Cell Growth and Division</u></p> <ul style="list-style-type: none"> <i>Activity:</i> Mitosis Flash Cards 	<p><u>Cologne Diffusion</u> Cheap Cologne or air freshener</p> <p><u>Osmosis Demonstration</u> Last night, students placed cucumbers in two different solutions (salt water and dH₂O)</p> <p><u>Mitosis Flash Cards</u> Index Cards Colored Pencils</p> <p><u>Osmosis and Diffusion Kit</u> (45641-08) Set-Up Procedure in the kit. Will need 6 1-Liter bottles to make solutions. Also will need knives and potatoes. Apparatus needed: electronic balance.</p>
Afternoon	<p><u>Lecture: Protein Structure & Function</u></p> <ul style="list-style-type: none"> <i>Warm-Up:</i> Dehydration Synthesis Primary Structure of Proteins <i>Demonstration:</i> Toobers and Protein Folding Secondary, Tertiary and Quaternary Structures Protein Functions <p><u>Lab: Mitosis Microscopy Lab</u></p> <p><u>Lab: Cheek Cell Lab (if time permits)</u></p>	<p><u>Cells Observation</u> Each lab station should have 2 microscopes and slides of various cells.</p> <p><u>Prepared Slides of Onion root tips</u> (45643-08) Microscopes (400x power or oil immersion?).</p> <p>Need slides of different types of cells.</p>
Evening	<p><u>Mastery Quiz #3*:</u></p> <ul style="list-style-type: none"> Chapter 7-3: Movement through the Membrane Structure and Function of the Cell Membrane <p><u>Mastery Quiz #4*:</u></p> <ul style="list-style-type: none"> Protein Structure and Function Chapter 10: Cell Growth and Division <p><u>Mastery Quiz #5:</u></p> <ul style="list-style-type: none"> Chapter 3: The Biosphere Chapter 6: Humans in the Biosphere 	

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Wednesday, July 21th: Energy		
Morning	<p style="text-align: center;"><u>NEW UNIT: Energy</u></p> <p><u>Video:</u> Magic School Bus: The Digestive System</p> <p><u>Lecture:</u> Thermodynamics</p> <ul style="list-style-type: none"> ▪ 1st Law of Thermodynamics (Conservation of Energy) ▪ 2nd Law of Thermodynamics (Entropy) ▪ Gibb’s Free Energy ▪ $\Delta G = \Delta H - T\Delta S$ ▪ Anabolic vs. Catabolic Reactions ▪ Exergonic vs. Endergonic Reactions (ATP and coupled reactions) <p><u>Lecture:</u> Enzymes and Catalysis</p> <ul style="list-style-type: none"> ▪ Enzymes ▪ <i>Demonstration:</i> Old Foamey ▪ <i>Demonstration:</i> Dollarbillase <p><u>Activity:</u> Toothpickase</p> <p><u>Lecture:</u> Energy Transfer</p> <ul style="list-style-type: none"> ▪ Energy Flow in an Ecosystem ▪ Energy Transfer Processes <ul style="list-style-type: none"> • Photosynthesis • Cellular Respiration 	<p><u>Old Foamey Kit</u> (45608-00)) Will need a 100mL graduated cylinder and food coloring. Place a tray beneath the cylinder so that the foam doesn’t get on the table.</p> <p><u>The effect of temperature on the human enzyme toothpickase</u> Toothpicks Bucket of ice water</p>
Afternoon	<p><u>Lab:</u> Finish Osmosis Lab Discuss results and graph. Allow time for students to make a conclusion statement.</p> <p><u>Lab:</u> Finish Water Potential Lab Discuss results and graph. (Apply the terms: hypertonic, isotonic and hypotonic)</p> <p><u>Lecture:</u> Transpiration and the properties of water</p> <ul style="list-style-type: none"> ▪ The ascent of xylem sap depends mainly on transpiration and the physical properties of water. ▪ <i>Demonstration:</i> Water drops on a penny ▪ Differences in water potential drive water transport in plant cells. ▪ Transpiration – Cohesion – Tension Mechanism 	<p><u>Water drops on a penny</u> Contest of how many drops of water can fit on a penny. Need: Pennies Water dropper</p>
Evening	<p><u>Mastery Quiz #6*:</u> Energy Chapter 2-4: Chemical Reactions and Enzymes (pgs. 49-53) Chapter 8-1: Energy and Life (pgs. 201-203) Chapter 3-2: Energy Flow (pgs. 67-73) Chapter 38-1: Food and Nutrition (pgs. 971-976)</p> <p><u>Mastery Quiz #7*:</u> Osmosis and Diffusion lab Enzymes and Catalysis (including lab)</p>	

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Thursday, July 22nd: Energy Transfer		
Morning	<p><u>Lecture: Photosynthesis</u></p> <ul style="list-style-type: none"> ▪ <i>Activity:</i> Science as a Process using clues to the discovery of photosynthesis ▪ The Light Reactions ▪ <i>Demonstration:</i> Photoexcitation ▪ The Calvin Cycle ▪ Evolutionary Adaptations (C3, C4 and CAM Plants) <p><u>Activity: Pigment Chromatography Lab</u></p> <p><u>Chapter 8: Photosynthesis</u></p>	<p><u>Science as Process of Photosynthesis</u> Using clues from past discoveries, students will attempt to explain how photosynthesis works.</p> <p><u>Photoexcitation</u> Extract chlorophyll pigments with ethanol from spinach leaves. Illuminate pigments with UV lamp.</p> <p><u>Pigment Chromatography and Photosynthesis Kit (45644-08)</u> Ethanol</p>
Afternoon	<p><u>Lab: Rate of Photosynthesis</u></p> <p><u>Alternative Plan:</u></p> <ul style="list-style-type: none"> • Computer Animations • Bleaching of leaves and testing for starch • 	<p>Electronic Balance Photosynthesis Kit (see pigments kit) Spectrophotometers with cuvettes (or test tubes)</p>
Evening	<p><u>Computer Animations</u></p> <p><u>Mastery Quiz #8*</u> Chapter 8: Photosynthesis</p> <p><u>Mastery Quiz #9:</u> Chapter 22: Plant Diversity (22-1; 22-4; 22-5) Chapter 23: Roots, Stems and Leaves (23-1; 23-4; 23-5)</p>	
Friday, July 23rd: Energy Transfer part II		
Morning	<p><u>Lecture: Cellular Respiration</u></p> <ul style="list-style-type: none"> ▪ The Aerobic vs. Anaerobic ▪ The Mitochondria ▪ Krebs's Cycle ▪ Electron Transport ▪ <i>Demonstration:</i> Alcoholic Fermentation ▪ Fermentation ▪ Comparison of Photosynthesis and Cellular Respiration <p><u>Chapter 9: Cellular Respiration</u></p> <p><u>Computer Animations of Cellular Respiration</u></p>	<p><u>Alcoholic Fermentation</u> Using yeast and grapes in zip lock bags, students will observe and hypothesize the expanding bag due to cellular respiration.</p>
Afternoon	<p><u>Lab: The Rate of Cellular Respiration</u></p>	<p><u>Cellular respiration kit (45645-08)</u></p>
Evening (Sunday)	<p><u>Mastery Quiz #10:</u> Cellular Respiration (including lab)</p>	

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Monday, July 26th: The Continuity of Life		
Morning	<p><u>Introduction to DNA</u></p> <ul style="list-style-type: none"> ▪ <i>Demonstration:</i> I love DNA song <p><u>Lecture:</u> Structure and Function of DNA</p> <ul style="list-style-type: none"> ▪ The process of DNA discovery <ul style="list-style-type: none"> ▪ Griffith and Avery ▪ Hershey and Chase ▪ Rosalind Franklin ▪ Watson and Crick ▪ DNA Structure ▪ The Human Genome ▪ <i>Demonstration:</i> The Hemoglobin Gene ▪ <i>Demonstration:</i> The vast information database (Yarn) <p><u>Activity:</u> Strawberry DNA Extraction</p> <p><u>Lecture:</u> DNA Replication</p> <ul style="list-style-type: none"> ▪ Continuity and Change (Replication and Mutation) 	<p><u>Strawberry DNA Extraction</u> Students isolate DNA from strawberries with ethanol, detergent and coffee filters.</p>
Afternoon	<p><u>Lecture:</u> Protein Synthesis</p> <ul style="list-style-type: none"> ▪ Transcription and Translation ▪ <i>Activity:</i> Codon Bingo ▪ <i>Animation:</i> The Human Genome Project's animation of protein synthesis ▪ Fill in the details of Protein Synthesis 	VCR and TV
Evening	<p><u>DNA Replication and Protein Synthesis Computer Animations</u></p> <p><u>Mastery Quiz #11</u> Chapter 12: DNA and Protein Synthesis</p>	
Tuesday, July 27th: The Human Genome & DNA Technology		
Morning	<p><u>Lecture:</u> DNA Technology and the Human Genome Project (TA lecture)</p> <ul style="list-style-type: none"> ▪ About the Human Genome... (Mutations, polymorphisms, karyotype, autosomes) ▪ Restriction Enzymes, gel electrophoresis ▪ Genetic Engineering ▪ <i>Activity:</i> Poster Sized Paper Gel Electrophoresis <p><u>Video:</u> The Human Genome Project</p> <p><u>Pre-lab:</u> Genetic Transformation</p> <ul style="list-style-type: none"> ▪ Demonstration: Paper plasmids and recombinant DNA 	<p>TV/VCR</p> <p><u>Paper Plasmids and recombinant DNA</u> Students will incorporate paper genes into paper plasmids; kinesthetic method of the pGLO lab.</p>
Afternoon	<p><u>LAB:</u> Genetic Transformation</p> <ul style="list-style-type: none"> ▪ pGLO Transformation Lab 	<p><u>Bio-Rad Transformation Lab</u> (Bio-Rad: 166-0003 EDU) Water Bath Incubator</p>

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Evening	<u>Mastery Quiz #12</u> DNA Technology Chapter 13: Genetic Engineering Chapter 14: The Human Genome <u>Mastery Quiz #13 (Open Book: Optional)</u> Chapter 39-1 and 39-2: Endocrine System CD-ROM Chapter 45 – 1 and 45 – 2 ONLY <i>Answer Questions on Pages 1002 and 1008</i> Chapter 29-4: Animal Development CD-ROM Chapter 47 <i>Answer Questions on pages 1024</i>	
Wednesday, July 28th: Who Killed Mr. Fitz?		
Morning	<u>Crime Scene Investigation</u> Lab: RFLP: DNA Fingerprinting <u>Introduction to Genetics</u> <i>Demonstration: Inventory of Human Traits</i> <ul style="list-style-type: none"> ▪ Dominant vs. Recessive ▪ Genotype vs. Phenotype 	<u>Bio-Rad DNA Fingerprinting Kit (Bio-Rad: 166-0007 EDU)</u> Gel Electrophoresis
Afternoon	Lecture: Meiosis <ul style="list-style-type: none"> ▪ <i>Activity: Making a Meiosis Manipulative</i> ▪ Simple Punnett Squares using meiosis <u>Genetics In Depth</u> <ul style="list-style-type: none"> ▪ Monohybrid Crosses ▪ Dihybrid Crosses ▪ Incomplete Dominance ▪ Co-dominance ▪ Multiple Alleles ▪ Pedigress 	
Evening	<u>Mastery Quiz #14</u> Meiosis <u>Practice Problems (tough!) Genetics</u>	
Thursday, July 29th: Genetics		
Morning	Lecture: Meiosis and Genetics <ul style="list-style-type: none"> ▪ Sex-Linked Crosses ▪ Law of Independent Assortment ▪ Gene Linkage (violation of the above law) <u>Paper Lab: Karyotype “Baby”</u> Problem Set: Problems in Genetics (selected problems)	<u>Karyotyping Baby Lab: Each student will pair up. Each "parent" will receive 23 chromosomes. The students will combine chromosomes and look at their child's karyotype. They must determine gender, carrier and any genetic diseases.</u>
Afternoon	Lab: Crossing Over Frequency with Live Sordaria Lecture: Molecular Biology applied to the Biology of Cancer	<u>Live Sordaria Cross Demo Plate (67074-00)</u> Coverslips and Slides (use from previous kit)
Evening	<u>Mastery Quiz #15</u> Genetics Problems Read Chapter 15: Darwin’s Theory of Evolution	

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Friday, July 30th: Updating Darwin		
Morning	<p><u>Lecture: Evolution and Genetics</u></p> <ul style="list-style-type: none"> • Darwin's Observations and Inferences • Natural Selection • The concept of a gene pool • Mutation and Polymorphisms • Hardy-Weinberg • Speciation • Punctuated Equilibrium vs. Gradualism <p><u>Activity: Hardy-Weinberg Simulation</u></p>	<p><u>Population Genetics and Evolution Kit (45647-00)</u>) The class will simulate Hardy-Weinberg Equilibrium.</p>
Afternoon	<p><u>Lab: (Computer lab)The DNA Tree of Life: How do scientists use molecular information to form evolutionary relationships?</u> Students will choose 5 related animals. They will then search the national genomic database for the cytochrome b sequence. By using the DNA learning center's sequence server, they will compare the gene sequences to look for evolutionary relationships.</p>	Computer Lab
Evening	<p><u>Mid-Term Examination:</u> The purpose of this exam is to test for proficiency in the five areas studied thus far. The exam consists of two parts. The first part is the multiple choice section. This section evaluates for basic understanding. The second section is essay. The essay evaluates conceptual understanding and main ideas/themes.</p>	
Monday, August 2nd : Biodiversity		
Morning	<p><u>Lecture: Viruses</u></p> <ul style="list-style-type: none"> ▪ Life Cycle of a Virus ▪ Retroviruses and HIV <p><u>Activity: The Invertebrate Phylums</u> Students will be given a model invertebrate. They will make a 3 minute presentation on that animal phylum.</p> <p><u>Lecture: Biodiversity</u></p> <ul style="list-style-type: none"> • Introduction to Taxonomy • The 6 Kingdoms • The Animal Phylums • The Plant Divisions • <i>Demonstration: Organisms in a jar</i> 	<p>HIV Life Cycle Video</p> <p>Organisms in a Jar</p>
Afternoon	<p><u>Enzyme Catalysis Lab</u></p>	
Evening		
Tuesday, August 3rd: Sports, Food and Energy		
Morning	<p><u>Peer Teaching: Interdependence of the Body systems</u></p> <ul style="list-style-type: none"> • The Circulatory System • The Respiratory System • The Muscle System • The Nervous System • The Immune System <p>Each group of 3 will become "experts" on one body system. After 1 1/2 hours, three "large" groups will form comprising of one student from each body system. Each student will teach about their system.</p>	

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Afternoon	Peer Teaching: Interdependence of the Body Systems: (continued)	Physiology of the Circulatory System (45649-08; 60668-10 \$28.50; 67421-50) (didn't work: Daphne died in the mail) Steromicroscopes
Evening	Mastery Quiz #16: Human Body Systems Each body system group made a 6-7 question quiz.	
Wednesday, August 4th: Homeostasis		
Morning	Preparation for Dissection Virtual Dissection (need computer lab) Lab: Dissection Students will look for various organs of the body systems that we covered in class.	
Afternoon	Question and Answer period about the body systems Lecture: Introduction to Ecology The relationships found in the Coral Reef. This will be a picture session of various organismal relationships found in the Coral Reef.	
Evening	Mastery Quiz #17: Biodiversity and Evolution Students will work on 2 worksheets that compare the kingdoms, phylums and animal invertebrates. The quiz will cover these 2 worksheets.	
Thursday, August 5th ***		
Morning	Lecture: Population Ecology and Evolution <ul style="list-style-type: none"> ▪ Population Growth Curves (Logistic vs. Exponential) ▪ Succession (Primary vs. Secondary) ▪ Biomagnification Activity: Biome Travel Brochure on Eco-Tourism Students will select 3 biomes and develop a travel brochure of selected destinations. They must advertise eco-tourism. Discussion: Human Impact upon the Biosphere	
Afternoon	CTY Post-Test	
Evening	Movie: Lorenzo's Oil Students will fill out a viewing guide that inquires about certain biological principals discussed in the film.	TV/VCR
Friday, August 6th ***		
Morning	Movie: Lorenzo's Oil Wrap-Up Picture Slide Show	