



COPPELL ISD **IB Biology** YEAR AT A GLANCE

SUBJECT

IB BIOLOGY YEAR 1 & 2

**GRADE
LEVEL
11-12**

**UNIT 1
OF 6**

Program Transfer Goals

- Ask questions, recognize and define problems, and propose solutions.
 - Safely and ethically collect, analyze, and evaluate appropriate data.
 - Utilize, create, and analyze models to understand the world.
 - Make valid claims and informed decisions based on scientific evidence.
 - Effectively communicate scientific reasoning to a target audience.
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Assurances for a Guaranteed and Viable Curriculum

Adherence to this scope and sequence affords every member of the learning community clarity on the knowledge and skills on which each learner should demonstrate proficiency. In order to deliver a guaranteed and viable curriculum, our team commits to and ensures the following understandings:

Shared Accountability: Responding to the Needs of All Learners

- High levels of learning for all students.
- The district and course formative assessments aligned to the standards for this course support educators and learners in monitoring academic achievement and leveraging interventions.

Shared Understanding: Curriculum Design

- The district curriculum design weaves together the elements of content, skills and assessments in order to adhere to curriculum design at the macro and micro level, ensuring vertical alignment.
- The district curriculum incorporates standards, scope and sequence, enduring understandings, essential questions, performance assessments, and recommended resources.

Interdependence: Curriculum Units

Members of the learning community utilize the curriculum units, plan collaboratively, and reflect on results for continuous improvement.

The district curriculum units may be found: <http://tinyurl.com/Coppell-Curriculum>

UNIT 1: Cell Biology

TIMELINE: 3.5 WEEKS - 1ST YEAR, 1ST NINE WEEKS

Unit Summary:

Learners explore how cells work and the problems that arise should cellular functions be faulty.

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Students will know that...

- The evolution of multicellular organisms allowed cell specialization and cell replacement
- Eukaryotes have a much more complex cell structure than prokaryotes.
- Living organisms control their composition by a complex web of chemical reactions
- Water is the medium of life.
- Compounds of carbon, hydrogen and oxygen are used to supply and store energy
- Proteins have a very wide range of functions in living organisms
- The structure of biological membranes makes them fluid and dynamic.
- Membranes control the composition of cells by active and passive transport.
- There is an unbroken chain of life from the first cells on Earth to all cells in organisms alive today.
- Cell division is essential but must be controlled.

Students will be skilled at...

- Use of a light microscope to investigate the structure of cells and tissues, with drawing of cells
- Calculation of the magnification of drawings and the actual size of structures and ultrastructures shown in drawings or micrographs
- Drawing of the ultrastructure of prokaryotic cells based on electron micrographs.
- Drawing of the ultrastructure of eukaryotic cells based on electron micrographs.
- Interpretation of electron micrographs to identify organelles and deduce the function of specialized cells
- Drawing molecular diagrams of glucose, ribose, a saturated fatty acid and a generalized amino acid.
- Identification of biochemicals such as sugars, lipids or amino acids from molecular diagrams
- Use of molecular visualization software to compare cellulose, starch and glycogen.
- Determination of body mass index by calculation or use of a nomogram
- Drawing molecular diagrams to show the formation of a peptide bond
- Drawing of the fluid mosaic model.
- Analysis of evidence from electron microscopy that led to the proposal of the Davson-Danielli model.
- Analysis of the falsification of the Davson-Danielli model that led to the Singer-Nicolson model
- Estimation of osmolarity in tissues by bathing samples in hypotonic and hypertonic solutions.
- Identification of phases of mitosis in cells viewed with a microscope or in a micrograph.
- Determination of a mitotic index from a micrograph.

UNIT 2: Molecular Biology

TIMELINE: 5.5 WEEKS - 1ST YEAR, 1ST NINE WEEKS

Unit Summary: Learners explore how cells function on the molecular level allowing them to overcome the challenges of the outside environment.

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Students will know...

- Enzymes control the metabolism of the cell.
- Metabolic reactions are regulated in response to the cell's needs.
- The structure of DNA allows efficient storage of genetic information.
- Genetic information in DNA can be accurately copied and can be translated to make the proteins needed by the cell.
- Cell respiration supplies energy for the functions of life
- Photosynthesis uses the energy in sunlight to produce the chemical energy needed for life.

Students will be skilled at...

- Design of experiments to test the effect of temperature, pH and substrate concentration on the activity of enzymes.
- Skill: Experimental investigation of a factor affecting enzyme activity.
- Calculating and plotting rates of reaction from raw experimental results.
- Skill: Distinguishing different types of inhibition from graphs at specified substrate concentration.
- Drawing simple diagrams of the structure of single nucleotides of DNA and RNA, using circles, pentagons and rectangles to represent phosphates, pentoses and bases.
- Use a table of the genetic code to deduce which codon(s) corresponds to which amino acid.
- Skill: Analysis of Meselson and Stahl's results to obtain support for the theory of semi-conservative replication of DNA.
- Skill: Use a table of mRNA codons and their corresponding amino acids to deduce the sequence of amino acids coded by a short mRNA strand of known base sequence.
- Skill: Deducing the DNA base sequence for the mRNA strand.
- Analysis of results from experiments involving measurement of respiration rates in germinating seeds or invertebrates using a respirometer.
- Drawing an absorption spectrum for chlorophyll and an action spectrum for photosynthesis.
- Skill: Design of experiments to investigate the effect of limiting factors on photosynthesis.
- Skill: Separation of photosynthetic pigments by chromatograph.

UNIT 3: METABOLISM

TIMELINE: 3 WEEKS - 1ST YEAR, 2ND NINE WEEKS

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Students will know...

- Energy is converted to a usable form in cell respiration.
- Light energy is converted into chemical energy.

Students will be skilled at...

- Analysis of diagrams of the pathways of aerobic respiration to deduce where decarboxylation and oxidation reactions occur.
- Skill: Annotation of a diagram of a mitochondrion to indicate the adaptations to its function.
- Annotation of a diagram to indicate the adaptations of a chloroplast to its function.

UNIT 4: NUCLEIC ACIDS

TIMELINE: 2 WEEKS - 1ST YEAR, 2ND NINE WEEKS

Unit Summary: Learners explore how nucleic acids are responsible for the functionality of an organism.

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Students will know...

- The structure of DNA is ideally suited to its function.
- Information stored as a code in DNA is copied onto mRNA.
- Information transferred from DNA to mRNA is translated into an amino acid sequence.

Students will be skilled at...

- Analysis of results of the Hershey and Chase experiment providing evidence that DNA is the genetic material.
- Skill: Utilization of molecular visualization software to analyse the association between protein and DNA within a nucleosome.
- Skill: Analysis of changes in the DNA methylation patterns.
- Skill: Identification of polysomes in electron micrographs of prokaryotes and eukaryotes.
- Skill: The use of molecular visualization software to analyse the structure of eukaryotic ribosomes and a tRNA molecule.

UNIT 5: GENETICS & Evolution

TIMELINE: 3.5 WEEKS- 2ND NINE WEEKS

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Students will know...

- Every living organism inherits a blueprint for life from its parents.
- Chromosomes carry genes in a linear sequence that is shared by members of a species.
- Alleles segregate during meiosis allowing new combinations to be formed by the fusion of gametes.
- The inheritance of genes follows patterns.
- Biologists have developed techniques for artificial manipulation of DNA, cells and organisms.
- Meiosis leads to independent assortment of chromosomes and unique composition of alleles in daughter cells.
- Genes may be linked or unlinked and are inherited accordingly.
- Gene pools change over time.

Students will be skilled at...

- Use of a database to determine differences in the base sequence of a gene in two species.
- Use of databases to identify the locus of a human gene and its polypeptide product.
- Drawing diagrams to show the stages of meiosis resulting in the formation of four haploid cells.
- Construction of Punnett grids for predicting the outcomes of monohybrid genetic crosses.
- Skill: Comparison of predicted and actual outcomes of genetic crosses using real data.
- Skill: Analysis of pedigree charts to deduce the pattern of inheritance of genetic diseases.
- Design of an experiment to assess one factor affecting the rooting of stem-cuttings.
- Skill: Analysis of examples of DNA profiles.
- Skill: Analysis of data on risks to monarch butterflies of Bt crops.
- Drawing diagrams to show chiasmata formed by crossing over.
- Calculation of the predicted genotypic and phenotypic ratio of offspring of dihybrid crosses involving unlinked autosomal genes.
- Skill: Identification of recombinants in crosses involving two linked genes.
- Skill: Use of a chi-squared test on data from dihybrid crosses.
- Comparison of allele frequencies of geographically isolated populations.
- Construction of dichotomous keys for use in identifying specimens.
- Skill: Analysis of cladograms to deduce evolutionary relationships.

UNIT 6: HUMAN & ANIMAL PHYSIOLOGY

TIMELINE: 4 WEEKS

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Students will know...

- The structure of the wall of the small intestine allows it to move, digest and absorb food.
- The blood system continuously transports substances to cells and simultaneously collects waste products.
- The human body has structures and processes that resist the continuous threat of invasion by pathogens.
- The lungs are actively ventilated to ensure that gas exchange can occur passively.
- Neurons transmit the message, synapses modulate the message.
- Hormones are used when signals need to be widely distributed.
- Immunity is based on recognition of self and destruction of foreign material.
- The roles of the musculoskeletal system are movement, support and protection.
- All animals excrete nitrogenous waste products and some animals also balance water and solute concentrations.

Students will be skilled at...

- Production of an annotated diagram of the digestive system.
- Skill: Identification of tissue layers in transverse sections of the small intestine viewed with a microscope or in a micrograph.
- Recognition of the chambers and valves of the heart and the blood vessels connected to it in dissected hearts or in diagrams of heart structure.
- Skill: Monitoring of ventilation in humans at rest and after mild and vigorous exercise.
- Skill: Analysis of oscilloscope traces showing resting potentials and action potentials.
- Annotate diagrams of the male and female reproductive system to show names of structures and their functions.
- Analysis of epidemiological data related to vaccination programmes.
- Annotation of a diagram of the human elbow.
- Skill: Drawing labelled diagrams of the structure of a sarcomere.
- Skill: Analysis of electron micrographs to find the state of contraction of muscle fibres.
- Drawing and labelling a diagram of the human kidney.
- Skill: Annotation of diagrams of the nephron.
- Annotation of diagrams of seminiferous tubule and ovary to show the stages of gametogenesis.
- Skill: Annotation of diagrams of mature sperm and egg to indicate functions.