**Instructor:** Ajchara Aksomboon Vongsawan

**The Goal:**

The three-year Biology curriculum serves as a pre-requisite for Science-Math majors in preparation for entering biomedical sciences as well as other science fields.

Mathayom 4 (Secondary Grade 10): Year 1 Biology 1, 2

Mathayom 5 (Secondary Grade 11): Year 2 Biology 3, 4

Mathayom 6 (Secondary Grade 12): Year 3 Biology 5, 6

The study approach adheres to the Thai curriculum using combination of US and Singaporean textbooks with emphasis in preparing students to apply analytical thinking in the subject matter. English is the language of instruction in the English Program. Students planning to enter the biomedical field or medical field within the Thai university system are advised to read a Thai version of textbook in preparation for their entrance exam due to technical term discrepancy that may be used in Thai exams. Pre-med and biomedical science students will be expected to pay close attention to current knowledge of bioscience technology for future use at undergraduate university level.

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| **Grade 10 (M4): Year 1 Biology 1****Semester 1: (SCI 31241) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1: Maintaining stability of living things** **Homeostasis**  | • Science and Biology• Structure and Function Characteristics of Living Things • Research Methodology and Ethics |
| **Unit 2: Cell and Cellular Function** | • Subunit of life: cell• Cell Specialization and Structure • Microscope: types and application in research studies, component and proper usage• Cellular Reproduction and Inheritance: Mitosis, Meiosis |
| **Midterm Exam**  | **Material Covered from Units 1 and 2** |
| **Unit 3: Chemistry of Life** **Basic Molecules of Living Things** | • Organic and Inorganic molecules in the human body• Biomolecules that are Macromolecules: Carbohydrate, Protein, Lipid, Nucleic acid• Small biomolecules such as water and ions• Chemical Reactions and Processes within living cells• Enzymatic reactions  |
|  **Unit 4: Cellular Respiration** | • Biomolecules within Cells of Living Organisms• Breakdown using Aerobic and Anerobic process• Biomolecule in which Cells use Energy: glucose• Basic Biomolecules in Living Things• Cellular Respiration |
| **Final Exam** | **Material Covered from Units 3 and 4** |
| **Grade 10 (M4): Year 1 Biology 2****Semester 2: (SCI 31242) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1: Heredity** | • Gregor Mendel: also known as the Father of Modern Genetics.• Mendel’s experiments with pea plants• Mendel’s Laws of Inheritance• The Chromosomal Basis of Inheritance• Genetic Material and Gene Expression• Mechanisms leading to Mutations |
| **Unit 2: Genes and Chromosome** | • History of Genetic Material: experiments leading to unraveling Genetic Material, DNA structure and function.• DNA Replication• Central Dogma: Gene flow from DNA- RNA-Protein |
| **Midterm Exam**  | **Material Covered from Units 1 and 2** |
| **Unit 3: Genetics and DNA Technology** | • Errors during Gene Expression giving rise to Mutations• Genomics and Biotechnology• Genetic Engineering/  Recombinant DNA Technology |
| **Unit 4: Evolution** | • Darwin’s Theory of Natural Selection• Genotype Frequency• Hardy-Weinberg Theory • Origin of Species |
| **Final Exam** | **Material Covered from Units 3 and 4** |
| **Grade 11 (M5): Year 2 Biology 3****Semester 1: (SCI 32241) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1:** **Structure and Function of Flowering** **Plants** | • Structure and Function of Plant tissue• Structure and Function of Root, Stem and Leaf• Transpiration in Plant• Transport System of water and  Mineral Salt in Plants• Transport of Organic Substance in Plants |
| **Unit 2: Plant Growth and Development** | • Plant Hormones• External Stimulus Inducing Plant Development  |
| **Midterm Exam**  | **Material Covered from Units 1 and 2** |
| **Unit 3:** **Adaptations Flowering Plant use for** **Survival** | • Life Cycle of Flowering Plant• Reproduction in Flowering Plant• Plant Sexual Organs• Seed Germination  |
|  **Unit 4:** **Photosynthesis** | • Importance of Photosynthesis• Mechanism of Photosynthesis • Photorespiration• C3 and C4 Plants• CAM Plants• Factors affecting Photosynthesis |
| **Final Exam** |  **Material Covered from Units 3 and 4** |
| **Grade 11 (M5) Year 2: Biology 4****Semester 2: (SCI 32242) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1: Respiratory System and Circulatory** **System** | • Gas Exchange in Living Things• Open and Closed Circulatory System• The Structure and Function of Mammalian Heart.• Human Circulatory System |
| **Unit 2:** **Maintaining Homeostasis in the body** | • Excretion of waste product in Unicellular Organisms, invertebrates, and vertebrates including humans• Kidney Function• Kidney Diseases |
| **Midterm Exam** | **Material Covered from Units 1 and 2** |
| **Unit 3:** **Digestive System** | • Digestive System in Micro-organisms• Digestion System in Mammals• Digestion System in Humans |
| **Unit 4:** **Immune System** | • Defence Mechanisms of the Body• Types of Immune System• Components of the Immune System• Immune Deficiency |
| **Final Exam** | **Material Covered from Units 3 and 4** |
| **Grade 12 (M6) Year 3 Biology 5****Semester 1: (SCI 33241) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1: Animal Reproduction**  **Animal Development and Growth** | • Sexual and Asexual Reproduction• Male and Female Reproductive System• Spermatogenesis, Oogenesis, and Fertilization*• In vitro* fertilization• Embryogenesis |
| **Unit 2: Nervous System** | • Central Nervous System (CNS) in Vertebrates: Brain and Spinal Column (Function of Synapse within brain cells and Spinal Column)• Peripheral Nervous System (PNS): Cranial and Spinal Nerves, Ganglia, and Sensory Receptors• Function of Nervous System: Somatic and Automatic• Sympathetic Nervous System |
| **Midterm Exam**  | **Material Covered from Units 1 and 2** |
| **Unit 3: Endocrine System and Ductless**  **Glands**  **Endocrine System and Hormones** | • Endocrine System and Ductless Glands• Ductless gland and hormonal production in animals• Mechanism of Hormone produced from Ductless Glands/Endocrine Signaling• Hormonal Balance and Regulation |
|  **Unit 4: Conservation** | • Energy Transfer in Ecosystem• Biomass• Biogeochemical Cycles: Nitrogen, Sulfur,  Phosphorus• Renewable and Nonrenewable Energy• Sustainability• Environmental Problems |
| **Unit 5: Population Growth** | • Population Growth: Exponential and Logistic• Population Control |
| **Final Exam** | **Material Covered from Units 3 and 4** |
| **Grade 12 (M6) Year 3 Biology 6****Semester 2: (SCI 33242) 1.5 Credits, 60 hours** |
| **Course Content** | **Details** |
| **Unit 1: Biodiversity** | • Kingdoms of Life• The Origin of Life and the Cell Theory• Taxonomy and Biological Classification• Binomial Nomenclature |
| **Midterm Exam** | **Material Covered from Unit 1** |
| **Unit 2:** **Muscular and Skeletal System** | • Protein Filaments for muscle function• Interaction of Protein Filaments for Muscle Function• Muscular System in vertebrate: Skeletal, Smooth, and Cardiac Muscle  |
| **Unit 3: Animal Behavior** | • Mechanism of Animal Behavior• Inherited Behavior• Learned Behavior |
| **Final Exam** | **Material Covered from Units 2 and 3** |
| **Grading and Evaluation** |
| **Percent Allocation** | **Percent** |
| Attendance and Participation | 10 |
| Assignments and Quiz | 20 |
| Experiments and Lab Report | 30 |
| Midterm | 20 |
| Finals | 20 |
| **Grade** | **Percent** |
| A | 80-100 |
| B+ | 70-74 |
| B | 75-79 |
| C+ | 65-69 |
| C | 60-64 |
| D+ | 55-59 |
| D | 50-54 |
| F | Below 50 |

**Expectations from students:**

(1) to always attend class

(2) to critically read the assigned material before class

(3) to enthusiastically participate in class discussions and problem-solving sessions

(4) to diligently prepare for all exams

**Study and Reading Materials**

**(1) Campbell PowerPoint Lectures and uploads given in conjunction with textbooks**

**(2) Textbooks**

2.1. Biology: A Global Approach, Global Edition, 10/E

Neil A. Campbell, University of California, Riverside

Jane B. Reece, Palo Alto, California

Lisa Urry

Michael L Cain, Bowdoin College, Brunswick, Maine

Steven A Wasserman, University of California, San Diego

Peter V Minorsky, Mercy College, Dobbs Ferry, New York

Robert B Jackson, Duke University, Durham, North Carolina

**or equivalent version**.

2.2. New Century Elective Biology: Secondary 4,5, and 6.

 Hodder Education Singapore, 2019 Edition.

 Beverly Tay, Loo Kwok Wai, Ong Bee Hoo, and Janlin Chan

**(3) Video Clips and Scientific Readings from Journals**