Yale-NUS Module Brief - Additional Information for Students

Note:

Please note that the information in this brief is tentative as instructor could be in the ongoing process of developing or refining their module details.

<table>
<tr><td>Module Code and Title</td><td>YSC2256 Science of Life</td></tr>
<tr><td>Module Description
The 100 word course description from Course Catalogue will be made available to students. Please provide additional information if you wish.</td><td>This module introduces the fundamentals necessary to develop an understanding for a broad range of topics that encompass life sciences in the 21st century. It also introduces the manner in which life scientists frame questions, design experiments, and communicate their findings. Specific topics include molecular and cellular biology, genetics, evolutionary biology, and application of statistical and quantitative analysis to study biological questions. Emphasis will be placed on preparation needed to take the next tier of courses in the Major, learning basic laboratory skills, and gaining a beginning competency in parsing primary literature.</td></tr>
<tr><td>Learning Objectives</td><td>Upon successful completion, students will
be able to summarize the findings in several specialized research methods and the current state of the art in life science.
have beginning level competency to parse a research publication to identify questions, understand methodology.
present a structured scientific presentation to an audience with mixed scientific knowledge.
be prepared for the required courses in the second, the third, and the fourth tiers of Life Sciences where students encounter the breadth and/or gain specialized knowledge.</td></tr>
<tr><td>Modes of Learning & Teaching
Please provide details of the learning activities learners will participate in etc.</td><td>1. JoVE CORE Biology (https://www.jove.com/science-education/jovecore)
2. Supplementary Material generated from various sources including primary literature.
3. Principles of modern biology. “What is Life?: Understand Biology in Five Steps By Paul Nurse.</td></tr>
<tr><td>Assessment Criteria
Please provide details of the assessment methods or what proportion of the overall grade is composed by each component of assessment</td><td><table><tr><th>Content</th><th>Percentage</th></tr><tr><td>in class presentations, quizzes</td><td>50</td></tr><tr><td>Participation in group work and discussion</td><td>20</td></tr><tr><td>Written assignments</td><td>20</td></tr><tr><td>Attendance and class participation.</td><td>10</td></tr></table></td></tr>
<tr><td>Required Reading List</td><td>Material generated from various sources including primary literature. “What is Life?: Understand Biology in Five Steps” By Paul Nurse (ISBN13 - 978-1788451406).</td></tr>
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Reading List (additional/supplementary)	Biology Briefs; Podcasts JoVE Videos. What is Life? by Erwin Schrödinger Campbell Biology Primary Literature Review articles
Any other Information	This is not an exact syllabus but, many of these topics will be covered. **Week 1, 2, 3: Introduction to Biology in the 21st Century** • What is life? • Viruses as life forms, oldest life forms, and Panspermia • Introduction to reading primary literature • Features of experimental design (controls, randomization, and double-blind) **SARS CoV-2** • What do we know? Unicellular and multicellular life forms. • Viruses as life forms –molecular biology of replication • Viruses as life forms - infectious process and R0 values • The blueprint for life – DNA as the genetic material • The **Week 4, 5, 6: Cellular and Molecular Biology** **DNA, RNA, and Genomes - I** • Have you seen your DNA lately? • A simple lab session on DNA extraction from saliva using household items • Lab sessions in DNA visualization and gel electrophoresis • Introduction to genomes, size of genomes, and the SARS-CoV2 genome **DNA, RNA, and Genomes - II** • What are genes? • DNA structure, Organization of genes • Gene talk – genetic lingo, terms and essential jargon. • Genetic laws of segregation and independent assortment • Alleles, polygenic traits, and disease susceptibility • Guest **Key Cellular Processes and Functions** • Cellular physiology and normal functions of the cells. • ACE2 receptors (entry point for SARS-CoV2) as a means to understand cell communication with the outside world • Protein synthesis, and the replication machinery • Cell death and apoptosis **Week 7: Experimental design, hypothesis testing, and statistical analyses** • Recap of the molecular and cellular biology.

	• Discussion of group project– Using publicly available quantitative data to design and answer questions related to SARS CoV2 • Experimental design to test predictions • Statistical analysis. • Reading primary literature on the evolutionary history of SARS-CoV2. **Week 8, 9, 10:** **Evolutionary history and medical forensics** • Where did the SARS-CoV2 originate? • Tracing the evolutionary history of SARS-CoV2, introduction to molecular phylogeny and lineage analysis using genomes. **Natural Selection** • Principles of natural selection applied to SARS-CoV2 • Mutation rates and genetic variation; the engine for evolution. • Understanding limits of natural selection; Viral mutant D614G as an example of inquiry (genetic drift and founder effects). • Guest **Ecosystems** • Zoonotic diseases and what is so special about bats? • Trophic levels, and bats as vectors. • Ecological niches and protecting wildlife • A segue into animal behaviour – the incredibly sophisticated echolocating bats. **Week 11 : Physiological, Immunological, and Neurological effects of SARS-CoV2 in humans (each topic below will be expanded.** • What is herd immunity? • Types of immune responses in humans • Development and physiology of the normal respiratory systems • Covid-19 infection rate in children vs. adults; lessons on innate immunity • Understanding neurology and examining long term impacts • Vascular symptoms and the impact on human physiological functions. **Science and the society** • Vaccines • Methods and rationale behind different types of tests (PCR, Antibody, Histology) • Understanding and communicating risk (and the science behind pandemics).

	• Guest **Week 12, 13: Wrap up;** • Group project presentations. • Connecting the threads; Recap. • What do we know? What can we know? • Final assessment; term paper
Instructor Profile & Contact *Please provide brief profile and email contact if instructor's profile info is not available on Yale-NUS Website -Faculty.*	https://www.yale-nus.edu.sg/about/faculty/ajay-s-mathuru/
Course goals	• Understand and be able to articulate the basic concepts in molecular biology, genetics, and evolutionary biology. • Recognize and discover connections between molecular level and ecosystems level biology. • Demonstrate beginning competency in reading primary literature in biology. • Demonstrate a knowledge of the type of methods and quantitative analyses employed by life scientist to solve problems. • Demonstrate a knowledge of the course topic (in the first delivery for example, how different the breadth of life-sciences in the context of SARS-CoV2). • Describe or model how biological scientific knowledge builds on experimentation, observation, and interpretation in presence of uncertainty.