ILLINOIS MATHEMATICS AND SCIENCE ACADEMY®
igniting and nurturing creative, ethical scientific minds that advance the human condition

Comprehensive Course Syllabus
Advanced Biological Systems

Course Description:
Advanced Biological Systems is a year-long, junior level course that will serve as a comprehensive study of the field of Biology. IMSA students will gain substantial understanding and experience working with foundational biological concepts in the context of current practice in the discipline. The course is primarily focused on three of the United Nations Sustainable Development Goals, 1) Good Health and Well-Being; 2) Clean Water and Sanitation; and 3) Sustainable Cities and Communities. These UN goals will serve as focal points to give relevance and purpose to our study of four essential areas in Biology. These four areas are: 1) the history and evolution of life on earth; 2) the metabolic processes of organisms and ecosystems, 3) biological processes fundamental to cellular function, replication, and diversification, and 4) the interactions and interdependence of organisms and the environment. Students will engage in learning designed to generate growth in select Standards of Significant Learning.

Instructors:

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office hours	TBD	TBD	TBD	TBD	TBD

Text(s)/Materials:
There is no required textbook expected for this course. Instead, appropriate online materials, science journal articles, and curriculum developed by the team will be used to support learning. Generally, we expect that students will learn through short lecture, class discussion, laboratory experiences, and other guided inquiry projects.

Essential Content:

1) Conceptual:

Students will be able to evaluate current issues in biological diversity and connect these to an evolutionary and geological historical perspective.

- Understand current environmental issues in the context of geological history.
- Provide evidentiary support for the Theory of Evolution.
- Integrate different variables that affect the process of speciation.
- Connect the processes of cellular respiration and photosynthesis as a foundation for an ecosystem.

Students will understand current theory regarding application of medicine and technology to human disease (i.e. stem cell and genetic therapies, prevention), with attention to connecting disease processes to environmental and evolutionary concepts.

- Connect biomolecules to the processes pertaining to therapies.
- Model gene regulation as a basis to understand cellular diversity
- Determine the foundations of cell function and differentiation.
- Develop a model of the human microbiome as an ecosystem.
- Detail the interactions between microbiome, infection, and the human host

Students will understand issues related to relationships and connectedness in modern ecosystems and sustainability.

- Using evidence, model an interconnected and stable ecosystem.
- Examine the human impact on ecosystems, and draw parallels to medical interventions.
- Propose and evaluate solutions for sustainable agriculture.
- Propose and evaluate solutions to ensure water quality and global availability.

2) Standards of Significant Learning:

IA. Students are expected to demonstrate automaticity in skills, concepts, and processes that enable complex thought by:

- completing homework activities and assigned reading to support content,
- becoming adept at identified lab skills,
- demonstrating competence on quizzes, and
- applying content knowledge with novel scenarios and problems.

IB. Students are expected to construct questions, forge connections and deepen meaning

- informally in discussion groups, during set up and analysis of labs, and when observing data from experiments, and
- on formal assessments.

IC. Students are expected to precisely observe phenomena and accurately record findings

- through formative and summative assessments, and
- through analysis of data generated from lab experiments.

ID. Students are expected to evaluate the soundness and relevance of information and reasoning

- by evaluating sources for research papers,
- through analysis of experiments completed in lab, and
- through explanation of models of phenomena in biology.

IIA. Students confront misconceptions

- by completing pre-assessments,
- engaging in discussion in class, and
- completing a follow-up assessment to determine extent of resolution of misconceptions.

IIIA. Students use appropriate technologies as extensions of the mind

- through daily use of computers, including web sources and videos,
- by using the course website as a resource,
- by using computers to create graphical representations and perform other analyses of laboratory data, and
- through use of standard laboratory equipment.

IIIB. Students recognize, pursue, and explain substantive connections within and among areas of knowledge

- by studying the chemistry behind the biology, and
- by studying the connections between areas within biology.

IIIC. Students recreate models and systems in biology, such as cell theory, evolution, DNA synthesis, as well as structure and functions of the cell and DNA, etc.,

- with classroom discussion, projects, and activities, and
- on formal assessments.

VB. In order for students to make reasoned decisions which reflect ethical standards, and act in accordance with those decisions, students

- are made aware of what plagiarism is, its ethical implications, and repercussions of plagiarizing,
- are made aware of the scientific and ethical significance of accurately representing data (vs. not skewing data to fit expectations), and
- are assessed for the authenticity of written work and the efficacy of analysis of lab experimentation.

Student Expectations:

1) Late work:

Students may submit work late with a penalty of 10% each day the assignment is late up to 3 calendar days maximum. Once any assignments are returned to students with grades/comments, this late work will not be accepted. Once the deadline has passed, a zero will be assigned.

Computer problems of any kind (including document corruption, hard drive failure, problems with uploading to Moodle) will not be treated as acceptable excuses for submitting late work. This being the case, it would be wise to make a backup copy of any computer work that you do for this course, and we suggest ensuring that you've received return receipts in your email from Turnitin. However, if you are having problems getting your work in, it is recommended that you talk with your teacher.

2) Attendance:

See the IMSA handbook for official attendance policy. If you have a counselor excused absence, or an unexcused absence, you will not be able to make up the missed work. This includes earning a zero on any tests or quizzes given during the missed period.

If you have an excused absence, be sure to contact your teacher to find out what you will miss. If that is not possible, you should see your teacher as soon as possible to discuss your absence. It is **your responsibility** to follow up on what you missed in class.

3) Plagiarism:

Plagiarism is unacceptable and will be dealt with as per IMSA policy on academic dishonesty. Plagiarism includes, but is not limited to, knowingly using another person's work – whether it is a student or a research paper – as your own, improper citations and bibliographic information, improper use of secondary sources, or any other behavior that is deemed dishonest.

Assessment Practices, Procedures, and Processes:

Assessments may include quizzes, tests, presentations, projects, writing assignments, and homework. We will also be gauging student progress with respect to both learning skills and mindset, as highlighted in the Standards of Significant Learning.

Tests are used to examine factual knowledge and problem solving. Also, students will be asked to apply knowledge gained in class to address novel situations (approximately 30-40% of any individual test grade). We call this ability 'transfer' and tests generally prompt a developing skill over the course of time.

Written reports are used to examine both communication and critical thinking skills in students. Students will be asked to forge connections between the lab activities or literature

research and a broader context in the field of Biology. This sort of work mimics science practice and expands student thinking in science.

Projects and Presentation: This category of student work examines model building and critical thought. This complements reports as students must draw upon various activities and knowledge to construct holistic models that represent their understanding.

Various categories of work are not weighted to calculate the student grades in this course. Instead, a running total of all work is maintained to reflect on student grades. An approximate contribution percentage of categories of assessment toward the final grade is:

- Formative assessment: projects, reports, presentations: 40%
- Summative assessments: tests and major projects: 60%

Grading generally follows the scale:

90% and above = A
80-89% = B
70-79% = C
Below 70% = D

Major assessments will be graded and returned to students for review as soon as possible. This will usually be seven to ten days for tests, major projects and reports. Formative work that demands quick turnaround time to support continued student progress will be given priority in grading.

We expect that students will be capable of the levels of assessment commonly used in the Biology program. Students who are at risk of failing (<73%) will be required to meet with one of the ABS teachers until such time that the grade issue is resolved. If a student has a failing grade at the end of the first semester, they will be permitted to complete the entire year-long sequence. The recorded grade will be a running total of the entire year.

Calendar (tentative and subject to change as learning needs arise)

Fall Semester 2019

Week	Date	Unit / Topic	Assessment
1	Aug 19-23	First Week of Class Intro to ABS & Pre-Course Test	

		Unit 1: Evolution Mechanisms of Evolution Assign Walk through time	
2	Aug 26-30	Unit 1: Evolution Walk through time presentations	Walk through time presentations
3	Sep 3-6	Unit 1: Evolution LAB: Origami Birds ***Sep 2nd Labor Day***	
4	Sep 9-13	Unit 1: Evolution LAB: Genetic Drift / Founder Effect LAB: Evolutionary Evidences	
5	Sep 16-20	Unit 1: Evolution Pre-field trip discussion & prep Unit 2 intro: Introduce Documentary Project Discuss UNSDGs	Current Era Video Project
6	Sep 23-27	**Field Trip - Sep. 24th** Unit 2: Current Era Ecology basics National Climate Assessment Activity Walk through the current era video assessment assigned	Field Trip Assessment Unit Exam
7	Sep 30-Oct 4	Unit 2: Current Era Documentary - Food Waste Humans as part of a global ecological system Film Ecosystem Adoption Projects	Ecosystem Adoption Project
8	Oct 7-10	Unit 3: Organismal Diversity Domains of Life Microbial Diversity - Luca Paper	

		Extended Weekend Oct 11-13	
9	Oct 15-18	Unit 3: Organismal Diversity LAB: Gram Stain Microbiome Discussion	
10	Oct 21-25	Unit 3: Organismal Diversity Protist Diversity, Plant Cells Animal Cells LAB: Microscopy, plant vs animal cells	
11	Oct 28-Nov 1	Unit 3: Organismal Diversity LAB: Catalase Lab Cell Differentiation	Unit assignment: plant vs animal cells
12	Nov 4-8	Unit 4: Metabolism Central Metabolism Thermodynamics	
13	Nov 11-15	Unit 4: Metabolism Cellular Respiration, Fermentation LAB: Yeast Fermentation	
14	Nov 18-22	Unit 4: Metabolism Photosynthesis LAB: Algae Metabolism Day 1	
15	Nov 25-26	Unit 4: Metabolism LAB: Algae Metabolism Day 2 ***Thanksgiving Break Nov 27-29***	
16	Dec 2-6	Unit 4: Metabolism Ecosystem Metabolism Essay Work	
17	Dec 9-13	Unit 4: Metabolism Essay Work Course Surveys	Unit Assignment: Metabolism Essay

Spring Semester 2020

Week	Date	Unit / Topic	Assignment / Assessment
1	Jan 13-17	Documentary prep week Documentary - Choose groups, invite ITMC to speak and introduce video editing software	
2	Jan 21-24	Unit 5: Gene Expression Central Dogma of Molecular Biology Protein Structure/Function ***Jan 20th MLK Day***	
3	Jan 27-31	Unit 5: Gene Expression Stem cells and cell differentiation Lab: Beta gal expression	
4	Feb 3-7	Unit 5: Gene Expression Prokaryotic regulation of expression - Operons	
5	Feb 10-13	Unit 5: Gene Expression Eukaryotic regulation of expression Epistasis/Genetics ***Feb 14-17 Extended Weekend***	Unit Quiz
6	Feb 18-21	Unit 6: Cell Signalling Cell Cycle Basics	
7	Feb 24-28	Unit 6: Cell Signalling Signal Transduction Cell Cycle Posters	
8	Mar 2-6	Unit 6: Cell Signalling Continue Cell Cycle Posters Introduce Hallmarks of Cancer Introduce Cancer Research Project	Cell Cycle Posters Due

9	Mar 9-13	Unit 6: Cell Signalling Continue Hallmarks of Cancer	
	Mar 16-20	***Spring Break***	
10	Mar 23-27	Unit 6: Cell Signalling Work on Cancer Posters	
11	Mar 30-Apr 3	Unit 6: Cell Signalling Cancer Poster Symposium	Cancer Poster Symposium
12	Apr 6-9	Unit 7: Molecular Biology Using molecular Bio to study cancer ***Apr 10-13th Extended Weekend***	
13	Apr 14-17	Unit 7: Molecular Biology LAB: Ligation and restriction digest LAB: Transformation and plate cells, count colonies	
14	Apr 20-24	Unit 7: Molecular Biology Microbiome & Restaurant hypothesis LAB: Oral microbiome day 1	
15	Apr 27-May1	Unit 7: Molecular Biology LAB: Oral microbiome day 2 LAB: Oral microbiome day 3	
16	May 4-8	Unit 7: Molecular Biology Immune system, vaccines, viruses	Unit Exam
17	May 11-15	Documentary Production	
18	May 18-22	Documentary Production ABS Study Post Testing and Course Surveys	Documentary, Final Script and Works Cited (Due May 20th)