Department: Science
Course Title: Biology IB HL
Course Number: 3033-3034
Grade Level(s): 11 & 12
Length of Course: 2 Years
Prerequisite(s): A or B in Chemistry, or C with teacher recommendation; first year of course is AP Biology; Signed IB Contract

UC/CSU (A-G) Requirement: D

AP Exam Requirement
Students attempting to receive college credit for Advanced Placement and International Baccalaureate courses are required to pass a College Board exam which validates coursework. This exam is not a requirement for District High School credit, grade increases, or extra credit.

Student fees are allowable for Advanced Placement and International Baccalaureate Diploma examinations for college credit, so long as (1) taking the exam is not a course requirement; (2) the exam results have no impact on a pupil’s grade or credit in a course; and (3) eligible economically disadvantaged high school pupils who receive school district funding towards the exam fee shall pay $5.00 of the fee. (EC sections 52240-52244; 52920-52922.)

IB Diploma Programme course outlines

Teachers responsible for each proposed subject must prepare a course outline following the guidelines below. While IB subject guides will be used for this exercise, teachers are expected to adapt the information in these guides to their own school’s context. Please be sure to use IBO nomenclature throughout. The name of the teacher(s) who wrote the course outline must be recorded at the top of the outline.

Name of the teacher who prepared the outline:

John P. Jones
Name of the course:
For example, English A1, HL.

Biology HL

Course description:
In two to three paragraphs, describe the course in terms of focus, purpose, aims and objectives, the inclusion of internationalism, the proposed process, and expected assessment. This should be a summary.

IB Biology will incorporate a global and inquiry based approach to teaching the biological science concepts. Students will examine the nature of science and scientific discovery within the scope of four major unifying themes: Structure and Function, Universality vs. Diversity, Equilibrium within Systems, and Evolution.

The nature of this biology course will emphasize the investigative and analytical skills of the students with focus on process, design, and evaluation of experimental science. Students will be expected to take an active and personal role in their learning of biological concepts through critical thought processes and creative problem solving. Students will be expected incorporate knowledge gained through other courses, such as math and history, in their analysis of science content. Examining the historical significance of scientific discovery and the role of other cultures in science will be included in discussions and evaluation of major biological themes. Math knowledge, in particular, will be integrated into data analysis and explanations of statistical significance of data in conclusions of laboratory activities and projects.

An important component of each major topic will be to explore the global implications of science in terms of research, history of discovery, and human ecological and biogenetic impact. In modern times, topics such as biotechnology, genetic engineering, global warming, habitat destruction, and alternative fuels have far reaching consequences. Students will be expected to explore the international implications of such topics through debates, Socratic seminars, and research papers, in addition to examining the wide reaching aspects of their practical laboratory experiences through the analysis process. The examination of personal responsibility in society and how scientific knowledge can help in becoming an active and positive force in the community will be a major component of biological content in order to encourage students who are socially conscious and scientifically aware of their personal impact on the world from a moral, social, and economic perspective.

The IB Learner Profile will be incorporated into daily lessons since the teacher already addresses the Expected Schoolwide Learning Results for MVHS, which are directly aligned with the key qualities from the IB Learner Profile.

Assessments will include both formative and summative assessments that incorporate teacher designed materials, in addition to the required IB external and internal assessments.
Topics:

In narrative or outline form, list what you will cover in your course to meet the IB syllabus requirements. In addition, if IB courses are going to be combined with Advanced Placement or other curriculums, outlines should address additional non-IB topics to be covered.

<table>
<thead>
<tr>
<th>Biology - HL</th>
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<tbody>
<tr>
<td><strong>Topic</strong></td>
<td><strong>Sub-Topics</strong></td>
<td><strong>Labs/Activities</strong></td>
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<tr>
<td>1. Statistical Analysis (Topic 1)</td>
<td>1.1 – 1.6</td>
<td>Activity: Introduction to statistical analysis</td>
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<td>2. The Chemistry of Life (Topic 3 &amp; 7)</td>
<td>3.1 – Chemical elements and water</td>
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<td>3.2 – Carbohydrates, lipids, proteins</td>
<td>Lab: Organic Chemistry</td>
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<td>7.5 – Proteins</td>
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<td>7.6 – Enzymes</td>
<td>Lab: Enzyme Catalysts (IB)</td>
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<td>3. Cells (Topic 2)</td>
<td>2.1 - Cell theory</td>
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<td>2.4 – Membranes</td>
<td>Lab: Diffusion/Osmosis</td>
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<td>2.2 - Prokaryotic cells</td>
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<td>2.3 - Eukaryotic cells</td>
<td>Lab: Comparing Cells</td>
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<td>2.5 – Cell division</td>
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<td>4. Cellular Respiration &amp; Photosynthesis (Topic 8)</td>
<td>8.1 – Cellular respiration</td>
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<td></td>
<td>8.2 – Photosynthesis</td>
<td>Lab: Plant pigments &amp; photosynthesis</td>
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<td>5. Genetics (Topic 4 &amp; 10)</td>
<td>10.1/4.2 – Meiosis</td>
<td>Lab: Meiosis – Sordaria Asci</td>
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<td>4.1 – Chromosomes, genes, alleles, mutations</td>
<td>Activity: Karyotyping</td>
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<td>4.3 – Theoretical genetics</td>
<td>Lab: Fly Lab</td>
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<td>10.2 – Dihybrid crosses &amp; linkage</td>
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<td>10.3 – Polygenic inheritance</td>
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<td>4.4 – Genetic engineering &amp; biotechnology</td>
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<td>6. Nucleic Acids &amp; Proteins (Topic 7)</td>
<td>7.1 – DNA structure</td>
<td>Lab: Extracting DNA</td>
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<td>7.2 – DNA replication</td>
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<td>7.3 – Transcription</td>
<td>Activity: Modelling Protein Synthesis</td>
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<td>7.4 - Translation</td>
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</tbody>
</table>
| 7. Evolution  
(Topic 5/ Option D) | 5.5 - Classification  
D1 - Origin of life  
D2 – Species and speciation  
D4 – Hardy-Weinberg  
D3 – Human evolution  
D5 – Phylogeny  
Lab: Natural Selection  
Lab: Population genetics and evolution |
|------------------|--------------------------------------------------|
| 8. Plant Science  
(Topic 9) | 9.1 – Plant Structure & growth  
9.2 – Transport in angiosperms  
9.3 – Reproduction in angiosperms  
Lab: Transpiration  
Lab: Fruits & flowers |
| 9. Ecology  
(Topic 5) | 5.3 – Populations  
5.1 – Communities & ecosystems  
5.2 – The Greenhouse Effect  
Lab: Primary Productivity  
Lab: Greenhouse gases |
| 10. Human Health and Physiology  
(Topic 6/Topic 11)  
(Options E and H) | 11.2 – Muscles and movement  
E1-E6 – Neurobiology and Behavior  
6.5 – Nervous/endocrine system  
H1 – Hormone Control  
6.2 – Transport system (circulatory)  
H5 – The Transport System  
6.4 / H6 – Gas exchange (respiration)  
6.3/11.1 – Immune system  
6.1/H2 – Digestion  
H3 – Absorption of Digested Foods  
H4 – Functions of the Liver  
11.3 – Kidneys (excretory)  
6.6/11.4 – Reproduction  
Activity: Reaction time  
Lab: Animal Behavior (IB)  
Lab: Physiology of the Circulatory  
Lab: Digestive Enzymes  
Lab: Urinalysis |

**Assessment:**

Knowledge of IBO-required assessments and descriptors should be evident. All parts of IB assessment should be addressed, both internal and external. In addition, examples of non-IB monitoring should be given, if they are part of the course.
Internal assessments (24% of total) will consist of practical laboratory activities assessed using criterion based rubrics. Formal laboratory write up will be assessed based on the following criteria; Design, Data Collection and Processing, Conclusion and Evaluation, Manipulative Skills, and Personal Skills.

External assessments (76% of total) will consist of the three IBO required written papers. Paper 1 comprises 20% of total and includes multiple choice questions based on objectives 1 and 2. Paper 2 comprises 36% of total and addresses objectives 1, 2, and 3 using data based questions. Paper 3 comprises 20% of total and consists of short answer responses which address the two options covered and objectives 1, 2, and 3.

Students will also be assessed by teacher constructed non-IBO assessments including oral presentations, group and individual projects, interviews with teacher, chapter quizzes and tests, and research papers.

The Group 4 Project will involve an interdisciplinary approach to scientific investigation and will encompass all 3 IB sciences; Biology HL & SL, Chemistry HL & SL, and Physics SL. Students will collaborate in small groups of 3 individuals. In order to account for all 3 disciplines, the group 4 project will be completed during the first year of HL biology. On the Group 4 Project, three main components. Planning involves the student directed meetings to develop their hypothesis and experimental design. Action encompasses the performance of the experiment procedure as designed by the group. Evaluation includes interpreting data and drawing conclusions, as well as preparing and presenting results.

**Resources:**

List the books and other resource materials and software that will be used in the course. Information should include what is currently available as well as what is being ordered.

**Course Textbook:** Biology, AP Edition, Campbell, Neil A; Reese, Jane B. Pearson Education Inc., San Francisco, CA 2008

**Additional References:**

Biology for the IB Diploma Study Guide. Oxford University Press. 0-19-915143-1
**Teaching time:**

List all classroom teaching hours for each HL and SL course. Explain how the hours are calculated.

<table>
<thead>
<tr>
<th>HL/SL course</th>
<th>Teaching hours</th>
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<tbody>
<tr>
<td>Biology HL</td>
<td></td>
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<tr>
<td>Semester 1:</td>
<td>39 regular days x 100 minutes = 3900</td>
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<tr>
<td></td>
<td>(Year 1) 3 minimum days x 60 minutes = 240</td>
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<tr>
<td>Semester 2:</td>
<td>45 regular days x 100 minutes = 4500</td>
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<td></td>
<td>(Year 1) 1 minimum day x 60 minutes = 60</td>
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<tr>
<td>Semester 1:</td>
<td>39 regular days x 100 minutes = 3900</td>
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<tr>
<td></td>
<td>(Year 2) 3 minimum days x 60 minutes = 240</td>
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<tr>
<td>Semester 2:</td>
<td>32 regular days x 100 minutes = 3200</td>
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<tr>
<td></td>
<td>(Year 2) 1 minimum day x 60 minutes = 60</td>
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<td></td>
<td>**Total hours before May 1st External Examination period = **266 hours</td>
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</tbody>
</table>

**In addition:**

**For group 4 subjects:**

- Have the teachers organized appropriate laboratory exercises and optional topics for study that conform to IBO requirements for the specific science course?
- Does the course provide adequate training in analytical and critical thought?
- Have science teachers collaborated and planned for the group 4 project?
- How do you envision that the methodology and resources with which the sciences are presented will enhance the international perspective of your students?
- Has there been an assessment of the laboratory facilities?
- Is there adequate instructional space for the group 4 courses?
- Are the science laboratories adequately equipped to perform those exercises required by the IB Diploma Programme curriculum?
- Does the school subscribe to appropriate scientific periodicals and journals and maintain balanced, current and adequate stocks in the life and physical sciences?
A minimum of two laboratory exercises will be completed to complement each of the units described in the outline. Lab activities and optional topics are in accordance with the IBO biology guidelines. The course is designed to engage the students in critical thinking exercises as a component of the laboratory activities, as well as through group discussions and presentations of material to the class.

Science teachers from all three disciplines are currently working on the planning of the group 4 project, which is still in the early planning stages. The group 4 project will be completed by April of the first year of the IB science courses.

The inquiry based model of the IB biology course will foster the investigative, creative, and analytical skills of students by requiring them to come up with methods of solving scientific problems on their own. Rather than providing lab procedures, students will be given the problem and will design their own experiments to find answers. Analysis of results and experimental error will require extended interpretation of data, as well as encouraging creative and evaluative thought processes. Students will also be expected to take a global approach to investigating modern scientific issues, which will include evaluating research papers, impact of topics like genetic engineering of foods for improvised countries, disease epidemics, and conservation of natural resources. In addition, students will determine their own impact on the world and how they can be a positive influence on both global and local community issues.

Laboratory facilities are adequate for IB courses and will be conducted in the larger science classroom to allow for space and equipment access in order to support the requirements of the course. Lab are equipped with the standard laboratory equipment and supplies to support the IB course and many of the laboratory exercises will correspond with the labs being run in the AP Biology course. Lab equipment and consumable supplies will be shared between the courses. Additional supplies for biotechnology related labs may be required and will be obtained through teacher participation in several biotechnology workshop opportunities in the San Diego area (Scripps Research Institute and Biogen IDEC).

Students will have access to the EBSCO online database for periodical research through the school media center. In addition, our media specialist is currently working on obtaining access to databases though the University of California and California State Universities.

For all subjects:

- Has a thorough review of the available resource materials and equipment (both within the department and in the library/media centre) been conducted?
- Are instructional materials available in sufficient quality, quantity and variety to give effective support to the aims and methods of the courses?
- Are community resources used both within the classroom and as part of regular field trips?
- Are the needs and projected costs of acquiring all necessary materials and equipment for each subject group clearly stated?
• Is an international perspective included?

The science department has a variety of resources available in the common laboratory area, as well as in individual teacher’s classrooms, including textbooks, periodicals, and personal reference books. A review of additional resources and media resources is currently in progress and there is active collaboration with the media specialist on obtaining access to University of California online resources in ongoing. Instructional materials that are readily available, such as higher level science journals, will be purchased as the program develops.

Access to internet and online databases, such as EBSCO will improve as our school wide technology continues to be updated. Science materials are maintained in a common science hallway and access of all material and laboratory supplies is available. Some materials for specialized investigations, especially biotechnology, will need to be purchased. Additional textbooks (Biology, Campbell) may need to be purchased to accommodate both the IB and AP courses. A mobile computer lab, in addition to a new desktop computer lab, is available for internet research and connections to real time research projects that are occurring world wide.

The proximity to San Diego with a large biotech community, excellent research universities, museums, and prominent zoological facilities allows for multiple opportunities for student involvement with a variety of science experiences and field trips, in addition to outreach programs offered by various science institutions.

The majority of the supplies required are already available within the existing courses offered through the science department. Additional resources will be obtained through teacher participation in workshops and professional development courses offered at local universities and biotech companies. These workshops provide curricula and limited laboratory supplies.

Students will be investigating biology topics from a broad outlook, including local, national, and international perspectives. Course content will incorporate global issues, such as disease pandemics, ecological and environmental conservation, and genetic engineering to support food growth in impoverished areas. Students will be expected to examine historical influences and contributions of different cultures on scientific knowledge, the global influence of modern technology and information availability, and the process of sharing and presenting scientific research within the international scientific community. The evaluation of how and why scientific information is obtained, as well as the ethical and moral concerns of how that information is used, will be incorporated into analysis of personal responsibility and understanding of scientific knowledge. Students will be responsible for assessing their personal methods of critical thinking and comprehension of scientific information through self reflection and peer evaluation of course work.