Bachelor of Science in Biology

Programme Specification
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<td><strong>Awarding Body</strong></td>
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Bachelor of Science in Biology

BS Biology is a 4-year undergraduate honors program that provides a rigorous approach to the biological sciences. Its curriculum, consisting of essential biological disciplines and over 50 options for majors’ electives, is excellent preparation for medical schools, as well as for graduate studies in institutions here and abroad. Majors choose from among four areas of Specialization, namely: Biomedical Science, Cell and Molecular Biology, Ecology and Systematics, and Microbiology. These being the research areas of the Department, the majors are given rigorous training through innovative lecture and laboratory courses and through the undergraduate Thesis and Practicum. Majors choose eight electives within their chosen area, ultimately leading to a formal Specialization in that area upon graduation.

Admission Requirements

Applicants for admission to the Bachelor of Science in Biology must satisfy the University requirements for admission. The applicant should pass the Ateneo College Admission Test (ACET) and belong to the 85 percentile rank or higher of the takers. ACET Passers who are not coming from STEM Strand in Senior High School have to take and pass bridging courses in Biology, Chemistry, Physics, and Mathematics.

Retention Requirements

For a student of the B.S. Biology program to stay in his/her program in the succeeding school year, he/she must have:

1. Had a yearly QPI of 2.50 or above in the previous school year;
2. Passed all the Biology fundamental courses in the first year for students from the SHS STEM strand;
3. Pass the Biology, Chemistry, Physics, and Mathematics bridging courses in addition to the courses mentioned above for students from the SHS non-STEM strands;
4. Not had more than three (3) Ds and Fs in science subjects (Chemistry, Mathematics, Physics) for the duration of his/her program;
5. Not had more than three (3) Ds in Biology subjects for the duration of his/her program; and

Shifting Requirements

For a student of another Department to be allowed to shift into B.S. Biology, he/she must have:

1. Had a cumulative QPI of 2.75 in the previous school year or in the last two semesters (excluding the Intersession);
2. Had a grade of C+ or higher in all science and engineering subjects (Chemistry, Mathematics, Physics) taken, including Natural Science subjects;
3. Undergone an interview with the Department Chairperson and/or Undergraduate Student Coordinator; and
4. Met all other shifting requirements set by the OCGC and the OADAA.

If the shifting student did not come from the STEM strand in Senior High School, he/she must follow the non-STEM track of the B.S. Biology program in addition to the above conditions.

Programme Learning Outcomes

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<tr>
<th>Core Curriculum Learning Outcomes (CCLO)</th>
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<tr>
<td><strong>CCLO1.</strong> Demonstrates effective communication skills (listening and speaking, reading, and writing) in English and Filipino</td>
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<tr>
<td><strong>CCLO2.</strong> Evaluates information and issues in various spheres of life using mathematical reasoning and statistical tools to process and manage data</td>
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<tr>
<td><strong>CCLO3.</strong> Proposes ways to address pressing social and ecological problems using appropriate critical approaches and scientific methodologies</td>
</tr>
<tr>
<td><strong>CCLO4.</strong> Develops a creative and moral imagination that is responsive to contemporary global realities and challenges, but also deeply rooted in local histories, conditions, norms, and institutions</td>
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<tr>
<td><strong>CCLO5.</strong> Internalizes the significance and value of her/his own unique existence and purpose in life in light of Christian faith</td>
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<tr>
<td><strong>CCLO6.</strong> Discerns life choices with a keen awareness of ethical dilemmas and considerations</td>
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<td><strong>CCLO7.</strong> Exemplifies a commitment to enhancing human life and dignity, especially of those who are excluded and in greatest need</td>
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<tr>
<td><strong>CCLO8.</strong> Practices a vision of leadership and committed citizenship rooted in Christian humanism</td>
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<th>Major Curriculum Learning Outcomes (MCLO)</th>
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<tr>
<td><strong>MCLO1.</strong> Discuss with conviction basic biological concepts in both formal and informal settings.</td>
</tr>
<tr>
<td><strong>MCLO2.</strong> Determine the appropriate methodologies in approaching a specific scientific problem.</td>
</tr>
<tr>
<td><strong>MCLO3.</strong> Demonstrate a high level of proficiency in basic field and laboratory techniques and data analysis.</td>
</tr>
<tr>
<td><strong>MCLO4.</strong> Produce high quality outputs (e.g. research, products, etc.) that will contribute to the society.</td>
</tr>
<tr>
<td><strong>MCLO5.</strong> Apply ethical principles in their respective practices.</td>
</tr>
<tr>
<td><strong>MCLO6.</strong> Initiate social transformation through strong leadership in their chosen disciplines.</td>
</tr>
<tr>
<td><strong>MCLO7.</strong> Demonstrate love for all life that translates into concrete action toward its protection and conservation.</td>
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# Bachelor of Science in Biology Curriculum (2018 version)

## First Year

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## Second Year

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### First Semester

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**Programme Specification**
### THIRD YEAR

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### Curriculum Map

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<td>8</td>
<td>20</td>
<td>21</td>
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<td>175 units</td>
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</table>

**Biology Fundamental Courses**
- BIO 100.01
- BIO 110.01
- BIO 120.01
- BIO 130.01
- BIO 150.01
- BIO 160.01
- BIO 140.01
- BIO 171.01

**Biology Tool Courses**
- CHEM 31.21
- CHEM 41.21
- CHEM 51.21
- BIO 30.01

**Core Curriculum Courses**
- ENGL 11
- HISTO 11

**Specialization Courses**
- THEO 11
- PHILO 11
- SOCSC 11

**Thesis and Practicum**
- MATH 10
- STS 10

- BIO 199.1
- BIO 197
- BIO 199.2
- BIO 199.3
Core Curriculum Programme Learning Outcomes (CCPLOs) to Ideal Ateneo Graduate

<table>
<thead>
<tr>
<th>IDEAL ADMU GRADUATE</th>
<th>CCPLO₁</th>
<th>CCPLO₂</th>
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<th>CCPLO₈</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develops the self and deepens self-awareness continuously (life-long learning) in the context of a community (Conscience)</td>
<td>✔</td>
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<tr>
<td>1. Exemplifies resourcefulness, creativity, respect and appreciation for rigor, scholarship, and love of learning</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>2. Manages the self in diverse contexts -- private and public, while being aware of strengths, limitations, and role in society</td>
<td>✔</td>
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<tr>
<td>3. Demonstrates the capacity to discern the rightness and goodness of one’s thoughts and actions, guided by an inner sense of purpose and a deep awareness of one’s gifts and weaknesses</td>
<td>✔</td>
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<tr>
<td>Engages the world while critically rooted in local sensibilities, local and global cultures, and social realities (cultural rootedness, global perspective) (Compassion)</td>
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<tr>
<td>4. Critically evaluates how local history and conditions, contemporary events, and the Filipino heritage, in all its dimensions, shape the Filipino identity</td>
<td>✔</td>
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<td>✔</td>
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<tr>
<td>5. Participates proactively and productively in national and global discourses, while remaining rooted in local culture and local social conditions</td>
<td>✔</td>
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<tr>
<td>6. Participates in a global exchange of experiences to contribute to national and global development</td>
<td>✔</td>
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<td>7. Engages in productive dialogues with people from different cultures and different faiths</td>
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<td>IDEAL ADMU GRADUATE</td>
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<td>Uses the scientific spirit, the creative imagination, a continuing sustainable</td>
<td>✓</td>
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<td>development perspective, and Christian values in becoming a leader and agent of</td>
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<tr>
<td>change (academic excellence, sustainable development perspective)</td>
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<td>8. Uses technical competencies, understanding of complexity, appreciation of</td>
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<tr>
<td>local conditions, and global and sustainable development perspectives in analyzing</td>
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<td>contexts, solving problems, and making decisions</td>
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<td>9. Reflects and acts with sensitivity, reason, and faith; consistent with</td>
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<td>Christian values that respect and recognize diverse creeds and spiritualities</td>
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<td>10. Leads with passion, a sense of purpose, and critical intelligence, innovates</td>
<td>✓</td>
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<td>in one’s area of expertise, and in the process, facilitates dialogue and resolution</td>
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<td>of conflicts, and engages others</td>
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<td>Develops a vision of personal and structural transformation, grounded in social</td>
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<td>awareness and in Ignatian spirituality that is strongly oriented to faith and</td>
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<td>justice (spiritual grounding, social involvement)</td>
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<td>11. Works with others to create a just and hopeful vision of the future,</td>
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<td>proceeding with integrity and conviction towards personal, structural, and</td>
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<td>institutional transformation grounded in Ignatian spirituality</td>
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<tr>
<td>12. Translates one’s sense of service to involvement in the renewal of the</td>
<td>✓</td>
<td>✓</td>
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<td>Church and of society, especially work with the marginalized, at the frontiers or</td>
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<td>the peripheries</td>
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<td>13. Reaches out with compassion to others as a result of a discerning spirit that</td>
<td>✓</td>
<td>✓</td>
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<td>comes from an awareness of one’s own woundedness and the joy and hope that comes</td>
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<td>from a personal encounter with a merciful God</td>
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</table>
## Major Programme Learning Outcomes (MPLOs) and the Ideal Ateneo Graduate

### Develops the self and deepens self-awareness continuously as a life-long learner in the context of a community (Conscience)

<table>
<thead>
<tr>
<th>IDEAL ADMU GRADUATE</th>
<th>MPLO₁</th>
<th>MPLO₂</th>
<th>MPLO₃</th>
<th>MPLO₄</th>
<th>MPLO₅</th>
<th>MPLO₆</th>
<th>MPLO₇</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Exemplifies resourcefulness, creativity, respect and appreciation for rigor, scholarship, and love of learning</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td></td>
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</tr>
<tr>
<td>2. Manages the self in diverse contexts -- private and public, while being aware of strengths, limitations, and role in society</td>
<td></td>
<td>✓</td>
<td></td>
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<tr>
<td>3. Demonstrates the capacity to discern the rightness and goodness of one's thoughts and actions, guided by an inner sense of purpose and a deep awareness of one's gifts and weaknesses</td>
<td></td>
<td>✓</td>
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</table>

### Engages the world while critically rooted in local sensibilities, local and global cultures, and social realities (Compassion)

<table>
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<tr>
<th>IDEAL ADMU GRADUATE</th>
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<tbody>
<tr>
<td>4. Critically evaluates how local history and conditions, contemporary events, and the Filipino heritage, in all its dimensions, shape the Filipino identity</td>
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<td>✓</td>
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<tr>
<td>5. Participates proactively and productively in national and global discourses, while remaining rooted in local culture and local social conditions</td>
<td>✓</td>
<td></td>
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<td></td>
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<tr>
<td>6. Participates in a global exchange of experiences to contribute to national and global development</td>
<td>✓</td>
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<tr>
<td>7. Engages in productive dialogues with people from different cultures and different faiths</td>
<td>✓</td>
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<td>IDEAL ADMU GRADUATE</td>
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<tr>
<td><strong>Uses a scientific spirit, creative imagination, an integral and sustainable development perspective, and Christian values in becoming a leader and agent of change</strong> (Competence)</td>
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<tr>
<td>8. Uses technical competencies, understanding of complexity, appreciation of local conditions, and global and sustainable development perspectives in analyzing contexts, solving problems, and making decisions</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>9. Reflects and acts with sensitivity, reason, and faith; consistent with Christian values that respect and recognize diverse creeds and spiritualities</td>
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<td></td>
<td>✓</td>
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</tr>
<tr>
<td>10. Leads with passion, a sense of purpose, and critical intelligence, innovates in one's area of expertise, and in the process, facilitates dialogue and resolution of conflicts, and engages others</td>
<td>✓</td>
<td>✓</td>
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</tr>
<tr>
<td><strong>Develops a vision of personal and structural transformation, grounded in an awareness of the “signs of the times” and in Ignatian spirituality that is strongly oriented to faith and justice</strong> (Commitment)</td>
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<tr>
<td>11. Works with others to create a just and hopeful vision of the future, proceeding with integrity and conviction towards personal, structural, and institutional transformation grounded in Ignatian spirituality</td>
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<td>✓</td>
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<tr>
<td>12. Translates one's sense of service to involvement in the renewal of the Church and of society, especially work with the marginalized, at the frontiers or the peripheries</td>
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<td>✓</td>
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<tr>
<td>13. Reaches out with compassion to others as a result of a discerning spirit that comes from an awareness of one's own woundedness and the joy and hope that comes from a personal encounter with a merciful God</td>
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</table>
Major Programme Learning Outcomes (MPLOs) with CHED Memorandum Order No. 49, Series of 2017

<table>
<thead>
<tr>
<th>CHED Memorandum Order No. 49, Series of 2017</th>
<th>MPLO₁</th>
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<tr>
<td>Program Outcomes specific to BS Biology</td>
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<tr>
<td>1. Develop an in-depth understanding of the basic principles governing the science of life.</td>
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<tr>
<td>2. Utilize techniques/procedures relevant to biological research work in laboratory or field settings.</td>
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<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
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<tr>
<td>3. Apply basic mathematical and statistical computations and use of appropriate technologies in the analysis of biological data.</td>
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<td>✔️</td>
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<tr>
<td>4. Extend knowledge and critically assess current views and theories in various areas of the biological sciences.</td>
<td></td>
<td></td>
<td></td>
<td>✔️</td>
<td>✔️</td>
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Course Offerings

BIO 1.01
FOUNDATIONS OF THE BIOLOGICAL SCIENCES, LECTURE
3 units
Co-requisite: BIO 1.02
Basic Concepts in Biology, Lecture (3 units) is meant for students who did not graduate from the Science, Technology, Engineering, and Mathematics (STEM) Strand and serves as a bridging course to higher biology lecture subjects. It covers basic concepts of biology such as the definitions and origins of life, the hierarchies of organization among living organisms, and evolution.

BIO 1.02
FOUNDATIONS OF THE BIOLOGICAL SCIENCES, LABORATORY
2 units
Co-requisite: BIO 1.01
Basic Concepts in Biology, Laboratory (2 units) complements the lecture course BIO 1.01. It is meant for students who did not graduate from the Science, Technology, Engineering, and Mathematics (STEM) Strand and serves as a bridging course to higher biology laboratory subjects. It trains students in basic laboratory procedures such as microscopy, specimen preparation, collection, the scientific method, and good laboratory practice.

BIO 10.01
BIODIVERSITY: LIFE ON EARTH, LECTURE
3 units
Co-requisite: BIO 10.02
Biodiversity: Life on Earth, Lecture (3 units) provides a scientific approach to the astounding diversity of life on Earth. Basic concepts of biodiversity, conservation, and ecology will be covered. This course aims to provide students with the knowledge and perspective that will enable them to formulate informed opinions on issues affecting global biodiversity. Socioeconomic drivers of biodiversity loss, impacts of climate change, and causes of extinction will also be discussed.

BIO 10.02
BIODIVERSITY: LIFE ON EARTH, LABORATORY
1 unit
Co-requisite: BIO 10.01
Biodiversity: Life on Earth, Laboratory (1 unit) will allow the students to practice key field and laboratory techniques involved in the study of the diversity of life on Earth. These techniques include visual and other sensory observations, sampling, and cataloguing, as well as experiments simulating the effects of environmental fluctuations on organisms and their ecosystems. Problem-solving exercises in conservation and management will also be performed. This course will use the university campus as a natural laboratory, particularly in the context of urban biodiversity. An educational field trip to a natural ecosystem outside of the university will also be a likely requirement.

BIO 11.01
HUMAN BIOLOGY, HEALTH, AND DISEASE, LECTURE
3 units
Co-requisite: BIO 11.02
The Human Biology, Health, and Disease, Lecture (3 units) is a problem-based course dealing with common illnesses, conditions and their effects on the human body designed for the non-science major. The overview of structures and functions of the organs will be covered, with particular emphasis on how these work together to maintain wellness. Particular focus will also be given to current trends in medicine, health, and disease prevention.

BIO 11.02
HUMAN BIOLOGY, HEALTH, AND DISEASE, LABORATORY
1 unit
Co-requisite: BIO 11.01
The Human Biology, Health, and Disease, Laboratory (1 unit) is a problem-based course dealing with common illnesses, conditions and their effects on the human body for the non-science major. Together with the lecture class, the overview of structures and functions of the organs will be discussed, with emphasis on the practical aspects of the organ systems of
the human body. Particular focus will also be given to current trends in medicine, health promotion methods, disease prevention practices, aging, sex, nutrition, and exercise. Workshops on the basic concepts of first-aid and disaster management will also be introduced in this course.

**BIO 12.01**  
**BIOTECHNOLOGY FOR EVERYONE, LECTURE**  
3 units  
**Co-requisite:** BIO 12.02  
Biotechnology for Everyone, Lecture (3 units) introduces the scientific basis, historical development, and current applications of traditional and modern biotechnology. It will focus on the basic principles of biotechnology and its application in food, agriculture, industry, environment, health, and medicine. Discussions on the ethical, legal, and moral issues brought by these applications will guide students to make informed decisions as our society adopts more of what modern biotechnology has to offer.

**BIO 12.02**  
**BIOTECHNOLOGY FOR EVERYONE, LABORATORY**  
1 unit  
**Co-requisite:** BIO 12.01  
Biotechnology for Everyone, Laboratory (1 unit) complements the lecture course BIO 12.01. This course introduces the scientific basis, historical development, and current applications of traditional and modern biotechnology for the non-science major. It will focus on the basic application of biotechnology in food, agriculture, industry, environment, health, and medicine.

**BIO 21**  
**THE BIOLOGY OF SCIENCE FICTION**  
3 units  
**Pre-requisite:** Any literature course  
The Biology of Science Fiction (3 units) deals with the critical analysis and discussion of science fiction, the genre of the novum, and of the biological basis behind popular trends in the genre. Here the nova are wondrous biology-themed nova such as strange alien worlds and their life-forms, hybrids, clones, genetically modified organisms, and bizarre reproduction.

**BIO 22**  
**WELCOME TO THE CLONE CLUB: CLONING ETHICS AND GENETICS IN “ORPHAN BLACK” AND OTHER SCI-FI WORKS**  
3 units  
Welcome to the Clone Club: Cloning Ethics and Genetics in “Orphan Black” and Other Sci-fi Works (3 units) tackles cloning technology in popular culture, primarily through the insightful and intelligent television series “Orphan Black.” This course discusses the science of cloning, grounding it in the field of genetics; and the wealth of bioethical issues surrounding the creation of clones, especially humans. What does it mean to be a clone from a biological, social, legal, and philosophical perspective? What is the price to be paid for being a member of the “Clone Club?”

**BIO 23**  
**THE POKÉDEX DECODED: BIOLOGY OF POKÉMON**  
3 units  
The Pokédex Decoded: Biology of Pokémon (3 units) tackles concepts such as the anatomy, morphology, evolution, and ecology of the titular organisms. Although the science behind the franchise mimics concepts seen in reality, the different media in which Pokémon appear only scratch the surface of the biology regarding the growth, survival, development, habits, and adaptability of these organisms. This course locks on to the different concepts ingrained behind the possible nature of these creatures and will bind together different biological topics in order to bestow students with knowledge applicable to real organisms.

**BIO 24**  
**CRYPTOZOOLOGY: THE BIOLOGY OF MYTHICAL CREATURES**  
3 units  
Cryptozoology: The Biology of Mythical Creatures (3 units), deals with the science behind cryptids. This course aims to discuss questions like "What is the science behind bigfoot?", "Is the loch ness monster real?", "Do mermaids exist?" and the like. The anatomy, morphology, ecology, and behavior of multiple cryptids will be
discussed for the students to be able to ultimately prove or refute the existence of these organisms.

**BIO 30.01**
**BIOPHYSICS, LECTURE**
2 units
Co-requisite: BIO 30.02
Biophysics, Lecture (BIO 30.01) is a 2-unit lecture course that discusses physical processes across the hierarchical levels of organization in life, from molecular to organismal. The focus will be on how physics governs molecular, anatomical, physiological, and ecological function. The course will also cover applications in biomedical sciences, ecology, and biotechnology.

**BIO 30.02**
**BIOPHYSICS, LABORATORY**
2 units
Co-requisite: BIO 30.01
Biophysics, Laboratory (2 units) provides an avenue for applying and modeling the various physical processes that govern life on Earth. Exercises that simulate biological and environmental phenomena that affect behavioral, systemic, and organismic processes are focused on. The course also tackles biomedical, ecological, and genetic applications of these physical processes.

**BIO 31.01**
**BIOSTATISTICS, LECTURE**
2 units
Co-requisite: BIO 31.02
Biostatistics, Lecture (2 units) serves as an introduction to basic statistical principles and methods. These include basic descriptive and inferential statistics, as well as data management from collection to presentation, analysis and interpretation. It introduces students to basic experimental design concepts, as well as some common study design examples. Focus is given to data and experiments from various biological sciences and disciplines.

**BIO 31.02**
**BIOSTATISTICS, LABORATORY**
1 unit
Co-requisite: BIO 31.01
Biostatistics, Laboratory (1 unit) complements the lecture course BIO 31.01. The course provides hands on experience in the collection, analysis, interpretation and presentation of varied forms of biological data. It allows the creation of an experimental design utilizing statistical methods. The course also introduces the utilization of varied software that can be used for various biological problems.

**BIO 32**
**BIOSCIENCE ENTERPRISE**
3 units
Bioscience Enterprise, Lecture (3 units) aims to provide an interdisciplinary education for bioentrepreneurs and future leaders of the life science sector. The syllabus covers an overview of concepts in technology management, the latest in the biomedical science field, together with business management and the ethical, legal and regulatory issues associated with bringing scientific advances to market.

**BIO 100.01**
**GENERAL ZOOLOGY, LECTURE**
3 units
Co-requisite: BIO 100.02
General Zoology, Lecture (3 units) deals with the diversity of form and function in the animal kingdom. The major topics of discussion are animal systematics and structure-function relationships as seen from the cellular to the organism level, thus covering the major evolutionary trends across the major animal taxa and their structures and functions. It will include discussions on human impacts on animal biodiversity and ecology.

**BIO 100.02**
**GENERAL ZOOLOGY, LABORATORY**
2 units
Co-requisite: BIO 100.01
General Zoology, Laboratory (2 units) complements the lecture course BIO 100.02. It develops hands-on laboratory skills that pertain to the study of animals across all hierarchical levels. Topics include specimen preparation and microscopy, dissection and identification of structures, and identification and classification of animals.
Helminthology (3 units) deals with the anatomy and physiology of medically important worms (cestodes, trematodes, nematodes) and the epidemiology and treatment of diseases caused by these organisms, particularly in the tropics.

Histology (3 units) provides a comparative study of the structure and function of vertebrate tissues and organs using the systems approach. It includes demonstrations and return-demonstrations on the use of microscopic techniques in studying histologic structures. Moreover, it tackles basic applications on biomedicine and research.

Aquatic Animal Nutrition (3 units) discusses the digestive anatomy, nutrient requirement, and feeding standards for different marine and freshwater species for growth, maintenance, and reproduction. Current demands, trends, operations, management and marketability of the aquaculture industry and its products in the Philippine setting are also discussed.

Comparative Vertebrate Anatomy, Lecture (3 units) deals with important anatomical principles and theories with emphasis on the study of comparative anatomy, phylogeny and an introduction to relationship in structure, function and evolution in vertebrates.
BIO 110.02
GENERAL BOTANY, LABORATORY
2 units
Co-requisite: BIO 110.1
General Botany, Laboratory (2 units) complements the lecture course BIO 110.01. It includes exercises that explore their basic structural, functional, and physiological characteristics through microscopic examination, specimen preparation and morphological diagnosis.

BIO 110.11
PLANT MORPH-ANATOMY, LECTURE
2 units
Pre-requisites: BIO 110.01 and BIO 110.12
Plant Morph-Anatomy, Lecture (2 units), discusses archetypes of internal and external structure across various plant groups. The morphogenesis and anatomical development of basic plant organs is also discussed in detail. Emphasis is placed on the structural and functional specialization of cells, tissues and organs, with a focus on angiosperms.

BIO 110.12
PLANT MORPH-ANATOMY, LABORATORY
1 unit
Pre-requisites: BIO 110.01 and BIO 110.02; Co-requisite: BIO 110.11
Plant Morph-Anatomy, Laboratory (1 unit) complements the lecture course BIO 110.11. It focuses on microscopic examination and characterization of cells and tissues of the root, stem, leaf, flower, fruit and seeds. The different stages of development of the plant organs are traced. Macroscopic and diagnostic features of the plant organs will be observed, examined and described.

BIO 110.2
PLANT EMBRYOLOGY
3 units
Pre-requisites: BIO 170.01 and BIO 170.02
Plant Embryology (3 units) deals with the descriptive, comparative, and experimental embryology that controls the fertilization, embryogenesis, and endosperm development of flowering plants. It is integrated with the genetic and molecular mechanisms underlying these processes. Technologies and applications that emerged from this field, such as plant tissue culture techniques and production of genetically modified plants will be discussed.

BIO 111
ENTOMOLOGY
3 units
Pre-requisites: BIO 100.01 and BIO 100.02
Entomology (3 units) serves as an introduction to the most diverse taxonomic group of organisms, including taxonomy, morphology, anatomy, development, and ecology of insects. These topics are discussed with emphasis on the importance of insects for medicine, pollination, and ecological bioindication. Classification schemes of the major insect orders are studied. Specific focus is given to aquatic and medically important groups. The course incorporates field collection, laboratory study and taxonomic analysis of insects.

BIO 112
INVERTEBRATE ZOOLOGY
3 units
Pre-requisites: BIO 100.01 and BIO 100.02
Invertebrate Zoology (3 units) deals with the morphology, systematics, ecology, and physiology of representative invertebrates.

BIO 120.01
MICROBIOLOGY, LECTURE
3 units
Co-requisite: BIO 120.02
Microbiology, Lecture (3 units) deals with the basic principles involving methodologies and techniques used in microbiology. Cell structure and function, diversity, and nutrition and metabolism of prokaryotic and eukaryotic microorganisms are highlighted in the discussions. Fundamental techniques utilized in microbiology and the principles behind these will be given emphasis. An overview of microbial biotechnology, medical, and industrial microbiology are also presented.

BIO 120.02
MICROBIOLOGY, LABORATORY
2 units
Co-requisite: BIO 120.01
Microbiology, Laboratory (2 units) complements the lecture course BIO 120.01. It aims to cover the fundamental
BIO 120.11
BACTERIOLOGY, LECTURE
2 units
Pre-requisites: BIO 120.01, BIO 120.02, CHEM 51.21, and CHEM 51.22; Co-requisite: BIO 120.12
Bacteriology, Lecture (2 units) focuses on an advanced understanding of bacteria including their taxonomy, metabolism, ecology, and genetics. Special emphasis will be given on the relationship between bacteria and humans with an introduction on diseases, epidemiology, pathogenesis, and diagnostic techniques.

BIO 120.12
BACTERIOLOGY, LABORATORY
1 unit
Pre-requisites: BIO 120.01, BIO 120.02, CHEM 51.21, and CHEM 51.22; Co-requisite: BIO 120.11
Bacteriology, Laboratory (1 unit) complements the lecture course, BIO 120.11. The course emphasizes basic aseptic techniques used in bacterial isolation and cultivation. Methods used in bacterial identification using morphological, cultural, and biochemical characteristics are highlighted. Exercises on common microbiological diagnostic procedures using culture techniques are also done.

BIO 120.2
MYCOLOGY
3 units
Pre-requisites: BIO 120.01 and BIO 120.02
Mycology (3 units) is an introduction to the general field of fungi and fungi-like organisms. Essential concepts on fungal structure and morphology, taxonomy, ecology, and diversity are given emphasis. A general overview of the impact of fungi relating to humans in terms of diseases and economic importance are also presented.

BIO 120.3
MEDICAL MICROBIOLOGY
3 units
Pre-requisites BIO 120.01 and BIO 120.02
Medical Microbiology (3 units) covers the mechanisms of bacterial, fungal, viral, and parasite pathogenesis. Basis for antimicrobial resistance, emerging and rediscovered infectious agents, medical outbreaks, and topics from current medical research literature are also discussed. Several small-scale laboratory demonstrations are presented to focus on the diagnosis of infectious diseases, such as but not limited to: microbial culturing, antimicrobial susceptibility testing, staining, conventional and recent laboratory testing for the identification of infectious organisms, and evaluation of host immune parameters.

BIO 120.41
FOOD MICROBIOLOGY, LECTURE
3 units
Pre-requisites: BIO 120.01, BIO 120.02, CHEM 51.21, and CHEM 51.22; Co-requisite: BIO 120.42
Food Microbiology, Lecture (3 units) focuses on factors affecting the growth and survival of microorganisms in food systems. Physical, chemical, and biological controls of microbial growth in food are discussed. Emphasis is given to beneficial uses of microorganisms in food production such as fermentation and preservation. In addition, mechanisms employed by foodborne spoilage and pathogenic microorganisms are characterized according to their survival and elimination.

BIO 120.42
FOOD MICROBIOLOGY, LABORATORY
2 units
Pre-requisites: BIO 120.01, BIO 120.02, CHEM 51.21, and CHEM 51.22; Co-requisite: BIO 120.41
Food Microbiology, Laboratory (2 units) complements the lecture course BIO 120.42. The course teaches the techniques in isolation, detection, and cultivation of foodborne microorganisms. Procedures in qualitative and quantitative detection of specific microorganisms present in different types of food are given emphasis. In addition, effects of microbial growth on
the physico-chemical characteristics of different foods are also investigated.

BIO 120.5
INDUSTRIAL MICROBIOLOGY
3 units
Pre-requisites: BIO 120.01, BIO 120.02, CHEM 51.21, and CHEM 51.22
Industrial Microbiology (3 units) covers fundamental and applied aspects in industrial processes focusing on the microorganisms of industrial importance. Principles of screening and strain preservation and fermentation processes of primary and secondary metabolites production are also discussed. Other microbial products at laboratory, pilot, and industrial scales are also introduced.

BIO 121
VIROLOGY
3 units
Pre-requisites: BIO 120.01, BIO 120.02, BIO 140.01, and BIO 140.02
Virology (3 units) defines what viruses are and how they replicate in their hosts and spread in individuals and populations of bacteria, plants and animals. The molecular biology of viral replication and virus-host interactions is discussed. Methods in studying viruses, applications of viruses in molecular biology are also taken up. Virus infection, control, evolution and roles in disease in the context of the modern world will integrate the foundation topics discussed.

BIO 122.01
PARASITOLOGY, LECTURE
2 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 120.01, and BIO 120.02; Co-requisite: BIO 122.02
Parasitology, Lecture (2 units) focuses on life stages, vectors, and host-parasite interactions of parasitic protozoans, helminths and arthropods. It discusses human-associated diseases, detection procedure, mode of entry, and mitigating strategies. It covers current events and updates linked to parasite epidemiology and recent development on its treatment.

BIO 122.02
PARASITOLOGY, LABORATORY
1 unit
Pre-requisites: BIO 100.01, BIO 100.02, BIO 120.01, and BIO 120.02; Co-requisite: BIO 122.01
Parasitology, Laboratory (1 unit) complements the lecture course BIO 122.01. It focuses on procedures and dissection used to extract and isolate parasites from its host and vector. It includes microscopic examination and morphological characterization of various parasites. Stages of parasite development and mode of infection are also examined.

BIO 123
MICROBIAL BIOLOGY
3 units
Pre-requisites: BIO 120.01, BIO 120.02, BIO 150.01, and BIO 150.02
Microbial Ecology (3 units) deals with the basic principles of the inter-relationships of bacteria, virus, fungi, algae, and protozoa in natural environments. The interaction of microbes with animals and plants and the ecological significance of microbial activities are discussed.

BIO 124
MICROBIAL GENETICS
3 units
Pre-requisites: BIO 120.01, BIO 120.02, BIO 130.01, and BIO 130.02
Microbial Genetics (3 units) is a course that puts emphasis on microorganisms as major agents of gene transfer. Various patterns of microbial gene transfer and the principles of heredity based on the central dogma of molecular biology are covered. Topics on underlying microbial gene action and regulation in microorganisms are discussed. The impact and importance of microorganisms in recombinant DNA technology and gene cloning are also highlighted.

BIO 125
MOLECULAR MICROBIOLOGY
3 units
Pre-requisite: BIO 120.01, BIO 120.02, BIO 140.01, and BIO 140.02
Molecular Microbiology (3 units) introduces basic knowledge on the molecular biology of microorganisms in relation to their ecology and medical importance. Particular emphasis is given
on bacterial gene structure, replication, and expression, mutations, plasmids, and genetic recombination. Correlations of how these behaviors affect bacterial growth in wild-type strains and their adaptation capabilities will be given emphasis.

**BIO 125.01**
**MICROBIAL PHYSIOLOGY, LECTURE**
2 units
**Pre-requisite:** BIO 120.01, BIO 120.02, BIO 171.01, and BIO 171.02; **Co-requisite:** BIO 125.02

Microbial Physiology, Lecture (2 units) is a course that deals on the study of microbial cell structure and function. Microbial growth, energy utilization, transport, and cell-to-cell communication will be comprehensively discussed. An introduction to the mechanisms of microbial antibiotic resistance, biofilm formation, and secondary metabolite-production are covered.

**BIO 125.02**
**MICROBIAL PHYSIOLOGY, LABORATORY**
1 unit
**Pre-requisite:** BIO 120.01, BIO 120.02, BIO 171.01, and BIO 171.02; **Co-requisite:** BIO 125.01

Microbial Physiology, Laboratory (1 unit) complements the lecture course BIO 125.01. The course deals with the study of microbial cell structure and function. Experiments relating to microbial growth, characterization and identification, and observation of morphological structures are the main focal points of the course. Exercises demonstrating antimicrobial resistance, biofilm formation, and production of secondary metabolites are also included.

**BIO 130.01**
**GENETICS, LECTURE**
3 units
**Co-requisite:** BIO 130.02

Genetics, Lecture (3 units) discusses the chromosomal and molecular basis of heredity. It also covers genotypic and phenotypic interactions driving organismal development. Furthermore, it deals with the concepts involving the structure, organization and expression of genes at the organismal and population levels.

**BIO 130.02**
**GENETICS, LABORATORY**
2 units
**Co-requisite:** BIO 130.01

Genetics, Laboratory (2 units) complements the lecture course BIO 130.01. It provides students with hands-on experimental approaches in learning and understanding the basic concepts in classical and molecular genetics. Exercises tackle selected problems in Mendel, non-Mendel, molecular and population genetics. Modern techniques and applications of genetic analyses are also included.

**BIO 130.1**
**MOLECULAR GENETICS**
3 units
**Pre-requisites:** BIO 130.01 and BIO 130.02

Molecular Genetics, Lecture (3 units) discusses the architecture, maintenance, expression, control, and regulation of genetic material in prokaryotic and eukaryotic cells. Special topics such as the genetic basis of development, immunity, and cancer that serve to illustrate and evaluate the essential roles of genomes in living systems.

**BIO 130.2**
**HUMAN GENETICS**
3 units
**Pre-requisites:** BIO 130.01 and BIO 130.02

Human Genetics (3 units) is designed to provide students with a thorough knowledge and understanding of the basic concepts of Genetics as it occurs in human beings. The course also underscores some of the most current technologies applied in the analysis of specific problems in Genetics such as human diseases and forensics. Human Genetics encompasses a variety of overlapping fields including classical genetics, cytogenetics, biochemical and molecular genetics, developmental genetics, population genetics, genomics and the fairly recent field of epigenetics.
BIO 130.3
MEDICAL GENETICS
3 units
Pre-requisites: BIO 130.01 and BIO 130.02
Medical Genetics (3 units) applies the principles and current applications of genetics in the medical sciences. It examines the role of DNA in the current understanding of human disease. Genomics, chromosome abnormalities, metabolic diseases, single gene disorders and genetic aspects of complex diseases like cancer and diabetes are discussed. The complexities in diagnosis of disease and disorders and the ethical dilemmas in contemporary genetic medicine which arise will also be tackled.

BIO 130.4
POPULATION GENETICS
3 units
Pre-requisites: BIO 130.01 and BIO 130.02
Population Genetics (3 units) focuses on the concepts of natural selection, genetic drift, mutation and migration. It discusses how those aforementioned factors influence patterns of genetic variation within populations, inferences about population structure and the speciation process. It covers topics including quantitative genetics, F-statistics, detecting selection and local adaptation, linkage disequilibrium and site of frequency spectrum.

BIO 140.01
CELL AND MOLECULAR BIOLOGY, LECTURE
3 units
Pre-requisites: CHEM 51.21 and CHEM 51.22; Co-requisite: BIO 140.02
Cell and Molecular Biology, Lecture (3 units) discusses the structure and function of the different components of the cell at the molecular level. Biochemical processes, energetics, and cellular interactions are also covered. Fundamental principles on gene structure, organization, and expression are examined. Cancer and immunology serve as models for topics in complex cell interactions in multi-cellular organisms.

BIO 140.02
CELL AND MOLECULAR BIOLOGY, LABORATORY
2 units
Pre-requisites: CHEM 51.21 and CHEM 51.22; Co-requisite: BIO 140.01
Cell and Molecular Biology, Laboratory (2 units) complements the lecture course BIO 140.01. It introduces students to the basic laboratory practices involved in cell and molecular biology. The course provides hands-on exercises on microscopy, isolation and characterization of biomolecules, recombinant DNA techniques, and cell culture.

BIO 141
IMMUNOLOGY
3 units
Pre-requisites: BIO 120.01, BIO 120.02, BIO 130.01, BIO 130.02, BIO 140.01, and BIO 140.02
Immunology (3 units) is an introduction to the principles of immunology that covers the components and aspects of the innate and adaptive immune response of multicellular organisms as well as the function of these components in health and disease. Genetic factors governing the immune mechanisms will be discussed.

BIO 143.01
BIOTECHNOLOGY, LECTURE
3 units
Pre-requisites: BIO 130.01, BIO 130.02, BIO 140.01, and BIO 140.02; Co-requisite: BIO 143.02
Biotechnology, Lecture (3 units) introduces the scientific basis, historical development, and current applications of traditional and modern biotechnology. It focuses on the utilization of plants, animals, and microbial cells in producing beneficial products for the improvement of human life. The course covers molecular- and cellular-level manipulations and applications in food security, industry, environment and health. Discussions on the ethical, legal, and moral issues brought by these applications will guide students in making informed decisions as society adopts modern biotechnology.
BIO 143.02
BIOTECHNOLOGY, LABORATORY
2 units
Pre-requisites: BIO 130.01, BIO 130.02, BIO 140.01, and BIO 140.02; Co-requisite: BIO 143.01
Biotechnology, Laboratory (2 units) complements the lecture course BIO 143.01. The course covers cell culture and molecular and cellular-level manipulation techniques. It expands on the experiments introduced in Cell and Molecular Biology Laboratory and focuses on both instrumentation and methodologies used in basic modern biotechnology.

BIO 144
BIOINFORMATICS
3 units
Pre-requisites: BIO 140.01 and BIO 140.02
Bioinformatics (3 units) provides an overview of the interdisciplinary methods and tools for solving biological problems involving sequences of genomes, transcriptomes, and proteomes. Emphasis is on the use of bioinformatics software for managing and assessing biological data that includes sequences and morphological measurements. Tools for the calculation of evolutionary distances, form and function relationships, molecular structure, and phylogeny are also discussed and utilized. The strengths and limitations of various existing bioinformatics methods will be discussed and applied to practical problems encountered in the life sciences.

BIO 145
INTRODUCTION TO MOLECULAR MEDICINE
3 units
Pre-requisites: BIO 130.01, BIO 130.02, BIO 140.01, and BIO 140.02
Introduction to Molecular Medicine (3 units) provides a molecular insight into the normal processes and diseases of the human body. It gives an overview of the scientific concepts, discoveries, and technologies that have shaped and revolutionized the field of molecular medicine. It also conveys how the outcomes of basic research in molecular medicine figure in the clinic, as well as in society.

BIO 150.01
GENERAL ECOCLOSY, LECTURE
3 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, BIO 110.02, BIO 120.01, BIO 120.02; Co-requisite: BIO 150.02
General Ecology, Lecture (3 units) deals with the interactions of organisms with each other and with their environment on the level of individuals, populations, communities, and ecosystems. Discussions will cover the interplay of abiotic and biotic factors through an evolutionary perspective on key ecological processes occurring across these levels. The course will also cover the impacts of human activities on global ecology.

BIO 150.02
GENERAL ECOCLOY, LABORATORY
2 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, BIO 110.02, BIO 120.01, BIO 120.02; Co-requisite: BIO 150.01
General Ecology, Laboratory (2 units) complements the lecture course BIO 150.01. It trains students in basic field and laboratory methodologies employed in ecological studies. These include sampling procedures, biodiversity assessments, and simulations of ecological relationships. The course culminates in a field study to be conducted at a natural ecosystem outside the university.

BIO 150.1
MARINE BIOLOGY
3 units
Pre-requisites: BIO 150.01 and BIO 150.02
Marine Biology (3 units) deals with the diversity and ecology of marine species across the biological kingdoms. Marine organisms across habitats—from the intertidal mangroves and seagrass beds to the coral reefs and the open sea—and the various ecological processes that affect them are discussed. Current issues in human impacts on the marine environment are also covered.

BIO 151
BIOECODOVITY
3 units
Pre-requisites: BIO 150.01 and BIO 150.02
Biodiversity (3 units) helps students understand the processes involved in the development of the tremendous variety
and variation of life; appreciate the nature and importance of genetic, species, ecosystem and cultural diversity; learn essential methods used in proper documentation of biological resources; and become aware of the issues on loss of global and local biodiversity.

**BIO 152**  
**PRINCIPLES OF CONSERVATION BIOLOGY**  
3 units  
**Pre-requisites:** BIO 150.01 and BIO 150.02  
Principles of Conservation Biology (3 units) deals with the maintenance, loss, and preservation of global and local biodiversity. Biodiversity and allied fields are discussed alongside economics and resource management, stressing the multidisciplinarity and rapid development in the search for solutions to problems in conservation biology. Special emphasis is on conservation biology and sustainable development of biological resources in the Philippines.

**BIO 153**  
**MOLECULAR ECOLOGY**  
3 units  
**Pre-requisites:** BIO 140.01, BIO 140.02, BIO 150.01, and BIO 150.02  
Molecular Ecology, Lecture (3 units) discusses the increasing use of molecular techniques in approaching problems in ecology, evolution, biodiversity, and conservation. Concepts and issues from a wide range of topics including genes and their products, behavior, population structure, microbial diversity, and genetically modified organisms are discussed. The course also covers molecular ecology techniques such as molecular marker development, molecular diagnostics, and barcoding.

**BIO 154**  
**PHYSIOLOGICAL ECOLOGY**  
3 units  
**Pre-requisites:** BIO 150.01, BIO 150.02, BIO 171.01, and BIO 171.02  
Physiological Ecology (3 units) deals with the interplay between the physiological mechanisms of organisms and their environment. It delves into how organisms adjust their behavior and physiology in response to environmental changes in order to survive and reproduce successfully. Among the physico-chemical factors affecting the activities of organisms and thus will be focused on in the course are temperature, light availability, water availability, salinity, and pH. This course is particularly significant due to the environmental fluctuations brought about by changing global climate.

**BIO 155.01**  
**SYSTEMATICS, LECTURE**  
3 units  
**Pre-requisites:** BIO 160.01 and BIO 160.02  
Systematics, Lecture (3 units) serves as an introduction to the principles of modern systematic biology, including nomenclature, taxonomy, classification, cladistics, and phylogenetics. These topics are discussed within the context of modern evolutionary biology, with emphasis on the phylogenetic aspect. Classification schemes of the major taxa are studied. Specific focus is given to select taxonomic groups.

**BIO 155.02**  
**SYSTEMATICS, LABORATORY**  
2 units  
**Pre-requisites:** BIO 160.01 and BIO 160.02  
Systematics, Laboratory (2 units) complements the lecture course BIO 155.01. It introduces students to the various methods utilized in the practice of systematic biology including taxonomic description, identification, and classification of various organisms. It also involves complementary taxonomic techniques, such as sample collection, preparation, storage, and documentation. The course trains students in methods used in modern phylogenetic analysis such as cladistics, morphological and morphometric analysis, and molecular genetic analysis.

**BIO 160.01**  
**EVOLUTIONARY BIOLOGY, LECTURE**  
3 units  
**Pre-requisites:** BIO 150.01 and BIO 150.02;  
**Co-requisite:** BIO 160.02  
Evolutionary Biology, Lecture (3 units) discusses key principles and concepts of evolution, highlighting its central role in the biological sciences. The course includes overviews of the history of evolutionary thought, micro- and macroevolutionary processes, major mechanisms of evolution
(i.e. genetic drift, natural selection, gene flow), and links to other biological disciplines. The evolutionary history of the human species is also covered, including societal views on evolution and its increasing importance in such fields as medicine.

BIO 160.02
EVOLUTIONARY BIOLOGY, LABORATORY
2 units
Pre-requisites: BIO 150.01 and BIO 150.02; Co-requisite: BIO 160.01
Evolutionary Biology, Laboratory (2 units) complements the lecture course BIO 160.1. It allows students to directly observe, investigate, analyze, and reconstruct key evolutionary concepts and processes through hands-on field and laboratory activities. Topics include phylogenetic reconstruction, microevolution, genetic change, and simulations of evolutionary processes.

BIO 161
BIOGEOGRAPHY
3 units
Pre-requisites: BIO 160.01 and BIO 160.02
Biogeography (3 units) deals with the geographical distribution patterns of species and the various factors that determine them. The focus is on ecological and evolutionary factors, such as dispersal and vicariance, and anthropological sources of pattern changes over time. Being a course that covers multiple disciplines within Biology, pertinent concepts not only in biology but also in geography and geology are discussed.

BIO 170.01
DEVELOPMENTAL BIOLOGY, LECTURE
3 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, and BIO 110.02; Co-requisite: BIO 170.02
Developmental Biology, Lecture (3 units) discusses principles of development of plants and animals at the organismal and molecular levels. Emphasis is on tissue formation and development, as well as later organogenesis of model plants and animals.

BIO 170.02
DEVELOPMENTAL BIOLOGY, LABORATORY
2 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, and BIO 110.02; Co-requisite: BIO 170.01
Developmental Biology, Laboratory (2 units) complements the lecture course BIO 170.01. It includes exercises that explore the development of plants and animals. This is done through microscopic and gross specimen examination of reproductive systems and their products. Model organisms are examined at various stages of development.

BIO 171.01
GENERAL PHYSIOLOGY, LECTURE
3 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, and BIO 110.02; Co-requisite: BIO 171.02
General Physiology, Lecture (3 units) uses a systems approach to the study of plant and animal organismic form and function in the maintenance of homeostasis. Topics also include the application of physiological concepts in understanding common diseases.

BIO 171.02
GENERAL PHYSIOLOGY, LABORATORY
2 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, and BIO 110.02; Co-requisite: BIO 171.01
General Physiology, Laboratory (2 units) complements the lecture course BIO 171.01. It includes exercises that are intended to give a hands-on experience on physiological processes and concepts making use of physio-chemical techniques, instruments, and simulations.

BIO 171.1
HUMAN ANATOMY AND PHYSIOLOGY
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Human Anatomy and Physiology (3 units) is a lecture course on the essential principles and concepts of the structure and function of the human body and the mechanisms for maintaining homeostasis. The study of cells and tissues, the different
organ systems, and how these organ systems function and interact with each other are discussed. Topics include certain disease processes that affect the human body.

BIO 171.2
GASTRO-INTESTINAL BIOLOGY & NUTRITION
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Gastro-intestinal Biology and Nutrition (3 units) focuses on the human digestive system. The course provides the students with knowledge on the anatomy and physiology of the digestive system, and as well as basic nutrition concepts. It also delves into the biochemical pathways of metabolism. Furthermore, it requires students to use this basic information in understanding common gastro-intestinal and nutritional diseases, diagnostic tests assessing gastro-intestinal function, and application of nutritional concepts on health and fitness.

BIO 171.3
ENDOCRINOLOGY
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Endocrinology (3 units) focuses on the normal anatomy and physiology of the human endocrine system. It also discusses the biochemistry of the hormones involved in homeostasis. Furthermore, it requires students to use this basic information in understanding common endocrine diseases, their presentation, diagnostic tests to assess endocrine function, and basics in management of these diseases.

BIO 171.4
CARDIO-RESPIRATORY BIOLOGY
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Cardio-respiratory Biology (3 units) is a course that deals with the normal anatomy and function of the cardiovascular and respiratory systems. The course includes discussions on diseases in both systems to further emphasize cardio-respiratory biology. Topics include common clinical instruments like the stethoscope, ECG to give a more practical and complete overview of both systems.

BIO 171.5
NEUROBIOLOGY
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Neurobiology (3 units) is a course that deals with the normal anatomy and physiology of the central and peripheral nervous system, its effects on human function and behavior, as well as common diseases that affect it. Specific nervous functions such as stimulus sensing, motor action, and memory formation among others are discussed. Topics include diseases of the nervous system such as stroke, Alzheimer's, Parkinson's to emphasize the normal structure and function of the nervous system.

BIO 180.01
PHARMACOLOGY AND TOXICOLOGY, LECTURE
2 units
Pre-requisites: BIO 140.01, BIO 140.02, BIO 171.01, and BIO 171.02; Co-requisite: BIO 180.02
Pharmacology and Toxicology, Lecture (2 units) provides background on different naturally occurring and synthetic drugs, including their chemical structures and nomenclatures. It evaluates influences of these drugs on the normal and pathophysiology of varied organisms. Interactions, toxic effects, and medical applications and antipathogenic capabilities of these drugs are also examined. Emphasis will also be given to the two main areas of pharmacology: pharmacodynamics and pharmacokinetics.

BIO 180.02
PHARMACOLOGY AND TOXICOLOGY, LABORATORY
1 unit
Pre-requisites: BIO 140.01, BIO 140.02, BIO 171.01, and BIO 171.02; Co-requisite: BIO 180.01
Pharmacology and Toxicology, Laboratory (1 unit) demonstrates and investigates the effects of the drugs on toxicity and the functions of different organ systems of the mammalian body using rodents and small non-rodent species as model animals. Toxicity pathways will be modeled, and studies focusing on the systemic effect of different compounds will be focused on.
BIO 181
BIOMEDICAL INSTRUMENTATION
3 units
Pre-requisites: BIO 171.01 and BIO 171.02
Biomedical Instrumentation (3 units) is about understanding how instruments measure physical and physiological parameters involved in the evaluation of health and illness in human beings. The measurements of health parameters such as heart, respiratory, and sensory functions will be covered and their physiological basis and clinical significance discussed. The course will also cover different imaging techniques, their appropriate use, as well as common findings in these imaging modalities. Finally, the instruments will be discussed from an engineering and technological perspective that will show students how these instruments work and the basic physical science principles that underpin these machines.

BIO 182
MICROCOPY AND MICROTECHNIQUE
3 units
Pre-requisites: BIO 100.01, BIO 100.02, BIO 110.01, and BIO 110.02
Microscopy and Microtechnique (3 units) is a laboratory course which covers various methods of slide preparation using different sectioning, processing, staining and mounting techniques. These serve as preliminary steps in the creation of temporary and permanent slides of animal and plant tissues for microscopic assessment. Slides are evaluated using compound, stereo, and epifluorescent microscopy.

BIO 183
ETHICS IN BIOLOGICAL RESEARCH
3 units
Pre-requisites: All fundamental biology courses
Ethics in Biological Research (3 units) covers currently accepted international ethical standards and guidelines in experiments involving humans and other animals. As such, existing laws and policies on animal welfare will be discussed. Ethical guidelines governing the practice of clinical trials are also introduced.

BIO 184
CURRENT TRENDS IN BIOLOGY
3 units
Pre-requisites: All fundamental biology courses
Current Trends in Biology (3 units) is an introduction to advances in the life sciences that are defining the present state of the field. It builds on standard knowledge of molecular biology and genetics towards genome analysis, manipulation, and various -OMICs approaches that increasingly provide a precise view of organisms as integrated, complex systems built through the interactions of their genes, gene products, and environment. These technologies are discussed in the context of biomedicine, plant biology, microbiology, evolution, and ecology.

BIO 197
PRACTICUM
3 units
Pre-requisites: All fundamental biology courses
Practicum (3 units) is a 150-hour on-the-job training or work placement in several institutions to give students a chance to develop skills relating their chosen fields. Working under a supervisor, it will allow students to integrate and apply the knowledge and skills they have gained from previous courses to actual laboratory, clinical or industrial scenario.

BIO 199.1
THESIS I: BIOSEMINAR
2 units
Pre-requisites: BIO 100.01 and BIO 100.02
Thesis I: Bioseminar (2 units) teaches students basic skills in verbal and written communication and proper experimental design in biological research, with the goal of producing and defending a proposal for their undergraduate thesis. Toward this end, the emphasis is on choosing topics for research, doing the literature review, designing an experiment, writing the scientific paper, and presenting it orally both in the classroom setting and in the form of seminars. Steps in evaluating a seminar delivered by a peer are also discussed and applied in this course. The training is further enhanced by required attendance in Department-sponsored
lectures and talks and in thesis defense sessions of current seniors.

**BIO 199.2**  
**THESIS II**  
2 units  
**Pre-requisites: BIO 199.1**  
Thesis II (2 units) deals with the implementation and conduct of a research plan to gain experience in the management of a major field of study and laboratory experiment. It also includes continuation and completion of the research plan, with the goal of finishing data gathering and analysis in preparation for writing the thesis paper.

**BIO 199.3**  
**THESIS III**  
2 units  
**Pre-requisites: BIO 199.2**  
Thesis III (2 units) deals with the drafting of the thesis paper, defense of the research in front of a pre-determined panel and audience of peers in the scientific community, and submission of the final paper as fulfilment of requirements for the program.

**BIO 198.1**  
**CAPSTONE I**  
3 units  
**Pre-requisites: BIO 100.01, BIO 100.02, 110.01, and 110.02**  
The first of two capstone courses, Capstone I involves the conceptualization, preparation, and initial conduct of a project designed to demonstrate mastery in a chosen track in the Life Sciences. Under the supervision of a biology and a communications/management faculty mentor, the student will identify a topic of significance from which a creative venture is designed. The final outcomes of the project may include a creative portfolio, an advocacy campaign, or a business plan, among others.

**BIO 198.2**  
**CAPSTONE II**  
**Pre-requisites: BIO 198.1**  
The second of two capstone courses, Capstone II involves the completion of the creative project determined in Capstone I. The course deals with the drafting and presentation of the final project, to be defended/presented orally and publicly in front of a pre-determined panel. The final outcomes of the course include the completion of the project and submission of the necessary documents, portfolio, media, or strategic management plan as fulfilment of requirements for the degree program.
Department of Biology
Faculty Profile

FULL-TIME

Aguirre, Ariel Lorenzo Jose II Y.
Instructor
MD/MBA
Ateneo School of Medicine and Public Health

Bagonoc, Rej B.
Assistant Instructor
MS in Biology
Ateneo de Manila University

Constantino, Maria Katrina C.
Instructor
MS Molecular Biology and Biotechnology
University of the Philippines, Diliman

Cruz, Ronald Allan L.
Assistant Professor
MS Marine Science
University of the Philippines, Diliman

Delocado, Emmanuel C.
Assistant Instructor
BS in Biology
Ateneo de Manila University

Freitag, Hendrik
Professor
PhD Animal Ecology
Martin Luther University Halle

Gulpeo, Pia Clarisse R.
Instructor
MS Microbiology
University of Santo Tomas

Lachica, Maria Kenosis Emmanuelle G.
Assistant Instructor
MS in Biology
Ateneo de Manila University

Lagunzad, Catherine Genevieve B.
Assistant Professor
PhD Biology
University of the Philippines, Diliman

Lopez, Crisanto M.
Assistant Professor
Dr. rer. nat
Leibniz Institute for Natural Product Research and Infection Biology, Jena

Maini, Zomesh A. N.
Instructor
MS Biology
Ateneo de Manila University

Maliwat, Gian Carlo F.
Instructor
MS Biology
Ateneo de Manila University

Moendeg, Kharleezelle J.
Assistant Professor
PhD in Animal and Food Hygiene (Parasitology)
Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan

Panes, Vivian A.
Assistant Professor
PhD Biology
University of the Philippines, Diliman

Ragaza, Janice A.
Associate Professor
PhD Fisheries Science
Kagoshima University

Velazquez, Stephanie F.
Instructor
MS Biology
Ateneo de Manila University
PART-TIME

Casis, Roderick M.
Lecturer
Doctor of Medicine
University of the East Ramon Magsaysay Memorial Medical Center

De Leon, Jemillie Madonna S.
Lecturer
MS Biology (on going)
Ateneo de Manila University

Gambe-Gilbuena, Arni E.
Lecturer
PhD Engineering
Osaka University

Gellynck, Marc P.
Lecturer
Doctor of Medicine
University of Santo Tomas

Manaloto, Ninez Bernardine L.
Lecturer
MS Biology
Ateneo de Manila University

Sagun, Vernie G.
Lecturer
PhD Plant Biology
University of Illinois

Tanierga, Rommel M.
Lecturer
M.Sc. in Zoology
University of the Philippines, Los Baños

Yan, Jonathan Patrick H.
Lecturer
MS Marine Science
University of the Philippines, Diliman