**Syllabus**

**Instructors:** Nathan Yee, nyee@envsci.rutgers.edu

**Office Hours:** By appointment

**Basis of Grade:** *10 of 12 quizzes* (50%); *Final Exam* (50%)

Learning Goals:Students will study biological processes common to all life on Earth and apply the principles of biology to explore the origins, evolution, and distribution of life in the Universe. Student will examine the basic geologic/chemical/physical processes relevant to the formation of habitable worlds. Students will learn about the transition from speculation to scientific inquiry that has resulted in our scientific exploration of astrobiology. Finally, students will analyze and interpret scientific data, including fossil records on Earth, chemical data from the robotic rovers on Mars, and remote sensing data of other planets and moons telescope data.

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| **Dates** | **Topic** |
| Week 1 | Introduction to Astrobiology |
| Week 2 | Topic: What is Life? Structure of Life; Cells; Replication; Building Blocks of Life; Biochemistry and Molecular Evolution |
| Week 3 | Topic: Early Life. Prokaryotes; Hydrothermal Vents; Energy Generation and Metabolism; Last Common Ancestor; Bacteria and Archaea |
| Week 4 | Topic: Earth: A Dynamic World. Earth and Life History; Co-evolution of the Biosphere and Geosphere; Geologic Drivers of Evolution |
| Week 5 | Topic: Photosynthesis. Anoxygenic Phototrophs; Oxygenic Photosynthesis; Carbon Isotopes; The Great Oxidation Event  |
| Week 6 | Topic: Evolution. Mutation and Genetic Change; Adaptation and Selection; The Tree of Life; Eukaryotes |
| Week 7 | Topic: Habitable Worlds Processes and conditions that create and maintain habitable environments; Earth and life history; Ancient and contemporary habitable environments |
| Week 8 | Topic: Complex Life. The Rise of Multicellularity; Evolution of Animals |
| Week 9 | Topic Biomarkers: How to Look for Biosignatures; Chemical and Molecular Fossils; Evidence of Past Life on Earth |
| Week 10 | Topic: Search for life beyond the Earth: Drake equation; Exobiology; NASA missions |
| Week 11 | Topic: Mars: Formation, geology, interior, and surface; Meteorites and AH 84001; Water on Mars; Environment and Habitability; Search for Life on Mars |
| Week 12 | Topic: Icy Worlds: Europa; Enceladus; Other Icy Bodies |
| Week 13 | Topic: Exoplanets: Methods of Detection; Types of Planets; Exoplanetary Systems; Exoplanet Atmospheres  |
| Week 14 | Topic: Is There Anybody Out There? Exoplanet Atmospheres; The Search for Extraterrestrial Intelligence |