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Relevance of Plant Science classes to ending world hunger: epistemologies and connections, parts of a topology

Cornell University (Undergraduate Degree, Minor):

Disclaimer: This document is not intended to be a substitute for formal education. It does not involve the critical thinking and epistemological and malinative development and intellectual enrichment that a formal education entails. Reading this document may make you smarter, but it pales in comparison to the benefits derived from working hard in classes at a formal university. Please think of it as a construct parallel to a recruiting effort, meant to increase your motivation to apply yourself and pursue a similar track at Cornell or another University in order to be part of the movement of ending world hunger. In other terms, this is one intellectual loadout you can play in the game of life, and logging hours on it will develop your level.

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Behavior and Biotic Interactions

Course Description

How do plants respond to antagonists, such as herbivores and pathogens? What are the checks and balances that keep mutualist organisms in their tight interactions? How are symbioses organized on molecular, metabolic and ecological levels? What are the molecular, plant hormonal, and metabolic mechanisms mediating plant biotic interactions with other organisms? What ecological and evolutionary consequences do these interactions have for the fitness of the plants and their interactors? This course provides an overview of plants' myriad interactions with antagonists and mutualists, from microbes to multicellular organisms, and explains the underlying ecological and evolutionary concepts. It gives an introduction to the study of induced plant responses in the light of a behavioral biology framework.

Course Outcomes

- Identify, explain, categorize and examine the ecological, physiological and molecular mechanisms of plant biotic interactions.
- Discuss these mechanisms and interpret associated data analyses in the light of evolutionary theory and draw conclusions about potential agricultural applications.
- Broadly apply and critically evaluate the four levels of proximate and ultimate causation for the study of biotic interactions in general.
- Apply, categorize and integrate basic conceptual and analytical tools to describe complex behavioral interactions.
- Discuss, contrast and design a number of experimental and synthetic approaches to analyzing and discovering chemical ecological processes including bioassays and chemical and molecular analyses.
- Read, discuss, evaluate, and objectively criticize original studies in the field.
- Provisioned with observations or a theoretical framework, students will be able to formulate scientific questions, derive hypotheses and design an appropriate experimental plan.

Summary: one sentence

Study of interactions between nodes in organism composition and structure, as a parse of broad ecological systems guided by an intelligent design

Summary: one paragraph

Summary: one page

Summary: ~five pages

Foundations of Biology

Course Description

The course offers an introduction to biology at the cell and molecular levels, including cell function, energetics, Mendelian genetics, molecular genetics, DNA technology and evolution. The emphasis is on key concepts that underlie living systems, rather than a myriad of unrelated facts. This is a lecture course with an integrated discussion section in which active learning and student engagement activities further emphasize the key concepts with compelling examples from living systems. Designed to meet the biology requirements of science students who need to fulfill the distribution requirement in CALS and Human Ecology. It does not meet the requirement for the premedical or prevet program nor the major in biological science. It, along with courses in the core major program, may be used to fulfill the Arts and Sciences distribution requirement. There is no laboratory for this course. Students that require a biology laboratory experience as part of their requirements should enroll in BIOG 1500 BIOG 1500 - Investigative Biology Laboratory.

Summary: one sentence

Partially intermediately detailed study of deconstructed nodes in biological systems and the broad spanning connections between them, optimized for foundational understanding of biology.

Summary: one paragraph

Summary: one page

Summary: ~five pages

Introduction to General Chemistry

Course Description

A one-semester introduction to chemistry, both qualitative and quantitative. CHEM 1560 prepares students for CHEM 1570; CHEM 1560 is not recommended for premedical or preveterinary students. Students planning to take CHEM 2080 should be enrolled in CHEM 2070 rather than CHEM 1560.

Summary: one sentence

Reinforcement of the most important knowledge in the vast systems of nodes that make up the lattice of the universe we inhabit

Summary: one paragraph

Summary: one page

Summary: ~five pages

Introduction to Organic and Biochemistry x2

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

General Chemistry I

Learning Outcomes

Covers fundamental chemical principles, with considerable attention given to the quantitative aspects and techniques important for further work in chemistry.

Summary: one sentence

Summary: one paragraph

Summary: one page

Description:

Traits of the elements on the periodic table (universal trend, pattern, and property)

Connections

Epistemology

Approximate geometry
Summary

Topology

Summary: ~five pages

Textbook

“General Chemistry, Fourth Edition”, Donald A. McQuarrie, Peter A. Rock, Ethan B. Gallogly, University Science Books

1. Chemistry and the scientific method

1. The study of chemistry
2. The scientific method
3. Quantitative measurements
4. The metric system
5. Units of energy
6. Accuracy and percentage error
7. Precision and significant figures
8. Significant figures in calculations
9. Dimensional analysis
10. Guggenheim notation

2. Atoms and molecules

1. Elements and their chemical symbols
2. States of matter
3. Separation of mixtures
4. The law of constant composition
5. Daltons atomic theory
6. Molecules
7. Chemical nomenclature
8. Atomic and molecular mass
9. The nucleus

10. Protons, neutrons and electrons
11. Isotopes
12. Ions

3. The periodic table and chemical periodicity

1. Chemical reactions
2. Chemical equations
3. Group properties
4. Periodicity
5. Groups of elements
6. Classification of elements
7. Periodic trends

4. Early quantum theory

1. First ionization energies
2. Ionization energies and periodicity
3. Electromagnetic spectrum
4. Line spectra of atoms
5. Photons
6. De Broglie wavelength
7. Wave-particle duality
8. Quantization
9. Electronic transitions

5. Quantum theory and atomic structure

1. Quantum theory
2. Azimuthal quantum number
3. Magnetic quantum number
4. Electron spin
5. Atomic energy states
6. Pauli exclusion principle
7. Electron configurations
8. Hund's rule
9. Excited states
10. Electron configurations and periodicity
11. *d* orbitals and *f* orbitals
12. Atomic radii, ionization energies, and periodicity

6. Ionic bonds and compounds

1. Ionic bonds
2. Ionic charges and chemical formulas
3. Transition metal ions
4. Nomenclature of transition metal ions
5. Ground state configurations of transition metal ions
6. Sizes of ions
7. Ionic bond energies

7. Lewis formulas

1. Covalent bonds
2. Octet rule and lewis formulas
3. Hydrogen and lewis formulas
4. Formal charges
5. Multiple bonds
6. Resonance hybrids
7. Free radicals
8. Expanded valence shells
9. Electronegativity
10. Polar bonds

11. Dipole moments

8. Prediction of molecular geometries

1. Molecular shape
2. The tetrahedron
3. VESPR theory
4. Prediction of molecular geometry
5. Lone pairs and shape
6. VSEPR and multiple bonds
7. Trigonal bipyramidal compounds
8. Structure and dipole moment
9. Optical isomers

9. Covalent bonding

1. Molecular orbitals
2. Molecular orbitals of H₂
3. Bond order
4. Molecular electron configurations
5. *sp* localized bond orbitals
6. *sp*² localized bond orbitals
7. *sp*³ localized bond orbitals
8. Bonding in molecules with lone pairs of electrons
9. Hybrid orbitals from *d* Orbitals
10. Double bonds
11. *cis-trans* isomers
12. Triple bonds
13. Delocalized pi electrons and benzene

10. Chemical reactivity

1. Combination reactions
2. Nomenclature of polyatomic ions
3. Acids and bases
4. Decomposition reactions
5. Hydrates
6. Single-replacement reactions
7. Relative activities of metals
8. Relative activities of halogens
9. Double-replacement reactions
10. Acid-base reactions
11. Oxidation-reduction reactions

11. Chemical calculations

1. The concept of a mole
2. Avogadro's number
3. Simplest formula
4. Determination of atomic mass
5. Molecular formulas
6. Combustion analysis
7. Coefficient in chemical equations
8. Stoichiometry
9. Stoichiometry without chemical equations
10. Limiting reactant
11. Percentage yield

12. Chemical calculations for solutions

1. Solutions
2. Molarity
3. Electrolytes

4. Reactions in solution
5. Precipitation reactions
6. Acid-base titrations
7. Formula mass from Titration data

13. Properties of gases

1. Gases
2. Measurement of pressure
3. Atmospheric pressure
4. Boyle's and Charles's laws
5. Avogadro's law
6. Ideal-Gas equation
7. Determination of molar masses
8. Partial pressures
9. Maxwell-Boltzmann distribution
10. Kinetic theory and root-mean-square speed
11. Graham's law of effusion
12. Mean free path
13. Van der waals equation

14. Thermochemistry

15. Liquids and solids

16. Colligative properties of solutions

17. Chemical kinetics: rate laws

18. Chemical kinetics: mechanisms

19. Chemical equilibrium

20. The properties of acids and bases

21. Buffers and the titration of acids and bases

22. Solubility and precipitation reactions

23. Chemical thermodynamics

24. Oxidation-reduction reactions

25. Electrochemistry

26. The chemistry of the transition metals

Introductory Plant Biodiversity

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Evolutionary Plant Biology 2x

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Vascular Plant Systematics 2x

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Physiology

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Genetics

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Crop Nutritional Quality

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

The Nature of Plants

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Hydroponic Food Production

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Principles of Vegetable Production

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Biological Management of Plant Diseases

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Science and Systems

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Science New Student Seminar

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Functional Plant Biology

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Food Cycle: Systems Thinking

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Behavior Biotic Interactions

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Reflection on Plant Science Experience

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Plant Science Senior Portfolio

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Senior Seminar: Plant Sciences

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Hemp Production Systems

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Soil Science

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Soil Ecology

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Introductory Statistics for Biology

Summary: one sentence

Summary: one paragraph

Summary: one page

Summary: ~five pages

Pending.