COLLEGE OF SAN MATEO

COURSE OUTLINE

ᵀ 'ARTMENT ______PALN (Paleontology)____________________ NUMBER ___110____

COURSE TITLE: ___General Paleontology____________________

UNITS:__3___

LECTURE/RECITATION HOURS/WEEK_3__ LAB HOURS/WEEK____ OTHER HOURS/WEEK 1 By Arrangement

LENGTH OF COURSE:_X__SEMESTER-LONG ____SHORT COURSE (SPECIFY NO. OF WEEKS____)

____OPEN ENTRY/OPEN EXIT

GRADING:_X_LETTER ___CREDIT/NO CREDIT ___GRADE OPTION (letter or Credit/No Credit)

(Please use *Stylistic Considerations in Writing Course Outlines of Record*; copies available in Division Offices.)

1. **PREREQUISITE** *(Attach Enrollment Validation Form) (See models of Validation narratives.)*

none

2. **COREQUISITE** *(Attach Enrollment Validation Form)*

none

RECOMMENDED PREPARATION: *(Attach Enrollment Validation Form)*

none

4. **CATALOG DESCRIPTION** *(See* Stylistic Considerations, *pp. 4-10; include Prerequisites/Corequisites/Recommended Preparation)*:

110 General Paleontology (3) *Two lecture hours, one recitation hour and one hour by arrangement per week plus two half-day field trips.* Evolution of life through the past 3.8 billion years of earth history. Fossils as evidence of the history of life. Animals and plants related to modern and ancient environments. Methods of interpreting the fossil record. The impact of drifting continents on speciation and mass extinction. Emphasis on the complexity and diversity of life with an environmental and ecological approach. (CSU/UC)

5. **CLASS SCHEDULE DESCRIPTION** *(See* Stylistic Considerations, *p. 10; include Prerequisites/Corequisites/Recommended Preparation)*:

General Paleontology Evolution of life through the past 3.8 billion years of earth history. Interpretation of fossils as evidence of the history of life. Animals and plants related to modern and ancient environments. The impact of drifting continents on speciation and mass extinction. Emphasis on the complexity and diversity of life with an environmental and ecological approach. Two half-day field trips required plus one hour by arrangement per week. (CSU/UC)

6. **COURSE OBJECTIVES** :

Upon completion of the course, the student should be able to:

a. Understand and apply their knowledge of what science is (and is not) and how science works to differentiate between true science and pseudo-science.

b. Define and demonstrate an understanding of general paleontology terminology, methods and concepts. Topics include but are not limited to:

- the geologic time scale and dating methods
- origin of the earth and life
- fossils: excavation, preparation and interpretation
- plate tectonics and its influence on evolution
- sedimentary rocks and environments
- phylogeny and taxonomy
- genetics and mutation
- history of the theory of evolution and evolution by natural selection
- evidence of evolution
- patterns in the evolution of life on earth and their causes
- ecosystems and environmental influences
- morphology and environment
- extinctions: background extinction, mass extinctions and their causes

c. Compare modern and ancient morphologies with habitats and apply these relationships in deciphering the ancient ecosystems of fossil organisms.

d. Analyze the physical evidence in the rock and fossil record and interpret the evidence to reconstruct ancient environments.

e. Appreciate the interdisciplinary nature of paleontology and synthesize information and ideas from many fields to apply scientific reasoning and critical thinking to relate changes in ancient lifeforms to changes in their physical environments.

f. Speculate on the causes of specific adaptations or extinctions.

g. Recognize the position of the earth and its biosphere in the universe.

h. Critically assess arguments presented by opposing sides in paleontological controversies.

7. **COURSE CONTENT AND SCOPE**: *(Attach topical outline and relate specific objective with content)*

A. Introduction to the scope of the course
- Defining Science
- Eclectic nature of Paleontology
- History of Paleontology

B. Time
- Origin of the Earth, Solar System and Universe
- Geologic Time Scale
- Relative Dating
- Radiometric Dating

C. Rocks provide clues to environments
- Interpreting Sedimentary Rocks
  - Colors
  - Textures
  - Compositions
- Sedimentary structures as environmental indicators
  - cross-bedding, raindrop imprints, laminar bedding, flute casts, mudcracks, oscillation ripples, current ripples, graded bedding, etc.
- Sedimentary Facies Interpretation

COURSE CONTENT AND SCOPE (continued)

D. Fossils
- Nature and Quality of the Fossil Record
- Preservation
  - Actual (refrigeration, entombment in amber/tar, rapid burial, mummification)
  - Petrifaction (carbonization, replacement, permineralization, casts, molds)
  - Trace Fossils (tracks, trails, burrows, gastroliths, coprolites)
- Fossils as Clues to Environments

E. Organization of Life
- Taxonomy
  - Organization of life into kingdoms, phyla, class, order, family, genus & species
  - Identification of fossil phyla
- Phylogeny
- Cladistics

F. Evolution
- Prior beliefs
- Darwin's Contribution
- Evidence of Evolution
- Genetics (gene recombination, simple genetics problems, phenotypes & genotypes)
- Populations, Species and Speciation
- Mechanisms (variation, natural selection & isolation)
- Patterns and Rates of Evolution
- Extinction

G. Stratigraphy
- Correlation throughout the world utilizing rock and fossil horizons
- Index Fossils

H. Plate Tectonics
- Earth Structure
- Plate Tectonics Basics
- Effect on Life and Climates of the Past

I. Origin of Life on Earth
- Investigation of the rock record, understanding of early atmospheric conditions, Miller experiment, carbonaceous chondrites
- Life on other planets?

J. Pre-Cambrian Life
- Evolution of Marine communities--Plankton & Nekton
- Prokaryotes to Eukaryotes to Multicellularity

K. Paleozoic Life
- Evolution of marine communities (trophic levels and zonation)
  - Cambrian Explosion
  - Burgess Shale
  - Predators
  - Corals
  - Cephalopods
  - Fish evolution
- Transition to land
  - Amphibian
  - Reptiles
  - Plants
  - Gymnosperms (coal swamps)
- Permian Extinction

COURSE CONTENT AND SCOPE (continued)

L. Mesozoic Life
- Dinosaurs and dinosaur controversies
- Marine Reptiles
- Flying Reptiles
- Early Mammals
- The bird controversy (evolution from dino's or separate lineage?)
- Flowering Plants
- K/T extinction

M. Cenozoic Life (lecture and lab)
- Mammals
  - Marsupials
  - Placentals
- Ice Age Mammals
- Pleistocene Extinction
- Current Mass Extinction

N. Mass Extinction Causes
- Bolide impacts
- Disease
- Volcanism
- Motion of the plates altering global climatic patterns
- Other theories

8. **INSTRUCTIONAL METHODS** *(Instructor-initiated learning strategies):*

The following methodologies are appropriate. Individual faculty will use whatever mix of these they find most effective in the presentation of each topic. One instructor's mix of instructional methodologies integrated with objectives is shown below.

a. Lecture presentation supplemented by demonstrations, visuals and/or rocks or fossils to
- define science and the scientific method and contrast true science with pseudo-science
- introduce paleontological terminology, methods and major concepts

b. Instructor-led class discussions to
- compare and contrast Earth and the other known planets
- contemplate the likelihood of life on other planets
- critically assess controversies in paleontology

c. Hands-on work with fossils and/or rocks to
- illustrate differences in the fossil phyla
- provide practice in identifying taxonomic groups
- illustrate types of preservation
- compare morphology of living organisms to fossil organisms
- illustrate sedimentary features and structures
- provide practice in analyzing fossils and sedimentary rocks, interpreting their clues and reconstructing an ancient environment or ecosystem
- reinforce paleontological excavation methods
- determine attributes of an animal (speed, diet, degree of thermal regulation) from fossil information (footprints and bone length, type of teeth, bone structure)

d. In-class exercises to
- practice the application of the principles of relative and radiometric dating
- understand the nature of phylogeny as a series of nested groups
- experience "doing" paleontology by applying the scientific method in a simulated dig
- learn to recognize evolutionary patterns and make interpretations based on these patterns
- determine attributes of an animal (speed, diet, degree of thermal regulation) from fossil information (footprints and bone length, type of teeth, bone structure)
- understand the frequency of bolide impacts on Earth compared to other planetary bodies

e. Field trips to
- enrich the learning experience with hands-on field experience and exposure to marvelous fossil specimens and reconstructions on display at other locations
- find and excavate fossils
- apply paleontological concepts to interpret the ancient environments

9. **MULTIPLE METHODS OF EVALUATION** *(Measurements of course objectives):*

Instructors have considerable discretion in determining course grades, but the department expects in-class tests to account for at least 65% of the final grade, with the final exam worth about 20% of the grade. Projects, field trips, homework and in-class assignments typically combine to account for the remaining 15% of the grade. One instructor's methods of evaluation are shown below.

a. Written tests. Objective questions (true-false, multiple choice, matching) are used to appraise mastery of paleontological terminology and basic concepts, while essay questions test the student's ability to
   - communicate their ideas in writing
   - analyze the physical evidence in the rock and fossil record and interpret the evidence to reconstruct ancient environments
   - apply scientific reasoning and critical thinking to relate changes in ancient lifeforms to changes in their physical environments
   - synthesize information from different fields to produce and/or support a hypothesis
   - discriminate between science and pseudo-science
   - create a hypothesis given either a cause (bolide impact, new land bridge, continental rifting, mass extinction) or an effect (mass extinction, increased competition, speciation, adaptive radiation), and use scientific reasoning to propose tests that would support or refute their hypothesis
   - compare and contrast similar organisms or taxonomic groups
   - relate the evolutionary significance of a transition fossil to the history of life

b. Class discussions. Student participation in instructor-led class discussions can be used to estimate their ability to
   - communicate verbally
   - follow and apply scientific reasoning
   - critically assess arguments/interpretation of evidence by others

c. In-class exercises. Typically include practice in the identification, interpretation/application of new skills/knowledge using fossils, rocks, manipulatives or simulated situations. These are used to assess the student's
   - mastery of terminology
   - understanding of basic concepts
   - ability to apply concepts in new situations
   - critical thinking skills in analysis and interpretation of data/evidence

d. Homework. Typically includes reading assignments, textbook exercises, internet assignments, and instructor-prepared problems or questions. These are used to assess the student's
   - mastery of terminology
   - understanding of basic concepts
   - ability to apply these concepts in new situations.

e. Field trips. Used to measure a student's ability to
   - apply theories and concepts learned in class to real world situations
   - verbally communicate their knowledge

10. **REPRESENTATIVE TEXT MATERIALS**:

William I. Ausich, Life of the Past, Fourth edition, New Jersey: Prentice Hall Publishing, 1999.

11. **REQUIRED OUT-OF-CLASS ASSIGNMENTS** *(Supplemental reading, outside projects):*

Library research for oral presentation on relevant topic is required, as well as preparation of accompanying visuals and class handout. Field trip attendance is also required.

12. **WRITING ASSIGNMENTS/PROFICIENCY DEMONSTRATION**:

Examinations are predominantly in essay form.
Proficiency is evaluated in written portions of in-class exercises, student-authored class handout and homework.

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10/28/00