

CATALOG DESCRIPTION

GS 151 The Age of Dinosaurs
Prerequisite: None.

3c-01-3sh

A thorough introduction to dinosaurs and the world they inhabited. Topics will include the most current theories regarding dinosaurian biology (behavior, metabolism, evolution), ecology (greenhouse climate, associated plants and animals), and extinction (asteroid impact, volcanism, climate change). Not open to Geoscience majors and minors.

COURSE SYLLABUS

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I. Catalog description

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II. Course objectives

Through this course students will

1. be introduced to the major dinosaur groups, their distinguishing characteristics, and the evolutionary and ecologic significance of those distinctive traits.
2. come to understand, through numerous examples drawn from recent research on dinosaurs, the scientific method and the perpetual self-correcting nature of science.
3. gain an appreciation for dinosaurs as a spectacular, very successful group of vertebrates that dominated the land environments of this planet for nearly 100 million years.

III. Course Outline

A. Major dinosaur groups and their characteristics (10 lectures)

- Distinguishing features of the major groups within the Dinosauria
- Unifying characteristics and likely ancestors
- Prominent groups associated with, related to, but excluded from the Dinosauria
- Classification: Are dinosaurs reptiles (Class Reptilia) or a class unto themselves?

B. Dinosaurian biology (11 lectures)

- metabolism: the "hot-blooded dinosaur" controversy
- behavior/functional morphology (why dinosaurs looked the way they did)
- behavior/trace fossil evidence (fossil trackways)
- reproduction and nesting behavior of the dinosaurs

C. Dinosaurian Ecology (10 lectures)

- climatic conditions and climate change in the Mesozoic world
- habitat preference of major dinosaur groups
- Mesozoic plant groups and their relationships to the Dinosauria

D. The Fate of the Dinosaurs (8 lectures)

- late Triassic and late Jurassic extinctions: changing of the guard during reign of the Dinosaurs
- the late Cretaceous extinctions: asteroid impact and/or death by volcanism
- modern (avian) dinosaurs: an overlooked branch of the dinosaur family tree

IV. Evaluation Methods

The grade will be based on four hourly exams given during the semester, each worth 25% of the final grade (the last of these four exams will be a non-comprehensive final). Scores on all exams will be adjusted to a mean of 75% so that 90-100%=A; 80-89%=B; 70-79%=C; 60-69%=D and below 60%=F.

V. Required books

Text: Norman, D.B. 1985. The illustrated Encyclopedia of Dinosaurs. Salamander/Crescent Books, London/New York. 280 p.

Non-text: Horner, J.R. and Gorman, J. 1988. Digging Dinosaurs. Workman Publishing, New York. 210 p.

The non-text reading provides a more personal account of dinosaur study, the excitement of dinosaur "hunts", and the personalities of the individuals that compose the community of dinosaur researchers. Questions from this reading will be included on the final exam.

VII. Additional Resource Materials (Bibliography)

Bakker, R.T. 1986. The Dinosaur Heresies. William Morrow and Company, New York, 486 p.

Charig, A.J. 1979. A new look at the Dinosaurs. Heinemann, London. 223 p.

Colbert, E.H. 1983. Dinosaurs: an illustrated history. Hammond Inc. New Jersey. 224 p.

Desmond, A.J. 1975. The hot-blooded Dinosaurs: a revolution in Palaeontology. Blond & Briggs, London. 352 p.

Padian, K. and Chure, D.J. 1989. The Age of Dinosaurs. Short Courses in Paleontology #2. Culver, S.J. Series Editor. 210 p.

Many other references, primarily individual articles on more specific topics, will be provided as the course proceeds.

LIBERAL STUDIES COURSE APPROVAL FORM

Part I: Basic Information

Category:	Natural Sciences Non-lab
Approval type:	Regular
Substitution for Gen. Ed.	None

Part II: Liberal Studies Goals (See explanations on following page)

Intellectual Skills:	Scientific inquiry (primary) Values (secondary)
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Acquiring a body of Knowledge	Earth History (primary) Paleontology (primary) Organic evolution (secondary)
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Part III: General Criteria

A. This is not a multi-section, multiple instructor course.

B. Ethnic and racial minorities and women have contributed extensively to the ongoing debate regarding dinosaur extinctions. Specific reference will be made to Walter and Luis Alvarez as the originators of the recent theory of asteroid or comet impact as the cause of late Cretaceous extinctions. Likewise, Kenneth Hsu has provided critical insights on the environmental and evolutionary causes of late Cretaceous mass extinction. Wendy Wolberg and Jennifer Kitchell are well known for their work on evidence for wildfires associated with the demise of the dinosaurs and the biological selectivity of mass extinctions, respectively.

C. The text was selected for its thorough, moderately technical treatment (and accurate illustrations) of the major dinosaur groups. The non-text reading provides a different perspective on dinosaur study and the emergence of new theories on dinosaur biology; this book provides insight into the personalities, attributes, and all-too-human failings of the individuals that compose the community of dinosaur researchers. It is a more personal account of the interesting career of Jack Horner, a "renegade" within a rather orthodox community of dinosaur specialists. Students will be evaluated on this reading through questions included on the final exam.

D. The introductory courses that introduce similar concepts to department majors are GS 131 Historical geology and GS 133 Intensive Historical Geology Lab. In GS 131 only three or four lectures are devoted to dinosaurs. Coverage in the lab (GS 133) is limited to brief reference in two lab exercises. With so many other topics in Earth History (other prehistoric life and geologic periods), there is insufficient time for more in-depth coverage of the dinosaurs. The proposed course (GS 151) will have no lab and is intended to provide an overview and to instill an appreciation for dinosaur study--not to establish a foundation for professional involvement in such research.

Explanation of how course will meet Liberal Studies goals:

A. Intellectual skills and modes of thinking:

Scientific Inquiry - It is a primary goal of the course to use the captivating vehicle of dinosaur study as the means of illustrating how science advances through meticulous collection and objective evaluation of data -- in this case, the recovery of dinosaur remains, scrutiny of the skeletons recovered, and analysis of associated rocks and fossils for evidence that supports or refutes existing theories on what dinosaurs were and how they lived. By reevaluating long-standing theories (and new proposals in similar fashion) in the light of new information, the course will thoroughly familiarize students with the standard methods of scientific inquiry: the formulation of hypotheses, selection of appropriate tests directed toward falsification of the hypotheses, and unbiased acceptance of the test results (whether they destroy your favorite theories or not!)

Values - a secondary objective of the course is to modify the chauvinistic outlook that the students possess as they enter the course. All too often, mammals in general and humankind in particular are perceived as the pinnacle of evolutionary success. From this perspective, organisms (like dinosaurs) that preceded us on this planet were inferior creatures that we supplanted as the ruling class; the organisms that presently share our world are, likewise, less significant than we are. Hopefully, a more objective account of the evolutionary history of mammals and dinosaurs, recasting the dinosaurs in their proper role as a well designed class of vertebrates that outcompeted the mammals for over 100 million years, will challenge students to reevaluate their views on the "inferiority" of other organisms, past and present.

B. Acquiring a body of knowledge -

Earth History & Paleontology - Some knowledge of the strikingly different conditions and organisms that have prevailed on our planet qualifies, I believe, as something essential to an educated individual. The course will provide a reasonable familiarity with dinosaurs and other fascinating creatures with which they coexisted. It will, likewise, provide a good introduction to the science of paleontology, its methodology, value, and even some of its practitioners. Other relevant topics include 1) climate change resulting from interaction of the Earth's crust, atmosphere, and oceans 2) plate tectonics ("continental drift") mechanisms and consequences and 3) the interdependence of different organisms as parts of a regional and global ecosystem.

Organic Evolution - It is impossible to discuss in any detail 1) the functional significance of the many remarkable features displayed by dinosaurs, 2) the classification of dinosaurs and the relationships established between the major groups within the class or 3) the importance of dinosaurs in the major change in taxonomic composition of terrestrial floras (and vice versa) in the Mesozoic Era without dealing repeatedly with the fundamentals of organic evolution.

E. Of the six ways that liberal studies courses should enhance students' abilities, the proposed course will contribute to all six by

1. touching briefly on ethical issues regarding the supposed superiority of mammals in general, and the human species in particular, over other life forms on this planet. In detailing the evolutionary appearance and relative success of the mammals and dinosaurs through the Mesozoic, a major point of emphasis is that mammals emerged as the dominant class of land vertebrates only after external environmental factors removed the dinosaurs from the competition; we are not the "new and improved" model or pinnacle of success in the evolutionary process. This perspective casts a very different light on such issues as protection of endangered species.

2. Critical evaluation and systematic analysis of models proposed for dinosaur evolution, behavior, and ecology will provide considerable practice in defining and analyzing problems, framing questions, and choosing those interpretations that best fit the available information. Some specific examples include a) dinosaur metabolism -- endothermy, ectothermy, or something altogether different? b) dinosaur extinctions -- asteroid/comet impact, volcanism, or other terrestrial causes? c) dinosaur ecology (for specific groups) -- aquatic, semiaquatic, or completely terrestrial? d) functional morphology -- e.g. what purpose did the plates on the back of stegosaurs have.

3. Students will be challenged in class discussions to exchange ideas and defend positions taken on such matters as those presented in a) to d) above (metabolism, extinction mechanism, etc.).

4. Exposure to such seemingly outlandish ideas and interpretations as asteroid impact, "death stars", "hot-blooded dinosaurs" and extant (still living) representatives of the Dinosauria -- along with the body of substantial evidence lending credibility to each of these ideas -- will demonstrate the need for creative thinking and for an open mind receptive to unorthodox interpretations.

5. In coming to appreciate the existing body of knowledge in paleontology (and any other scientific field) as essentially a progress report, constantly in need of revision, students will realize the need for constant update of their knowledge of this (and other) fields. the variety of information sources tapped in GS 151 will remain available to them long after their one-semester structured introduction to dinosaurs has been completed.

6. Several current issues are related to dinosaur study: the "nuclear winter" scenario proposed for the time immediately following nuclear war was developed and refined primarily in research on conditions that would have resulted from asteroid impact at the end of the Cretaceous Period -- the end of the reign of dinosaurs. In considering the climate of the Mesozoic World, the "greenhouse effect" is central to the discussions of dinosaur ecology. The dinosaurs inhabited a world with "greenhouse" conditions and high sea level stands, conditions many fear may result from continued large-scale consumption of fossil fuels by modern industrialized societies.

IV. Criteria for curriculum category

To fulfill the Knowledge Area and Natural Science Criteria that the course must (and should) meet, the students will:

1. become very familiar with the organisms collectively referred to as dinosaurs -- which groups are properly included in that category, which are not (although often mistakenly depicted as such...even by the U.S. Postal Service!), and the features that unify those that are included (obviously mastering the basic vocabulary used in dinosaur study in the process).
2. weigh the evidence that bears on major unresolved questions regarding how dinosaurs lived as individuals and died out as a group. (Were dinosaurs actually "hot-blooded"? Is the group truly extinct? Did asteroids or comets impact with the Earth 65 million years ago and, if so, what role did the results play in the demise of the dinosaurs?)
3. learn in the process to conduct science---to formulate and test multiple working hypotheses to explain dinosaur morphology, evolution, and ecology. Many ideas, some long-established and others very new (and widely publicized), do not survive critical evaluation.
4. examine the body of paleontological and geological knowledge assembled through the study of dinosaurs and appreciate the collective efforts of those who have contributed, including women and minorities.
5. learn to appreciate dinosaurs as a captivating, spectacularly diverse, and successful group of organisms that dominated the terrestrial fauna of this planet for nearly 100 million years.
6. recognize the importance of dinosaurs and the events that influenced them in the evolutionary history of our own class, the Mammalia.
7. appreciate the "dinosaur renaissance" of the last two decades and the very different perspectives provided on dinosaurs and their world that have emerged from this reevaluation of the group.

UWUCC COURSE ANALYSIS QUESTIONNAIRE

Section A: Details of the course

- A1: This course has been specifically designed to fulfill the Liberal Studies non-lab science requirement. Department majors and minors are not permitted to formally enroll in this course.
- A2: This course requires no changes in any other course
- A3: This is a traditional 3-hour 3-credit lecture class.
- A4: This course has never been offered on a trial basis at IUP.
- A5-6: This course is not a dual-level or variable-credit course.
- A7: Geoscience departments at an increasing number of colleges and universities are developing survey courses on dinosaurs. A short list of institutions that have such a course is provided on the last page of this document, along with 2 typical catalog descriptions
- A8: The content of this course is not required by any accrediting agency.

Section B: Interdisciplinary implications

- B1: This course will be taught by only one instructor.
- B2: No other courses are needed to teach this course.
- B3: Other departments at IUP should not be affected by the adoption of this course.
- B4: Students from Continuing Education are welcome.

Section C: Implementation

- C1: Resources:
a) Because of a recently approved change in some Geoscience Department lab courses (from 3 to 2 hours) faculty load is now available for this course.
b-e) No additional space, equipment, lab supplies, library materials, or travel funds are needed to offer this course.
- C2: No grant-funding is available for this course.
- C3-5: This course will be offered on a yearly basis, as a single lecture section for up to 75 students.
- C6: No enrollment limits have been placed on this course by any professional society.

INSTITUTIONS THAT OFFER INTRODUCTORY LEVEL COURSES ON DINOSAURS

Smith College, Massachusetts

107b Dinosauers and Extinct Mammals
 The study of the origin, evolution, and ecology of dinosaurs, ancient birds, and extinct mammals from a geologic perspective. Controversies concerning dinosaur social behavior and physiology and the extinction of these intriguing animals will be examined in light of recent geological evidence. Current debates concerning the habits and habitats of extinct mammals and early humans will also be discussed. Field trips to a local dinosaur footprint site and to a natural history museum will enhance our examination of the origin and extinction of species on our planet.
 4 credits
Constance Soja
 T Th 10:30-11:50 a.m.

University of Washington

GEOL 100 Dinosauers (2) A *Fensberger* Biology, behavior, ecology, evolution, and extinction of dinosaurs, and a history of their exploration. With dinosaurs as focal point, course also introduces the student to how hypotheses in geological and paleobiological science are formulated and tested. Optional ten-day, pre-quarter field trip to dinosaur deposits offered when possible.

University of California - Berkeley *

University of Chicago *

University of Rhode Island *

* - no catalog description available.

TO: Drs. Rob Gendron and Mike Kesner, Co-chairs of Biology Department
Curriculum Committee

FROM: Dr. John F. Taylor, Geoscience Department October 18, 1990

John F. Taylor
RE: Biology Department evaluation/support of Liberal Studies Course
Proposal - GS 151 The Age of Dinosaurs.

It was appropriately recommended that I contact you regarding my course proposal (copies for each of you enclosed) dealing with dinosaurs. Because the course includes a considerable amount of material regarding the biology of dinosaurs (ecology, metabolism, reproductive biology, and behavior), your comments on the proposal and a letter of support are herein requested. As a paleontologist (essentially a "geobiologist") I have a strong background in these fields, particularly as they pertain to ancient organisms such as dinosaurs. If you can respond immediately, I will attach a copy of your response to my proposal as it is resubmitted to the curriculum committee (going in Monday, Oct. 22). If you require a little more time, please forward your response through your department's representative to the College Curriculum Committee. If you would like additional information or would care to meet and discuss the course and proposal please contact me at X4469.

26 October 1990

TO: Darlene Richardson / Geoscience UCC

FROM: Biology UCC / Rob Gendron

SUBJECT: GS 151 - Age of the Dinosaurs

This is to inform you that the UCC has no problem with this course. Although it touches on biological issues the subject is clearly within the realm of paleontology. There is no overlap with any current Biology course, including Herpetology.