

Biology/Geology 350
Invertebrate Paleontology: The History of Life on Earth
Exam Number One

Remember, this is only the essay portion of the test, and although you are to *prepare* answers to all questions provided, you will answer only one or perhaps two for the test. Which one or two you will not know until the time you take the test. Also, you may have a choice.

QUESTION FOUR
APPLYING CHAOS AND COMPLEXITY THEORY
TO EVOLUTION

Evolutionary theory is not simple. Not only is the phenomena itself complex, but the human struggles and controversies add their own dimension (for example, Gould's eternal metaphors, and the Ultra-Darwinian-Naturalism debate). Even what we covered in class is too complex to easily contain in one question. So . . . you have a choice of either Option One or Option Two below. You need prepare for only one of them and if this question comes up do the Option you have chosen.

Option One - Microevolutionary Processes - If the record of life is indeed fractal then we must find explainability for how that fractal record is generated, and this ultimately gets down to information flow, positive and negative.

In terms of chaos theory (the logistic equation $X_{\text{next}} = rX(1-X)$, and the verbal definition), positive and negative feedback, and microevolutionary processes, explain how the fractal nature of the evolutionary record is generated.

If this question is a choice you will be provided with a blank (i.e. all text removed) copy of "Allopatric Models for the Evolution of Species and Clades . . ." to help organize and illustrate your arguments.

Be sure to include, in addition to any other arguments you make, the following terms and concepts in your discussion (see Glossary of Terms in Evolutionary Biology).

- Allopatric
- Clade
- Deme
- Founder effect

- Gradualism
- Logistic equation
- Negative feedback

- Positive feedback
- Punctuation
- Stasis
- Sympatric

Option Two - Macroevolutionary Processes - Paleontologists of necessity are concerned with macroevolutionary patterns and processes. This is because the evidence lends itself to comparing and contrasting longer term events.

In lecture notebook is "***The Implications of Evolutionary Theory For Interpreting the Fossil Record.***" Those statements summarize what we think we have learned about evolutionary processes. But in that form they are mythical truths ("it is so because it is said to be so.")

Construct the analytical and empirical truths which lie behind those statements. Analytical truths are the statements of theory, and logical deductions from the theory, that supports the statements. Empirical truths are the observations from life's record which illustrates and demonstrates the validity of the theory. Your arguments may come from any arguments or evidence made through the semester that apply.

If you get and choose this question you may have the following handouts open and available to you to draw ideas from.

- ☺ ***The Implications of Evolutionary Theory For Interpreting the Fossil Record***
- ☺ ***The Relationship Between Proximal Causes and Positive and Negative Feedback Mechanisms.***
- ☺ ***Two Basic Evolutionary Arguments: The Effect Hypothesis and The Turnover Pulse Hypothesis.***