(2-0) Cr. 1. Alt. F., offered even-numbered years.
Readings and discussion of influential ideas in ecological and evolutionary theory, with an emphasis on how models are used as conceptual tools for building synthetic paradigms. Topics are chosen according to student interests; may include spatial ecology, behavioral theory, chaos, community assembly and biodiversity, and others.

We will discuss how theory relates to topics of interest to the enrolled students. We are not really driving for a complete understanding of the theory on that topic. Indeed, that could not be accomplished in a seminar devoted to the theory of just one of these topics. Rather, we are looking to understand how theory was influential and useful in the development of that field. What did the theory contribute to moving the field forward?

Emphasis will be on what is “the theory,” how it differs from models, how models are validated, how theory evolves, and in what ways theory relates to empirical research. We will also discuss and even make rudimentary attempts to create some models that address a specific question within a broadly defined body of theory. However, this is not a course that is intended to teach specific methodologies for modeling (see EEOB 578).

A schedule of topics and discussion leaders will be drawn up in the first week of the semester. Readings will be chosen by the discussion leader in conjunction with the instructor(s).

This course is intended to compliment EEOB 578, Foundations of Theoretical Ecology and Evolution. However, each course can be taken independently of the other.

Any student who feels s/he may need an accommodation based on the impact of a disability should contact me privately to discuss your specific needs. Also, please contact the Disability Resources Office at 515-294-6624 in room 1076, Student Services Building to coordinate reasonable accommodations for documented disabilities.

![Diagram](FIG. 1.-Plot of the possible outcomes for the relationship between morphology and ecology. Species positions along the abscissa represent variation in ecology; positions along the ordinate denote variation in morphology. a, The relationship between morphology and ecology is similar between localities. b, Distance relationships between ecology and morphology are similar, but the distribution of species in each space is shifted between localities. c, The correlation between morphology and ecology differs between localities. d, The distributions of morphological and ecological positions differ in both localities. (From: Miles DB, Ricklefs RE, and Travis J. 1997. CONCORDANCE OF ECOMORPHOLOGICAL RELATIONSHIPS IN THREE ASSEMBLAGES OF PASSERINE BIRDS Am. Nat. 129: 347-364).)
Topics from 2016

- Scheiner & Willig General Theory of Ecology & NRC Role of Theory in Advancing 21st Century Biology
- Marquet et al. On Theory in Ecology
- Richard Levins entitled, “The strategy of model building in population biology
- Schmitz et al. Trophic cascades in terrestrial systems
- Density dependence in population models (this was a hands-on manipulative exercise)
- Hastings Complex interactions between dispersal and population dynamics
- Armsworth and Roughgarden directed vis random movement
- Hamilton and May Evolution of dispersal as an ESS
- Lande Dispersal and population synchrony
- Levins Metapopulations
- Hanski & Gilpin More metapopulations
- Roff Evolution of Life-History Variation
- Trivers Evolution of parent-offspring conflict
- Valone Evolution of optimization

Topics from 2014

- Introductions
- Why model - a philosophy of theory
- What is a model, a theory, and a hypothesis
- Community Structure
- Niche Evolution
- Invasion Ecology
- Game Theory
- Disease Ecology
- Social Evolution
- Kin Selection
- Succession
- Making a model
- Making a model
- Novel Ecosystems
- Spatial Ecology
- Assembly Rules
- Trophic Dynamics
- Life-history Tradeoffs
- Complex Traits
- Red Queens
- Aging
- Sleep Theory
- Neutral Theory
- Swarms
- Evolution of ecosystems
- *Meleagris gallopavo* Diem
- Hosts and Parasites
- Co-Evolution
- Grand Unified Theories
Leading and contributing to a discussion

Being able to present your ideas to others is the most important skill you can have in any career. How else will you be able to contribute to anything? To this end, how might you become better at this? The following is advice that will help you prepare yourself for discussing the topics that we will address in this course.

Advice for contributing (constructively) to a discussion

Many of you may find discussion sessions to be either fairly easy or very difficult. For those of you that tend not to contribute substantially to discussion, you should keep in mind that the discussion counts for about 30% of your total grade. For those of you that find it difficult to speak (you know who you are), I assume that you find it difficult to speak out for one of two major reasons. If you follow the two-part process below, you may be able to minimize these obstacles. Those of you that do find it easy to speak up, may also find the suggestions below useful in improving the quality rather than the quantity of your contributions.

Part A, after reading the article, you may feel that you have nothing to say or nothing to ask. This is can be remedied by carefully thinking about what you’ve just read and answering a few questions. If you take a few minutes to write out answers to the following questions, you will find that you have more to say than you think. It is important that you actually write them out in complete sentences on paper. Then bring them with you to class.

1. What is the take home message of the article? In two sentences, what is the point of the article?
2. What part of that message is the most controversial, do you agree with the author, and WHY or WHY NOT?
3. What part of the message do you agree with (there must be some portion that you can go along with? Why?
4. If you were rewriting the article, what parts of it would you change? What is the reason for the change?
5. How does that take home message relate to other things we have talked about in class, other things we have read, things you have learned in other courses or read in other places?

Part B, you might feel that you have things to say (and with your list from Part A, you now have several right in front of you), but you have difficulty interjecting them into the discussion. There are several mechanisms to do this. To prepare yourself for this, scan through your list frequently before and during the discussion. Then jump into the discussion in one of the following ways:

1. Be first to speak up. That way, you don't have to interrupt or change the direction of the discussion. By being first, you have more control of the conversation and can ensure that everyone discusses the most interesting topics (that you’ve already determined in Part A).
2. Learn to interrupt. While often not considered polite in its rudest forms, interrupting (skillfully) is a very valuable social skill. If you listen to any conversation, you will notice that the most influential people interrupt frequently and others are rarely offended. Something as simple as "Hold on a second I don't agree, I think...." is a great way to get your ideas out in front of folks before the discussion moves on to other topics. Or, "Yes, I agree but, I think you have to consider...", or try, "No, I think ...." Sooner or later, you MUST learn to do this.

3. Frequently, there are momentary pauses in any conversation or discussion. When these occur, step in immediately with one of the statements, ideas, or questions from Part A. Do not be afraid to change the direction completely or go back to something that was covered earlier, but which you feel needs more coverage.

4. Respond to other individuals in the room. Do not wait for the instructor to introduce a new question. Respond directly to the other person. Sometimes, when teaching this class, I feel that I am having 14 simultaneous but independent conversations with each student. Not all discussion has to go through me. Indeed, none of it should in the ideal world.

5. Stop by after class and tell me that you really find it difficult to get involved in the discussion, but you are prepared and have things to say, if only you could find a way to get them out. I can assist you by simply creating an opportunity for you to speak by asking something like "Well John Doe, what do you think about Jane Doe's idea?" Obviously, this method is quite contrived, and artificial, but it will help you get used to speaking to the group. After a few sessions, your confidence may improve substantially and you may find it much easier to jump in on your own.

**DO NOT LET YOUR SELF FALL INTO A RUT. BE PROACTIVE AND GET OFF TO A GOOD START!**
How to “Think Critically?”

1. When confronted with a seemingly obvious cause-effect relationship, ask, “Is there any way the obvious could be wrong?”

2. When considering that a cause-effect relationship may exist, ask, “If this is indeed happening, what are the implications beyond the immediate phenomenon being observed? What are the extended consequences, what other processes must also be affected?”

3. If the cause-effect relationship really does exist, “What does this phenomenon require of the players, physiologically, ecologically, behaviorally, etc. and are these requirements reasonable? What processes (ecological or evolutionary) must be assumed?”

4. For more details in thinking critically, check out: http://www.criticalthinking.org/pages/critical-thinking-where-to-begin/796
Subject: On thinking outside the box – or – How A Truly Bright Student Thinks

The following concerns a question in a physics degree exam at the University of Copenhagen:

"Describe how to determine the height of a skyscraper with a barometer."

One student replied:

"You tie a long piece of string to the neck of the barometer, then lower the barometer from the roof of the skyscraper to the ground. The length of the string plus the length of the barometer will equal the height of the building."

This highly original answer so incensed the examiner that the student was failed immediately. He appealed on the grounds that his answer was indisputably correct, and the university appointed an independent arbiter to decide the case. The arbiter judged that the answer was indeed correct, but did not display any noticeable knowledge of physics.

To resolve the problem it was decided to call the student in and allow him six minutes in which to provide a verbal answer which showed at least a minimal familiarity with the basic principles of physics. For five minutes the student sat in silence, forehead creased in thought. The arbiter reminded him that time was running out, to which the student replied that he had several extremely relevant answers, but couldn’t make up his mind which to use.

On being advised to hurry up the student replied as follows:

"Firstly, you could take the barometer up to the roof of the skyscraper, drop it over the edge, and measure the time it takes to reach the ground. The height of the building can then be worked out from the formula \( H = 0.5g \times t^2 \). But bad luck on the barometer.

Or if the sun is shining you could measure the height of the barometer, then set it on end and measure the length of its shadow. Then you measure the length of the skyscraper's shadow, and thereafter it is a simple matter of proportional arithmetic to work out the height of the skyscraper.

"But if you wanted to be highly scientific about it, you could tie a short piece of string to the barometer and swing it like a pendulum, first at ground level and then on the roof of the skyscraper. The height is worked out by the difference in the gravitational restoring force

\[ T = \pi \times \sqrt{\frac{l}{g}}. \]

"Or if the skyscraper has an outside emergency staircase, it would be easier to walk up it and mark off the height of the skyscraper in barometer lengths, then add them up.

"If you merely wanted to be boring and orthodox about it, of course, you could use the barometer to measure the air pressure on the roof of the skyscraper and on the ground, and convert the difference in millibars into feet to give the height of the building.

"But since we are constantly being exhorted to exercise independence of mind and apply scientific methods, undoubtedly the best way would be to knock on the janitor's door and say to him 'If you would like a nice new barometer, I will give you this one if you tell me the height of this skyscraper'."

– The student was Niels Bohr, the only Dane to win the Nobel Prize for Physics