

Notes on the Evolution of Behavioral Systems: Preface and Outline of Topics¹

Eth. & Behav. Ecol.
Biology 287
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This will be the most mechanistic section of the course. It represents our take on one of Tinbergen's four approaches to animal behavior: **what are the internal mechanisms responsible for the production of behavior?** Often called **neuroethology**, it is more than just the study of the nervous system.

Our purpose here is to continue to explore the relationship between genes, the environment and behavior – our subjects since the start of the course. Please think of what you will learn here within that context.

Much of what you will learn represents a rather unusual but I believe, very 21st century view of certain aspects of the evolutionary study of mechanisms of behavior. So, I suspect that certain parts will be very new to you (or perhaps you have heard me speak of them in other courses).

As we work through this section, please keep in mind the following:

1. It is hard to believe that the first living things "behaved" in the sense we speak about it now. That is, it is hard to believe that they responded to the environment by some sort of external directed action -- for instance motion or release of some defensive chemical.
2. Yet it is easy to see that the ability to measure certain environmental conditions and take appropriate behavioral action (for instance moving) would be highly adaptive.
 - It first, this would seem to be in response to the physical environment -- the presence of noxious chemicals or food compounds.
 - Later, as the biotic environment became more complex there is increasing selection to be able to respond to certain other organisms in specific contexts (in fact we know today that the biotic environment is usually a far greater challenge for the organism than the abiotic and moreover, most behavior is directed towards biotic elements.
 - The first behavioral systems had to evolve from components that were already in place for some other reason. It did not come from nothing but it was new and had to be perfected reached gradually.

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3. If you come to understand this, you will be less susceptible to the pathetically constructed arguments of "**irreducible complexity**"² used to advance **creationist agendas** that simply do not belong in science.
4. Keep in mind that every behavioral system has to work according to the rules of information processing. Thus, somehow a system had to develop that was composed largely of proteins (directly linked to genes) but that could transmit and store information, make decisions, and initiate adaptive actions. The rules of information processing are independent of living systems (computers use them). We will see them as major selective forces on the evolution of behavioral systems and the purpose of the rather theoretical first set of notes is to give you some familiarity with information processing.
5. Put another way, it is the purpose of this section to lay out the features that information system would have to possess and then look at how biological systems *instantiate* these features. For comparison, we will consider in a non-technical way how computers do the same things.

Finally please note two important things:

- These notes are not meant to be an authoritative account of how things happened. It is anything but that. What it does do is lay out some of the things that did happen and use these as examples. It is speculative and you must treat it that way but at the same time it represents a series of useful hypotheses as to the evolution of behavioral systems.
- I apologize that we cannot get into all the wonderful molecular work that is being done on topics related to the speculations in this section. There is only so much time and we have other things we need to cover in this course. However, perhaps some of you will go on and make a research career in these areas.

² If you don't know what this, you should. Please follow this link for an overview (just read the top if you don't have enough time to read the whole thing):
http://en.wikipedia.org/wiki/Irreducible_complexity