

I find that fundamental insights about biological evolution, about cognition, and about the character of causation in special sciences can be gained from close attention to the nature and role of chance in various theoretical contexts. My work on general causal and probabilistic characteristics of processes in evolution provides a basis for a deeper understanding of the evolution of cognition, and provides a relatively simple context in which to develop ideas which can be applied to more difficult cases in medicine and the social sciences.

### **Philosophy of Biology and Probability**

I have been developing conceptions of biological processes (“organism-environment histories”) and probabilistic laws of nature (“mechanistic probability”) which I believe can clarify issues concerning the nature of explanation and causation in special sciences (e.g. evolutionary biology, medicine, psychology). Mechanistic probability is defined in terms of a kind of complex causal structure. I have been using mechanistic probability and organism-environment histories to help provide answers to questions such as these:

- Is a unified conception of the processes described in evolutionary theory possible, or is evolutionary theory only a collection of models which apply loosely related concepts and techniques in divergent contexts?
- What principles determine which environmental and other factors affect biological fitness? What portions of the world count as relevant parts of an organism’s environment? What does it mean to say that the biological fitness of an organism varies in different parts of its environment, varies over time, or is affected by its behavior?
- Are existing conceptions of natural selection untestable because they depend on a tautology? (Despite much attention, this issue has not been put to rest.)

The majority of my papers will be incorporated into a book (working title: *The Nature of Evolutionary Processes*) which will provide a unified metaphysics of evolutionary processes.

### **Cognitive and Cultural Evolution**

I have been using my work on probability, fitness, and the environment to provide insights concerning the evolution of mind and culture. I intend to continue to develop ideas such as these:

- It’s often that argued complex environments faced by our ancestors help explain the evolution of sophisticated cognitive capabilities. Using my work on relationships between fitness and the environment, I argue that only very particular kinds of environmental complexity can help to explain what is special about the evolution of sophisticated cognitive capabilities.
- I have argued that mental content—what thoughts are “about”—cannot, as some argue, depend on biological functions defined in terms of natural selection. I have developed a teleological basis for content which depends on relationships similar to but different from those required by natural selection.
- In what senses are cognitive processes sensitive to probabilities in the environment? Are there selection pressures toward cognitive processes which accord with the predictions of one or another version of decision theory? Is it possible to give an account of mental content in terms of natural selection and decision-theoretic properties?
- If, as some have argued, learning from others is similar to the acquisition of genes from parents, then beliefs and emotional states of the learner and his or her external conditions can modify the “heritability” and “fitness” of ideas available for learning. What are fitness and heritability in this context, and how should we understand the way in which they are biased by internal and external conditions?

### **Probability in Social Science and Medicine**

I intend to extend my mechanistic interpretation of probability to elucidate issues like these:

- What it is for a behavior or medical condition to raise or lower the probability of various medical outcomes?
- In what sense do social conditions such as income, education, and race change probabilities that an individual will make certain behavioral choices?
- In what sense do factors like those just mentioned cause or explain outcomes if more fine-grained causes and explanations exist?