

**Biology 350**  
The Biology of Hope and Belief

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**Course Description:** The underlying premise of this course is that the human mind and human behaviors have been shaped by the force of natural selection. That is, we are not born as blank slates waiting to be shaped by the environment and experience. Rather, we come into the world with predispositions, preferences and passions that evolved because they helped our ancestors survive. Some of these behaviors are complex, longstanding and present in every human cultures ever studied. This course explores the biological basis for two of them: the human capacity for hope and the human desire to believe in a deity.

The course begins with an evaluation of hope. What is it and how is it different from optimism? Thereafter, we explore the nervous system, how it is structured and how it has evolved over time. Do we find evidence for hope among other species, including our closest cousin, the chimpanzee? We will look at the neurobiology of hope and how that changes when one is in a state of hopelessness. We will ask whether it is possible to cheat death with hope and what data support this contention.

From there, the course takes on an issue that is intimately related to hope, i.e., the near universal human desire to believe in God. We will examine how causality is learned in young children and from that how beliefs are formed neurologically. We will study how malleable beliefs are once they are formed, how false beliefs are created and the neurobiological events that attend the changes. Thereafter, we will examine the neurobiology that underscores religious states such as reverie, mysticism and hallucination. We will learn how brain activity is studied using various types of brain scans and data from brain-injured subjects. We will evaluate data used to support different points of view about the reality of religious states.

Throughout the course, we will seek to understand how the force of natural selection might have led to both hope and religious faith. What were the selective advantages to our ancestors and what, if any, data support these contentions. The course, in short, explores the biological bases for qualities thought to be uniquely human: our capacity for hope and our relationship to a supernatural deity.

**Course Format**

Lecture: M, W, F 10:30-11:18  
Recitation: T or R 10:30-11:18

**GEC Objectives:** Courses in natural sciences foster an understanding of the principles, theories and methods of modern science, the relationship between science and technology, and the effects of science and technology on the environment.

**Learning Objectives and How They Will Be Met:**

- 1. Students will understand the basic facts, principles, theories and methods of modern science as they relate to the biology of hope and belief.**

This course is structured around two themes that are pivotal to modern biology. The first of these themes is that the force of natural selection has played a key role in producing the capacity for hope in humans as well as the human desire to believe in a supernatural deity. Each lecture explicates the adaptive significance of these phenomena and the evidence we have to support the claim that these behaviors developed as a consequence of natural selection. The second theme is that, if these qualities are the result of evolutionary forces, then it should be possible to identify the underlying physiological and biochemical mechanisms for them. In the course of making these arguments, students will be exposed to the facts, principles and theories of modern evolutionary theory as well as modern cell theory, physiology and neurochemistry.

- 2. Students will learn key events in the history of science;**

We will trace evolutionary theory from the time of Darwin to the present in an effort to understand how natural selection can be adduced to explain hope and belief. In so doing, students will understand how the theory of natural selection unifies key ideas in biology. In addition, students will learn about the nature of science, how evidence is evaluated and how critical experiments are designed. For instance, students will learn that indirect observation and experimentation valid ways of doing science as are making and testing predictions from evolutionary theory.

- 3. Students will provide examples of the inter-dependence of scientific and technological developments;**

Students will learn about how neurological activity can be assessed and interpreted. Students will learn about current brain scan technologies (eg. fMRI, PET, EEG etc.) and how the development of these technologies have facilitated our ability to measure subjective characteristics such as hope and belief. We will also discuss the limitations of these technologies and future directions in technology.

**4. Students will discuss social and philosophical implications of scientific discoveries and understand the potential of science and technology to address the problems of the contemporary world.**

Over the 10 week quarter, we will have many opportunities to explore the social and philosophical implications raised in the course. For instance, how should our capacity for hope be incorporated into end-of-life treatment decisions? If nonhuman animals have a capacity for hope, should that affect how we treat them? Can we ethically use brain-damaged people as guinea pigs for understanding how the brain works? If we can understand belief in God neurologically, does this diminish the spirituality of the religious experience? These issues will be covered both in the lecture and recitation sections.

**Prerequisites:** None

**GEC Category:** Natural Sciences Breadth

**Required Books:**

Crick, Francis (1994) *The Astonishing Hypothesis: The Scientific Search for the Soul*. Simon and Schuster, New York, 317 pgs.

Newberg, A., E. C'Aquili and V. Rause (2001). *Why God Won't Go Away: Brain Science and the Biology of Belief*. Ballantine Books, New York. 223 pgs.

Wilson, David Sloan (2003). *Darwin's Cathedral: Evolution, Religion and the Nature of Society*., University of Chicago Press, Chicago, 258 pgs.

Wolpert, L. (2006). *Six Impossible Things Before Breakfast: The Evolutionary Origins of Belief*. W.W. Norton and Co., London, 230 pgs.

<b>Lecture</b>	<b>Topic</b>	<b>-</b>
1	Course introduction and administrivia	
2	What is hope: several views from history, literature and science	
3	Brain architecture and anatomy of the nervous system	

- 4 How neurons communicate
- 5 Neurotransmitters and chemically-induced moods
- 6 The biochemistry of hope
- 7 Chemical signs of hopelessness; experiments with animals
- 8 Artificial hope: psychotropic drugs and how they work
- 9 Hope and the course of AIDS
- 10 Do animals have hope?
- 11 Evolutionary origins of hope
- 12 Hour exam 1
- 13 The selective advantage of hope
- 14 The organization of society and hope
- 15 Hope as a progenitor of religion
- 16 The evolution of the hominid brain
- 17 Tool use and the concept of causality among early hominids
- 18 How beliefs are formed in the brain; the neurological development of childhood beliefs
- 19 Resistance of belief to contrary evidence: what does the neurochemistry tell us?
- 20 Spiritual beliefs and the brain
- 21 The evolution of ritual in human societies
- 22 Mysticism and the biology of transcendence
- 23 Visual experiences and mental states: biological basis of Christic visions

24	Hour exam 2
25	Religion and evolutionary biology: what is the adaptive value of religion?
26	Is there a “God Gene”? What is the evidence?
27	Genetics and influences on religion and values
28	Neurobiological basis for consciousness and the soul
29	The curious case of music: a neurological portal to the divine?
30	Neurotheology: science or pseudoscience?

Students will enroll for one recitation section on either Tuesday or Thursday. Students will read assigned topics from the list below and discuss the selections in class.

**Recitation Reading List** Readings that are not found in the required textbooks will be copied and provided to you in class. A quarter-long paper will be required in recitation. You will receive a separate handout in recitation giving details about what is required.

### **Week 1 Hope from Several Points of View**

Tiger, L. (1979). *Optimism: The Biology of Hope*. Simon and Schuster, New York.

Excerpts:

As necessary as air. Pp. 13-37

The past of an illusion pp. 39-80

Room at the inn pp. 81-146

Havel, V. (2004). An orientation of the heart. Adapted from *Disturbing the Peace*. In: *The Impossible will Take a While.*, Loeb, P.F. (ed). Perseus Book Group, New York, pp. 82-87.

Harris, S.L. and G. Platzner (2008). *Alienation of the Human and Divine: Prometheus, Fire and Pandora*. In: *Classical Mythology: Images & Insights*, 5<sup>th</sup> Edition, McGraw Hill Higher Education, New York, pps 106-113.

### **Week 2 Structure of the Brain and Nervous System:**

Crick, F. (1994). The Neuron. In: *The Astonishing Hypothesis*, Simon and Schuster, New York, pp. 91-105.

Newberg, A. et al. (2001). Brain Architecture. In: Why God Won't Go Away, Ballantine Books, New York, pp. 35-53.

### **Week 3 A Society that Runs on Hope**

Wright, R. (2005). Dancing to Evolution's Tune, *Time Magazine*, January 17.

Gilson, M. (2000). Pete Seeger and the Psychology of Hope. *Monitor on Psychology*, 31: 1-5.

Wallis, C. (2005). The New Science of Happiness. *Time Magazine*, January 17, pp. A3-A18.

### **Week 4 When Medicine Fails and Hope is all that's left**

Chochinov, H.M. (2004). The art of oncology: When the tumor is not the target. *Amer. Soc. Clinical Oncology* 22: 1336-1340.

Capiello, D. (2003). The Reeve Factor. *The New Yorker Online Only Version*, November 11, 2003.

Groopman, J. (2004) Excerpts from: *The Anatomy of Hope*, Random House, New York, 246 pg.

Chapter 2: False Hope, True Hope, pp. 28-57

Chapter 3: The right to hope, pp 58-81

### **Week 5 Hope as a Selective Agent**

Wilson, David Sloan (2003). Excerpts from *Darwin's Cathedral: Evolution, Religion and the Nature of Society.*, University of Chicago Press, Chicago.

Chapter 1: The View from Evolutionary Biology pp. 5-46

Chapter 6: Forgiveness as a Complex Adaptation, pp. 189-218

### **Week 6 How Beliefs are Formed in the Brain**

Wolpert, L. (2006). Excerpts from *Six Impossible Things Before Breakfast: The Evolutionary Origins of Belief.*, W.W. Norton and Co., New York:

Chapter 2: Belief, pp. 23-34

Chapter 3: Children, pp. 35-50

Chapter 4: Animals, pp. 51-68

Chapter 5: Tools, pp. 69-82

### **Week 7 God on a PET Scan**

Newberg, A. and M.R. Waldman (2006). Excerpts from *Why We Believe What We Believe*, Free Press, New York.

Chapter 7: Nuns, Buddhists and the Reality of Spiritual Beliefs, pp. 167-190

Chapter 9: The Athiest who Prayed to God, pp. 215-245.

### **Week 8 Mysticism**

Newberg, A. , E. D'Aquili and V. Rause (2001). Excerpts from *Why God Won't Go Away*, Ballantine Books, New York:

Chapter 4: Myth-making, pp. 54-76

Chapter 5: Ritual: The Physical Manifestation of Meaning, pp. 77-97

Chapter 6: Mysticism: The Biology of Transcendence, pp 98-12

### **Week 9 Evolutionary Biology of Belief**

Wilson, David Sloan (2003). Excerpts from *Darwin's Cathedral: Evolution, Religion and the Nature of Society.*, University of Chicago Press, Chicago.

Chapter 2: A View from the Social Sciences, pp. 47-85.

### **Week 10 Origins of consciousness**

Crick, F. (1994). The General Nature of Consciousness. In: *The Astonishing Hypothesis*, Simon and Schuster, New York, **pp. 13-22.**

Newberg, A. , E. D'Aquili and V. Rause (2001). Excerpts from *Why God Won't Go Away*, Ballantine Books, New York:

Chapter 2: How the Brain Makes the Mind, pp. 11-34

## **Determination of Grades:**

You grade will be determined from the following distribution of points:

Hour Exam 1—100 points  
Hour Exam 2---100 points  
Final Exam (comprehensive) 200 points  
Recitation Paper—100 points  
Recitation Participation—100 points

Total Course Points: 600

**Final Grades:** Your final grade will be based on the percentage of the 600 points that you earn during the course of the quarter, as indicated below:

93-100%	A	80-82%	B-	67-69%	D+
90-92%	A-	77-79%	C+	60-66%	D
87-89%	B+	73-76%	C	<59%	E
83-86%	B	70-72%	C-		

**Absences:** If you are too ill to take an exam, please contact your TA or Dr. Fisher within 24 hours of the class period in which the exam was taken. You must be seen by and receive written documentation from a professional health care practitioner on the day of the exam in order for a make up to be given. Other serious personal problems will be considered, in advance, on an individual basis. In all instances, documentation supporting the excused absence will be required.

**Academic Misconduct:** OSU has a strict code of academic that requires us to report any and all cases of suspected misconduct (e.g. cheating on an examination, plagiarism in written assignments, using an examination proxy, failure to follow course policies etc.) to the OSU Committee on Academic Misconduct for adjudication.

**Accommodation of Special Needs:** Any students registered with the Office of Disability Services needing accommodation should speak with Dr. Fisher regarding those needs. Please do this within the first two weeks of the quarter. Dr. Fisher will sign the ODS form.

**Sexual Harassment:** OSU considers sexual harassment offenses to be unacceptable behaviors that erodes the quality of the learning environment. Please report any concerns about questionable behavior to Dr. Fisher.



