SYLLABUS
SCIENCE AND RELIGION 3:
COGNITIVE NEUROSCIENCE
Summer 2013
SocSci 130B; Psych 172S; RS 100; Logic & Philosophy of Science 140B

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The schedule of assignments for this course is being revised, to make the homework load more manageable within a 5-week summer session. The schedule is not yet available. All the assigned readings will be found in the course reader or online. The final exam will not require coming to campus.

Description:

In this course we address questions that arise from the scientific study of the mind & brain but cannot be answered adequately on the basis of empirical science alone. We approach questions about self-identity, freewill, consciousness and religious experience, not primarily from the viewpoint of history or sociology, but from the viewpoint of philosophy, especially the sub-disciplines of epistemology, philosophy of science, and philosophy of mind.

What kind of thing is a human being? Why are we here? In our age, it is science that purports to answer these ancient questions, while technology promises to make us “more than human.” Religions have provided the powerful, history-shaping answers in the past, and it was the Judaeo-Christian-Muslim world-view that gave birth to modern science in Europe. What is the logical/epistemological relationship between these two most powerful engines of change? What will be, and what should be, their relationship in the future?

The New Atheists (Sam Harris, Richard Dawkins, Christopher Hitchens, Dan Dennett) argue that the epistemology of science and the epistemology of religion are radically different: one is based on empirical evidence & rational argument and the other is based on blind, irrational faith. Is this true? Do the process by which we form religious beliefs and the process by which we form scientific beliefs differ in essential ways? The same people argue that by making irrational “faith” a virtue, religious communities undermine civic practices of public reasoning that are essential to democracies. This is an important criticism. If true it would support their belief that tolerance of other people’s religious beliefs is not a virtue. Is this correct? Are the religions a public danger?

The development of genomics, stem-cell research, robotics, nanotechnology, and neuropharmacology hold out the promise of transforming and enhancing human nature, posing difficult religious and philosophical questions in what some refer to as our “posthuman” future. If we are truly to understand ourselves and our place in the cosmos, we must adopt interdisciplinary approaches that cut across fields of knowledge, institutional boundaries, cultural borders, and religious traditions. We need to explore such questions as these: Is there a human nature? Is human well-being to be sought in fulfilling essential human capacities, or is the
concept of “human nature” a malleable social construct?

Are religious faith and spirituality compatible with contemporary scientific theories of the universe?

Is creation by God compatible with evolution by natural selection? Are human morality and religion biological phenomena determined by our genes? What are the strengths and weaknesses of “evolutionary psychology”?

Does quantum physics point to inadequacies in the mechanistic world-view that accompanied the birth of modern science? What role does consciousness play in quantum measurement?

There is something inescapably private and “first person” about consciousness. What accounts for this? Can third-person, objective science give a complete analysis of first-person, subjective experience?

The human brain manifests a massive complexity, comprising about 100 billion neurons and 100 trillion ($10^{14}$) synapses. But are we our brains? Or is there something we are that is irreducible to brain states? Is there a soul?

The sciences of the mind -- cognitive science, neurobiology, psychiatry -- are in dialogue with millenia-long traditions of meditation and mental discipline. Neuroscientific evidence that experienced meditators have increased memory for words and images, increased capacity to maintain focused attention, and the ability over time to substitute positive emotions like compassion for negative emotions like fear, anger and anxiety raises questions about the potential (and the limitations) of introspective methodologies in the sciences of the mind. Do the meditative disciplines of the world’s great religions have something to teach us about neuroplasticity and the mind/brain’s capacity for self-transformation? Can introspective and phenomenological methods achieve sufficient objectivity to be incorporated into the neurosciences?

The approx. 1000 million of us who are Hindus believe that the individual human soul is one with an Infinite Consciousness that is the ultimate reality underlying phenomenal experience. The 330 million of us who are Buddhists believe that there are no independently existing entities, that all phenomenal being is inter-relational, but at the same time that each of us has an indestructible Buddha nature. What does contemporary cognitive neuroscience tell us about the nature of personal self-identity? How does the current scientific understanding of personal self-identity compare with Hindu teaching? with Buddhist teaching? with the Judaeo-Christian-Muslim-Baha'i belief that humans are made in the image of God? The monotheistic religions have placed a special emphasis on personal freedom and responsibility. What do we mean by “freewill”? Is our belief that we have freewill an illusion? Is freewill incompatible with a physicalist understanding of the world?

If you want a quick introduction to some new developments in neuroscience, and a chance to think about how this knowledge should change your understanding of your "brain", "mind", and "soul", you might really enjoy this class. It's an exciting time in the neurosciences. For example: there are three new major projects underway to map the neural activity of the brain. The Obama administration is planning a decade-long scientific effort called the Brain Activity Map. A group of nanotechnologists and neuroscientists believe that new technologies are available for recording the electrical activity of individual neurons of the entire brain. One proposal involves
mapping brain activity by creating fleets of molecule-size machines to noninvasively act as sensors, measuring and recording brain activity at the cellular level, and storing it using synthetic DNA. Meanwhile, Europeans are investing a billion euros in a second, Swiss-led effort to understand human brain activity by constructing a supercomputer simulation of it. Henry Markram, director of the Human Brain Project, has high hopes: "As the model becomes more accurate and behaves more like a brain, we could couple it to a robot and see the robot learning. Then we'll be able to trace the chain of events from molecules to cognition." A third project, already underway, is the Human Connectome Project. The goal of the HCP is to map the larger-scale connections between major anatomical and functional systems of the brain, using diffusion MRI, which maps the structure of the white matter that insulates the "wires" of the brain and other traditional neuro-imaging methods.

The concepts and categories of psychology are being revised on the basis of new neuroscientific knowledge. What effect should this have on our understanding of the concepts like "person", "free will", and "moral responsibility" that undergird our moral and legal systems? Should neural imaging data be admissible in court? Should what we know about memory revise downward the weight given in court to eyewitness testimony? How reliable is perception itself? What underlies the individuality, continuity and unity of a person? When does personhood start and stop? Can personal identity extend beyond physical death? Is there a transcendent spiritual dimension to reality? Does contemporary science support the central teachings of the world's religions? Is consciousness an epiphenomenal by-product of neural processes, with no causal powers of its own, or is consciousness the fundamental reality in the universe?

These are some of the questions addressed in this course. A short impromptu video about it is available on YouTube at www.youtube.com/watch?v=qN-G4yvZicQ The class is cross-listed in the following subject areas: Psychology, Social Sciences, Logic & Philosophy of Science, and Religious Studies.

Course objectives:

This course is part 3 of the Science & Religion series. In the first course we discuss the relationship between religion and the physical sciences. In the second course we explore the relationship between religion and evolutionary biology. In this course we discuss religion and cognitive neuroscience, focusing especially on questions about the mind-brain relation, the biological basis for meaning and agency, neural plasticity, self-transformation, the top-down causality of mental states, consciousness, and the nature of self-identity or the “soul”.

By the end of this class the successful student will have a basic understanding of the representational/computational theory of mind, as well as its embodied and “extended” nature. She will be familiar with neuroscientific research that bears on the nature of self-identity, consciousness, self-consciousness, decision-making, and religious experience. She will be familiar with the puzzle of personal self-identity. And she will have sufficient understanding of 3 prevalent philosophic world-views (reductive physicalism, non-reductive physicalism, and panpsychism) to make well-reasoned evaluations of religious beliefs about the “soul”.

Faculty Advisors.

The following people have contributed to this 3-course Science & Religion series:

Francisco Ayala, Ph.D. is the Donald Bren Professor of Biological Sciences in the Department of Ecology and Evolutionary Biology; Professor of Philosophy in the School of Humanities; and
Professor of Logic and the Philosophy of Science in the School of Social Sciences at UC Irvine. Dr. Ayala has published more than 900 articles, authored or edited 30 books, and is a member of the National Academy of Sciences. He chaired the committee that wrote the National Academy of Science booklet, *Science, Evolution, and Creationism*. His lecture in one of my earlier classes is available directly from UCI's open courseware site.

**Jeff Barrett, Ph.D.** is Professor of Logic & Philosophy of Science at UC Irvine. His book *The Quantum Mechanics of Minds and Worlds* (Oxford University Press, 2001) is a major contribution to the philosophy of quantum mechanics. Prof. Barrett spoke to my students about Hume's discussion of miracles and the general question of the epistemology of religious beliefs.

**Warren S. Brown, Ph.D.** is Professor of Psychology at Fuller Graduate School of Psychology and Director of the Lee Edward Travis Research Institute. His research includes study of cognitive deficits associated with pathology of the corpus callosum; child development and adult aging; and evoked EEG potentials in mental activity and psychopathology. He is co-author of the book *Did My Neurons Make Me Do It?* (Oxford, 2007) with Nancey Murphy. He presents a neuroscience-based model of downward causation of the mental on the physical, in Lesson 5 of this course.

**Michael Dennin, Ph.D.** is Professor of Physics & Astronomy in the School of Physical Sciences at UCI. He is a nationally known expert on condensed matter and biological physics. Prof. Dennin spoke on the philosophical issue of reductionism in physics, using examples from his work on foams. His online physics textbook forms part of the assigned reading for this course.

**Stephen R. Friberg, Ph.D.** is a physicist who has done pioneering experiments in quantum optics, optical telecommunications, and photonics. He is interested in the relationship of science and religion. Currently a senior principal scientist at KLA-Tencor, he gave a lecture in a previous class, about quantum mechanics and the challenges it poses for common sense.

**William Heidbrink, Ph.D.** is Professor of Physics & Astronomy in the School of Physical Sciences at UC Irvine. He specializes in experimental plasma physics. Professor Heidbrink's research involves studies of "fast" ions in magnetized plasma. In an earlier class he shared his reflections on the harmony between theistic assumptions and scientific practice. These are summarized in the assigned reading for Lesson 4 of this class.

**Donald Hoffman, Ph.D.** is Professor of Cognitive Science, Professor of Philosophy and Professor of Logic & Philosophy of Science at UC Irvine. He is author of more than 70 scientific papers and three books, spanning topics from perception to metaphysics. His lecture on perception as the construction of a virtual reality, the mind/body problem, and his theory that consciousness is ontologically fundamental, forms the basis for Lesson 8 of this class.

**Aaron Kheriaty, M.D.** is a resident physician at UCI and the Founder/Director of UCI’s Psychiatry and Spirituality Forum. He graduated from the University of Notre Dame and earned his MD from Georgetown University. He spoke to an earlier class on the history of the relationship between psychiatry and spirituality.

**Nancey Murphy, Ph.D.** is Professor of Christian Philosophy at Fuller Theological Seminary, Pasadena, CA. She has published many articles on specific topics in the area of science & religion. She is co-author, with Warren Brown, of *Did My Neurons Make Me Do It?*, the book that forms the basis for Lesson 5 of this course.
Ron Shigeta, Ph.D., a recent graduate in biochemistry and biophysics from Princeton, does analysis and genomics for Affymetrix, a leading biotech company. He spoke to a previous class on genetic engineering and the significance of scientific discoveries for the future of religion. Our ongoing conversations, especially about Dawkins's early books, have influenced the positions I take in course 2 of this series.

Michael Spezio, Ph.D., Ph.D., M.Div. is Assistant Professor of Psychology at Scripps College and Visiting Scientist, Affective & Social Neuroscience, at Caltech. He has doctorates in biochemistry and cognitive neuroscience and a masters degree in divinity. His recent studies include face-to-face eye-tracking experiments, fMRI studies of affective touch and political judgments, and detailed analyses of how people with autism process faces. He spoke to an earlier class about the early development of self-consciousness and theory-of-mind in humans as compared with non-human primates.

Kyle Stanford, Ph.D. is Associate Professor of Logic & Philosophy of Science at UC Irvine. His research interests are in philosophy of biology and philosophy of science. His recent book, *Exceeding Our Grasp: Science, History, and the Problem of Unconceived Alternatives* (Oxford University Press, 2006), is a critique of scientific realism. Prof. Stanford's lecture on evolutionary psychology will form the basis of one of the Lessons in course 2 of the series.

Jessica Utts, Ph.D. is Professor of Statistics at UC Irvine. She is interested in statistics education and in statistical studies of the paranormal. She was one of two statisticians chosen to prepare a report for Congress on the formerly classified Stargate Project that sought to determine whether “remote viewing” could be used to gather intelligence on the battlefield. In a lecture to a previous class she used reactions to the Stargate report to illustrate the way our prior beliefs influence the weight we give to empirical evidence, in science as well as in religion.

Anshu Vashishtha, M.D., Ph.D. did his residency in internal medicine and his Ph.D. in immunology. He has held several positions in the pharmaceutical industry. He is active in the Chinmaya Mission, and in the Swadhyay and Nithyananda Hindu communities. Dr. Vashishtha spoke to previous classes on the relationship between Hindu metaphysics and western science.

Roger Walsh, M.D., Ph.D. is Professor of Psychiatry & Human Behavior in the UCI School of Medicine. His research interests include Asian psychologies, Asian philosophies, Asian religions, meditation, and transpersonal psychology. He lectured on meditation in a previous class, and an excerpt from his book *Essential Spirituality* forms part of the assigned reading for Lesson 1 of this class.