

SCIENCE AND RELIGION IN THE WESTERN TRADITION: An Introduction to Historical Approaches

Institution: Harvey Mudd College

Instructors: Richard Olson and Robert Cave

COURSE DESCRIPTION COURSE OBJECTIVES (CONTENT, SKILLS AND ATTITUDES):

To learn more about the character of science and religion and their complex interactions from the Bronze Age to the present; To learn to appreciate both the differences between religious and scientific approaches to the human condition and the similarities; To examine a variety of interpretive schemas used by historians and anthropologists to organize knowledge about science/religion interactions; and To improve research skills and both oral and written communications skills.

ASSIGNMENTS AND GRADING:

Discussion Participation and Attendance (20%): Seminars depend for their success on the contributions of all members. If you are not prepared or not present, you cannot enrich the experience of others in the class. Grading on this portion of the class will be based on the instructors' evaluation of participation. More than 3 unexcused absences will lead to a lowering of the participation grade, so if you are gone from a meeting for a legitimate reason let either instructor know.

Written Reflections On Reading (10%): For each reading, students will write out a one to two page response to be turned in at class. This response should either list the most important thing you learned from the reading and the most important question it left you with or it should disagree with some point made in the reading with an indication of the grounds for your disagreement. Grading will be on a two point scale: 0 if not turned in, 1 if the response shows a minimal grasp of some issue, and 2 for a thought-provoking response. At the end, any average of <0.75 will get an F, between 0.75 and 1.25 will get a C, and >1.25 will get an A for this segment of the grade.

Discussion Leading (20%): About 20 class sessions will be devoted primarily to discussion of common readings. For each of these sessions, 2 students will act as discussion leaders; so over the semester, each student will share responsibility for two (2) sessions. By the class period before that which they will lead, the two students should prepare a plan. This plan should be discussed with Professor Olson, but it will not be graded.

Additional Perspectives Paper and Presentation (10%): Several sessions will be built at least in part around presentations based on supplemental readings aimed at deepening our understanding, or offering alternative perspectives, which are not represented in common readings. (These readings are hereinafter referred to as "Sources of Additional

Perspectives.”) Each student should sign up for one special reading and should prepare a 4-5 page review based on that reading. A draft of the paper will be peer edited on Friday of Week 3 (February 7) and will be due, along with the peer editing sheet, on Wednesday of Week 4 (February 12). Oral presentations based on the readings will be spaced throughout the semester at the meetings for which the reading was listed as a Source of Additional Perspective.

Essay Review (10%): Each member of the seminar should write a 4-5 page essay review on two sources (NOT COMMON READINGS) which cover the same topic. This is an opportunity to think about what you might be interested in doing your research paper on and to get a start on reading; or you might link it to your Additional Perspectives paper. This paper will be peer edited on Friday of Week 6 (February 28) and will be due on Wednesday of Week 7 (March 5).

Research Project (30%): Each student will be part of a group of between 3 and 5 members that writes a substantial research paper on some topic (details to be worked out in class) and offers an oral presentation to the seminar. Points on the research project will be distributed as follows: 5% to the proposal and annotated bibliography; 15% to the written report; and 10% to the oral presentation. All members of the group will receive a common grade modified to take into account peer assessments of the relative contributions of group members. THERE WILL BE NO FINAL EXAM.

Common Readings: The following texts, listed roughly in order of first use are available at Huntley Bookstore. Major portions of each will be used during the semester: Pervez Hoodbhoy, *Islam and Science* (London, Zed Books, 1991); Ian Barbour, *Religion in an Age of Science* (San Francisco, Harper San Francisco, 1990); Plato, *Timaeus* (New York, Viking-Penguin); Maurice Finochiarro, *The Galileo Affair: A Documentary History* (Berkeley, U. of California Press, 1991); William Appleman, ed., *Darwin* (New York, Norton, 1979); Christopher Toumey, *God’s Own Scientists* (New Brunswick, Rutgers University Press, 1994); and Daniel C. Matt, *God and the Big Bang: Discovering Harmony between Science and Spirituality* (Woodstock, Jewish Lights Publishing Co., 1996). In addition, a number of common readings will be on reserve at Sprague Library in two (2) Humanities 2C folders. Common readings will average under 120 pages per week or 40 pp. per session; but they will be unevenly distributed over the semester.

Common Due Dates: January 22: Short (2 pp.) in-class paper completed February 7: Review paper draft for peer edit due February 12: Review paper due February 28: Essay review draft for peer edit due March 5: Essay review due March 24: Research proposal due April 4: Annotated bibliography due May 2,5 & 7: Oral presentation of research results due May 7: Research paper due Provisional Schedule of Readings, Topics and Activities (adjustments may have to be made, but we will try to keep on schedule):

PART I: ESTABLISHING A COMMON UNDERSTANDING OF KEY TERMS AND INTERPRETIVE FRAMEWORKS

MEETING 1 (JANUARY 20): Discussion of aims and procedures for the course; introduction to members of the seminar; some discussion of differences between humanistic and scientific discourse.

Key questions to orient reading and discussions: What are the differences between interpretive and hermenentic methods, on the one hand, and claims to objectivity and knowledge on the other? What assumptions regarding determinism and the possibility of choice and responsibility have shaped humanistic and scientific discourse respectively?

MEETING 2 (JANUARY 22): Preliminary discussions: what do we currently think science is? religion? How are they (or are they) related?

Preparation of in-class paper. Principal goal of this session is to determine what views students hold on entering the course. The final course evaluation will include an opportunity for students to reflect on whether they think their views have changed in important ways.

MEETING 3 (JANUARY 24): A Case Study To Raise General Issues: Islam and Science in the Modern World Part I.

Key questions to orient reading and discussions: * What features must religions have in order to be compatible with modern science? * In which social institutions are the tensions between religious and scientific commitments most often expressed? * What different justifications are critical to understanding the role of science in contemporary cultures?

Common Reading: Pervez Hoodbhoy, *Islam and Science*, pp. ix-49.

MEETING 4 (JANUARY 27): A Case Study To Raise General Issues: Islam and Science in the Modern World Part II.

Key questions to orient reading and discussions: * How might we reconcile the universality claimed by modern science with the particularity of different religious traditions? * What tensions exist between the values promoted by scientifically oriented and religiously oriented educations?

Common Reading: Hoodbhoy, *Islam and Science*, pp. 50-139.

Sources of Additional Perspectives: Donald Hill, *Islamic Science and Engineering* (Edinburgh, 1993); Said al Andalusi, *Science in the Medieval World: Book of the Categories of Nations* (Austin, 1991); Seyyed Hossein Nasr, *An Introduction to Islamic Cosmological Doctrines* (Cambridge, 1964); Seyyed Hossein Nasr, *Science and Civilization in Islam* (Cambridge, 1968); E. S. (Tiger) Kennedy, et al., eds., *Studies in the Islamic Exact Sciences*, (Beirut, 1983).

MEETING 5 (JANUARY 29): Refining Our Ideas About Science, Religion, and their Interactions - Part I: A Taxonomy of Relations.

Key questions to orient reading and discussions: * What are the fundamental features of the various “models” of science/theology interactions explored in Barbour (i.e., the conflict model, the independence model, the dialog model and the integrative model)?

Common Reading: Ian Barbour, *Religion in an Age of Science*, pp. xiii-30.

Sources of Additional Perspectives on the Character of Science: Richard Olson, *Science Deified and Science Defied*, (Berkeley, 1982), Vol. I, Chap. 1; J.R. Ravetz, “The Varieties of Scientific Experience” in A.R. Peacocke, ed., *The Sciences and Theology in the Twentieth Century* (London, 1981); Reinhard Bendix, “Science and the Purposes of Knowledge”, *Social Research* 1975 (preprint available from Professor Olson); Norman Campbell, *What Is Science?* (New York, 1952 from 1921 original) Stephen Toulmin, *Foresight and Understanding: An Enquiry Into The Aims of Science* (New York, 1961); Thomas S. Kuhn, *The Structure of Scientific Revolutions* (Chicago, 1962); Norman Storer, *The Social System of Science* (New York, 1966); Alan Chalmers, *Science and Its Fabrication* (Minneapolis, 1990); Henry H. Bauer, *Scientific Literacy and the Myth of the Scientific Method* (Urbana, 1992); Tom Sorell, *Scientism: Philosophy and the Infatuation with Science* (London, 1991). Charles A. Taylor, *Defining Science: A Rhetoric of Demarkation* (Madison, 1996).

MEETING 6 (JANUARY 31): Refining Our Ideas About Science, Religion, and Their Interactions - Part II: Common Features.

Key questions to orient reading and discussions: * Have your experiences as scientists-in-training and as religious lay persons resonated with Barbour’s appropriation of concepts from the philosophy of science (especially theory, the theory dependence of “facts”, evidence and paradigms) to claim structural similarities between science and religion? * What defensible meaning might the term “objectivity” have today if “facts” are theory-dependent and every scientific theory operates within the presumptive structure of a paradigm?

Common Reading: Barbour, *Religion in and Age of Science*, pp. 31-65.

Sources of Additional Perspectives on the Character of Religion: Charles Glock and Rodney Stark, *Religion and Society in Tension* (Chicago, 1965); Stanley J. Tambiah, *Magic, Science, Religion and the Scope of Rationality* (Cambridge, 1990); Morton Klass, *Ordered Universes: Approaches to the Anthropology of Religion* (Boulder, 1995); Morton Smith, “Historical Method in the Study of Religion,” *History and Theory, Beiheft* 8 (1968), pp. 17-30; Robert D. Baird, “Interpretive Categories and the History of Religions”, *History and Theory, Beiheft* 8 (1968), pp. 17-30; Mircea Eliade, *Patterns in Comparative Religious Life* (New York, 1958); Emile Durkheim, *The Elementary Forms of Religious Life* (London, 1954 from 1912 French original); W.F.S. Pickering, ed., *Durkheim on Religion* (Alpharetta, GA, 1994); William James, *The Varieties of Religious*

Experience (New York, 1963 from 1902 original); Clifford Geertz, "Religion as a Cultural System", in Michael Banton, ed., *Anthropological Approaches to Religion* (New York, 1966), pp. 1-46; Sigmund Freud, *The Future of An Illusion* (New York, 1961 from 1927 German original); Hildred Geertz, "An Anthropology of Religion and Magic, 1", *Journal of Interdisciplinary History* 6 (1975), pp. 71-89.

MEETING 7 (FEBRUARY 3): Refining Our Ideas About Science, Religion, and Their Interactions- Part III: Differences.

Key questions to orient reading and discussions: * What are the most significant differences between the evidence appealed to in religious discourse and that appropriate to scientific arguments? * Does it make any sense to say that there are truths that are not factual? * Why should science be universal while religions are culturally specific? Or, is it possible that science may have culturally specific features?

Common Readings: Barbour, *Religion in an Age of Science*, pp. 66-92; AND David Lindberg and Ronald Numbers, eds., *God and Nature*, pp. 1-14 (on reserve).

Sources of Additional Perspectives on Science/Religion Interactions: *Zygon: Journal of Religion and Science* (March 1996), "Symposium on Ian Barbour's Gifford Lectures," pp. 11-114. John Hedley Brooke, *Science and Religion: Some Historical Perspectives* (Cambridge, 1991); James R. Moore, *The Post Darwinian Controversies* (Cambridge, 1979), Part I, "Historians and Historiography", pp. 1-122; W. Mark Richardson and Wesley Wildman, eds., *Religion and Science: History, Method, Dialogue* (New York, 1996); John William Draper, *History of the Conflict Between Religion and Science* (New York, 1874); Andrew D. White, *A History of the Warfare of Science With Theology in Christendom* (New York, 1896); Bronislaw Malinowski, *Magic, Science and Religion and other essays* (Garden City, 1954 from 1925 original); Robin Horton, "African Traditional Thought and Western Science," *Africa*, 1967, pp. 50-71, 155-187; Martin J. Rudwick, "Senses of the Natural World and Senses of God: Another Look at the Historical Relation of Science and Religion" in A.R. Peacocke, ed., *The Sciences and Theology in the Twentieth Century* (Notre Dame, IN, 1981), pp. 241-261; Robert K. Merton, "Science, Technology, and Society in Seventeenth Century England," *Osiris*, 4 (1938), pp. 360-632; Charles E. Raven, *Natural Religion and Christian Theology* (Cambridge, 1952-3). Richard H. Bube, *Putting it All Together: Seven Patterns for Relating Science and the Christian Faith* (Lanham, MD, 1995).

MEETING 8 (FEBRUARY 5): Olson's Interacting Subcultures Model for Science/Religion Interactions and Its Relationship to Barbour's Taxonomy; discussion of characteristics of a book review.

Key questions to orient reading and discussions: * What are some of the paths by which scientific concepts enter into religious discussions? * What are some of the paths by which religious concepts enter into scientific discussions?

Common Reading: Richard Olson, "A New Model for Science/Religion Interactions

With Some Examples from Early Modern Europe,” text of the Merrick Lectures delivered March 28, 1996 at Ohio Wesleyan University (on reserve). Work on draft of first (review) paper.

MEETING 9 (FEBRUARY 7): Peer editing of first paper (no reading discussions scheduled for this meeting).

PART II: PRE-CHRISTIAN INTERACTIONS BETWEEN SCIENCE AND RELIGION IN THE “WESTERN” TRADITION

MEETING 10 (FEBRUARY 10): Astronomy, Astrology and Astral Religions in the Ancient Near East c. 2500 B.C.E. to c. 312 B.C.E.

Key questions to orient reading and discussions: * Henri Frankfort has argued that in most early cultures, people live in an “I, thou” relationship with nature. How do the rituals of intercessory prayer, sacrifice, and omen interpretation in the ancient world support this notion? * Why did the astral element in the near Eastern religions drive them increasingly to focus on omenology and to accept a deeply fatalistic and deterministic view of human existence from c 2000 B.C.E. to c 300 B.C.E.?

Common Reading: Franz Cumont, *Astrology and Religion Among the Greeks and Romans, Introduction and Lecture I*, pp. xi-21.

Sources of Additional Perspectives: Richard Olson, *Science Deified and Science Defied* (Berkeley, 1982), Ch. 2; A.L. Oppenheim, “Divination and Celestial Observation in the Last Assyrian Empire,” *Centaurus*, 14 (1969): 97-135; B.L. Van der Waerden, *Science Awakening II* (New York, 1974); Vladimir S. Tuman, “Cerebus Slab of Hatra May Represent Important Astronomical Events”, *Nineveh* 4 #3, pp. 10-12; 4 #4, pp. 4-7; 5 #1, pp. 3-5; Tamsyn Barton, *Ancient Astrology* (London & New York, 1994).

MEETING 11 (FEBRUARY 12): Interpreting Some Near Eastern Astral Texts.

Principal goal of this session is to use a variety of astral texts to demonstrate both the increasing astral emphasis in Near Eastern religion and its dependence on the growing precision and sophistication of astronomical observations and theories. These texts include early omen texts from c. 2000 B.C.E., a text identifying stars as the source of truth in entrail divination from c. 1800-B.C.E., the so-called “Venus text” from c. 1561 B.C.E., the earliest known stellar intercalation text from c. 1000-B.C.E., astronomical diaries from c. 720 B.C.E., and finally a Selucid calendar text from c. 312 B.C.E.

Common Readings: English translations and reconstructions of a number of astral texts will be distributed in class to be discussed and analyzed.

Sources of Additional Perspectives: Otto Neugebauer, *Astronomical Cuneiform Texts*, 3 vols. (London, 1955); Otto Neugebauer, *The Exact Sciences in Antiquity* (New York, 1952).

MEETING 12 (FEBRUARY 14): The Spread of Astral and Anti-Astral Doctrines in the Hellenic and Hellenistic Worlds.

Key questions to orient reading and discussions: * How did the three perennial and related questions of (i) the existence of a single transcendent God, (ii) the reasons for the existence of evil, and (iii) the need for salvation in an afterlife, emerge in the Gnostic reactions to Babylonian astral religion during the period immediately prior to the emergence of Christianity? * None of these questions are really new in the Hellenistic world; so how do the Gnostic answers relate to the answers found, for example, in the Biblical story of Job, the story of Utnapishtim/Noah, or the Zoroastrian dualism between good and evil gods?

Common Reading: Cumont, *Astrology and Religion Among the Greeks and Romans*, pp. 22-110.

Sources of Additional Perspectives: R. Beck, *Planetary Gods and Planetary Orders in the Mysteries of Mithras* (Leiden, 1988); D. Hahn, *The Origins of Stoic Cosmology* (Athens, Ohio, 1977); Hans Jonas, *The Gnostic Religion*, 2nd ed. (Boston, 1958), especially Chs. 2, 3, 7, 9 and 10; Epicuros, *Letters, Principal Doctrines and Vatican Sayings* (Indianapolis, 1964); F. H. Cramer, *Astrology in Roman Law and Politics* (Philadelphia, 1954); D. Ulansey, *The Origins of the Mithraic Mysteries: Cosmology and Salvation in the Ancient World* (New York and Oxford, 1989).

MEETING 13 (FEBRUARY 17): Pre-Socratic “Science” and Greek Religious Consciousness.

Key questions to orient reading and discussions: * What kind of philosophical arguments for monotheism and against assigning human characteristics to God emerged among the Pre-Socratics? * Can you identify any of these arguments in modern religious discussions? * In many ways, Epicurean atomism not only shows many similarities with contemporary scientific materialism in its open hostility to religion, it literally provides the central claims to the modern tradition in the 17th and 18th centuries. How did the specifically anti-astral element in Epicureanism influence its doctrines?

Common Readings: Selections in Philip Wheelwright, ed., *The Pre-Socratics* (on reserve).

Sources of Additional Perspectives: Robert Grant, *Miracle and Natural Law in Greco-Roman and Early Christian Thought* (Amsterdam, 1952); W.C.K. Guthrie, *The Greeks and Their Gods* (Boston, Beacon Press, 1950); Warner Jaeger, *Paidea*, 3 vols. (Oxford, 1947); G.E.R. Lloyd, *Magic, Reason and Experience: Studies in the Origin and Development of Greek Science* (Cambridge, 1979).

MEETING 14 (FEBRUARY 19): Discussion of Plato’s Timaeus, the Key to Science/Religion Interactions in the Western World for 1500 Years.

Key questions to orient reading and discussions: * In what ways does it make sense to think of Plato's cosmology in the *Timaeus* as scientific? In what ways does it seem more religious? * Why do you suppose that Christian thinkers found the arguments of the *Timaeus* so congenial? * How does the *Timaeus* account for evil? How is that account related to Gnostic attitudes toward the physical world?

Common Reading: Plato, *Timaeus*.

Sources of Additional Perspectives: Gregory Vlastos, *Plato's Universe* (Seattle, 1975); Richard Olson, *Science Deified and Science Defied* (Berkeley, 1982), Ch. 4; J.E. Raven, *Plato's Thought In The Making* (Cambridge, 1965); Eric Havelock, *Preface to Plato* (Cambridge, 1963).

PART III: CHRISTIANITY AND EARLY MODERN SCIENCE: THE CASE OF GALILEO

MEETING 15 (FEBRUARY 21): Background, Part I Greek Science and Early Christianity.

Key questions to orient reading and discussions: * How did the so-called design argument for using scientific knowledge to support arguments for both the existence and character of God emerge as a key feature of early Christian religious discussion? * Why do you suppose that the early verses of Genesis, with their cosmological focus, became such a focus of interest among Christian writers? Why does it still seem to be the focus of so much critical interest? * Why do you suppose, in the face of the evidence presented regarding the positive reinforcements given by Greek philosophy and Christian religion to one another in the ancient world, the most common late 20th century popular perception is that they were in fundamental opposition?

Common Reading: R. Olson, *Science Deified and Science Defied*, Vol. 1, Ch. 5, pp. 146-180 (on reserve).

Sources of Additional Perspectives: Gerhard May, *Creatio ex Nihilo: The Doctrine of Creation Out of Nothing in Early Christian Thought* (Edinburgh, 1994); Jaroslav Pelikan, *Christianity and Classical Culture* (New Haven, 1993); Henry Chadwick, *Early Christian Thought and the Classical Tradition* (New York, 1966); D. S. Wallace Hadrill, *The Greek Patristic View of Nature* (Manchester, 1968). **Primary sources** are to be found in *The Ante-Nicene Fathers* (New York, 1896), especially Clement of Alexandria's "Stromata", and Origen's "Against Celsus," and "On First Principles", and in *Nicene and Post Nicene Fathers* (Grand Rapids, 1892), especially Gregory of Nyssa, "On the Making of Man," Hippolytus, "The Refutation of All Heresies," and Augustine's *Against the Academics* and *On Christian Doctrine*. The special category of hexameral literature is discussed in Frank E. Robbins, *The Hexameral Literature* (Chicago, 1912). Among the most important works were St. Basil of Nyssa's *The Hexameron* and St. Augustine's *The Literal Meaning of Genesis*.

MEETING 16 (FEBRUARY 24): Background, Part II : Science and Medieval Christianity

Key questions to orient reading and discussions: * White suggests that only the Judeo-Christian tradition, which removes “spirit” from nature, could provide an environment in which modern objective science could thrive. Does his claim seem legitimate? * If the natural world is purely a collection of objects, can it deserve to be “respected”, or is the only justification for ecological concern one from human enlightened self-interest?

Common Readings: Lynn White, Jr., “The Historical Roots of our Ecological Crisis” (on reserve), AND Ed Grant, “Science and Theology in the Middle Ages” from Lindberg & Numbers, *God and Nature*, pp. 49-75 (on reserve).

Sources of Additional Perspectives: G.R. Evans, *Philosophy and Theology in the Middle Ages* (New York, 1993); Etienne Gilson, *Reason and Revelation in the Middle Ages* (New York, 1938); Bryan Stock, *Myth and Science in the Twelfth Century* (Princeton, 1972); John Murdoch and Edith Sylla, eds., *The Cultural Context of Medieval Learning* (Dordrecht, 1975); Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton, 1986). John Whipple, “The Condemnations of 1270 and 1277 at Paris,” *Journal of Medieval and Renaissance Studies*, 7(1977).

MEETING 17 (FEBRUARY 26): Background, Part III: Copernicanism and Religion to the Time of Galileo (Olson lecture).

Principal goal of this session is to provide the technical vocabulary and perspective needed to recognize key Copernican/Galilean arguments, to detail how counter-intuitive the Copernican assumptions are, and to emphasize that prior to 1615, there was no systematic religious criticism of Copernicus from within either Catholic or Protestant theological discourse.

Common Reading: NONE. Work on Essay Review

Sources of Additional Perspectives: Thomas Kuhn, *The Copernican Revolution* (Cambridge, 1957); Robert Westman, ed., *The Copernican Achievement* (Berkeley, 1975); J. Dobrzycki, ed., *The Reception of Copernicus’ Heliocentric Theory* (Dordrecht, 1972); James M. Lattis, *Between Copernicus and Galileo: Christopher Clavius and the Collapse of Ptolemaic Cosmology* (Chicago, 1994).

MEETING 18 (FEBRUARY 28): Peer editing of Essay Review paper (no reading discussions scheduled for this meeting).

MEETING 19 (MARCH 3): Case Study of the Galileo Affair, Part I: Galileo and the Church Issues Before July, 1616

Key questions to orient reading and discussions for Meetings 19-21: * How much of the anti-Copernican/anti-Galilean sentiment emerged out of: (a) counter reformation reaction to Protestantism? (b) scriptural literalism? (c) Urban VIII's need to separate himself from Bourbon supporters? (d) Galileo's own arrogance and irreverence? (e) university natural philosophy professors' anxieties about Aristotelean philosophy? (f) genuine disagreements over epistemic issues? (g) the inconclusive character of Galileo's arguments? (h) guilt by association with such figures as Giordano Bruno and Thomasso Campanella? (i) the implications of Galileo's matter theory for the doctrine of the Eucharist? * Why do you think the Galileo case became the paradigmatic case for those who hold the conflict thesis?

Common Reading: Maurice Finochiarro, *The Galileo Affair: A Documentary History*, pp. 1-153.

Sources of Additional Perspectives: Mario Biagioli, "Galileo The Emblem Maker", *Isis*, 81 (1990): 230-258; Stillman Drake, *Galileo at Work: His Scientific Biography* (Chicago, 1978); William A. Wallace, *Galileo and His Sources: The Heritage of the Collegio Romano in Galileo's Science* (Princeton, 1984); Giorgio De Santillara, *The Crime of Galileo* (Chicago, 1955); Pietro Redondi, *Galileo, Heretic* (Princeton, 1987); Jerome Langford, *Galileo, Science and The Church* (Ann Arbor, 1966); Berthold Brecht, *Galileo* (New York, 1966). Thomasso Campanella, *A Defense of Galileo, The Mathematician from Florence*, edited and translated by Richard J. Blackwell (Notre Dame, 1994).

MEETING 20 (MARCH 5): Case Study of The Galileo Affair, Part II: 1617 - January, 1633 NOTE: ESSAY REVIEWS DUE TODAY

Key questions to orient reading and discussions: See Meeting 19 (March 3) above.

Common Reading: Maurice Finochiarro, *The Galileo Affair: A Documentary History*, pp. 154-255.

MEETING 21 (MARCH 7): Case Study of The Galileo Affair, Part III: The Trial and Its Aftermath

Key questions to orient reading and discussions: See Meeting 19 (March 3) above.

Common Reading: Maurice Finochiarro, *The Galileo Affair: A Documentary History*, pp. 256-296.

MEETING 22 (MARCH 10): Initial discussions of research projects; begin discussion of Science and Religion Between the Time of Galileo and Darwin/Pre-Newtonian Developments

Key questions to orient reading and discussions: * Why was the tradition of natural theology revitalized in 17th century England? * What religious motives were often associated with "conversion" to the mechanical philosophy? * What kinds of attitudes

toward miracles were developed by the mechanical philosophers of the 17th century?
How were these attitudes related to prophesy interpretation?

Common Reading: R. Olson, "On the Nature of God's Existence, Wisdom and Power...", in Fred Burwick, *Approaches to Organic Form* (Dordrecht, 1987), pp. 1-48 (on reserve).

Sources of Additional Perspectives: Eugene Klaaren, *Religious Origins of Modern Science* (Grand Rapids, 1977); Robert K. Merton, "Science, Technology and Society in 17th Century England", *Osiris*, 4, (1938): 360-632; Reijer Hooykass, *Religion and the Rise of Modern Science* (Grand Rapids, 1972); Richard Westfall, *Science and Religion in 17th Century England* (New Haven, 1958); John Morgan, "Puritanism and Science: A Reinterpretation", *The Historical Journal*, 22 (1979): 535-560; Christopher Hill, *The Intellectual Origins of the English Revolution* (Oxford, 1965); Charles Webster, *The Great Instauration: Science, Medicine and Reform- 1626-1660* (London, 1975); Samuel Hartlib and the Advancement of Learning (Cambridge, 1972). I.B. Cohen, ed., *Puritanism and the Rise of Modern Science: The Merton Thesis* (New Brunswick, 1990); Rivka Feldhay and Yebuda Elkhana, eds., "After Merton": Protestant and Catholic Science in Seventeenth Century Europe, special issue of *Science in Context*, Vol. 3, Spring 1989; Barbara Shapiro, Bishop John Wilkins (Princeton, 1964); Rose-Mary Sargent, *The Diffident Naturalist: Robert Boyle and the Philosophy of Experiment* (Chicago, 1995) [relates Boyle's experimental method to his Biblical Hermeneutics]; Michael Hunter, *Science and Society in Restoration England* (Cambridge, 1981); Steven Shapin and Simon Shaffer, *Leviathan and the Air Pump* (Princeton, 1986); James Jacob, "Boyle's Atomism and the Restoration Assault on Pagan Naturalism", *Social Studies of Science*, 8 (1978): 211-233.

MEETING 23 (MARCH 12): Newton's Religious Views and Newtonian Religion.

Key questions to orient reading and discussions: * What were the major "Newtonian" natural philosophical arguments for the continuing providential activity of God in the world? What do you make of Leibniz's reaction and Samuel Clark's rejoinder? * What was the relationship between his science and his theology in Newton's writings on prophesy interpretation? How do you react to his methods for interpreting prophesy?

Common Readings: Richard Olson, *Science Deified and Science Defied* (Berkeley, 1982), Vol. II, Chapter 3, "Religious Implications of Newtonian Science", pp. 87-128 (on reserve).

Sources of Additional Perspectives: I.B. Cohen and R.S. Westfall, eds., *Newton* (New York, 1996); I.B. Cohen, ed., *Isaac Newton's Papers and Letters on Natural Philosophy* (Cambridge, 1958), Ch. IV, pp. 271-396; Frank Manuel, *The Religion of Isaac Newton* (Oxford, 1974); I.B. Cohen, "Isaac Newton's Principia, The Divine Scriptures and Divine Providence" in S. Morgenbesser et al., eds., *Philosophy, Science and Method* (New York, 1969), pp. 523-548; James Force and Richard Popkin, *Essays on the Context, Nature and Implications of Isaac Newton's Theology* (Dordrecht, 1990). Margaret Jacob, *The Newtonians and the English Revolution, 1689-1720* (Ithaca, 1976); James Force, *William Whiston: Honest Newtonian* (Cambridge, 1985); Herbert Odum, "The Estrangement of

Celestial Mechanics and Religion”, *Journal of the History of Ideas*, 27, (1966): 533-548; Richard Olson, “Tory-High Church Opposition to Science and Scientism in the 18th Century....” in John Burke, ed., *The Uses of Science in the Age of Newton* (Berkeley, 1983), pp. 171-204.

MEETING 24 (MARCH 14): Final discussion of research projects: setting themes and teams (no reading discussions for this session).

SPRING BREAK, MARCH 15-23.

PART IV: EVOLUTION AND CHRISTIAN RESPONSES IN THE 19TH AND 20TH CENTURIES

MEETING 25 (MARCH 24): Genesis and Geology before Darwin NOTE: RESEARCH PROPOSALS DUE TODAY.

Key questions to orient reading and discussions: * Consider Barbour’s models of science and religion interactions: conflict, independence, dialog and integration. How was each of these reflected among those who investigated the history of the earth during the 18th and early 19th centuries? * What different sets of epistemic criteria were adopted by uniformitarians and catastrophist geologists?

Common Readings: James Moore, “Geologists and Interpreters of Genesis in the Nineteenth Century”, in Lindberg and Numbers, eds., *God and Nature*, pp. 296-350. (on reserve).

Sources of Additional Perspectives: Charles Coulston Gillispie, *Genesis and Geology--1790-1850* (Cambridge, 1951); Janet Browne, *The Secular Ark* (New Haven, 1983); Milton Millhauser, “The Scriptural Geologists: An Episode in the History of Opinion”, *Osiris*, 11 (1954): 65-86; Roy Porter, *The Making of Geology: Earth Science in Britain, 1660-1815* (Cambridge, 1977).

MEETING 26 (MARCH 26): Darwinian Science

Key questions to orient reading and discussions: * To what kinds of evidence did Darwin appeal in his *Origin of the Species*? * In what ways does his evidence seem to be “theory laden”? * What epistemic stances were typical of Darwin’s opponents? His friends? * In what way does Darwinian science claim to be predictive/falsifiable?

Common Readings: Phillip Appleman, ed., *Darwin*, selections from *The Origin of Species*, pp. 35-131.

Sources of Additional Perspectives: Phillip Appleman, ed., *Darwin, Part III- Darwin and Science*; Peter J. Bowler, *Evolution: The History of an Idea* (Berkeley, 1983). Daniel C. Dennett, *Darwin’s Dangerous Idea. Evolution and the Meanings of Life* (New York, 1995). Adrian Desmond, *The Politics of Evolution* (Chicago, 1989). Thomas Glick, ed.,

The Comparative Reception of Darwinism (Chicago, 1988). David Kohn, ed., *The Darwinian Heritage* (Princeton, 1985). Robert J. Richards, *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior* (Chicago, 1987). Frank J. Sulloway, *Born to Rebel: Birth Order, Family Dynamics, and Creative Lives* (New York, 1996).

MEETING 27 (MARCH 28): Religious Responses to Darwin in the Nineteenth Century

Key questions to orient reading and discussions: According to Ellegaard, why did Darwinian arguments often seem more threatening to religious “liberals” than to religious “conservatives”? According to Barbour, why were liberal religions and Darwinism ultimately more compatible?

Common Reading: Alvar Ellegaard, *Darwin and The General Reader* (Chicago, 1990), Chs. 5 and 6, pp. 95-140.

Sources of Additional Perspectives: A. Hunter Dupree, “Christianity and the Scientific Community in the Age of Darwin” and Fred Gregory, “The Impact of Evolution on Protestant Theology in the 19th Century”, in Lindberg and Numbers, eds., *God and Nature*, pp. 351-390. James Moore, *The Post Darwinism Controversies* (Cambridge, 1971); Harry Paul, *The Edge of Contingency: French Catholic Reaction to Scientific Change to Duhem* (Gainesville, FL, 1979); Owen Chadwick, *The Secularization of the European Mind in the 19th Century* (Cambridge, 1975); Frank M. Turner, “The Victorian Conflict Between Science and Religion: A Professional Dimension”, *Isis*, 69 (1978): 356-376; Alfred Kelly, *The Descent of Darwin: Popularization of Darwinism in Germany: 1860-1914* (Chapel Hill, NC, 1981). Frederick Gregory, *Nature Lost: Natural Science and the German Theological Traditions of the Nineteenth Century* (Cambridge, 1992). Joseph LeConte, *Evolution and its Relation to Religious Thought* (New York, 1891); James McCosh, *The Religious Aspects of Evolution* (New York, 1890); Jonathan Wells, *Charles Hodge’s Critique of Darwinism* (Lewiston, 1988).

MEETING 28 (MARCH 31): An Overview of Evolution and Twentieth Century Religion

Key questions to orient reading and discussions: What modern modifications of evolution allow for an element of directedness in the process? How are these elements relevant to Chardin’s evolutionary theology? To process theology? What are methodological, epistemological and ontological reductionism, and how does organicism oppose both the epistemological and ontological versions? * How do modern advocates of the argument from design understand the role of God in view of evolutionary theory?

Common Reading: Barbour, *Religion in an Age of Science*, pp. 154-214.

Sources of Additional Perspectives: Teilhard de Chardin, *The Phenomenon of Man* (New York, 1959); H. James Brix, *Interpreting Evolution: Darwin and Teilhard de Chardin* (Buffalo, 1991); John Cobb & David Griffin, *Process Theology: An Introduction*

(Philadelphia, 1976). Alfred North Whitehead, *Process and Reality* (New York, 1929).

MEETING 29 (APRIL 2): Science and Biblical Literalism, Part I: The Scopes Case

Key questions to orient reading and discussions: Many 20th century anti-evolutionists have been less concerned about “biological” evolution than about the impact of social Darwinism. Why? * In spite of the popular perception that the Scopes trial constituted a triumph for evolutionary biology, Miller and Grabiner suggest that quite the opposite was the case. Why? What were the mechanisms by which the teaching of evolution was suppressed from c 1924-1956?

Common Readings: Christopher Toumey, *God’s Own Scientists: Creationists in a Secular World* (New Brunswick, 1994), pp. 1-28; Judith V. Grabiner and Peter Miller, “Effects of the Scopes Trial,” *Science*, 185 (6 Sept., 1974): 832-837 (on reserve).

Sources of Additional Perspectives: N. F. Furniss, *The Fundamentalist Controversy: 1918-1931* (New Haven, 1954); L. S. Sprague de Camp, *The Great Monkey Trial* (New York, 1968); Richard Hofstadter, *Anti-Intellectualism in American Life* (New York, 1966), Ch. 5; Ray Ginger, *Six Days or Forever?, Tennessee v. John Thomas Scopes* (New York, 1958).

MEETING 30 (APRIL 4): Special Evening Meeting to view *Inherit The Wind*: Time and Place TBA

Common Reading: No reading discussions scheduled for this meeting. NOTE: Annotated bibliographies due today.

MEETING 31 (APRIL 7): Modern Creation Science

Key questions to orient reading and discussions: * Toumey suggests that creation-scientists, far from being anti-scientific, are trying to appropriate scientific authority to support their religious positions. Does this claim make sense to you? Why or why not? * What are the major epistemic disagreements between creation scientists and evolutionary biologists? What kinds of evidence are called on to defend “young earth” theories?

Common Reading: Toumey, *God’s Own Scientists: Creationists in a Secular World*, pp. 31-146.

Sources of Additional Perspectives: Raymond A. Eve & Francis Harrold, *The Creationist Movement in Modern America* (Boston, 1991); Ronald Numbers, *The Creationists* (New York, 1992); Dorothy Nelkin, *The Creation Controversy* (New York, 1982); John C. Whitcomb, Jr., and Henry Morris, *The Genesis Flood* (Philadelphia, 1961). Henry M. Morris, *Creation--The Cutting Edge* (San Diego, 1982). William Overton, “Judgment in McLean v. Arkansas Board of Education” reprinted in *Science* (19 February, 1982): 934-43.

MEETING 32 (APRIL 9): A Case Study of Modern Creationism: North Carolina.

Key questions to orient reading and discussions: * Thinking back to Hoodbhoj's discussion of Islamic science, what features are similar in the creation-science case and which are very different. (Think especially about the implied character of education and the question of the universality of scientific knowledge.) * What mechanisms have been used to enforce/promote commitments to creation-science? Evolutionary theory?

Common Reading: Toumey, *God's Own Scientists: Creationists in a Secular World*, pp. 149-265.

Sources of Additional Perspectives: Michael Bentley, "Creationism through the Back Door -- The Case of Liberty Baptist College," *Science, Technology, and Human Values*, 9 (1984): 49-53; Willard Gatewood, *Preachers, Pedagogues, and Politicians: The Evolution Controversy in North Carolina, 1920-27*. (Chapel Hill, 1966).

MEETING 33 (APRIL 11): Background: Late Classical Physics, Cosmology and Religious Issues.

Key questions to orient reading and discussions: * Olson seems to argue that developments associated with 19th century physics worked against integrationist approaches to science and religion but in favor of dialog and notion of compatible independence. Why? What changes in epistemology encouraged this trend? * What kinds of arguments did James Clerk Maxwell and P.G. Tait make against the ontological determinism and epistemic indeterminacy which had supported Laplace's understanding of physical laws? What theological consequences did they draw? What do you make of the character of their arguments?

Common Reading: Richard Olson, draft article on "Physics" forthcoming in *The Encyclopedia of Science and Religion* (Garland Publishing Co.) (to be distributed).

Sources of Additional Perspectives: Pietro Corsi, *Science and Religion: Baden Powell and the Anglican Debate, 1800-1860* (Cambridge, 1988); R.N.D. Martin, *Pierre Duhem: Philosophy and History in the Work of a Believing Physicist* (Peru, IL, 1991); Joe D. Birchfield, *Lord Kelvin and the Age of the Earth* (Chicago, 1975); P.G. Tait and Balfour Stewart, *The Unseen Universe or Physical Speculations on a Future State* (London, 1875); James Clerk Maxwell, "Does the Progress of Physical Science Tend to Give Any Advantage to the Opinion of Necessity or Determinism Over That of the Contingency of Events and the Freedom of the Will?" in Lewis Campbell and Wm. Garnett, *The Life of James Clerk Maxwell with a Selection from his Correspondence and Occasional Writings* (London, 1882), pp. 434-444; Frederick Gregory, *Scientific Materialism in Nineteenth Century Germany* (Dordrecht, 1977); William Whewell, *Astronomy and General Physics Considered with Reference to Natural Theology* (London, 1833).

MEETING 34 (APRIL 14): Theology, Relativity and Quantum Mechanics: An Overview

Key questions to orient reading and discussions: * How is each of the supposed fundamental presumptions of classical physics (epistemic realism, ontological determinism and reductionism) challenged by various interpretations of quantum mechanics? (Pay special attention to the EPR experiments and their alternative interpretations.) * Why does Barbour see the major impact of modern physics on religion as cautionary rather than constructive, or as promoting humility rather than confidence about theology? Does the position make sense to you?

Common Reading: Barbour, *Religion in an Age of Science*, pp. 95-124.

Sources of Alternative Perspectives: Ian Paul, *Science, Theology, and Einstein* (New York, 1982); Robert Russell, William Stoeger and George Coyne, eds., *Physics, Philosophy, and Theology, A Common Quest for Understanding* (Vatican City State, 1988); Kevin J. Sharpe, *David Bohm's World: New Physics and New Religion* (London, 1993); Paul Davies, *God and the New Physics* (New York, 1983); Erwin Hiebert, "Modern Physics and Christian Faith", in Lindberg and Numbers, eds., *God and Nature*, pp. 424-447; Arthur Peacocke, ed., *The Sciences and Theology in the Twentieth Century* (London, 1981); Fritzof Capra, *The Tao of Physics* (1975) and *The Turning Point* (1983); David Bohm, *Wholeness and the Implicit Order* (London, 1980); Charles Harshorne, *A Natural Theology for Our Time* (La Salle, 1967); John Polkinghorne, *The Faith of a Physicist* (Princeton, 1994).

MEETING 35 (APRIL 16): Modern Cosmology and Religion- An Overview.

Key questions to orient reading and discussions: * What danger does Barbour see in identifying "Big Bang" cosmology with religious creation stories? * How does modern cosmology fit into the long tradition of natural theology with its focus on design? * Thinking back to Plato's *Timaeus*, in what ways do modern cosmologies seem similar and different in their relationship to theological issues? (Consider, for example, questions about the necessity or contingency of God's actions, and what each says [if anything] about the human place in the cosmos.)

Common Reading: Barbour, *Religion in an Age of Science*, pp. 125-153.

Sources of Additional Perspectives: Mark W. Worthing, *God, Creation, and Contemporary Physics* (Minneapolis, 1996); Gerhard Stagnuhn, *God's Laughter: Physics, Religion, and the Cosmos* (New York, 1992); Frank Tipler, *The Physics of Immortality: Modern Cosmology, God, and the Resurrection of the Dead* (New York, 1994); Clifford Mathews and Abraham Varghese, eds., *Cosmic Beginnings and Human Ends: Where Science and Religion Meet* (Chicago, 1995). Erich Robert Paul, *Science, Religion, and Mormon Cosmology* (Urbana, 1992); Michael Corey, *God and the New Cosmology* (Lanham, 1993). Paul Davies, *The Mind of God: The Scientific Basis for a Rational World* (New York, 1992); Robert Russell, Nancy Murphy, and C.J. Isham, eds., *Quantum Cosmology and the Laws of Nature: Scientific Perspectives on Divine Action* (Vatican City State, 1993).

MEETING 36 (APRIL 18): Modern Cosmology and Jewish Mysticism

Common Reading: Daniel C. Matt, *God and the Big Bang* (Woodstock, 1996).

APRIL 21 - 30: No Class Meetings Scheduled. Work on Research Projects and attend Presentation Days. Each group should schedule a meeting with Professor Olson on April 23 or April 25 to assess progress and discuss problems.

MEETING 37 (MAY 2): Presentation of Research Reports

MEETING 38 (MAY 5): Presentation of Research Reports

MEETING 39 (MAY 7): Presentation of Research Reports NOTE: All Written Reports Due Today.