CREATION AND EVOLUTION

By
Dr. Roger Chambers

GPH 433 History and Logic of Science

GPH 433 is a study of the four following issues: (1) The history and character of the scientific method. (2) The Biblical view of the natural order and how that view relates to the scientific method. (3) The history and character of the conflict between Christianity and science. (4) Theistic and materialistic views on origins.

When you have finished this course, you will be have developed an awareness of what science is and of the general nature of scientific activity. You will recognize and be able to discuss the major transitions in scientific thought and the fundamental issues involved in each. You will able to understand and discuss the current issues and problems in the science-religion debate; you will be able to defend the Biblical view of man and of nature. It is hoped that you will develop an evangelistic approach to the science community.

Text: Bolton Davidheiser, Evolution and Christian Faith. Presbyterian and Reformed Publishing Co., 1982.

Course requirements:

1. Assigned reading.
2. A fifteen- to twenty-page research paper on one of the following topics:
   a. Science and miracle
   b. The Beginning of Life
   c. The Origins of Modern Scientific Thinking
   d. Genesis and the Theory of General Evolution

Grading criteria:

1. Major examinations 50%
2. Research paper 50%

After the final grade has been computed in terms of the above standard, it is subject to adjustment of as much as 15% at the discretion of the teacher. This factor might reflect such considerations as classroom participation, attendance, attitude, degree of progress, completing of reading assignments on schedule, extra study projects, and written grammatical expertise.

Teacher: Dr. Roger R. Chambers

Note: The research paper must conform to Kate L. Turabian, A Manual for Writers, Fourth Edition.

GPH 433 History and Logic of Science

The History of the Scientific Approach to Nature and the Questions Raised for and by the Christian World View

Introduction

A. Definitions

1. Science: Knowledge of the natural world obtained by sense interaction with that world. (Bube)

a. Science is concerned only with the physical world; that which is outside space and time is not properly within the domain of science.
b. Science can say nothing about the supernatural.
c. Science can say nothing about esthetics.
d. Science can say nothing about ethics.
e. In its narrowest definition, science speaks only of a methodology:
(1) Observation
(2) Hypothesis
(3) Repeated observation or experiment
(4) Verification or accommodation
(5) Prediction
f. Limitations: Even a successful theoretical model is limited in the accuracy and range of its application.
g. The process of the scientific method
(1) Hypothesis--no evidence, a guess, a surmise, an idea.
(2) Theory--scanty and insufficient evidence.
(3) Fact--inscrease in evidence qualitatively and quantitatively enough to convince the intellect; evidence of a nature to overwhelm the power of the intellect to reject it.
(4) Law--the fact can be observed and demonstrated to be repeatable and to be uniform; experimental reproducability.
h. For a process to be "scientific," it must move within the framework of four principles:
(1) Objectivity--existing outside the mind as an actual object and not merely within the mind as an idea.
(2) Empiricism--use of methods based on experiment and observation.
(3) Parsimony--offering as a hypothesis the alternative enjoying the fewest unresolved variables or having the highest degree of probability; the most natural and simple explanation.
(4) Convergence--the proper interrelating or putting together of data.
i. Scientific "proof"; a perspective
(1) Science is only one category of proof.

(2) Other categories of proof
(a) Proof based on authority
(b) Proof based on logic
Inductive--reasoning from particulars to the general.
Deductive-- " " generals to the particular.

2. The Christian World View of nature: God created the natural order. Psalm 8:3-9

a. Implications of the Christian World View of nature (Ramm et al.):
(1) Nature exists for spiritual purposes, and is capable of a teleological explanation.
(2) The universe is maintained by the providence of God.
(a) The impossibility of pantheism
(b) The possibility of miracles and answered prayer
(3) It is evil to worship any part of the creation (Ro. 1: 25,26).
(4) The regularity of nature is the constancy of God, and the laws of nature are the laws of God.
(5) Nature is temporal and temporary.
(6) Nature is a realm of probation and judgment.
(7) Nature is the legitimate object of study by man.
(8) The natural revelation is in harmony with special revelation.

b. General statements about Biblical cosmology (Ramm et al.):
(1) The references of the writers of the Bible to natural things are popular, non-postulational, and in terms of the culture in which the writers wrote.
(2) The cosmology of the Bible is not systematized and is not postulational. The Bible is not "about" a scientific explanation of the universe; the Bible is about the God and His redemptive acts. The Bible contains no positive cosmology; rather, the Bible works, in this regard, as a negative criterion, ruling out dualism, pantheism, and materialism.

B. An Analysis of the Conflict between Theology and Science--General Statements (Ramm)
1. Mistakes made by the theologian as he addresses the scientist
a. Unwarranted suspicion--the viewing of all scientists as scheming athiests or plotting infidels.
b. The identification of a particular world view, with the "science" supporting it, with the Bible; to defend this view with dogmatic certitude. Examples: Theistic evolution; Flood Geology; the Gap Theory; medieval Aristotelian science.
c. The inferring of too much empirical or specific data from the general assertions of Genesis 1.

2. Mistakes made by the scientist as he addresses the theologian
   a. The anti-religious or anti-supernatual bias; dogmatism is just as dangerous in science as in theology.
   b. The tendency to submit to the temptations of Scientism, i.e., allowing science to serve metaphysics or philosophy.
      (1) Science, in its technical definition, is not partial to any philosophical system, but forms a body of material which any philosophy must consider.
      (2) The materialist claims that science presents a world view, based on empiricism and experimentation, that materialism presents, based on philosophical speculation.
      (3) Science is exploited by the pragmatist, the naturalist, the positivist, et al. Result: Scientism.
      (4) The primary areas in which Scientism is unscientific:
         (a) Scientisms oversimplify both the scientific method and the scope of reliable knowledge.
         (b) Scientisms resort to reductionism, i.e., they attempt to explain the complex by the simple and the higher by the lower.
         Examples:
         -Complex processes are explained in terms of accident
         -Thought is explained as nothing more than chemical action.
         -Religion is reduced to physiology.
         (c) Scientisms exhibit an irrational prejudice against teleological thinking.

3. Mistakes made by both theologians and scientists
   a. The error of pronouncing a scientific hypothesis or theory as final.
   b. The error of failing to remember that human knowledge is defective, fluid, incomplete, growing, and often subjective

J. H. Pratt, Scripture and Science not at Variance (1872), p. 8:

> The Book of Nature and the Word of God emanate from the same infallible Author, and therefore cannot be at variance. But man is a fallible interpreter, and by mistaking one or both of these Divine Records, he forces them too often into unnatural conflict.

   c. The error of misinterpreting the Bible.

The Seventeenth Century

Introduction (Outline from Ian G. Barbour, Issues in Science & Religion)

A. The birth of modern science--crucial and rapid change.
B. Landmarks
   1. Galileo's Dialogues (1632)
   2. Newton's Principia (1687)

I. The Medieval View of Nature

A Methods in science
   1. Background
      a. Thirteenth-century recovery of Greek science
      b. Thomas Aquinas' synthesis of Christian theology and Aristotelian philosophy
   2. Concerns
      a. Form/essense of an object
      b. Purpose/potentiality
   3. Explanations
      a. Aristotle: The "natural" essense and purpose of objects
      b. Causes
         (1) Final causes (ultimate purpose to be seen in the future)
         (2) Formal causes (innate tendencies)
         (3) Not effecient causes (simple cause-and-effect; the effect of past events on passive materials)
      c. Focus: On the final end, not on moment-to-moment change.
      d. The behavior of a creature follows from its essential nature.
      e. Central feature of change = the transformation from potentiality to actuality (logical connections, not simply temporal connections).
   4. Cosmological assumptions
      a. Cosmi hierarchy; the creation of a purposeful God; the assumption of rationality.
      b. Every purpose not necessarily discernible.
   5. Method: deduction
      a. Primary question: "How does X fit into the overall scheme of things?"
      b. Secondary matters: description, prediction, control (Aristotle had done some biological classification, but the Platonic cosmology prevailed).
      c. The teleological approach did not require the creation of theories and the testing of those theories by experimentation.

B. Cosmology: Hierarchy of Beings
   1. Earth, the fixed center of the universe, surrounded by concentric spheres.
   2. Ptolemy's Almagest. (Ptolemy a 2nd-century Alexandrian; his Almagest was the standard handbook on astronomy used in the Middle Ages.)
   3. Position coincided with purpose and destiny; the hierarchy of reality (metaphysical) corresponds to the physical universe.
   4. The governing laws were moral, not mechanical.

5. Attitudes toward nature
   a. The world as Heaven's waiting room; no meaning other than a strictly religious meaning--not important in itself.
   b. The world as the realm of demonic powers--magic and sorcery rather than science.
   c. To some the world was an overwhelming example of the sovereignty and majesty of God--a positive attitude that contributed, indirectly, to the rise of science.
6. The world and the mind of man
   a. Medieval thought was realistic, i.e., it viewed the world to be real as perceived. The mind was capable of grasping the true essence of the world.
   b. The medieval mind saw the natural order as static, i.e., with all its species created in their present forms. The only novelty could be the providential acts of God. Nature was an unchanging organism.

C. Sources of authority in medeival thought--a synthesis
   1. Reason--natural theology (teleological argument)
   2. Revelation--the Church ("faith")

D. God in medieval thought
   1. Aquinas: synthesis of Unmoved Mover and Personal Father
   2. The cosmological argument used: reasoning that the chain of cause and effect leads back to God, the First Cause of Greek philosophy.
   3. Aquinas: God=the Continuing Ruler of Nature; divine concurrence required if anything is to happen.
   4. God works in various ways to accomplish His will
      a. Natural causes
      b. Angels
      c. The influence of the celestial bodies
      d. Miracles

E. Man the center
   1. Nature subordinate to man
   2. Nature primarily as the stage for the drama of God and man
   3. World history summarized in five words:
      a. Creation
      b. Covenant
      c. Christ
      d. Church
      e. Consumation
   4. The focal point: redemption
   5. Man as a union of mortal body and immortal soul (in the Greek sense)
   6. Man is a free and rational being.
   7. Human existence as a pilgrimage

F Effect of the Protestant Reformation: The medeival world view was not substantially altered by the Reformation.

II. Galileo

A. The new methodology, a combination of
-Mathematical reasoning
-Experimental observation

1. Antecedents
   a. Copernicus: the mathematical simplicity of the heliocentric vs. the geocentric model (fewer concentric circles).
   b. Kepler: the concept of mathematical harmony--the mathematically perfect and exact orbits of the heavenly bodies. ("God ever geometrizes.") The esthetical perfection of elliptical planetary orbits.
   c. Roger Bacon (1214-1294) pointed out the mistakes of Aristotle.
   d. Robert Grosseteste (1175-1253) " " " " " .

2. Galileo's combination of theory and experiment
   a. G. often used "thought-experiments," i.e., hypothetical descriptions of experiments never actually carried out.
   b. Experiments performed (examples):
      (1) A ball rolling down an inclined plane
      (2) The use of the telescope

3. The characteristics of the new science:
   a. Theory + experiment
   b. The goal of expressing laws of nature as mathematical relationships among measurable variables
   c. Experimental, but not completely empirical; did not leave out the theoretical side--the use of the imaginative new concept, e.g., motion in a vacuum (inertia).

4 With Galileo, teleological explanation gave way to descriptive explanation (not why, but how)--efficient, rather than formal or final causes.

B. Nature as particles in motion

1. Galileo assumed that unobserved or ultimate constituents of nature operated the same as observed constituents, i.e., matter-in-motion.
2. Central categories: mass, space, and time.
3. Change=the rearrangement of particles in space and time (vs. the transition from potentiality to actuality).
4. Mass and velocity=primary qualities.
5. Color, temperature, texture, etc.=secondary qualities (purely subjective reactions of the senses to the world.

Galileo: I cannot believe that there exists in external bodies anything, other than their size, shape or motion (slow or rapid), which could excite in us our tastes, sounds, and odors. And indeed I should judge that, if ears, tongues,

> and noses be taken away, the number, shape, and motion of bodies would remain, but not their tastes, sounds, and odors. . . And I again judge that heat is altogether subjective.
>
> The Assayer, p. 30.

6. G.'s criterion for distinguishing between primary and secondary qualities: measurability and reduction to mathematical presentation (he called it "permanence").
7. Descartes developed the philosophical expression of Galileo's paradigm, i.e., the radical dualism of matter and mind--the metaphysical chasm between observind mind and observed world.

Galileo and theology

1. G. was a devout Catholic who found no conflict between his scientific and his religious beliefs. He held that the Bible should not be looked to for "scientific truth."
2. Nature as the sole source of scientific knowledge, but, along with Scripture, also a way of knowing God. G. put nature and Scripture on the same level as paths to God. (His successors were to subject Biblical theology to natural theology.)
3. With final causality dismissed, God became the First Cause, the first link in the chain of efficient causes--the original creator of the interacting atoms in which would reside all subsequent causality. Nature, once created, was independent and self-sufficient.
4. Many feared that the idea of a completely mechanical world would destroy belief in God.
5. When the Roman Catholic Church attacked Copernicus and Galileo, it was because Aristotelian elements had become church orthodoxy (not because the Bible was being contradicted).

D. The Reformation and the rise of modern science

1. The Reformation did not cause the rise of modern science.
2. The Reformation and the Scientific Revolution were simultaneous in history.
3. MODERN SCIENCE WAS BORN OUT OF THE CHRISTIAN WORLD VIEW. (Alfred North Whitehead and J. Robert Oppenheimer)
   a. The medieval insistence on the rationality of God.
   b. General principles made possible by the intelligible rationality of a personal God.
4. Not all early scientists were Christians, but all lived within the thought forms existent in and produced by Christianity. The Christian faith made possible faith in the possibility of science. The world was viewd as the creation of a reasonable God; it was assumed that if there were no rationality in the First Cause(s), there could be no perceivable order in the effects.
5. Christianity is the mother of modern science.

E. Man as Demoted Spectator
   1. When the world was demoted from its position as the center of the universe, many felt that man was also demoted as the teleological center.
   2. Galileo's telescope raised speculation about life on other planets.
   3. G. was persecuted by the church.
   4. The nonlogic of the argument against God from the size of the universe or its construction.

III. Newton

A. Sir Isaac Newton (1642-1727) brought to fulfillment the revolution in scientific outlook and the combination of mathematics and experimentation that Galileo had pioneered.
1. Inventor of calculus
2. Experimenter in mechanics and optics
3. Creator of new concepts from creative imagination, i.e., the law of gravity--that the moon is kept in orbit by centripetal force, not a tangential force.
4. Newton insisted strongly that it is the task of the scientist to describe, and that premature speculation must be avoided.

B. Nature as a law-abiding machine
1. A structure of forces and masses, rather than a hierarchy of purposes.
2. The perfection of mathematical law suggested an image of the world as an intricate machine following unchangeable laws, with every detail precisely predicted. This served as the "basis" for the philosophies of materialism and determinism that would be developed later, i..e, an all-encompassing metaphysical scheme.
3. Galileo's particles in motion could be treated mathematically.
4. Efficient causes replaced final causes; all causality was assumed to be reducible to the rearrangement of atoms.
5. A method (science) was being turned into a metaphysics.
   a. Man became an irrelevant spectator.
   b. The world was reduced to hard, cold, colorless, silent, dead system; a world of quantity, a world of mathematically computable motions in mechanical regularity.
   c. Esthetics, ethics, religion, and human thought in general were reduced to accidental chemical actions in the brains of scattered organic machines.
   d. Whitehead: "the fallacy of misplaced concreteness," i.e., taking particular scientific abstractions as if they were concrete reality; using one mode of description as if it were the only possible one; reductionism to the extreme.
   e. The assumption that all satisfactory explanations of a process must be given in terms of its smallest parts.
6. Newton himself found room for both God and the human spirit.

C. "Natural Theology"
1. English scientists of the second half of the 17th century called themselves "virtuosi"; Puritans who pursued science "to the glory of God and the benefit of the human race." Science as a religious task.

Exemplified in Addison's hymn The Spacious Firmament on High

The Spacious firmament on high,
With all the blue ethereal sky
And spangled heavens a shining frame
Their great Original proclaim.

The unwearied sun from day to day,
Does his Creator's power display,
And publishes to every land,
The work of an Almighty hand.

2. The "virtuosi" worked with a sense of awe and reverence.
3. Pressures encouraging the move away from traditional Christianity:
   a. English religious strife and civil war created mood for a religious universality.
   b. The "virtuosi" were sensitive to the charge that "atomism" was equal to "materialism." They responded with the argument from design. They held for a pattern of divine benevolence.
   c. The "virtuosi" considered purpose to be external to nature; Nature as a complete and functioning machine which is not itself striving toward an end. Scientific explanations, therefore, could be given without reference to purpose. How vs. Why.
   d. God was granted First Cause, denied Final Cause.
   e. The idea of evolution was absent; the argument from design assumed that the world had been instantaneously created in its present form.
   f. The argument from design was used to support the idea of a reasonable and universal faith, not dependent on a special revelation. The core of this universal belief:
      (1) The existence of a Supreme Being
      (2) The immortality of the soul
      (3) The obligation to moral conduct
4. The move away from the God-centered orientation of the Middle Ages and the Reformation:
   a. Scientific categories dominated religious thought.
   b. Nature, not history, as the clue to the knowledge of God.
   c. God as Creator, not as Redeemer.
   d. Ethics reduced to utilitarian prudence.
   e. Spontaneous love replaced by minimum morality.
5. The change came by reinterpretation of Christianity from within, not from assault from without.
6. This must be understood as a reaction against the Puritan/Calvinistic concept of faith (infused faith), not as a reaction to the biblical concept of faith as intelligent response to reliable information.

D. God as "Clockmaker"
   1. Robert Boyle, Works: Boyle's favorite analogy for the world was the famous clock at Strasbourg.
   2. Metaphor made no room for providence or miracle.
   3. Most of the "virtuosi" permitted biblical miracles; others did not want to use regularity as an argument for God and irregularity as an argument for miracle.
   4. Newton asserted that God continually adjusts the solar system; he could find no scientific explanation for the pattern of the planets
   5. Most of the "virtuosi" ended by relegating God to First Cause.

E. Man as Rational Mind
   1. God and man were considered by the virtuosi as exceptions to the rule of mechanical law.
   2. The dignity of man resided in his reason.

3. Since nature is the product of divine reason, it is comprehensible by human reason. Soul = "rational spirit."
4. John Locke et al. built their philosophy of common-sense reason on Newton's concept of the natural order. Nature and reason as the guides of man and human institutions.
5. Hobbes' view of mind as reducible to the concourse of atoms was resisted.
6. The triumph of Newtonian science laid the groundwork for the Enlightenment and the confidence in man's inevitable progress.

IV. The Seventeenth Century--Summary

A. Methods in science: From explanation by purposes to mathematics and observation to experiment and theory.
B. The character of nature: From a hierarchy of beings to particles-in-motion to law-abiding machine.
C. Methods in theology: From the synthesis of Aristotle and theology to natural theology.
   Theology derived from nature:
   1. The "God of the Gaps."
   2. The Designer of particular features of organisms.
   3. The Creator of an orderly and intelligible universe.
D. The relation of God and nature: From the Supreme Good to the First Cause to the Divine Clockmaker.
E. The relation of man and nature: From center of the cosmic drama to demoted spectator with a rational mind.

The Eighteenth Century

Introduction

A. The scientific discoveries of the 18th century did not have the theological or philosophical impact of those of Newton in the 17th century.
B. The main change in worldview came from the spreading influence of the idea of science itself.
C. In this century a "modern" temper emerged.

I. The Age of Reason

A. The emergence of the Enlightenment--the international, varied, intellectual movement based on the ideal that the rationality demonstrated in science would permeate all human activity.
   1. The most articulate and extreme spokesmen were the French philosophes.
   2. The spirit of the Enligtenment influence the American colonies.
B. The primary ideas of the Enlightenment
   1. Nature as a deterministic machine
      a. The deification of Newton.
      b. Newtonian mechanics became the paradigm of scientific work.
      c. Laplace
         (1) Mechanics of planetary motion--extended the work of Newton.
         (2) Nebular hypothesis--the solar system formed from the cooling and condensing of nebular gases. This excluded what little "God" Newton had left in the explanation of the cosmos.
         (3) Nature as a self-sufficient and impersonal mechanism (vs. the "divine drama" of the Middle Ages) (vs. the continuing object of providential supervision of Newton).
         (4) Determinism--nature a completely mechanical system of inflexible cause-and-effect, and, therefore, absolutely predictable and inexorably determined.
         (5) Reductionistic--the confidence that, eventually, all phenomena will be explained by physical laws. All causes as mechanical causes. Reality consisting in the smallest somponents, matter-in-motion. (La Mettrie, Man the Machine)
   2. God as a Debatable Hypothesis
      a. The evolution of "rational religion":
         (1) The Natural Theology of the virtuosi (previously discussed).
         (2) Deism at its height
         (3) The waning of Deism (The remote, impersonal, absentee God evaporated.)
      b. Deists attacked the church, miracles, revelation, the Bible, and all creeds and dogmas.
      c. Examples: Voltaire, Paine
      d. The rejection of all forms of religion exemplified in Hume's Dialogues on Natural Religion (1779).
   3. Man as Perfectible by Reason
      a. The promise of the discovery of "social" laws of nature.
      b. " " " the removal of governmental constraints now that society could move in harmony with "nature." (nature=the good and rational)

c. The promise of perfecting man through scientific education and the eradication of religious superstition.
d. The promise of human progress.
e. " " " the progress of science and material well-being.
f. " " " the eradication of war and other human evils.
g. Unlimited confidence in "social engineering"--the technical control of society.
h. A passion for social justice and humanitarian reform.
i. Most rationalists were not antireligious in attitude; they lived in a culture that still reflected its Christian past.

II. The Romantic Reaction--the positing of imagination and intuition as the counterfoil of cold reason.
A. Political theory: revival of conservatism and of concern for traditional values. (Partly in revulsion over the French Revolution.)
B. Romanticism in literature, focused on man's emotional and imaginative life. Experience set over against the artificial abstractions of scientific theory.
1. Examples: Shelley, Byron.
2. Values:
a. Freedom (vs. determinism)
b. Individuality (vs. the universal and general)
c. Wholeness (vs. atomism and reductionism)
3. The emphasis on feeling and imagination.
4. God as a Spirit pervading nature, rather than as the external Creator of an impersonal machine.
5. Wordsworth, "The Tables Turned":

> ~~Our~~ meddling intellect
> Mis-shapes the beauteous forms of things
> We murder to dissect.
> And I have felt
> A presence that disturbs me with the joy
> Of elevated thoughts, a sense sublime
> Of something far more deeply interfused,
> Whose dwelling is the light of settings suns,
> And the round ocean and the living air,
> And the blue sky and in the mind of man;
> A motion and a spirit that impels
> All thinking things, all objects of all thought,
> And rolls through all things.

C. Pietism and Methodism
1. German Pietism: Spener and Francke--the inner experience of the soul.
2. The Methodist Movement--spiritual rebirth.
3. The great religious revivals in America.

III. Philosophical Responses

A. David Hume (1711-1776)

1. Precursors
   a. Descartes, Leibniz, and Spinoza in the 17th century had been impressed by the rational, theoretical, mathematical side of early physics. True knowledge exists in the mind's grasp of innate ideas. Mathematics was self-evident, i.e., deducible without any necessary resort to particular observations.
   b. Bacon, by contrast, stressed the observational side of science.
   c. Lock--the systematic foundationof empiricism, insprited by Newtonian science. As opposed to innate ideas, Locke thought of the mind as a tabula rosa, a blank tablet, on which the senses write. Ideas are emprical in origin, built up from data furnished by the five senses. The mind creates forms and symbols, it does not start with them.
2. Hume: the only reliable human knowledge is based on sense-impressions that are discrete, fleeting, and fragmentary. Ideas are memory-images of these perceptions, so their validity must be tested by tracing them back to the sense-date from which they arose. Therefore any idea not derived from the senses is meaningless.
   a. Self exists only as a stream of isolated impressions.
   b. All knowledge is atomistic.
   c. Seeming connections between cause and effect are only repeated temporal successions of sense-impressions. The "laws of nature," therefore, are only probable expectations based on previous experience. Subjective vs. objective. With this Hume argued that the idea of God as First Cause is invalid. Since God has not been seen creating or performing miracles, and since cause cannot be inferred from effect alone, the idea of God and miracles is empty speculation. Hume argued for an infinite series of events in a self-sufficient universe, rather than an uncaused First Cause.
   d. Hume attacked the argument from design. He argued that the universe is less like a clock than a plant, with a life-force within. A finite world containing only relative good (the presence of evil and pain) can only imply a finite God of relative goodness with finite power.
   e. Hume rejected the Enlightenment's confidence in the power of reason; he was skeptical of the possiblity of demonstrable knowledge of the laws of nature.
   f. Hume admitted that he had to drop his "unmitigated skepticism" when he left his study and entered the real world, otherwise life would be impossible.
   g. Hume was agnostic, not atheistic.
   h. Hume's extreme empiricism undermined Deism and natural theology.

B. Immanuel Kant (1724-1804)

1. Kant agreed with Hume that sense-data is the only source of knowledge, but he argued that the mind contains the innate ability to organize, a structure of consciousness, and it thus interprets data in terms

of its own forms of understanding.
2. Examples of these forms of sensibility: space & time.
3. Knowledge is, therefore, the joint product of sensory material and innate structure of consciousness.
4. Causality is a category of understanding that the mind brings to the sense data rather than that which is derived from it. The idea that every effect has a sufficient cause is not an empirical observation, but an indispensable presupposition of human thought. Causality is a general form by means of which the mind unifies the chaos of atomistic data. Man's mind provides the general categories for interpreting the relationships among impressions.
5. Because scientific knowledge is limited to perceptual experience, we can never know things-in-themselves apart from whatever distortions might be introduced by our mental processes.
6. Kant denied the validity of argument from causality, since it is only a subjective catagory. The concept of cause can be applied only within a temporal series, it cannot be applied to the whole series and back to First Cause. Hence the existence of God can be neither proved nor disproved in and by human knowledge.
6. The starting point in religion is man's sense of moral obligation; ethics, not theoretical problems of metaphysics. Man experiences value as well as fact; he asks what ought to be. Kant argued for rationally justifiable universal human obligations to do the right. Religious beliefs are postulates of the moral order, assumptions required by our recognition of moral obligation. The idea of God emerges rationally from the practical awareness of moral obligation, but moral experience does not provide the basis for claims of religious knowledge. Truth is in the action, not the belief--practical rather than theoretical.
7. Kant thus set up a dichotomy between science and religion. Religion exists innately, and does not have to defend or explain itself by pointing to gaps in the scientific account or by the argument from teleology.

IV. Summary
A. God and Nature--the reductionist view of nature as a self-sufficient machine in which all future events are inexorably determined by the laws of matter-in-motion.
1. God=the clockmaker of Deism, them omitted completely by the materialism of the French Enlightenment.
2. The Romantic Movement as a reaction, holding for an underlying spiritual reality to nature.
B. Methods in Science
1. Hume--denial of the significance of any idea not traced to sense-data.
2. Kant--maintained that man's mind supplies crucial categories of interpretation.
C. Methods in Theology
1. Revelation--attacked by the Enlightenment; defended by Pietism and Methodism.
2. Natural theology, undermined by Hume and Kant in their attack on reason.
3. Moral and religious experience--Pietism and Kantian experiential religion.

The Nineteenth Century

Introduction

A. The expansion of physics
   a. Theories about light
   b. " " electricity
   c. " " thermodynamics
B. Totally new scientific concepts
   a. Interacting fields
   b. Statistical probabilities
C. Chemistry in its modern form grew from its foundation in Dalton's atomic theory early in the century to Mendeleev's formulation of the periodic table and the rise of organic chemistry at its close.
D. The flourishing of practical technology based on the physical sciences.
E. The development that had the most profound impact on human thought--creating a major intellectual revolution: THE REVOLUTION IN BIOLOGY; DARWINISM AS A UNIFYING PRINCIPLE.
   1. Evolution as an interpretive principle spread into literature, history, ethics, religion, the "social sciences," etc. No field of intellectual endeavor could tolerate being anything but evolutionist.
   2. The rise of liberal, critical, scholarship.

I. Darwin and Natural Selection

A. The component elements of the theory of evolution had been proposed long before the publication of Origin of Species (1859). Darwin's idea of natural selection as the mechanism of evolutionary change constituted a basis for the synthesis of theories of evolution; Darwin seemed to make evolution intellectually and scientifically respectable.
B. Forerunners of Darwin
   1. Charles Lyell's Principles of Geology created the modern science of geology. Uniformitarianism vs. catastrophism.
   2. Jeane Baptiste Lamarck and his theory of the transmission of acquired modifications. Vs. belief in the stability (fixity) of biological forms. This undercut the argument for God from design.
C. Darwin's work
   1. Darwin's 1832 trip on the Beagle (5 years). The crucial experience of the journey was his study of slight variations among species, especially those found between one island and the next in the remote Galapagos chain.
      a. While on the trip, Lyell's book on geology reached him.
      b. Darwin's read Malthus's theory on the role of human population pressure and competition, which furnished the "clue" for a theory by which to interpret the data collected on the voyage. He later wrote:

         . . . being well-prepared to appreciate the struggle for existence which everywhere goes on, from long-continued observation of the habits of animals and plants, it at once struck me that under these circumstances favorable variations

would tend to be preserved and unfavorable ones to be destroyed. The result of this would be the formation of new species. Here, then, I had at last got a theory by which to work.

Life and Letters, I, 68.

D. Darwin's theory
   1. Random variations
   2. The struggle for survival
   3. The survival of the fittest

E. Darwin and human evolution: In Origin of Species, Darwin did not include man; in The Descent of Man (1871) he discussed human origins

F. With Darwin, scientific interest shifted from astronomy (Newton and Galileo) to biology.

G. Darwin's importance was that he provided what was thought to be a causal explanation for genetic change.

II. Nature as Dynamic Process

A. Nature in flux vs. nature as static; this constituted a genuine revolution in thought.

B. Interacting forces in organic interdependence. The environment assumed a new and profound significance.

C. The "rule of law": Accidental variations preserved lawfully. Determinism reigned in the new biology.

D. "Nature" includes man and his culture. The animal ancestry of man meant that human culture could be analyzed in categories derived from biology.

III. The failure of Darwinism in the physical sciences

A. Darwin's "natural selection" could explain (it seemed) the survival of the fittest, but it could not account for the arrival of the fittest. Darwinism explains the transformation of species, but not the creation of species upon which the process of natural selection work. Darwin theorized that the body sent particles into the blood as messengers to the "gonads" (sexual reproductive structures. As body organs changed under environmental influences, so would the messenger particles. Francis Galton (1822-1911) tested Darwin's theory by injecting blood from male rabbits of one color into female rabbits of another color. Darwin's theory predicted that the offspring would have coat colors intermediate between those of the parent blood donors because they would receive a mixture of messenger particles. It didn't work. Darwin, toward the end of his life, returned to the basic Lamarckian scheme of vital fluid as the medium that preserved organizational change in organisms and transmitted them to offspring.

B. Gregor Mendel (1822-1884) proposed the theory of change through hereditary units called traits or genes. Although Mendel's work was published in 1865, it went unnoticed until 1900 when Hugo De Vries (et al.) rediscovered and confirmed his findings. De Vries coined the term "mutation." It was found, however, that a single mutation usually results only in a slight or barely perceptible modification of a phenotypic characteristic.

C. The reasearch of August Weismann (1834-1914) destroyed Lamarckianism; he demonstrated the inability of biological forms to transmit acquired characteristics to offspring.
D. It was noticed that variation arising from mutation is removed by the purifying force of natural selection that rejects all but the fittest type. This is called "stabilizing selection." Therefore, natural selection was seen as antithetical to variation, and a genetic basis for evolution was unsubstantiated.
E. At the turn of the century, Darwinism and evolution was an unshaken faith among the "new biologists." But there was sceptisism and agnosticism on the subject of the mechanism of change. The theory of evolution by natural selection was held in low esteem between 1900 and 1925.

IV. The brilliant success of Darwinism in other areas
A. Herbert Spencer (1820-1903)--the father of the Social Darwinists. Spencer (who coined the phrase "survival of the fittest," extended the theory of biological evolution to all of life, including ethics. Spencer began men thinking about human society as an evolutionary organism.
B. William Graham Sumner (late 19th-century political and social scientist) proposed the concept of social evolution through antagonistic cooperation among parties distinguished by specialization of function (e.g., labor vs. management).
C. Lothrop Stoddard, Nathaniel Southgate Shaler, et al. and the evolutionary theory of race.
D. Oliver Wendell Holmes the legal Darwinist.
a. Law as the codification of evolution.
b. The sacrifice of individual rights to the proper evolution of the state (ultimately).
E. Karl Marx and his desire to dedicate Das Kapital to Darwin.
F. The rise of theological liberalism.

V. Science and religion
A. Liberal Christianity reinterpreted theology to fit the Darwinian model.
B. Conservative traditionalists reacted in various ways
1. The irrational rejection of evolution
2. The Roman Catholic Vatican Council of 1870 attacked the new trends in Biblical scholarship.
C. The controversy between religion and science which opened up in 1860 was devastating to the cause of Christ. Science spoke from arrogance and ignorance in areas where science does not belong; The Church was unprepared to counter the new science.

The Twentieth Century

Theories of Evolution

A. The agnostic period--@1900-1925

1. The mechanism of evolution by natural selection fell into disrepute; evolutionists clung to their faith by relying on the circumstantial evidence of the fossil record.

Excerpt from speech by William Bateson given at teh 1921 convention of the American Association for the Advancement of Science:

> I may seem behind the times in asking you to devote an hour to the old topic of evolution. Discussions of evolution came to an end primarily because it was obvious that no progress was being made. . . .When students of other sciences ask us what is now currently believed about the origin of species, we have no clear answer to give. Faith has given place to agnosticism . . .we have absolute certainty that new forms of life, new orders and new species have arisen on earth. That is proven by the paleontological record . . . our faith in evolutoin stands unshaken. (Italics mine)

B. The restoration of Darwinian natural selection--the synthetic version of the Neo-Darwinian theory

1. Forerunners of the restoration: J.B.S. Haldane (1892-1964), R. A. Fisher (1890-1962), S. Wright (b. 1889) and S. S. Chetverikov (b. 1880) independently worked out the theoretical models to study the variations in population.
2. The advent of the synthetic theory of evolution.
   a. Theodosius Dobzhansky (1900-1975), Genetics and the Origin of Species (1937); Dobzhansky correlated mathematical models in population genetics with the refined chromosomal theory of heredity. For the Neo-Darwinist, evolutionary changes take place when the genic variation by mutation and recombination is subject to the process of natural selection. Theoretical gradualism. These changes are determined at the population level by the way in which the environment is changing relative to the adaptation of the organisms in the population. Based on the different organism-environmental interactions, natural selection works in three ways:
      (1) stabilizing selection--the elimination of marked deviations from a well-adapted population by natural selection.
      (2) directional selection--Deviants in one direction become dominant and populations undergo change; the result of progressive change in environment. (E.g., industrial melanism.)
      (3) disruptive selection--the elimination of the majority of a population and the establishment of extreme variants. The opposite of stabilizing selection.

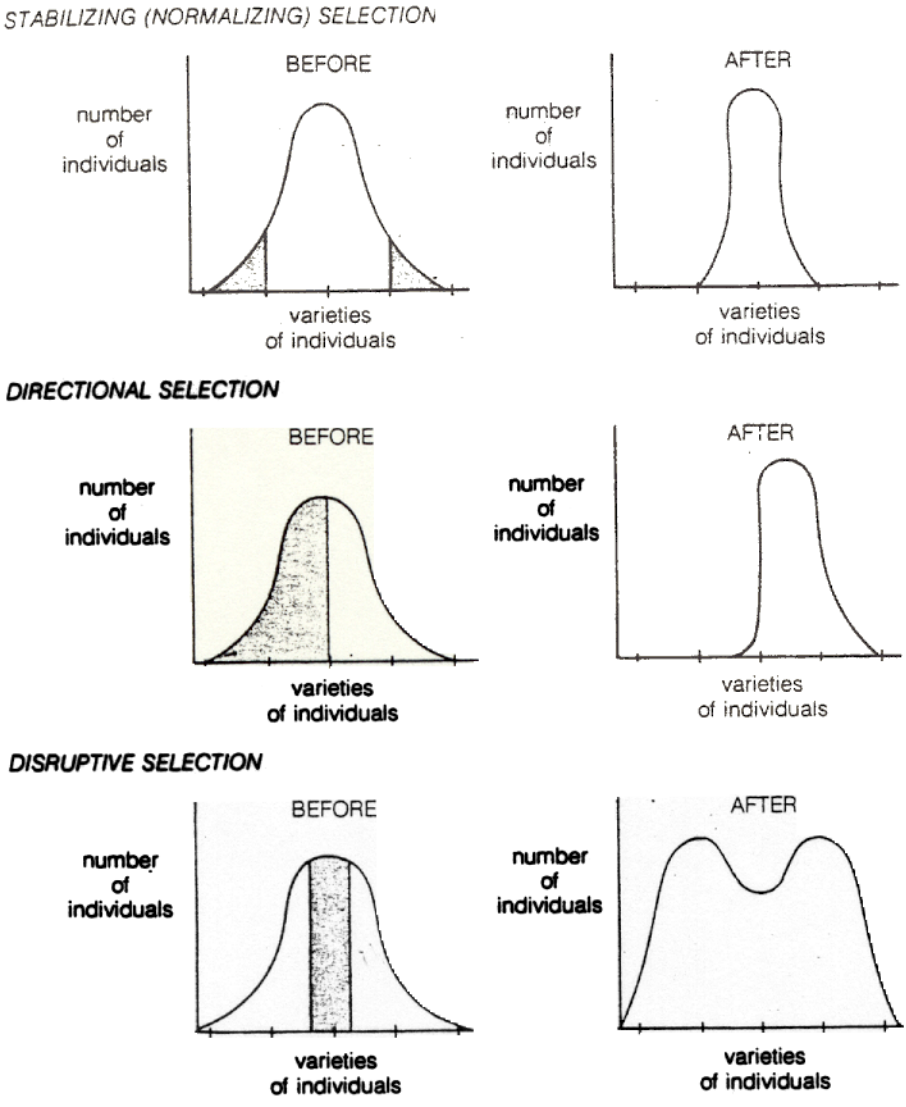

Figure 1.6. Diagrams illustrating the effects of stabilizing (normalizing), directional, and disruptive selection. Varieties of individuals can be represented by phenotypic variations such as height, skin color, etc., that are controlled genetically. Shaded and open areas on the *Before* selection curves represent adverse and favorable selections respectively.

3. Dobzhansky's work supplemented by the writings of
   J. S. Huxley (b. 1887)
   E. Mayr (b. 1904)
   G. Gaylord Simpson (b. 1902)
   G. L. Stebbins (b. 1906)

C Micorevolution, Macroevolution, and the Synthetic Theory
1. The first systematic attempt to categorize different levels of evolution was made by Richard B. Goldschmidt (1878-1958).
   a. G. took the original allusion of Dobzhansky to microevolution as the evolutionary process observable within man's lifetime and gave it an experimental meaning (controlled breeding studies).

b. Macroevolution (megaevolution), a term coined by Simpson, was perceived as the territory of the paleontologist, the comparative anatomist, and the embryologist. Therefore microevolution = observable changes that give rise to variations; macroevolution = the historical evolution of the "good" species that have been placed in higher taxonomic categories. Macroevolutionary changes have been correlated with the geological time scale.

2. The Neo-Darwinist claim: the accumulation of gene mutations and the isolation and selection of new variants that continue to undergo the same process account for all evolutionary diversification. Goldschmidt (The Material Basis of Evolution) challenged the concept of gradualism; he said that the above cannot account for macroevolution. G. challenged Neo-Darwinists to explain (not show evidence for) the evolution of 18 features by the accumulation of small mutations: The features included hair in mammals, feathers in birds, segmentation of arthropods and vertebrates, visceral arches, muscles, nerves, teeth, shells of mollusks, ectoskeletons, compound eyes, blood circulation, and alternation of generations.
   a. Goldschmidt's alternative: systemic mutation (emergent evolution, the "hopeful monster")
   b. Goldschmidt's objections to Neo-Darwinism
      (1) The improbability of gradualism
      (2) The absence of transitional forms in the fossil record
   c. The reaction to Goldschmidt: Neo-Darwinists did not even try to meet his challenge, but they declared his explanation untenable and adhered to their assertion that macroevolution can properly be extrapolated from microevolution.
3. The Synthetic Theory involves three categories:
   a. abiogenesis
   b. microevolution--the "special theory of evolution"
   c. macroevolution--the "general theory of evolution"
4. Neo-Darwinism appeals to the future for proof of the concept.
   G. A. Kerkut, The Implications of Evolution (1960):
   There is a theory which states that many living animals can be observed over the course of time to undergo changes so that new species are formed. This can be called "The Special Theory of Evolution" and can be demonstrated in certain cases by experiments. On the other hand there is the theory that all the living forms in the world have arisen from a single source which itself came from an inorganic form. This theory can be called "The General Theory of Evolution" and the evidence that supports it is not sufficiently strong to allow us to consider it as anything but a working hypothesis. It is not clear whether the changes that bring about speciation are the same nature as those that brought about the development of new phyla. The answer will be found by future experimental work and not by dogmatic assertions that the General Theory of Evolution must be correct because there is nothing else that will satisfactorily take its place.

D. Recent developments: Jay Gould and Niles Eldridge and the concept of "Punctuated Equilibria."

II. Theories of the Origin-of-matter and the Organization of the Universe

A. The Nebular Hypothesis
1. The oldest scientifically proposed theory; held by some in the days of Galileo; gained widespread acceptance in the 18th, 19th, and part of the 20th centuries. Immanuel Kant (1775).
2. Used in elementary school textbooks because it so simple to demonstrate and understand.
3. Incorporated in many explanations of the origin of various objects within the cosmos.
4. Basic concept: Various objects that we see in space had their origin in a spinning blob of matter which, as it contracts through the the force of gravity, increased its angular velocity to conserve momentum so that it spun faster and faster. As the centrifugal force increased, chunks of matter solidified into various objects in the universe.
   a. The modern versious suggests that eddies formed in the rotating cloud and thus concentrated matter in various places at various distances from the center. Since eddies can curve in virtually any direction, this would explain such things as backward-rotating planets like Venus.
5. It does not address the question of the origin of matter.
6. The variable masses and spin rates of the planets do not fit the predictions of the theory; the unusual motions of some satellites and the low density composition of such massive bodies as Jupiter also do not fit the model. Pluto's highly inclined oribit is especially difficult to fit into this theory. Other objections.

B. The Planetesimal Hypothesis
1. Source: In 1900, T. C. Chamberlin, an American geologist, and F. R. Moulton, an American astronomer, proposed an alternative to the Nebular Hypothesis.
2. Basic concept: An intruder star from somewhere else in our galaxy came near the Sun, and as it did, the gravitational forces that were generated produced tidal forces that tore material out of the sun which became the solar system.
3. Virtually all objections noted for the Nebular Hypothesis apply to this model.
4. It does not address the question of the origin of matter.
5. Not considered seriously by most astronomers.

C. The "Big Bang" Theory
1. The most commonly used explanation of the origin of the cosmos; the most viable at the present time.
2. Basic concept: All that we see is the result of an ancient explosion of a primeval blob of matter. Matter was sent flying out through space in all directions. Those pieces nearest the edge of the blob were thrown out the fastest and the fartherest. Those objects the most distant from the explosion center travel the fastest.
3. Seems to fit with observations; a few problems remain unresolved.
4. It does not address the question of the origin of matter.

D. The Continuous Generation Theory
   1. Is present in several forms.
   2. Basic concept: Matter is constantly being created in the universe by a not-yet-identified process.
   3. Two basic forms of the hypothesis:
      a. The theory that matter is "popping" into existence all around us; somewhere inspace there is an atom created from nothing by a thus far unknown physical process during every instant of time that passes. If you have enough places where these spontaneous creations take place, you can theorize a chance creation of the cosmos. This is the skeptics best suggestion. There is, however, not a single detected case of this happening. (Proponents of the theory suggest that the process is too diffuse to allow us to detect them.) The known laws of conservation of mass, momentum, and energy cannot be fitted into this model.
      b. Creation at points in space called irtrons; as matter is created it is thrown by a so-far unknown process out in a radial pattern. The difficulties with this paradigm are huge.

E The Quasi-Statal Theory
   1. Basic concept: Matter had no beginning--it has always existed.
   2. Sometimes called the Oscillating Universe theory, i.e., matter simply goes in cycles or oscillations from matter to energy, back to matter, ad infinitum.
   3. Violates the Second Law of Thermodynamics (The universe is a closed system.)

F. Non-Physical Origin
   1. Creation by a Force or Being who stands outside the time-space continuum; not subject to the laws of the three dimensional universe; not subject to time; fills all of space.
   2. Finds support in the work and conclusions of Albert Einstein
      a. Time as relative to speed at which an object or person is moving.
      b. A finite universe

III. The Mythology of Science

(Rushdoony, Rousas John. The Mythology of Science. New Jersey: Craig Press, 1967.)

Introduction

A. Myth--definition: The explanation offered by an age or a culture of life and its origins.

Expanded definition: The attempt of a culture to overcome history, to negate the forces and ravages of time, and to make the universe amenable and subject to man.

B. The purpose of myth: to end history.
   1. History demonstrates movement in terms of forces beyond man and in judgment over man; is inescapably ethical; shows the conflict between good and evil; shows man to be the actor, not the playwright and not the director.
   2. Man uses myth to end history, to make himself the absolute ruler.

C. The means of achieving the goal of the myth: magic.
   1. Magic has for its purpose the total control of man over man, nature and the supernatural.
   2. Under the influence of Christianity, science escaped from magic; the Christian is God's viceregent over the earth and science is one of the tools given to man to establish and maintain that dominion.
   3. When science oversteps that role, it stops being science and becomes, once again, magic.

D. The purpose of modern science: the exercise of total control.
   1. Prediction
   2. Planning
   3. Control

E. The popularity of modern science
   1. Wedded to magic.
   2. Overcomes history.
   3. Eliminates the ethical struggle.
   4. Places man beyond good and evil and beyond jugment.

F. The sovereignty of science
   1. The Christian view: with God all things are possible, and with Him nothing is impossible (within the realm of total reality).
   2. The view of modern scientism: all things are possible for man through and by the use of science.
      Example: Kenneth Heuer, specialist in planetary astronomy and a fellow of Britain's Royal Astronomical Society--concerning the death of the sun:

      > Still another possibility would be to construct our own sun, a source of heat and light which might be suspended in the sky and hold the hovering demons of cold and darkness at bay. This artificial sun would operate by subatomic energy. In the remaining years of grace, man might learn how to run the carbon cycle. Hydrogen, the fuel, is abundant, and other light atoms, such as lithium, are also plentiful sources of energy. With several billions of years of time at his disposal for research, man should be able to develop cheap, abundant, and manageable

subatomic power.
K. Heuer, "The End of the world," in Panorama.

G. Science and the utopian mentality
1. The promise of a "workless world" in which everyone lives well.
2. Sceintists self-consciously offer themselves as the vanguard of a new renaissance.
3. Scientists often think of themselves as the guardian of society.

H The ethical requirements of the promised scientific utopia.
1. The removal of ethical absolutes.
2. The openening of the mind to new possibilities; unbounded optimism.
3. The willingness to admit that scientific man is his own god.
4. The removal of God.
5. The establishment of scientific absolutism.
6. Passionate dedication to scientism.
Example: the fervent, passionate, desire of those working with the space program to find evidence of life on other planets. Supposedly science is objective; i.e., it is interested in discovering the truth, not making a case.

I Evolution as a cultural myth
1. Cultural myths (explanation of life and its origins) so coincide with the contemporary spirit that their often radical contradictions and absurdities are never apparent. They express the basic presuppositions of everday life and thought.
2. The fundamental assumption of the modern era: autonomous nature.
3. The " motive " " " " : moral freedom.
4. Better a world without meaning that a world under divine control and judgment.
5. Evolution grants man a seemingly adequate power of creation with none of the requirements imposed by the God of the Bible. A concept of creation that permits man to take total control of the natural order.

J. The promised blessings of the scientific utopia
1. The computerized workless society--scientific, egalitarian, international (one-world government).
2. Bio-engineering: creation of life, prolongment of life, physical modification, mental modification, fertility control, abortion, control of sexual desire, artificial insemination, sex-control in births, artificial inovulation, artificial placentas, cloning (parthenogenesis), regenerated body parts, eugenics, electrical control of the brain, chemical control of behavior-memory-intelligence, freezing techniques.
3. Control of nature: total scientific agriculture, control of weather factory-produced food.
4. Colonization of the universe; exploitation of space.

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