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# UNIT 1

## Science: Finding Order in Complexity

### CHAPTER 1

#### The Scientist and His Methods

Text Pages 3–12

*Work of the Scientist*

*Goals of the Scientist*

*Specialization of the Scientist*

#### ◆ Suggestions for Motivation or Enrichment:\*

1. As you think of some common “-ologies” which describe fields of science, like *biology* and *zoology*, make up a few “-ologies” for yourself, even if you have never considered them before. Include your own words for the study of mammals and for the study of viruses. Do not hesitate to originate a word, providing you can justify your decision. Then with a dictionary or other resource aid, discover if there is a better term than you have chosen in each case.
2. Choose an outstanding scientist, such as Einstein or Edison, who has been widely described in literature, and research a list of his specific accomplishments, noting which ones seem to have been the result of incidental discovery, and which ones seem to have been planned as such from the beginning of his work.
3. Think of some incidental information which a soil bacteriologist might find out as he goes about his study of bacteria in soil, and write out a hypothetical report of his incidental findings as if you had worked with him. Think in terms of such things as soil acidity, pollutants in the area, and plant growth.
4. Presume that you have the responsibility of hiring a drinking water analyst for a city laboratory, and state the qualifications that you consider vital for such a position. Make your statements in writing as if they represent a group of applicants for the position.

#### ◆ Suggestions for Multimedia Resources:\*

1. *Creation* (Answers in Genesis, CD-ROM). Answers in Genesis wants to do all it can to counter the massive propaganda push by PBS, NOVA, and Clear Blue Sky productions. Millions of dollars in funding were spent in the production of seven anti-Christian programs in the television series

entitled *Evolution*. As a response to this series, and to equip people to defend the Christian faith, Answers in Genesis has created this multimedia-rich CD-ROM.

2. *Project 3:15* (Answers in Genesis, CD-ROM). With hundreds of pages of articles, over 10 hours of audio files, and the complete video *The Image of God*, this CD will effectively equip you to answer many timely questions. It also contains Dr. Jonathan Sarfati’s entire book *Refuting Evolution 2*.
3. The “Riddle” of Origins, video/DVDs: *Does it Matter What We Believe?*, *The Origin of Life*, *The Origin of Humans*, and *Dating Fossils and Rocks* (Institute for Creation Research, approximately 60 min. each). Mike Riddle,\*\* former Olympic athlete and Microsoft communications expert, emboldens students of all ages to defend their faith in the Bible and become more effective witnesses.
4. *Episode 4: All Systems Go* (NASA CORE, 22 min.). This videotape shows research conducted aboard the space shuttle on six systems that examine the heart, lungs, blood, muscles, cells, and the immune system, among others.
5. *Science in Space: Fundamental Biology on STS-107* (NASA CORE, 34 min.). This video on the space shuttle Columbia STS-107 mission (2003) is dedicated to research investigating human physiology, fire suppression, and other areas of research relevant to people across the globe.\*\*\*
6. *Unlocking the Mystery of Life/DVD and Video* (Illustra Media, 67 min.). This presentation explores timeless questions on the origins of life and offers compelling evidence to support an idea that could revolutionize scientific thought—the theory of intelligent design. (Also available: *The Privileged Planet* and *Where Does the Evidence Lead?*)
7. *God of Creation/DVD and Video* (Moody, 28 min.). This all-time Moody favorite explores the power and beauty of the universe we live in. You will see the food “factories” that plants use and peer through a telescope into the vast reaches of space, while you ponder the God who put the galaxies in place—the same God who gave His Life for us on the cross.

\* The listing of these suggestions does not necessarily imply endorsement of content.

\*\* Mike is the president of *Christian Training and Development Services* (<http://www.train2equip.com/index.asp>) and currently travels around the country teaching and delivering seminars on the biblical and scientific truths of creation.

\*\*\* To see online *Tribute Videos*, visit <[spaceflight.nasa.gov/shuttle/archives/sts-107/memorial](http://spaceflight.nasa.gov/shuttle/archives/sts-107/memorial)>.

### ◆ Suggestions for Supplementary Reading:<sup>\*</sup>

1. Behe, M.J., W.A. Dembski, and S.C. Meyer. October 2000. *Science and Evidence for Design in the Universe*. Ignatius Press, 234 pages. In a lucid primer to the Intelligent Design debate, three neo-creationists summarize their most important data and conclusions and rebut critics. It examines how the complexity and interrelatedness of creation argue for a Creator.
2. Bevington, Linda K., et al. *Basic Questions on Genetics, Stem Cell Research, and Cloning: Are These Technologies Okay to Use?* BioBasics Series. Kregel Publications, 125 pages. This booklet uses a biblical perspective to examine the scientific and ethical issues surrounding such interventions. It not only clarifies current and future developments but also gives guidelines for developing a Christian response.
3. Marsch, Glenn A. "The Book of the Law and the Book of Nature: A Two-Volume Set?" *Scientific Voice, Center for Scientific Studies*. To read this article online, visit Dr. Marsch's own Web site at <<http://members.aol.com/drgmarsch/faithframes.html>>. It discusses the relationship between general and special revelation for the Christian scientist.
4. Mortenson, Terry. November 2004. "National Geographic is wrong and so was Darwin." *Answers in Genesis*. To read this article online, visit <<http://www.answersingenesis.org/docs2004/1106ng.asp>>. It refutes the 33-page cover story of the November 2004 issue of *National Geographic* (NG). Scientifically informed and careful thinking readers will want to analyze NG's "overwhelming evidence" before accepting its conclusion.
5. Sarfati, Jonathan. June 1999. *Refuting Evolution*. Master Books, 176 pages. This book is a general critique of the most up-to-date arguments for evolution; it will challenge educators, students, and parents alike.

### ◆ Answers to Questions

#### Work of the Scientist (Text page 9)

##### ➤ Questions: Work of the Scientist

1. The term *science* is the study of God's creation. Because creation was brought into existence by God's wisdom, and man was created as a part of it, man is called to fulfill the Creation Mandate—to understand and subdue creation for God's glory.
2. The assumption of *uniformity*—that nature is orderly and that events can be repeated—is fundamental to the study of science.

3. A *hypothesis* is only a temporary explanation formed to explain a problem, and *it must be testable*. However, a *theory* involves a broad range of concepts concerning many problems and usually includes some imagined aspect; thus, *no theory can be tested directly*.
4. A *law* is more extensive than a *theory* because it has been well established by the efforts of many researchers—who repeat the steps, reach the same conclusion, and rule out other explanations.
5. The criteria of a good theory are (1) to identify the *orderly relationship* of many seemingly diverse and isolated observations of the natural environment; (2) to *predict* certain future events; these predictions become an indirect means of confirming a theory because they are limited in scope and they are subjected to testing, as a hypothesis; (3) to be *modifiable* so that adjustments can be made as new data are accumulated, or as ideas about the imagined unit or aspect need to be changed; and (4) to *develop new directions* for research so that new observations of the natural environment can be collected.
6. It is important to repeat experiments to discover an orderly sequence of events, usually assuming that the first event is the cause of the second.
7. A *control group* is needed as a standard of comparison in judging the effects of an experiment in which the subjects are treated the same except for the omission of the procedure or agent under test, which the *experimental group* receives.

##### ➤ Taking it Further: Work of the Scientist

1. It is impossible to prove scientifically how the earth was formed because it was an unrepeatable event that took place in the past; it cannot be tested.
2. It is possible to test for more than one variable at a time, but it would be impossible to determine accurately which variable caused the results that were observed. Yet, multiple variables in combination may cause the desired effect observed.
3. Science has the self-imposed limitation of studying only those things that can be demonstrated by or to the senses. Science is also limited by the ability and objectivity of those who do the research. Science is also influenced by prevailing views of the time, which may limit the scope of other scientific endeavors. The inability to experiment also imposes limitations in such fields as astronomy or archaeology. Moreover, experimentation is limited in time and space.

#### Goals of the Scientist (Text page 10)

##### ➤ Questions: Goals of the Scientist

1. It is necessary for the findings of a scientist to be checked by other scientists before being accepted

\* The listing of these suggestions does not necessarily imply endorsement of content.

because the scientist may have developed an erroneous hypothesis, overlooked certain factors or problems, “observed” something he wanted to see, or been sloppy in his methodology.

2. *Supernaturalism* is the belief in a supernatural being or power responsible for the created order and that intervenes in the course of natural laws.
3. “Pure science” is knowledge pursued for its own sake, and “applied science” is knowledge pursued for the material benefit of man.

➤ **Taking it Further: Goals of the Scientist**

1. The teleological views of the Bible transformed the idea of *cause and effect*, based on the Word of God. There is not only a pattern but also a plan in the mind of the Creator, which gives purpose to all of creation. Greek mythology, however, taught that the universe was constructed according to a pattern that could only be demonstrated through a study of cause-and-effect relationships.

Creationists believe that creation is the sum total of acts by God the Creator, who brought the universe into existence. Evolutionists, however, believe that all life came from an inorganic beginning and that human life came from one-celled forms through multicellular organizations of two-cell layered and three-cell layered forms of animals.

2. While the findings of science are not absolutely supreme, it is in the application of such findings that the questions of morality are introduced; for example, the sacrifice of the unborn in stem cell research, supposedly for the good of others. Such issues as cloning, genetic engineering, and stem cell research raise many moral questions that need to be addressed.\*

**Specialization of the Scientist (Text page 12)**

➤ **Questions: Specialization of the Scientist**

1. Biology in general is the science of *life*, which is the subject matter included in biology but not in the physical sciences.
2. The five main characteristics of living things are as follows: (1) *they respond to stimuli*, (2) *they are highly organized*, (3) *they metabolize*, (4) *they grow*, and (5) *they reproduce*.
3. Biology has contributed in the field of agriculture by increasing the productivity of the soil, developing disease-resistant varieties of plants and animals, and combating plant and animal diseases when they arise. In the field of medicine, biology has helped to increase life expectancy. Biologists have also contributed substantially in such fields as conservation, fisheries, and public health.

➤ **Taking It Further: Specialization of the Scientist**

1. The difference between nonliving material and living material is that *living systems show all five characteristics*, whereas a *single nonliving system shows at most one or two of these characteristics*, and only in a manner unrelated to its welfare or continuation. Therefore, it is possible to distinguish between them by determining if all five characteristics are present at once or not.

➤ **Questions: Chapter Review**

1. *Science* is the study of God’s creation. The physical sciences have benefited mankind with the discovery of each new energy source (coal, petroleum, natural gas, atomic power, solar energy, etc.), which brings greater wealth and less physical toil. The biological sciences have also helped to grow better food crops to support more and more people. Developments in medicine have been used to substantially lengthen the average life span. Many dread diseases (smallpox, bubonic plague, polio, and tuberculosis) have been conquered; and new surgical techniques have also corrected conditions that at one time were hopeless.
2. Greeks approached science by reasoning without making observations; they despised experimentation. Today, scientists use the scientific method to establish a valid interpretation of facts that has not previously been known; they are not satisfied with mere data or facts, which consist of observations and measurements, but desire to find out the reason for the facts being what they are.
3. The work of a scientist consists of stating a *problem* that no one else has studied or solved. The scientist gathers many facts, or does research, which may have a bearing on the problem. A *hypothesis*, or estimate, is formed that might explain the problem. More facts are gathered, and their relevance to the hypothesis is carefully weighed. If possible, experiments are performed. If the facts gathered are consistent with the suggested explanation, or hypothesis, the scientist concludes that the explanation is valid, and the results are published.

Scientists have agreed to deal only with *sense observations* and to limit themselves to a study of those things that can be demonstrated by or to the senses. They are also limited by those phenomena that can be repeated. Often they are limited by their own limited knowledge and trends of the day.

4. The assertion, “scientists pride themselves on their objectivity,” means they try to look only at the evidence and draw conclusions only supported by the evidence; in weighing facts, they are presumably impartial and unemotional. Yet, they have an understandable emotional attachment to the concepts they have developed or embraced and are

\* For more information, visit the Web site for *The Center for Bioethics and Human Dignity* at <<http://www.cbhd.org/>>.

influenced by prevailing views of their time. *Examples may vary.*

5. The primary goal of the scientist is *objectivity*, but he also seeks to find *purpose* in the created order—to discover not only a pattern but also a plan in the mind of the Creator. A third goal of the scientist is to discover *truths* regarding the natural world, recognizing that all scientific conclusions are tentative (only the Bible provides absolute truth).
6. A hypothesis is important as a working basis; it presents something which may be true, to be tested by logic or experiment.
7. Scientists may rule out facts that point toward a conclusion that is “undesired,” judging that those facts have no bearing on their hypotheses or their theory of origins. However, such *undesired conclusions* should not be overlooked. Also, scientists may not know how present scientific “truths” or concepts will be changed, but we can be certain that they will; they are considered to be *tentative conclusions*. Finally, *correct conclusions* are unmixed with error; they require a disciplined mind, guided by the principles of God’s Word.
8. Since we live in a universe of absolutes with absolute time and absolute space, the role of science is to discover *absolute truth*. Moreover, the scientist would not be able to function or have a purpose in a world without absolutes.
9. It is difficult to define *life* from a scientific perspective because life is unique—there is nothing like it. Yet, for an adequate definition, the subject (e.g., of life) must be placed into a broad category and then described as to how it differs from other subjects in the category. However, there is no broad category where the subject of life can be placed.

*Answers may vary. The student is also asked to explain how would a creationist or evolutionist define life. According to evolutionists, new species are created by a purposeless, random process of genetic mutation. However, if you study the biological world with an open mind, you will see more evidence that each separate species was created by an Intelligent Designer (i.e., God). Moreover, evolutionists have not found the fossils of any transitional species—half reptile and half bird, for instance. Similarly, there are no rich fossil deposits before the Cambrian era (550 million years ago). If Darwin was right, what happened to the fossils of all their evolutionary predecessors? Evolution is unscientific, because it is not testable or falsifiable; it makes claims about events (such as the very beginning of life on earth) that can never be recreated. A better solution is that God, or a designer, deposited each new species on the planet, fully formed and marked “made in heaven.”\**

## CHAPTER 2

### Application of Scientific Methods to the Insect World

Text Pages 15-24

*Knowledge of Insects*

*Management of Insects*

*Description of Common Insects*

#### ◆ Suggestions for Motivation or Enrichment:

1. Make a list of the insects that you personally dislike most and give reasons for your choices. Make another list of insects that may be serving a good purpose in your life and tell how they serve.
2. Prepare a report on a present-day insect problem as it is related to world travel, ecology, housing, disease, or food supplies.
3. Write out a practical plan for organic gardening, identifying the relationships it would have to insect life. You may think you know who your insect “friends” are, but beware: *Your garden could be crawling with impostors that are actually pests.*
4. Presume that you are directing some young scientists to study a strange new insect for classification purposes; as their director, present your guidelines or instructions to your colleagues.

#### ◆ Suggestions for Multimedia Resources:\*\*

1. *City of the Bees*/DVD and Video (Moody, 28 min.). Examine the complex community of the bees and marvel at their amazing sophistication. Learn why God’s design for humans is vastly superior.
2. *Pests In and Around the Home*/CD-ROM (University of Florida/IFAS). This CD contains a computerized knowledge base of house pests, plus information on pest biology, life cycle, identification, distribution, damage, and management. Hundreds of scientific definitions, graphics, and photos are also included. (For more information, visit <[http://pests.ifas.ufl.edu/software/det\\_pests.htm](http://pests.ifas.ufl.edu/software/det_pests.htm)>.)\*\*\*
3. The Department of Entomology at Michigan State University works with farmers and homeowners to better understand how insects affect our lives and how to effectively manage our interactions with them. Their Web site has many helpful articles. (For more information, visit <[www.ent.msu.edu/Extension/extension.htm](http://www.ent.msu.edu/Extension/extension.htm)>.)

\* Visit <[www.wasdarwinright.net](http://www.wasdarwinright.net)> for more information.

\*\* The listing of these suggestions does not necessarily imply endorsement of content.

\*\*\* For information on other insect software, see the UF/IFAS Buggy Software site at <<http://pests.ifas.ufl.edu/software/>>.