Studying Life Science
Chapter 1

1A: What is Science?

Science comes from the Latin word *scientia*, which means "knowledge."

Science: **the knowledge gained from the careful, systematic investigation of the natural world**
(all the knowledge gained by exploring the natural world) (an organized way of studying things and finding answers to questions) (from 2nd edition: the total collection of knowledge gained through man's observations of the physical world)

Many types of science exist:
Earth Science
Physical Science
Chemistry
Biology
Anatomy & Physiology
Physics
Forensic science
Astronomy

Life Science (Biology): the study of living things

Scientists use skills such as observing, inferring, predicting, classifying, and making models to learn more about the world.

Successful scientists possess certain attitudes, or habits of mind (Characteristics):

- *Curiosity* (loves to ask questions esp. why questions; If a person can find out what causes something in nature, he will have a good chance at making useful predictions – a key goal in the work of science.)
- *Caution*
  He knows not everything he reads or hears is true.

  He knows scientific thinking is based on **observation (information a person gains by using one or more of his five senses**)
  Good scientific observations must be measurable & repeatable.
  Observations can be either **quantitative** (deal with a number, or amount) or **qualitative** (deal with descriptions).

  He knows science is limited:
  1. Science deals only with observables.
  2. Science cannot prove universal negatives.
     universal negative: a statement that excludes everything (a blanket statement of denial)
  3. Science cannot make value judgments.

value judgment: a determination of the worth of something (deciding whether something is right or wrong, good or bad, valuable or worthless)

4. Science cannot provide final answers.
   final answer: an answer that is absolutely true (and therefore never needs to be rejected or revised)
   Science is NOT about truth; it's about finding predictions that work.

- *Critical thinking*
  (critical does not mean here finding and pointing out faults; it means a **careful, exact evaluation**)

  He is willing to make an **inference**, or logical conclusion, based on his observations. (When you explain or interpret your observations, you are making an inference. For example, if you see your friend smile after getting back an exam, you might infer that she got a good grade. Inferences are not always correct.)

  Inference is the method of science. A theory is proposed based on multiple observations, usually observations carried out with great care, using measurement. The theory is then tested many times, by independent investigators, using their own multiple observations. If the theory proves correct to within the accuracy of those observations, then it is provisionally accepted. Any scientific theory is subject to additional testing, and may be modified or overthrown based on additional evidence.

  Thinking is guided by certain presuppositions.
  presupposition: an idea that a person takes for granted, something a person assumes to be true without having convincing proof for it.
  - Scientists believe that there are rules that govern what happens in nature. Things don't just happen. Such as the growth, movement, and reproduction of plants.
  - Scientists believe that in nature the future will be like the past. (This allows them to make predictions.)
  - Scientists believe that the orderliness of nature can be known by humans.

The Bible encourages Christians to think critically. ("My dear friends don't believe everything you hear. Carefully weigh and examine what people tell you." 1 John 4:1 MSG)

Only God's Word is absolute truth. God is the Creator of all life. If you remove God from any part of your life, then that part of your life will become meaningless. Only God is able to give meaning to things He has made.

Worldview: the perspective from which a person interprets all evidence in life (how you view every aspect in your life)

From a Christian standpoint, there are only 2 worldviews:

1. Christian worldview
2. Non-Christian worldview

The most important teachings found in a Christian worldview are:

1. God made the world and everything in it.
2. The world has fallen into a tragic state because of sin.
3. God is working to redeem this world to Himself.

Why do we need to be concerned about this?

Our purpose is to declare the glory of God.

God made this world for His own glory. We can study nature to know more about God's marvelous character. ("The heavens are telling the glory of God; they are a marvelous display of his craftsmanship. Day and night they keep on telling about God. Without a sound or word, silent in the skies, their message reaches out to all the world." Psalms 19:1-3 (TLB)

Our main focus of learning about nature should not be to improve the lives of humans, but instead it should be to love God through the study of nature.

1B: Why Study Life Science?

God Made Living Things for His Own Glory

1st and most important reason for studying life science: You can demonstrate your love for God and gain a better understanding of how creation reveals God's glory.

" For everything comes from God alone. Everything lives by his power, and everything is for his glory. To him be glory evermore." Romans 11:36 (TLB)

The ***glory of God*** refers to the ways in which God's greatness and good new are superior to that of any of His creatures.

Life science helps demonstrate God's greatness more clearly.

Life science strengthens appreciation for God's goodness.

How do creatures, other than humans, declare God's glory? By pointing out aspects of God's remarkable intelligence, power, and creativity.

How do humans declare God's glory? By being like Him "Then God said, "Let Us make man in Our image, according to Our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the

cattle, over all the earth and over every creeping thing that creeps on the earth." So God created man in His *own* image; in the image of God He created him; male and female He created them." Gen 1:26-27 (NKJV)

Then God said, "Then God blessed them, and God said to them, "Be fruitful and multiply; fill the earth and subdue it; have dominion over the fish of the sea, over the birds of the air, and over every living thing that moves on the earth." Gen 1:28 (NKJV) This command is often called the **Dominion Mandate** because it describes the responsibility mankind has to govern God's creation.

Adam began to obey the Dominion Mandate by performing his first God given task – to name all the creatures God brought to him.

When we figure out ways to feed more and more people with less and less land, we declare God's glory. When we discover ways to power our machines and warm our homes without carelessly destroying the beautiful things God has made, we declare God's glory. When we learn ways to be more efficient in our daily routines by observing the efficiency of bees and ants, we declare God's glory. **We glorify God when we exercise wisdom and good stewardship in our use of the living things He has made.**

God Cursed Living Things Because of Sin

Physical Effects of the Fall

- Getting plants to grow is challenging
- Raising animals for food is not easy
- It is a struggle to keep our bodies from sickness, harm, or death

Mental Effects of the Fall

- We do not think about living things as we should (Adam blamed his wife)
- Tendency to love self and not to love God or other humans as we should
- Many people reject what the Bible teaches about life

God is Redeeming This World to Himself

God began revealing His plan for redeeming humans shortly after the Fall. "And I will put enmity between you and the woman, and between your seed and her Seed; He shall bruise your head, and you shall bruise His heel." Gen 3:15 (NKJV)

The **meaning of redemption** is more than just the conversion of lost souls. It also includes the restoration of all that has been marred and twisted by the Fall.

God wants to use us in redeeming the world.

And Jesus came and spoke to them, saying, "All authority has been given to Me in heaven and on earth. [19] "Go therefore and make disciples of all the nations, baptizing them in the name of the Father and of the Son and of the Holy Spirit, [20] "teaching them to observe all things that I have commanded you; and lo, I am with you always, *even* to the end of the age." Matt 28:18-20 (NKJV)

Life science is one of the most powerful tools for relieving human suffering and proclaiming the gospel.

1C: What Do Scientists Do?

How does the process of scientific investigation work?

Scientists use a series of procedures called the scientific method (sometimes referred to as scientific inquiry).
Scientific method: **an organized way of arriving at a workable solution to a problem** (a logical procedure for choosing an answer to a question)

Steps of the Scientific Method
- Establish the problem
- Form a hypothesis
- Test the hypothesis
- Classify and analyze the data
- Choose and verify the answer
- Predict outcomes

Establish the Problem

This process often begins with a problem or question about an observation.
Questions come from experiences that you have and from observations and inferences that you make.
Some questions cannot be investigated by science.
Does my dog eat more food than my cat?
Which makes a better pet – a cat or a dog?

problem: a question that may be answered by the use of the scientific method

The problem must:
- fall within the limitations of science
- be observable
- be measurable
- be repeatable

Establishing the problem also involves background research and limiting (defining) the problem.

Background research: reading books and talking to qualified people about the topic or the problem
Limiting the problem: means stating the problem carefully

Form a Hypothesis

hypothesis: a possible solution (it is a guess - but an educated one) (a prediction that can be tested)

Test the Hypothesis

A scientist will then gather evidence that will either support or disprove the hypothesis.
This is done one of two ways:
- by conducting an experiment
- by conducting a survey

This information (evidence) is called data.
data: pieces of information (facts, figures, and other evidence gathered through observations)
Data must be measured and recorded accurately.

In experiments you have:

Experimental variable (factor): a condition that affects the result of an experiment (also known as independent variable or manipulated variable)
A variable is something in an experiment that can change. Each experiment should have only one variable.

Control group: the group, in an experiment, that is not exposed to the experimental variable
A control is the standard to which the outcome of a test is compared.

Experimental group: the group that is exposed to the experimental variable

survey: a set of observations that are made to determine what is a common practice in a particular area

Classify and Analyze the Data

classify: arranging so relationships can be seen
often involves grouping or sorting the data (making a chart or table) which makes answers easier to find
Graphs can reveal patterns or trends in data.

analyzing: determining whether a set of data supports a hypothesis

Choose and Verify the Answer

Once an answer is chosen, it must be verified.
How? Gathering additional data through experiments or surveys.
The more data that is found to support the answer, the more likely it is that the answer is correct.
Proving and verifying are not the same. A scientist can never completely prove an answer. Why? Because it is based on observations done by humans who make mistakes.
The goal is to find a workable answer.
workable: able to be used successfully

Predict Outcomes

predict: to make a statement about the expected future outcome of a certain action