CHAPTER 1 - INTRODUCTION

This course is intended to be an introduction to general science for non-science majors. Though the emphasis is on science concepts, it is written from a Biblical Christian perspective. Scripture quotations will be from the King James Version unless noted otherwise.

I. WHY SHOULD CHRISTIANS STUDY SCIENCE?

Visual #1-1

The word science is from the Latin *sciencia*, meaning "knowledge." So why should Christians study science? After all, 1 Cor. 2:2 shows that the only thing necessary for salvation is belief in Christ and Him crucified. However, our relationship with God should not stop with our own salvation. Jesus told us that the greatest commandment is "Thou shalt love the Lord thy God with all thy heart, and with all thy soul, and with all thy mind" (Matt 22:37). Many Christians seek to glorify the Lord by using their minds to learn more about Him and His creation. (Or, they simply have to satisfy a course requirement!)

Proverbs 1:7 tells us that the fear of the LORD is the beginning of knowledge (Hebrew *da'at*, Strong's number H1847) and the Ps. 111:10 says that the fear of the LORD is the beginning of wisdom (Hebrew ḥ*okmâ*, Strong's # H2451). Thus, if we want knowledge and wisdom the most important thing for us to know is the fear of the LORD. However, we are not intended to live unto ourselves (2 Cor. 5:15), but for Christ. We are intended to be a light to those whose lives we touch (Mt. 5:16). This sometimes includes our being able to explain why we believe the things we do. As 1 Pet. 3:15 says, "But sanctify the Lord God in your hearts: and be ready always to give an answer to every man that asketh you a reason of the hope that is in you with meekness and fear…"

The "hope" referred to is in Christ as our Savior. How do we know that He really is the Savior? Through God's Word. At a deeper level, then, our hope lies in our belief that God has told us the truth in the Scriptures.

It is not the intention of this course to prove that the Bible is true. The intention is rather to show how true science is completely compatible with it.

It has been said that the Bible not a science textbook. This is correct. First, unlike many science textbooks, it has never had to be revised as new discoveries occur. Second, it does not give us detailed lessons in any area of science – chemistry, physics, geology, paleontology, and so on. Nevertheless, it has never been shown to contain a single error in any area of science that it does mention.

Some statements in the Bible are clearly miraculous, such as Gen. 30:37-41. It is impossible to test such events.

Visual #1-2

> And Jacob took him rods of green poplar, and of the hazel and chesnut tree; and pilled white strakes in them, and made the white appear which was in the rods. And he set the rods which he had pilled before the flocks in the gutters in the watering troughs when the flocks came to drink, that they should conceive when they came to drink. And the flocks conceived before the rods, and brought forth cattle ringstraked, speckled, and spotted… And it came to pass, whensoever the stronger cattle did conceive, that Jacob laid the rods before the eyes of the cattle in the gutters, that they might conceive among the rods.

God had already decided to bless Jacob. He did not do so because the colors of the rods made it happen, but in spite of Jacob's ignorance.

Despite the miraculous events it records, many of the Bible's scientific statements can be tested. A few examples that have been demonstrated to be correct:

- "In the beginning" - Gen. 1:1 The universe is not infinitely old, but had a beginning
- Each star is unique - 1 Cor. 15:41

Visual #1-3

- "He hangeth the earth upon nothing" - Job 26:7
- Circulation of the atmosphere - Eccl. 1:6
- Living things reproduce only after their "kind"
- Humans made of the elements found in the dust of the earth - Gen. 3:19
- Humans have sometimes dwelt in caves (Job 30:5-6)
- The hydrologic cycle - Job 36:27-29, Ps. 135:7, Jer. 10:13, Eccl. 1:6-7, Isa. 55:10
- The earth is circular - Isa. 40:22
- The earth turns - Job 38:14
- The sun moves across the heavens. "His going forth is from the end of the heaven, and his circuit unto the ends of it…" (Ps. 19:6) The Bible says the sun is making a lengthy circuit through space, NOT that it orbits the earth!
- Air has weight - Job 28:25
- Springs in the sea ("fountains of the great deep") - Gen. 7:11, Job 38:16
- There are channels (valleys) under the surface of the sea - 2 Sam. 22:16
- Paths in the sea (ocean currents) - Ps. 8:8
- Entropy (things wear out) - Ps. 102:25-26
- All things held together by an unexplainable force - Col. 1:17 "And he is before all things, and by him all things consist." The Greek word translated "consist," συνέστηκεν, means "hold together."
- "By what way is light diffused…" Job 38:24 NKJV, I.e., the sunlight spreads by diffusion
- Heavens cannot be measured - Jer. 31:37
- Stars too numerous to count - Gen. 15:5
- There is water in space - Ps. 148:4
- Visible things made out of things that cannot be seen - "Through faith we understand that the worlds were framed by the word of God, so that things which are seen were not made of things which do appear." Heb. 11:3

II. SCIENCE AND THE NEED FOR GOD.

Atheists scoff at Christians because we believe in the existence of God. An atheist will often say something like, "I can't believe in something I can't see." But what he doesn't realize, or won't admit, is that he DOES believe in something he can't see. Creation and theistic evolution both require us to believe in something outside the realm of science - but so does atheistic evolution.

A. CHARACTERISTICS OF CREATIONIST'S GOD.

Visual #1-4

Creation requires a God who has certain characteristics:

1. He cannot be seen directly. His presence can only be detected by what He does. He is INVISIBLE.
2. If God established the laws of nature, He is obviously not subject to those laws. He is above nature, or SUPERNATURAL.
3. He has existed since before what we call "time" began. He is ETERNAL.
4. Where is God? Everywhere. His influence extends throughout the universe. He is OMNIPRESENT.
5. If God brought matter and energy into existence and then brought about laws to govern their operation, then He is either directly or indirectly responsible for everything that has ever happened. He is all-powerful, or OMNIPOTENT.
6. Who made God? Nobody. He is SELF-EXISTENT.

B. CHARACTERISTICS OF THEISTIC EVOLUTIONIST'S GOD.

It would seem that the creationist is in trouble. After all, he needs to appeal to something

invisible, eternal, supernatural, omnipresent, omnipotent, and self-existent in order to justify his belief. But evolutionists are no better off. The vast majority believe that evolution occurred under the guidance of God (*theistic evolution*). Since this belief depends upon the existence of God it has no scientific advantage over creation. It seems that atheistic evolutionists hold the only truly scientific position. Or do they?

C. CHARACTERISTICS OF ATHEIST'S "RANDOM CHANCE."

Visual #1-5

For the sake of argument, let's assume that the atheists are right and rule out God. If this is the case, how did the universe get here? Call it "Mother Nature," a lucky series of accidents, quantum fluctuation, or whatever you will, but the universe would have to be the product of a collection of forces, processes, and events operating for billions of years without any particular purpose. Let's call the whole collection Random Chance for short, with the understanding that Random Chance is not a tangible thing in itself but is a term used to describe the whole series of forces, processes, and events. Following are some of the characteristics that logic demands it must have.

Visual #1-6

1. It cannot be seen directly. Its presence can only be detected by what it does. It is INVISIBLE. (You can turn the tables on your atheist friends and ask them, "You mean you believe in something you can't see?")
2. If Random Chance established the laws of nature, it is obviously not subject to those laws. It is above nature, or SUPERNATURAL.
3. It has existed since before what we call "time" began. It is ETERNAL.
4. Where is Random Chance? Everywhere. Its influence extends throughout the Universe. It is OMNIPRESENT.
5. If Random Chance brought matter and energy into existence and then brought about laws to govern their operation, then it is either directly or indirectly responsible for everything that has ever happened. It is all-powerful, or OMNIPOTENT.
6. "Who made Random Chance?" Nobody. It is SELF-EXISTENT.

Neither Creation, Theistic Evolution, nor Atheistic Evolution has any scientific advantage over the others on this point. All require us to believe in something invisible, eternal, supernatural, omnipresent, omnipotent, and self-existent. (Of course, Random Chance would not have any personal characteristics such as omniscient, loving, wise, merciful, and so on.)

THERE IS NO POSSIBILITY THAT GOD DOES NOT EXIST! You may call your God Jehovah, Yahweh, Allah, or Random Chance, but you HAVE TO believe in some sort of a god. Even the most determined atheist has no choice but to admit that he, too, has a god - Random Chance. Since the Bible tells us that "Whoever would draw near to God must believe that He exists..." (Heb. 11:6 RSV), the greatest service you can do for your atheist friends is to confront them with the realization that it is impossible NOT to believe in a god of some sort. By lovingly confronting your atheist friends, you may start them on a quest which will ultimately lead them to the REAL God.

Whichever choice we make, we must take a step of faith. Suppose we choose to believe in the God of the Bible, and live accordingly. There are two possibilities: either we are right or wrong. (You may recognize the following as "Pascal's Wager.")

PASCAL'S WAGER.

Visual #1-7

1. If we are right, at the end of our earthly lives we are headed to a glorious eternity in heaven.
2. If we are wrong, we will live a life of joy and expectation, come to our deathbed fully expecting to meet our Savior, lose consciousness at our death, and never know we were wrong. Meanwhile, we will have lived a happy and fulfilled life, so we're no worse off.

Suppose instead that we reject the possibility that God exists. Again, we may either be right or wrong.

3. If we are right, we will live a life filled with the constant certainty that we will one day die. We may try to do good while we are here on earth, but what's the point? If there is no God, then all the stars will one day burn out and all life will become extinct. All our good deeds will have counted for nothing.
4. If we are wrong, we will go to our deathbed expecting to simply lose consciousness, then, at the moment of death, we will suddenly become aware of the presence of a dreadful being -- the God whose existence we denied -- to whom we must give an account for our lives. The Bible says that "...he that cometh to God must believe that he is..." (Heb. 11:6) -- that is, there will be no atheists in heaven. You will be headed for an eternal hell.

Visual #1-8

Atheists sometimes ridicule those who believe in God, saying that we believe in "an invisible man in the sky" who made everything. Let's take it a step further. Before Jesus became a man, He was always an *intelligence*. One might therefore say that we believe in an invisible intelligence in the sky that is so powerful that it (He) is responsible for all the parts of the universe in all their complexity, from the largest scale (cosmology) to the smallest (subatomic).

What alternative does atheism offer? Atheists believe in an invisible *NON-intelligence* in the sky that is so powerful that it is responsible for all the parts of the universe in all their complexity, from the largest scale (cosmology) to the smallest (subatomic). Yet they claim that they are the only true scientists!

An atheist's step of faith moves him toward an impersonal god that doesn't know he exists and doesn't care about him. Our step of faith moves us toward a personal God who knows how many hairs we have on our heads and loves us so much He sent His Son to die for our sins. If atheists are right nothing matters anyway and we believers are no worse off than they are. If we're right, we're headed for heaven but atheists are headed for an eternal hell. Which step of faith is more reasonable?

III. THE RELIGIOUS ROOTS OF SCIENCE.

Science itself has its roots in religion.

Visual #1-9

There are two main groups of religions in the world: Western (Christianity, Judaism, Islam) and Eastern (Hinduism, Buddhism, and the like). Some Eastern religions believe that the physical universe is an illusion. In some branches of Hinduism, for instance, the whole universe is part of a dream being dreamed by the great god Vishnu. You and everything around you are merely parts of his dream. If this is the case, there would be no point in trying to study and measure it, because we – who are parts of a dream ourselves – would be studying and measuring a dream.

Western religions, on the other hand, believe that the physical universe is real and that we can study and measure with some degree of accuracy. (Atheists recognize this as a reasonable belief and follow it also.) There is no way a follower of Western religion can prove to a follower of Eastern philosophy that he is wrong, or vice versa. Either school of thought requires a step of faith.

The logical outcome of Eastern religious thought: there is no point in studying the physical universe because it isn't real anyway. The logical outcome of the Western school of thought: the scientific method. If not for Western religions there would be no such thing as science.

IV. HOW DO YOU KNOW WHAT YOU KNOW (OR THINK YOU KNOW)?

The branch of philosophy that has to do with how we know the things we think we know is called *epistemology*. In light of movies such as the "Matrix" trilogy, we might wonder how we know anything at all for sure. Is there really a universe out there, or is it all just an illusion?

A. SOLIPSISM.

Visual #1-10

Hundreds of years ago the noted French philosopher Descartes struggled with the question of whether the universe is real. He wondered what, if anything, he could be absolutely certain about. After all, most people recognize that their senses are not always completely trustworthy. What if you are all alone in the universe and everything is just a figment of your imagination, made up either to prevent you from going insane or because you already *are* insane? (If this thought has ever occurred to you, you are not alone. It is common enough that it has a name, *solipsism*.)

If you follow Descartes' logic to its extreme, you must conclude, as he did, that the only thing you can be absolutely certain about is that you exist. As Descartes put it, "I think, therefore I am." In order for you to even question whether you exist, there must be someone to ask the question.

Beyond the certainty of your own existence, everything else you think you know is based on a greater or lesser amount of faith. If you want to know whether it makes sense to believe in anything besides yourself, ask yourself where you came from. Unless you are insane you do not remember making yourself. Therefore, you would have to conclude either (1) that you have always existed, (2) that you made yourself and forgot about it, or (3) that someone else made you. If you choose to believe either of the first two, there is nothing anyone could say or do to persuade you otherwise. However, if it seems more reasonable to you – by faith – that you had a definite beginning, you would naturally conclude that someone or something outside yourself is responsible for your existence. There must be at least one other entity besides yourself. This could be either your concept of God ("Know ye that the LORD he is God: it is he that hath made us, and not we ourselves" - Ps. 100:3) or else it could be Random Chance.

If you are the result of random processes, those processes are not conscious. They could not deliberately make sure your senses constantly deceive you. Or if you take a step of faith to believe that there is a God, you would wonder: if He took the trouble to make you, is it likely that He wants you to be totally deceived about the nature of your own existence? If you choose by faith to believe so, you may be living in a Matrix-like illusion. The alternative is to believe – again, by faith – that God made you in such a way that, even though your senses may not be totally trustworthy, they are at least somewhat reliable. In that case, the world is real and you are not alone!

If you are not willing to believe that the universe really exists then you might as well stop reading because this book really doesn't exist anyway. However, if you are willing -- still by faith – to admit that the universe is real, how can you know things about it?

B. SCIENTIFIC KNOWLEDGE.

As noted previously, the word *science* came from the Latin word for knowledge. Thus, we "do science" in an attempt to gain new knowledge. But what does it mean to know something? (The following is inspired by and expanded from Michael Behe's excellent book *Darwin's Black Box*, ISBN 0-684-82754-9.)

Take a few minutes and make a list of some of the things you know, or at least think you know. Just a few examples:

- Perhaps you know what a bee sting feels like.

- You may know when you were born.
- You may know how far away the sun is.
- You may know what it feels like to love someone.

But how do you know these things?

1. **SENSES.** Many of the things we say we know are because of personal experience through the physical senses.

Visual #1-11

> We learn in school that there are five senses: sight, hearing, smell, touch, and taste. However, there are other senses such as hunger, balance, and *proprioception*, the sense of where our body parts are. Here we are concerned only with the traditional five senses.

Assuming our senses are functioning normally, we see colors, hear sounds, smell odors, feel textures, and taste flavors. Thus, we know colors, recognize voices, feel pain, and so on. Such sense knowledge has the potential to be duplicated so that anyone in the world with normally functioning senses could experience it in much the same way.

Of course, not everyone's senses work the same. A blind or deaf person would not be able to know some of the above things in the same way most people can. They would have to rely on an authority to describe those things, as below.

2. **AUTHORITY.** There are a great many things we say know not because we have personal experience, but because somebody – an authority – told us and we decided to trust them.
   - If you have never been stung by a bee you could provoke one so as to get the experience for yourself, or else you could trust somebody else's description of what it feels like.
   - You may think you know when you were born. But how do you know? It is not likely that you remember emerging from the womb and looking at a calendar to see what day it was. Instead, you trust what your mother told you. And how do you know she really is your mother? She told you that too. You made a decision to trust her. After all, she fed you, clothed you, changed your diapers, hugged you, tucked you into bed, and so on, so why would she lie to you?
   - Since none of us has a tape measure long enough to measure the distance to the sun, how do we know how far away it is? We read it in a book and decide to trust it.

     There are hundreds of experiments described in science books. Few of us are likely to repeat all of them ourselves, but we accept the statements and trust the authority of the authors.
   - How do we know who the first President of the United States was? We read it in a book and decide to trust it.

   In each case, we have to decide whether the authority really is trustworthy. As Christians, we should be aware that we should not necessarily believe everything. (1 Jn. 4:1 - "Beloved, believe not every spirit, but try the spirits whether they are of God: because many false prophets are gone out into the world.") We will need to be especially cautions in the last days, when the Bible warns us to beware of "… him, whose coming is after the working of Satan with all power and signs and lying wonders, And with all deceivableness of unrighteousness in them that perish; because they received not the love of the truth, that they might be saved" (2 Thess 2:9-10). Sometimes people lie!
3. **LOGIC.** You know how far away the sun is because you read about it in a book. But how did the person who wrote the first book about it know what the distance was? By logic. They used principles of geometry and physics to calculate the distance.

   Likewise, people claim to know that the universe and earth are billions of years old. But how do they know? They surely do not have sense experience, nor can they refer

to an authority that claims to have such experience. They, too, rely on logic.

There are several different types of logic. Those relevant to science are known as *deductive* and *inductive*.

a. Deductive Logic.

Visual #1-12

Deductive logic starts with certain presuppositions (also known as axioms, postulates, or assumptions) accepted as self-evident without proof. We assume that those presuppositions are absolutely true and use them to draw conclusions which must also be absolutely true. For example, if you have ever read the Declaration of Independence you have encountered the presupposition "We hold these truths to be self-evident…"

Since deductive logic starts with general principles then applies them to specific cases, it is also known as *a priori* logic. Deductive logic is the basis of much of mathematics. Geometry, for example, is based on 23 postulates, general principles accepted as absolutely true by the ancient mathematician Euclid and others. If those postulates are true, then the theorems, corollaries, and lemmas of geometry must also be true.

Visual #1-13

Deductive logic is often arranged in a conditional argument in the form of "If P then Q," that is, if the first condition is true then the second is also. This is followed by an *affirming* statement, "P." The conclusion must be "Q."

An example of this would be something like:

"If someone is a human then they are mortal," followed by
"I am a human," leading to the conclusion
"I am mortal."

Syllogisms can also be chained. We could say,

"If I live in Louisiana then I live in North America.
"If I live in North America then I live on earth.
"If I live on earth then I live in the Milky Way galaxy," and conclude that if I live in Louisiana then I live in the Milky Way galaxy.

i. Need for correct premises.

Visual #1-14

What if one of the postulates is false? Euclid's Parallel Line Postulate implies that if a point does not lie on a given line, then there is exactly one line through that point parallel to the first line. (Any other line would either intersect the first or else be a skew line in a different plane.) Though the postulate seems to make sense, in order to prove it we would have to examine every line and every point in the universe.

Others think that when it comes to extreme cosmological distances, this postulate is simply wrong. Lobachevsky believed that on a large enough scale there is no such thing as a straight line, so an infinite number of parallel lines could pass through the external point. Riemann believed that space curves in such a way that all lines intersect at infinity, so there are no such things as parallel lines. There is no way to prove either Euclid's postulate or either of the alternatives. Though Euclidean geometry is used in measurements on earth and in the solar system, we cannot be sure it would work on a large enough scale.

Whether we call them presuppositions, axioms, or postulates, deductive logic depends on statements accepted as true. It is usually set up in the form of a

syllogism. This structure starts with a major premise (an axiom) accepted as true, then a minor premise also accepted as true, and ends in a conclusion that must also be true. For instance, if we start with the major premise

"All humans are mortal" and add the minor premise
"I am a human," we are forced to the conclusion
"I am mortal."

But what if either of the premises is not correct? In that case, the conclusion may be false. For instance, if I start with the major premise

Visual #1-15

"All dogs bark" and add the minor premise
"Snoopy is a dog," then I would be forced to conclude that
"Snoopy barks."

However, it is not true that all dogs bark. Snoopy may be bashful, he may have a sore throat, or he may belong to the Basenji breed of Africa from which the ability to bark was eliminated by selective breeding (presumably so as not to frighten away prey). Since not all dogs bark, perhaps Snoopy is one of the exceptions.

ii. Need for correct structure.

Besides the need for correct premises, a second condition for reaching a reliable conclusion by deductive logic is that the structure must be correct.

Normally, a conditional statement is set up in the form

If P, then Q

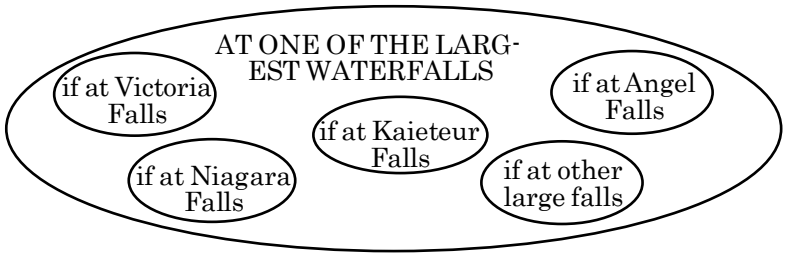
Reversing this we get the *converse* If Q, then P.

Visual #1-16

(There are other aspects of conditionals such as *inverses* and *contrapositives*, but they are not pertinent at this point.)

Suppose someone makes the statement, "If I am at Niagara Falls then I am at one of the largest waterfalls on earth." This is true. However, the converse, "If I am at one of the largest waterfalls on earth then I am at Niagara Falls," is not reliable because there are many other large waterfalls.

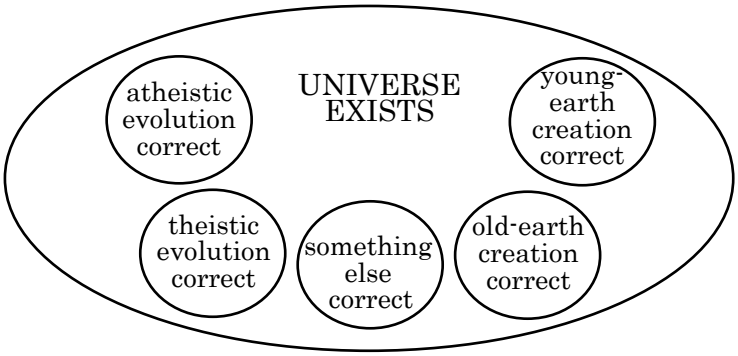
Visual #1-17



This sort of error is called *affirming the consequent.* The only way a converse is automatically true is in a *biconditional*, which can be expressed as an "if and only if" statement such as, "If and only if I am at Mount Everest, then I am at the highest mountain in the world."

Likewise, it is valid to say "If evolution is correct, then the universe and life would exist." It is invalid to say, "If the universe and life exist, then evolution is correct" because more than one explanation is possible: young-earth creation, old-earth creation, atheistic evolution, theistic evolution, or something else we haven't thought of. The fact that the universe exists does not automatically tell us which is the correct explanation.

Visual #1-18



This principle is pertinent to science because, as we will see in our discussion of evolutionary concepts in biology, many textbooks affirm the consequent and treat evolution as the only possible explanation for the origin and development of life.

b. Inductive Logic.

Visual #1-19

Deductive logic starts with general principles (*a priori*) and applies them to specific examples. By contrast, inductive logic works by examining many specific examples and looking for the most reasonable explanation (*a posteriori*).

Science is supposed to work by inductive logic and thus can only lead us to what seems to be the most reasonable explanation. No matter how confident we are about our results, we should be honest enough to admit that science can never bring us to absolute certainty. There could be something we have overlooked.

As time goes on, we will probably keep correcting earlier ideas. For instance, the ancient Greeks thought that everything on earth was made of the four essences earth, air, fire, and water, and that the heavenly bodies were made up of a fifth essence, the *quintessence*. There is no question that they were wrong. Will we ever be able to be sure that our present understanding of matter is absolutely true? No, but we can be confident that we are less wrong than they were.

4. INTUITION OR FEELING.

Visual #1-20

A fourth type of potentially valid knowledge is intuition, or a "gut feeling."

- If you were standing next to the prophet Jeremiah when a word came to him from the Lord, you would not have heard a thing. He would not feel compelled to prove that he really did hear from the Lord.
- If you believe that some person is your "soul-mate," you do not need to prove it to anybody (except perhaps that person).
- If you believe you know your purpose in life, you do not need to prove that to anyone.

Perhaps your intuition is correct, or perhaps it is just an emotional reaction to something. Either way, it is for you only. It is certainly not part of science.

There are also several types of so-called knowledge that are not really knowledge at all.

5. WISHFUL THINKING.

Sometimes people delude themselves into believing that something that they really want to happen will indeed happen.

- For instance, not many people who buy lottery tickets say, "I love my state so much that I am going to donate the cost of this lottery ticket to it." More likely, they are telling themselves something like "I just know these are the winning numbers!"
- Or, a man who is obsessed with a movie star gets the idea that if he shows up at her home with flowers she will fall in love with him and leave her husband.

It *could* happen, and the person really wants it to, but it is not very likely.

6. **BLUFFING**.

We might think of bluffing as controlled lying. Those who are bluffing are trying to get others believe that something false is actually true, usually for an ulterior motive.

- A football team plans to run to the right, but tries to make the other team think they plan to pass to the left.
- A player in a poker game tries to make others think he has a better hand than he actually does so as to win their money.
- Even in science, there have been instances where a person trying to achieve fame or position makes up claims that go far beyond the facts. For instance, someone might claim that he has made a great archeological discovery, when his motive is to open up a museum and sell tickets.

In the case of bluffing, the individual tries to get others to believe something that he doesn't even believe himself.

V. COULD THERE BE SUCH A THING AS ABSOLUTE TRUTH?

Visual #1-21

Some college professors tell their students that there is no such thing as absolute truth. An appropriate response to such a claim would be, "Is that absolutely true?" The original statement was self-contradictory. It takes as absolute truth the claim that there is no absolute truth.

Since our senses are not 100% reliable, we cannot depend on them for absolute certainty. Nor is our logic or intuition always completely trustworthy. The only way we could be absolutely certain that something was true would be if a perfectly reliable eyewitness told us.

Visual #1-22

This disqualifies every human. However, it is possible that there could be a supernatural God who could reveal absolute truth to us.

VI. TYPES OF KNOWLEDGE USED IN SCIENCE

The process we call "science" has developed through the centuries. For the ancient Greeks, what constituted science had little to do with experimentation but relied almost entirely on logic. Modern scientists, on the other hand, are supposed to rely on experiments as they "do science."

Though there is not only one way to approach the study of the natural world, when we refer to scientific methods we usually follow steps such as the following. Note that scientific methods rely not just on one type of knowledge, but on at least three.

Visual #1-23

1. You become curious about something in nature (SENSES) and ask a question.
2. You do research into what others have already done. (AUTHORITY)
3. You come up with a testable hypothesis about what you think is going on. (DEDUCTIVE LOGIC – *if I do <u>this</u>, then I expect <u>that</u> to happen*)
4. You devise a way to test the hypothesis by experimentation and observe the results. (SENSES)
5. You repeat the experiment enough times that you feel confident in your conclusions (SENSES, INDUCTIVE LOGIC).
6. You publish your results so that your peers can review them for errors and either confirm or refute them. You now become the AUTHORITY.

Wishful thinking and bluffing have no place in science. The only place INTUITION might possibly be involved would be as you were trying to come up with a hypothesis, but it would still need to depend on logic. Others are not interested in your intuition, only in whether the hypothesis is logical.

VII. SCIENCE, HISTORY, AND BELIEF.

A. SCIENCE: PRESENT, REPEATABLE, OBSERVABLE.

Visual #1-24

1. ***Observable.*** Science requires one or more OBSERVERS who use their senses (sight, hearing, etc.) or some sort of mechanical means to record what happens so they can observe it later.
2. ***Repeatable.*** In order for the processes or events to be tested as many times as desired, they must be REPEATABLE so they can be tested.
3. ***Present.*** Because we can neither observe nor test the past (we can't put it in a test tube and experiment on it), science can deal only with PRESENT processes and events.

B. HISTORY: PAST, NON-REPEATABLE, EYEWITNESSES.

Knowing things about the past is different. Though none of us was there, we believe that George Washington was the first President. We can't put him in a test tube and do experiments, nor can we repeat the events that made him President. However, the fact that there were OBSERVERS allows us to make *historical* statements about what happened.

1. ***Eyewitnesses.*** History requires at least one eyewitness OBSERVER. Before we decide to believe the statements of the alleged eyewitnesses, we must judge how trustworthy they are or were.
2. ***Past.*** It deals with PAST processes or events.
3. ***Non-Repeatable.*** Since the events occurred in the past, they are NON- REPEATABLE and thus untestable.

C. BELIEF: PAST, NON-REPEATABLE, NO EYEWITNESSES.

If there are no eyewitness accounts for a past event (e.g., the extinction of dinosaurs) the best we can do is make an educated guess. We can examine circumstantial evidence such as impact craters and chemical composition of geologic strata, but without an eyewitness account we can never really be sure we are right. Even if we come up with what we think is a plausible explanation, we can't be sure that our process is the same one that actually happened. Thus, if an alleged event had the following characteristics:

1. ***No Eyewitnesses***,
2. Deals with ***Past*** processes or occurrences,
3. ***Non-Repeatable*** and thus ***non-testable***,

the best we can do is come up with a BELIEF. If we try to use this belief as a unifying principle for many phenomena it becomes a BELIEF SYSTEM. If we use it as a guide for living, it may even develop into a RELIGION. As we will see, evolution is supposed to be Past + no eyewitnesses + non-repeatable. This makes it a BELIEF SYSTEM.

D. OPERATIONAL (EMPIRICAL) vs. "HISTORICAL" SCIENCE.

The "operational sciences" such as chemistry deal with the way things work in the world today and are subject to direct experimentation. However, the "historical sciences" such as archaeology and so-called "historical geology" do not allow direct experimentation but rely entirely on interpretation of rocks, artifacts, and the like. (Historical geology should not be confused with petroleum geology, which has to do with repeatable observations used to find oil deposits in the present.)

The historical sciences are attempts to explain how things got to their present condition. This is not to say that they are necessarily wrong, but we would do well to be skeptical about things that cannot be tested.

CHAPTER 1 REVIEW QUESTIONS

1. Give an example of a scientifically accurate statement in the Bible.

   _____

2. List six characteristics that would have to be true of either God or Random Chance.

   _____ _____

   _____ _____

   _____ _____

3. Give an example of a characteristic of the God of the Bible that would NOT be true of Random Chance.

   _____

4. Some adherents of Eastern religions such as Hinduism believe that the whole universe is an _____, part of a dream being dreamed by one of the highest gods.
5. The belief that you are all alone and are making up the rest of the universe to keep from going insane is called _____.
6. Identify something you know through your senses. _____
7. Identify something you know only through authority that you cannot test for yourself.

   _____

8. Identify something that humans say they know only through logic, but no one is able to test.

   _____

9.. What would be the only way we could have absolute certainty in our knowledge?

   _____

10. What are the three types of knowledge used in scientific investigation?

    _____ _____

    _____

11. Science occurs in the _____, can be tested because it can be _____, and requires one or more _____.
12. History occurred in the _____, cannot be _____, but we believe it because we have _____ accounts.
13. If evolution (e.g., apes to humans) occurred it was in the _____. It cannot be _____. We have no _____ accounts. It is nothing more than a _____ system.
14. "Historical geology" and archaeology are not considered operational science because they deal with events that cannot be repeated so as to be _____.