

Chapter Nine - Science and Pseudoscience

"We are living at a time of rising interest, on the part of an uninformed public, in wild beliefs which the entire science community considers close to zero in credibility."
--Martin Gardner

"The most common of all follies is to believe passionately in the palpably not true. It is the chief occupation of mankind."
--H. L. Mencken

Many of our students emerge after years of compulsory education with no grasp of the nature of science. Polls done for the National Science Foundation have repeatedly found that many Americans are scientifically illiterate. Millions of Americans believe that the sun goes around the earth, that it takes one day for the earth to orbit the sun, that an electron is larger than an atom, and that sound travels faster than light. Most Americans could not tell you what a molecule is.

The great majority of American high school graduates have not had a day's instruction in algebra, physics, or chemistry. In one survey, 75 percent said they believe antibiotics are effective against viruses. In another, one in six could not identify DNA. One study even found that about 19 percent of high school biology teachers erroneously believe that dinosaurs and humans lived at the same time. Dr. Raymond Eve, director of the study, was most surprised by the finding that 95 percent of the teachers surveyed seemed to misunderstand what science is all about. Given the statement, "Scientists seek facts, but sometimes the best they can do is theories," only 5 percent correctly answered "definitely false."

Only about one-fourth of the biology teachers responding to Eve's study have degrees in biology. A study on physics instruction found the same statistic for high school physics teachers: only a fourth hold degrees in physics. According to a promotional piece for the chemistry department at Jarvis Christian College "a high percentage of our nation's students are learning chemistry from teachers who have no degree in chemistry."

Some blame our scientific illiteracy on our education system. Others blame the media. Some blame politicians who promote science only when it accords with their own religious views. Whatever the reason may be, many scientists and defenders of science are convinced that America is becoming less and less rational. We may be living in an age of science, but it is also very much an age of wild beliefs.

1. Wild beliefs in the age of science

Despite the fact that scientists almost universally agree that astrology has no scientific credibility, belief in

astrology increased from 25% to 28% over the last decade of the 20th century, according to a Gallup poll. According to the same poll, belief that some people can get messages from the dead has increased from 18% to 26%. This number has probably increased recently due to the popularity of self-proclaimed psychics like James Van Praagh. He claims he has a special gift that enables him to receive messages from anyone who has died. He appears frequently on entertainment talk shows such as Larry King Live, where he says he hears voices of spirits who want him to pass on a message to his host or to members of the audience. He even claims to get messages from the dead pets and from the spirits of those who telephone the show. He passes on information such as, "It's nice over here" and "I forgive you." Or he throws out cryptic messages such as "There is a Miss Piggy involved here" or "Your

The National Opinion Research Council reports that 42 percent of American adults believe they have been in contact with someone who has died (up from 27 percent a decade earlier). And two-thirds of American adults say they have experienced extrasensory perception (ESP). Twenty-three percent believe in reincarnation.

-- John Dart, "The 'New Age' Christians : Parapsychology comes out of the closet in theological circles," San Francisco Chronicle, March 8, 1987.

dog is upset that you gave away his favorite food bowl.” There is a two-year wait for those who want a private reading from Mr. Van Praagh. Similar stories can be told about others who have found a large market for the bereaved, such as John Edward, Silvia Browne, George Anderson, and a host of others. The list of pet psychics is also growing, led by Sonya Fitzpatrick, who always asks the pet owner for the pet’s name before proceeding to tell the owner that the pet wants him or her to know this or that.

Millions of people believe psychics have a special gift that brings them into direct contact with the spirits of the dead, even dead animals. This belief not only supports their hope that there is life after death, it gives them hope that they might be able to make contact with a loved one who has died, even a beloved spaniel. These hopes are so strong in some people that they lead to irrational behavior. Take this example from Sylvia Browne and Larry King on the Larry King Live show (December 5, 2003):

KING: Shizuoka, Japan. Hello.

CALLER: Oh, hi.

KING: Hi.

CALLER: I’d like to ask about my mother. We had some unresolved issues.

BROWNE: Yes. But I don’t know if you could have had any resolved issues with your mother because she was so very difficult to deal with. And I’m not saying that to be cruel. So, you see, the thing that you got to realize is when somebody goes to the other side, everything is OK.

CALLER: But she’s -- you can definitely see her on the other side?

BROWNE: Yes. Little. She’s little.

CALLER: Yes, well, the last time I spoke to her, she was alive.

BROWNE: Yes, but see, I don’t -- she’s not alive now.

CALLER: She’s dead.

BROWNE: Yes.

CALLER: You’re telling me my mother has died?

BROWNE: Yes.

CALLER: You’re sure about this?

BROWNE: I’m positive.

CALLER: OK. Well, I’ll have to get back to you after I’ve called her.

BROWNE: All right.

CALLER: Thank you.

KING: OK, now, what -- she doesn’t know, hasn’t heard from her mother.

BROWNE: No.

KING: And she's trying to reach her, hasn't heard from her.

BROWNE: That's right.

KING: You saw her as gone.

BROWNE: That's right.

KING: OK. And you were truthful enough to say that.

Of course, the caller was never heard from again. Neither King nor Browne will give it another thought. They are not going to follow up and see if the mother is dead or not. Why? They don't have to. The woman's dead. Sylvia "saw her as gone." That's all you need to know. Next caller, please. It doesn't matter that Browne just says whatever pops into her head, no matter how silly or stereotypical. She's little! She's Japanese so she must be little. Even in death the Japanese are little. Everybody else who called wanted to contact the dead, so why would Sylvia assume this lady from Japan was any different? A mother and daughter have unresolved issues and the daughter wants to make contact. What would Browne do if she was confronted with the fact that the mother is alive. She said she was positive the mother had died. She could always say: I never claimed to be infallible. Sometimes I get it wrong. Let's move on. This is a win-win situation for the psychic. If the client can make sense out of what you say, you're right. If the client can't make sense out what you say, you're also right. And if the client can make sense out of what you say and find you in error, you're still right because you never said you were always right. Therefore, whether you're right or wrong, you're right!

Belief in psychic phenomena is widespread, though the scientific evidence for such beliefs is scant. The Gallup poll mentioned above found that belief in ghosts has increased in recent years from 25% to 38%. Belief in ESP has remained steady at 50%. Yet, more than one hundred and fifty years of research has produced little of significance in parapsychology, the science that studies ESP and psychokinesis. As mentalist and author Milbourne Christopher put it: "Many brilliant men have investigated the paranormal but they have yet to find a single person who can, without trickery, send or receive even a three-letter word under test conditions" (Christopher 1970: 37). We still await the first person to move even a pencil across a table without blowing it or pulling it by a thin thread. And we implore all the many self-promoting psychic detectives and clairaudients to use their powers to please tell us where a terrorist will strike next.

Bizarre psychotherapies, with no empirical studies to support their validity, sprout up like mushrooms in the wild. In 2001, two psychotherapists went on trial for smothering a 10-year-old girl to death during "rebirthing therapy." The 70-minute therapy-killing was videotaped. Jurors wept as they watched. The prosecutor called it "torture" not therapy. The therapists were unlicensed, but so is every other psychotherapist in Colorado. They were also unregistered, which is illegal in Colorado. The victim, Candace Newmaker, was found not breathing and with no pulse when she was unwrapped after the procedure. Prosecutors say she asphyxiated on her own vomit. The two therapists were found guilty of "reckless child abuse resulting in death," which carries a mandatory minimum prison sentence of 16 years in Colorado. Rebirthing therapy is now illegal in that state. But many other unorthodox and unproven therapies are not illegal in Colorado or anywhere else.

So-called "alternative" medicine has been joined by "alternative" history and "alternative" science. In each case, "alternative" seems to mean "we don't have to follow traditional rules of evidence and argumentation. We can substitute imagination and desire for proof. We have satisfied customers; that's all that matters." Alternative medicine is often based upon metaphysical beliefs and is frequently anti-scientific. Because truly alternative medical practices would be ones that are known to be equally or nearly equally effective, most alternative medical practices are not truly alternative.

Some of our most popular television programs feature alien visitations, spirits, angels, psychics, healing prayer, and government conspiracies to cover up each of the above. Daily newspapers feature stories on astrology, graphology, or personology, a revitalized version of physiognomy, a 16th century pseudoscience. One is more likely to see a biography of Michel Nostradamus, a 16th century French astrologer, or Edgar Cayce (d. 1945), an

American psychic who predicted California would sink into the ocean and who recommended “bedbug juice” as a remedy for dropsy, than one is to see a biography of Albert Einstein, Sir Isaac Newton, or Carl Sagan.

It is not just avid readers of *The National Enquirer* or *The Star* who are likely to be attracted to tales of alien abductions or of children who can read newspapers by sitting on them. Numerous educated and intelligent people believe and advocate equally incredible claims.

Why is it that occult, paranormal, and pseudoscientific claims are so popular in this Age of Science?

On the other hand, are the critics of *wild beliefs* simply close-minded skeptics who will not give an idea a chance if it does not fit with their preconceived notions of a tidy, scientifically explicable universe? Are the disagreements over alien abductions, channeling, ESP, biorhythms, psychics, apparitions, healing prayer and the like, nothing more than what we would expect when reasonable people tackle complex issues? Are the skeptics too skeptical?

We should note that skeptics of pseudoscience are not all atheists who believe that only scientific claims are meaningful. Many skeptics are religious. Many recognize the *limits* of science and do not restrict themselves to belief in only empirical, scientific matters. On the other hand, believers in pseudoscientific, occult, or paranormal claims are not all ignorant and uneducated. They are not all gullible to the point of intellectual disablement, resenting anyone smarter than they are. Many believers are highly educated, intelligent people, with no axes to grind. Because of the varied natures of skeptics and believers, it is not possible to determine whether an idea is a legitimate scientific idea or a crackpot idea simply by determining *who* holds the idea. Thus, we will not be able to identify *pseudoscience* solely by a set of characteristics that apply to all believers. Nor can we identify something as *science* by a set of characteristics that apply to all scientists. There are distinguishing features of scientists and pseudoscientists, but these features are to be found in their *methods of investigation*, in their *treatment of evidence*, and, to some extent, in the areas they believe are open to scientific discovery. We will consider each of these features, but first let me give the reader some more examples of what Gardner means by *wild beliefs*.

One current *wild belief* is the belief in **channeling**, a process whereby an individual (the “channeler”) claims to be invaded by a spirit entity. The spirit allegedly speaks through the channeler. Actress Shirley MacLaine and the ABC television network gave credibility to this modern version of ghosts speaking through a medium.¹ Channeling has become big business. In 1987 in the San Francisco Bay area, \$15 would get you in to hear “Michael”, an entity said to have had 1,050 beings over time, give personal advice to enthusiastic young professionals. After the show, customers were offered *Acu-Kinetic Repatterning*. For \$520 anyone could become a “certified practitioner,” and for \$150 anyone could purchase the program “Change Your Life Through Colors.” The latter was usually \$275, but this was a special introductory offer.² According to the Gallup poll mentioned earlier, about 15% of adult Americans believe in channeling.

In Tacoma, Washington, people spend thousands of dollars to attend sessions by J.Z. Knight. She claims to channel Ramtha, a 35,000 year-old warrior spirit who once lived in the mythical land of Atlantis. Another *wild belief* is the belief in **alien abductions**. The popularity of books such as Whitley Strieber’s *Communion: A True Story* or movies such as *Fire in the Sky* indicates the attractiveness of the idea of humans being abducted by aliens. Yet, the idea has little or no scientific backing. There are many such ideas that are very popular today, even among educated and intelligent people. John E. Mack, a professor of psychiatry at the Cambridge Hospital, Harvard Medical School, has published an account of his patients who claim to have been abductees.³ After four years of treating some twenty people, Mack says “it became clear to me that I was dealing with a phenomenon that could not be explained psychiatrically, yet was simply not possible within the framework of the Western scientific worldview.” In other words, ‘I don’t think my patients are crazy and there is no way they could be telling the truth unless we abandon all the laws of nature and rules of scientific evaluation of evidence we’ve developed these past two millennia. Therefore, they are probably telling the truth.’ This is not very good logic, but it may make Mack rich and famous. (It was reported that he received a \$200,000 advance for his first book about the abductions.) He has recently published another book, *Passport to the Cosmos: What the Alien Visitations Are Teaching Us* (Crown Publishing, 1999), to prepare us for the new millennium.

Another *wild belief* is the belief in **dianetics**, the so-called “modern science of mental health” created by L. Ron Hubbard. *Dianetics* is a text that has zero credibility in the scientific world, yet it has sold millions of copies and is the foundation of a very lucrative organization, Scientology. Another popular *wild belief* is the belief in **biorhythms**. Like astrology, biorhythm theory holds that your fate is determined by your time of birth. Unlike

astrology, however, biorhythm theory is based on alleged natural cycles, rather than on the positions of celestial phenomena at the time of birth. The numbers 23, 28, and 33 are all you need to know. Where the moon, sun, stars, planets, and the like were at the time of your birth are unimportant. What little scientific study there has been of biorhythms has indicated that the theory is false, yet its adherents remain undaunted.

Finally, there is the popularity of belief in **apparitions**, such as the case of Audrey Santo. A steady stream of letters and visitors pour into the Santo home in Worcester, Massachusetts, where Linda Santo has set up a kind of shrine to her daughter. Many people believe that Audrey has the power of healing the sick. Since 1987, Audrey has been in a coma-like state known as akinetic mutism because of a swimming accident. She was three years old when she nearly drowned. Her mother took her comatose daughter to Medjugorje in the former Yugoslavia, where pilgrims have been going since some young children in the village claimed that the Virgin Mary had appeared to them. (The local bishop investigated the matter and declared that the story was a fraud, but that did not deter the pilgrims.) According to Mrs. Santo, the Virgin Mary appeared to Audrey and asked her if she would agree to become a “victim soul,” someone who takes on the sufferings and ailments of other people. According to her mother, the four-year-old, comatose Audrey agreed. How even a healthy child at age four could understand the concept of a ‘victim soul’ is a mystery. What is not a mystery is that while on the pilgrimage Audrey suffered cardiac arrest and had to be evacuated to the U.S. so she could receive proper medical care. Her mother did not see the cardiac arrest as Audrey’s first experience as a victim soul, however. Instead, she blamed it on being near an abortion clinic. A documentary has been made about Audrey, and she has been featured on the ABC news magazine program *20/20* several times. (For more on wild beliefs, see my *Skeptic’s Dictionary* published by John Wiley & Sons (2003) or my website at www.skepdic.com).

Of course, not all *wild beliefs* are equally wild. Furthermore, not all *wild beliefs* claim to be supported by empirical evidence. When we refer to **pseudoscientific** beliefs, we are not referring to every wild belief imaginable. We are referring only to those that falsely claim to have scientific or empirical validity. Thus, *we do not classify metaphysical or religious beliefs as pseudoscientific, no matter how wild those beliefs may be, as long as they are not claimed to be scientific beliefs*. If a person’s religion requires her to believe that the souls of women are inferior to the souls of men, we do not call that belief *pseudoscientific* unless the believer claims it is a scientific fact. If he believes it on *faith* in some text he holds sacred, it is a **metaphysical** belief, not a pseudoscientific belief. In any case, it is not really the *beliefs* we should be interested in so much as *the methods of arriving at and supporting those beliefs*. After all, there are some *wild beliefs* that are generally accepted by the scientific community as having very strong probability, such as *the theory of evolution of species* and *the Big Bang Theory*. We should not disconnect beliefs from how they were acquired and how they are supported. Scientific methods of testing and evaluating claims are an integral part of scientific claims. When those methods are misunderstood, misapplied, or ignored, the beliefs based on them lose whatever scientific integrity they might otherwise have had. The result is not science but **borderline science, junk science, or pseudoscience**. I prefer the term **pseudoscience**, and will use it in this chapter to describe *those endeavors to defend a claim or theory as scientific when either (1) the methods used to defend the belief are misapplied or misunderstood scientific methods; (2) the belief itself is not capable of being scientifically tested; or (3) the belief is capable of being scientifically tested and has been falsified, but its adherents refuse to give up the belief*.

Before examining some *wild beliefs*, we will first outline what is required of a scientifically credible claim. This should help us understand some important features of scientific reasoning. Then, we will go on to examine some examples of pseudoscience.

2. Scientific facts and theories

Science presupposes a regular order to nature and assumes there are underlying principles according to which natural phenomena work. It assumes that these principles or laws are relatively constant. Science systematically

gathers facts about the empirical world and proposes theories to explain those facts. But this process is more complex than, say, gathering flowers in a basket and then going home to categorize them.

A scientific theory is a unified set of principles, knowledge, and methods for explaining the behavior of some specified range of empirical phenomena. Non-scientists commonly use the term ‘theory’ to refer to a speculation or guess based on limited information or knowledge. However, when we refer to a scientific theory, we are not referring to a speculation or guess, but to *a systematic explanation of some range of empirical phenomena*. Scientific theories attempt to understand the world of observation and sense experience. They attempt to explain how the natural world works. A scientific theory must have *some logical consequences* we can test against Nature by making predictions based on the theory. The exact nature of the relationship of a scientific theory making predictions and being tested is something about which philosophers widely disagree, however (Kourany 1997).

It is true that some scientific theories, when they are first developed and proposed, are often little more than guesses based on limited information. On the other hand, when mature and well developed, scientific theories systematically organize knowledge and allow us to explain and predict wide ranges of empirical events. In either case, however, one characteristic must be present for the theory to be *scientific*. The distinguishing feature of scientific theories is that they are “capable of being tested by experience” (Popper 1959: 40). To be able to test a theory by experience usually means to be able to predict certain observable or measurable consequences from the theory. For example, from a theory about how physical bodies move in relation to one another, one predicts that a pendulum ought to follow a certain pattern of behavior. One then sets up a pendulum and tests the hypothesis that pendulums behave in the way predicted by the theory. If they do, then the theory is **confirmed**. If pendulums do not behave in the way predicted by the theory, then the theory is **falsified**. This assumes that your predicted behavior for the pendulum was correctly deduced from your theory and that your experiment was conducted properly.

The fact that a theory passed an empirical test does not *prove* the theory, however. The greater the number of severe tests a theory has passed, the greater its **degree of confirmation** and the more reasonable it is to accept it. However, to *confirm* is not the same as to prove logically or mathematically. No scientific theory can be proved with absolute certainty.

The more tests that can be made of the theory, the greater its empirical content (Popper 1959: 112, 267). A theory from which very few empirical predictions can be made will be difficult to test and generally will not be very useful. A useful theory is **rich**, i.e., many empirical predictions can be generated from it, each one serving as another test of the theory. Useful scientific theories lead to new lines of investigation and new models of understanding phenomena that heretofore have seemed unrelated (Kitcher 1983). For example, Darwin’s theory of natural selection enormously increased our understanding of biology when it was joined with the new field of genetics (Larson 2004).

However, even if a theory is very rich and even if it passes many severe tests, it is always possible that it will fail the next test. It is always possible that a new hypothesis will be derived from the theory. An experiment may be set up to test the new hypothesis and it may turn out that what *should* follow from the theory does not occur.

Evolution “is a scientific theory only, and it has in recent years been challenged in the world of science and is not yet believed in the scientific community to be as infallible as it was once believed.” --Ronald Reagan

There are at least three errors in this quote from Mr. Reagan: 1. Evolution is a fact *and* a theory (such as Darwin’s theory of natural selection); 2. Natural selection has been challenged but the scientific community has rejected the challenges; and 3. The scientific community has never thought of natural selection or any other theory as infallible.

Karl Popper calls this characteristic of scientific theories “falsifiability.” A necessary consequence of scientific claims being falsifiable is that they are also **fallible**. For example, Einstein’s special theory of relativity is accepted as “correct” in the sense that “its necessary inclusion in calculations leads to excellent agreement with experiments” (Friedlander 1972: 41). This does not mean the theory is infallibly certain.

Scientific facts, like scientific theories, are not *infallible certainties*, either. Noted paleoanthropologist and science writer Stephen Jay Gould reminds us that in science ‘fact’ can only mean “confirmed to such a degree that it would be perverse to withhold provisional assent” (Gould 1983: 254). However, facts and theories are different things, notes Gould, “not rungs in a hierarchy of increasing certainty. Facts are the world’s data. Theories are structures of ideas that explain and

interpret facts.” In Popper’s words, “Theories are nets cast to catch what we call ‘the world’: to rationalize, to explain, and to master it. We endeavor to make the mesh ever finer and finer.”

For many people, ‘theory’ means *uncertain*. To the uninformed public, facts contrast with theories. However, scientific theories vary in degree of certainty from the highly improbable to the highly probable. That is, there are varying degrees of evidence and support for different theories. Some are more reasonable to accept than others. But even the most reasonable scientific theory is not absolutely certain. On the other hand, so-called ‘facts’ are not absolutely certain, either. Facts involve not only easily testable perceptual elements; they also involve interpretation.

One sign that an idea is not scientific is the claim that the idea is infallibly certain and irrefutable. Claims of infallibility and the demand for absolute certainty characterize not science but pseudoscience. The idea of **creationism** is a good example of a non-scientific theory because its adherents claim it is absolutely certain and cannot be falsified. Creationism is the doctrine that God created the universe and all species that have ever existed one by one. Although Karl Popper’s falsifiability notion has been much attacked by philosophers of science (Kitcher 1983), it seems undeniable that there is something profoundly different about such theories as creationism and natural selection. It also seems undeniable that one profound difference is that the metaphysical theory is consistent with every conceivable empirical state of affairs, while the scientific one is not (Carroll 2003: 88). “I can envision observations and experiments that would disprove any evolutionary theory I know,” writes Gould, “but I cannot imagine what potential data could lead creationists to abandon their beliefs. Unbeatable systems are dogma, not science.” Some creationists consider the theory of creation described in *Genesis* to be a *scientific* account, and the Big Bang theory and the theory of evolution to be false.⁴ In this debate, creationists have asserted such things as *evolution is not a fact, it is just a theory*. Some scientists, such as Carl Sagan, on the other hand, have asserted that *evolution is a fact, not a theory*. Stephen Jay Gould claims that evolution is *both* a fact *and* a theory. *That* evolution has occurred is a fact; the mechanism by which it occurred is theoretical. Darwin, notes Gould, “continually emphasized the difference between his two great accomplishments: establishing the fact of evolution, and proposing a theory—*natural selection*—to explain the mechanism of evolution.” Darwin’s proposed theory initiated a very fruitful debate. Creationists, mistaking the *uncertain* in science for the *unscientific*, see the debate among evolutionists as a sign of weakness. Scientists, on the other hand, see uncertainty as simply an inevitable element of scientific knowledge. They regard debates on fundamental theoretical issues as healthy and stimulating. Science, says Gould, is “most fun when it plays with interesting ideas, examines their implications, and recognizes that old information may be explained in surprisingly new ways.” Thus, through all the debate over evolutionary mechanisms no biologist has been led to doubt that evolution has occurred. “We are debating how it happened,” says Gould (1983: 256). What makes so-called “scientific creationism” a pseudoscience is that it attempts to pass itself off as science although it shares very little in common with scientific theorizing. Creationism will remain forever unchanged as a theory. It will engender no debate among scientists about fundamental mechanisms of the universe. It generates no empirical predictions that could be used to test the theory. It is considered irrefutable by its advocates, who will not consider any evidence that might falsify their beliefs.

The history of science, however, clearly shows that *scientific* theories do not remain forever unchanged. The history of science is not the history of one absolute truth being built upon other absolute truths. Rather, it is, among other things, the history of theorizing, testing, arguing, refining, rejecting, replacing, more theorizing, more testing, and so on. It is the history of theories working well for a while, anomalies occurring at times (i.e., new facts being discovered that do not fit with established theories), new facts being discovered that invigorate old theories (like genetics did for natural selection), and new theories being proposed and eventually replacing the old ones partially or completely.

Of course, it is possible for scientists to act unscientifically, to be dogmatic and dishonest. However, the fact that one finds an occasional oddball or charlatan in the history of science (or a person of integrity and genius among pseudoscientists) does not imply that there really is no difference between science and pseudoscience. Because of the public and empirical nature of scientific debate, the charlatans will be found out, errors will be corrected and the honest pursuit of the truth is likely to prevail in the end.

We should remember that science, as Jacob Bronowski put it, “is a very human form of knowledge....Every judgment in science stands on the edge of error.... Science is a tribute to what we can know although we are

fallible” (Bronowski 1973: 374). “One aim of the physical sciences,” he said, “has been to give an exact picture of the material world. One achievement of physics in the twentieth century has been to prove that aim is unattainable” (Bronowski 1973: 353).

Bronowski made his point about the *human* quality of scientific knowledge in a most poignant manner. For the televised version of his *Ascent of Man*, he went to the concentration camp and crematorium at Auschwitz. Millions of Jews, homosexuals and other ‘undesirables’ were murdered and cremated there during World War II. Some of those executed were Bronowski’s relatives. Standing in a pond where the ashes were dumped, and grabbing a handful of muck, he said

It is said that science will dehumanize people and turn them into numbers. That is false, tragically false. Look for yourself. This is the concentration camp and crematorium at Auschwitz. This is where people were turned into numbers. Into this pond were flushed the ashes of some four million people. And that was not done by gas. It was done by ignorance. When people believe that they have absolute knowledge, with no test in reality, this is how they behave. This is what men do when they aspire to the knowledge of gods (374).

Scientific knowledge is *human* knowledge and scientists are human beings. They are not gods, and science is not infallible. Yet, the general public often thinks of scientific claims as *absolutely certain* truths. They think that if something is not certain, it is not scientific and if it is not scientific, then any other non-scientific view is its equal. This misconception seems to be, at least in part, behind the general lack of understanding about the nature of scientific theories.

Another common misconception is that since scientific theories are based on human perception, they are necessarily relative and therefore do not really tell us anything about the real world. Science, according to certain “postmodernists” cannot claim to give us a true picture of what the empirical world is really like; it can only tell us how it appears to scientists. There is no such thing as scientific truth. All scientific theories are mere fictions. However, just because there is no one, true, final, godlike way to view reality, does not mean that every viewpoint is as good as every other. Just because science can only give us a *human* perspective, does not mean that there is no such thing as scientific truth. When the first atomic bomb went off as some scientists had predicted it would, another bit of truth about the empirical world was revealed. Bit by bit we are discovering what is true and what is false by empirically testing scientific theories. To claim that those theories that make it possible to explore space are “just relative” and “represent just one perspective” of reality is to profoundly misunderstand the nature of science and scientific knowledge.

3. Non-scientific or conceptual theories

There is wide disagreement as to what can be a subject for scientific theorizing. The behavior of gasses or particles can be a subject for science, but can *human behavior* be a subject for science? There is much disagreement here among philosophers and practitioners of the social sciences such as psychology, sociology, history, and related fields. Is human behavior reducible to a set of principles or laws, just as the behavior of particles or waves is? Is human behavior reducible to observable phenomena or to the observable effects of lawful and regular phenomena? If so, human behavior can be the subject of scientific theorizing. If not, then no matter how empirical the study of human behavior is, it cannot be scientific. If human will, desire, and motivation cannot be reduced to principles of regularity, then human behavior is essentially different from the behavior of anything else in nature and cannot be the subject of scientific theorizing. But even if there can be no science of human behavior, there can still be explanations and theories of human behavior, whether they are psychological, sociological, or historical. Those explanations can be very heavily empirical, but because such theories are not falsifiable or testable in any way, they are non-scientific.

Can spiritual phenomena be a subject for scientific theorizing? Some scientists think so. Several articles claiming to have scientific evidence of the healing effects of intercessory prayer have been published over the past few years in reputable medical journals. A scientist at the University of Arizona has written a book called *The Afterlife Experiments: Breakthrough Scientific Evidence of Life After Death* (Atria Books 2002). Yet, most

scientists believe that science is limited to explanations of the *natural* world and that *supernatural* matters should be left to the philosophers and theologians.

On the other hand, some non-scientific theories attempt to explain *non-empirical* concepts or values. Others do not try to explain anything; they are *prescriptive* in nature. A prescriptive theory, such as a theory of justice, prescribes what *ought to be* rather than describes what is. Aesthetic theories, ethical theories, literary theories and metaphysical theories are non-scientific. As theories, they are not inferior to scientific ones, but they are different and must be evaluated differently. As we shall see, each type of theory has its proper place in the human quest for knowledge and understanding of the world we live in.

Non-scientific theories—sometimes called **conceptual theories**—are characterized, in part, by not being falsifiable or empirically testable. Generally speaking, a non-scientific theory is tested by its *utility*, its *logical coherence* (i.e., the compatibility of the concepts which make up the theory), and *its consistency with what we know about the world and with our beliefs*. Thus, while it is possible to point out that certain empirical facts can be predicted from some non-scientific theories, such predictions are not tests of the theory. Non-scientific theories, if they are coherent, are *consistent with every imaginable state of affairs in the universe*. It is not surprising, then, that many non-scientific theories are put forth dogmatically. They are not offered to be tested, but to be accepted as infallibly true.

The metaphysical theory of **materialism** is an example of a conceptual or non-scientific theory. Materialism is the theory that the nature of all reality is physical. Materialism denies the existence of a non-corporeal God and it denies the existence of immaterial souls. If a materialist believes in God, it is a belief in a physical being: one who occupies space, is tangible, and the like. If a materialist believes in souls, it is a belief in physical beings. There are no spirits, or non-physical realities, according to the materialist. When a materialist tries to explain the *mind*, he or she generally claims that the mind is a function of the brain and that all mental phenomena are reducible to brain states.

How would one go about testing the theory of materialism? Like all conceptual theories, *materialism cannot be empirically tested*. It is not falsifiable. It is logically coherent. That is, there are no logical contradictions in believing that everything real is physical. It is consistent with what we know about the world. That is, everything that can be explained by spirits or non-physical realities can be explained by materialism. Furthermore, a materialist would find the theory to be compatible with science, atheism, biochemical theories of mental illness, neurological explanations for apparent paranormal experiences, and so on. A believer in materialism would no doubt find the theory useful for explaining all kinds of phenomena. Nonetheless, materialism cannot be empirically tested; thus, it cannot be empirically confirmed in any meaningful way. On the other hand, it cannot be refuted, either. There is no way one could prove that materialism is false by appeal to empirical evidence. Furthermore, everything that could be said about the value and validity of materialism applies equally to the theory of **immaterialism** (also called **metaphysical idealism**), the theory that only spiritual or non-physical reality exists, and that the material world is an illusion.

4. Pseudoscientific theories

A **pseudoscientific theory** is not another *kind* of theory, to be evaluated along with scientific and conceptual theories. A pseudoscientific theory is *not* scientific but its proponents claim that it is. The defenders of a pseudoscience will claim that their belief is based on empirical evidence. They may even use scientific methods, but often they misapply or misunderstand those methods. Their theory is either essentially *not falsifiable*, or it is falsifiable and has been falsified but the adherents refuse to accept the evidence against their theory.

Pseudoscientists are fond of pointing out the *consistency* of their theories with the known facts or with predicted consequences, but they do not recognize that such consistency is not proof of anything. For example, “the truth of the hypothesis that plague is due to evil spirits is not established by the correctness of the deduction that you can avoid the disease by keeping out of the reach of the evil spirits” (Beveridge 1957: 118). The fact that a dowser finds water does not prove he is using paranormal powers. The fact that someone performs better than chance in a card-guessing experiment is not proof of ESP, even though parapsychologists claim that it is.

Several characteristics of pseudoscientists and pseudoscience seem to stand out (Radner and Radner 1982: ch. 3):

Characteristics of pseudoscience and pseudoscientists

- 1. The tendency to propose as scientific theories that cannot be empirically tested in any meaningful way;**
- 2. The dogmatic refusal to give up an idea in the face of overwhelming evidence that the idea is false, and the use of *ad hoc hypotheses* to try to save the theory;**
- 3. Selective use of data: the tendency to count only confirming evidence and to ignore disconfirming evidence;**⁵
- 4. The use of personal anecdotes as evidence;**
- 5. The use of myths or ancient mysteries to support theories, which are then used to explain the myths or mysteries; and**
- 6. Gullibility, especially about paranormal, supernatural, or extraterrestrial claims.**

A critical thinker should recognize the difference between scientific and non-scientific theories, and differentiate between the methods appropriate for the investigation and evaluation of each. A critical thinker ought not to claim that a belief or theory is scientific when it is actually non-scientific or pseudoscientific. The following accounts of pseudoscientific theories will provide examples of some of the above traits.

4.1 Applied Kinesiology: refusal to give up an idea in spite of the evidence against

The practitioners of applied kinesiology (mostly chiropractors) believe that muscles reflect the flow of chi (“energy”) and that by measuring muscle resistance one can determine the health of bodily organs and nutritional deficiencies (Carroll 2003: 28-29). These are empirical claims and have been tested and shown to be false (Hyman 1999; Kenny et al. 1988). Some chiropractors who believe in this bogus therapy maintain that if presented with glucose (which they consider to be a “bad” sugar) and fructose (which they believe is a “good” sugar), they can detect which is which by muscle resistance. This claim was put to the test by Dr. Wallace Sampson and several others, including psychologist Ray Hyman. A baseline was established, so that the chiropractors could demonstrate in a clear fashion just what they were claiming to be able to do.

The chiropractors had volunteers lie on their backs and raise one arm vertically. They then would put a drop of glucose (in a solution of water) on the volunteer’s tongue. The chiropractor then tried to push the volunteer’s upraised arm down to a horizontal position while the volunteer tried to resist. In almost every case, the volunteer could not resist. The chiropractors stated the volunteer’s body recognized glucose as a “bad” sugar. After the volunteer’s mouth was rinsed out and a drop of fructose was placed on the tongue, the volunteer, in just about every test, resisted movement to the horizontal position. The body had recognized fructose as a “good” sugar. (Hyman 1999).

The experiment involved a number of test tubes that had been filled with either fructose or glucose and had been coded by an experimenter who was not present during the testing.

The arm tests were repeated, but this time they were double-blind—neither the volunteer, the chiropractors, nor the onlookers was aware of whether the solution being applied to the volunteer's tongue was glucose or fructose. As in the morning session, sometimes the volunteers were able to resist and other times they were not. We recorded the code number of the solution on each trial. (Hyman 1999).

The experimenter with the code then revealed what was in each tube. The researchers found that “there was no connection between ability to resist and whether the volunteer was given the “good” or the “bad” sugar. Rather than admit that the theory seemed to have been shown to be false, one of the chiropractors said to Hyman: “You see, that is why we never do double-blind testing anymore. It never works!” Hyman thought he was joking, but the man was completely serious. The pseudoscientist would rather abandon one of the best scientific techniques we have than admit his theory is wrong.

4.2 Dianetics: claims to be scientific but is not testable

In 1950, Lafayette Ronald Hubbard published *Dianetics: The Modern Science of Mental Health*.⁶ The book is the “Bible” for Scientology, which calls itself both a Church and a religion. Hubbard tells the reader that dianetics “...contains a therapeutic technique with which can be treated all inorganic mental ills and all organic psychosomatic [sic] ills, with assurance of complete cure...” and that he has discovered and demonstrated “The single source of mental derangement...” (6). However, in a disclaimer to the reader on the frontispiece of the book, we are told that “Scientology and its sub-study, Dianetics, as practiced by the Church...does not wish to accept individuals who desire treatment of physical illness or insanity but refers these to qualified specialists of other organizations who deal in these matters.” The disclaimer seems clearly to have been a protective mechanism against lawsuits for practicing medicine without a license; for, the author repeatedly insists that dianetics can cure just about anything that ails you. He also repeatedly insists that *dianetics is a science*. Yet, anyone knowledgeable of scientific texts will be able to tell from the first few pages of *Dianetics* that the text is no scientific work and the author no scientist. Dianetics is a classic example of a pseudoscience.

On page 5 of his book Hubbard tells us that a science of mind must find: “A single source of all insanities, psychoses, neuroses, compulsions, repressions and social derangements.” It should provide “invariant scientific evidence as to the basic nature and functional background of the human mind.” And, it should find the cause and cure of all psycho-somatic ills.” He also notes that it would be unreasonable to expect a science of mind to be able to find a single source of all insanities, since some are caused by “malformed, deleted or pathologically injured brains or nervous systems” and some are caused by doctors. Hubbard is undaunted by the blatant contradiction in saying a science of mind must find a *single* source of all mental problems *and* that such a source can’t be found. He claims that this science of mind “would have to rank, in experimental precision, with physics and chemistry.” Dianetics, he says, is just such a science. It is “an organized science of thought built on definite axioms: statements of natural laws on the order of those of the physical sciences” (6).

There are broad hints that this so-called science of mind isn’t a science at all. The empirical sciences are not built on axioms and they do not claim *a priori* knowledge of the number of causal mechanisms that must exist for any phenomena. A real science puts forth *tentative* proposals to account for observed phenomena. Scientific knowledge of causes, including how many kinds there are, is a matter of discovery not stipulation.

According to Hubbard, the **engram** is the single source of insanity and psychosomatic ills. Engrams are in your *engram bank*, which is in your *reactive mind*. “The reactive mind is that portion of the mind which files and retains physical pain and painful emotion and seeks to direct the organism solely on a stimulus-response basis. It thinks only in identities” (39). The reactive mind, he says, “can give a man arthritis, bursitis, asthma, allergies, sinusitis, coronary trouble, high blood pressure and so on down the whole catalogue of psycho-somatic ills, adding a few more which were never specifically classified as psycho-somatic, such as the common cold” (51). One searches in vain for evidence of these claims. “These are scientific facts,” he says. “They compare invariably with observed experience” (52).

He defines an *engram* as “a definite and permanent trace left by a stimulus on the protoplasm of a tissue. It is considered as a unit group of stimuli impinged solely on the cellular being” (60 note). Engrams are only recorded during periods of physical or emotional suffering. During those periods, the analytical mind shuts off and the reactive mind turns on. The analytical mind has all kinds of wonderful features, including being incapable of error. It has standard memory banks, in contrast to the reactive bank. These standard memory banks are recording all possible perceptions and, says Hubbard, they are perfect, recording exactly what is experienced by the senses.

What is the evidence that engrams exist and that they are “hard-wired” into cells during physically or emotionally painful experiences? Hubbard does not say that he has done any laboratory studies, but he says that

in dianetics, on the level of laboratory observation, we discover much to our astonishment that cells are evidently sentient in some currently inexplicable way. Unless we postulate a human soul entering the sperm and ovum at conception, there are things which no other postulate will embrace than that these cells *are* in some way sentient (71).

Despite Hubbard’s claim, this explanation is not “on the level of laboratory observation.” Furthermore, the theory of souls entering zygotes has at least two advantages over Hubbard’s own theory: it is not deceptive and is clearly metaphysical. Hubbard tries to clothe his metaphysical claims in scientific garb.

The cells as thought units evidently have an influence, as cells, upon the body as a thought unit and an organism. We do not have to untangle this structural problem to resolve our functional postulates. The cells evidently retain engrams of painful events. After all, they are the things which get injured....

The reactive mind may very well be the combined cellular intelligence. One need not assume that it is, but it is a handy structural theory in the lack of any real work done in this field of structure. The reactive engram bank may be material stored in the cells themselves. It does not matter whether this is credible or incredible just now....

The scientific fact, observed and tested, is that the organism, in the presence of physical pain, lets the analyzer get knocked out of circuit so that there is a limited quantity or no quantity at all of personal awareness as a unit organism (71).

Why are these claims “scientific facts,” but the claim that souls enter zygotes is not? No reason is given. Hubbard asserts that these are scientific facts based on observations and tests, despite the fact that there has not been any real work done in this field!⁷

If you are still wondering how engrams work, here is Hubbard describing “an example of an engram”:

A woman is knocked down by a blow. She is rendered “unconscious.” She is kicked and told she is a faker, that she is no good, that she is always changing her mind. A chair is overturned in the process. A faucet is running in the kitchen. A car is passing in the street outside. The engram contains a running record of all these perceptions: sight, sound, tactile, taste, smell, organic sensation, kinetic sense, joint position, thirst record, etc. The engram would consist of the whole statement made to her when she was “unconscious”: the voice tones and emotion in the voice, the sound and feel of the original and later blows, the tactile of the floor, the feel and sound of the chair overturning, the organic sensation of the blow, perhaps the taste of blood in her mouth or any other taste present there, the smell of the person attacking her and the smells in the room, the sound of the passing car’s motor and tires, etc. (60).⁸

What does this have to do with insanity or psychosomatic ills?

The engram this woman has received contains a neurotic positive suggestion.... She has been told that she is a faker, that she is no good, and that she is always changing her mind. When the engram is restimulated in one of the great many ways possible [such as hearing a car passing by while the faucet is running and a chair falls over], she has a ‘feeling’ that she is no good, a faker, and she *will* change her mind (66).

Therefore, not only do we learn how engrams work, we find out that changing one's mind is a symptom of neurosis!

Hubbard tells us that enormous amounts of data have been collected and not a single exception has been found (68). We are to take his word on this, apparently, for all the data he presents are in the form of anecdotes or made-up examples.

Another "scientific fact" is that the most harmful engrams occur in the womb. The womb turns out to be a terrible place. It is "wet, uncomfortable and unprotected."

Mama sneezes, baby gets knocked "unconscious." Mama runs lightly and blithely into a table and baby gets its head stoved in. Mama has constipation and baby, in the anxious effort, gets squashed. Papa becomes passionate and baby has the sensation of being put into a running washing machine. Mama gets hysterical, baby gets an engram. Papa hits Mama, baby gets an engram. Junior bounces on Mama's lap, baby gets an engram. And so it goes (130).

We are told that people can have "more than two hundred" prenatal engrams and that engrams "received as a zygote are potentially the most aberrative, being wholly reactive. Those received as an embryo are intensely aberrative. Those received as a foetus are enough to send people to institutions all by themselves." What is the evidence for this nonsense? "All these things are scientific facts, tested and rechecked and tested again" (133). You must take L. Ron Hubbard's word for it.

Furthermore, to get cured of your illnesses you need a dianetic therapist, called an *auditor*. Who is qualified to be an auditor? "Any person who is intelligent and possessed of average persistency and who is willing to read this book [viz., *Dianetics*] thoroughly should be able to become a dianetic auditor" (173). The auditor must use "dianetic reverie" to cure you. The goal of dianetic therapy is to bring about a "release" or a "clear." The former has had major stress and anxiety removed by dianetics; the latter has neither active nor potential psychosomatic illness nor aberration (170). The 'reverie' used to achieve these wonders is described as an intensified use of some special faculty of the brain that everyone possesses but which "by some strange oversight, Man has never before discovered" (167). Yet, when Hubbard describes this 'reverie' in terms we can all understand, he simply says that it is like a man sitting down and telling another man his troubles (168). Therefore, he says, it "falls utterly outside all existing legislation," unlike psychoanalysis, which "may in some way injure individuals or society" (168-169). It is not clear, however, why auditors could not injure individuals or society.

Dianetics exhibits several classical traits of a pseudoscience. While much lip service is given to providing supportive facts and observations, little in the way of actual evidence is provided. Most, if not all, of the basic explanatory claims of dianetics are untestable. In fact, Hubbard advises auditors: "Don't evaluate data....don't question the validity of data. Keep your reservations to yourself" (300). This does not sound like a scientist giving proper advice to his followers. This sounds like a guru giving orders to his disciples or a con man giving instructions to his gang.

4.3 Parapsychology: tested, refuted, but adherents refuse to give it up

A good scientific theory ought to be testable; it should be capable of making *specific* predictions, not vague ones. If an explanation is sound, we demand that it be self-consistent, and that it be consistent with our experience and observations. Furthermore, we ought to expect certain things to follow from a scientific theory. If our predictions do follow from our theory, then our explanation is **confirmed**. Moreover, if there is enough support for our theory for it to pass the most rigorous tests of experience we can devise, then our theory is said to be worthy of belief. If, however, our predictions are consistently frustrated, if our theory consistently fails to pass experiment after

experiment devised to test the theory, then the reasonable thing to do is to admit that the facts refute the theory. In the view of many psychologists and historians of science, *parapsychology* has been refuted beyond a reasonable doubt. A century and a half of experimentation has not provided a single unambiguous piece of evidence in support of ESP (extra sensory perception) or PK (psychokinesis). What has been unambiguously provided by most parapsychologists is fraud and incompetence (Gardner 1957, 1983; Hansel 1989; Hines 2003; Randi 1982; Radner and Radner 1982, and Stein 1996).

The one exception seems to be the **ganzfeld** and **autoganzfeld** studies done by Charles Honorton, William Braud, and Adrian Parker from the mid-1970s to the mid-1980s. There are three phases to these tests of telepathy, the ability of the mind to send and receive information without the use of the ordinary senses.

Phase 1. Preparing the receiver and the sender. The receiver is placed in a comfortable chair. She wears headphones which play continuous white noise. [White noise is a type of noise that is produced by combining sounds of all different frequencies together. If you took all of the imaginable tones that a human can hear and combined them together, you would have white noise. This masks any distinguishable sounds and virtually eliminates sensory input from sounds.] Over her eyes are halves of ping-pong balls. A red light shines on her face. Before the test begins, a relaxation tape is played to put her in a relaxed state.

After several minutes of the unchanging sensory field, the receiver allegedly achieves a state similar to being in a sensory isolation chamber. Hallucinations are commonly reported in this state. Before being sealed in the ganzfeld chamber, the receiver is asked to say out loud what she is feeling or “seeing.” She does this for about 20 minutes before being sealed in.

Phase 2. Sending the target. In another room, an assistant has already selected one picture from a target pack out of a large pool of packs. Each pack has four pictures or videos that are very unlike each other. The target is in an opaque envelope. The experimenter is blind to the target. The assistant gives the experimenter the target envelope and the experimenter gives it to the sender and seals him in the room. The sender tries to telepathically communicate the target to the receiver. Breaks are taken and the sending process is repeated several times.

In many of these experiments (the autoganzfeld), the selecting of the target is automated. (This was in response to psychologist Ray Hyman’s criticisms about randomization of the targets. Receivers tend to select the first or second choice offered them.) The experimenter has a direct communication to the receiver’s room and can hear and record everything she says, as well as communicate with her. The sender’s room is equipped to hear what the receiver is saying. This is considered “feedback” and is supposedly helpful in guiding the sender to alter his method of telepathic sending.

Phase 3. Judging the outcome. The whole process lasts from 15 to 30 minutes. The receiver is relieved of her headphones and eye covers and is shown the four possible targets. She is asked to rank them 1 to 4, according to how well each matches her impressions during the ganzfeld stimulation period. The sender then reveals which target he was given. If the receiver ranks the actual target 1, then the trial is considered a hit; otherwise it is a miss. If the hit rate is significantly above chance (25%), the researchers take this as evidence of telepathy. If not, they take it as evidence of what you’d expect from just guessing.

A meta-analysis of 28 ganzfeld studies was done by Honorton and Daryl Bem, 23 of which had resulted in greater than chance hit rates, and the results were, according to parapsychologist Dean Radin, “odds against chance of ten billion to one.” A further analysis by Honorton recalculated the odds against chance as being 10,000 to one, with replication in eight other labs besides Honorton’s own. No obvious fatal design flaws could be found by skeptics, though Ray Hyman took issue with some of the randomization procedures. Radin claims that the hit rate of 37% for 25 studies corresponds to odds against chance of about a trillion to one (Radin 1997: 84).

From 1983 onward, Honorton and others began doing computer controlled ganzfeld studies (autoganzfeld) with the same kind of results as the earlier studies. Radin concludes: “We are fully justified in having very high confidence that people sometimes get small amounts of specific information from a distance without the use of the ordinary senses. Psi effects do occur in the ganzfeld” (Radin 1997: 88). (*Psi*—pronounced *sigh*—is a term used by parapsychologists to refer to either ESP or psychokinesis).

However, all we are truly justified in having a very high confidence in is that when ganzfeld studies are done, receivers are likely to guess correctly a one-in-four target at significantly greater than chance odds. It is still a leap to assume that information has been transferred and that the transfer was done by paranormal means. To say that you can’t think of any other explanation for the data and that a skeptic can’t provide a naturalistic explanation for it, does not justify high confidence that telepathy has been established.

Even if we are confident that our controls eliminate such things as cheating, sensory leakage (non-verbal communication to the receiver), inadequate randomization, lucky guess, unconscious pattern recognition, etc., how can we be sure that the only reasonable explanation is that what appears to be a transfer of information is in fact a genuine transfer of information? And how can we be sure that some other factor that we have not controlled for, either because we didn't think of it or because we *couldn't* think of it, is not responsible for the anomaly? In short, it doesn't follow logically that the anomaly is likely due to telepathy simply because it is not likely due to sensory input that we've controlled for. As psychologist James Alcock points out, the anomaly may not represent a genuine transfer of information. For all we know, Zeus might be responsible for it.

The departure from chance expectation could be due to any number of influences—a non-random 'random generator', various methodological flaws, or...Zeus. (I could posit that Zeus exists and likes to torment parapsychologists, and thereby gives them significant outcomes from time to time, but does not allow replication outside parapsychology. The significant outcome would provide as much support for my hypothesis that Zeus exists as it does for the Psi hypothesis that the human subject's volition caused the results.) (Alcock 2003: 43)

Thus, even if odds against chance are achieved, it is always possible that this has nothing to do with telepathy. It may have nothing to do with Zeus, either. But it is possible that it has to do with something naturalistic that has not been accounted for. Nevertheless, says Radin, we must admit that "something interesting was going on" (1997: 79). But is it telepathy or clairvoyance? I don't know. Is it Zeus? I doubt it, but I also doubt it is telepathy or clairvoyance. However, my doubts are irrelevant as to what is really going on. The best we can say is that we do not know why some subjects perceive targets at a non-random rate. It might be worthwhile to study such subjects, not to see if they can transfer information, though we could do that, but we already know the results would show no transfer of information. We know this because if it were possible for anyone to transfer information telepathically in an unambiguous manner, it would have been done already.

Parapsychologists display another characteristic of pseudoscience: the introduction of **ad hoc hypotheses** to cover up failures to confirm their theories. The ad hoc hypothesis tries to explain away apparently contradictory or falsifying evidence. For example, rather than admit that an experiment could not be duplicated because the ESP it was supposed to confirm couldn't be confirmed, experimenters have been known to blame the hostile thoughts of onlookers for unconsciously influencing pointer readings on sensitive instruments. Of course, if this objection is taken seriously, then no experiment on ESP or PK (psychokinesis) can ever fail: Whatever the results, one can always say they were caused by paranormal psychic forces, either the ones being tested or others not being tested. This kind of ad hoc hypothesizing reached a ludicrous peak with parapsychologist Helmut Schmidt. He put cockroaches in a box where they could give themselves electric shocks. One would assume that cockroaches do not like to be shocked and would give themselves shocks at a chance rate or less (if cockroaches can learn from experience). The cockroaches gave themselves more electric shocks than predicted by chance. Schmidt concluded that "because he hated cockroaches, maybe it was *his* PK that influenced the randomizer!" (Gardner 1983: 59).

One key element of the ad hoc hypothesis is that it cannot be independently tested. In the example above, there is no independent way to test for the effect of hostile vibes. Thus, if a hypothesis appears to be ad hoc, one should always ask: Can this be tested independently of the theory it is trying to save? For example, when William Herschel discovered the planet Uranus in 1781 by telescopic observation and its orbit did not fit with predictions made using Newton's laws of planetary motion, it was proposed that another planet must exist further out from the sun than Uranus. This hypothesis could be independently tested. Its size and orbit could be calculated based on how much it perturbed the motion of Uranus. Thus was Neptune discovered. When the math for Neptune's orbit didn't work in accordance with Newton's laws, it was proposed that still another planet awaited discovery. Both of these hypotheses could be independently tested, albeit with some difficulty given the state of knowledge and technology at the time.

"The popularity of borderline science is a rebuke to the schools, the press and commercial television for their sparse, unimaginative and ineffective efforts at science education; and to us scientists, for doing so little to popularize our subject."
–Carl Sagan

Perhaps an even more ludicrous peak was reached with Joseph Banks Rhine, sometimes called the father of American parapsychology. Rhine once declared that a horse (Lady Wonder) had ESP. When he later tested the horse under more controlled

conditions, the horse couldn't perform. Rather than conclude that the better controls made it impossible for the horse to pick up non-verbal cues from her mistress, Rhine declared that the horse had lost its psychic powers. Rhine also maintained that **the decline effect** explained why some subjects in his card-guessing experiments would do better than chance for awhile but then the number of correct guesses would start going down. Psychic power wanes with use, he declared, rather than admit that in the long run, if chance is operating on guessing what card someone is trying to telepathically send to a receiver, then you expect regression toward the mean. Rhine even went so far as to declare that subjects who consistently scored below chance gave proof of psychic powers. He called it **psi missing** and claimed it was done intentionally by subjects who were hostile to him or to belief in the paranormal. Other analysts might think that in the long run, one should expect to find some subjects scoring above chance and others below chance, and some performing above chance for awhile and then below chance for awhile. Why? Because in the long run the correct and incorrect guesses would approach chance rates, all things being equal.

Defenders of alleged psychic Edgar Cayce provided a classic ad hoc hypothesis to explain away their hero's failures. For example, Cayce and a famous dowser named Henry Gross set out together to discover buried treasure along the seashore and found nothing. Their defenders suggested that their psychic powers were accurate because either there once was a buried treasure where they looked but it had been dug up earlier, or there would be a treasure buried there sometime in the future. One wonders why Cayce did not discern this with his psychic powers.

Ad hoc hypotheses are not limited to pseudoscientists. Another type of ad hoc hypothesis occurs in science when a new scientific theory is proposed that conflicts with an established theory and which lacks an essential explanatory mechanism. An ad hoc hypothesis is proposed to explain what the new theory cannot explain. For example, when Wegener proposed his theory of **continental drift** (discussed below) he could not explain *how* continents move. It was suggested that *gravity* was the force behind the movement of continents, though there was no scientific evidence for this notion. In fact, scientists could and did show that gravity was too weak a force to account for the movement of continents.

Parapsychology is unique in that it is a discipline that devotes most of its energy to trying to prove the existence of something it cannot explain. *Most sciences try to explain observable phenomena. Parapsychology tries to observe unexplainable phenomena.* Furthermore, its practitioners do not seem to be the least bit interested that from the standpoint of physics an explanatory mechanism for alleged psychic phenomena is not likely to be forthcoming. All psi researchers have found that *spatial distance is irrelevant to the exercise of ESP*. Three of the other four known forces in nature weaken with distance. Thus, as Einstein pointed out, "This suggests...a very strong indication that a nonrecognized source of systematic errors may have been involved [in ESP experiments with favorable results]."⁹

All the other sciences have led us *away from* superstition and magical thinking. Parapsychology is alone among the sciences in its quest to find a scientific basis for divination, magical powers, and spirits. It is true that parapsychology has moved out of the séance room into the laboratory, where it seeks quantifiable and replicable data. However, parapsychologists now quest for statistical anomalies. It's simply exchanged stories of weird experiences for studies with weird statistics.¹⁰

Also, believers ignore or dismiss out of hand such things as the year-long study done by the United States Air Force Research Laboratories, which was unable to verify the existence of ESP. The VERITAC study, named after the computer used, is considered insignificant by psi researchers because it did not support their viewpoint. Other negative result studies, such as the one done by Richard C.

Sprinthall and Barry S. Lubetkin published in the *Journal of Psychology* (vol. 60, pp. 313-18), are also rejected by psi advocates.

Researchers who claim to have found positive results systematically ignore or rationalize their own studies that do not support their claims. They also allow *optional starting* and *optional stopping*. In many tests of psychic powers, the researcher allows the subject to start or stop whenever he or she feels like it. For example, a subject may go through some warm-ups at predicting numbers or card suits or whatever other silly thing is supposed to be psychically transmitted and received. The responses of the warm-ups are recorded, however, and if they look

**“The mystery of horoscopes, psychic phenomena, and biorhythm cycles never vanishes, no matter how much you delve into the ‘research’ on the subject. There are no underlying principles to understand.”
–Radner and Radner**

good (i.e., if they look like the psychic is revved up and getting good vibes) then the responses are counted in the experimental data. If not, then the warm-up data is discarded. Likewise, if the psychic has had a good run at guessing numbers or card suits and starts to have a bad run, he can call it quits and the researcher discards the negative data. Any reasonable test of psychic powers should have a protocol that specifically determines *before the experiment begins* exactly when the experiment will begin and when it will end.

Most psi researchers seem to limit their research to investigating either parlor tricks, like guessing a simple picture on a card, or parlor tricksters like Ingo Swann and Uri Geller. On the other hand, when they do claim to have proof of a real psychic, they cannot get the psychic to duplicate the amazing results of the study that allegedly was the final proof of paranormal phenomena. For example, J.B. Rhine claimed that Hubert Pearce, who later became a Methodist minister, correctly identified 25 ESP cards in a row after having been promised \$100 for each card he could correctly identify. The only use to which Pearce ever put his alleged powers was in another test done by Rhine and J.G. Pratt, another believer. Not only did Rhine and Pratt not take precautions to make sure that Pearce did not cheat, when they had a magician independently test Pearce, he performed at the level expected by chance guessing. Rather than admit that tighter controls made it more difficult for Pearce to cheat, Rhine and other parapsychologists determined that instituting tighter controls shows lack of trust and this diminishes the ability of psychics to perform. Much of the literature on this topic deals with *integrity*: skeptics proposing that cheating was possible and Rhine and Pratt taking offense that anyone would challenge their integrity or competence, much less the integrity of their subject, Mr. Pearce. There would not have been any controversy if Pearce had gone on to demonstrate publicly his psychic powers. I suspect Pearce did not publicly demonstrate his psychic powers because he did not have any. I suspect, too, that Pearce was not an accomplished magician like Uri Geller, another star witness for the ESP defense, who did demonstrate his powers to the public: He can bend spoons and keys. He claims he can do so using his psychic powers, but another magician, James Randi, performs the same tricks and demonstrates how to do it the easy way.

Of course, many believers in ESP have not done any experiments, nor have they read the studies of J.B. Rhine, Charles Tart, Russell Targ and Harold Puthoff, Dean Radin, and the like. They base their belief upon personal and authoritative anecdotes. The personal anecdote takes the form of Aunt Daisie's dream about her father dying right before he did die, and how the dream was so vivid and accurate that it could not possibly be explained by ordinary means. Therefore, some sort of supernatural or paranormal event must have occurred. *How else could the dream be explained?* What are the odds of anyone dreaming of a person dying and then that person actually dying within 12 hours of the dream? A statistician has calculated that in Britain this should happen to someone every two weeks (Blackmore 2004: 301).

Most people know nothing about probability odds and this affects their misconceptions as to what is or isn't likely to be a coincidence. For example, the odds of being dealt any particular bridge hand are over 635 billion to one. So what? The next time you are dealt a hand are you going to declare: Do you know what the odds are of me being dealt just this hand? 635 billion to one! How weird is that? The odds of four perfect hands being dealt in bridge are staggering. The odds of it happening again are ridiculous. Even if everybody on earth played 120 hands a day the odds of a second perfect deal would be something like 2,000 billion to one. Yet, every year, cases of perfect deals are reported. It need not be paranormal. It need not involve cheating, either. And it's certainly not due to chance! All it requires is two perfect shuffles of a new deck of cards, an event that Las Vegas card dealers have shown to be not that rare or difficult.

Two "perfect" shuffles (in which the deck is divided exactly into two halves, and perfect interleaving of the two halves is accomplished) followed by any number of simple cuts (which have no effect on the cyclic order of the cards, merely changing the starting point) will invariably generate a "perfect" bridge deal. (Alcock 1981: 152)

Finally, there are billions of dreams a night on this planet and it would be pretty odd if none of them corresponded in vague or precise ways to actual events past, present, or future. Yet, most dreams about people dying, airplanes crashing, buildings collapsing, and so on, do not correspond to future events. If a significant number of dreams of a single person corresponded to future events, then I would be the first to try to get close to the clairvoyant and recommend government funding to try to find out what mechanism was at work here. Maybe this power could be harnessed for the good of the human race. Most of us have many anxieties and concerns about people we know

and love, and have frequent dreams of both good and harm befalling our loved ones. If we are honest with ourselves, I think we will admit that most of these dreams belie very real present fears and concerns. We forget most of these dreams, but if you have a dream of your mother dying and she dies the next day, there will be a natural tendency in many people to think that somehow their dream was an omen. Furthermore, as noted in chapter one, we know from many studies done on memory that many of our memories are filled in after the fact, i.e., we remember things that we learn of after the event we witnessed or experienced and incorporate those later experiences into our memories of earlier events. It is likely that memories of dreams would follow the same pattern. The striking precision of clairvoyant dreams may well come from data supplied *after* the dream but remembered as being part of the dream itself.

One thing that defenders of psychic phenomena have in common is *faith*. This alone accounts for why they pursue and provide reams of empirical data to support their claims but disregard or trivialize all empirical evidence that indicates their claims are in error. Their faith is not complete irrational fideism—belief without regard for and totally in spite of the evidence. Their faith is the kind of controlled faith that marks some religious persons. Evidence counts, but only if it supports one's beliefs. This trivializes the concept of evidence and explains, in part, why so many of the empirical tests for *psi* are inadequately designed, controlled, and administered. It explains, too, why so much ad hoc hypothesizing and rationalization goes on to explain away failures to confirm psychic events.

5. Scientific theories

The purpose of a scientific theory is to organize, unify, and make sense out of some range of natural phenomena. In short, scientists are trying to understand and, to some extent, control Nature. We have seen that pseudosciences, such as dianetics and parapsychology, also try to explain and make sense out of observations and experience. The differences between science and pseudoscience, however, outweigh their similarities. Pseudoscientists either believe untestable theories or they refuse to accept results that falsify their claims. They misuse scientific methods, as parapsychologists do when they search for an anomalous statistic and claim when they find one that they have proof of ESP. The same can be said for those who seek anomalous statistics in their healing prayer studies. Pseudoscientists tend to be selective in their use of evidence. They tend to be dogmatic and to act as if they are in search of disciples instead of critically thinking followers.

We will now examine two theories from the history of science, each exemplifying important differences between science and pseudoscience. The examples were chosen because they might erroneously be thought to be examples of science *not* at its best.

5.1 Continental drift

In commenting on the distinction between science and pseudoscience, the Radners note that there is a fine line separating speculative science from pseudoscience. Scientists, they say, recognize when their theories are sketchy, superficial, or unsupported; pseudoscientists do not (1982: 91). As an example of the difference between the practitioners of science and pseudoscience, the Radners cite the case of Alfred Wegener's *The Origin of Continents and Oceans* in which Wegener proposed the theory of **continental drift** against the prevailing theory that the earth was formed by cooling from a molten state and contractions. "Wegener's mode of reasoning lent itself to criticisms and counter-arguments. Wegener made assertions that could be checked and refuted as further evidence came in. He left room for his speculations to be superseded" (Radner and Radner 1982: 92). Wegener did not have disciples, but sympathizers who "acted like scientists."

Yet, Wegener's idea that continents move was rejected by most scientists when it was first proposed. Stephen Jay Gould notes that when the only American paleontologist defending the new theory spoke at Antioch College (where Gould was an undergraduate at the time), most of the audience dismissed the speaker's views as "just this

side of sane” (Gould 1979: 160). A few years later, all the early critics of the new idea would accept it as true. Why? Was it simply a matter of Wegener and a few others jumping the gun by accepting a new idea before the evidence was sufficient to warrant assent? Were the latecomers ‘good’ scientists, waiting for more facts to confirm the theory? Gould’s view is that dogmatic adherence to the view that the ocean floor is solid and unchanging was the main stumbling block to acceptance of the new theory. Most scientists rejected continental drift because it did not fit with their preconceived ideas about the nature of the earth’s crust. They assumed that if continents did drift they would leave gaping holes in the earth. Since there were no gaping holes in the earth, it seemed unreasonable to believe that continents move. The theory of continental drift, says Gould, “was dismissed because no one had devised a physical mechanism that would permit continents to plow through an apparently solid oceanic floor.” Yet, “during the period of nearly universal rejection, direct evidence for continental drift—that is, the data gathered from rocks exposed on our continents—was every bit as good as it is today.”

Continental drift was considered *theoretically impossible* by some, even if it was physically possible for continents to move. The new theory could not be made to fit the theoretical model of the earth universally accepted at the time. Then, the theory of plate tectonics was proposed—the idea that the continents ride on plates that are bounded by areas where new crust is being created from within the planet and old crust is falling into trenches. This provided a mechanism for explaining how continents could drift. Continental drift, according to Gould, came to be accepted not because more facts had been piled up, but because it was a necessary consequence of the new theory of **plate tectonics**.

More facts were piled up, though—facts for the new theory of plate tectonics, of which the theory of continental drift is an essential element. Today it is taken as a fact that continents move. Yet, the exact mechanism by which plates move is still incompletely understood. This area of science will no doubt generate much debate and theorizing, testing of hypotheses, rejection and refinement of ideas. It is, as Gould says, a good example of how science works. To someone who does not understand the nature of science, the early rejection of the idea of continental drift might appear to show how dogmatic scientists are about their pet theories. If scientists had not been so devoted to their belief that the earth’s crust is solid and immovable, they would have seen that continents can move. However, the fact that Wegener’s theory turned out to be correct does not mean that he and his few early followers were more reasonable than the rest of the scientific community. After all, Wegener did not know about plate tectonics and he had not provided an acceptable explanation as to how continents might move. Wegener argued that gravity alone could move the continents. Gould notes: “Physicists responded with derision and showed mathematically that gravitational forces are far too weak to power such monumental peregrination.” Alexis du Toit, a defender of Wegener’s theory, argued for radioactive melting of the ocean floor at continental borders as the mechanism by which continents might move. “This ad hoc hypothesis added no increment of plausibility to Wegener’s speculation,” according to Gould (1979: 163). It is true that the idea that the earth’s crust is solid and immovable has been proved wrong, but Wegener didn’t prove that. What the new theory could explain (about rocks and fossils, for example) other theories could explain equally well.

However, in the end, the idea of continental drift prevails. It prevails because the dogmatism of science—the tendency to interpret facts in light of theories—is not absolute but relative. What distinguishes science from pseudoscience is not that scientists are not dogmatic while pseudoscientists are. It is that scientists stand ready to give up one dogma for another should the evidence warrant it. Most pseudoscientists refuse to give up their dogmas regardless of the evidence against them. Gould notes with obvious admiration that a distinguished stratigraphy professor at Columbia University (where Gould did graduate work), who had initially ridiculed the theory of drifting continents, “spent his last years joyously redoing his life’s work” (Gould 1979: 160). It is hard to imagine a comparable scene involving a pseudoscientist.

The Wegener episode demonstrates an essential difference between science and pseudoscience. That difference is to be found not in the correctness or incorrectness of proposed ideas, but *in the method used to gain acceptance for the ideas*. The difference is not to be found in the personality of the theorizer or in his stubborn adherence to an idea. It is to be found in the pseudoscientist’s dogmatic refusal to give up an idea for which there is contrary evidence or for which there is not, nor ever could be, any test in experience.

5.2 Piltdown man

Piltdown was an archaeological site in England where fossil remains of humans, apes, and other mammals were found in 1908 and 1912. In 1913, an ape's jaw with a canine tooth worn down like a human's was found at a nearby site. To make a long story short, papers were published and the general community of British paleoanthropologists came to accept the idea that the fossil remains belonged to a single creature with a human cranium and an ape's jaw, the so-called "missing link." In 1953, Piltdown 'man' was exposed as a forgery: The skull was modern and the teeth on the ape's jaw had been filed down. How had so many scientists been duped? Gould offers several reasons, among them *wishful thinking* and *cultural bias*, which no doubt played a role in the lack of critical thinking among British paleoanthropologists. However, as with the Wegener episode, the Piltdown forgery demonstrates the *fallibility* and *human* quality of scientific knowledge. It demonstrates, too, the way theories and facts are related in science. Theories precede facts; they are the filters through which facts are interpreted. Yet, facts also precede theories; they are the events that theories try to explain and make sense of. Gould notes that today a human cranium with an ape's jaw would be considered extremely implausible and far-fetched. But in the early part of this century, anthropologists were imbued with the cultural prejudice that considered man's big brain to be his ticket to rule and the key to understanding all his other unique features. There was a pre-conceived notion that the human brain must have developed to its human size before other changes occurred in human structure. So, a human cranium with an ape's jaw didn't rouse as much suspicion as it would today, when the fossil evidence clearly shows a progression from small-brained but upright (hence, non-simian) hominids, to larger-brained upright humans. Scientists "modeled the facts" instead of modeling their theory to fit the facts. This was "another illustration," says Gould, "that information always reaches us through the strong filters of culture, hope, and expectation" (Gould 1982: 118). Once committed to a theory, people see what fits with the theory. Even scientists are guilty of **confirmation bias**.

The main reason Piltdown was not spotted as a fraud much earlier was that scientists were not allowed to see the actual bones, which were kept securely locked in the British Museum. Instead of focusing their attention on examining the "fossils" more closely with an eye to discovering the fraud, scientists were not allowed to examine the physical evidence at all! They had to deal with plaster molds and be satisfied with a quick look at the originals to justify the claim that the models were accurate.

The moral of Piltdown is that science is fallible, a human activity that does not always take the most direct route in fulfilling its aim of understanding nature. When an **anomaly** such as the discovery of a human cranium with an ape's jaw occurs one must either fit it into a new theory, re-examine the evidence for error in discovery or interpretation, or show that the so-called anomaly is not really an anomaly at all but in fact fits with current theories and knowledge.

As noted above, scientists can sometimes appear to be dogmatic. They resort to seemingly ad hoc hypotheses to save their theories, as in the case of not abandoning Newton's laws when it was discovered that the motion of Uranus didn't fit with what was predicted by the laws. Herschel proposed that there was another planet beyond the orbit of Uranus that would account for the apparent anomalous orbit of Uranus. This idea

<p>An anomaly is something abnormal and not easily classified. In science, an anomaly is something that cannot be explained by currently accepted scientific theories.</p>

could be independently tested. It was, and Neptune was discovered. However, it too had an anomalous orbit, that is, one not in accord with Newton's laws. Again, rather than abandon Newton's laws, which worked so well in explaining numerous natural phenomena, it was proposed that there must be another planet beyond Neptune. This, too was an independently testable hypothesis. Eventually, Pluto was discovered. However, its orbit is also anomalous. Should we abandon Newton's laws or keep looking for other bodies or groups of bodies on the outer edges of the solar system that might account for this discrepancy? Should we abandon Newton's laws or look for some previous error we might have made regarding the mass of the other planets? Is there anything that scientists would accept as falsifying Newton's laws? Is there anything that would lead the community of biological scientists to give up the neo-Darwinian synthesis (natural selection in light of genetics)? It is questions such as these that have led some philosophers of science to declare that Popper's notion of falsifiability is untenable. Has Popper's theory been falsified? Perhaps, but his theory is a *philosophical* one, not a scientific theory. It's a

philosophical theory *about* scientific theories—a *metascientific theory*, if you will. Hmm. Maybe we should leave this one to the philosophers to work out.

6. Scientific, metaphysical, and pseudoscientific cosmological theories

A **cosmological theory** is a theory about the origin and nature of the universe. Such theories may be scientific, **metaphysical**, or **pseudoscientific**. Some theories are so broad or vague that they are consistent with just about any state of affairs, even apparent contradictions. They cannot be refuted, even in principle. For example, Freud's theory of the Oedipus complex postulates that there is an attraction on the part of a child toward the parent of the opposite sex. This attraction supposedly leads to jealousy, rivalry, and hostility toward the parent of the child's own sex. If the child doesn't behave in overtly jealous and hostile ways toward the parent of the same sex, then the theorist can declare that the child is repressing his feelings or sublimating them into socially acceptable behaviors. Or, the believer might declare that the child is asexual. Or, if the child shows anger toward both parents, the child might then be labeled as bisexual. And, if the child is hostile to the parent of the opposite sex, the child will grow up to be gay. Any behavior, friendly or hostile against either parent, can be made to fit the theory. No behavior could ever falsify the theory of the Oedipus complex.

A religious cosmology, such as that offered in *Genesis* and accepted as a literal account of the origin of the universe by fundamentalist Jews and Christians, is an *irrefutable* type of cosmological theory. Other theories allow definite predictions to be made from them; they can, in principle, be refuted. They can be tested by experience and observation. The Big Bang Theory, for example, is a *refutable* cosmological theory. There are events that, if discovered, would falsify the theory. The religious cosmology is non-scientific and *metaphysical*; the Big Bang theory is *scientific*. Metaphysical theories are "airtight" if they are self-consistent, i.e., contain no self-contradictory elements. No scientific theory is ever airtight.

A cosmology held by a religious group may be scientific, however. For example, if a Young Earth theory says that the world was created in 4004 B.C., but the evidence indicates that the earth is several billions of years old, then the theory is a scientific one *if it is thereby taken to be refuted by the evidence*. But if, for example, the ad hoc hypothesis is made that God created the world in 4004 B.C. complete with fossils, which makes the earth look much older than it really is, then nothing could refute it.¹¹ It is airtight. It is pseudoscience.

If the age or dating techniques of fossil evidence is disputed, but considered relevant to the truth of the Young Earth theory, and is prejudged to be consistent with the theory, then the theory is a pseudoscientific one. If the religious cosmologist denies that the earth is billions of years old on the grounds that scientific tests prove the earth is very young, rather than very old, then the burden of proof is on the religious cosmologist to demonstrate that the standard scientific methods and techniques of dating fossils are erroneous. No reasonable person should consider such an unsupported claim to be reasonable. To maintain it would require us to believe that the entire scientific community is in error about dozens of different dating techniques.

The unscientific nature of pseudoscientific religious cosmologies is evident not just in their overriding concern to make facts fit a preconceived theory. As we have seen, this is a human tendency that affects scientists, too.¹² Rather, the unscientific nature of pseudoscientific religious cosmologists is evident in the belief that the absolute truth has already been revealed and inquiry is not needed to search for the truth. To the pseudoscientific mind, truth is not something that must be constantly open to question, refined, and, possibly, rejected. To the pseudoscientific creationist mind, scientific truth is something eternal and unchanging that is recorded in the Bible. Compare this attitude to that of the leading European creationists of the 17th century who had to admit eventually that the Earth is not the center of the universe and that the sun does not revolve around our planet. They did not have to admit that the Bible was wrong, but they did have to admit that human interpretations of the Bible were in error (Carroll 2003: 87).

In recent years, creationism has been replaced by something called **intelligent design theory (ID)** as an alternative to Darwin's theory of natural selection. ID is a classic example of a pseudoscience: The theory is said to be scientific but it isn't. The theory says that some observable phenomena could not have evolved piecemeal. Some things require that several parts must have been produced simultaneously; otherwise, they would not work

together as they do. Thus, some things require an intelligent designer or, in other words, a **miracle**.

If we grant that the universe or some discoverable part of it—such as the flagellum of a bacterium or the production of protein in a human cell—is possibly or even probably the result of intelligent design, what follows from that? Certainly no scientific research program will follow; for, the theory doesn't direct us anywhere. It does us no good to throw up our arms and yell "it's a miracle" every time we come upon some biological mechanism that we can't *at present* explain by natural selection.

Let's assume a particular eco-system is the creation of an intelligent designer. Unless this intelligent designer is human-like and unless we have some experience with the creations of this and similar designers, how could we proceed to study this system? If all we know is that it is the result of ID, but that the designer is of a different order of being than we are, how would we proceed to study this system? We would be limited in always responding in the same way to any question we asked about the system's relation to its designer. The most we could ever say is *It is this way because of ID* or *To be this way requires a miracle; it couldn't have happened naturally*. Furthermore, we would have to assume that since God is the intelligent designer and has designed everything, then everything is due to intelligent design. The theory explains everything but illuminates nothing (Carroll 2003: 182).

There are many believers in religious cosmologies, such as that given in *Genesis*, who do not claim that their beliefs are scientific. They do not believe that the Bible is to be taken as a science text. To them, the Bible contains teachings pertinent to their *spiritual* lives, not their scientific endeavors. The Bible expresses spiritual ideas about the nature of God and the relationship of God to humans and the rest of the universe. Such people do not believe the Bible should be taken literally when the issue is a matter for scientific discovery. The Bible, according to this metaphysical cosmology, should be read for its spiritual messages, not its lessons in biology, physics, or chemistry. Amen to that.

7. The popularity of pseudoscience

Why is pseudoscience so popular? Two factors have been repeatedly cited: the irresponsible portrayal of science and scientific matters in the mass media and the poor quality of science education. It should be a matter of national embarrassment that it is not uncommon to see stories in *The New York Times* with headlines that read "Biology teaching flunks panel's test." The story tells us that biology, the first science presented to most students, is taught so poorly that the experience seems designed to snuff out interest in all science education at an early age. The panel was comprised of biologists and educators convened by the National Research Council. It was not hopeful for the future, said Dr. Timothy Goldsmith of Yale, chairman of the committee that did the three-year study. Most proposals for overhauling the education system, he said, focused on managerial or administrative solutions, such as lengthening the school day or requiring more standardized tests, rather than looking at the learning process in the classroom. Bill Aldridge, executive director of the National Science Teachers Association, concluded that the state of science education in this country is disastrous.

F. James Rutherford, director of Project 2061, a science curriculum reform project of the American Association for the Advancement of Science (AAAS), laments that "much of what's done in schools focuses on facts and information, on separate disciplines and subject matter that is often unconnected." The AAAS report states that "Today's overstuffed curriculum places too much emphasis on memorizing countless formulas and generalizations, which severely hinders students' abilities to learn and understand materials....students should spend more time learning how science touches their lives and less time memorizing facts." More and more studies are calling for hands-on methods of science instruction, which include interdisciplinary approaches to current issues such as global warming, famines, earthquakes, volcanoes, and the like. However, because many parents oppose the teaching of evolution or even the teaching of science that might be applied to politically sensitive areas such as global warming, we can expect a great deal of opposition to any meaningful change in our science curricula. An enormous amount of wasted energy in school boardrooms has been spent in recent years quibbling about whether to allow intelligent design into the biology classroom. This is likely to continue, especially since an increasing number of politicians and a large vocal part of the citizenry are concerned that secular education is promoting atheism and materialism by not bringing God into the educational picture.

Rutherford gives an example of good and bad science education in teaching about cells. High school texts list 120 technical words about the cell, and students are often required to memorize the words. “We found that 11 of the words were sufficient,” he said. “If you concentrate on what goes on in the cell, how it relates to the system, you come out with a deeper understanding.” The committee doesn’t want to eliminate learning facts, just reduce the workload so time can be spent on understanding what the terms are about. It seems, then, that unless we change the way science is taught to our young people, it is unlikely that many of them will come away with an understanding of the nature of science, much less with a desire to scientifically understand the world they live in.

According to Martin Gardner, poor science instruction is only one of several reasons for the rise in pseudoscience. In his view, there are several main reasons for the increase in wild beliefs: “The decline of traditional religious beliefs among the better educated, the resurgence of Protestant fundamentalism, the disenchantment with science for creating a technology that is damaging the environment and building horrendous war weapons, and the increasingly poor quality of science instruction on all levels of schooling...” An overlooked factor, according to Gardner, is “the role of the media as feedback,” especially movies and television. He writes, “just as mild porn stimulates a demand for pornier porn, and mild violence a demand for more violent violence, so does crazy science create a demand for crazier science.” Television and movies “rapidly accelerate any trend.” In Gardner’s view, the mass media has a moral obligation not to contribute to “the growing inability of citizens to tell good science from bad” by programs such as *Exploring the Unknown*, which present numerous ‘paranormal’ events claimed to be on the new frontiers of modern science, when in fact everything shown is “considered rubbish by the entire science community.” Such shows far outnumber scientifically grounded programs such as *NOVA* or *Scientific American Presents*.

On the other hand, wishful thinking and human gullibility should not be discounted as essential explanatory factors in understanding why pseudosciences continue to have widespread appeal even in an Age of Science. Human beings seem to be very uncomfortable in the face of what seems inexplicable. We seem to have a need to make sense out of everything. We also like mysteries and seem to prefer supernatural or paranormal explanations to scientific ones, especially if the non-scientific explanations are not too technical and fill us with a sense of excitement and wonder. Many fear that science is telling us that there is no meaning to our lives, that we are just so much ‘dirt’ that will pass back into the universe of wandering atomic particles when our time is up. They want hope; belief in things spiritual and paranormal gives them that hope.

The following is an extreme example of the lengths to which some people will go to maintain their wild beliefs, yet it exemplifies a common problem: rationalization to maintain even obviously false beliefs. Marian Keech was the leader of a UFO cult in the 1950s. She claimed to get messages from extraterrestrials known as The Guardians, through automatic writing. Like the Heaven’s Gate folks forty years later,¹³ Keech and her followers, known as The Seekers or The Brotherhood of the Seven Rays, were waiting to be picked up by flying saucers. In Keech’s prophecy, her group of eleven was to be saved just before the earth was to be destroyed by a massive flood on December 21, 1954. When it became evident that there would be no flood and the Guardians weren’t stopping by to pick them up, Keech

became elated. She said she’d just received a telepathic message from the Guardians saying that her group of believers had spread so much light with their unflagging faith that God had spared the world from the cataclysm...Most disciples not only stayed but, having made that decision, were now even more convinced than before that Keech had been right all along....Being wrong turned them into true believers (Levine 2003: 206).

Rather than give up their belief in the face of strong evidence of its falsehood, their belief became even stronger. Why? Why do people believe obvious falsehoods? According to H. L. Mencken, believing in the “palpably not true” is the “chief occupation of mankind.” Maybe he’s right.

Michael Shermer, publisher of *Skeptic* magazine, and author of *Why People Believe Weird Things*, says: “More than any other, the reason people believe weird things is because they want to...It feels good. It is comforting. It is consoling.” Weird beliefs also offer “immediate gratification.” People like weird beliefs because they are simple. Weird beliefs also satisfy the quest for significance: They satisfy our moral needs and our desire that life be meaningful. Finally, he says, people believe weird things because weird things give them hope.

We might add *ignorance* to Shermer's list. Ignorance seems to be the main reason many people believe weird things. They simply do not know any better. If they had some knowledge about physics, chemistry, biology, memory, the brain, the body, and the like, they would not even consider many of the crackpot ideas put forth for their consideration. Only a person ignorant of physics and neurology, for example, could consider it reasonable to wear a takionic headband to improve thinking.

Also, many weird beliefs are the beliefs of *groups*, not isolated individuals. They are perpetuated and spread like viruses because of mechanisms such as communal reinforcement. It is always easier to believe something, no matter how wild or weird, if others believe it, too.

Finally, some weird beliefs are empowering. Some people's beliefs make them feel special. They set them apart from the crowd and the ordinary people who just don't get it.

8. The Hidden Persuaders

In 1957, social scientist Vance Packard published a book called *The Hidden Persuaders*, in which he chronicled the many methods that advertisers and marketing experts use in their quest to manipulate the thoughts and actions of consumers. Many years later, two psychologists, Geoffrey Dean and Ivan Kelly (2003), used the expression 'hidden persuaders' to describe perceptual and cognitive illusions that lead us to erroneous beliefs. In this book, we have explored a number of logical fallacies and cognitive illusions—*hidden persuaders*, if you will—that lead people to believe in “the palpably not true.”

Hidden persuaders originate in quite useful adaptations. Seeing patterns, especially causal patterns, is quite beneficial to our species. Recognizing how data support our beliefs and having others share those beliefs are also beneficial. Drawing inferences quickly may mean the difference between life and death. Having hope, reducing tension caused by conflicting ideas, and even deceiving ourselves can be psychologically advantageous. But all of these positive tendencies can become perverted and lead us into error if we are not careful.

Hidden persuaders sometimes seem to affect people in proportion to their intelligence: the smarter one is the easier it is to develop false beliefs. There are several reasons for this: (1) the hidden persuaders affect everybody to some degree; (2) the smarter one is the easier it is to see patterns, fit data to a hypothesis, and draw inferences; (3) the smarter one is the easier it is to rationalize, i.e., explain away strong evidence contrary to one's belief; and (4) smart people are often arrogant and incorrectly think that they cannot be deceived by others, the data, or themselves.

If you have learned nothing else from reading this book, I hope you will have learned, as Michael Novak put it: “Our capacity for self-deception has no known limits.”

Exercise 9-1 Self-test: True or false? (Check your answers in Answers to Selected Exercises.)

- 1 Non-empirical, non-scientific theories attempt to explain concepts or values, or are prescriptive in nature, or they attempt to explain natural phenomena in ways that are not empirically testable.
- 2 To be likely, a scientific explanation usually must be in accordance with current knowledge, beliefs, laws and principles of the field in which the explanation is made.
- 3 Every test a scientific theory passes confirms it, but only thousands of passed tests will prove with absolute certainty a scientific theory.
- 4 The mass media, especially television, have historically shown a great concern for presenting accurate scientific information.
- 5 The best scientific and metaphysical theories have nothing in common.
- 6 Pseudoscientists are rarely motivated by an overriding commitment to religious dogma or mythology.
- 7 Scientific theories connect directly to experience and observation in an essential and profound way.
- 8 Metaphysical theories can be empirically confirmed to a lesser degree than scientific theories.
- 9 What distinguishes science from pseudoscience is that scientists are not dogmatic while pseudoscientists are.
- 10 A critical thinker must try to establish a complete set of *a priori* conditions which a theory must meet before any reasonable person should accept it.
- 11 There are many believers in a religious cosmology such as that given in *Genesis* who do not claim that their beliefs are scientific.
- 12 One sign that an empirical idea is not scientific is the claim that the idea is absolutely certain and irrefutable.
- 13 Any good theory must be free from self-contradictions, consistent with experience, and free of *ad hoc* hypotheses to patch up holes or weaknesses.
- 14 Any reasonable test of psychic powers should have a protocol that specifically determines *before the experiment begins* exactly when the experiment will begin and when it will end.
- 15 The moral of Piltown is that science is fallible, a human activity that does not always take the most direct route in fulfilling its aim of understanding nature.
- 16 Scientists seek facts, but sometimes the best they can do is theories.
- 17 Many people, including the highly educated, may be attracted to pseudoscience because of ignorance regarding the nature of science.
- 18 The proponent of a novel idea in science must provide very good reasons for rejecting established principles because the established views are considered infallible.
- 19 The dogmatism of science—the tendency to interpret facts in light of currently accepted theories—is not absolute but relative.
- 20 When a pseudoscientist says that he or she believes in astrology or biorhythms or dianetics, etc., because it *works*, he or she usually means that there is anecdotal evidence the theory fits some data.
- 21 The ganzfeld studies prove beyond any reasonable doubt that telepathic communication does happen.
- 22 If a metaphysical theory is not self-contradictory and is consistent with the evidence of experience, it cannot be shown to be false.
- 23 Good scientists generally back up their theories with appropriate anecdotes.
- 24 The more intelligent a person is the less likely she is to be negatively affected by the hidden persuaders.
- 25 Sciences are built on axioms and claim *a priori* knowledge of the number of causal mechanisms that must exist for any phenomena.
- 26 Parapsychology, astrology, and dianetics are pseudosciences.
- 27 Pseudoscientific theories are put forth as if they are scientific when they are not.
- 28 If a scientific cosmology is inconsistent with a metaphysical cosmology, an empirical test must be done to determine which is the better theory.
- 29 The distinguishing feature of non-scientific theories is that they are not capable of being tested by experience.
- 30 To be a reasonable scientific explanation, it is enough that the explanation be a possible and consistent account of phenomena.
- 31 Intelligent design theory is considered a reasonable alternative to the theory of natural selection by most biologists; that is why the National Science Foundation insists it be part of the biology curriculum.
- 32 To be able to test a theory by experience means to be able to predict certain observable or measurable consequences from the theory.
- 33 To say of a scientific theory that it *works* means that it is empirically rich: many specific predictions have been deduced from it with accuracy; it is compatible with other scientific theories; it explains a great deal.

214

34 Parapsychology tries to observe unexplainable phenomena.

35 A good scientific theory ought to be capable of being used to make *specific* predictions, not vague ones.

36 The history of science is the history of one absolute truth being built upon other absolute truths.

37 To say that a scientific theory is “very rich” is to say that many empirical hypotheses can be generated from it, each one serving as another test of the theory.

38 The greater the number of severe tests a scientific theory has passed, the greater its degree of confirmation and the more reasonable it is to accept it.

39 If a metaphysical theory is inconsistent with the evidence of experience, it is not a good theory.

40 Pseudoscience is distinguished by its refusal to be guided by factual evidence and logical reasoning because its commitment is to dogma itself, not to evidence or fallible truth.

41 Facts are used to test scientific theories.

42 All scientific theories attempt to make sense out of the phenomena they are put forth to explain.

43 A necessary consequence of scientific claims being falsifiable is that they are also highly improbable.

44 Pseudoscience is characterized by its theories being false.

45 Scientific theories vary in degree of probability from the highly improbable to the highly probable.

46 A sign that a theory is not scientific is the fact that the theory is not falsifiable.

47 Scientific theories are explanations of events.

Exercise 9-2

Evaluate the following theory. Can you come up with a better theory than the one given? Why is yours better?

The Dreams of College Students

The three most frequently occurring kinds of dreams of college students are (1) dreams of falling, (2) dreams of being pursued or attacked, and (3) dreams of attempting to perform a task but failing.

Dreams of falling obviously originate with our tree-dwelling ancestors. Any miscalculation or neglect of the laws of gravity could mean death. If you wanted to survive, you had to stay aware of where you were. Ever present throughout the day, this awareness naturally made its way into dreams at night, where it continued to serve its purpose. The falling dream was an evolutionary mechanism to keep the primate in a tree from tossing and turning in its sleep, a habit that could be fatal.

Being pursued or attacked also originated with our ancient ancestors. There is little difficulty in imagining how the early hominids felt about saber-toothed tigers. The fear of being eaten was a formidable anxiety. If you weren't alert, you perished. Anxiety about being eaten made early man a light sleeper. The horror of attack-and-pursuit nightmares would have occurred quite often, keeping early man alert and awake.

Finally, attempting a task and repeatedly failing symbolizes the struggle of man's intelligence against the forces of nature. If a hominid tried to invent a new weapon during his waking hours but continually failed, he would be likely to dream about his efforts. He might dream about throwing stones at animals and recognize how inefficient the practice is. He might dream that during one hunt he had been jabbed by a sharp stick while running through the forest, and then he might see that a spear could be invented.

Exercise 9-3

Research and evaluate one or more of the following theories. Determine if the theory is scientific or not.

- 1 The theory of evolution
- 2 The theory of determinism
- 3 The global warming theory
- 4 The Big Bang theory
- 5 The virus theory of contagious diseases
- 6 The retributive or utilitarian theory of punishment
- 7 The theory of intelligent design
8. Auras
9. Psychic photography (thoughtography)
10. The psychological theory of “repression”

Exercise 9-4

Invent a pseudoscientific theory regarding (a) the healing power of color; (b) math anxiety; (c) romantic love; (d) sexism; (e) I. Q. enhancement through power breathing; or (f) some phenomenon of your own choosing.

Bibliography - Chapter Nine

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Notes – Chapter Nine

¹ The ABC television network showed a mini-series based on MacLaine's book *Out on a Limb*. It depicts MacLaine conversing with spirits through channeler Kevin Ryerson. One of the spirits who speaks through Ryerson is a contemporary of Jesus called "John." This "John" doesn't speak Aramaic--the language of Jesus--but a kind of Elizabethan English. "John" tells MacLaine that she is co-creator of the world with God. MacLaine, a consummate egoist, becomes ecstatic to find out that she is right about a belief she'd expressed earlier, viz., that she IS God. Cf. Martin Gardner, "Isness Is Her Business," *New York Review of Books*, April 9, 1987.

² Alice Kahn, "Channeling for Dollars," *The San Francisco Chronicle*, April 19, 1987. Kahn's article was based on her attendance at one of the sessions. She also notes that for \$125 anyone could attend the 3rd annual Michael Retreat at Harbin Hot Springs for "shamanic rituals, dream-sharing, breakfast and dinner."

³ *Abduction: Human Encounters with Aliens* (New York: Scribners, 1994) by John E Mack.

⁴ One of the main leaders of ‘scientific creationism’ is Duane T. Gish, author of *Evolution, the Challenge of the Fossil Record* (San Diego, Calif.: Creation-Life Publishers, 1985) and *Evolution, the Fossils Say No* (San Diego, Calif. : Creation-Life Publishers, 1978).

⁵ Carl Sagan wrote to a parapsychology institute to tell of a precognitive dream he had which did not pan out. They ignored him. Imagine, he asks, what kind of treatment they would have given him had he claimed that his dream had coincided with some future event. “The hits are recorded, the misses are not” (Sagan 1979: 45).

⁶ Published by the American Saint Hill Organization, Los Angeles. All page references are to this hardback edition.

⁷ To his credit, Hubbard recognized that the belief “no recordings can take place in the mind until the nerves are sheathed depends upon a theoretical postulate,” i.e., it is a metaphysical not an empirical claim. However, his criticism of this notion because it “has never been subjected to scientific research” indicates that he doesn’t recognize one key difference between metaphysical and empirical claims: only the latter can be subjected to scientific research. (p. 127)

Also, in 1961 Hubbard set up an academic laboratory in East Grinstead, England. He is said to have “examined in depth the entire body of his work with the intention of systematizing auditing procedure.” According to Tom Joyce, a former member of the Church of Scientology, this was probably the first time Hubbard “conducted himself as a scientist, *albeit one unencumbered by peer review.*” [Italics added.] “Hubbard’s Ladder,” in *Gnosis Magazine*, 1989.

⁸ Martin Gardner notes that throughout *Dianetics*, “Hubbard reveals a deep-seated hatred of women....When Hubbard’s Mama’s are not getting kicked in the stomach by their husbands or having affairs with lovers, they are preoccupied with AA [attempted abortion]--usually by means of knitting needles.” *Fads & Fallacies in the Name of Science* (New York: Dover Publications, 1957), p.267. Gardner devotes chapter 22 to exposing the pseudoscientific traits of dianetics.

⁹ From a letter to Dr. Jan Ehrenwald, 13 May 1946, translated and reprinted in Martin Gardner’s *Science Good Bad and Bogus*, p. 153.

¹⁰ A good example of this quest for the weird statistic is the work of Robert Jahn at Princeton University in the Princeton Engineering Anomalies Research (PEAR) lab. See the description of this work in the previous chapter.

¹¹ Philip Henry Gosse made this claim in Darwin’s time in a work entitled *Creation (Omphalos): An Attempt to Untie the Geological Knot*, published in 1857.

¹² The pseudoscientist often invents a theory to fit his beliefs and then uses the beliefs to support the theory. This type of circular reasoning is common among those who use ancient myths to support their theories and their theories to explain the ancient myths. See the work of Erich von Däniken (*Chariots of the Gods?*), Immanuel Velikovsky (*Worlds in Collision*), and Zecharia Sitchin (*Earth Chronicles*).

¹³ In March 1997, 39 member of the UFO millennium cult known as Heaven’s Gate committed suicide. They were promised by their leader, Marshall Applewhite, that a space ship would pick up their bodies and deliver them to a “higher level.”