



The North Texas

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Alchemy to Chemistry: Pseudoscience to Science

Part I

by Kristine Danowski

Shrouded in futility, mystery, and the occult, the ancient art of alchemy persists to this day. Alchemy is the belief that base metals can be converted (“transmuted”) into gold. Alchemy has been called the Great Arte, the Black Arte, the Great Work, and the Divine Arte. Alchemists view(ed) themselves as working with nature to perfect it and themselves to realize their true divine essence. Parts I and II of this article describe some basic alchemical concepts and Parts II and IV describe some famous alchemists and the development of chemistry.

The words *alchemy* and *chemistry* can be derived from Arabic *al kimiya* or Greek *chymeia*, the latter word meaning “to pour.” The Hebrew word *chamaman*, meaning “mystery” or “religious secret,” and Greek *chymike*, meaning “laboratory work,” are alternative derivations. Other etymology includes the Arabic *al khem* meaning “black;” this is an ancient name for Egypt because of its dark soil. The notion of alchemy as a “Black Arte” refers to its Egyptian origins, its secretive nature, and the first step in achieving the Philosopher’s Stone, the tool that transmuted metal into gold.

To understand alchemy, we need to recognize the extent of ancient civilizations’ scientific knowledge. They had none of the concepts we take for granted today. They had no atomic theory, so they had no concept of the atom, nucleus, electron, or chemical reaction. Similarly, they had no concept of a pure substance or chemical element. They had no modern concept of energy, so they did not know heat is a form of energy. They had no modern concept of animate organisms vs. inanimate matter. Finally, the ancients did not know that air is a mixture of substances or that bubbles are gaseous product(s) of chemical reactions. When we examine ancient alchemical concepts we need to keep all of these points in mind. Ancient notions contain some logic when we set aside our advantage of modern science. After all, we have our

EVENTS CALENDAR

June Program

Saturday 16 June 2007 at 2 p.m.
Center for Nonprofit
Management
2900 Live Oak Street in Dallas

Bad Fiction

How should skeptics respond to fiction dealing with paranormal phenomena?

Kristine Danowski and John Brandt will lead a discussion.

NTS Social Dinner and Board Meeting

Saturday 23 June 2007 at 7 p.m.
Good Eats 6950 Greenville
Avenue, in Dallas

Let us know if you are coming.
We need to reserve a table.

Check the NTS Hotline for more information at 214-335-9248.

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modern science because ancient people had to start somewhere, and their alchemical theories were their start. As astronomy developed from astrology, so chemistry developed from alchemy.

The precise origins of alchemy are obscure. It arose independently in Egypt, China, India, Greece, and America at least five thousand years ago. Many alchemical texts name one Hermes Trismegistus (“Hermes Thrice Magisterial”) as the founder of the Great Arte ca. 2500 BCE. However, modern scholars regard this character as a myth. Egyptian and Arabic cultures contributed significantly to the development of both alchemy and chemistry.

The ancients knew the following chemical elements: the metals gold, silver, mercury (quicksilver), copper, lead, tin, and iron. They knew sulfur and carbon as nonmetals but did not regard them as important. The elements arsenic, antimony, bismuth, and zinc were discovered between 1250-1500 CE and incorporated into alchemical theories of the day. Alchemy combined true chemistry with mythological, mystical, and philosophical beliefs. Practiced as trial and error, it was mostly a solitary endeavor, with knowledge passed orally from master to apprentice.

Here is where mysticism enters the picture. The ancients believed that metals were living things with souls, and that metals multiplied inside the Earth. For example, when all the metal was extracted from a mine, the mine was sealed so that the metal would have time to regenerate. This belief persisted well into the 1700s CE. Mining was the removal of metal from the womb of Mother Earth. Thus metallurgy became a secretive and mystical activity, and metallurgists/chemists became similar to priests. Some scholars think that metallurgy or mining were possible origins of alchemy.

Therefore, ancient alchemy combined both the practical and the mystical. Practical chemistry included metallurgy (mining and purification of metals for weaponry, jewelry, and coins), art (paints, inks, dyes), medicine (various healing herbs and herbal preparations, funeral rites), and the mundane (flavoring herbs, spices, cosmetics). For example, ancient texts describe metallurgical methods that, when followed as written, produce quantitative yields of nearly pure metals. Civilizations depended on these metals, so naturally they would know how to extract and purify them. Mystical chemistry was the search for the Philosopher’s Stone, symbolism, and various theories about the origin of matter.

We now know that naturally occurring metals are found in varying states of purity; many ores, minerals, and chemical compounds can be decomposed to the individual metals they contain. The ancients observed that alloys and amalgams such as bronze (copper and tin), and pewter (lead and tin) retained their metallic properties even if their physical appearance changed. In other words, when ancient metallurgists combined two metals, the alloys remained lustrous, malleable, and thermally conductive just like their source metals. These properties logically suggest continuity, a common aspect, or substance among these metals. If we can change two different metals into a third metal or decompose one metal into two, ancient alchemists might have reasoned,

can we not change a single metal into a different metal? Changing one metal into another, or transmuting, was one explanation of metallic behavior.

Alchemists injected more mysticism into their craft by attributing various qualities and symbolic associations to the known elements. Gold was chemically inert to the ancients' methods, so it became pure, incorruptible; it represented perfection. Gold became identified with divine powers. It could overcome death. Gold is the color of the Sun that nurtures life by day. Alchemists symbolized gold as the King. Alchemists also identified silver with divine powers, although not as powerful as gold. It is the color of the Moon that nurtures life by night. Antimony was the "wolf of metals" (*lupus metallorum*) and "lead of the philosophers" since it can dissolve the other known metals. The ancients called mercury "quicksilver" because the silvery liquid moved quickly when they tried to catch it. The ancient Romans called mercury *hydrargyrum*, or "liquid silver." Mercury became associated with volatility, change, and the god Hermes. The modern word "mercurial," meaning a volatile person, retains this association. Eventually mercury became identified with alchemy's mythical founder Hermes Trismegistus.

Alchemists also associated the seven known metals with the seven known planets as shown in Table I. Some planets and metals became associated by color, such as the Sun and gold, the Moon and silver, and Mars and iron (rust is red). The slowest known planet, Saturn, became associated with the densest known metal, lead. Retaining this association, the modern word "saturnine" means slow or sluggish. The fastest planet Mercury was associated with the deity Hermes, the quick messenger of the gods, so the metal mercury/quicksilver retained this association. An alchemical text illustrating how alchemists used planetary symbols as elemental symbols is shown in Figure 1. Anyone familiar with astrology will recognize the planetary symbols as those astrologers use today. Antimony was not associated with a planet; the known planets were already associated when antimony was discovered. The other symbols in the text are: *Sal amac* is ammonium chloride, *A.F.* or *aqua fortis* is formic acid, *A.R.* or *aqua regia* ("royal water," "water of the King," the only acid that dissolves gold) is nitric:hydrochloric acid, *S.V.* or *spirit of wine* is ethanol, and the remaining symbols are self-explanatory.

Table I. Planets and Their Associated Metals

Planet	Metal
Sun (Sol)	Gold
Mercury	Mercury (Quicksilver)
Venus	Copper
Moon (Luna)	Silver
Mars	Iron
Jupiter	Tin
Saturn	Lead

Figure 1. Symbols of Planets and Their Associated Metals from a ca. 1678 CE Alchemical Text

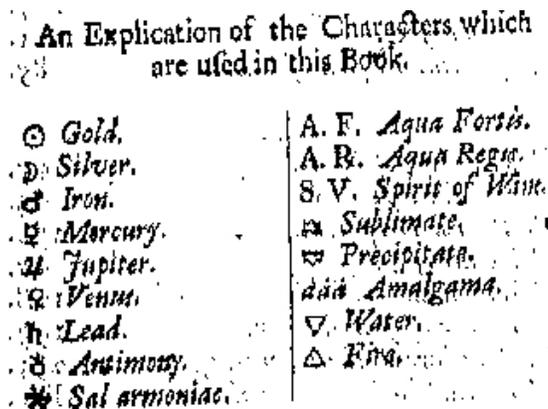
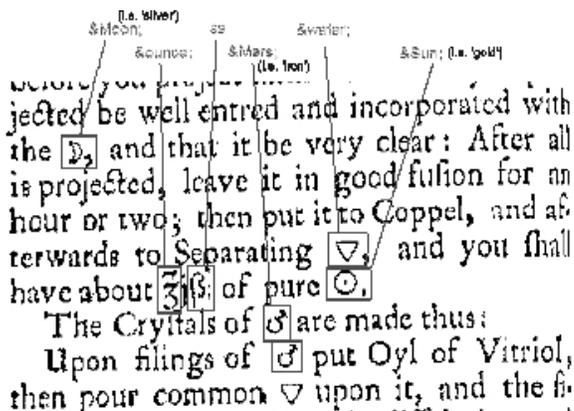


Figure 2 shows how alchemists used these symbols in their manuscripts. Figure 2 can be roughly translated as "...be well entered and incorporated with the silver, and that it be very clear: After all is projected, leave it in good fusion for an hour or two; then put it to Coppel [unknown], and afterward to separating water, and you shall have about ounces of pure gold. The Crystals of iron are made thus: Upon filings of iron put sulfuric acid, then pour common water upon it..." The very notion of representing metals with symbols or abbreviations originated with alchemy and continues in modern chemistry with letters representing chemical elements. Alchemy, however, had few standardized notations and its symbols were open to interpretation. Even alchemical apparati had numerous symbols in alchemical literature.

Figure 2. Use of Alchemical Symbols in a ca. 1678 CE Text



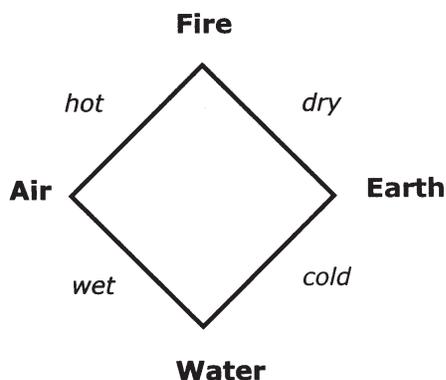
Like modern physics, alchemy had its own theories of everything. Alchemy postulated a fundamental state of matter which is the basis for the formation of all substances and called it primary matter or Prima Materia. Thales of Miletus, ca. 624-546 BCE, proposed that water is the Prima Materia. His

student Empedocles of Agrigentum, ca. 500-430 BCE, proposed that all matter consists of four primordial Elements of equal importance – Earth, Air, Fire, and Water. Similar ideas of the Four Elements emerged in Egypt, India, and China ca. 1500 BCE.

Greek natural philosophers continued to develop alchemical theory. Democritus, ca. 460 – ca. 370 BCE, described two realities in nature: Atoms (atomos, “not cuttable”) and Void (vacuus, “empty”). Democritus’ Atoms were not today’s atoms. Atoms assumed the physical characteristics of their substance. For example, Atoms of water were smooth and slippery while Atoms of iron were jagged with hooks. Democritus regarded Void to be as real as Atoms.

Aristotle, 384-322 BCE, was an anti-Atomist. He could not accept the idea of Void. (Later Descartes would echo this sentiment when he said “nature abhors a vacuum.”) Aristotle declared that matter consisted of the Four Elements plus a heavenly Fifth Element, Ether. He also proposed two pairs of opposite “Qualities” related to the Four Elements. Aristotle’s ideas remained canonical until the late 1600s CE. Figure 3 illustrating Aristotle’s ideas is one of the fundamental symbols in alchemical literature until the 1700s CE.

Figure 3. Aristotle’s Four Elements with Their Associated Qualities



According to Aristotle, all matter is composed of the Four Elements (Ignis, Aer, Aqua, and Terra) in varying proportions. Figure 3 shows that each Element can be converted to the other by adjusting the proportion of each Quality. For example, to make Fire from Air one adds more hot and dry Qualities. To make Water from Earth one adds more cold and wet.

To the ancients, the Four Elements theory made sense. Plants and animals die without Water and Air; plants need Earth to grow; one can produce a spark of Fire when rubbing two rocks together. When heated over Fire metals can melt; molten metals are hot or contain more Fire. When wood burns, it breaks down into steam, flames, gases, and ash; the Four Elements are released. A logical assumption is that the wood, metals, and or-

ganisms contain the Elements in question. Without modern knowledge the Four Elements are eminently reasonable.

Kristine Danowski is Vice-President of The North Texas Skeptics.



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Web News

by John Blanton

The World Wide Web is a wonderful source of information and news. Some of it is true, and some of it is not.

Man-to-Monkey Billboards Turn Up the Heat on Evolution

<http://www.ntskeptics.org/news/news2007-05-15.htm#monkey>

Thanks. I'm feeling the heat already.

Anti-evolution billboards point viewers to website announcing \$5,000 contest and new 'Let's See How Evolution Works' game

Billboards are pointing drivers to evidence against evolution. Which could turn out to be a long drive. The billboards direct readers to the Who Is Your Creator Web site, which will then carefully explain the theory of evolution and challenges to it. Starting May 14 the WIYC forum will feature the Let's See How Evolution Works game. The game is going to present and critique evolutionary transitions that are "commonly used as proof for evolution."

Skeptics, wait. There's more. WIYC is offering a \$5,000 prize for a winning four-part legal opinion on the "scientific and legal aspects of teaching evolution and creation in public education."

[A] retired attorney donated the prize money and framed the contest rules. The contest is meant to educate the public on the urgent need of a critical analysis of evolution. "Evolution needs to be assessed by empirical scientific standards - not by the current philosophical standards based on 'naturalism,'" claims Who Is Your Creator's founder, Julie Haberle.

You can follow the WIYC forum at <http://pub17.bravenet.com/forum/1424646898>.

The rules for the contest are available at http://www.whoisyourcreator.com/contest_rules.htm

While U.S. Constitutional law permits "teaching the controversy," school boards, judges, and legislators are systematically prohibiting educators and schools from presenting any critical analysis of evolution. However, according to a August 2005 Pew Research Center survey, Americans believe in creation over evolution by a 60% to 26% margin and "nearly

two-thirds of Americans say that creationism should be taught alongside evolution in public schools."

That shocking piece of news comes from an item published in The New York Times nearly two years ago:

<http://www.nytimes.com/2005/08/31/national/31religion.html>

WIYC considers its anti-evolution campaign successful.

Receiving worldwide attention from their previous billboard campaign, Who Is Your Creator considers their status listed under "Threats to Evolution Education" by the American Institute of Biological Sciences their most prized accomplishment. "How silly that they would think we are a threat unless they don't what the public to know the truth," commented Haberle.

An outdoor advertising (billboard) company picked up on what WIYC about and donated additional space to them in Oregon and Georgia. Fund raising aims at promoting additional displays in the key legislative states of Pennsylvania, Ohio, Tennessee, Kentucky and Missouri.

Who Is Your Creator is a 501(c)3 public charity based in Minnesota that uses media, including display advertising, to raise awareness of the serious misrepresentations and lack of scientific proof for the theory of evolution.

I checked the WIYC forum, and as I far as I can tell, it's the classic dialog between evolutionists and true believers. I invite you to log on and follow the discussion. It's a great answer to claims by creationists that their argument is scientific, not religious.

Testing Adam Dreamhealer's claims

<http://www.ntskeptics.org/news/news2007-05-24.htm#dreamhealer>

By **ANDREW MacLEOD** May 23 2007

Does his presence boost, or discredit, a UVic alternative health conference?

Simon Fraser University psychology professor Barry Beyerstein once organized a test for Adam McLeod, who until recently used only a first name for his public appearances and who now goes by Adam Dreamhealer.

From <http://www.cicap.org/congress/beyerstein.html>:

Barry Beyerstein is Associate Professor of Psychology and a member of the Brain Behaviour Laboratory at Simon Fraser University. A native of Edmonton, Alberta, he received his bachelor's degree from Simon Fraser University and a Ph.D. in Experimental and Biological Psychology from the University of California at Berkeley.

Dr. Beyerstein chairs the Society of B.C. Skeptics. He is also a Fellow and member of the CSICOP Executive Council.

It was about six years ago, when Dreamhealer was still in high school and building a reputation as a healer who connects to people's "holographic energy fields" to help them heal themselves. Now 20, Dreamhealer is a popular alternative therapist and the author of three books. His six-hour workshop this weekend at the Body Heals conference at the University of Victoria sold out weeks ago at \$110 a ticket, an admission separate from the rest of the conference.

Dreamhealer has many fans who attest that he is doing something special. Others, including Beyerstein, call him a likely fraud. His presence is a knock against the credibility of the conference on integrated health care, the university and the other presenters, they say.

Dr. Beyerstein has agreed to arrange a test of Dreamhealer's wonderful powers.

"At first I wasn't interested," says Beyerstein, recalling the invitation to test Dreamhealer's abilities. Dreamhealer's father kept trying to arrange a meeting between the professor and Dreamhealer, however, and eventually Beyerstein agreed to talk with the boy.

Having been told Dreamhealer could tell people what illnesses they have even over great distances, Beyerstein asked Dreamhealer to diagnose him over the phone. "He tried to diagnose me and it bombed horribly," he says. "He told me stuff that was not true and missed stuff that was true."

To bad there won't be a test. Dreamhealer's parents have pulled the plug on such an enterprise. The assumption is they feared their son would bomb again. That's my fear, as well.

There's more. Dreamhealer and his parents figure Beyerstein is too closed minded to evaluate this wonderful gift. Talk about an echo. When have we heard this excuse before?

Interview: Creation Museum Founder on Evolution Clash

<http://www.ntskeptics.org/news/news2007-05-24.htm#clash>

Skeptics. The big day is almost at hand.

Wed, May. 23, 2007 Posted: 11:35:25 AM EST

Protests have been planned, petitions have been signed, and people have voiced their opposition to the new \$27 million dollar Creation Museum that will open next week just outside Cincinnati. Ken Ham, the president and CEO of Answers in Genesis and founder of the museum, has not been dismayed, however. He has a message to tell, and he thinks it's more than worth hearing.

Skeptics, you need to still your protests and put down your banners. This is what we live for. If it weren't for Ken Ham and his like, what would we be doing in our spare time? I know—watching Rosie O'Donnell on View. Wait. On second thought we better not go there.

With less than a week away until the museum opens to the public, Ham was able to take some time away from his slew of interviews and other projects to speak with The Christian Post. During his time, Ham explained how his ministry's view of creation is more than valid when put up against other models such as evolution, and that it is biblical as well. Through the Creation Museum, he hopes to change some mindsets that people hold onto so strongly.

What I love most about this is what it must be doing to the other clowns at Discovery Institute. They spend a lot of energy explaining that Intelligent Design (creationism) is based on science, not religion. I'll bet they don't plan on sending Ken Ham a Christmas card this year.

May 28 is the big day. Got your tickets?



Future Meeting Dates

June 16, 2007

October 13, 2007

July 14, 2007

November 10, 2007

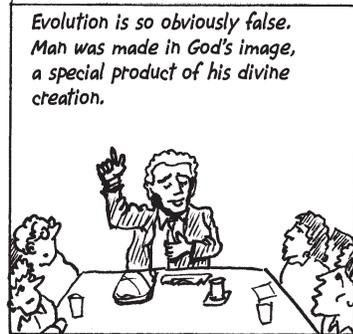
August 11, 2007

December 8, 2007

September 8, 2007

Skeptic Ink

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What's new

By Robert Park

[Robert Park publishes the What's New column at <http://www.bobpark.org/>. Following are some clippings of interest.]

Creation: vegetarian dinosaurs line up to board Noah's Ark.

Jurassic Park it's not. The \$27M Creation Museum in Petersburg, KY opens Monday. Petersburg is across the Ohio River from Cincinnati, but it's about 150 years behind. I was in Cincinnati for a meeting a number of years ago. It was a bright spring day, and I took the lunch period to walk in a pleasant park that ran a mile or so along the bank above the river. There were bronze plaques set in the walkway depicting long-extinct life forms characteristic of each geologic period. As they walked further and further back in time, children would stop to read each one. Across the river, the Creation Museum shows the world after "the fall" and expulsion from Eden. Frozen in time, dinosaurs and people were created on the sixth day, and never ate each other. The museum is a monument to the failure of education. Meanwhile, the National Association of State Boards of Education will elect officers in July. There is only one candidate for President-elect: Kenneth Wilson, a Kansas Republican who voted to change the state's science standards to include intelligent design.

DOE polygraph program: counter intelligence taken literally.

A 30 Apr 07 memo notified Los Alamos employees that random polygraph tests of 8,000 personnel in high-risk categories will be conducted by the DOE as part of a new counter-intelligence program. Three years ago, a National Academy of Sciences study done at the request of the DOE, *The Polygraph and Lie Detection*, (<http://bobpark.physics.umd.edu/WN03/wn041803.html>) concluded that the high incidence of false positives made the polygraph worse than useless. Nothing indicates it will work any better for randomly

chosen personnel. The polygraph, in fact, has ruined careers, but never uncovered a single spy. If you have an orgasm while being tested and lie about it, the operator can probably tell. For anything else, it's a coin toss.

Collapsing bubble: Purdue launches a new probe of Taleyarkan.

Our last episode in the continuing Rusi Taleyarkhan sonofusion mystery ended as Rep. Brad Miller (D-NC), chair of the Science Investigations Subcommittee, asked for the report (<http://bobpark.physics.umd.edu/WN07/wn032307.html>). Last week, the subcommittee concluded that, although Purdue had bungled the investigation, the still-secret internal report reveals serious deviations from accepted scientific practices. In today's installment, according to Science, there are new allegations, as a result of which the University is undertaking a broader study, expected to take another 3 months. It's already been a year.

Intelligent Design: creationist astronomer denied tenure.

Guillermo Gonzalez was denied tenure at Iowa State University. The Discovery Institute was shocked at this blatant disregard of the cherished principle of viewpoint diversity. With Jay Richards, a theologian, Gonzalez wrote *The Privileged Planet: How Our Place in the Cosmos is Designed for Discovery*. It's a daffy twist on the anthropic principle, which was already daffy enough. The simple fact is that his colleagues voted him off the island. It's not like he was tenured and then fired.

Tenure: it does not guarantee you'll be taken seriously.

Something happens to scientists who think too much about the anthropic principle. Frank Tipler and John Barrow wrote *The Anthropic Cosmological Principle* in 1986. Last year it won Barrow the \$1.4M Templeton Prize. Tipler probably thinks he should have gotten it in 1994 for *The Physics of Immortality*, but he's not giving up. In his new book, *The Physics of Christianity*, out this month, Tipler equates the Holy Trinity with the cosmological singularity.

Bob Park can be reached via email at opa@aps.org.

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