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Healthy skepticism

A LESSON IN CHEMISTRY AND CHICANERY

By Tim Gorski MD

Antioxidants are all the rage among “nutritional supplements” these days. The promoters of these “miracle breakthroughs” say that they can prevent heart disease, cancer, and ensure astounding longevity and vigor. They vie with one another as to which of their nostrums is “the most potent” and “the strongest” antioxidant. Now Royal Body Cure of Dallas, Texas, is offering “Microhydrin,Ô” which is claimed to be a special preparation of “silica hydride,” a “nutritional form of hydrogen,” which is “the ultimate antioxidant.” But to understand the preposterousness of this scam, a cursory understanding of basic chemistry is necessary.

Consider acid-base chemistry. Most people probably have some sense of acid being a bad thing. After all, they’ve seen what the villains do with acid in films and TV shows. They know that “acid rain” is some sort of environmental retribution for air pollution. And they’re familiar with ads touting antacids for stomach upset and heartburn. But how many people know that lye, which is found in most household drain-cleaning products, is an excellent antacid? It is far more powerful, in fact, than Maalox?, Rolaids?, Tums?, and all the rest of them put together. Yet, surely, most people would shudder at the thought of drinking Drain-O?. Likewise, most people would be skeptical, to say the least, of a remedy for stomach upset and heartburn that was claimed to consist of specially-formulated lye. But why is this? If antacids relieve symptoms of excess stomach acidity, why isn’t lye a good choice for heartburn and upset stomach?

Acid-base reactions refer to chemical transformations involving the release or consumption of positively-charged hydrogen ions (H+), or protons, since this is what you get when a hydrogen atom is stripped of its single electron. An acid is a proton source and a base is a proton sink. Acidity corresponds to an abundance of protons, while alkalinity corresponds to their scarcity. The strength of acids and bases depends on how well they donate or accept protons. Strong acids, for example, continue to release protons even under very acid conditions, while strong bases continue to consume them even when protons are very scarce.

Acid-base reactions are very important in biochemical processes. But almost always these involve weak acids and weak bases: acids and bases that donate or accept protons only somewhat reluctantly under physiological conditions. Indeed, many biological materials, including the familiar amino acids, incorporate acidic and basic properties in the same

molecule. It is this preference for milder conditions that makes relatively weak bases such as calcium carbonate and aluminum hydroxide most suitable for use as antacids for an upset stomach. These substances do a fine job of neutralizing excess stomach acid that would otherwise continue to be painfully neutralized by our living tissues. Lye, on the other hand, would wreak acid-base havoc with those same tissues before it ever had a chance to neutralize any stomach acid.

Now we are ready to consider redox reactions. Whereas acid-base chemistry has to do with the release or uptake of protons, redox chemistry refers to similar transformations involving electrons. When a chemical substance donates electrons, it is said to become oxidized. And when a molecule accepts electrons it is said to be reduced. When oxygen is the final recipient of electrons - as it is in many redox reactions - the substance from which it receives the electrons is oxidized and it is oxygen which is actually reduced.

Under ordinary conditions, these oxidative reactions tend to be energetically favorable. That is, they release energy. This is why fires give off heat and light, why cars, airplanes and spacecraft can burn fuel for power, lift, and thrust, and why iron rusts. Getting these processes to run in reverse, on the other hand, is more difficult because it requires an input of energy. Photosynthesis using sunlight is necessary in the case of making wood and petrochemicals from carbon dioxide and water, while smelting is necessary to make steel from iron oxides. Thus, it is reasonable to say that there is something of a bias in favor of oxidative reactions under ordinary conditions.

Life as we know it would be impossible without redox reactions. This is because most organisms take advantage of the ready availability of oxygen and the energetics of oxidative processes to drive the many biochemical pathways which comprise metabolism. In some biochemical processes, molecules other than oxygen are the electron acceptors, and these are referred to as reductive reactions. Special enzymes and cofactors are used in most of these transformations and often they are still linked, directly or indirectly, to oxidative reactions in which oxygen molecules are the final recipients of electrons.

As might be now suspected, biochemical processes are not compatible with either strongly oxidizing or strongly reducing conditions. For in either case fragile molecules would quickly become damaged by both untoward oxidative as well as reductive processes, though it appears that the risk of oxidative damage almost certainly predominates under ordinary conditions because these are energetically favored. It is this last that suggests that antioxidants may be a good thing to have around. And the facts support this supposition to some degree.

It has been known for decades, for example, that preservative chemical substances that act as antioxidants can reduce the incidence of various cancers. In fact, butylated hydroxyaniline and butylated hydroxytoluene (BHA and BHT), two common additives of the multisyllabic "artificial" sort that the "all natural" crowd love to hate, reproducibly protect against cancer in animal studies. It is now thought that cumulative oxidative damage may also play a role in atherosclerosis and heart disease. This is the basis for supposing that antioxidant vitamins or supplements may be of some use in preventing these serious disorders, though the scientific evidence in favor of any particular substance remains weak.

But just what are antioxidants, anyway? Put simply, antioxidants stand in the same relation to redox reactions as antacids stand in relation to acid-base reactions. That is, antioxidants do not prevent oxidative reactions. Rather, they actually participate in redox reactions as reducing agents that readily donate electrons to other, unspecified substances. In essence, they serve as decoys, being themselves more readily oxidized than, it is theorized, the various important structural biomolecules of which our bodies are made. And, as in the case of the best antacids for stomach upset and heartburn, the best antioxidants would be those that donate their electrons perhaps a bit more readily than our own living tissues, but not too much more readily.

And therein lies the problem. No one knows what sort of antioxidants might be best for the prevention of cancer, heart disease and possibly other health problems. Ongoing research is studying exactly this question. But it is apparent on the face of the matter that a "stronger" antioxidant isn't a "better" antioxidant for any more than Drain-O® is a better antacid for stomach upset and heartburn than Tums®. This is why "silica hydride," which supposedly releases hydrogen anions (electrons in the form of hydrogen atoms with an extra electron, H-) as "the ultimate antioxidant" and "a nutritional form of hydrogen" is so preposterous. For such a reactive substance would immediately initiate vigorous

reductive transformations with any and all other molecules with which it came into contact. In fact, “silica hydride” would likely react – explosively – with water to give rise to silicon dioxide and flammable hydrogen gas. When physical chemists wish to use a strong electron donor, they typically turn to borohydrides. But these are toxic substances as well, just as lye is.

Royal Body Cure claims that their “Microhydrin?” product is the result of the work of “Drs. Patrick and Gael Crystal Flanagan, ... the world renown [sic] research team” that developed this “nutritional form of hydrogen.” But the “Drs.” Flanagan do not show up on a MEDLINE search. Nor is there any more reason to think that H- — even if present in this product in any amount whatsoever — is any more “nutritional” than H+, of which there are plenty in ordinary water.

To date, it appears that the most important antioxidative safeguards are to be found in a diet high in fruits and vegetables and there is little evidence to support the use of various extracts or single antioxidant agents. Indeed, some of these, because they are not particularly “strong” antioxidants, can sometimes promote oxidation as well as reduction, just as weak acids and bases can sometimes act as proton donors or acceptors.

But pills sell. And advertising hype like “all natural,” and “miracle medical breakthroughs,” and “X times more powerful,” are far more a part of everyday life for many people than are the basics of redox chemistry or biochemistry. But, based solely on the latter, “Microhydrin™” is either not what it is claimed to be or it cannot have the beneficial effects claimed for it. It cannot be any more than an antacid claimed to consist of lye could either really contain significant amounts of such a strong base or be effective in allaying heartburn or stomach upset. Nor does the usual “unconditional 30-day money back guarantee” change matters in the least.

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Post-rational

By Jimmy Reynolds

NEW CONSPIRACY THEORIES

Last fall yielded a bumper crop of conspiracy theories. This might only prove that anything will grow if you spread enough manure on it. Whatever the source, conspiracies and cover-ups seem to be everywhere. In fact, with the help of the Lubbock-Interplanetary Alien Research Service (L.I.A.R.S.), I’ve managed to uncover some cover-ups of my own. Consider it a contribution to the war on ignorance; I won’t say to which side.

Cassini Deception

NASA launched its Cassini probe toward the planet Saturn in 1997. The space agency admitted that Cassini was carrying ninety-four pounds of plutonium, the radioactive metal used in the cores of most nuclear weapons. In this case, according to NASA, the plutonium was fuel for a radio-thermal generator (RTG), a kind of miniature nuclear reactor that provides the spacecraft’s power. Fearing a catastrophic accident, anti-nuclear groups protested the launch. They were ignored and Cassini is now on its way to Saturn. It should arrive there in 2004.

This is not the whole story. L.I.A.R.S. put me in touch with one of their confidential sources, a man who claims to have first-hand knowledge of NASA’s inner workings. He insists that his real name not be printed. We agreed to use his code name, “Dueling Banjo”, instead. He recently spoke to me by phone from his camouflaged bunker in the Rocky Mountains.

JR: Thank you for speaking to me, uh, D.B.. What exactly are your credentials? What did you do at NASA?

DB: I was their top nuclear physicist. I knew all their secrets, I had total access to the Administrator and the President.

JR: That's quite a claim. I could check it out, you know.

DB: No you can't. They erased my personnel records and college transcripts. They're doing everything they can to discredit me. They even tried to kill me. I think they put nerve gas in my septic tank. CNN wanted to do a story about it, but their producer quit returning my calls. Then they hauled me into town for psychia—

JR: Sorry to interrupt, but what's this about a Cassini cover-up?

DB: The "radio-thermal generator" is just a cover story. Ninety-four pounds of plutonium is enough to make several nuclear bombs. That's exactly what it's for: Cassini is a nuclear strike against alien bases on some of Saturn's moons. The Voyager probe spotted 'em.

JR: Voyager went through there in 1979. Why the delay?

DB: It took that long to develop the targeting system. You don't really believe all that propoganda about Reagan's "Star Wars" program being aimed at the Russians, do you?

JR: That's certainly intriguing. I was wondering about a technical detail, though. If there's no RTG, what does Cassini do for power? Solar panels won't work that far from the sun.

DB: True. Actually, Cassini has a gasoline generator with a really big air tank.

JR: Even so, how could it carry enough fuel to last seven or eight years in deep space?

DB: You are new to this conspiracy business, aren't you? Remember that experimental eighty mile-per-gallon carburetor that somebody's cousin accidentally got on his new Cadillac but had to give back a week later?

JR: Sure, that story's been around for fifty years. It's been called an urban legend.

DB: Well, it's not, Cassini's generator engine has one of those carburetors. The oil companies donated it.

JR: That ties up a loose end. But aren't you afraid that going public will tip the aliens off? Won't they read about it or see it on TV?

DB: Does Area 51 subscribe to The Skeptic?

JR: Not yet.

DB: Then they won't read about it, and they're way too intelligent to watch TV. That concluded the interview since DB had to go take his medication. I've been asked to look into some other conspiracy theories. Here, briefly, are my findings:

1. There is no evidence that Elvis, rather than the U.S. Government, is bankrolling the international UFO cover-up.
2. We don't know what became of the baby alien who was smuggled out of Area 51 in somebody's lunchbox in 1952. Al Gore is a few years too old. Maybe it became a talk-show host.
3. Your neighbors do not keep a black helicopter in their garage. That's just their old AMC Pacer with a tarp over it.

Remember, you heard it here first.

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The Third Eye

NEWS AND COMMENTARY FROM THE WEIRD WORLD OF THE MEDIA

By Pat Reeder

Being in need of a gallon of milk at three in the morning, I was listening to Art Bell on KLIF in my car last week, when his guest was noted UFO abduction guru Budd Hopkins. Not surprisingly, the two got into a nice, stimulating round of “Bash the Skeptics” which, alas, only served to reinforce my skepticism of them. Let’s review, shall we?

As I tuned in, Hopkins was attacking the PBS science series, *Nova*, over an alien abduction episode in which he’d had some involvement. He claimed to have provided the producers with photos of cuts and scoop marks on the skin of alleged UFO abductees, yet when the show aired, it said that there was no hard evidence. Hopkins suggested that PBS is part of a vague, shadowy conspiracy to suppress the truth. After all, how could they say there’s no hard evidence when they have actual photos of superficial skin abrasions?! Why, that sounds to me like **IRREFUTABLE** proof that people are being hauled away in the middle of the night by flying saucers full of bug-eyed space monsters! There is certainly no other plausible explanation!

At this point, the conversation incongruously shifted to Art and Budd congratulating themselves on their own mental prowess and explaining why it is actually they who are the true skeptics, and skeptics who are the irrational believers (follow me on this). As Hopkins explained it, skeptics can accept only that abductees are either lying or mentally disturbed because their “religion” of science refuses to let them accept the third possibility that their stories could be true. Thus, skeptics have only two belief choices on this issue, whereas Hopkins has three, making him half-again more open-minded (although if he really thinks there’s a possibility alien abductions aren’t real, you wouldn’t know it from the career he’s built out of promoting that belief).

My response to this is always the same: I’m much more open-minded than you, Budd, because I’m willing to believe any proposition whatsoever, no matter how ridiculous: just show me the proof first. And by “proof,” I mean real evidence, not photos of paper cuts and recordings of hypnosis sessions led by untrained armchair psychologists. I’m even willing to believe in unicorns. Just tie one up in my front yard, and I’ll write a whole column about it.

Next, the conversation turned to Bell’s recent receipt of CSICOP’s “Snuffed Candle Award,” for doing more than any other person in 1998 to undermine the public’s understanding of science and logic. Bell rather smugly recounted how he invited Joe Nickell of CSICOP onto his show to talk about the award, then tripped him up by asking if he had ever listened to Bell’s show. He said there was a long pause and then Nickell answered, “No.” Of course, Bell and Hopkins made much merriment out of us hypocritical skeptics for condemning something we’d never heard.

But of course, what this anecdote really proved is that CSICOP was dead right: Art Bell wouldn’t recognize the scientific method if it plucked him out of his bed and gave him an anal probe. His argument was based on a false premise: just because Nickell is a member of CSICOP, and CSICOP gave him (Bell) the award, it does not automatically follow that Nickell had anything to do with choosing the award recipients. That is called a “leap of logic,” and if such leaps were Olympic events, Art Bell would be Jesse Owens.

At this juncture, I arrived at the supermarket and sadly, had to bid adieu to the Bobbsey Twins of bunk. But I just thought I’d write it all up for you to prove that yes, indeed, there are lots of skeptics (mostly those who enjoy a cheap laugh at someone else’s expense) who do listen to Art Bell, at least on occasion (you don’t want to feed your brain too much of this stuff). And Art, speaking as a card-carrying skeptic who actually listens to you on a semi-regular basis, I just want to say: “Enjoy your Snuffed Candle Award. You earned it.”

[See [Web News](#) for an excerpt from Budd Hopkins’ Web Page.]

Since last we spoke, the Vatican has issued new exorcism guidelines, the first revision since 1614. Apparently, the devil

is getting harder to evict (even impeachment won't work anymore), so some new rules were necessary. They're not much different, aside from offering priests a couple of optional new texts to try (they can read *The Bridges of Madison County* and see if the demon wouldn't rather go back to Hell than listen to it). And the exorcism rite is still in Latin ("Am-scray!"). But one major departure is that priests are now warned to take psychiatric medicine into account and not to mistake mental illness for genuine demonic possession. Yes, it is vitally important that you be able to distinguish between those two things...

USA Today ran a good article this month on the Great Asbestos Cancer Panic. Surely, you've seen news footage of men in space suits, like the G-men in E.T., going into evacuated schools to remove that deadly asbestos that's been sitting there for 50 or more years with no noticeable ill effects on the students? Well, it turns out the EPA and other alarmists panicked the populace and forced us to spend untold billions on asbestos clean-up, all for no apparent reason.

The original cancer-asbestos link involved a group of people who worked for decades in close quarters with a different kind of asbestos than that which is used in buildings. In fact, the chief epidemiologist for the American Cancer Society said the risk of getting cancer from asbestos in a building is so tiny, removing it makes no sense. A Harvard study found that you are 21,500 times more likely to die from smoking than from exposure to asbestos. And an epidemiologist with the Arizona Health Department called asbestos removal "a fiasco," and said we'd save far more lives if we spent the money on research, sunscreen, more guardrails, or "almost anything, really."

Of course, there's no way that we will just admit our mistake and drop the whole thing. No, asbestos removal is now a multi-billion dollar industry which must be protected, and anyone who dares to say nay will soon be hit with a gigantic lawsuit. So on we go with the pointless waste of money and effort. At times like these, I get so hot under the collar I'm afraid I might spontaneously combust. Thank God, I didn't throw out my nice, comfy, asbestos easy chair!

New York Mayor Rudy Giuliani's war on crime is now targeting psychics. In a crackdown called "Operation Crystal Ball," the NYPD has busted 15 psychics in the past year, one of whom charged a sucker \$250,000 to remove a "curse." Police warned that "they'll take anything": after one woman exhausted her life savings, she gave the psychic her wedding and engagement rings.

This crackdown is ongoing, and let's hope it catches on with police departments around the country, since many "psychics" are transient crooks who will move to another city if the heat is on only in New York. By the way, the best part about "Operation Crystal Ball" is that it's an undercover sting operation: cops pose as clients and go along with the psychic until they have enough evidence to bust him. So far, not a single psychic has realized that the client was a cop. That alone should tell you all you need to know about the powers of professional psychics.

Finally, I'll close out with a plug for a book that I haven't even read yet myself, but after seeing the reviews, I'm very much looking forward to it. *Apocalypse Pretty Soon: Travels In End-Time America* by *Wired* magazine editor Alex Heard sounds like just my cup of java. Heard has spent 10 years doing anthropology work among various wacko fringe cults. He covers everyone from the Unarius sect (waiting for the aliens to land in 1973...Oops, make that 2001!) to the "Immortals" who think they'll live forever if they just refuse to believe that they will die.

Entertainment Weekly said, "Heard's mix of humorous skepticism for these obsessed, unquenchable characters results in an engagingly sane book that acknowledges the cultural need for eccentrics and weirdoes and also the cultural need to keep an eye on them." Gee, it's just like like what we do around here!

The book sounds worth the price just for Heard's description of sitting in some dark Minnesota woods with a group of CSETI members who were trying to attract flying saucers by shining flashlights into the sky. Suddenly, they went on full alert when they heard an eerie, otherworldly sound. It turned out be a big-eyed creature trying to contact them, all right. It was "a large, indignant owl."

However, I feel I must point out that nobody has yet been able to prove that this particular owl did NOT come from outer space. Okay, Art and Bud: how's THAT for open-mindedness?!

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Web news

By John Blanton

The Internet is one of the least reliable sources of accurate information, but it's free. Read with caution.

Budd Hopkins' response to New York (City) Area Skeptics

Peter Huston has forwarded this from Budd Hopkins' Web site:

Some months after I delivered a lecture on the UFO abduction phenomenon at the Chappaqua, New York, library, I received a letter from a program director of the New York Area Skeptics. The writer had attended my lecture and as a result was inviting me to participate in a "debate" on "the nature of UFOs" before his organization. I, or a surrogate debater, was being asked to "defend" what he described as "this point of view," though he neglected to spell out exactly what he meant by that phrase.

The following is my answer to his politely worded invitation, which I subsequently mailed to him. I publish it here in full, though I have omitted the name and address of the Skeptics' official to whom it was sent, and my own telephone number.

Despite the obvious fact that each of us has his or her personal policy about such invitations, I offer my reply as one possible response, in the hope that some may find it useful in similar situations.

Dear [Sir] :

I must apologize for my delay in answering your letter and invitation to debate the New York Area Skeptics. Since I received your letter I have been travelling extensively and then undergoing the holidays, so many things have been postponed.

With regard to a debate with your group, my policy is this: I believe an extraordinary phenomenon — which the UFO reports certainly comprise — demands an extraordinary investigation. Too often I have been on programs of one sort or another with skeptics who hold strong personal beliefs about the UFO phenomenon but who have never carried out an investigation and who have little information as to the range or weight of the supporting evidence.

Ironically, I find myself the skeptic in such confrontations. I am not sure until I investigate an abduction report whether I am dealing with a hoaxer; with someone who is, to at least some extent, suffering from psychological problems; or with someone who is truthfully reporting a real, physical experience. Here, the so-called skeptic is all too often the true believer: he/she knows that the third option is impossible because UFO abductions are not happening. From my more open position I can entertain all three interpretations — and then conduct an investigation to decide which is closest to the truth.

I find it a waste of time, then, simply to debate the reality of the UFO abduction phenomenon with anyone whose knowledge of the evidence is sketchy and whose beliefs are rigid. Too often that kind of experience has seemed more like arguing with a street corner evangelist than sharing the quest for truth with a genuinely open-minded colleague.

However, I would like to propose a meeting with your group with a purpose other than a debate. I would like to set forth the protocols for the shared investigation of future cases as they come to my attention, to be carried out by any

interested mental health professionals, especially those skilled in administering the standard battery of psychological tests and those with extensive clinical experience. Since we all agree on the prevalence of these very similar UFO abduction reports, I am sure that open-minded mental health professionals in your organization would be quite interested in joining with me in the investigation of such cases, and may have procedural suggestions and particular protocols that they would like to amalgamate with my own.

If you are interested in such a meeting — and it could be restricted to such open-minded mental health professionals — please let me know. I can be reached by phone at [deleted]. In the interest of science, we should be working together, not in counter-productive ideological opposition. We should all be so skeptical that none of us can, at the outset, reject the possibility of anything — least of all something potentially so important to science.

Sincerely,

Budd Hopkins

P.S. I have no objection to your circulating this letter among your members.

CONTACT INFORMATION

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OR, YOU CAN “SNAIL MAIL” US AT:

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Skeptics: I think this means he's turning us down. It's obvious we don't have any class (JB).

Andrew Weil endorses therapeutic touch

(Forwarded to us by Michael Schermer <skeptics@lyris.net>): The following was on the 'Ask Dr. Weil' web site. ([Http://www.pathfinder.com/drweil](http://www.pathfinder.com/drweil)) Thought you might find it interesting.

Q. I was terribly upset by the reports discrediting therapeutic touch as a healing art, especially since I've heard so many good things about it from people I trust. What's your opinion on the matter?

A. I agree with you that the recent news on therapeutic touch has been disturbing. The name “therapeutic touch,” or “TT” for short, is something of a misnomer, since it usually does not involve actual touch. Instead, practitioners (mostly registered nurses) use their hands as sensors to assess and balance the energy field surrounding the body in order to promote our own natural ability to heal. Some call this energy field an aura, others familiar with Asian healing arts know this energy as “Chi.” It's the energy your body radiates by being alive, flowing within you and without you.

TT was pioneered 25 years ago by Delores Krieger, Ph.D., a registered nurse and professor at New York University, and Dora Kunz, a noted healer. Now the technique is practiced by an estimated 20,000 to 30,000 professionals around the world, offered in at least 200 U.S. hospitals, including Beth Israel Medical Center in New York and Georgetown University Medical Center in Washington, D.C., and taught in more than 80 universities.

A typical TT session lasts somewhere between 10 and 30 minutes, during which the recipient sits or lies down fully clothed. The practitioner uses her hands to sense energy blockages around the body, then directs healing energy from herself to the patient. The vast majority of patients who receive TT report feeling deeply relaxed during the treatment (some may even fall asleep).

While the health benefits of TT have been and are continuing to be demonstrated in many clinical studies, along comes an 11-year-old girl with a science project that gets published in The Journal of the American Medical Association (JAMA) and picked up by the press. The objective was to investigate whether TT practitioners can actually perceive a “human energy field.” The 21 experienced TT practitioners tested were unable to detect the investigator’s “energy field.” The conclusion was that their failure to substantiate TT’s most fundamental claim is proof that the claims of TT are groundless and that further professional use is unjustified.

I don’t buy that. There’s too much evidence that healing energy systems work, in cultures throughout the world, in a variety of forms, including Reiki, Jin Shin Jyutsu and American-style TT.

There is controlled research on TT in which patients with chronic pain were randomly divided into two groups. One group got real TT from trained practitioners, and the other got placebo treatments from nurses who held up their hands and were told to count backward in sevens. Patients having the real TT treatment experienced a statistically significant reduction in pain over the group getting false treatments. I regularly recommend this modality to my patients as a means of boosting the healing process and easing pain without the side effects of drugs, and I’ve witnessed the efficacy of TT. We don’t yet understand how it works, but that shouldn’t keep us from using it and investigating it.

Dr. Andrew Weil

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On confronting creationist fallacies

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If there is any arena in which the interface between the scientific community and society at large is of importance it is the education of the public, and especially the education of the young public. And perhaps no part of that arena in the US is of more consequence to many citizens than the attempt by certain groups to fashion the teaching of science according to preconceived religious views... D. Wise (Franklin and Marshall College, US) reviews the current controversy between the scientific community and creationists and discusses a strategy of intellectual confrontation. Among other things, Wise enumerates the following creationist ideas from the Bible that are totally irreconcilable with extant scientific data: 1) the Earth came into existence before the sun and stars; 2) the land plants came into existence before the Sun; 3) the first life forms were plants; 4) fruit trees appeared before fish; 5) fish appeared before terrestrial arthropods; 6) birds appeared before land reptiles.

Indeed, the acceptance of any of these ideas with a restraint of consistency results in the tearing down of the entire fabric of modern science (and the tearing down of all its applications, including modern medicine). Wise concludes, “As scientists, we must emphasize repeatedly that the argument against creationism is not against religion as such but rather against a fringe group’s attempt to force the Bible into the public schools in the guise of a science textbook... The time has come to stop fighting defensive skirmishes and start challenging creationists to defend in toto what they call science — humorous absurdities and all.” Donald U. Wise d_wise@acad.fandm.edu (*American Scientist* Mar/Apr 1998)

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