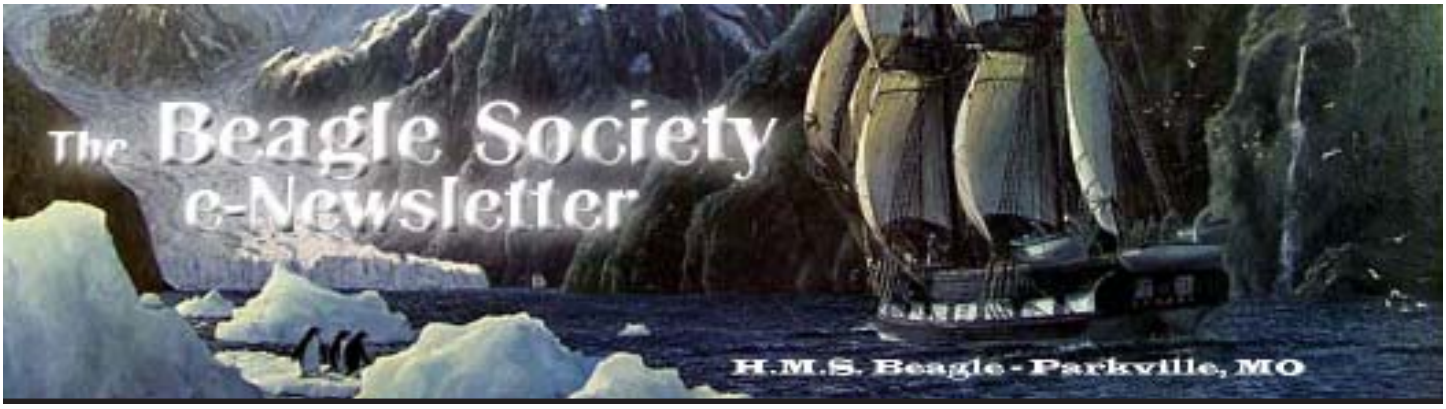

ISSUE #3 **August 2009**

Beagle Society Meeting

7 pm on August 17, 2009

An Overview of the Philosophy of Science
Guest Presenter: Ginger Nedblake

This month's Beagle Society topic is an overview of the Philosophy of Science. We will discuss the major players in the long history – we will go natural with Aristotle, slice and dice with Ockham, and find some consilience with Wilson. Philosophers strive to find method in the madness and madness in the method, and this evening we hope you'll join us for a fast-paced journey through centuries of thinking about scientific thinking.

Ginger Nedblake has a B.S. in Biology, a B.A. in Philosophy and is seeking to reach amateur status in both fields. She is the daughter of John and Carol, wife of Bill, and designs clinical research software in her spare time.

The Beagle's Baloney Corner

A Word about Fossilization

William Nedblake

You've probably seen the video on the Internet somewhere: usually, someone claims that "fossils" couldn't take tens or hundreds of thousands, or even millions of years to form and be consigned to their stony prisons. Therefore, they continue, the world couldn't possibly be as old as those misguided, conspiratorial "scientists" say. Never minding the huge flaw in this logic (ie; even if fossils form relatively quickly, that says nothing about their age relative to that of the Earth), this presents an opening for an argument over the validity of the fossil record. In one particularly egregious example, notorious creationist Kent Hovind (of Dinosaur Adventure Land infamy) claims to have such "petrified" or "fossilized" artifacts as a pickle, a cowboy boot with leg still in situ, and a New Zealander's hat (1). It is even possible, so some sites claim, to "fossilize" an acorn simply by leaving it in a

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Fossilization

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bucket of water over the winter. Hovind's website goes on to state that "Fossilization can happen rapidly under the right conditions, but it is a rare event today (2)." Except, one presumes, if you are a pickle, a cowboy boot and foot, or a rather fetching hat.

Many of us - including me - toss the word "petrified" around without always thinking of its meaning. It's the sort of verbal infelicity which makes it possible for ideologues intent on undermining science to seize on what they think is an opportunity. Of course, it goes without saying that these items are neither "petrified" nor "fossilized", and that the presenter of the video is little more than a fairground huckster. Fossilization is a comparatively rare event which has a very specific definition in scientific literature, and we should take a moment to understand what it is.

The word "fossil" comes from the Latin "fossus", meaning "dug up". In it's most general sense, then, the word could mean that a fossil is anything which has been dug up. In fact, Georgius Agricola, the 16th century mining engineer best known for his book De Re Metallica ("On Metals"), wrote another book entitled De Natura Fossilium ("On the Nature of Things Dug Up"), which, confusingly perhaps, is largely about mineralogy. However, the word in its most general meaning to science means "any trace, impression, or remains of a once-living organism. Thus fossils include the faintest imprint of an early jellyfish or an ancient fern, a cast in rock of a shell, the footprints of a striding dinosaur, the teeth and bones of our own ancestors, and a myriad of other things (3)."

As the definition suggests, fossils can take many forms. When we talk about something being petrified, we are addressing a very specific form of fossilization. Literally turning to stone, as "petrified" implies, could be said to represent one of two possible kinds of fossilization. The first, called permineralization or impregnation, involves the replacement of decaying biomatter with minerals, sometimes down to the cellular level. Cavities within the bony materials are filled with calcium carbonate or silica, these materials could be said to be either lithified or petrified, as both mean "turned to stone", although technically they are turned to mineral. The other type of preservation, called replacement, involves a mineral replacing the existing minerals in a hard structure. For example, shells of sea creatures can be replaced with the mineral pyrite, producing a beautiful replica of the living organism.

Now for the question of how long it takes for something to fossilize. Naturally, this isn't a straightforward question. Taphonomy, the study of the process of fossilization, is sometimes cagey on a direct answer to the question, but for very good reason. Conditions under which fossils form vary wildly, and, therefore, so do the lengths of time which it can take to make a fossil. So, in short, could something "fossilize" in a year? Or even over the winter - as we have heard claimed within the walls of the Beagle - in a bucket of water? In some instances, given an anoxic (oxygen-free environment), bacterial decay in dead shrimp can be halted and soft tissues will be preserved and this process has been shown to be quite rapid, sometimes happening in the course of weeks and months (4). Often, the tissues are preserved in the mineral apatite, a calcium phosphate, in laboratory experiments (5). So yes, while under specific conditions it is possible to drive fossilization very quickly, that is not the same as freezing an acorn - or even a crustacean - in a bucket of water over the winter.

More often, though, fossilization is a process taking tens or hundreds of thousand of years (6). Particularly in the case of the burial of already-decayed bodies, leaving only skeletons, which become and are subsequently found in a disarticulated condition, or in the case of hard-shelled

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Fossilization

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creatures, like ammonites, the fossilization of bone or shell can be estimated based upon likely geological processes, and this number more closely matches our general expectation of “a really long time” (7). And, as pointed out before, comparatively quick or slow, the other lines of evidence for the ages of fossils and the strata in which they are found all serve to corroborate a coherent picture of the age of fossils - and of the Earth.

In the case of these purported “fossils” in the videos, then, what can we suggest? Two things are immediately evident, the first being that these boots and hats and pickles are very likely not real fossils (and a few quick tests can demonstrate that quite effectively, testing chemically for apatite, for instance), and second being that, even if by some definition they are, so what? If a fossil takes three thousand years to form, but is buried for thirty million years, that doesn’t invalidate the fact of the fossil record in the main, and what it tells us about the history of life.

So the next time you encounter someone who says that they have fossilized an acorn, or that they’ve collected a particularly fetching stone fedora, be prepared with a few basic questions - questions which despite their simplicity will nevertheless be hard for your interlocutor to answer. After all, it’s always better to be ready with some facts when your baloney detector goes off than to be caught by surprise.

Notes

1. Hovind, “Fossilized” video.
2. Malone, “Fossils Do Not Prove Evolution”.
3. Shipman, p. 1.
4. Briggs, “Fast Fossilization”.
5. Briggs and Kear, “Fossilization of Soft Tissue in the Laboratory”.
6. Shepherd, “What Is a Fossil? How Do They Form?”
7. Prothero, p. 51-54.

Bibliography and Further Consideration

Briggs, Derek E.G. “Fast Fossilization: Nature’s Histological Technique” - Abstract. http://shum.huji.ac.il/~por/icz_xviii/abstracts/Briggs.html. Retrieved 8 August 2009.

Briggs, Derek E. G. and Kear, Amanda J. “Fossilization of Soft Tissue in the Laboratory” - Abstract. http://www.sciencemag.org/cgi/content/abstract/259/5100/1439. Retrieved 8 August 2009.

Dawkins, Richard. “The Blind Watchmaker”, part 1. http://www.youtube.com/watch?v=VhJdai8eKic. Retrieved 8 August 2009.

— “The Blind Watchmaker”, part 5. http://www.youtube.com/watch?v=acJu9xYbJVw. Retrieved 8 August 2009.

“Foolish Fossils”. http://www.kent-hovind.com/articles/foolish_fossils.htm Retrieved 11 June 2009.

Fortey, Richard. Fossils: The Key to the Past. Washington: Smithsonian Books, 2002.

“Fossil”. http://en.wikipedia.org/wiki/Fossil Retrieved 11 June 2009

Hovind, Kent. “Fossilized”. http://www.youtube.com/watch?v=by8zxOcdEmQ. Retrieved 11 June 2009.

Malone, Bruce. “Fossils Do Not Prove Evolution”. http://www.drdino.com/read-article.php?id=12. Retrieved 11 June 2009.

Prothero, Donald. Evolution: What the Fossils Say and Why It Matters. Berkeley: University of California Press, 2007.

Shepherd, Roy. “What Is a Fossil? How Do They Form?” http://www.discoveringfossils.co.uk/whatisafossil.htm. Retrieved 8 August 2009.

Shipman, Pat. Life History of a Fossil: An Introduction to Taphonomy and Paleoecology. Cambridge, Mass.: Harvard University Press, 1982.

A book review by Leif Bahl

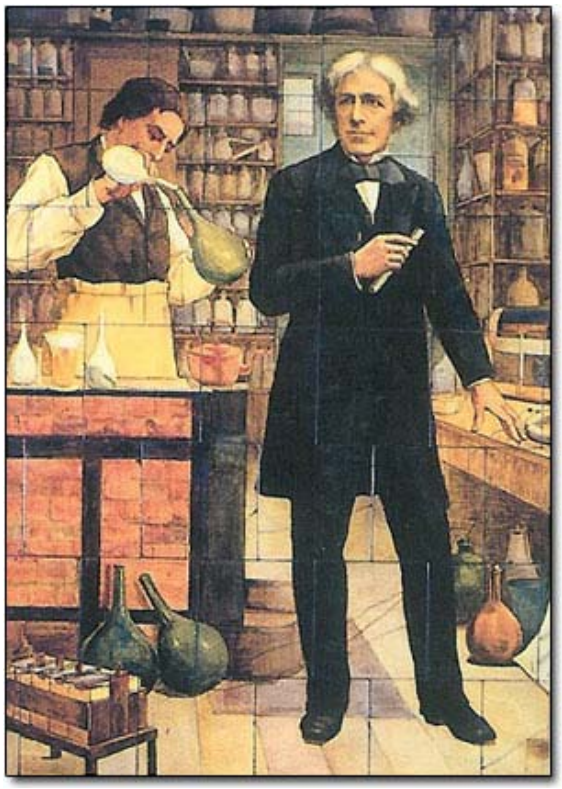
The Chemical History of a Candle

by Michael Faraday

In the past few years I've increasingly become a "fan" of Michael Faraday. Science in Faraday's time was a pursuit of the gentry, someone (typically for the times a man) who was well-off enough that he had the free time and money for such pursuits. Faraday was a different sort though. His family was not well-off and he had to work hard just to be allowed to assist Sir Humphrey Davy at the Royal Institution. Once he got his foot in the door he worked hard and demonstrated a certain scientific talent and eventually worked his way up the scientific hierarchy making people take him seriously by the caliber of his work. He is now recognized as one of the greatest experimental scientists of all time. His work with electricity created the science of electrochemistry and was the inspiration for James Clerk Maxwell who went on to discover the laws of electrodynamics.

Oftentimes the more you learn of a hero eventually something turns up to tarnish his or her reputation. I have not found such an oxidizer to my views on Faraday. To the contrary, all new facts that I learn only serve to polish his reputation in my mind. One such fact being that during the Christmas Holidays of 1860-1 he delivered a course of six lectures to children. These lectures are gathered in one volume published by Dover called The Chemical History of a Candle.

While more interested in what Faraday has to say about electricity, I am interested in chemistry and I thought a children's lecture might be something I could grasp. Thankfully this was the case but not only because these are children's lectures. Another of Faraday's studies – once he established himself as a scientist – was the art of lecturing. He notes in his own letters that audiences "expect to be entertained not only by the subject of the lecture, but by the manner of the lecturer; they look for respect, for language consonant to their dignity, and ideas on a level with their own…. Lastly, listeners expect reason and sense, whilst gazers only require a succession of words…. A lecturer should appear easy and collected, undaunted and unconcerned, his thoughts about him and his mind clear and free for the contemplation and description of his subject…. His whole behavior should evince respect for his audience, and he should in no case forget that he is in their presence…. [H]e should never, if possible, turn his back on them, but should give them full reason to believe that all his powers have been exerted for their pleasure and instruction" (pg. 4).



While a candle may not sound like an exciting subject for an entire book, Faraday uses it as a jumping off point to explore a variety of chemical and scientific topics. As Faraday himself says, "[…] so abundant is the interest that attaches itself to the [chemical history of a candle], so wonderful are the various departments of philosophy. There is not a law under which any part of this universe is governed which does not come into play and is touched upon in these phenomena. There is no better, there is no more open door by which you can enter into the study of natural philosophy than by considering the physical phenomena of a candle" (pg. 9-10).

From such an ordinary candle Faraday goes on to demonstrate all the principles of combustion, what elements make up our atmosphere, how we and most animals respire, all with a liberal amount of fire an explosions thrown in for fun, I mean, for educational purposes.

Faraday intended for the children attending his lectures to go home and try many of the demonstrations themselves, with safety in mind of course. It is this spirit that leads me to believe that this would be a good series of lectures to recreate here at HMS Beagle, for children and adults. I have encouraged all my colleagues to read this book so that we can work on recreating these lectures.

We will also carry this book in the future so that you can read and try some of these demonstrations yourself. I certainly recommend it.

What's Up This Month

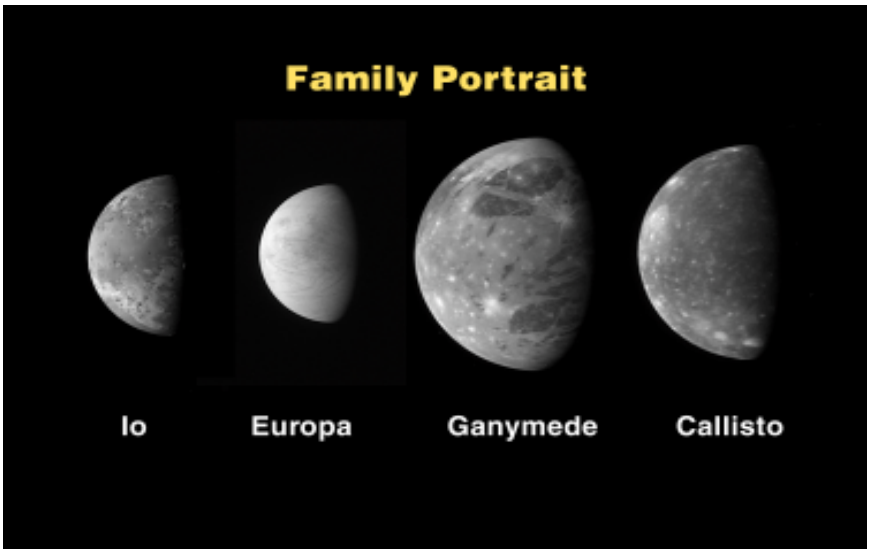
Leif Bahl

If you've looked at the night sky at all this month you've surely noticed an extremely bright "star" in the east shortly after sunset. That "star" is Jupiter. Right now it shines at about magnitude -2.9, or about 3.5 times brighter than the brightest nighttime star, Sirius.

Jupiter reaches opposition on August 14. A planet reaches opposition when it stands exactly opposite the sun from earth's point of view. Being at opposition means that Jupiter will rise at or near sunset, move across the sky all night long, and then set when the sun rises. This places Jupiter highest, and at best viewing angle, at midnight (a reasonable time for observing).

At opposition a planet makes its nearest approach to earth and being near means appearing larger. This month Jupiter expands to about 48 arc seconds. Only Venus appears bigger at its biggest and only because it's much closer than Jupiter.

The first thing you will notice in a telescopic view of Jupiter is the four brilliant "stars" lining up with Jupiter's equator. These aren't stars at all but satellites of Jupiter. During the night, and especially from one night to the next, you will notice these satellites orbit the giant planet. An 8-inch or larger telescope will start to resolve the moons into more disk-like than star-like objects. If you see fewer than four moons, one or more of the moons may be behind or in front of Jupiter. Check an astronomy magazine or online to see predictions of moon locations.



Skyandtelescope.com has a great interactive observing tool that will show you the location of Jupiter's moons.

One of the most fascinating spectacles in the universe is to watch a moon disappear behind the giant planet. At favorable geometries the moon will enter the planet's shadow long before it actually moves behind the planet. The extended size of the moon becomes obvious as it slowly fades out traveling into Jupiter's shadow.

Another phenomenon to look for is the shadow of a moon as it passes in front of Jupiter. During such an event you will see a small, sharp black dot on the face of the planet. Keeping an eye on this spot you will notice it move across the face of the planet. At this time it is difficult if not impossible to see the moon against the backdrop of Jupiter's surface. Watch long enough and the shadow will disappear and several minutes later the moon will emerge from in front of Jupiter.

The most obvious thing about Jupiter itself is its cloud bands. Jupiter-watchers call the light bands "zones" and the dark bands "belts." Even the smallest telescope will show the two equatorial belts very nicely. The better the seeing, or steadiness of the atmosphere, the more detail you will see. At moments of very good seeing last month I could see nine out of eleven dark belts with a 10" telescope.

In many ways Jupiter is the most interesting of the planets to watch. There's a lot to look at and look for. It's worthy of your intense scrutiny and perhaps its own separate observing journal. And now's the time to observe it.

Designing, Building and Using a Home Laboratory

John Farrell Kuhns

This is the first in a series of articles on the "whys" and "hows" of building your own home laboratory.

Part 1. INTRODUCTION

In today's world with its terrorism, seemingly rampant drug use and other scary goings on it is certainly not unusual for the idea of building and using a home laboratory to be looked upon, by some, as an activity that must be very suspicious. There will be a never-ending stream of unwarranted remarks from friends and neighbors if you tell them you have a home laboratory. Usually, you'll hear some smart-alecky person ask, "So, you makin' meth?" On the other hand, if you tell someone that you have a workshop in your home, they'll either be very interested and want to talk about their own workshop and what projects you're working on, or they'll be so intimidated by your presumed skills that they'll quickly change the subject. A workshop is a laboratory; a laboratory is a workshop.

My personal travels into life with a home laboratory started when I was 12. Many of my customers at our science store in Parkville know my story well. I received an aquarium and a chemistry set for Christmas. As I like to say, aquariums and chemistry have been inextricably linked, in my life, ever since. That link started in 1959 for me; I'd would have liked it to have started earlier, and I now tell our customers that 9 years old for a child, girl or boy, is the nearly perfect age to build and start using a home science laboratory. My father was a cabinet maker, and I never wanted for really nice workspaces with custom built desks and shelving. My first serious laboratory was in our home on Russell Road in Kansas City, It was in the basement, against a wall. My dad's cabinet workshop was on the other side of the basement. If I needed a test tube rack I simply crossed over to his side of the basement and working with a band saw, drill press, glue, clamps and table sander built what I needed. Even though my dad took little interest in what I did in my lab, he was always concerned about my safety, and was ready to assist me when his particular skills were needed.

I was an avid consumer of chemistry books; I read every one I could lay my hands on. I remember visiting my uncle Richard Hudson in Norman, Oklahoma. He showed me his *Handbook of Chemistry and Physics*. It was about four inches thick (probably slightly more) and with its leatherette cover and "India" paper pages that were thin and delicate the heft of the book and the feel of its pages had me hooked. I bought my first *Handbook* in 1963. As I did with my uncle's copy, I used to page through the *Handbook* for hours on end reading about the elements and their compounds and imagining myself at home in my lab working with some exotic chemical and exploring its reactions. In junior high school I started a notebook of reactions. I would "collect" chemical reactions by writing them in my notebook and then at home I would try them out.

I always thought the ideal home lab would look more like movie set from Frankenstein than a gleaming modern lab with all in stainless steel and white cabinets. My ideal lab would have rock walls with a heavy oak door clad in iron and set into a rock archway. I have to admit, I liked the "romance" of a home lab as much as I enjoyed the pure science that I did in it. My discovery of the early Dutch painters' depictions of alchemists at work in their labs cemented my mental "ideal" of a home laboratory. Those ancient labs with their furnaces, retorts, alembics, monstrously large books lying open on hand-hewn wooden tables and stacked on the floors everywhere, and specimens of dried plants and animals hanging from the ceilings were the most wondrous things. One of my favorite paintings from that period is of Brandt's discovery of phosphorus by Joseph Wright (1734-1797). In that painting the alchemist, Brandt, is kneeling before the receiver flask into which phosphorus is being distilled. Hennig Brandt, was an alchemist who successfully isolated phosphorus from urine in the late 1660s. The first time I walked into Griffin's Apothecary on Petticoat Lane in downtown Kansas City, Missouri, it felt like stepping into one of those paintings.

I'll be mentioning Griffin's further on, but allow me a story I often tell about one of my experiences in Griffin's shop. A couple of friends and I pooled our money and went into Griffin's to buy chemicals. As we walked up to the high glass counter he peered over it and blew a smoke ring from his giant Cuban cigar and said, "What can I do for you, boys?" We stepped up to the counter and plopped down our coins and replied, "We want fifty-eight cents worth of potassium chlorate." He racked off the money, leaned over and said, "You boys are gonna blow your balls off!"

In the next edition of the Beagle Society Newsletter, John will talk about determining the location for your home laboratory.

Science News and Articles

From various sources around the web, here are some current science stories on a variety of subjects.

Scary Ancient 'Spiders' Revealed In 3D Models, With New Imaging Technique
http://www.sciencedaily.com/releases/2009/08/090804211128.htm

Whether from biological or geological processes, where is the methane on Mars coming from?
http://news.bbc.co.uk/2/hi/science/nature/8186314.stm

Platinum Was 'Stirred' Into Earth: Finding the Origins of Platinum on Earth
http://www.sciencedaily.com/releases/2009/07/090731085813.htm

Find Hyperactive Galaxies In Early Universe: Stars Moving at Incredible Speeds in the Early Universe
http://www.sciencedaily.com/releases/2009/08/090805193113.htm

Plastics That Convert Light To Electricity Could Have A Big Impact: More Research into Generating Power for the Future
http://www.sciencedaily.com/releases/2009/08/090804114106.htm

Double Engine Fuels Star's Remarkable Nebula: A Brilliant New View of a Starfield in the Keel (Carina)
http://www.sciencedaily.com/releases/2009/08/090805095646.htm

Brain Difference In Psychopaths Identified: At last, an explanation for Norman Bates
http://www.sciencedaily.com/releases/2009/08/090804090946.htm

The Beagle Society offers an opportunity to be a part of community of individuals with an abiding interest in all the sciences.

For an annual membership fee of $25.00 per person or $40.00 per household, members will be able to participate in events, presentations, lectures, workshops, trips and other, unique experiences. Through the Beagle Society, members can further their interests and satisfy their curiosities in everything from Astronomy to Zoology.

Bimonthly meetings are held on the third Monday at 7:00 PM in February, April, June, August, October and December. Each meeting focuses on a different science-related subject.

Other events, including field trips, will be scheduled throughout the year. Each meeting includes a *Free-Range Science Discussion* where all opinions and comments are welcomed.

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The Beagle Society e-newsletter is a publication of H.M.S. Beagle. Contributions are always welcome.

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