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Generous Genes and Teaching the Big History of Life

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What is the best way to teach evolutionary biology?

Biological evolution is a central theme in Big History. How can we succeed in teaching evolution, when current evolutionary education seems to be losing ground? More Americans than ever, 46%, believe that humans were created in our present form without any kind of evolution, according to a recent Gallup poll.* This is in spite of growing mountains of evidence for evolution and the glut of books and documentaries about evolution appearing since Darwin's 200th birthday celebrations.

Despite recent trends, I audaciously believe that we can teach evolution in ways that inspire all people to celebrate evolution. Furthermore, I believe that Big Historians are in a unique position to lead this revolution in teaching.

> ***"When evolution is presented as unthreatening, explanatory, and useful, it can be easily grasped and appreciated by most people, regardless of their religious or political beliefs."***
> ~ **David Sloane Wilson**, in ***Evolution for Everyone***

Although Big History classes devote less time to evolution than a biology class, we can present evolution in ways that are "unthreatening, explanatory and useful" and in ways that inspire

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Reflections on the 2012 Inaugural IBHA Conference

David Christian, IBHA President

"I missed the big bang but I made it to Grand Rapids, MI, Aug 3-5 2012 (Planet Earth time) for the first conference of the International Big History Association." I still have some secret regrets that we didn't run up a t-shirt with this slogan on it.

But no regrets about the conference itself, which was wonderful. Well over 200 people attended and there were over 130 presentations. The organization was superb, and we owe a vote of thanks to our hosts (Grand Valley State University) and sponsors (Microsoft and ChronoZoom). The attendees were very diverse: some independent scholars, some research scholars, a wonderful cohort of graduate students, and many who are teaching big history in different environments. The presentations were also extraordinarily diverse, touching on how to teach big history, the philosophical and ethical implications of the field, its scholarly future, the future of teaching in schools and colleges, the globalization of Big History, and lots more. I think this sort of diversity is exactly what we should expect of a conference in Big History.

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awe, wonder, a sense of belonging, purpose and hope. We can present a simple, yet integrated model of evolution that reflects recent discoveries. We can show how cooperative, creative and generous genes play a central role in evolution.

Currently, however, many people equate evolution with descent from slime, survival of the selfish, random mutations, extinction, and a struggle for existence. Furthermore, evolution is often taught in ways that lack relevance, lack adequate explanation and threaten people's sense of belonging and purpose.

We can change these perceptions.

So why are Big Historians so uniquely suited to reform the teaching of evolution? Three ways: 1) Context, 2) "Awe and Wonder," and 3) a new pedagogy. Within the context of Big History, everything makes more sense, especially when we see universal themes throughout Big History (such as energy flows leading to thresholds of emergent complexity.) From this vast context, it is easy to have a sense of "Awe and Wonder." This "Awe and Wonder" is in stark contrast to the "Struggle and Extinction" so often emphasized in traditional teachings on evolution. Third, as a new discipline, Big History needs a new pedagogy, which can be written from the ground up to include the latest empirical evidence.

I am not saying that creating this new pedagogy will be easy. Molecular biology is challenging to understand and even more challenging to teach. But new discoveries in science and in pedagogy will make it easier to teach biological evolution. Furthermore, this new evidence offers the best way to counter the false and misleading claims of Creationists and Intelligent Designers.

In this article, I offer some ideas that 1) simplify the teaching of this new view of evolution; 2) that explain the new findings in DNA and cell biology; and 3) that inspire "Awe and Wonder."

To do this, I share a Tree of Life image that provides an overview of evolutionary biology. Then, I briefly discuss Generous Genes, Mobile DNA and Natural Genetic Engineering that cause the weblike appearance of the Tree. I then show how this new evidence integrates into a third theory of evolution which has "evolved" since Darwin's time. I then show how this new view of evolution inspires a sense of belonging, purpose and hope. Finally, I offer a vision for teaching this new model of evolution in Big History.

Tree of Life: Box Top to the Puzzle of Evolutionary Biology

A few years ago I taught a Big History class that I called "Exploring Evolution." As if teaching Big History over a semester to high school or college age students wasn't challenging enough, I taught this class over 5 days to 10-12 year olds. Whee!

To teach 13.7 billion years of "Big History" in five days to kids, I needed educational materials that provided the biggest possible overviews. I found

Kids showing off the DNA molecules they made in Exploring Evolution.

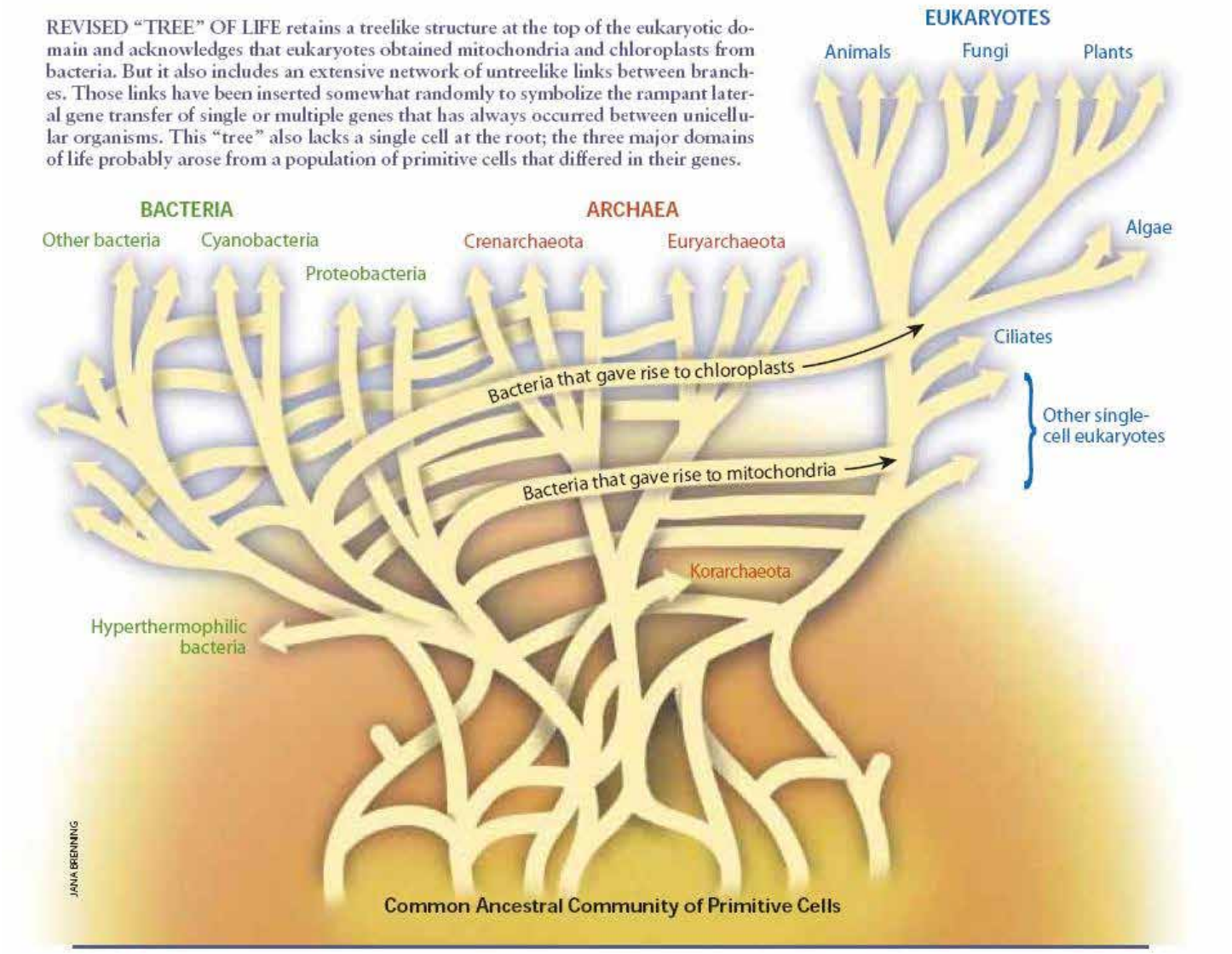
excellent posters showing cosmic evolution, the geological ages and highlights of human evolution. But when it came to finding a Tree of Life poster, none of the images told the story of life reflecting recent discoveries. As a scientist who worked with phylogenetic trees made famous by Carl Woese, I wanted a tree that reflected the Three Domains. As a former student of Lynn Margulis, I wanted an image that featured endosymbiosis. Because I was teaching a class on Big History, I wanted a poster that reflected deep time. As a molecular biologist who studied the role of horizontal gene transfer in evolution, I wanted an image like Ford Doolittle's showing HGT.

FORD DOOLITTLE'S TREE

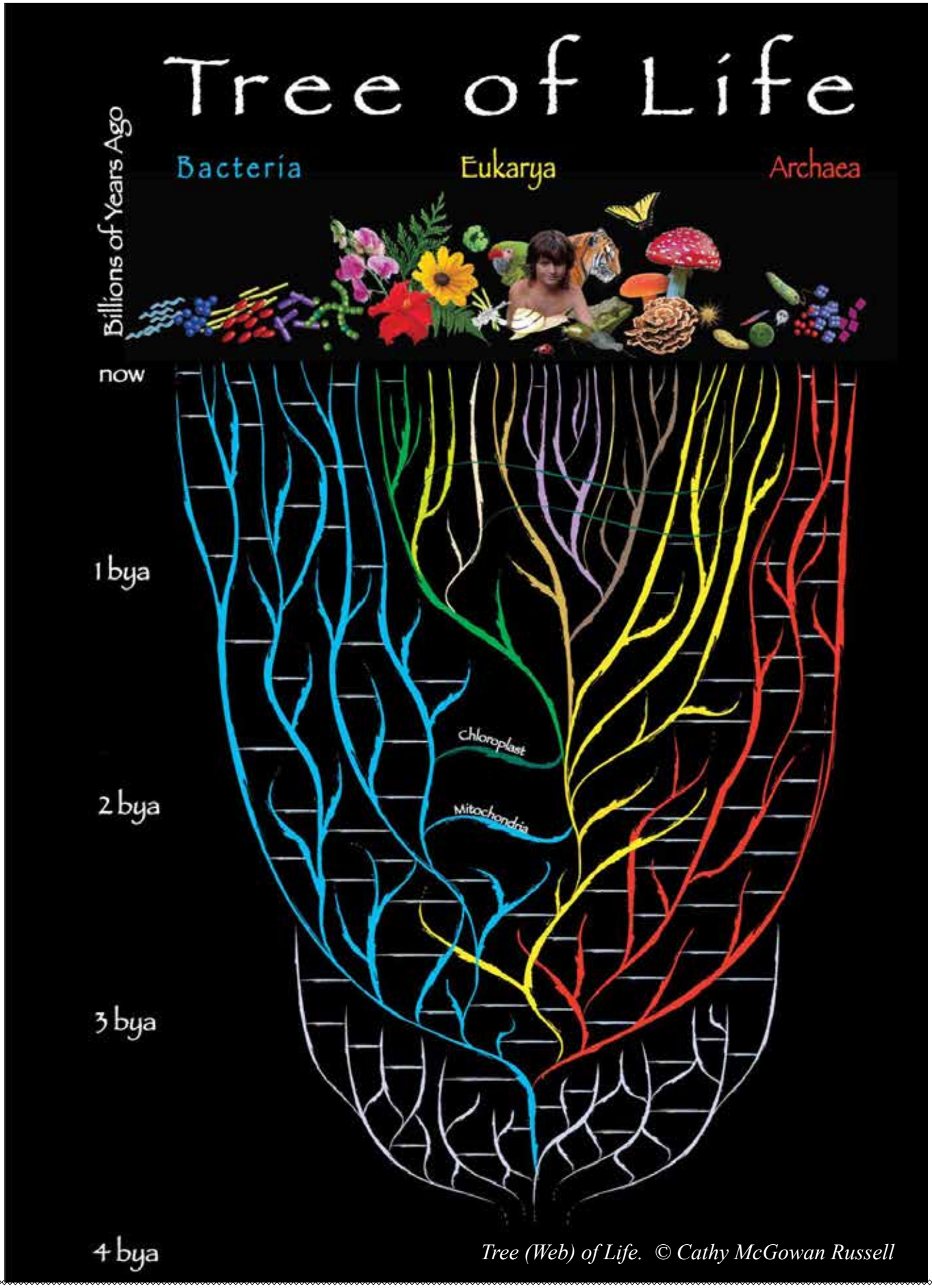
Another feature was to show that all creatures alive today are equally evolved. And, since I was teaching kids, I wanted a poster depicting familiar creatures that kids could relate to.

Not finding a ready made image of the Tree of Life that met my needs, I created a new image.

As Bob Bain suggested at our 2012 Big History meeting, it's easier to put together a complex jigsaw puzzle when you have the image on the box top. This Tree of Life image is like the box top of the puzzle we call evolutionary biology. I use this



Ford Doolittle's Tree of Life showing horizontal gene transfer (HGT).



Tree (Web) of Life. © Cathy McGowan Russell

Cathy McGowan Russell continued

image to put together important events in evolution: "Here is the beginning of life" "Here was when photosynthesis emerged;" "Here is when eukaryotes formed"; "These horizontal white lines show DNA moving from organism to organism." "Here is when dinosaurs went extinct"; "Here (a pixel back from the present) is when humans emerged." "These blue lines represent the Bacteria." "See how fungi and animals are closely related," and so on.

For more information on this Tree of Life, visit http://epicofevolution.com/treeoflife. If you would like to use this image in your teaching and/or you would like some lessons plans for using this, please contact me for a high resolution image.

Mobile DNA, Generous Gene and Natural Genetic Engineering

This Tree of Life looks more like a web than a tree. This weblike appearance can be explained by mobile DNA. Mobile DNA is the movement of whole stretches of DNA strands from one place to another. This DNA movement can be from one part of the chromosome to another. It can be DNA movement from one chromosome to another chromosome. It can me movement from one organism to another. It can even be movement of segments of DNA from one species to a vastly different species! Mobile DNA shows that inheritance is not only about vertical inheritance from parents to offspring as Darwin suggested. It is also about horizontal inheritance, also known as horizontal gene transfer, which is DNA movement from one living organism to another living organism.

Mobile DNA goes beyond explaining horizontal gene transfer. It also explains how useful genetic variation is created. Transposons are a famous example of this. Transposons, also known as "jumping genes" are stretches of DNA that jump from place to place within the DNA in a single cell. Transposons can duplicate and move functional genes. Once duplicated, these genes can be reused for a new purpose. This is how the most useful genetic variation is created.

Sometimes, transposons hitchhike onto viruses and then they can travel to distantly related organisms and move into the new host's DNA.

Mobile DNA is so essential for creating variation that many mechanisms have evolved. Scientists have discovered numerous other examples of Mobile DNA including plasmids, phage, retrotransposons, recombination, chromosome rearrangements, sex and symbiogenesis.

Some of this DNA is mobilized by systems that molecular biologist James Shapiro calls Natural Genetic Engineering. Natural Genetic Engineering is when cells actively create variation upon which natural selection may act. This idea is in contrast to the conventional wisdom that all variation is due to random accidents.

"Genetic and epigenetic changes result from the actions of cell biochemical activities, not from accidents. This is a critical fundamental discovery of molecular genetics."
~ James Shapiro

Darwin knew that variation, inheritance, selection and time (VIST) are all essential for evolution. Since Darwin had no way to know how variation was created, he focused his attention and his book on explaining Natural Selection instead.

About 50 years after Darwin, scientists observed that copy errors and DNA damage due to radiation caused changes in the heritable material. Since then, most people have assumed that all variation was the result of such "random mutations." More recently, scientists have found that the most significant kind of variation is the result of Mobile DNA. Mobility of DNA creates the spectacular variety of life on Earth. Mobile DNA appears to be generous, because it is helpful in creating new life.

Evolution and natural selection are not the same thing. Today, over 150 years after the publication of Darwin's book, most people still conflate evolution with natural selection. If variation is discussed at all, it is talked about as "random mutations" that are the result of errors or damage due to radiation or chemical mutagens.

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> ***"Gene duplication emerged as the major force of evolution."*** ~ **Susumo Ohno**, *1970*

Molecular biologists know that the most useful genetic variation is the result of whole segments of functional DNA being duplicated, moved and modified. One metaphor is that of computer code. Programmers can create elaborate programs use preexisting chunks of functional code. Similarly, living organisms can duplicate preexisting DNA "code" and modify it to do new things.

Random point mutations (accidents) are important, but by themselves cannot account for the tremendous diversity of life on Earth.

This new information creates confusion, which the press likes to hype. For example, a "New Scientist" cover recently stated that "Darwin Was Wrong." Creationists cite this apparent confusion as evidence that evolution has not occurred. In reality, this new evidence bolsters the theory of evolution.

Although Darwin didn't know about DNA and was therefore "wrong" in certain details, his general theory is still profoundly right. He wrote about several "laws" of evolution, including Variation, Inheritance, Selection and Time. These laws can be expressed as VIST, a memorable mnemonic.

Scientists recognize that all of these "laws" are essential elements of evolution. However, in popular culture, "Natural Selection" is emphasized, while the mechanisms of variation are barely mentioned. As a result, many people have a false impression of how evolution happens. They believe that evolution is primarily a destructive and limiting process. Paradoxically, as Darwin acknowledged, sometimes natural selection is not even involved in evolution. Variation, however, is ALWAYS a prerequisite for evolution.

To say that evolution happens solely via natural selection is like saying critics create art; that wars create civilization; or that a bush grows by pruning. While these statement contain partial truths, they lack of explanatory power. None explains the creative process of how variation happens.

Evolution Evolving

To make sense of the confusion about Darwin being "wrong," it helps to know that the theory of evolution is itself evolving. The following table shows three different models of evolutionary theory. The first is Darwin's model as described in Origin of Species. The second model (featured in most textbooks and web sites) is the Modern Synthesis, a model that integrated mid 20th century genetics with Darwinian theory. The most recent model I call the "Integral Model." This model integrates the Modern Synthesis with recent evidence from cell biology and DNA sequence data.

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	Darwin	Modern Synthesis	Integral Model
Variation	Unknown	Random mutations due to copy errors and damage	• Non-random variation • Natural Genetic Engineering • Mobile DNA • Random mutations
Inheritance	Vertical	Vertical	Vertical and Horizontal
Selection	Natural, Artificial, Sexual	Natural, Artificial, Sexual, **Drift**	Natural, Artificial, Sexual, **Drift**
Time	Millions of Years	~ 3.7 billion years	~ 3.7 billion years

Three models of evolution and their explanation for Variation, Inheritance, Selection and Time. Darwin's model is represented by the color green. New information from the Modern Synthesis is highlighted in blue. New information from the "Integral Model" is highlighted in purple.

For example, while Darwin knew nothing about how variation was created, scientists in the middle of the last century found that changes in DNA created heritable changes. These were dubbed "random mutations." In the Modern Synthesis, all variation was assumed to be random and the result of errors and or damage to DNA. We now know that genetic change is also the result of mobile DNA, gene duplications, and natural genetic engineering that leads to nonrandom changes. This is part of the "Integral View." For another example, Darwin's theory and the Modern Synthesis only knew of inheritance from parent to child. In the new, Integral Model, DNA is known to also be transferred horizontally.

The integrated model of evolution helps make sense of a major mystery. It explains why 70% of the human genome is made of mobile genetic elements. Instead of "junk DNA" this extra DNA could more aptly be described as "Evolution's playground." This mobile DNA is free to be modified and put to new uses.

Generous Genes

The more I learn about this new view of evolution the more awe and wonder I experience and the more connected I feel. Yet this awe, wonder and connection is in stark contrast to the sense of alienation that many people (including me at one time) experience when they learn about biological evolution.

In grad school, I studied how bacteria evolve. While watching evolution in action fascinated me, the implications depressed me. At that time, like many of my colleagues, I thought evolution proved that the universe was indifferent, that life was meaningless, and that only the most ruthless survived. Life seemed a struggle for existence. It seemed that cooperation, love and altruism were really only selfishness in disguise. The fact that we descended from slime didn't bother me so much, but I wasn't keen on extinction. I also found it depressing to be told that humans were like a cancer on the planet.

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After grad school, I turned my attention to Big History, what I call the Epic of Evolution. I registered the Epic of Evolution web site and began creating links to storytellers of this amazing story.

Big History shows long term trends toward greater complexity and organization. Over time, my view of biological evolution shifted.

Then, one day, Eureka!

In a single instant, my whole way of seeing the world shifted from seeing the universe as indifferent and going nowhere, to seeing it as extravagantly friendly, cooperative and going somewhere (at least on Earth). In that moment, I realized that over 20,000 genes cooperated in each of my 75 trillion cells which in turn cooperated so that I could breathe and dance. 100 trillion synapses allowed me to marvel at the wonders of the universe. Trillions of plants converted sunlight into my supper and recycled CO2 into oxygen that I could breathe. Quadrillions of nitrogen fixing bacteria turned atmospheric nitrogen into a form my body could use. Quintillions of microbes recycled nutrients. Millions of people cooperate in a rich culture so that I may learn about the wonders of the world, listen to beautiful music, eat exotically prepared foods, live in a comfortable house, and connect to amazing people around the world. All of a sudden I realized that life was cooperating for the benefit of me, my family and all of life. Far from seeming indifferent, the universe seemed supportive. And genes, far from seeming selfish, all of a sudden seemed overwhelmingly generous.

Much later, I discovered that I was not alone in seeing genes as generous and cooperative. Richard Dawkins, in his preface to the 30th edition of his book, *The Selfish Gene* wrote that an alternative name for the his book could have been *The Cooperative Gene*. "It sounds paradoxically opposite, but a central part of the book argues for a form of cooperation among self-interested genes," Dawkins writes. In most cases, self interest is indistinguishable from generous cooperation.

This new view gives me a sense of grace, an awe-filled awakening to the gift of evolving life. Filled to overflow with enthusiasm and gratitude, I feel "called" to share my sense of awe, wonder, and connection. Since that Eureka Moment, I have devoted my life to exploring and teaching Big History. To this end, I have taught evolution to people of all ages and have given talks to religious people and community groups about the science of evolution. From experience, I know that the science of evolution can inspire people to live with clarity, joy and purpose.

Generous Genes, Generous Memes

In the past 20 years, we have learned so much more about how evolution actually happens. In that time, our catchphrases and metaphors for evolution have matured. Often, these phrases mirror our worldview. Table 2 shows how these phrases have evolved over time.

Table 2. Catchphrases of Evolutionary Paradigms

Darwin	Modern Synthesis	Integral Model
•Natural Selection; •Struggle for existence; •Survival of the fittest;	•Natural Selection; •Survival of the fittest; •Winner takes all; •Selfish Genes; •Descent from slime; •Random mutation • Reductionist •Humans are cancer cells on planet	•Variation creates & selection purifies; •Survival of the most harmonious; •Cooperation & Competition; •Generous Genes; •Cosmopolitan Genes •Creative Variation •Ascent from community • Emergence •Humans are the Sensory System and Immune System of Planet

Cathy McGowan Russell continued

While many blame fundamentalists for the public's lack of accepting evolution, I feel that the problem is more subtle. People are often exposed to evolutionary science in ways that contradict their everyday experience: they are told that evolution proves life has no meaning; it proves that life is selfish; it proves that religion is evil; it proves that to get ahead one must vanquish competitors.

In contrast, the new science not only gives a better explanation of how life diversified into so many magnificent forms, it also offers a more hopeful view of nature. This new view explains how cooperation and generosity are essential in evolution. Furthermore, new research in anthropology and evolutionary psychology show the importance of cooperation, compassion, awe, sympathy and that religions evolved for the good of the group.

This new, integrated view has important implications since people's view of reality shapes their behavior. Two corporate leaders, one from Enron, the other from Apple, illustrate the effect that worldview has on behavior. With a worldview shaped by Dawkin's Selfish Gene and Darwin's Origin, Enron's CEO Jeffrey Skiller believed he must adopt principles of Natural Selection to get ahead. Believing that competitive crushing of others led to evolutionary success, Skiller led Enron into disaster, dragging down thousands of innocent people on his way over the cliff.

Another corporate leader, Steve Jobs, believed that sharing information was the way to get ahead and to better the world. Jobs employed a strategy analogous to Natural Genetic Engineering (Natural Memetic Engineering.) He fostered the sharing of ideas ("memes" or cultural replicons) by encouraging frequent meetings and the construction of buildings that promoted frequent "meme exchanges" between employees. Although unaware of the power of generous genes in creating evolutionary novelty, Steve Jobs promoted "generous memes." This sharing of memes enriched his company and gave his customers exceptional products.

Vision for Big History

This new, integrated model shows a more complete, more hopeful and more useful view of evolution. It shows how cooperative, creative and generous DNA plays a central role in evolution.

My vision is that Big Historians can revolutionize the teaching of biological evolution. Because teachers of Big History have only a few days in a semester to teach evolution, we have to create an entirely new pedagogy. We can use this opportunity to create a pedagogy based on the latest evidence. We can use the simple acronym VIST to emphasize each of the principles of Variation, Inheritance, Selection and Time. We can tell students that variation happens both by random mutations (errors and DNA damage) AND also by Mobile DNA, by Gene Duplications, and by cellular mechanisms that promote Natural Genetic Engineering. We can teach about Natural Selection. We can tell our students that DNA is inherited both vertically from parents, AND sometimes horizontally from distantly related organisms.

We can also use language that inspires students rather than brings them down. DNA has no intention, so it is neither selfish nor generous. That said, DNA appears to behave in ways that are, for the most part, cooperative and generous (and selfinterested). We can emphasize to our students all the ways that cooperation has helped genes, cells, organisms and societies to evolve. We can talk about "Survival of the Most Harmonious" as well as "Struggle for Existence."

Cathy pointing to iridium layer in New Mexico.

Cathy McGowan Russell continued

I am not suggesting that we sugar coat the science of evolution. Extinction is real. Death is real. What I am suggesting is that we give a more balanced emphasis to both variation and selection. In so doing, we will present 1) a more accurate view and 2) a more inspiring view of evolution that focuses on both the creative and destructive aspects of evolution.

By presenting a more accurate, more useful and more inspiring view of evolution, more people will come to accept, and even to celebrate evolution.

I hope that I have sparked your curiosity to explore these ideas. Please email me at cat23@me.com if you would like to discuss these ideas. If you are interested in a summary of the science of this new view of evolution, I recommend Dr. James Shapiro's blog at the Huffington Post.

In closing, I give the last word to a man who clearly saw the awe and wonder of an evolutionary worldview.

"Though frightened for a moment by evolution, people now perceive that what it offers them is nothing but a magnificent means of feeling more at one with the power that creates the universe."
~ paraphrase of **Pierre Teilhard de Chardin**

About Cathy McGowan Russell

Cathy is passionate about teaching Big History in ways that empower people with a sense of belonging, awe and new possibilities for thriving in the future. After a two year pilgrimage in Asia, Cathy earned a Ph.D. by researching evolution. With colleagues in the "Research on Microbial Evolution," (ROME lab) at Michigan State University's Center for Microbial Ecology, Cathy observed evolution in action via horizontal gene transfer. Entirely new capabilities emerged when genes, derived from distantly related organisms, combined in new ways. After grad school, Cathy expanded her interest from biological evolution to the Epic of Evolution. In one transformative moment, Cathy's view of Big History changed from "We're going nowhere" to "Wow, we're going somewhere and it's toward greater consciousness and cooperation and unimaginable possibility." Today, Cathy hosts the Epic of Evolution web site (EpicOfEvolution.com). Cathy lives in Boulder, Colorado with her scienceeducator husband, Fly, their teen son, Sean, and their fluffy dog, Nuff.

For Further Exploration

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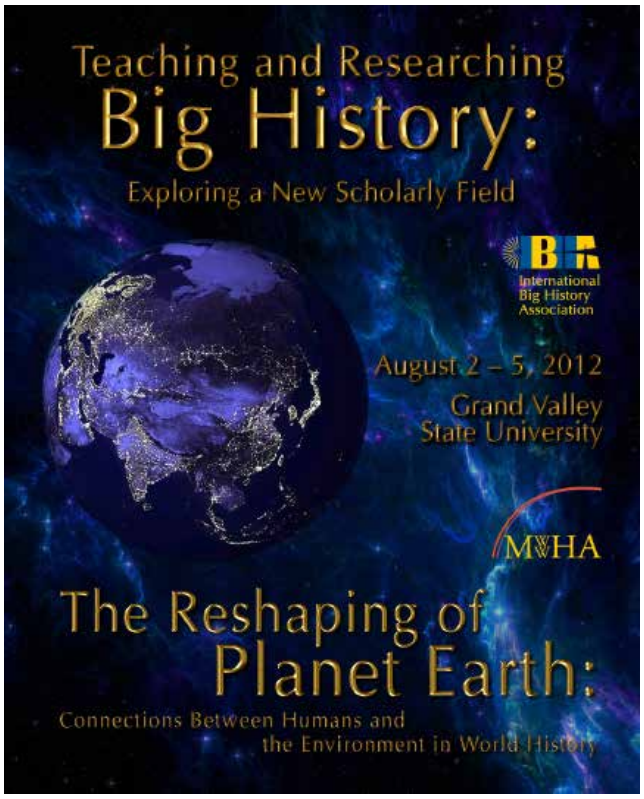
Conference Reflections continued from page 1

I think we also have a lot to learn. None of us really knew in advance what a Big History conference would look like. Now we have a better idea, and we have received much very helpful feedback since the conference. All of this will help us as we organize future conferences. It will encourage us to schedule different types of papers in ways that do justice to the very different types of work people are doing under the capacious umbrella of 'Big History.' We will also face growing pains as big history starts to acquire its own institutional structures. Should there be a journal? How can we encourage cutting-edge research in Big History? How can we encourage graduate research in big history? Should we be pushing for entire programs in Big History in colleges and universities? Should we be focusing on the needs of independent learners and researchers?

As Big History becomes more visible we will clearly need to start planning more carefully. Do we need a strategic plan for building the organization and building Big History?



So, there's a lot to do, but when I start worrying too much about what we must do, I have to remind myself that we are all engaged in developing a field of great power and richness. As Bob Bain reminded us at the conference, Big History can help us give shape to our ideas because it shows us how the bits and pieces of the jigsaw fit together. Big History has a great future both in education and research, and our job is perhaps just to give it an occasional nudge.

Fred Spier,
IBHA Vice-President

In addition to David's wonderful statement, I have the following personal observations. The goals of the conference as I understood them were:

1. Organizing the first meeting of IBHA members that included as many people as possible involved in big history in various ways, and, by doing so, create a larger face-to-face big history community, while also reinforcing a great many old ties.

Even in this digital globalized age, in which a great many big history contacts have taken shape in the form of electronic exchanges of different kinds, it remains important to meet colleagues face-to-face and have open, warm, and sometimes candid, exchanges. For me, that had certainly happened during the conference. I have, in fact, never been to a conference with so much positive energy. This was noticeable from the very beginning to the very end. Even during the last day, the panels were well attended, while the conference ended with a great many spontaneous public statements saying how wonderful the experience had been.

There have been some feelings of discontent, expressing that some expectations were not met, either because the conference was not sufficiently academic, or because it was considered too academic. In this respect the program committee made a conscious choice, which we debated at some length, to allow the widest possible range and variety of big history presentations. Yet to me it seems that most participants left the conference with the exhilarating feeling to be part of group of scholars and lay people who share great enthusiasm for this new all-encompassing approach to history that helps to understand the world we live in better than any other form of academic orientation. All in all, I met a great many people that I have not known personally before, and I look back on many fascinating discussions and wonderful exchanges. I very much hope that many other participants have had similar experiences.

2. Holding public discussion of important big history initiatives, most notably The Big History Project, Chronozoom and The First Year Big History Experience at Dominican University of California.

These sessions were surely a huge success. I was very much impressed by what The Big History Project had achieved, and where they are going. The same was the case for the presentations by faculty from Dominican University. I particularly loved some of the presentations by faculty who sought to look at their own subject through the lens of big history, and learned a lot from their creative approaches. The Chronozoom project, which also looks very promising, allowed conference participants to contribute their input during Rane Johnson's most energetic and stimulating presentation.

3. Creating an inventory of where we are in big history today, and where we could go, based on paper and panel presentations, and thus hopefully learning as much as possible about new ideas and directions.

This is a more diffuse subject. Given the fact that there were almost always panels running simultaneously, I had to make choices all the time about what to attend. As a result, I missed a considerable number of potentially very interesting presentations, while my overview of what happened is therefore equally limited by these choices that needed to be made. I heard several complaints about this. I don't know how we could have prevent this from happening, but it is surely a healthy sign that many concurrent panels were considered similarly interesting.

Based on the panels that I did attend, it seems to me that we are in the process of beginning to shape a graduate student big history agenda, and, as part of that, the first contours of Big History research. But

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this is just a first beginning, and during the coming years we will have to devote a great many efforts to shape this agenda in more detail. We may also be trying to refine a little our theoretical insights. But this was not a major thrust of the conference, and we may want to pay more attention to this theme in the future. I would also have liked to see more contributions by natural scientists. Walter Alvarez's wonderful keynote speech made clear how much there is to gain to combine insights from the natural and the social sciences. Also this will be an IBHA focus for the future.

All in all, I left the conference with the feeling to be part of a much larger, very congenial, and most stimulating group of colleagues. We have come a long way since David Christian, John Mears, and a few others began their pioneering attempts at teaching the big story more than 20 years ago, and even since we hesitantly founded the IBHA about 2 years ago during that week-long, most memorable, geological meeting organized by Walter Alvarez and Sandro Montanari at their geological observatory in Coldigioco, Italy. We were hesitant, because we did not know whether there would be a sufficiently large number of big history enthusiasts willing to join the IHBA. But we took the plunge, and now, 2 years later, all doubts have evaporated. We exist as a vibrant group, and we are all very much aiming to create a better future for Big History.

Conference pictures by Nathan Everett


MISSION


GRAND VALLEY
STATE UNIVERSITY
www.gvsu.edu


ChronoZoom beta
The Future
Today
billion years ago
Cosmic history
Earth (planetary) history
Life history
Human history
Origin of Life: probably between 3.5 and 4 Ga
Formation of Earth and Solar System ~4.5 Ga
Big Bang
nothing "before" this

The International Society for the Study of Time

Fifteenth Triennial Conference

Time and Trace

June 30 - July 6, 2013

Orthodox Academy of Crete

http://www.oac.gr/htm/main_en.html

Call for Papers

Proposals (300 words) due by Sept 10th, 2012

The International Society for the Study of Time (ISST) seeks proposals for presentations at its 2013 conference on the island of Crete, on the theme of Time and Trace. The ISST, renowned for its interdisciplinary scope, welcomes contributions from all scholarly, creative, or professional perspectives. Our format features plenary presentations delivered over several days, creating a sustained, interdisciplinary engagement among participants.

If time is a river, it etches its courses through many substrates: physical, biological, social, cognitive. Although we are sensible of the more obvious tracks in our histories, contexts and lives, many of the traces of these are subtle or brief, but no less profound in their making and influence. Etymologically, Trace is tractus (L) (and perhaps tragen (G)), 'drawn', 'pulled' or 'carried', whence 'traction' and 'attraction'. It is also trait (F), 'line', 'outline', 'feature' and ri-tratto (I), 'por-trait'; Trace is what happens when a point becomes, in time, a line; and therefore is graphein (Gr.), to trace or draw. It is also traccia (I), 'spoor', 'trail' or 'track'. Tractare (L) is 'to treat' any subject narratively, as in a 'tract' or 'tractate'. Works of literature were also called "brush traces" (hisseki) in Japanese.

We invite scholars, artists and educators to contribute to and co-create an interdisciplinary exploration of 'Time and Trace,' a theme that may stimulate reflection from many fields of inquiry, including (but certainly not limited to): physics & cosmology, geology, chemistry, music, drawing & painting, literature & litemedrary theory, the biological and cognitive sciences, archeology & paleontology, anthropology, engineering, philosophy.

Possible topics:
· The trace of social, political, demographic, economic, and historical trends
· Traces left by the causes of observed natural events
· Tracing the future: from mantic to futurology
· Temporal traces, trajectories and forms in narrative
· The trace in philosophy
· Imprints recorded/archived/reconstructed/anticipated
· Psychoanalysis and the temporal trace
· Trajectories and orbits in dynamical systems theory

· Traces of light, matter, and time in cosmology
· Archeological or paleontological traces of life
· Changing concepts of how time is measured and traced
· Evolution, extinction, and artifacts of change
· Chemical or biological traces that evolve over time
· Medical traces that are molecular, electrochemical, or topological
· Forensic traces in a documentary, financial, or biological sense
· vestigia Dei -medieval/early modern perception of the creator's 'footprints'
· The ideal of "not leaving traces" - from Buddhism to Environmentalism
· A trace or a blaze in its figurative sense as a symbol in ritual or sacrament
· The trace as a visible sign of spiritual grace
· Artistic and literary orchestrations of traces left or lost

Guidelines and Timeline for Proposals: Proposals will be for 20 – 30 minute presentations in diverse formats: scholarly paper, debate, performance, overview of creative work, installation, workshop. Proposals for interdisciplinary panels are especially welcome (each paper for a panel must be approved by the selection committee). In this latter case, three speakers might present divergent points of view around a central topic, and be responded to by a moderator. All work will be presented in English, and should strike a balance between expertise in an area of specialization and accessibility to a general intellectual audience.

Proposals, approximately 300 words in length, are submitted electronically. The author's name(s) should not appear in the proposal, as the ISST does blind reviewing in selecting papers for its conferences. The deadline for submission is September 10, 2012, with acceptances communicated by November 1, 2012. The Society also seeks session chairs, whose names will be included on the printed conference program.

To submit proposals, go to the ISST website:

http://www.studyoftime.org/forms/confsubmit.aspx

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