"It is interesting to contemplate a tangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent upon each other in so complex a manner, have all been produced by laws acting around us. ... There is grandeur in this view of life, with its several powers, having been originally breathed into a few forms or into one; and that, whilst this planet has gone circling on according to the fixed law of gravity, from so simple a beginning endless forms most beautiful and most wonderful have been, and are being evolved." - Charles Darwin

The November 11, 2017 Science News Magazine cover headline, *Tangled Paths - Species are not as distinct as textbooks would have us believe*

In the article, "The fuzzy art of defining species - A vital concept sparks many arguments" the article’s author, Susan Millius, writes,”As concerned readers question our reports of hybrid species, a vast debate among specialists over how to define and identify species rolls on. The biological species concept has drawbacks, to put it gently, for coping with much of the variety and oddness of life. Alternative concepts have pros and cons, too. As specialists argue over the fine details of species concepts, I’m struck by how often the word ‘fuzzy’ comes up.”

Indeed, *species* as a taxon is as messy and dubious as are various attempts to define life. Something missed by reductionist neo-Darwinists is that nature’s multi-level, dynamic processes are not *static independent things*, but dynamic continua. Darwin’s “tangled bank” is multi-level and dynamic. Its organisms are radically dependent upon each other “in so complex a manner” as to defeat definitions based on singular models or the privileging of one level of causation, molecules.
This “news” would be greeted by students of Lynn Margulis’s graduate seminar, Symbiosis and Earth History, or her groundbreaking Earth systems science course, Environmental Evolution with a resounding “Duh.” The problems with various definitions of species, notions of animal individuality, zoological models of evolution, exclusively gene determined phylogenies and tree modeling of composite life forms were among a raft of biological nonsense regularly the subject of classroom discussions and student presentations.

The Hegemony of the Culture of Margulis

It was surprising to find that there is a “hegemony (dominance) of the culture of Margulis”. Even more surprising was that the first mention of this was in a Huffington Post article by Suzan Mazur, Overthrowing the Hegemony of the Culture of Margulis. Considering how many in the “neo-Darwinist” camp have revised science history and neo-Darwinist “theory” to write Lynn Margulis out of the story of endosymbiosis, it is ironic that she is once again given credit when endosymbiosis is challenged. This time the challenge comes from Swedish investigators Charles Kurland and Ajith Harish. Their paper, Mitochondria are not captive bacteria, posits that eubacteria and “akaryotes” (archaea and eukaryotes) all descended in parallel from a Universal Common Ancestor. The authors highlight their use of Bayesian & Sankoff Parsimony algorithms applied to the Structural Classification of Proteins (SCOP) Superfamilies database to reconstruct a rooted tree of mitochondria that shows that mitochondrial descent is autogenic and not endosymbiotic. It all sounds very impressive. So in one fell swoop Kurland and Harish rehabilitate parsimony as scientific evidence, tree models as the viable topology for modeling evolution, and the use of yet another molecular partial phylogeny as the definitive basis for mapping relationships.

Their paper is over my head. It certainly has the ring of an outrageous hypothesis, but no more so than Lynn Sagan’s 1967 “hugely stimulating conjecture” that mitochondria are captive bacteria. Will Kurland and Harish be ridiculed and dismissed out of hand without further investigation? Will their extraordinary claims require extraordinary proof? Will they be forced to argue their case for 50 years? Let us hope Kurland and Harish are not dismissed out of hand or accepted without skepticism. Their ideas should be given the rigorous investigation that scientific ideas, even surprising ones, deserve.
Global Ecology Education Initiative (GEEI) “Calling Home” e-zine

Douglas Zook writes that the “GEE Initiative’s EarthCare effort brings me, often accompanied by students who have been a part of my Global Ecology course directly out to reveal in multi-media interactive presentations these examples of grassroots community and indigenous people around the world, who are prioritizing the biosphere and building an earth-centered ethic, are in the thousands and growing each day.”

The issue includes articles by students including deforestation in Poland, preserving coastal ecosystems, and the widespread assault on wildlife, particularly the targeting of wolves. There are also profiles of grassroots leaders such as the Black Mamba anti-poaching women rangers in South Africa (below) among other stories.

Zook notes that “Many of these examples must find their way not only into our conversations, actions, commitments, but they must be made accessible to young people, including as part of school curricula, to diverse school and community settings in metro Boston/Cambridge as well as beyond.”

Calling Home also includes Zook’s keynote presentation, Dynamic "symbionts" linked over two centuries: A tribute to Lynn Margulis (1938–2011), given at the International Symbiosis Congress held in Kraków, Poland in 2012. The presentation compares Lynn Margulis with Alexander von Humboldt who inspired Darwin’s voyage aboard the Beagle.

“In my mind, Lynn Margulis, whether she realized it or not, was decidedly Humboldtian. While he relentlessly and physically explored previously untouched areas of the globe, focusing particularly on tropical ecosystems, Margulis mentally explored those areas of biology where the mind had not dared travel. His perseverance and unparalleled resourcefulness led him to scale the highest mountain peaks known in the early 19th
century. She conquered mountaneous dogmatic science tradition and obstructive male chauvinism in providing a new realization of the dominance and impact of endosymbiosis. Humboldt constantly ignored established protocol by emphasizing the deep attributes of indigenous peoples and the need to respect cultures and races worldwide. Similarly, Margulis rebelled against convention as well and paved the way for a new emerging respect for Lamarck, Kozo-Polyansky, Vernadsky and others. Humboldt invented entire new disciplines such as biogeography and global ecology that allowed for new concepts of the merger of life and non-life forces, which are more relevant today than ever. She resurrected symbiogenesis, co-originated Gaian concepts, and poked holes in neo-Darwinian thinking, thereby initiating new paradigms of how we see the earth and ourselves.”

And speaking of poking holes in neo-Darwinism...

Denis Noble wrote to report that “Half of 2017 was taken up with a monumental (eventually 100 page) exchange with a Neo-D referee [reviewer]. It is a classic debate. We offered to have it (the interaction) published but the referee declined. I am not surprised. The arguments are wearing very thin. Essentially the defence now is ‘Neo-D is simply anything by which Darwinism has been updated’. [unstated: ‘Even if it is the precise denial of what it was originally.’]"

“1. That makes it no longer a theory, just a framework of ideas. Popper would certainly be turning in his grave!
2. Weismann and Wallace would also be turning in their graves.
3. So would Darwin, who said that Natural Selection alone was not sufficient.
4. Of course, Lamarck has been turning for 200 years anyway.
5. And one has to wonder what Waddington would have thought!
6. Not to speak of Lynn, symbiogenesis and the dumping of selfish genes.”

Denis and his brother, Raymond Noble, are celebrating the publication of their article deconstructing the Dawkins’ Watchmaker arguments, *Was the Watchmaker Blind? Or Was She One-Eyed?* The article’s abstract states:

“The question whether evolution is blind is usually presented as a choice between no goals at all (‘the blind watchmaker’) and long-term goals which would be external to the organism, for example in the form of special creation or intelligent design. The
arguments either way do not address the question whether there are short-term goals within rather than external to organisms. Organisms and their interacting populations have evolved mechanisms by which they can harness blind stochasticity and so generate rapid functional responses to environmental challenges. They can achieve this by re-organising their genomes and/or their regulatory networks. Epigenetic as well as DNA changes are involved. Evolution may have no foresight, but it is at least partially directed by organisms themselves and by the populations of which they form part. Similar arguments support partial direction in the evolution of behavior.”

Figure 1
Schematic diagram of gene-specific targeted hyper-mutation in immunoglobulin gene loci. The mutation rate is greatly increased only in the variable part of the genome, which is a ~1.5 kilobase region in each of the three immunoglobulin loci. In this figure, the rectangular elements (V, J, MAR, iEx, Cκ, 3′Ex) represent different functional parts of the DNA sequence for the immunoglobulin protein. V is the variable part, subject to hypermutation, while the other parts are fixed.

*Was the Watchmaker Blind? Or Was She One-Eyed?* can be read as the sequel to Denis Noble’s *Evolution viewed from physics, physiology and medicine*. The abstract for that paper reads as follows.

“Stochasticity is harnessed by organisms to generate functionality. Randomness does not, therefore, necessarily imply lack of function or ‘blind chance’ at higher levels. In this respect, biology must resemble physics in generating order from disorder. This fact is contrary to Schrödinger’s idea of biology generating phenotypic order from molecular-level order, which inspired the central dogma of molecular biology. The order originates at higher levels, which constrain the components at lower levels. We now know that this includes the genome, which is controlled by patterns of transcription factors and various epigenetic and reorganization mechanisms. These processes can occur in response to environmental stress, so that the genome becomes ‘a highly sensitive organ of the cell’ (McClintock). Organisms have evolved to be able to cope with many variations at the molecular level. Organisms also make use of physical processes in evolution and development when it is possible to arrive at functional development without the necessity to store all information in DNA sequences. This view of development and evolution differs radically from that of neo-Darwinism with its emphasis on blind chance as the origin of variation. Blind chance is necessary, but the origin of functional variation is not at the molecular level. These observations derive from and reinforce the principle of biological relativity, which holds that there is no privileged level of causation. They also have important implications for medical science.”
New publication Protist Notes

Michael Dolan, who was the working protistologist of the Margulis Lab, author and coauthor with Lynn Margulis of many papers on the Kingdom Protoctista, wrote to announce the publication of Protist Notes, a monthly compilation of published reports as well as news of the professional societies.

“Protist Notes consists of a front section that contains news reports on recent publications and a back section that lists the complete citations to the literature, organized by taxonomic group. Certain widely studied genera are listed separately. While it is intended to make the citation list comprehensive, not all publications will be noted.”

“Protist Notes is a publication of the Sona Dolan Memorial Microscopical Observatory. It is published monthly except for a combined July-August issue, and is available at no cost to anyone who requests it. The Dolan Microscopical Observatory is a non-profit research and education center, operated in collaboration with the protistology collections at the University of Massachusetts Amherst’s Du Bois Library, and specializing in the preservation of microscopical specimens from the field of protistology and related sciences.”

“In addition to Protist Notes, in the coming months the Observatory will be introducing three new newsletters:
Symbiosis Notes
Cyanobacteria Notes
Spirochete Notes”

The work of the Microscopical Observatory is funded by tax-deductible donations. For donations of $80, readers in the USA or $120 readers internationally, will receive free (including shipping) the monumental two-volume, 1400 page Illustrated Guide to the Protozoa, 2nd edition. [Editor’ note: The Illustrated Guide to the Protozoa is fabulous reference work and the perfect companion to The Handbook of Protoctista and Kingdoms and Domains.]

Metacoronynpha senta, a termite gut protist, with its nuclei stained with DAPI. Epifluorescence light microscopy. The cell is about 75 micrometers in diameter. Microphotograph by Michael Dolan.
Donation checks from a USA-based bank in US$ should be sent to:
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Readers many also contact Michael Dolan at mdolan.ecsn@outlook.com to pay using PayPal.

**Developmental Biology Film Series** the most viewed videos at UMass Amherst

Jeremy Smith, Digital Projects Manager in Scholarly Communication at the W.E.B. Du Bois Library, University of Massachusetts Amherst wrote to report that films in the **Developmental Biology Film Series** are the most watched on the official UMass YouTube channel. The 70+ films NSF-funded films were rescued and preserved by Lynn Margulis with the support of filmmaker Terrence Malick, the International Symbiosis Society, Chelsea Green Publishing, the Hardy Lane Foundation, Geobook Studio, Hummingbird Films and the donations from 124 supporters of the **Obtainium - Digitizing the Reel Life films of Lynn Margulis**.

Lynn Margulis as Na’vi in an Avatar-like poster for her summer course Reel Life in which the **DBF Series** was featured. Used for the Kickstarter project **OBTAINIUM**.

The DBF films, made in the late 1960s, use micro-cinematography and the time-lapse to capture developmental phenomena from the diversity of life on Earth. Unlike the world of Pandora in the movie *Avatar*, Earth is truly a “Symbiotic Planet.” “I thought you might like to know that a few of the DevBio films have really taken off,” Jeremy wrote, “These are the top 5, which are also the top 5 viewed videos on the Libraries’ YouTube channel:
Wilhelm Reich is perhaps the only physician scientist to have his papers burned in both Nazi Germany and the United States of America.

The research of science historian James Strick features prominently in the new documentary, “Love, Work and Knowledge - The Life and Trials of Wilhelm Reich,” which had its first private screening at the theater of the School of Visual Arts in New York on January 13, 2018. [Editor’s note: full disclosure: I donated to the making of the documentary and am listed in the credits as an associate producer.] Strick, with access to Wilhelm Reich’s laboratory notebooks and archives, wrote about the careful research of Reich, the student of Freud. Reich’s notable work in psychoanalysis and sexology brought him back into the laboratory as a life scientist to study the physics of the orgasm. Reich’s laboratory work is the subject of Strick’s excellent detective work in his book, published by Harvard University Press, Wilhelm Reich - Biologist.

The film has great production values and is carefully crafted to make use of historic footage and Reich’s own laboratory films and “home movies”. Unusual in the 1930s and even now was the combination of microcinematography and microscopes with magnifications of up to 4000x. The phenomena described by Reich could not be seen with the instruments in use at the time or by most research laboratories even today. What is clear from the movie is that Reich, who was, for a
short time, a member of the communist party in Germany before quitting and opposing both communism and fascism would subsequently be targeted by other researchers competing for funding, prudes, communists, fascists and anti-communist capitalists.

Reich’s research, like that of Lynn Margulis, produced surprising results and hypotheses that ran counter to mainstream beliefs. Reich was repeatedly attacked and mischaracterized by those completely ignorant of his science or who relied on scandalous hearsay, innuendo and a variety of lurid sexual fabrications.

After his investigations of Reich’s detailed laboratory notes, painstaking controlled experiments and repeated attempts to involve experts, such as Albert Einstein, Strick concludes, "Whatever else this work is, it is not pseudo-science."

It is noteworthy to recall that Lynn Margulis spent much of her entire career being dissed by neo-Darwinist biologists. Ernst Mayr remarked that even though she was correct about endosymbiosis of mitochondria and chloroplasts, "what she’s saying now, it’s startling to find a reputable scientist arguing such fantasies." Richard Dawkins responded to an obituary of Margulis that, "She was right about one big thing – and not many people can say that, so she deserves credit for it. But she more than used that credit up being wrong, in a big way, about almost everything else."

“Love, Work and Knowledge” details Reich’s early work in psychoanalysis and sexology, his path to the discovery of spontaneously-generated microscopic vesicles that he named “bions,” a new form of energy he dubbed “orgone,” how these led him to cancer research, and his development of orgone accumulators.

I do wish that there had been time in the documentary (110 minutes) to have gone into the same level of detail about Reich’s development and use of “cloud buster” devices that Reich claimed could harness atmospheric orgone to produce rain. While the film gives a couple of examples when the use of the “cloud busters”
was followed by rain, many viewers will find such claims, with little else in the film for support, more likely to be coincidence than evidence.

The film, “Love, Work and Knowledge” and Strick’s book, “Wilhelm Reich - Biologist,” finally treat Reich factually and fairly. They help to set the record straight given that almost everything else written about Reich is based on the malicious slurs and disinformation that dogged this gifted scientific pioneer throughout his life. Convicted for violation of an injunction banning the sale of his orgone accumulators brought by the Food and Drug Administration, Reich died in Federal prison of heart failure in 1957. The burning of Reich’s books and journals are exposed in the film as governmental excess spurred on by fabrications of a prudish yet prurient American press.

James Strick argues, “If there’s anything to Reich’s bion experiments, one of the reasons somebody might want to pursue them is to find out if Reich’s theory of cancer might have any substance to it or not. If it did, it would suggest dramatically different kinds of interventions to prevent cancer than current cancer therapies do, which focus mostly on trying to deal with the tumor after it has formed.”

**Holobionts as Units of Selection**

Scott Gilbert sent in “Holobionts as Units of Selection and a Model of Their Population Dynamics and Evolution” a paper on which he is one of the co-authors. The abstract reads:

“Holobionts, consisting of a host and diverse microbial symbionts, function as distinct biological entities anatomically, metabolically, immunologically, and developmentally. Symbionts can be transmitted from parent to offspring by a variety of vertical and horizontal methods. Holobionts can be considered levels of selection in evolution because they are well defined interactors, replicators/reproducers, and manifestors of adaptation. An initial mathematical model is presented to help understand how holobionts evolve. The model offered combines the processes of horizontal symbiont transfer, within-host symbiont proliferation, vertical symbiont transmission, and holobiont selection. The model offers equations for the population dynamics and evolution of holobionts whose hologenomes differ in gene copy number, not in allelic or loci identity. The model may readily be extended to include variation among holobionts in the gene identities of both symbionts and host.”