environmental evolution
effects of the origin and evolution of life on Earth
2021 August

2006 Harvard Forest field trip with John O'Keefe.

Subject: Have you seen this article?: James Lovelock (Gaia hypothesis) helped Shell create climate change denialism

EXTERNAL MESSAGE

Just started reading this, and wow ---- I always found the notion of Gaia sentimental pablum --- never occurred to me it could be used to facilitate the murder of the earth.

Someone should make a movie about the collab.

www.journals.uchicago.edu/doi/10.1086/712129#.YN9Y9g2WV_I.twitter

"This article tells the story of the oil and gas origins of the Gaia hypothesis, the theory that the Earth is a homeostatic system." (1/2) https://t.co/0Xa2gz7Plu

"It shows how Gaia's key assumption—that the climate is fundamentally stable, able to withstand perturbations—emerged as a result of a collaboration between James Lovelock, and Royal Dutch Shell in response to Shell's concerns about the effects of its products on the climate."

I haven't even finished the article. There's so much wrong with this alternate set of facts that it is hard to guess how much is right!

Bruno Clarke is finishing his study of the subject, so I'm curious what he makes of this.

Hello all: Yes, Jim, I saw this article when it came out in the spring and scanned through it at the time, went "eh," then put it aside. I was especially put off by the minimal and prejudicial synopsis of Margulis's career as a fellow 'contrarian.'

Fortuitously, your email today arrived at the very moment that I was arranging some notes to write up a synopsis of the "ozone affair" (Lovelock's phrase) as that is touched on in the Lovelock-Margulis correspondence. So I called it up and have just given it a complete reading.

Bruce Clarke

--from the working manuscript for *Writing Gaia: The Scientific Correspondence of James Lovelock and Lynn Margulis*, edited by Bruce Clarke and Sebastien Dutreuil, forthcoming from Cambridge University Press:

The onset of the "ozone affair" (Letter 87), regarding the potentially deleterious effects of man-made halocarbons on the stratospheric ozone layer and the policy decisions summoned in response, will loom at least as large over Lovelock's professional life in the mid 1970s as the "quest for Gaia" itself.[1] From the inception of this unforeseen complication in his scientific affairs, Lovelock is broadly skeptical about the "freon doom story" (Letter 73):

> I am exceedingly busy just now, all through having dabbled in atmospheric chlorine chemistry. . . . I doubt if there is anything to fret over. It is probably just another of those academic fashions which serve to keep Universities centers of intellectual corruption. . . . The Bowerchalke Lab is almost the sole source of atmospheric halogen compound information. You can guess the rest. (Letter 65)

A recent academic article argues that the two topics are already intertwined by their complicity in corporate apologetics. The Gaia hypothesis, its author contends, becomes a front for a Shell-funded claim that the planet itself will remediate the negative climatic effects of carbon emissions, thus taking Big Oil off the hook. So, too, in similar fashion, Lovelock's doubts about the certainty of the environmental dangers posed by the human release of CFCs consoles the chemical manufacturers (see Aronowsky 2021). Lovelock later records how such accusations date back to the occasion of his testimony on behalf of DuPont at a US Congressional hearing in 1975 on the issue of banning CFCs. In Homage to Gaia, he depicts his situation as one of political naiveté and inadvertent timing rather than committed advocacy. In any event, he contends that the science over which the warring sides inevitably drive to opposing conclusions is inconclusive at best. Referencing F. S. Rowland, co-author of the scientific paper that first presented the case against freon, he writes:

> Sherry Rowland was the environmentalists' champion, and I was in the odd position of being the principal witness for the industry's defense. . . . Had the stratospheric scientists approached me first, I would probably have appeared on Sherry Rowland's side. . . . It was not long after this hearing that environmental scientists . . . were calling me someone "in the pockets of the aerosol industry." (Lovelock 2000: 220)

Lovelock later recalls this slur against his professional integrity on the occasion of Margulis's receiving some bad press in the British newspaper The Guardian, noting sarcastically how that same outlet once "accused me of being a bought man of the chemical industry (quite untrue—no such luck)" (Letter 222). Lovelock sums up this difficult episode with words of censure for both the chemical industry and the scientific establishment. The Chemical Manufacturer's Association is "quite mad. They seem to go out of their way to offend those who might have something to say in their defense and contrary to the doomsters. The fluorocarbon issue is a scientific disgrace" (Letter 87).

While the central critique of Aronowsky 2021 strikes us as insupportable, this article does helpfully recover documentation regarding Lovelock's pointed interest at this time in the precise measurement of the naturally-occurring organic compound methyl chloride, also known as chloromethane. This topic comes up several times in the correspondence during the ozone affair: "We have just discovered a huge natural source of methyl chloride (about 5 megatons a year). It is almost certainly of marine origin . . . . It means that the input of chlorine to the stratosphere from natural biological sources is probably at least 100 times and possibly 1000 times larger than

from the freons" (Letter 69; see also Letter 76). Lovelock's inference from the discrepancy between these natural and anthropogenic proportions is that the drive to ban freons immediately to counteract stratospheric ozone depletion is, at the least, too precipitous. While this conviction may well have been an unusually severe misconstruction on Lovelock's part and one that was taken advantage of by other parties, we do not believe that his own development of the Gaia concept can be seriously indicted, as Aronowsky proposes, as a chapter in the "prehistory" of climate-change denialism.

[1] See "The Ozone War," chapter 8 of Lovelock 2000: 203-40.

Bruno

Dear Jim,

I've been spreading the gospel of developmental symbiosis in many strange places--including Lithuania, Korea, and China--thanks to Zoom meetings. I'm also revising my developmental biology book, which will have several new studies of developmental symbiosis in it.

I've also written some papers that might interest you. The one of especial interest is the one in Bruno Latour's "Body Politics" volume. ... I also included the chapter I wrote for the Sandro Minelli Festschrift. I think you'll appreciate the opening paragraphs of the "Becoming with others" section.

Best wishes,
Scott

Scott Gilbert
Swarthmore College, Swarthmore, PA, USA - University of Helsinki, Finland
photo Hummingbird Films

Towards a developmental biology of holobionts

Scott F. Gilbert

Abstract
We do not develop as monogenomic organisms, instructed solely from the DNA and cytoplasm of the zygote. Rather, we are holobionts, symbiotic consortia containing numerous microbial genomes, whose signals are critically important for our normal development. Microbes play crucial roles in forming and maturing animal guts, immune systems, nervous systems, and reproductive organs. In some species, they regulate such developmental phenomena as the proper orientation of the anterior-posterior axis and metamorphosis. One of the biggest challenges to developmental biology, then, is studying the developmental biology of holobionts, where co-development is the rule, and where the body is seen as a collection of interdependent ecosystems.

What a profession this is – this daily inhalation of wonder.

(Jean Rostand, 1962)

You complete me.

*(Dorothy Boyd, in **Jerry Maguire**, by Cameron Crowe, 1996)*

Quoted from **Becoming with others**

In the past century, the biological world has gone from a Darwin-Wallace paradigm, through a Dawkins-Collins phase, and is now entering the Margulis-Lewontin era. To be sure, the worldviews of each of the earlier eras, like evolving species or religions, are still present while the newer ones arise; but the Margulis-Lewontin view of biology emphasizes cooperative interactions and interpenetrations between individuals, rather than the strictly competitive interactions of the earlier paradigms. As Richard Lewontin (2002) documented, the boundaries of the organism are more porous, interpenetrating and interacting with the environment. The genotype gives us a repertoire of potential phenotypes, and the phenotype is often determined by environmental agents. And as Lynn Margulis (1998) showed, organisms can no longer seen as "monogenomic," bearing only the genes derived from the zygote. Rather, each organism is a holobiont, a symbiotic consortium with numerous microbes. Each organism is an ecosystem, and complex organisms, such as ourselves, are biomes, containing numerous ecosystems. Indeed, in this new view of the world, those animals most fit to survive are often those with the best systems of cooperation. As Richard Powers (2018, p. 142) concluded in his analysis of forests and their humans, "Competition is not separable from endless flavors of cooperation."

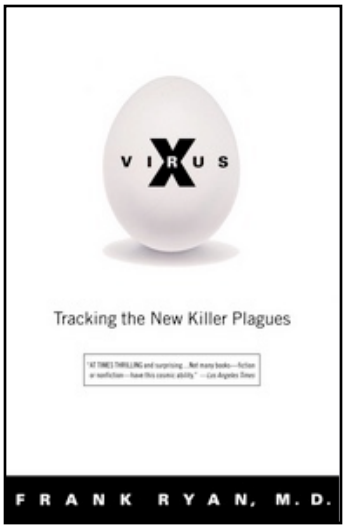
The Margulis-Lewontin perspective of biology highlights developmental plasticity and symbiosis (Levins and Lewontin, 1985; Margulis and Sagan, 2003; Gilbert and Tauber 2016). Developmental plasticity is most obviously seen in individuals, where the environment has agency, along with the genome, such that environmental agents generate different phenotypes from the same genotype (West-Eberhardt 2003; Minelli and Fusco 2010; Sultan 2017). Temperature, for instance, can determine the pigment patterns of some butterflies and the sex of many reptiles. Plasticity can also be seen in the "environment". Here, the environment is not a given context. Rather, habitats are formed by interactions between the organisms developing in them and as part of them. This extension of plasticity into the environment is called niche construction (Laland et al., 2008).

From: Frank Ryan
Subject: Re: Farewell imminent
Date: July 13, 2021
To: James MacAllister

Jim, keep me informed of any developments. I regard Lynn as my mentor into symbiogenetics. I remain deeply grateful that she helped me to understand symbiogenesis, even when she had no notion of the importance of viruses,

I recall our meeting at Oxford. She is much missed.

Frank



Deb Haaland as Ogimaakwe
by Rev'd Dr. Matthew Cobb

Science, the Rebel Educator: I

BY LYNN MARGULIS (2005 · — Sigma Xi President)

"For what a man more likes to be true, he more readily believes," wrote Francis Bacon (1561–1626).

We researchers resist this natural tendency; we do not try to "discover" or "scientifically prove" precon-ceived notions, to find what we like to be true. We discount gossip. We disdain common myth. We seek evidence, hard evidence. When doing science we try to avoid the influence of faith-based dogma.

Yet all of us who participate in science must share one common faith. We believe that the material-energetic world is knowable, at least in large part, by the concerted activity of research: exploration, reconnaissance, observation, logic, detailed study that includes careful measurement against standards. In short, we uphold the Sigma Xi values that lead us all, independent of wealth, creed or eye color, to be "companions in zealous research" who "encourage original investigation in science, pure and applied."

We in Sigma Xi are members of one of many strong science-promoting organizations based in, supposedly, the richest and freest country in the world. Then why, for example, do 15-year-old U.S. students rank 22nd of 40 countries in science literacy, according to the latest survey of student performance by the Organization for Economic Cooperation and Develop-ment? This, the first of three related "From the President" messages, presents my take on the national problem of inadequate science education. American students' persistent low scores on international tests and faltering interest in science and mathematics reflect, in my opinion, a contradiction in our national psyche, a deep cultural divide. Intellec-tual truths in this country are often sacrificed to what people "like to be true" and thus "more readily believe." What sells to the multitudes is what people like. Our culture puts a premium on being liked; we tend to seek and value popularity over truth, especially abstract scientific truth. James Baldwin (1924-1987), the outspoken Harlem, New York novelist and essayist who resided in Paris most of his career, claimed that life in the U.S.A. was "terrifying for black people." In a 1984 interview with Kay Bonetti for the American Audio Prose Library, he described America as "a conglomeration of many cultures, none of them really respected ... [all] at the mercy of what this country imagines itself to be ... a collection of pragmatic, pious businessmen.... the key to American life seems to me to be involved with their stubborn, manic refusal to accept their history." Baldwin was referring to America's legacy of slavery, but there is a corollary to his statement with importance for science. Science faces a vaster, more stubborn mania: the refusal to accept natural history.

The affliction of history-ignorance promulgates likable, arbitrary, pragmatic "facts." Memorizable trivia and arguments from authority substitute for logical narrative and hard evidence. A stubborn, manic refusal to accept evolutionary history cripples our national capacity to teach, learn and do science. The scientist studies nature in nature, and it is from nature that authentic scientists take dictation. Skepticism, particularly toward arrogant authorities, and disclosure of their distortions, omissions and halftruths, is mandatory for the health of science and growth of its knowledge. To challenge unstated assumptions, to resist arguments from authority, to detect and reject institutionalized bias, all are intrinsic to the scientific enterprise. In peer-reviewed professional journals, outlandish claims, overgeneralizations and personal experience don't count. Having heard something on the grapevine of the day—newspaper, telephone, lecture hall, television, Internet—does not constitute authority. Acceptable authority, on which our scientific lives depend, is limited to the primary scientific research literature. Nothing I say here is radical. Popular, palatable views of the world and how it came to be do not constitute science or truth. But decent science education requires that we share the truth we find—whether or not we like it.

Science, the Rebel Educator: II
By Lynn Margulis

Science, the Rebel Educator: III
By Lynn Margulis

Unlocking the 'gut microbiome'and its massive significance to our health

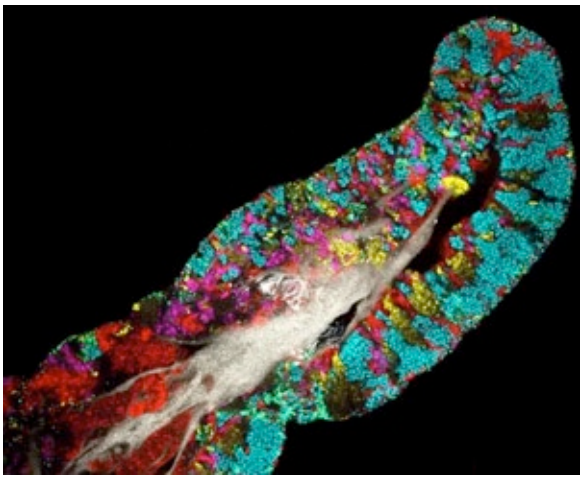
Scientists are only just discovering the enormous impact of our gut health – and how it could hold the key to everything from tackling obesity to overcoming anxiety and boosting immunity
by Rebecca Seal

If you want to learn more about what's going on in your gut, the first step is to turn your poo blue. How long it takes for a muffin dyed with blue food colouring to pass through your system is a measure of your gut health: the median is 28.7 hours; longer transit times suggest your gut isn't as healthy as it could be. We are only now beginning to understand the importance of the gut microbiome: could this be the start of a golden age for gut-health science?

From: Victor Fet
Subject: **A Protist Hosts Both Green Algae and Purple Bacteria Symbionts I The Scientist Magazine®**

How A Building Block Of Life Got Created In A Flash

Microbes are 'unknown unknowns' despite being vital to all life, says study



A human tongue with each colour representing a different type of microbe. Microbes in humans are linked to conditions from obesity and diabetes to anxiety. Photograph: Tabita Ramirez-Puebla and Jessica Mark Welch/Marine Biological Laboratory

The age of extinction

A new study has highlighted how little is known about microbes – the hidden majority of life on Earth.

Life on the planet relies on an enormous quantity of bacteria, fungi and other tiny organisms. They generate oxygen, keep soils healthy and regulate the climate. Microbes play a crucial role in food production, such as cheese, beer, yoghurt and bread.

But despite their importance to human life and the health of the Earth, a new scientific paper has shown our "profound ignorance" of microbial biodiversity and how it is changing.

"We have no idea whether global microbial diversity is increasing, decreasing, or staying the same," said David Thaler, a biologist at Basel University and author of the paper. "Most scientific papers tell us new facts. This is a different kind of paper; it does not answer anything but asks a new question. ..."

Niche construction and the transition to herbivory: Phenotype switching and the organization of new nutritional modes

Lynn Chiu
School of Biology, University of St. Andrews, Scotland, UK, ImmunoConcept Lab, University of Bordeaux, Bordeaux, France

Scott F. Gilbert
Swarthmore College, Swarthmore, Pennsylvania USA

Lynn Chiu

Keywords: holobiont, herbivory, niche construction, developmental plasticity, eco-devo, eco-evo-devo, symbiosis, biological individuality

Abstract

Gut microbiota have played important roles in the evolutionary transition from carnivory to herbivory. In the evolution of ruminants, three

modes of macrobe-microbe symbiosis have facilitated the phenotypic switch into a new nutritional mode. Mutualistic microbes acquired during birth enable the building of the rumen (developmental symbiosis), the digestion of plant fiber (nutritional symbiosis), and the detoxification of plant toxins (protective symbiosis). These symbioses created a new plant dietary niche through two types of niche construction: "perturbational niche construction," a phenotypic process whereby gut microbes initiate the building of a mature rumen from the non-functional anlagen of this stomach region; and "mediational niche construction," whereby microbe-induced changes alter how the animal experiences environmental resources without actual modification of the environment. Thanks to microbes, plants are now edible. We argue that the reciprocal niche construction of the host and its associated microbial organisms (i.e. the "holobiont") scaffold each other's developmental and phenotypic processes as well as organize a new selective environment of the holobiont as a whole.

Concept Paper

Toward a Symbiotic Perspective on Public Health: Recognizing the Ambivalence of Microbes in the Anthropocene

Salla Sariola [1] and Scott F. Gilbert [2]

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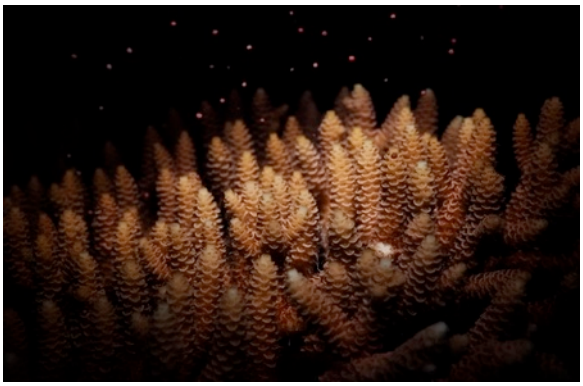
2 Department of Biology, Swarthmore College, Swarthmore, PA 19081, USA

Published: 16 May 2020

Salla Sariola

Abstract: Microbes evolve in complex environments that are often fashioned, in part, by human desires. In a global perspective, public health has played major roles in structuring how microbes are perceived, cultivated, and destroyed. The germ theory of disease cast microbes as enemies of the body and the body politic. Antibiotics have altered microbial development by providing stringent natural selection on bacterial species, and this has led to the formation of antibioticresistant bacterial strains. Public health perspectives such as "Precision Public Health" and "One Health" have recently been proposed to further manage microbial populations. However, neither of these take into account the symbiotic relationships that exist between bacterial species and between bacteria, viruses, and their eukaryotic hosts. We propose a perspective on public health that recognizes microbial evolution through symbiotic associations (the hologenome theory) and through lateral gene transfer. This perspective has the advantage of including both the pathogenic and beneficial interactions of humans with bacteria, as well as combining the outlook of the "One Health" model with the genomic methodologies utilized in the "Precision Public Health" model. In the Anthropocene, the conditions for microbial evolution have been altered by human interventions, and public health initiatives must recognize both the beneficial (indeed, necessary) interactions of microbes with their hosts as well as their pathogenic interactions.

Keywords: microbial evolution; public health; symbiosis; drug resistance; hologenome; AMR; allergy; anthropocene; Plantationocene



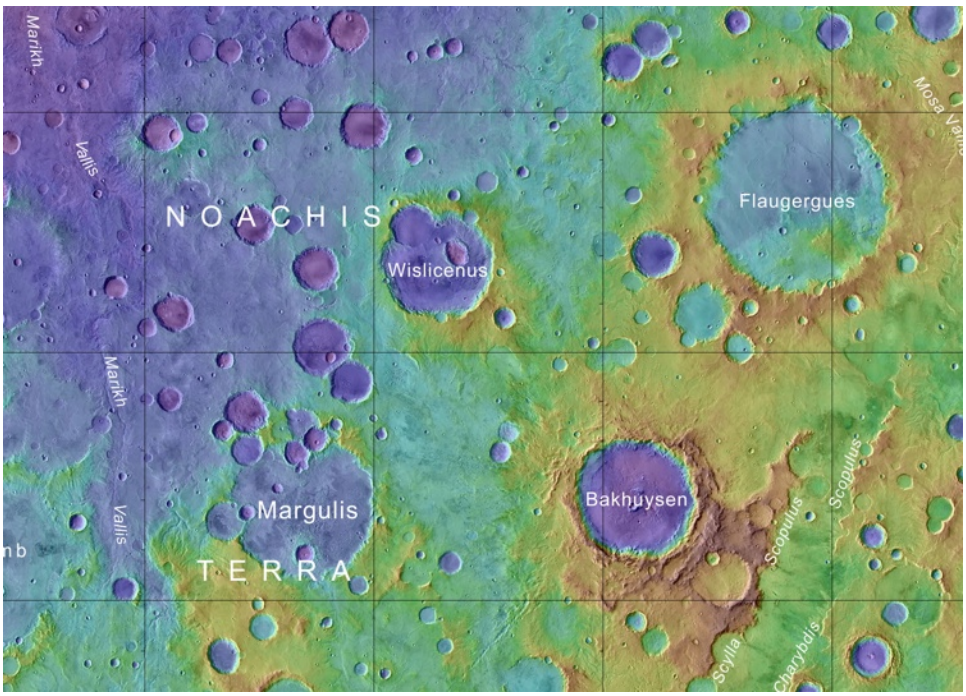
The coral *Acropora tenuis* (Cnidaria: Acroporidae) spawning.
photo: Coral Brunner / Shutterstock.com

When corals meet algae: first stages of symbiosis seen for the first time

By Tania Fitzgeorge-Balfour, science writer

The physical interactions between coral and algal cells as they combine to form a symbiotic relationship have been observed for the first time. Within minutes of being introduced, coral cells had started to engulf the algae, where they were either digested or moved to a protective 'bubble' within the cell. This new study, published in Frontiers in Marine Science, will form the basis of further research to understand what drives their symbiosis at a cellular and molecular level, including the eviction of algae, which is the cause of coral bleaching.

"We watched coral cells develop pseudopodia – temporary arm-like structures – that were used to engulf the algae as early as 5 minutes after the two cells were mixed," explains Professor Nori Satoh, co-lead author of the study and head of the Marine Genomics Unit at the Okinawa Institute of Science and Technology Graduate University, Japan. "Once inside the coral cell, some algae were moved to a vacuole, a protective membrane-bound bubble, while others were broken up and digested."



Margulis Crator on Mars

Dear Jim,
As you know Lynn for me was the best biology teacher I ever had.
I am writing a piece on her for Bruno Clarke's study of the correspondence between Lynn and Jim L.
Hope you are well…..
Best wishes
Stephan
Dr Stephan Harding
Deep Ecology Research Fellow
Senior Lecturer in Holistic Science
Schumacher College

Hi Jim,
Just saw this new paper about Lynn by Antonio Lazcano that I thought you might like to have.
best wishes,
Mike Dolan

Prokaryotic symbiotic consortia and the origin of nucleated cells: A critical review of Lynn Margulis hypothesis Antonio Lazcano, Juli Pereto,*

From: "Bruce Scofield"
Subject: Margulis crater
Date: May 31, 2021 at 5:53:04 PM EDT
To: jmacallister@environmentalevolution.org

https://dailyresearchnews.com/scientists-lynn-margulis-and-elizabeth-roemer-are-already-on-mars/?fbclid=IwAR2I9DzdtayB_3wsnifS4C_sKA6z-G-YjneTo3c47YV8FDLtz8IqBv_GVMg

here's a map
https://planetarynames.wr.usgs.gov/images/mc20_2014.pdf

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