Alexander Von Humboldt was a German polymath, geographer, naturalist, explorer, and proponent of what has been called "Romantic philosophy and science." Today we recognize him as a systems thinker and scientist long before these terms were invented. Von Humboldt died in 1859, the same year that Darwin published "On the Origin of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle for Life," The sciences (already informed by the utilitarian and mechanistic philosophies of Francis Bacon and René Descartes) made a turn away from systems science to an almost exclusively reductionist methodology.

Lynn Margulis encouraged me to pursue a Masters degree in geography with Richard W. Wilkie at the University of Massachusetts Amherst where the two professors taught in the Geosciences Department. At the time, I had applied my experience from my 30-year career as a scriptwriter/researcher, director, and editor of programs in science and medicine to digitize Margulis’s teaching materials and research library of over 550 videocassettes, audiocassettes, and interactive lectures. I had also created an animated sequence of her Serial Endosymbiosis Theory (SET).

I came to appreciate that both Wilkie and Margulis shared similar philosophies of teaching and systems geoscience. Richard Wilkie proposed his Process Method for multivariate (systems) statistical techniques analysis (page 2) in 1968. This is near the beginning of the period that Bruce Clarke documents in his book, *Gaian Systems: Lynn Margulis, Neocybernetics, and the End of the Anthropocene*. 
“The Process Method versus the Hypothesis Method

How valid are multivariate statistical techniques of analysis based on linear assumptions?

Is it possible that such techniques can at times misdirect the analysis in such a way that they may hide some relationships that exist in the real world? Many of those who work with quantitative data would agree that at times such techniques of analysis do cover up vital relationships between variables that exist only at certain levels within the data. Many others, however, seem to ignore this fact and thus fail to see countereffects within various levels of data (e.g., subculture groups) that are canceled out when lumped together in aggregate linear statistical analyses.

Therefore, it is the purpose of this article (a) to examine briefly the trend against exclusive use of linear analyses; (b) to point out that what this writer has called the Process Method is more effective than the Hypothesis Method for isolating the occurrence of nonlinear relationships in changing and evolving communities...

2010 EVOLUTION GEOGRAPHY SYLLABUS

(Final Feb23) Lynn Margulis (LM) and Richard Wilkie

Evolution Geography, a new course, develops a conceptual framework for studying evolution within the context of interconnected Earth physical systems and life, including humans, and the processes that have changed them as they relate to geography. Not a course about competition, neo-Darwinian population genetics and differential survival, rather we look more at the role of ecological relationships, including symbioses at the level of communities. Communities evolve through an interdependence of a
functioning set of systems that all require a continuous flux of matter and energy. In the case of humans, population growth and diffusion over the Earth’s surface is correlated with innovation, technology and change. All geographical Earth systems, including those of organisms embedded in their environment, involve interplay of components that lead to changes on the physical environment and human cultural landscapes and in biographical regions, many with catastrophic consequences for certain species...

MEMORIES OF TEACHING WITH LYNN MARGULIS
-- Richard Wilkie  (about May 2011)

I knew of Lynn’s work and reputation over many years, but I never thought that I would someday teach co-develop a graduate seminar with her. Such a thought would have bowled me over. Once she came to the Department of Geosciences, however, it was clear that we had much in common—a holistic, Alexander von Humboldt-like respect for understanding how all the earth systems interact in different places and over time.

Throughout my career I studied human perceptions of the environment and how their decisions—based on those perceptions and miss-perceptions—have impacted the Earth’s physical systems. In a very short era of time—the Holocene over the last 10,000+ years—humans have made a mess of virtually all earth systems and have sped up changes that have eliminated countless species of living things. Humans have altered the environment in ways that will change how those systems evolve during this period of hyper-evolution that seems to changing at speeds unrecognizable to humans previously. That story is only now being told—partially—and it most likely involves dimensions of change that humans cannot at this time fully comprehend.

When I more fully understood that Lynn’s work, and that of her students, approached these issues from the biological and deep-time earth-systems evolution perspectives, including the Gaia theory suggesting that Earth and all its interlocking systems form a self-regulating—and ever evolving—set of conditions that allow its continuation. Systems change and react to changes in other systems in ways that allow Earth to evolve infinitum. I had long argued for the study of change in those Earth and human systems using the Process Method that had evolved in my own research, but I was shooting in the dark until Lynn joined our department.

As Graduate Program Director in Geography, it was my pleasure to have greater contact with Lynn and her work—and her graduate students—as our program had both human geographers and physical geographers, especially climatologists and geomorphologists. Biogeography is an important subfield in geography, although our department only recently has shown an interest in that area, but it clearly was a link on which many of Lynn’s graduate students could connect to geography, and the discipline of geography’s limited perspective, I urged Lynn to have her students connect to the more holistic Earth-systems approach in geography. We talked about how the geography program might provide a home for her students, and indeed, that turned out to be the case, albeit with some resistance from several human geographers...
Bringing Cell Action into Evolution
James A. Shapiro
University of Chicago

ABSTRACT
“Lynn Margulis was an indefatigable advocate of positive cell action in the evolutionary process. Lynn focused her work on observing real-time interactions between cells and advocating the major role of cell fusions and symbiogenesis in rapid evolutionary change. Confirmation of the mitochondrion and chloroplast in eukaryotic cells as descendants of well-defined prokaryotes was a major turning point away from the gradualist ideology that dominated evolutionary thinking for most of the 20th Century. Since then, we have come to appreciate more the major evolutionary roles of cell-cell interactions and cellular control of genome structure. The well-established phenomena of symbiosis, hybridization, horizontal DNA transfers, genome repair, and natural genetic engineering have revolutionized our understanding of genome variation. Rather than a series of accidents randomly changing a ROM (read-only memory) heredity system, we realize that active cell processes non-randomly restructure a RW (read-write) genomic storage system at all biological time scales.

ABBREVIATIONS: ERV (endogenous retrovirus), NGE (natural genetic engineering), NHEJ (non-homologous end-joining), ROM (read-only memory), RW (read-write), VDJ (variable, diversity and join cassettes)...”

Can Reasons and Values Influence Action: How Might Intentional Agency Work Physiologically?
Raymond Noble1 · Denis Noble2
Accepted: 18 September 2020
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Abstract
“In this paper, we demonstrate (1) how harnessing stochasticity can be the basis of creative agency; (2) that such harnessing can resolve the apparent conflict between reductionist (micro-level) accounts of behaviour and behaviour as the outcome of rational and value-driven (macro-level) decisions; (3) how neurophysiological processes can instantiate such behaviour; (4) The processes involved depend on three features of living organisms: (a) they are necessarily open systems; (b) micro-level systems therefore nest within higher-level systems; (c) causal interactions must occur across all the boundaries between the levels of organization. The higher levels constrain the dynamics of lower levels. The experimental evidence and theoretical arguments are shown to be consistent with previous research on the neuronal mechanisms of conscious choice, and with the interconnected multi-level processes by which organisms harness stochasticity, whether conscious or unconscious...”
Biology Transcends the Limits of Computation
Perry Marshall
Evolution 2.0
Abstract
“Cognition-sensing and responding to the environment-is the unifying principle behind the genetic code, origin of life, evolution, consciousness, artificial intelligence, and cancer. However, the conventional model of biology seems to mistake cause and effect. According to the reductionist view, the causal chain in biology is chemicals --> code --> cognition. Despite this prevailing view, there are no examples in the literature to show that the laws of physics and chemistry can produce codes, or that codes produce cognition. Chemicals are just the physical layer of any information system. In contrast, although examples of cognition generating codes and codes controlling chemicals are ubiquitous in biology and technology, cognition remains a mystery. Thus, the central question in biology is: What is the nature and origin of cognition? In order to elucidate this pivotal question, we must cultivate a deeper understanding of information flows. Through this lens, we see that biological cognition is volitional (i.e., deliberate, intentional, or knowing), and while technology is constrained by deductive logic, living things make choices and generate novel information using inductive logic. Information has been called ‘the hard problem of life’ and cannot be fully explained by known physical principles (Walker et al., 2017). The present paper uses information theory (the mathematical foundation of our digital age) and Turing machines (computers) to highlight inaccuracies in prevailing reductionist models of biology, and proposes that the correct causation sequence is cognition --> code --> chemicals.”
On May 22, 2021, Bruce Clarke wrote:

Hi Jim: I hope all’s well out your way. If you would care to do so, you could add the link to this just-released podcast on Gaian Systems in conversation with another work of intrinsic interest to your audience, The Probiotic Planet.

In other news of mine, at this moment all systems are go for a trip to Ashland, OR, between June 10-16 to rendezvous with Jennifer M and also Margulis biographer Phil Hilts and open up the vault—that is, storage shed—holding Lynn’s papers and go through them one more time in front of submitting the Writing Gaia correspondence volume to Cambridge at the end of the summer. Wish us luck.

Think Again: The Power of Knowing What You Don't Know by Adam Grant

From Amazon “Intelligence is usually seen as the ability to think and learn, but in a rapidly changing world, there's another set of cognitive skills that might matter more: the ability to rethink and unlearn. In our daily lives, too many of us favor the comfort of conviction over the discomfort of doubt. We listen to opinions that make us feel good, instead of ideas that make us think hard. We see disagreement as a threat to our egos, rather than an opportunity to learn. We surround ourselves with people who agree with our conclusions, when we should be gravitating toward those who challenge our thought process. The result is that our beliefs get brittle long before our bones. We think too much like preachers defending our sacred beliefs, prosecutors proving the other side wrong, and politicians campaigning for approval and too little like scientists searching for truth…”

Think Again is a must read for anyone interested in the skills that set my mentors, Lynn Margulis and Richard Wilkie, apart as thinkers, teachers, and geoscientists writ large. Each understood that humility is essential for avoiding the temptation of certainty. Each also understood that change is the only constant in life.

Lynn credited her Nobel Prize winning brother-in-law with saying that it would be a great day when teachers only taught those things that they actually understood. I hope that Adam Grant feels the joy of being wrong because science is not a search for truth. Science is the ongoing search by humans for evidence-based knowledge. Grant also falls victim to a certainty that the ancient practice of astrology is all pseudoscience. Is it? I don’t know. I’m skeptical, but because I know so little about astrology, I remain curious and open to surprise. I suspect that, in this case, Adam Grant simply accepts the concensus of opinion as evidence. It isn’t. He just doesn’t know what he doesn’t know.

Lynn introduced visitors to her lab to one of her graduate students as an astrologer. It was her test of their critical thinking. Would the visitor respond with the typical knee jerk reaction of dismissal or with a probing question?