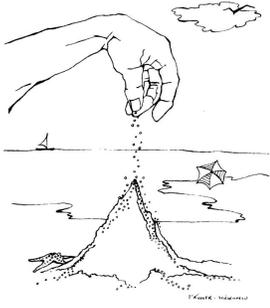


Complexity 101: How Nature Works

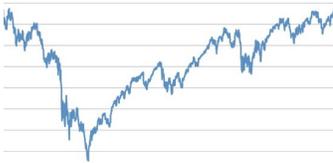
An Introduction to the Complexity Sciences
by Dr. Alder Stone Fuller, Ermah Ge



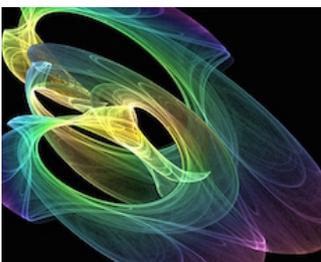
Sand piles demonstrate self-organized criticality (SOC) where all complex adaptive systems operate.



Self-organization in a chemical system (BZ) produces dynamic spirals similar to your heart's natural pacemaker



Healthy processes in nature & organizations are non-linear & non-equilibrium, whether ecosystems, physiologies, or economies, making them inherently unpredictable & uncontrollable.



Strange attractors can result in great benefits or catastrophic failures.

This course introduces the principles of the **complexity, system or network sciences**. They represent both a revolution and a renaissance in science and mathematics on par with relativity theory and quantum physics. However, they are *far easier* to understand — even for those with no science background — and applicable to everything: organisms, physiology, health and healing, ecology, climate, weather, corporations, organizations, permaculture, societies, economics, politics, Earth, the cosmos and everyday life (even cooking!). They are informed by the work of top scientists and mathematicians, including Nobel laureates, and yield profound changes in our understanding of nature, Earth, life, human organizations and societies. Complexity 101 is unique in the US for its integration and accessibility. It is prerequisite to all other courses in Ermah Ge's Earth Studies Program.

Topics & principles {key words taught are **bold**}

- **Networks, systems & complex adaptive systems**
- **Links** (& why they are more important than parts in a system), **circularity**, **feedback: negative** (stabilizing) v **positive** (accelerating)
- The concept of **nonlinearity**, why it makes nature & so much else unpredictable, & thus uncontrollable in any substantive way
- System **attractor states**, **critical thresholds** (tipping points) & **phase transitions** (rapid transitions between attractor states)
- **Self-organized criticality** (SOC) on **the edge of chaos** characterized by **fractals** (which are self-similar on many scales) & **power laws**
- **Self-organization**: spontaneous organization of matter when exposed to an **energy gradient**; studied by **non-equilibrium thermodynamics** (NET)
- **Autopoiesis**: a special kind of self-organization in living systems: key to **life**
- **Emergence & emergent properties** — why the whole is greater than the sum of the parts — & why they contribute to unpredictability
- **Chaos, strange attractors, & sensitive dependence** ('butterfly effect'), & why they wreak havoc on predictions about weather & markets
- Symbiosis & **sybiogenesis**, a newly-discovered component of evolution that works with natural selection & genetic mutation to create new species
- **Geophysiology**: study of Earth as a self-regulating, complex adaptive system
- **Science** as a process of knowing: role of logic & critical thinking; hypotheses, predictions, evidence & analysis; theories & models; peer review & publication; laws & paradigms; distinction from religion, philosophy & pseudosciences

Logistics

- Two or more sections offered on different days, times & locations in Bangor area
- Each week will include a lecture and/or video, with Q&A/discussion
- Total class time: approximately 16 hours in 2 hour weekly meetings
- Students will have access to class notes & videos by Alder