This course presents an overview for social scientists of recent theories and models of self-organization and emergence. These theories, associated with the Santa Fe Institute, have been developed for the most part in the physical and biological sciences. The course will explore, largely through discussion, the relevance of these theories for the social sciences.

The University of Chicago has participated in this intellectual movement through the development of the agent-based simulation platform Repast, which is oriented toward social science applications and is available for free: [http://repast.sourceforge.net](http://repast.sourceforge.net)

The course requirements are weekly 4-5 page book reports. You may pick any book or bunched set of articles to write about, one from each section (except first and eleventh). Include one conjectured social application in your discussion. Book reports are due by 9am the day of class, and should be distributed electronically to everyone in the course.

**Week 1: Popular Overviews**


**PART I: FOUNDATIONS**

**Week 2: Introduction to Self-Organization**


[http://www.media.mit.edu/starlogo](http://www.media.mit.edu/starlogo)

Scott Camazine et al., *Self-Organization in Biological Systems* (2001)
[http://beelab.cas.psu.edu](http://beelab.cas.psu.edu)

[http://www.brook.edu/sugarscape/](http://www.brook.edu/sugarscape/)


**Week 3: Introduction to Evolution** (and to debates therein)


**Week 4: Evolutionary Game Theory**


Martin Nowak and Robert May, “Evolutionary Games and Spatial Chaos,” *Nature* 359:
PART II: BIOLOGICAL NETWORKS AND LIFE

Week 5: Ecological Communities

Robert May, Stability and Complexity in Model Ecosystems (1973)
Brian A. Maurer, Untangling Ecological Complexity: The Macroscopic Perspective (99)

Week 6: Hypercycles and the Origin of Life

Erwin Schrodinger, What is Life? (1944)

Week 7: **Phenotypes and Macroevolution**


Leo Buss, The Evolution of Individuality (1987)


**PART III: PHYSICAL NETWORKS AND THE MIND**

Week 8: **Statistical Mechanics and Self-Organized Criticality**

Barry M. McCoy and Tai Tsun Wu, The Two-Dimensional Ising Model (1973)

Daniel Stein (ed.), Spin Glasses and Biology (1992)


Ricard Sole and Sergi Valverde, “Phase Transitions in a Model of Internet Traffic,” Santa Fe Institute Working Papers # 00-03-020 (2000)


Bernardo Huberman (ed.), The Ecology of Computation (1989) [optional background]

Week 9: Neural Nets


Patricia S. Churchland and Terrence J. Sejnowski, The Computational Brain (1992)


Week 10: **Artifacts, Translation, and Language**


Week 11. **Consciousness and Quantum Mechanics**

(an extra session led by Alex Wendt)

Danah Zohar and Ian Marshall, *The Quantum Society: Mind, Physics, and a New Social Vision*


