

Program Description

What are the origins of life? The human race has been pondering this question since the dawn of civilization. The question and the answer are multifaceted and have religious, philosophical and scientific implications. The diversity and complexity of the life that inhabits the earth would seem to require that the answer be a complex one yet recent developments in science indicate that complex order can and does emerge from random processes and simple rules. In this program we will investigate the mathematical basis of the origins of life. First it will be important to understand how ordered structures can emerge from random process. We will also study cellular automata and how they model self replicating structures. Of course an essential component of understanding the origins of life is to understand its evolution. To that end we will examine mathematical aspects of evolution including the evolution of macromolecules and the genetic code, the game theoretic modeling of animal behaviour and the dynamics of population genetics.

In this interdisciplinary program students must have an interest in pursuing connections between biology and mathematics. No previous background in biology is required, but the program will be enriched by the presence of students with such a background. Facility with college level algebra is essential. Knowledge of calculus will be a significant asset in some parts of the program but is not required for enrollment.

The program will consist of lectures, workshops, computer modeling labs and seminars. Students will be expected to complete an independent project with the aim of creating mathematical models in biology. Upper division science credit will be awarded for upper division work.

Course Equivalencies

Mathematical Models in Biology 5, Modeling Emergent Phenomena 3, Seminar: Origins of Life 2, Individual Project 2

Schedule

Monday	Tuesday	Wednesday	Thursday
	9:30-12:00 Discrete Mathematical Biology Sem2 C2109		9:30-12:00 Discrete Mathematical Biology Sem2 C2109
Lunch			
1:00-3:00 Seminar Sem 2 C2109	1:00-4:00 Modeling Emergence CAL	1:00-3:00 Optional Tutorial Sem2 C2109	1:00-3:00 Project Work Sem2 C2109

Texts

- Mathematical Models in Biology: An Introduction
by Elizabeth Spencer Allman
ISBN: 0521525861
Publisher: Cambridge Univ Pr
Publish Date: 11th December 2003
- Blind Watchmaker : Why the Evidence of Evolution Reveals a Universe Without Design
by Dawkins, Richard
ISBN: 0393315703
Publisher: W. W. Norton & Company
Publish Date: 01 September, 1996
- Garden in the Machine: The Emerging Science of Artificial Life
by Claus Emmeche, Steven Sampson
ISBN: 0691029032
Publisher: Princeton Univ Pr
Publish Date: 30 August, 1996
- Life's Other Secret: The New Mathematics of the Living World
by Ian Stewart
ISBN: 0471296511
Publisher: John Wiley and Sons Inc
Publish Date: 13 January, 1999

Seminar Reading for Week 1:

Preface and Ch1-3 of *Life's Other Secret* by Ian Stewart.

Other Supplies

We will be making use of NetLogo software in the computer labs. Students can use this software in the Computer Applications Lab which is open 9:00 am -10:00 pm during the week. If you plan to do most of your work at home you should obtain a copy for your computer from: <http://ccl.northwestern.edu/netlogo/>

Faculty Information

David McAvity, Tel: 867 5490, email: mcavityd@evergreen.edu

Website

The following program website has much more detailed information and will be updated regularly: <http://academic.evergreen.edu/curricular/origins/>