

**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**

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### **Website**

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