

Biomathematics Seminar  
(BIOL 380/MATH 383)  
Spring 2020

Item	Course Details
Meetings	Wed., 4:00 - 4:50 in Newton 209
Professors	<b>C. Leary</b> , South 324D, leary@geneseo.edu, 245.5383. Office Hours: M 10–11, Tu 11–12, W 9–10, F 9:30–10:30, or by appointment <b>G. Hartvigsen</b> , ISC 360, hartvig@geneseo.edu, 245.5448. Office hours: M 4:30 - 5:30, T 11:00 - 1:00
Textbook (required)	Solé, R., and B. Goodwin. 2000. Signs of Life. Basic Books.

## 1 Expected Learning Outcomes

After successfully completing this course you should be able to

1. discuss a wide array of applications of mathematics and computational approaches to questions involving biological phenomena;
2. explain the contributions of scientific papers to the field of biomathematics;
3. effectively lead a discussion on a book chapter and a primary literature paper. This will include the preparation and dissemination of questions that will guide participant reading; and
4. assess the use and application of quantitative methods to biological problems observed in student projects observed at GREAT Day.

## 2 Overview

The primary goal of this seminar is to bring together people interested in learning more about topics that span the disciplines of biology, mathematics, and computation. Your job is to actively participate. Our hope is that you learn a lot and enjoy being able to apply what you learn to potential research topics for yourself. There will be some complicated material discussed. You might feel lost with some of the primary literature papers. This is fine—we’re having an experience together! We hope you become engaged with the material. We intend for you to build and share **some of the models yourself** as discussion leader. Most of the models are accessible and pertinent to better understanding biological systems. Keep your eyes out for possible research projects.

The readings are from the Solé and Goodwin book and the primary literature (original findings that describe methods used to make the discovery). Papers will be provided on Canvas on Thursday the week before they are discussed (unless the discussion leaders let us down!).

This class fulfills a requirement of the biomathematics minor (see [https://bulletin.geneseo.edu/preview\\_program.php?catoid=10&pooid=788&hl=biomath&returnto=search](https://bulletin.geneseo.edu/preview_program.php?catoid=10&pooid=788&hl=biomath&returnto=search)).

## 3 Responsibilities

1. **Faculty.** Our jobs are to organize the class, especially topics and wrangle discussion leadership, make sure additional readings are chosen and made available in a timely fashion on

Canvas, and to assess participation and discussion leadership. Our job is not to yammer on incessantly about the good ol' days.

2. **Discussion leaders.** You will work in groups of three to lead two interesting, interactive discussions on two different chapters. For each discussion you also will choose a primary literature paper to accompany the chapter and provide a pdf of the paper to the instructors for approval one week before discussion is to take place. Additionally, you need to email your discussion questions to both professors for approval by the **Saturday (11:59pm)** prior to the Wednesday discussion. During discussions your job is to call on students to participate, being mindful to allow everyone the chance to earn participation points.
3. **Discussion participants.** Participate in discussion by making useful additions to discussions each week. This is more than just reading the week's chapter and paper. It means you are expected to actually think about how the system works and how you might actually model this. Consider being able to discuss the framework for modeling the system under discussion. What would you need? Or can you bring a leading question to get the discussion moving on how we would actually model this. Use Google searches. Everything we will discuss can, for instance, be modeled using R.

## 4 Characteristics of a good discussion

A good discussion occurs when everyone has done the reading and participates to highlight and extend the important points from the chapters and papers. Sometimes discussions are downright painful because few have done the reading and/or the leading questions do not evoke participation. For example, the question, "What was the third paragraph on page 98 about?" will invariably produce long periods of silence.

Keep in mind that your colleagues earn points by making **insightful contributions** to the discussion. They don't get points for answering your question, "Can anyone provide the name of the book?" Here are some characteristics of discussion leadership that get and/or keep things going well.

1. Everything you do revolves around asking students questions. Avoid the temptation to explain anything about the book or paper first! It's always tempting to review the major points of the chapter or paper. This is NOT the job of the discussion leader! You are stealing points from your fellow students and losing your own points, too!
2. Leading a dynamic, interactive, and interesting discussion on the chapter is done by **asking leading questions** that are core to the book chapter and paper. You need to stimulate discussions and give all students the chance to get participation points. Good questions may lay a foundation for an idea and then ask participants to extend the idea, often including examples other than those found in the reading. It certainly should include asking others to explain any figures or possibly equations (if not too gnarly). Failing to make participation points available for the earning denies your colleagues opportunities to share their thoughts (and get a good grade). Be sure to offer the opportunity for shy people to speak up. This is done by asking:

"Is there anyone who hasn't had a chance to speak who would like to add something?"

You then have to **wait** to give them a chance. If you're a shy person we understand, but this will be your chance to participate. Please try not to let such opportunities go by. And this question should be asked every day.

3. Consider asking the following question and have, in reserve, an answer to “**Can someone describe how you might model this?**”
4. Avoid making fun of an answer to a question. An answer might not be relevant to the question you *thought* you were asking! This is common in this course. If that happens say “good” or “thanks.” Then try restating the question. We want to encourage participation, and sometimes an answer that seems tangential to the question that you ask will lead to a fascinating and lively discussion.

## 5 Providing the paper and questions

It's your job to get an appropriate paper for discussion that aligns with the chapter you are overseeing. We can help you and make suggestions if you like (ask us!). Here are some sources for you to consider for papers:

1. <http://www.ploscompbiol.org/>
2. <http://www.pnas.org/>
3. <https://www.sciencemag.org/>
4. <http://www.nature.com/>
5. <http://www.journals.elsevier.com/physica-d-nonlinear-phenomena/>

You need to have approval from us on the paper and questions for your discussion by class time one week prior to your day of leadership. Supply the instructors with a document containing the leading questions you will ask about the chapter and paper, as a pdf.

## 6 Grading

Grading for this class is based on the following:

Activity	Points Available
Discussion Leadership	20 (10 pts ea.)
Participation	70
GREAT Day report	10
Total	100

Your engagement with the class each week affects your grade. See section 4 above for the criteria that will be used to assess your leadership performance. For participation you are expected to contribute in ways that add knowledge to the discussions, based on the readings and any additional knowledge you share which advances the discussion. Asking insightful, informed questions based on the reading can be helpful to further discussion. Questions asked on matters that were, for example, defined in the required reading or could have easily been looked up, are welcomed but do not count.

The GREAT Day Report will summarize results from two different presentations that each relies on the fields of both biology and mathematics or computation. One presentation must be a

poster and the other an oral presentation. These can't be your own research. Be sure to include the names of the authors and the title of the presentations.

Each unexcused absence as a participant results in the loss of 10% of your grade. Unexcused absences as discussion leader results in the loss of 20% of your grade.

Your final grade will be converted from a proportion of points earned of the total to a letter grade using the following ranges.

Score		Letter Grade		Score
0.933	≤	A	≤	∞
0.900	≤	A-	<	0.933
0.867	≤	B+	<	0.900
0.833	≤	B	<	0.867
0.800	≤	B-	<	0.833
etc.				

### Will I get a bad grade because I'm shy?

No. You may remain shy and that's okay, but you still are expected to contribute oral comments each week. Dr. H. once taught a course called "Advanced Racquetball" here at Geneseo. One student literally could not hit the ball. He ended up encouraging that person to withdraw from the class. We wish to accommodate everyone but, in the end, it may be that you have accidentally found yourself in Advanced Racquetball.

## 7 Electronic distraction devices, drugs, and other disabilities

Taking this course means you agree not to text, chat, "do Facebook," watch YouTube videos, or do similar electronic gaming or distracting activities during class. Also, you agree not to consume alcohol or other recreational drugs during class or come to class impaired by such activities. If you find scheduling these activities around class time difficult then you should seek professional help (e.g., through the Lauderdale Center for Student Health & Counseling).

Additionally, those of us at SUNY Geneseo will do our best to make reasonable accommodations for persons with documented physical, emotional, or cognitive disabilities. In addition, we will do our best to accommodate challenges brought about through pregnancy and/or parenting. Students should contact the [Office of Disability Services](#) (585-245-5112) and the instructors to discuss needed accommodations as early as possible in the semester.

## 8 Schedule

Date	Topic	Read
1/22/2020	Introductions	
1/29/2020	Nonlinearity, chaos, & emergence	Chapt. 1.
2/5/2020	Order, complexity, disorder	Chapt. 2.
2/12/2020	Genetic networks etc.	Chapt. 3.
2/19/2020	Physiology on the edge of chaos	Chapt. 4.
2/26/2020	Brain dynamics	Chapt. 5.
3/4/2020	Ants, brains, and chaos	Chapt. 6.
3/11/2020	The baroque of nature	Chapt. 7.
3/18/2020	SPRING BREAK	
3/25/2020	Life on the edge of catastrophe	Chapt. 8.
4/1/2020	Evolution and extinction	Chapt. 9.
4/8/2020	Fractal cities and market crashes	Chapt. 10.
4/15/2020	Leaders' choice	Papers
4/22/2020	Attend GREAT Day (GD) presentations	
4/29/2020	Hand in GD Report, discuss GD Presentations	
5/6/2020	Leaders' choice	Papers
5/13/2020	Final Examination Period 7:00–7:50 pm	