

# Seminar in Biomathematics (BSC 420.36 – Spring 2018)

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**CONTENT.** As a seminar in Biomathematics, the breadth of topics that we might cover is great. Because I am an ecologist and evolutionary biologist, I encourage people to choose topics in that general area, however, any topic related to application of mathematical tools and techniques to biology could be acceptable. Because I am a biologist and this seminar is run in biology, it is of primary importance that the papers and biological questions covered be important and generally significant from a biologist's perspective. An important secondary criterion is that some level of mathematical sophistication is involved in the papers we are to discuss. Papers addressing questions via dynamical or statistical models, or via novel statistical applications, would be suitable. In general, it will **not** be suitable to choose papers that make use of standard statistical techniques (however elaborate) for data analysis. We want something more innovative than that. My main criterion for approving your choice of papers is whether your choice seems to have sufficient conceptual content so that the papers and topic will be broadly interesting, and sufficiently sophisticated mathematical applications. I have appended a list of recent papers that I have encountered that may be of some interest.

**SEMINAR STRUCTURE.** Seminar will consist of readings from the primary literature, each led by one student. Each discussion leader will be responsible for giving a short (10 minute) introduction to the discussion, and providing a short (1 p.) critique of the paper that will provide direction of discussion. **Leaders should lead the discussion not lecture.** Other participants should come prepared to discuss the papers we have read.

Leaders will provide the group with an electronic copy of the paper(s) for discussion **one week in advance of our meeting. You must have my approval for the paper you have chosen**, so see me early on if you have a paper in mind. I can make suggestions of good recent papers. If you cannot come up with an electronic copy see me. If all else fails, get me a hard copy and I will have it scanned to a pdf and distributed. Leaders will e-mail the 1 p. critique (MS Word or pdf) to me and to all participants (I will provide all of you with email addresses) **on the Friday before our meeting.**

**Your grade** will be determined by both your success in leading the discussion (80%), including preparation, clarity, evidence of understanding, quality of questions posed, and quality of your written critique, and by your participation in discussion and attendance when you do not lead (20%). Note that this arrangement means you **cannot** manage an A in this seminar if you do not participate in discussions. I will provide feedback to discussion leaders following their presentations.

## The schedule

<b>Meeting date:</b>	<b>DISCUSSION LEADER</b>
16 January	Scheduling
23 January	Macie Hanneken
30 January	Logan Sauers
6 February	Gizem Yuce
13 February	Lexie Majewski
20 February	Haley Schul
27 February	Josselyn Gonzalez
6 March	Kate Evans
13 March	<i>Spring break</i>
20 March	Haley Schul
27 March	Macie Hanneken
3 April	Lexie Majewski
10 April	Josselyn Gonzalez
17 April	Kate Evans
24 April	Gizem Yuce
1 May	Logan Sauers

## Some suggestions

### Competition and Predation

- Cortez, MH, PA Abrams. 2016. Hydra effects in stable communities and their implications for system dynamics. *Ecology* 97: 1135–1145
- Grilli, J, G Barabás, MJ Michalska-Smith, S Allesina. 2017. Higher-order interactions stabilize dynamics in competitive network models. *Nature* 548:210–213 doi:10.1038/nature23273
- Soudijn, FH, AM de Roos. 2017. Predator Persistence through Variability of Resource Productivity in Tritrophic Systems. *The American Naturalist*. 190:844–853
- Toscano, BJ, V Hin, VHW Rudolf. 2017. Cannibalism and Intraguild Predation Community Dynamics: Coexistence, Competitive Exclusion, and the Loss of Alternative Stable States. *The American Naturalist* 190:617–630

### Conservation

- Barnett, L.A.K. & M. L. Baskett. Marine reserves can enhance ecological resilience. 2015. *Ecology Letters* 18: 1301–1310
- Dine, W. S. Lenhart & H. Behncke. 2014. Discrete Time Optimal Harvesting of Fish Populations with Age Structure, *Letters in Biomathematics*, 1:193-207, DOI: 10.1080/23737867.2014.11414480
- Pittman, SE., R. Muthukrishnan, NM. West, AS. Davis, NR. Jordan, JD. Forester. 2015. Mitigating the potential for invasive spread of the exotic biofuel crop, *Miscanthus × giganteus*. *Biological Invasions* 17:3247–3261 DOI 10.1007/s10530-015-0950-z

### Behavior

- Martin AE & L Fahrig. 2015. Matrix quality and disturbance frequency drive evolution of species behavior at habitat boundaries. *Ecology and Evolution* 5:5792–5800

### Disease dynamics

- Murillo, D, SA. Holechek, AL. Murillo, F. Sanchez & C. Castillo-Chavez. 2014. Vertical Transmission in a Two-Strain Model of Dengue Fever, *Letters in Biomathematics*, 1: 249-271, DOI: 10.1080/23737867.2014.11414484
- Roche, B., P. Rohani, A.P. Dobson, J-F. Guégan 2013. The Impact of Community Organization on Vector-Borne Pathogens. *The American Naturalist*, 181:1-11
- Searle, CL, MH Cortez, KK Hunsberger, DC Grippi, IA Oleksy, CL Shaw, SB de la Serna, CL Lash, KL Dhir, MA Duffy. 2016. Population Density, Not Host Competence, Drives Patterns of Disease in an Invaded Community. *The American Naturalist* 188:554–566.

### Applications of fractals

- Ribeiro, FL, RV dos Santos, AS Mata. 2017. Fractal dimension and universality in avascular tumor growth. *Physical Review E*. 95: 042406