Running successful student research groups

Chad Topaz, Professor of Mathematics, Macalester College

One man followed these five tips for student research groups. What happened next will blow your mind. LOL win omg cute

Chad Topaz, Professor of Mathematics, Macalester College

Vital stats

- 1999: First undergrad student (mid-Ph.D. @ Northwestern)
- 2006: First research group (late-postdoc @ UCLA)
- Nearly every summer since then (as faculty @ Macalester)
- Multi-institution
- 5 research papers
- 3 NSF grants

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Instabilities and patterns in coupled reaction-diffusion layers

Anne J. Catllá*
Department of Mathematics, Wofford College Spartanburg, South Carolina 29303, USA

Amelia McNamara† and Chad M. Topaz
Department of Mathematics, Statistics, and Computer Science, Macalester College, St. Paul, Minnesota 55105, USA

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formation in reaction-diffusion layers that are diffusively coupled. For
omponent reactions, we analyze the stability of homogeneous steady states
ructure of the linear problem. There are eight possible primary bifurcation
g bifurcation that involves two disparate length scales whose ratio may
. For systems of *n*-component layers and nonidentical layers, the linear
mate decomposition into lower-dimensional linear problems if the coupling
we apply these results to a two-layer Brusselator system. The competing
linear problem are readily apparent in numerical simulations of the full
e ratio produces an unusual steady square pattern.

PACS number(s): 05.45.−a, 82.40.Bj

action and dif-
al patterns [1].
morphogenesis
es of work on

contain the reactants) that are put in contact with or
By adding or removing a permeable membrane be
layers and by adjusting its properties, the coupling st
be altered. This approach with the chlorine dioxi
malonic acid (CDIMA) reaction has produced s

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PLOS | ONE

Social Aggregation in Pea Aphids: Experiment and Random Walk Modeling

Christa Nilsen[1], John Paige[1], Olivia Warner[1], Benjamin Mayhew[1], Ryan Sutley[1], Matthew Lam[2], Andrew J. Bernoff[2], Chad M. Topaz[1]*

1 Department of Mathematics, Statistics, and Computer Science, Macalester College, Saint Paul, Minnesota, United States of America, **2** Department of Mathematics, Harvey Mudd College, Claremont, California, United States of America

Abstract

From bird flocks to fish schools and ungulate herds to insect swarms, social biological aggregations are found across the natural world. An ongoing challenge in the mathematical modeling of aggregations is to strengthen the connection between models and biological data by quantifying the rules that individuals follow. We model aggregation of the pea aphid, *Acyrthosiphon pisum*. Specifically, we conduct experiments to track the motion of aphids walking in a featureless circular arena in order to deduce individual-level rules. We observe that each aphid transitions stochastically between a moving and a stationary state. Moving aphids follow a correlated random walk. The probabilities of motion state transitions, as well as the random walk parameters, depend strongly on distance to an aphid's nearest neighbor. For large nearest neighbor distances, when an aphid is essentially isolated, its motion is ballistic with aphids moving faster, turning less, and being less likely to stop. In contrast, for short nearest neighbor distances, aphids move more slowly, turn more, and are more likely to become stationary; this behavior constitutes an aggregation mechanism. From the experimental data, we

Step 1: Contemplate

- Research experience?
- Professional experience?

- Research progress?
- Portfolio enhancement?
- Emotional reward?

- Time
- Money
- Stress?
- Reduced speed?

Step 2: Fund

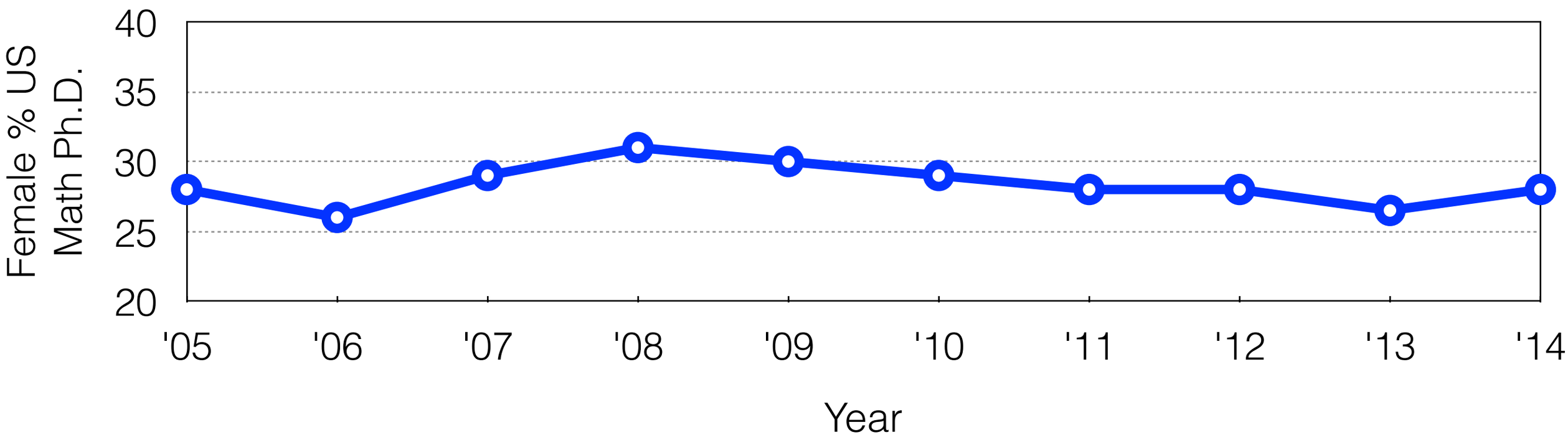
- Student stipends
- Student travel to site
- Faculty salary/stipend
- Computers
- Software
- Books
- Conference travel
- Snacks/meals
- Social events

- NSF REU site
- NSF standard (incl. RUI)
- NSF special programs
- Start-up funds
- College funds
- Department
- You have to ask!!!
  - Colleagues
  - Chair
  - SRO
  - Anyone

Step 3: Build

You are a manager with (likely) no managerial training

- Advertise (in classes, on websites, in newsletters…)
- Create application process (cover letters, cv, interviews…)
- Consider student grouping, project assignments, **diversity**
- Coordinate with campus for housing, food, etc.
- Set expectations with students



Step 4: Maintain

- Spend time. Then spend some more time. Then spend…
- Provide professional development: literature search, BibTex/BibDesk, research log, document code, write paper, write poster, give talk, set daily goals…
- Exchange feedback frequently (it goes both ways)
- Orchestrate fun

Step 5: Inspire

“**Here's what I think we need to tell students:** 99.9% of research progress consists of teeny, tiny steps in knowledge rather than Einsteinian leaps. Even to take these tiny steps we must stand on the shoulders of the many people who have taken many tiny steps before us. And tiny steps are worthwhile. And research is a community effort, and it is satisfying to be part of a great community of past and future scholars who will take tiny steps to move forward our understanding of and appreciation for the universe. And still, even though we are taking only tiny steps, it's really hard. But very much worth it. And you can do it.”

http://www.chadtopaz.com/2013/06/07/research-it-doesnt-take-a-genius/