Research into student learning

Ben Geller and Catherine Crouch

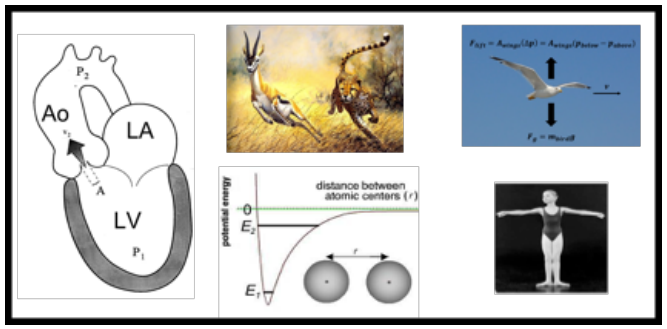
(two summer 2020 student positions)

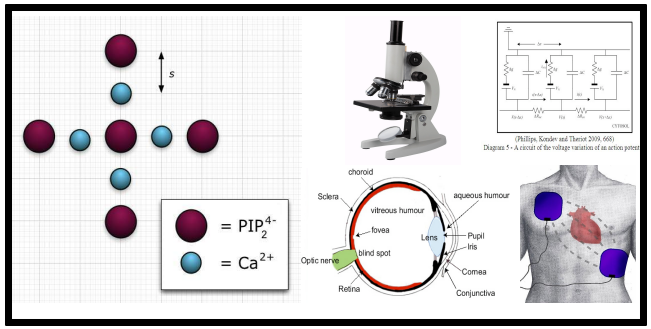
SWARTHMORE

Do life science students use what they learned in physics later on?

Ben Geller and Catherine Crouch

Collaboration with Sara Hiebert Burch (Biology), and colleagues at University of Maryland





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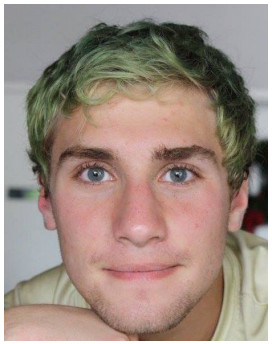
Tessa Williams ‘17

Haley Gerardi ‘17



Max Franklin ‘19

Fai Wisittanawat‘13

Jess Li ‘19

Kat Lima ‘20

Jonathan Solomon ‘20

Nathaniel Peters ‘18

Tarzan MacMood ‘20

SWARTHMORE

Research questions

- Do students in our physics for life sciences courses (Physics 3L-4L) successfully make use of what they learn in physics in later courses?
- What aspects of the courses support students to do so?

SWARTHMORE

Physics education research

- Add to basic knowledge about how students learn
- Improve curricula and teaching methods

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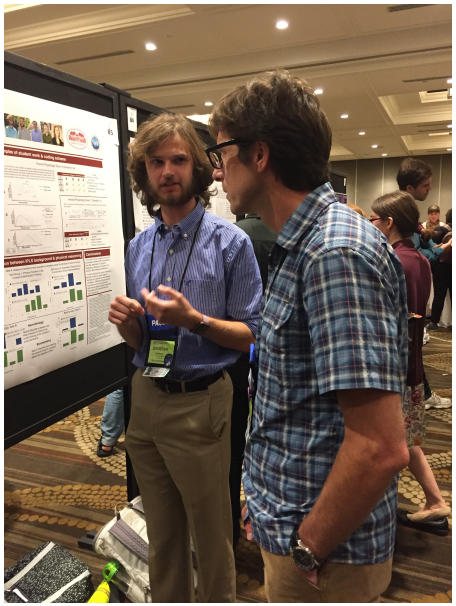
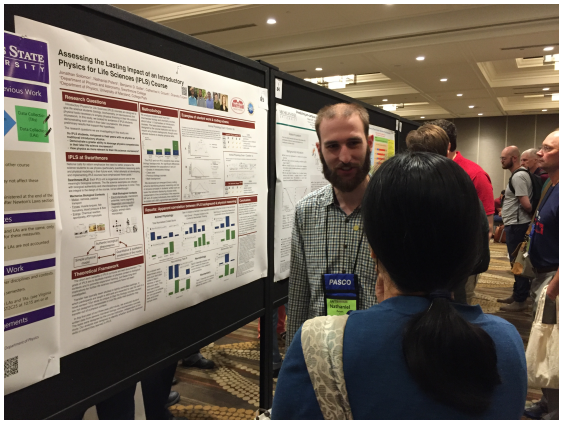
Research methods

- The best PER research combines **quantitative** (statistical) analysis of pre/post survey questions with more **qualitative** analysis (interviews, ethnographic classroom observation, open-ended survey questions)

Catherine will tell you about specifics!

National AAPT/PERC conference





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Condensed matter experiment

- I am not offering experimental projects for summer 2020
- You have great options here with Prof. Hillary Smith, Prof. Cacey Bester, and Prof. Eva-Maria Collins!
- If you're interested in nanoscale materials or biological experimental physics, I can recommend colleagues who supervise students at REUs

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SWARTHMORE

What would you do this summer?

- Statistics on survey results
- Reading (anonymized) student work and categorizing ("coding") the types of physical reasoning evident in these responses
- Analyzing and coding student interviews to look for prominent themes.

This research develops skills that are relevant to both teaching and research!

No biology experience necessary!

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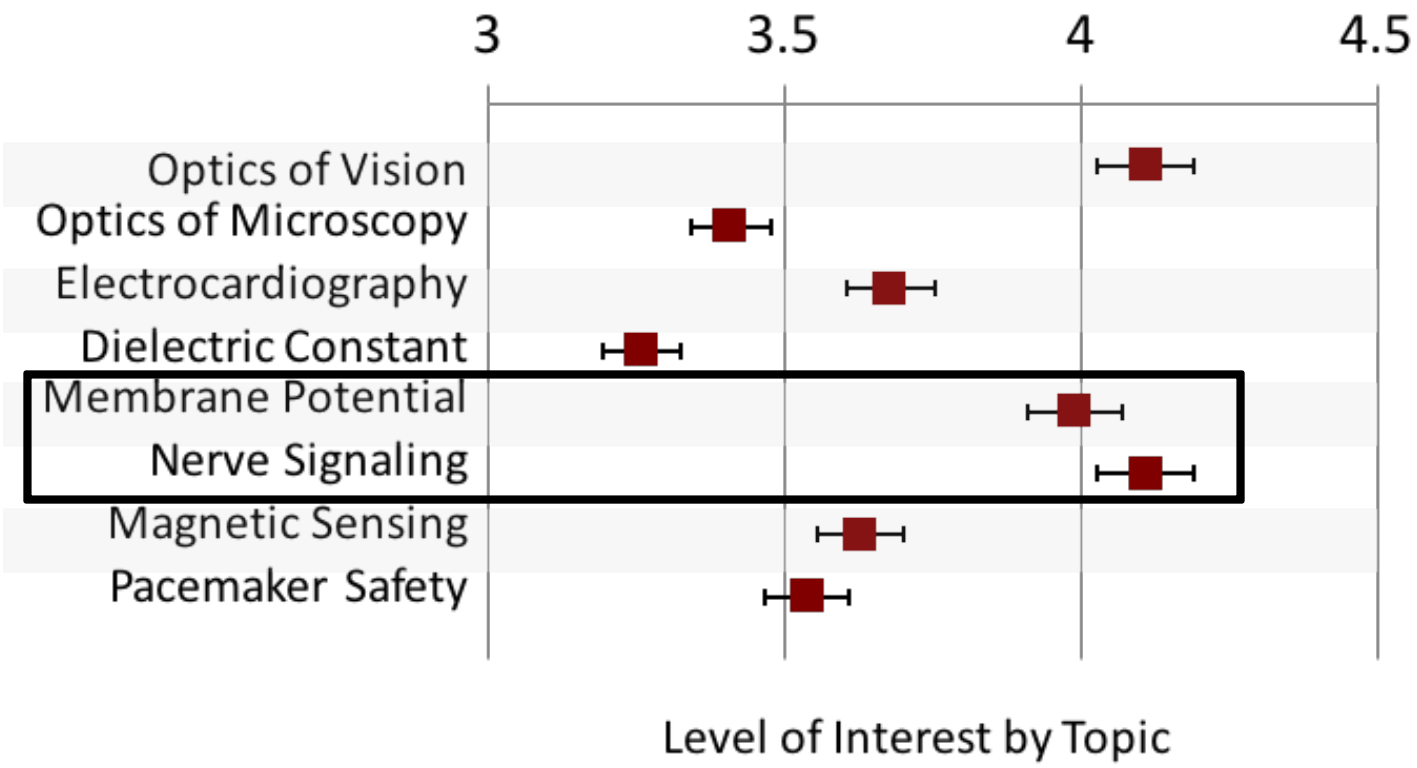
Interest in particular examples?



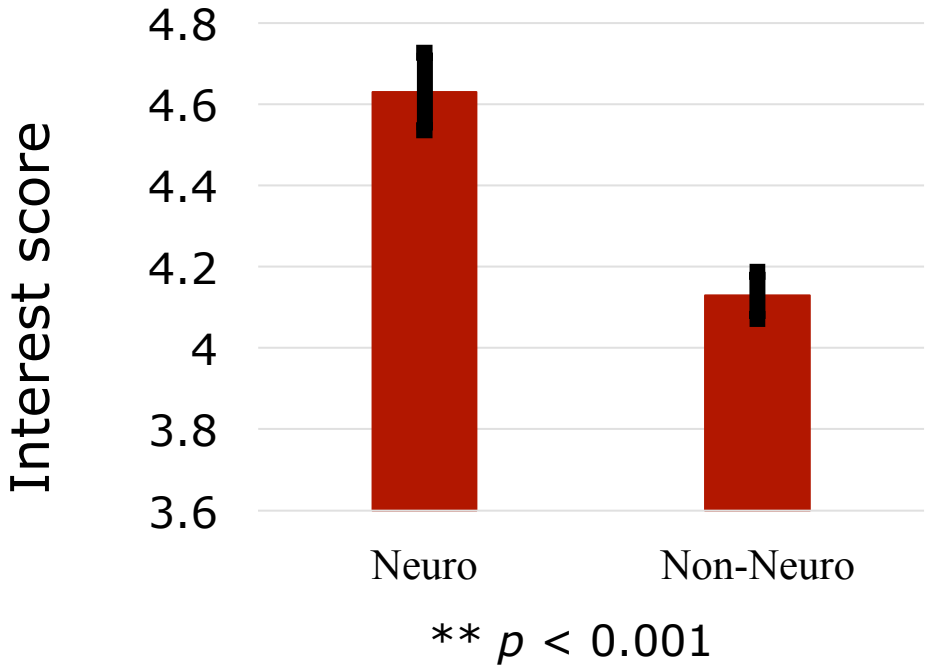
Data analyzed over 4 years (2012 - 2015), $N = 194$

Geller et al. (2018)

SWARTHMORE

Dependence on prior coursework

Example 1: Neural Signaling



Data analyzed over 6 years (2012 - 2017), N =256

Geller et al. (2018)

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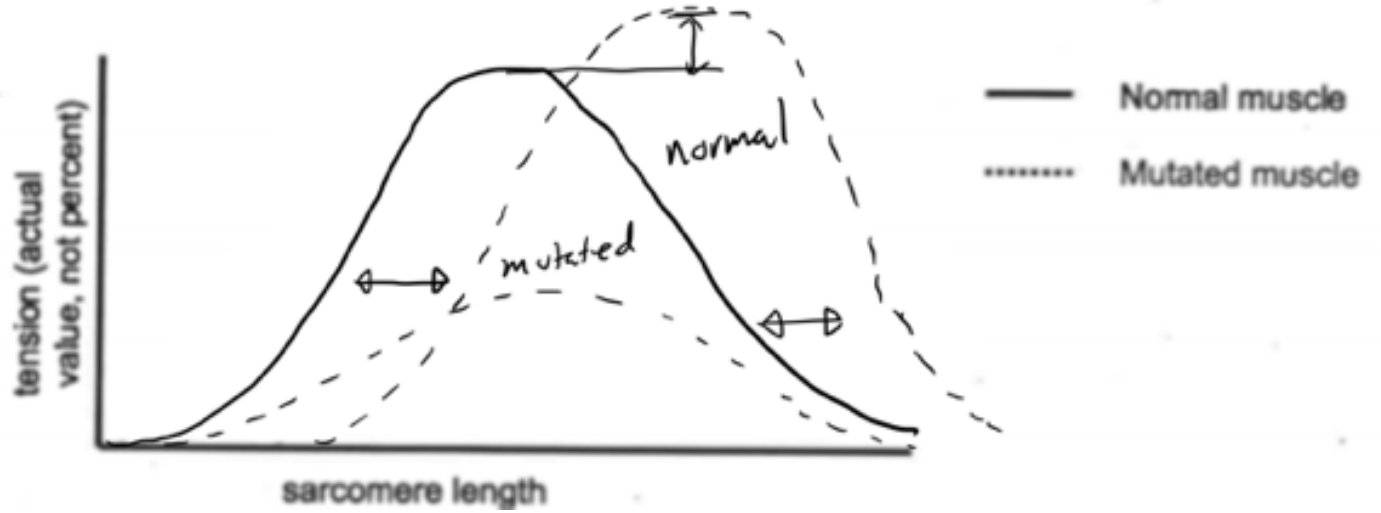
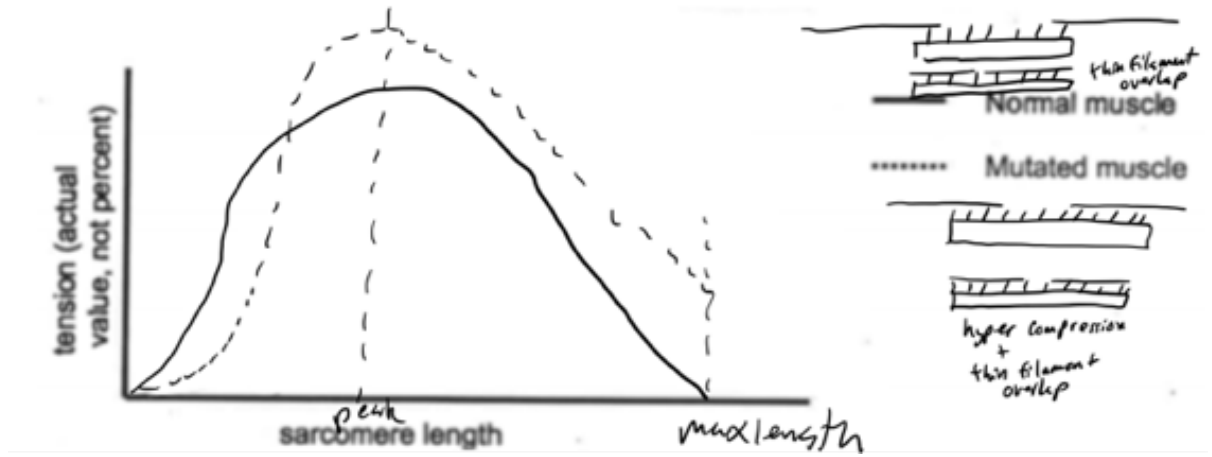
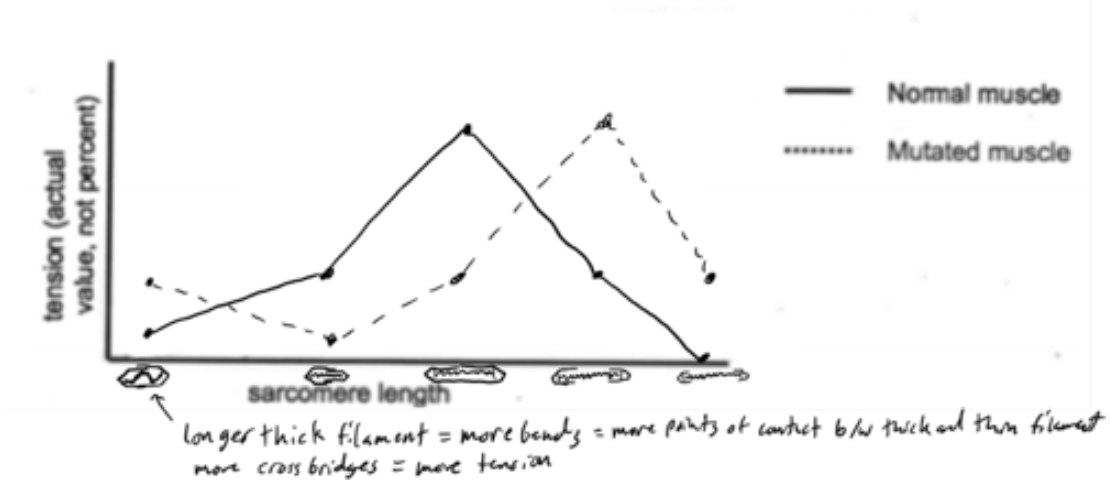
Coding student written work





Coding student written work



$$\dot{H} = \frac{KA(T_2 - T_1)}{d}$$

d = thickness of boundary between thermal zones

$\dot{H}$ = Heat exchange

K = conductivity coefficient [measure of a substances ability to conduct heat]

A = Surf... bet... therm...

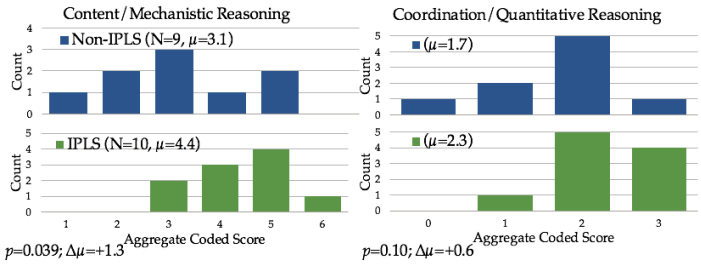
T_1 = Temp... zone

T_2 = temperature of thermal zone 2

CODE

STUDENT	Description	Diagram	Buckling	Label
A (None)	✗	✗	✗	✗
B (Trad.)	✗	✓	✓	✓
C (IPLS)	✓	✓	✓	✓

Grouping Codes by Skill



SWARTHMORE

To learn more ....

Ben and I are always happy to talk about these projects and opportunities!

If you would like to do research with us during Summer 2020, please make an appointment to discuss this further with one or both of us

ccrouch1@swarthmore.edu (SC L39)
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