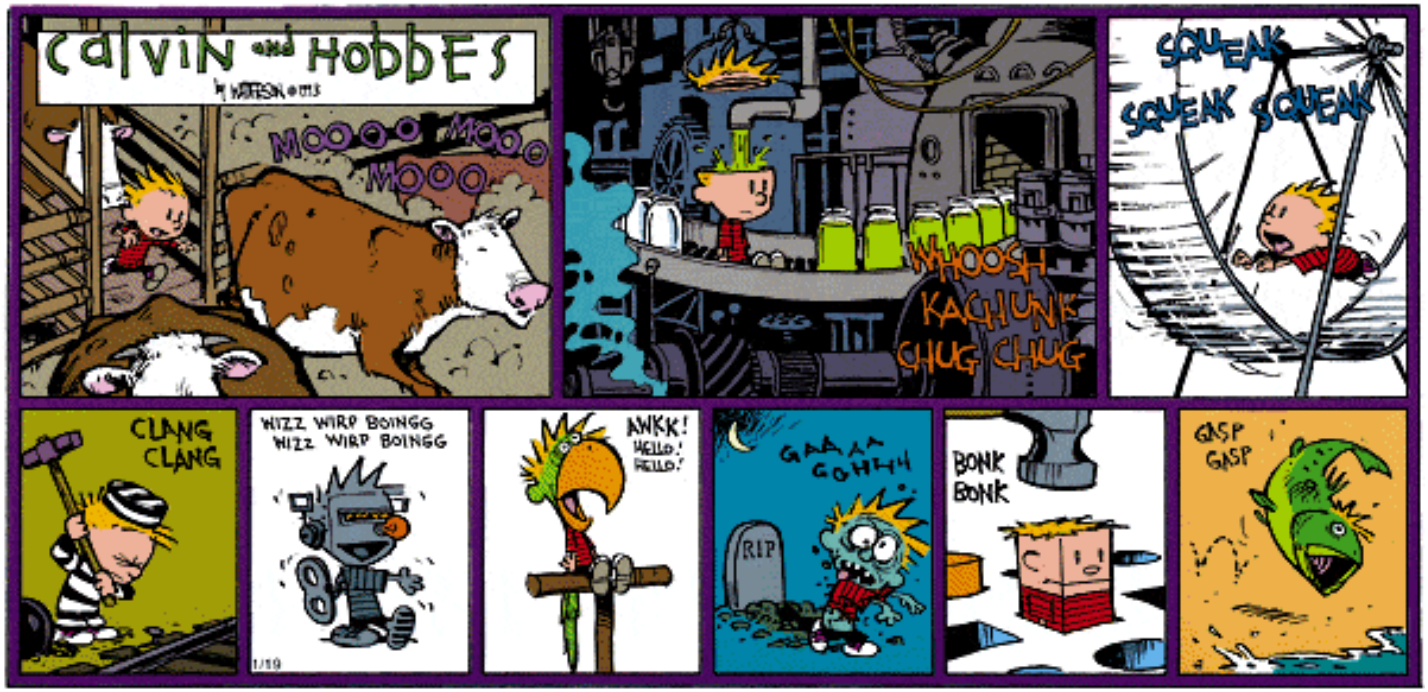
- **Topic: Introduction to Class & Ch1**
- **Cartoon: Bill Watterson *Calvin & Hobbes***



Forces in Living Systems

Example: The role of forces in Cancer

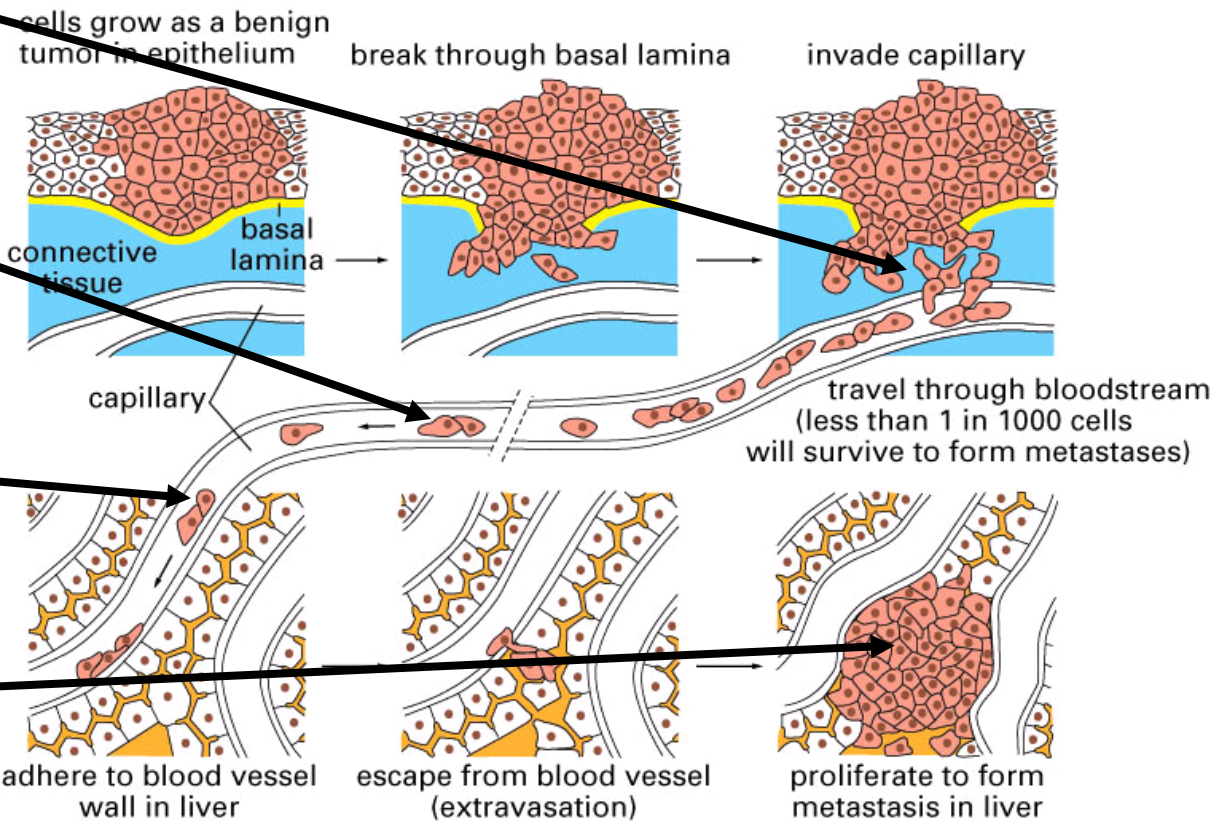
Work from W. Losert, University of Maryland

Cells generate forces to migrate

Cells are deformed by fluid forces

Cells adhere to new tissue

Cells grow in tissue with different stiffness



Overarching themes

- Thinking physically
  - Mechanism
  - Coherence
  - Multiple representations
- Models
  - Identifying key elements
  - Knowing what to simplify

- Math
  - Quantifying your experience
  - Thinking with equations
- Thinking about your thinking
  - Debugging
  - Checking
  - Strategizing

- Connecting to what you learn in biology and chemistry classes!

Thinking of what you want to get out of your college education and this course, which of the following is most important to you?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

All three of these goals are clearly important. Which do you think you can *make headway on outside of class* by your own reading and studying?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

All three of these goals are clearly important. Which do you think would be *best achieved in class* working with your classmates and me?

A. Acquiring information (facts, principles, concepts)
B. Learning how to use information and knowledge in new situations
C. Developing lifelong learning skills

My goals for this course are…

1. To develop a conceptual understanding of physics and the interconnectedness of physical phenomena, and how the laws of physics affect living organisms
2. To develop autonomous learning skills, particularly in relation to create a toolkit of representations for expressing and manipulating the laws of physics.
3. To learn to think clearly and simply about the physical world. We will work on increasing problem-solving and modeling skills.

Reading Questions

The biggest question that I have or will have throughout the course will definitely be depicting the connections and relationships between things by using a math problem/formula.

When the book talks about biology laws, or chemical reactions, in relation to physics, do we need to note those laws or understand them or just their relation to physics?

The topic that I would like to be addressed in class is simply how the laws of physics intertwine with other disciplines of science such as biology and chemistry.

Going into physics I really wasn't looking forward to it. To me just calculating equations and doing other things didn't sound interesting to me. However reading this chapter and seeing so many relations of physics to everyday life has made me really excited for the class. Please try and relate it to every day life and the body as much as possible.

What do I have to do to be successful in this class?

How we do it - Working in groups

- Science is not just a collection of facts or even of methods: it's a conversation.
- One of the things you have to do in learning to solve hard problems is to ask yourselves questions that lets you bring up what you know. It's often best to learn to do that by asking others.
- Good communication skills and the ability to work in teams are highly valued in modern workplace environments (including health care).

How we do it - Group activities

- In-lecture clicker questions.
- Group problem solving in hands-on.
- Find a group to work with on HW!
  - Our homework can be very hard if you try to do it yourself. It is designed for working together.
  - Help room highly recommended.

How we do it - Lectures

- Class MWF at 11:30am
- Before class: READ the chapter and ANSWER reading questions on LON-CAPA (deadlines on course calendar)
- When you come in: grab a whiteboard, eraser/ marker bag for every 3 people
- We will use iClickers every day! Make sure to bring yours and register it on LON-CAPA!

How we do it – Hand-on Sessions

- Attend one three-hour hands-on session per week in E-26A Holmes Hall (the physics lab - downstairs, right next to the Dean's office)
- Please go to the hands-on session in which you are scheduled! (But we can be flexible if you have a conflict.)
- Time will be spent on problem solving, labs, discussion - important to participate!
- Some hands-on assignments will be turned in at the end of your session to be graded, and will be returned the following week.

How we do it - Homework

- Two Kinds of HW:
  - HW on LON-CAPA: http://msu.lon-capa.org (one assignment per week, due Friday at 11:59 p.m.)
  - HW on paper: on the course website (linked from LON-CAPA) these are sporadic throughout the semester – first is due Sep 18
- Purpose of LON-CAPA HW is to help solidify the concepts and work on your problem-solving skills: multiple choice, T/F, numerical response questions
- Purpose of On-Paper HW is to mimic the kinds of questions you will see on exams – practice your explanations and short-answer responses
- I encourage you to work in groups! (On-Paper HW you can even work with a partner and turn in **ONE** completed assignment!)

How we do it – Help room

- Help room on Wed/Thurs/Friday in the 5th floor lounge in East Holmes Hall (help room starts Sept. 15)
  - Tues. 11am – 12pm; 3-5pm
  - Wed. 12:30pm – 2:30pm; 8 - 10 pm
  - Thurs. 11:30am – 5pm; 8-10pm
  - Friday 9-11am; 3-5 pm
- Place to get assistance with HW, hands-on session problems, exam prep
- Come to the help room prepared with questions about HW, etc. - the LAs will help

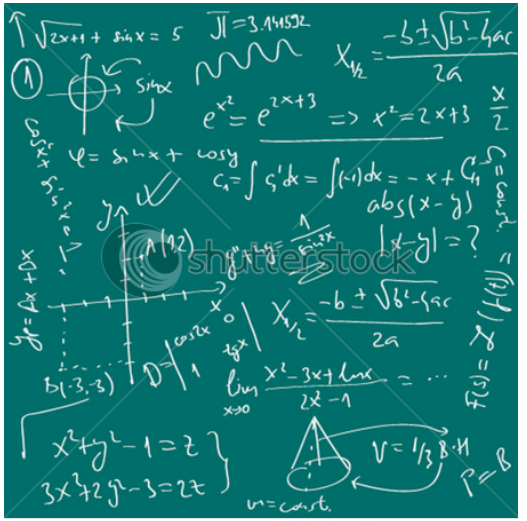
Contact info & Office Hours

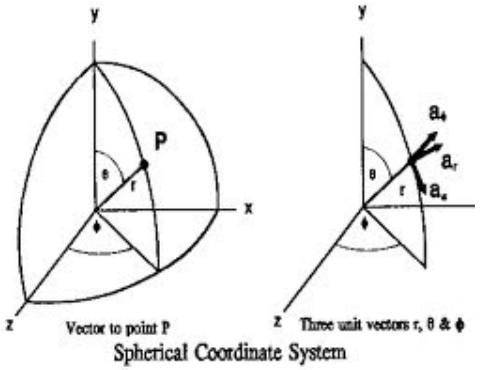
- My office: 193-B East Holmes Hall
- Leanne's office: C-1 East Holmes Hall
- Office hours: 9-11am on Wednesdays, by appointment, or whenever my door is open!
- Send **ALL** emails with subject line "LB273"
  - my email: vashtis@msu.edu and
    Leanne's email: ldoughty@msu.edu
- We are usually in Holmes MWF mornings

Announcements/Deadlines

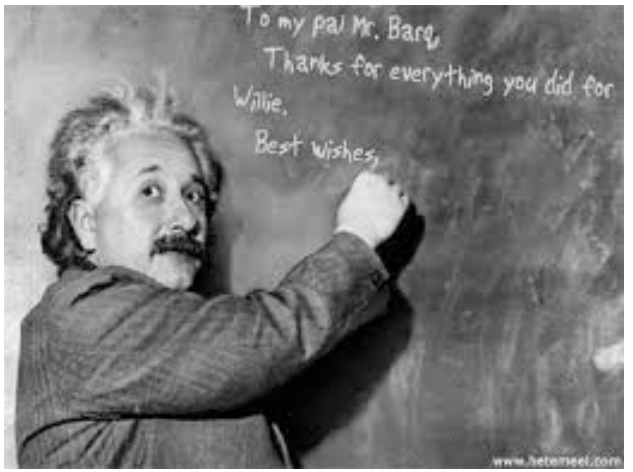
- Friday, 11:59 p.m.: Syllabus quiz / clicker registration due - find it in "Homework" folder on LON-CAPA page.
- Make sure to register your clickers in LON-CAPA! http://msu.lon-capa.org
- One of the RQ's was grading wrong (density of air is significantly less than density of water) -> we won't count this in your grade

Chapter 1: Physics & Life





Spherical Coordinate System



Reading Questions

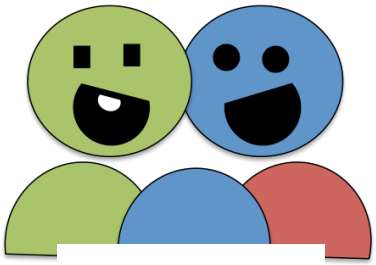
I'm interested in what type of calculus we will be using. Will it just be basic calculus one derivatives or more like differential equations?

I would like to look into the whole spherical cow and modeling concept. I am not sure why it works the way it does. And why does it apply for everything within our existence?

I would like us to go more in depth about SCA's and perhaps give more examples so we can get a better understanding of SCA's and their functions.

Will we be required to memorize all of the formulas given to us in this class, as seen in 1.4 (I know that these formulas are basic but are the more complex ones given)?

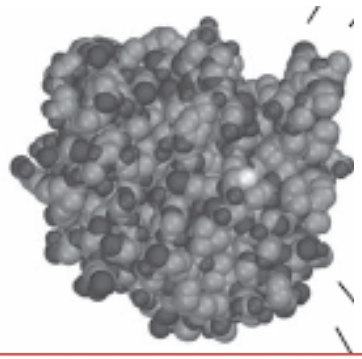
Develop a model of your favorite protein



Discuss It!

- Work in groups of 3

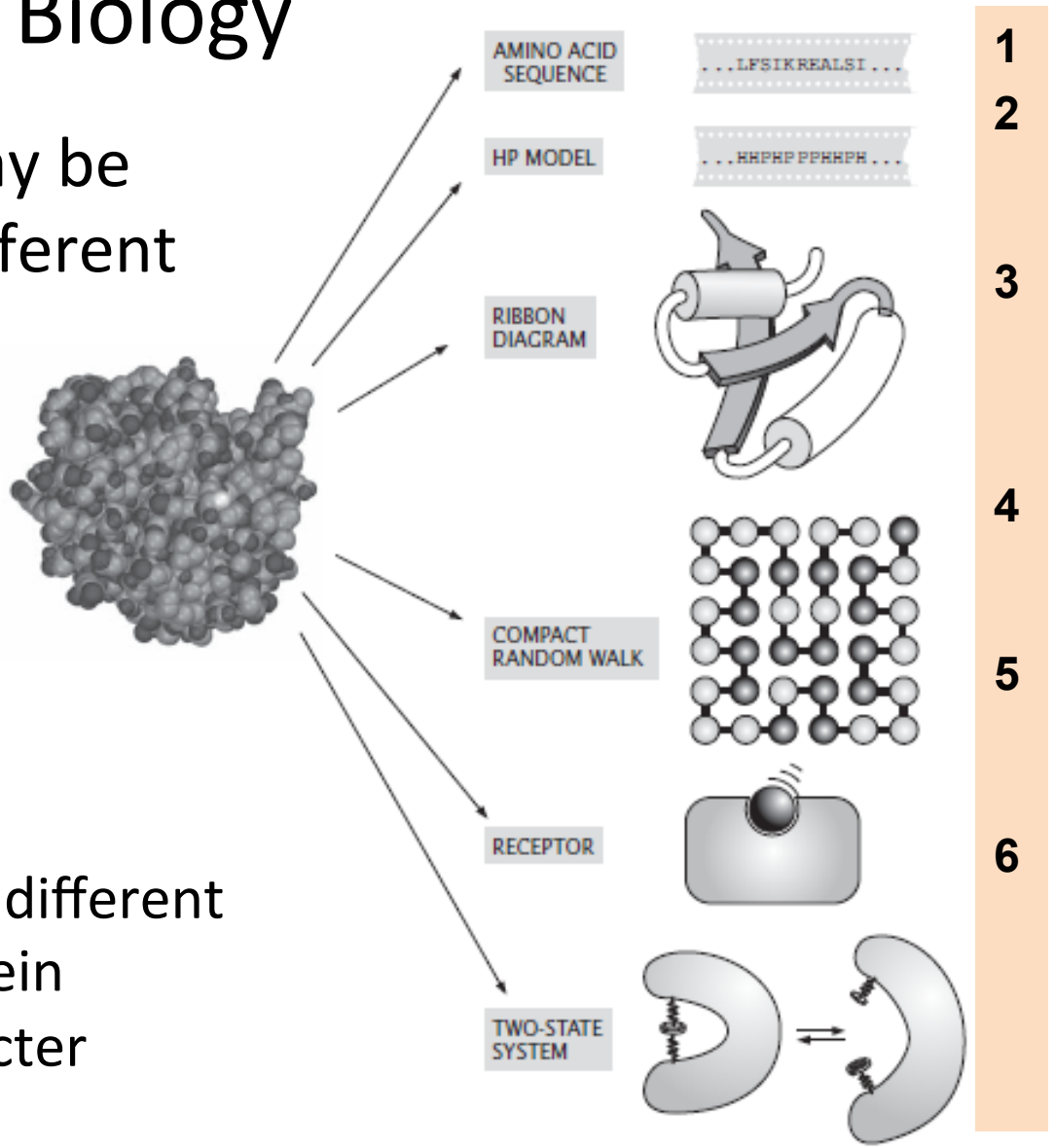
Teaching and Learning Assistants will participate



- A model is something used to represent a system.
- It should have the most important features of the system being represented but leave out less essential details.
- A good model lets you figure out things about the real system that you might have trouble doing if you tried to pay attention to everything.

Modeling in Biology

The same system may be modeled in many different ways



Each model highlights different properties of the protein

- Hydrophobic character
- Folding property

From: Physical Biology of the Cell (Theriot, Kondev, and Phillips)

Modeling in Physics

- Many of the models we use in intro physics are highly simplified to let us focus on just a few properties.
  - Point masses
  - Rigid bodies
  - Perfect springs
- These models let us first get a clear understanding of the physics. Then, more complex systems can be treated by building around that understanding.