

August 31, 2015

Physics 131

Prof. E. F. Redish

# ■ Theme Music: The Rolling Stones

*Start me up*

# ■ Cartoon: Lynn Johnston

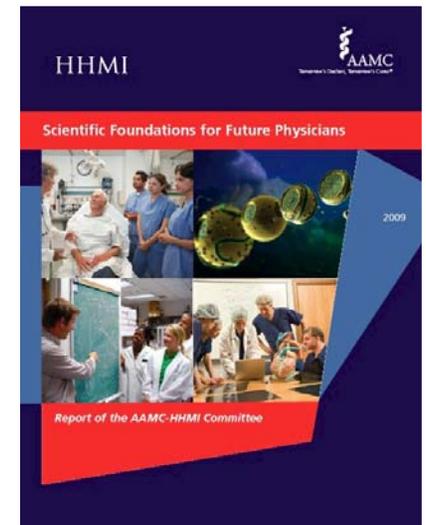
*For Better or for Worse*



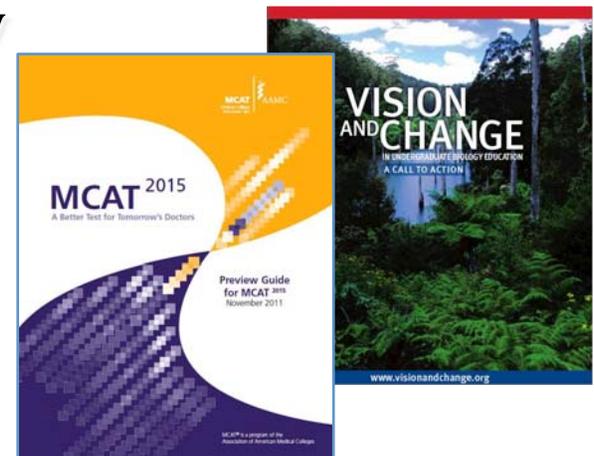
■ Over the past decade there have been increasing calls to modernize the teaching of biology and pre-med students.



■ This class is part of a national project sponsored by the Howard Hughes Medical Institute (HHMI) and the National Science Foundation (NSF) to respond to the *Scientific Foundations for Future Physicians Report (SFFP)*



■ This report calls for multi-disciplinary competency-based education for the biological sciences, and for medical, pharmacy, and veterinary schools.



# NEXUS/Physics

- The goal of this course is to help you understand the physics you need for advanced bio, chem, and professional school classes.
- This course is part of a new national model created here and supported by the Howard Hughes Medical Institute and the National Science Foundation.
- It is particularly designed to match the new MCAT exam.
- We are continuing to work on understanding how to make this class more effective for you.

# This week

- Go to our homepage and read it all carefully!
  - <http://www.physics.umd.edu/courses/Phys131/fall2015/>
- Please complete the online surveys if you haven't already done it. (5 pts each)
- Please go to your recitation to do the math pre-test. (5 pts each)
- Please go to lab (with your laptop if you have one) to install the lab software.
- Sign up for WebAssign.
- Do the readings for each class – WA questions begin next class.

# Overarching themes

## ■ Thinking physically

- Mechanism
- Coherence
- Multiple representations

## ■ Models

- Identifying key elements
- System schema

## ■ Connecting to what you learn in biology and chemistry classes!

## ■ Math

- Quantifying your experience
- Thinking with equations

## ■ Thinking about your thinking

- Debugging
- Checking
- Strategizing

# Motivational Reading (in Files on ELMS)

- For biology majors

- Joel Cohen,

- “Mathematics is biology’s next microscope”

- For pre-meds

- Jerome Groopman,

- “How Doctors Think” (Chapter 1)

# How we do it

- Reading first / Flipped class
- Working in groups
- Problem solving  
(serious homework!)
- Thinking on tests  
(really!)
- Scientific community  
(non-protocol) labs

# Reading First

- There are readings to do before every lecture.
- For some of these readings you have to ask a question on WebAssign (due at 9PM the night before). (1 pt each)
  - These questions will affect what happens in class.
- Part of the goal is to help you learn to read scientific text more professionally.
  - Working out difficult issues.
  - Connecting what you are reading with other things you know.
  - Thinking about the next step.

# Web links for readings

## ■ **Homepage**

– <http://www.physics.umd.edu/courses/Phys131/fall2015/>

## ■ **Schedule with links to reading**

– <http://www.physics.umd.edu/courses/Phys131/fall2015/ScheduleR.html>

## ■ **WebAssign assignments (Class key umd 9733 1643 )**

– <http://www.webassign.com/>

## ■ **Full text**

– [http://umdberg.pbworks.com/w/page/90716129/Working%20content%20I%20\(2015\)](http://umdberg.pbworks.com/w/page/90716129/Working%20content%20I%20(2015))

# 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 let 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 in health care).

# Group activities

- In-lecture clicker questions.
  - You get a point each time you share an answer with the full group.
- Group problem solving in recitation.
- Working in groups in lab.
- 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.
  - Course Center highly recommended.
  - How to do this without copying?!

# Problem Solving

- Physics is very much about learning to apply general principles to new situations. (Like medical diagnosis)
- These applications are often NOT amenable to automated thinking (algorithms).
- Problems in this class will NEVER be “plug and chug” or just using an equation to calculate something.
  - Essays
  - Modeling (creating equations)
  - Sense-making
  - Estimation (NOT guessing)
  - Representation translation & coherence building.

# Read the class Homepage, Mechanics page, and Grading Details carefully!

- There are ~1200 points in this class!
  - Two hour exams @ 100 pts each
  - One final exam @ 200 pts
  - Labs @ 165 pts
  - HW @ 300 pts
  - Eleven Quizzes @ 10 pts each (lowest dropped)
  - Clickers, lab & recitation interactions, & surveys (participation) 235 pts

# Learning to think scientifically

- Sometimes you're fighting your own brain!
  - We often assume an immediate recall (“**one-step thinking**”) is right – and the quicker and easier the recall the more we trust it!\*
  - We often don't pay attention to the right things! (“**selective attention**”)
  - We often assume our intuition (“**folk physics**”) is correct but don't check that it makes sense with what we see or with other things we know!

# Knowing-how-you-know icon: Coherence – Your safety net

- We will be establishing fundamental principles that we can (almost) always trust as “**stakes in the ground.**”
- The links among the different views creates a “**safety net**” that protects us against errors of recalled or reconstructed memory.
- We will use our coherence to “**reconcile**” what we know about the world with a coherent physics picture.

