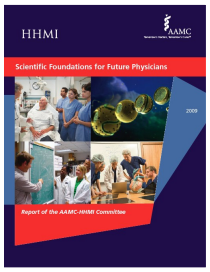
September 3, 2013 Physics 131 Prof. E. F. Redish

■Theme Music: Bon Jovi
Starting all over again

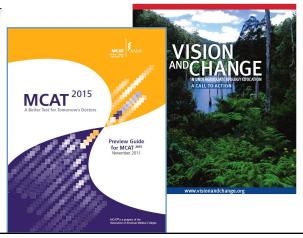
■Cartoon: Lynn Johnston
For Better or for Worse

- 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.



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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 a new national model created here. We have tested it for two years in small classes.
- This is our first implementation in a large class so we will still be figuring out what works and what can be done to improve.
  - Help us by signing our consent forms and...
  - Letting us know right away when there are glitches. (redish@umd.edu)

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Overarching themes

- Thinking physically
  - Mechanism
  - Coherence
  - Multiple representations
- Models
  - Identifying key elements
  - System schema
- Math
  - Quantifying your experience
  - Thinking with equations
- Thinking about your thinking
  - Debugging
  - Checking
  - Strategizing
- Connecting to what you learn in biology and chemistry classes!

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How we do it

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

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Reading First

- There are readings to do before every lecture. (due at 10AM)
- For some of these readings you have to write brief summaries and ask a question. (pts)
- 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.

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Web links for readings

- **Homepage**
  - *http://www.physics.umd.edu/courses/Phys131/fall2013/*
- **Schedule with links to reading**
  - *http://www.physics.umd.edu/courses/Phys131/fall2013/ScheduleR.html*
- **WebAssign assignments (RA#)**
  - *http://www.webassign.com/*
- **Full text**
  - *http://umdberg.pbworks.com/w/page/68358897/Working%20content%20I%20%282013%29*

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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).

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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?!

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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.

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Thinking on Tests

- Really? How?!
- Don't worry. We'll work up to it.

Labs

- Work in groups of 4
- Experiments last 2 or 3 weeks.
- NOT just protocol – you learn powerful tools and explore questions on your own.
- We do both macro and micro experiments.
- Lab reports written and handed in during lab.

What you need to pay attention to!

- There are ~1000 points in this class!
  - Two hour exams @ 100 pts each
  - One final exam @ 200 pts
  - Labs @ 200 pts
  - HW and reading @ 200 pts
  - Eleven Quizzes @ 10 pts each (lowest dropped)
  - Clickers & surveys (participation) 100 pts

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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!

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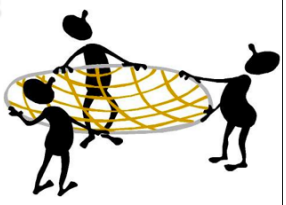
Knowing-how-you-know icon: Coherence – Your safety net

- 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.



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