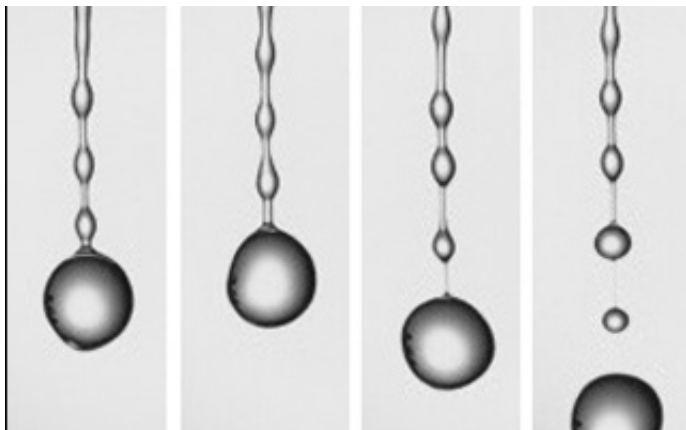


In Friend of OCW's July 2015 newsletter

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**MIT OPEN COURSEWARE**  
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

## Mastering Fluid Mechanics



This photo sequence shows the "[gobbling droplets](#)" phenomenon. (Photo by Jose Bico and Christian Clasen, used courtesy of Prof. Gareth McKinley.)

### To Master Fluid Mechanics, Go with the Flow

In physical terms, the universe is flowing, inside and outside us: our breath, the blood in our arteries, the wind, streams and tides, fast and slow, up and down. We learn about fluids and flow intuitively from the cradle. Engineers must aspire to understand and describe these phenomena mathematically and apply this knowledge to systems wind turbines, jet engines, airplane wings, pipelines, dams, boat hulls, and much more. The discipline is known as Fluid Mechanics. OCW has just published [2.25 Advanced Fluid Mechanics](#), an iconic MIT course on the subject.

The course site is organized sequentially by topic ("The Continuum Viewpoint and the Equations of Motion," "Fluid Statics," "Inviscid Flow and Bernoulli,"

**Make My Gift >**

Friend of OCW, we hope you learned something new or refreshed your memory on a topic you've previously studied.

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etc.). Each section lists readings, both required and supplemental, and has class notes and problems with solutions. Most sections have links to classic videos from the Illustrated Series in Fluid Mechanics series. A final exam with solutions rounds out the content.

The course is taught by [Professor Gareth McKinley](#), who oversees MIT's [Non-Newtonian Fluid Dynamics Research Group](#). As the syllabus says, the course is “designed to help students develop a mastery of the underlying principles and the ability to solve, quickly and efficiently, a variety of real fluid mechanics problems from first principles.” Although students are assessed solely on the basis of two 90-minute “quizzes” and the final exam, the emphasis is on problem solving, discussed in weekly tutorial sessions. Students are free to come and go as they please, but as Professor McKinley sees it, active participation is key to success:

“Both the assigned problems and the tutorials are entirely voluntary. No problem sets are collected, nor is roll call taken. However, based on repeated experience over many years, you may take our word that your chances of doing well in this course are minimal if you do not independently do at least the assigned problems before the tutorials, and use the tutorials to repair weaknesses and develop new insights.”

Professor McKinley goes on to observe: “There is . . . a profound difference between being taught and learning. To quote Benjamin Franklin: ‘Tell me and I forget, teach me and I may remember, involve me and I learn.’”

In keeping with this theme, students can gain extra credit and boost their grades by taking notes in class



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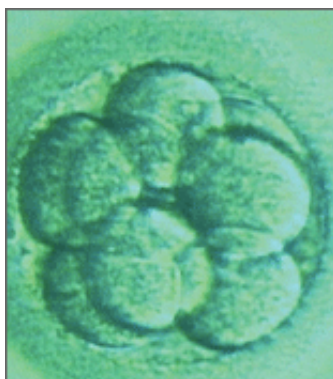


and amplifying them with further consideration in a notebook.

The motivation is plain and simple:

“ . . . thinking through and rewriting the lecture notes, preferably on the same day as the lectures and in consultation with a text, is one of the most effective forms of study, and well worth the effort.”

## New Courses



[7.344 Treating Infertility-  
- From Bench to  
Bedside and Bedside to  
Bench](#)



[6.858 Computer  
Systems Security](#)

- [2.086 Numerical Computation for Mechanical Engineers](#)
- [9.123 Neurotechnology in Action](#)
- [16.55 Ionized Gases](#)
- [21M.295 American Popular Music](#)

## Updated Courses

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IMAGE BY PIPPOGEM

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## OCW Educator

### Rate the problems

- how interesting (1="mind-numbing," 10="mind-blowing")
- how difficult (1="Trivial," 10="brutal")

### Rate the lectures

- quality of the material (1="pointless," 10="priceless")
- quality of the presentation (1="epic fail," 10="perfection")
- novelty of the material (1="old hat," 10="all new")

From surveys used in 18.783

**Student, Rate This Problem!**

Student evaluations of courses are a time-honored end-of-semester ritual at most educational institutions. The utility of these surveys, forms, and write-ups has never been highly regarded, as the responses only come from a portion of the students, tend to praise instructors known for easy grading, and are too general to improve teaching in any meaningful way. Of course, they are of little use to the students who took the course because they have already moved on to other things.

In an ideal world, instructors would get specific feedback from students on different aspects of a course as the semester is rolling along. That way, the instructor could see what's working well and what isn't, what excites students and what doesn't. This would enable improvements not just in future iterations of the course but also in the same semester, as the instructor could make adjustments for the particular mix of students in a given class.

[Dr. Andrew Sutherland](#) has actually implemented such a system in his course [18.783 Elliptic Curves](#), a graduate-level course on elliptic curves with applications to number theory and cryptography. The course has just published on OCW. Sutherland explains how his survey system works on his [This Course at MIT page](#).

Each of the 13 problem sets assigned during the semester ends with a survey, which students are required to fill out. The survey is brief and asks students to rate each problem in the set by interest, difficulty, and time spent, and to rate each lecture in a similar way, including the quality and novelty of the material and the pace of presentation. Although the surveys are a requirement, Sutherland keeps the tone lighthearted. For example, the rating scale for interest ranges from 1 = "mind-numbing" to 10 = "mind-blowing."

In response to problem set feedback, Sutherland has improved the course over several iterations. In particular, he has dropped or added problems, dropped or added hints, clarified points of confusion, and adjusted problems to make the connection clearer to the rest of the course content.

Deleted problems often get added to the course lecture notes. The lecture portion of the survey has led to a variety of adjustments, including the addition of review material and background topics and the slowing of the pace of delivery.

Sutherland reviews the surveys as he grades the p-sets, with a goal of turning everything around in a few days after the submission date. He often replies to students by email, sparking a dialogue. Sutherland has also used this survey strategy in another course, [\*18.782 Introduction to Arithmetic Geometry\*](#).

It might seem that gathering all this feedback requires a lot of dedication&mdas

“Perhaps the most useful thing I have learned as an educator from this dialogue is that it is very empowering (both for them and me) when students help to shape their own education. MIT students want to optimize everything and they have little patience for poor design. This can make them harsh critics, but it also makes them enthusiastic collaborators when they feel they are partners in the process.”

> [Learn more about OCW Educator](#)

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**Highlights for High School**





Win a **free** OCW temporary tattoo by participating in the Highlights for High School Online Scavenger Hunt!

Use the Highlights for High School Website to answer the questions below. Email your answers to [ocw-hs@mit.edu](mailto:ocw-hs@mit.edu).

**The first 5 people who respond with three correct answers will win an OCW temporary tattoo.** See [pictures](#) of the tattoo on our Twitter feed.

Navigate to the [Highlights website](#).

1.) In the “Money to Burn” video, part of the *Chemistry Behind the Magic: Chemical Demonstrations for the Classroom* video series, what denomination of money does Dr. Shakhashiri burn in the experiment?

2.) What is one example we list of ways that OCW has been used in high schools? (Hint: You might want to look at the page for teachers.)

3.) What are the four subjects included under Exam Preparation?

## MITx News

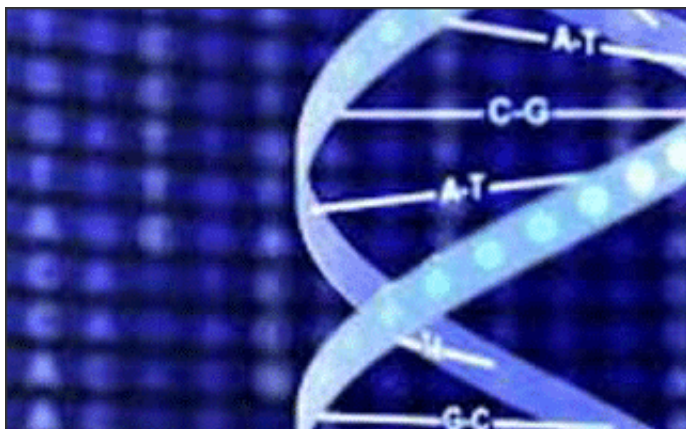


Image of a helix.

[MITx 7.00x Introduction to Biology - The Secret of Life](#) is now open in archived mode!

This means anyone can join the course at this time, and you can proceed through the materials at your own pace and schedule. We encourage you to use this content to learn biology and explore!

Also, if you are you looking for an in-depth molecular biology course after mastering the 7.00x material, then we are happy to announce the second release of [7.28.1x Molecular Biology: DNA Replication and Repair!](#) We will launch 7.28.1x on **August 4, 2015 at 14:00 UTC**. We are excited to share with you our animation-supplemented lecture videos and our data-analysis-based quizzes, both of which are designed to be an important part of your learning process.

Invite your biology-interested friends to join the course! If you did not have time to try the course during the first run, now is your chance to do so. If you already completed the course, come back to review or discuss the material with new learners. Understanding the experimental concepts in 7.28.1x is very important for moving on to 7.28.2x: Transcription and Transposition, which will release in

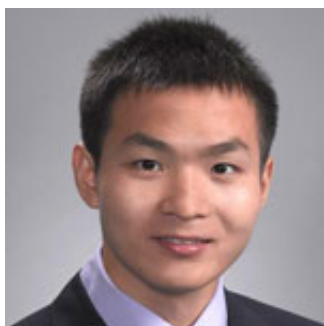


the near future. We hope to see you in the course!

> [Explore MITx on edX courses](#)

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## Views From Our Supporters



"I am very glad to donate to OCW since I learned a lot from the courses of Prof Gilbert Strang. I do feel that OCW offers a great opportunity for self-learning. I appreciate the contribution of MIT and other universities. Without your contribution, I would never be able to access this knowledge.

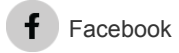
I am honored to be one of the donors who support OCW so that more people in the world have the opportunity to learn from these wonderful courses and achieve their dreams. I will continue supporting OCW in the future. "

- Zihao, Independent Learner, Singapore

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