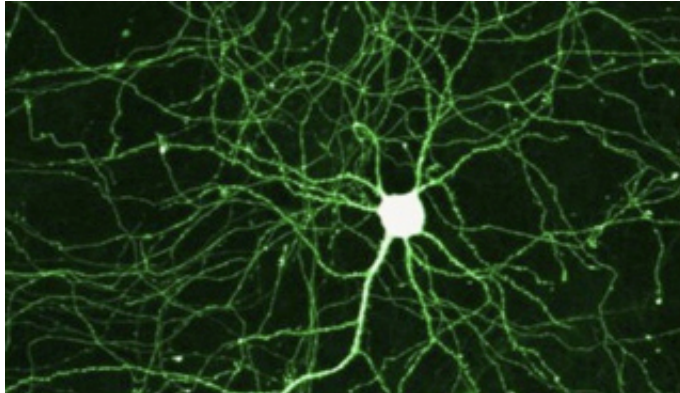


In Friend of OCW's February 2015 newsletter

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MITOPENCOURSEWARE
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Neural Networks on OCW

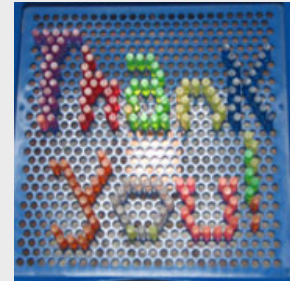


Neural synapses (Image courtesy of [Mike Seyfang](#) on Flickr)

Like Friends on Facebook, Some Nerves Are Tighter than Others

Brain researchers at the University of Basel recently reported [that nerve cells in the brain are organized like friends in a social network](#), conjuring a fascinating parallel between micro and macro human networks. In social networks, people often have many connections but only a few truly close friends. Similarly, "weak contacts in the brain have little impact, despite being in the majority," says [Professor Thomas] Mrsic-Flogel. "The few strong connections from neurons with similar functions exert the strongest influence on the activity of their partners. This could help them work together to amplify specific information from the outside world."

Those interested in understanding the science behind neural networks might explore [OCW's rich collection of courses](#) from MIT's [Department of Brain and](#)



Thank You for Your Support!

Friend of OCW, your support makes it possible for us to continue to create a foundation for a whole new generation of online learning opportunities.

We hope you'll help us spread the word about OCW by telling your friends and family to visit our site and we welcome you to connect with us further on our [social media sites](#).

We encourage you to learn more about our [corporate sponsorship program](#) and [other ways to contribute](#) to OCW.

Thank you again!

Cognitive Sciences. The courses range from the introductory to the specialized and advanced.

OCW has two recent course offerings that might seem particularly relevant:

- 9.04 Sensory Systems, taught by Professors Peter Schiller and M. Christian Brown, examines the neural bases for sensory perception, focusing on visual and auditory systems in mammals. The course has full video lectures, selected lecture notes, and a full list of readings.
- 9.14 Brain Structure and its Origins, taught by Professor Gerald Schneider, examines the larger neural structures that form in the brain and central nervous system. This course has full audio lectures, elaborately illustrated lecture notes, reading questions to accompany the readings, and more.

As for social networks, MIT offers many courses affording a variety of perspectives, and a number of these are represented on OCW. Here is a sampler:

- 14.15J Networks

“Our social life is organized around networks of friends and colleagues. These networks determine our information, influence our opinions, and shape our political attitudes.”

- MAS.961 Networks, Complexity and its Applications

“The goal of the course is to equip students with conceptual tools that can help them understand complex systems that emerge in both nature and social systems.”

- 15.599 Workshop in IT: Collaborative Innovation Networks



OCW is grateful for the support of:



“ . . .we will explore how to discover latest trends on the Web, and how to make them succeed in online social networks.”

New Courses



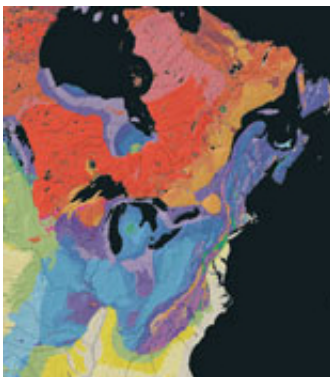
[21H.365 Cultural Pluralism in Modern Middle East](#)



[ES.S71 Increasing Your Physical Intelligence, Enhancing Your Social Smarts](#)

- [2.087 Engineering Math: Differential Equations and Linear Algebra](#)
- [15.879 Research Seminar in System Dynamics](#)

Updated Courses



[12.001 Introduction to Geology](#)

[18.175 Theory of Probability](#)

- [9.14 Brain Structure and Its Origins](#)
- [21F.311 Introduction to French Culture](#)

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OCW Educator



Drawing of King Arthur finding a giant roasting a pig. (Illustration is in the public domain from Roman de Brut by Wace, 2nd quarter of the 14th century. Courtesy of the [British Library](#).)

Actively Engaged Students: The Holy Grail of Teaching

One of the most poorly kept secrets among people who advocate flipping the classroom in the sciences and engaging students in active learning is that the

humanities have been flipping the classroom and practicing active learning for decades. So it's not an exaggeration to say that the sciences have been taking a lesson from the humanities in recent years.

It's well known that humanities classes often consist of discussions rather than lectures. Students read the text at home, and then the instructor leads a discussion in class.

The Quest for a Lively Discussion

But just as there are good and bad lectures, so too with discussions. How does a humanities instructor ensure that a discussion isn't just a free-for-all? Or a series of painful silences?

Enter into the lists [Professor Arthur Bahr](#), who has just published two literature courses on OCW.

To engage students, he has them help shape what happens in class. In the Instructor Insights of his [This Course at MIT page for *21L.460 Medieval Literature: Legends of Arthur*](#), Professor Bahr explains how he had students, working in groups of four or five, identify questions and passages that might form the basis for discussion. This priming of the pump was essential to making the class a success:

“ . . . if they were not prepared, it was not going to be a good class. I told students they were responsible for making good discussions possible, and they needed to take ownership of their learning.”

Professor Bahr typically pointed out connections between these student submissions to frame and direct the discussions. So the students were engaged to begin with, and they kept their instructor always on his toes.

In a variation of this technique, students submit

questions by email before class (the submissions are required and factored into final grades). Professor Bahr is then able to focus on things that students find interesting. This strategy has the side benefit of helping the more reticent students participate in the discussion because it allows “shy students to know in advance that their questions [are] going to be the subject of conversation.”

Posters of the Round Table

If the humanities have given something to the sciences, the sciences have also lent something to the humanities. After talking with a geneticist colleague, Professor Bahr decided to offer his students the option of creating a poster for their final project, in the same manner that science researchers create posters for conferences. So many students took up this challenge that he held a public poster session showcasing their work.

Mock Tests Make for Heroic Achievements

In *21L.730 Major Authors: Old English and Beowulf*, Professor Bahr took on the ambitious goal of teaching a medieval literary classic in its original language, all in a single semester. A key part of his instruction was another lesson learned from the sciences: low-stakes assessments in the form of mock exams.

The exams “gave [students] a sense of how difficult the real assessments would be and how they needed to pace themselves when taking the exams. Additionally, they provided an opportunity for me to model the thought processes involved in completing complex tasks, such as sight translations.” As an additional benefit, “I knew that if all of the students performed poorly on a particular item, I needed to reassess how I was teaching that concept.”

Maybe the sciences and humanities have more in

common than we might think.

Highlights for High School

You may know that the offices of MIT OpenCourseWare and Highlights for High School are located near Boston, Massachusetts. You also may have heard that Boston has gotten *just a bit* of snow.



A car's side mirror, peeking out from a snowbank, is the only evidence that a car is hidden underneath. Image courtesy of Cheryl Siegel.

Much of the Boston area is on the brink of accumulating close to 100 inches of snow for the season, most of it within the last month. (We're sure you have seen the pictures on the news and on social media.) To put it in perspective, on average, Boston receives only 40 inches of snow in a given winter. That means we have received over two years' worth of snow in only a few weeks!

So in this spirit, we'd like to share some of the fluffy white stuff with you. Watch MIT Chemistry Professor, Dr. John Dolhun, in this fun chemistry demonstration known as "[Let It Snow](#)." In this video, Dr. Dolhun

magically makes snow in a beaker!

If you like this video, you will enjoy the rest of the videos that are part of the [Chemistry Behind the Magic](#) video series, which explain the science behind exciting live science demonstrations. Each video includes teaching notes for educators. Enjoy!

MITx News



Digital Systems, Space Flight, DNA Repair

Starting in March, a number of exciting MITx courses are being offered for the first time on the edX platform.

- [6.004.1x Computational Structures -- Part 1: Digital Circuits](#)

Have you ever thought about creating a computer from scratch? The 6.004x series of courses offers the opportunity to do just that. This first installment in the series “is a bottom-up exploration of the abstractions, principles, and techniques used in the design of digital systems,” the course site says. All you need is “a rudimentary knowledge of electricity and some exposure to programming.”

The course is taught by Senior Lecturer Chris Terman, Professor Steve Ward, and Lecturer Silvina

Hanono Wachman. It starts on March 3 and lasts for 11 weeks.

OCW offers a version of Professor Ward's on-campus foundation for the series, [6.004 Computation Structures](#). The OCW course site has a full set of lecture notes, tutorial problems with solutions, exams with solutions, and labs.

- [16.00x Introduction to Aerospace Engineering: Aeronautics and Human Spaceflight](#)

Been dreaming since you were a kid of what it would be like to see the earth from outer space? Wishing you might one day get the chance to go for a spacewalk?

Prepare yourself! Study with someone who has!

Professor Jeffrey Hoffman, the lead instructor, knows something about space travel. He was a NASA astronaut from 1978 to 1997 and made five space flights, becoming the first astronaut to log 1000 hours of flight time aboard the Space Shuttle. He has taken four spacewalks.

The course explores "how rockets work, how spacecraft move in orbit, how we create artificial environments inside spacecraft to keep astronauts alive and healthy, what it's like living in a world without gravity, how the human body adapts to space, and how spacewalks happen." Blast-off is scheduled for March 3, and the flight will last eight weeks.

Professor Hoffman is no stranger to OCW either. He has published two courses: [16.885J Aircraft Systems Engineering](#) and [16.891J Space Policy Seminar](#) (with Professor Daniel Hastings).

- [7.28.1x Molecular Biology: DNA Replication and Repair](#)

"Did you know that your cells synthesize enough

DNA during your lifetime to stretch a lightyear in length? How does the cellular machinery accomplish such a feat without making more mistakes than you can survive?" The course site opens with this mind-boggler. It goes on, "Why isn't the incidence of cancer even higher than it is? And, if the DNA in each and every cell is two meters long, how is this genetic material compacted to fit inside the cell nucleus without becoming a tangled mess?"

Welcome to the world of modern molecular genetics, where the astounding gets mutated into the factual. The course is intended to help students "build [their] experimental design and data analysis skills" in molecular biology.

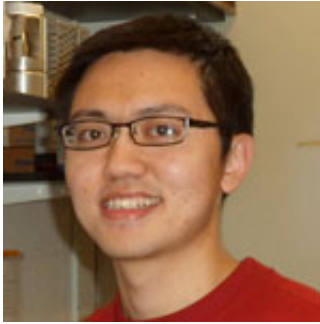
Professors Stephen Bell and Tania Baker are the lead instructors. The course starts on March 10 and lasts eight weeks.

OCW has a version of the on-campus course [7.28 Molecular Biology](#), as it was taught in Spring 2005.

The only prerequisite for 7.28.1x is a course in introductory biology along the lines of 7.00x Introduction to Biology or OCW's [7.01SC Fundamentals of Biology](#) or [7.013 Introductory Biology](#).

Views From Our Supporters

"Unfortunately, my undergraduate college couldn't provide good quality lectures on advanced courses such



as quantum physics, or solid state chemistry, or some math courses.

MIT OCW physics course series (course 8) include almost all physics topics in them, lots of experiments and demos, and great lecturers.

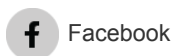
I especially learned a lot of new knowledge in Quantum Physics I and II (8.04 and 8.05), I hope some time later, 8.06 videos would be available soon. This is the BEST quantum mechanics courses I've taken!

thanks a lot!"

- Zhi, Independent Learner

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