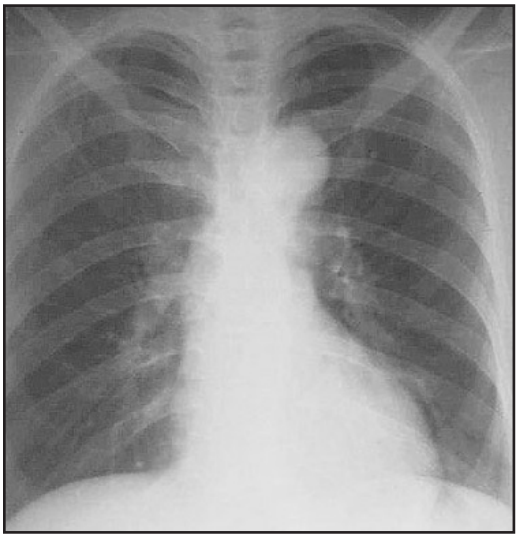
news briefs

An Advancement in Tuberculosis Vaccination

A new way of preserving and delivering the most common tuberculosis (TB) vaccine, Bacillus Calmette-Guérin (BCG), promises a more cost-effective and practical future for fighting off the rising tide of drug-resistant infectious diseases worldwide. The research team was led by Yun-Ling Wong, a graduate researcher, and David Edwards, Gordon McKay Professor of the Practice of Biomedical Engineering, at the Harvard School of Engineering and Applied Sciences [1].



An X-ray of a set of lungs that have been infected with tuberculosis.

BCG is presently stored by freezing and delivered by needle injection, with 100 million infant administrations annually. In contrast, the new spray-dry vaccine has the advantage of greater stability at room temperature and can be used in needle-free delivery. Moreover the new vaccine costs less, potentially enabling a greater number of safer and more effective administrations. The preservation process involves removing salts and cryoprotectants, such as glycerol, from bacterial suspensions, and is similar to the way powdered milk is prepared. Spray-drying techniques have been commonly used in the food, cosmetic, and pharmaceutical industries, but have not been used for drying cellular material [1].

Most promisingly, this new method could potentially lead to better delivery of vaccines for HIV/AIDS and other pressing global diseases of poverty. Edwards and his colleagues hope to build upon this advance to further improve vaccination approaches through the international nonprofit organization Medicine in Need, based in Cambridge, Paris and Cape Town, South Africa.

—Yongtian Tan '10

1. Rutter, Michael Patrick. "Spray-dry vaccine for TB developed." Harvard University Gazette. URL: <http://www.news.harvard.edu/gazette/2007/02.15/05-dr yspray.html>. Accessed 23 February 2007.

Game 'Ova' for Egg-derived H5N1 Vaccines

Since the 1950s, hen eggs have served as a staple for flu shot manufacturing, but the day is approaching when this may no longer be the case. Typically, each year, once the public health community has arrived at a consensus on the upcoming season's dominant virus strains, manufacturers embark upon the six-month process of vaccine development. To start, they inject a chosen strain into an egg's allantoic cavity, where it multiplies until there are sufficient virions from which to harvest the desired proteins—those that elicit an immune response in the body—that make up the vaccine. While this egg-dependent method has allowed for revolutionary advances in public health, its shortcomings are becoming increasingly pertinent, especially in light of recent concerns regarding the threat of a pending avian flu pandemic.

Avian flu, which predominantly infects wild waterfowl, is not easily transmitted between humans and, all human cases thus far have been confined to agricultural regions of Asia where humans and poultry often coexist in close proximity. Due to the virus's propensity for rapid genetic evolution, and the fact that various strains can simultaneously infect humans, many doctors, scientists and policy makers fear that an inauspicious genetic reassortment will yield a novel strain that readily infects humans. Such a virus would enjoy rampant passage across an immunologically naïve human population, leading to a pandemic of similar proportion to the Spanish flu outbreak of 1918.

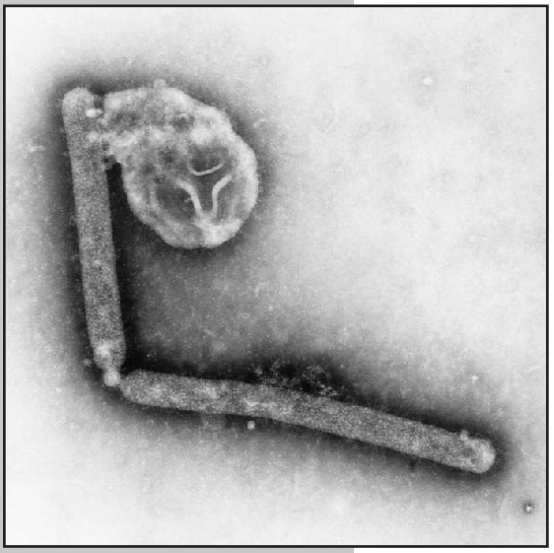
Current methods of vaccine manufacturing would be unable to rise to such a challenge. Apart from the mere time limitation, the probability of having access to about 4 billion healthy eggs—the projected amount needed to vaccinate a population of 1.2 billion high-risk individuals—is low, considering that the strain is especially virulent in poultry. Fortunately, recent improvements in vaccine production technology may finally give

credit: http://www.nature.com/embor/journal/v4/n6s/fig_tab/embor842_f3.html

hens a break.

Scientists have proposed a somewhat surprising solution—caterpillars. Researchers at Protein Sciences Corporation, a small biotechnology company in Connecticut, have developed a method utilizing recombinant DNA that enables a high yield harvest of the Influenza virus's immunologically dominant coat protein, hemagluttinin (HA), from insect cells that have been infected by a genetically-engineered baculovirus vector [1]. The simple efficiency of the process has enabled the company to triple the traditional vaccine dosage of 45 micrograms so as to provoke a stronger immune response. According to a recently published phase II/III study by Dr. John Treanor and his clinical team at the University of Rochester, this approach seems promising [2]. The study compared the new single-protein recombinant vaccine to its multi-protein subunit predecessor and demonstrated the single-protein vaccine to be sufficiently safe and immunogenic. Although the preliminary results are based on a sample size of only 460 healthy adults, they are still notable; a larger efficacy study with 4000 subjects is planned for later this year.

—Tavé van Zyl '08



▲ A transmission electron micrograph of the Avian flu virus, H5N1.

1. Enserink, M. "I'll Take the Flu Shot, Hold the Eggs" Science NOW Daily News 2007 April 11.
2. Treanor JJ, Schiff GM, Hayden FG et al. "Safety and immunogenicity of a baculovirus-expressed hemagglutinin influenza vaccine: a randomized controlled trial." JAMA. 2007 Apr 11;297(14):1577-82

Professor George M. Whitesides Awarded 2007 Priestly Medal

The American Chemical Society has awarded the 2007 Priestley Medal to Woodford L. & Ann A. Flowers University Professor George M. Whitesides, an eminent professor of chemistry at Harvard. This is the highest honor that the ACS awards. The Priestly Medal is given to those who have demonstrated a "lifetime of achievements and service to chemistry" [1].

Professor Whitesides graduated from Harvard College and completed his PhD degree at California Institute of Technology. He taught at M.I.T. before becoming a faculty member of the Department of Chemistry and Chemical Biology at Harvard University. Professor Whitesides' illustrious career includes three years as the Department Chairman at Harvard. In addition, he has published over 900 articles. His research spans a variety of interests including organic chemistry and materials and surface studies. In particular, one key research interest for the professor is the study of self-assembly of biological and physical systems [2]. Professor Whitesides has received awards from the ACS, Materials Research Society, and Carnegie Mellon University - among many others – ever since the very beginning of his career. He has also received fellowships and memberships from the American Academy of Arts and Sciences, the National Academy of Sciences, the National Academy of Engineering, as well as an honorary membership to the Materials Research Society of India. Furthermore, he served on the editorial boards of prestigious journals such as Bioorganic and Medicinal Chemistry Letters, Angewandte Chemie and Chemistry & Biology [2].

For many students, Professor Whitesides may be known as one of the principal instructors for the new course Physical Sciences 3: Electromagnetism, Light, Entropy, and Information, where he teaches the last third of the course on information processing. His pivotal role in the changes currently taking place in the undergraduate science curriculum is a testament to his continuous, active involvement in the Harvard community, and the progress of science in general.

—Michelle Jung '08

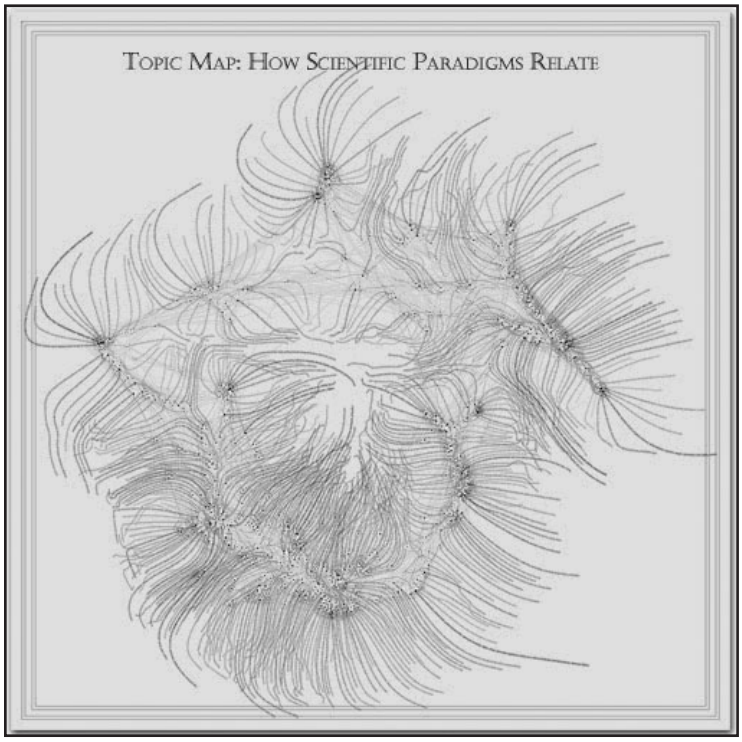
1. "Whitesides Named Priestley Medalist." Chemical & Engineering News. URL: <http://pubs.acs.org/email/cen/html/061306135937.html> Accessed 23 March 2007.
2. The Whitesides Research Group. URL: <http://gmwgroup.harvard.edu/> Accessed 23 March 2007.

credit: Centers for Disease Control and Prevention, http://phil.cdc.gov/PHIL_Images/8038/8038_lores.jpg

news briefs

A Hairy Representation of Science

A "map" of the articles on science retrieved from the Journal *Nature*.



True to form, a recently produced map of science resembles a hairy amoeba blob. This hairy map shows the relationship between 800,000 scientific papers [1]. Each of the circular nodes represents a paradigm based on the occurrence of citation of papers by authors, totaling to 776 different patterns [2]. Each paradigm contains words that only pertain to it. The sprawling nature of the map derives from the curved lines that link similar paradigms together and repel dissimilar ones [2]. Thus, the bigger the paradigm, the more paper relates to it. This hugely elaborate creation was done by W. Bradford Paley. When zooming in on the map (a high-quality version can be found on Nature's website), one can read the titles of the paradigms, varying from multiple antennae to molecular magnet to dialysis catheter. Although the diversity of science is enormous, Paley's diagram shows that much of science is interconnected and that no one subject stands alone. Ultimately, each subject relates to another and another. Such an undertaking has not been attempted before, making this Map of Science an interesting study of how astronomically vast, yet elegantly cohesive the realm of science is. By mapping out science, we discover that certain fields are closer than we could have ever initially presumed.

—Yan Yan Mao '10

1. Marris, E. Nature 444 (2006): 985.
2. Paley, B. W. (2006) Map of science in the journal *Nature*. Retrieved March 3, 2007. Web site: http://didi.com/brad/mapOfScience/

credit: ref 2

Reflections on a Dynamic Friday Afternoon Discussion on Music and the Brain

On Friday, February 2nd, the Fong Auditorium in Boylston Hall was packed. What was the source of this impressive gathering? Harvard's first Mind, Brain, and Behavior (MBB) event of 2007: On Music, Mind, and Meaning. Advertised as a conversation led by Professor of Music Fred Lerdahl, this year's MBB Faculty Fellow, the event promised an opportunity to witness a provocative exchange on the subject of music and cognitive neuroscience. Joining Professor Lerdahl in this discussion was an impressive crowd: Professor Mark Tramo, Director of the Institute for Music and Brain Science at Harvard Medical School, Professor Andrew Nevins of the Harvard Linguistics Department, Professor Erin Hannah, Director of the Auditory Cognition and Development Lab in Harvard's Psychology Department, and moderator Professor Marc Hauser, co-director of MBB and faculty member in the Psychology Department at Harvard. Unfortunately, this exciting event did not play out as smoothly as expected.

The exploration of the connections between music, language and the brain is a rapidly emerging field that has tremendous potential for development. At the same time, it is an area that appeals to the "world of espresso-science," as Professor Tramo describes. Academics and non-academics alike are drawn to the intriguing parallels between music and language, between music and thinking, and between music and science. As a result, to attempt a comprehensive dialogue on such a wide-raging topic, a diverse assembly of professors

was necessary; with so many passionate experts brought together on one stage, a heated discussion was inevitable.

From the beginning, Professor Lerdahl appeared pressed for time even as he opened-up the discussion. There was just too much to say. Looking back on the afternoon, Professor Lerdahl commented that he enjoyed having the opportunity to begin explaining his work to such a curious audience, but that "it seemed brief" and lacking in enough "time for questions and responses."

After Professor Lerdahl's introduction, the forum transformed to a more open exchange. Each of the participants approached the subject from a unique background, ranging from Professor Lerdahl, a trained music composer, to Professor Nevins, a linguist. While this diversity made for a dynamic discussion, no general consensus was reached. The greatest difficulty seemed to be in drawing the line between the theoretical parallels between music and spoken language. Topics of debate included the analogy between phrases in music compositions and phrases in sentences, and the neurological connections between the two, such as whether the brain in fact relies on similar structures to create both phrases with notes and phrases with words.

Nevertheless, the energy of both the speakers—Professor Tramo even leaping up to demonstrate several of his points about music on a keyboard—and the audience was the highlight of the event. The interface of music, language, and cognition is a budding field overflowing with people, ideas, opportunity, and excitement—so much in fact, that it is difficult even to identify a proper starting point. Perhaps it is only appropriate that most people left Fong Auditorium with more questions than answers.

—Susan DeWolf '10

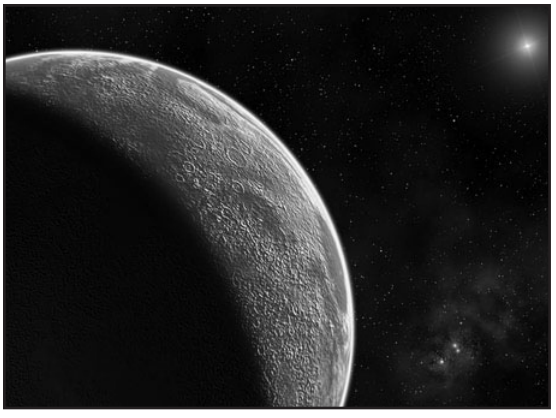
Discovery of a New Earthlike Planet

A new earthlike planet named OGLE-2005-BLG-390Lb was recently discovered. With a mass 5.5 times that of earth, this new planet has the lowest mass ever reported for an extrasolar planet orbiting a main sequence star [1]. The majority of planets currently known to exist outside of the solar system reside within the equivalent of Mercury's orbit [2]. Planets of the mass of Neptune or less have not been found at distances greater than 0.15 AU [1]. However, the orbit of this new planet is farther from its host star than Earth is from the Sun, the defined unit distance of 1 AU. The planet, which orbits a red dwarf star, has a rocky surface and is approximately 28,000 light-years away. With a surface temperature of 364 degrees Fahrenheit below zero, it is nearly as cold as Pluto [2]. This means that OGLE-2005-BLG-390Lb is probably too cold to support known forms of life.

Previous techniques used in detecting planets – for instance, those that take advantage of the Doppler effect – could find many large planets but not small planets that are far from their star [2]. This new planet was discovered by a different technique called gravitational microlensing [1]. This technique allows smaller planets to be detected. In gravitational microlensing, a foreground star bends and magnifies light from a distant star using its gravitational field such that the presence of a planet around the star causes the distant star's light to become brighter [2].

The discovery of OGLE-2005-BLG-390Lb also supports the standard model of solar system formation, or the core-accretion model. This is due to the fact that gravitational microlensing is 50 times more likely to find a gas giant planet like Jupiter than a smaller earthlike planet [2]. The fact that microlensing has not discovered dozens of Jupiter-sized planets means that most of the planets in our galaxy are probably of the small rocky kind, exactly as the core-accretion model predicts [1].

—Pushan R. Dasgupta '10



An artist's depiction of the Earthlike planet OGLE-2005-BLG-390Lb. ▼

credit: National Science Foundation, http://www.nsf.gov/news/mmg/mmg_disp.cfm?med_id=57155&from=mn

1. Beaulieu, JP. et al. "Discovery of the distant cool sub-Neptune mass planet OGLE-2005-BLG-390Lb by microlensing." 2005, *Nature*. 439, 7075.
2. Than, Ker. "Scientists spot a new Earthlike planet." MSNBC. URL: <http://www.msnbc.msn.com/id/11013519/>. Accessed 24 March 2007.

news briefs

What is the measure of a meal?

Why does a soufflé rise and fall? How long should one cool champagne? French epicure Herve This has made a career from asking these questions. This, pronounced "Teess," is an internationally renowned chemist who has been at the forefront of the science of molecular gastronomy, a field that seeks to apply science to culinary practices by bringing the instruments and experimental techniques of the laboratory into the kitchen [1].

The term molecular gastronomy was first coined in the 1980s by This and collaborator Nicholas Kurti, then a member of the physics department at Oxford University in England [2]. The two scholars shared a keen interest in food science, with a belief that empirical knowledge and tradition were as important in cooking as rational understanding [1]. This dogma is at the heart of the interdisciplinary nature of This' work, a nature that is reflected, for example, in This' scheduled appearances: in April, he appeared as a guest lecturer at the New York Academy of Sciences' series called the "Science of Food," and he will also be featured at a conference hosted by the International Association of Culinary Professionals [1,3].

For This, whose science background is rooted in physical chemistry, an interest in the science of cooking all started with a soufflé. While preparing the dessert for friends on an evening in 1980, This, wondering why the recipe called for adding eggs two-by-two, chose to test the validity of this direction by adding both eggs at once; the result was a soufflé that was "edible" but lacking the signature pouf of a perfectly prepared soufflé [1]. Thus, with this soufflé, This began a pursuit of experimentation in the kitchen.

Since that fateful evening in 1980, This has put thousands of recipes and glorified "old wives' tales" to the test, poring over detailed lists of culinary traditions to find intriguing cooking conundrums. In 2000, This quit his job at Pour la Science to work as a full-time researcher at the French National Institute for Agricultural Research (INRA) [1]. This has also enlisted the help of the culinary community, establishing a working relationship with his friend and world-renowned chef Pierre Gagnaire, challenging the gourmet to create recipes using This' culinary "precisions" [2, 4]. Therefore, by taking a close look at many familiar ingredients and culinary techniques, This shows how a scientific approach can help cooks cook both better and more inventively [5].

So the next time you eat out, remember: in a lab somewhere in the world, a new breed of scientist-chefs are testing the methods used to prepare your meal. And, thanks to the influence of This' work, their lab probably smells a lot better than any lab on campus.

—Meghan Galligan '10

1. Caravanos, Adelle. "Dinner: The Final Frontier." The New York Academy Sciences' Update Magazine, March/April, 2007, p. 18-19.
2. King, Emilie Boyer. "Food: his passion, his science." Christian Science Monitor, 18 February 2004.
3. "Conference Agenda-April 13, 2007." Online (available) URL: <http://www.iacp.com/displaycommon.cfm?an=1&subarticlenbr=297>. Accessed 10 March 2007.
4. "Molecular Gastronomy; Exploring the Science of Flavor" Online (available) URL: <http://www.columbia.edu/cu/cup/catalog/data/023113/023113312X.HTM.> Accessed 10 March 2007.
5. "Art et Science." URL: <http://www.pierre-gagnaire.com/francais/cdthis.htm>. Accessed 10 March 2007.