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The Rockefeller University

news & notes

January 27, 1995 Volume 5, Number 15

The Rockefeller University

N.Y. Hall of Science director to speak on challenges of science education

Courtesy of Alan J. Friedman

Alan Friedman, director of the New York Hall of Science, will speak at the Cohn Forum Tues., Jan. 31.

Alan J. Friedman, director of the New York Hall of Science, will speak at the Zanvil A. Cohn Forum on Health Affairs Tues., Jan. 31. His talk is entitled, "Science Education in New York City: We Know the Problems; What Are the Answers?"

"Alan Friedman has guided three major institutions in making science come alive for young students and the public," said Alexander Bearn, chair of the forum's program committee. "In the 10 years since he was appointed director of the New York Hall of Science, it has become a leading science-technology center and a resource the city is proud of."

Friedman received a B.S. in physics from Georgia Tech in 1964 and a Ph.D. in physics from Florida State University in 1970. After working as a college physics professor and publishing in the area of science education, Friedman joined the Lawrence Hall of Science at the University of California, Berkeley, as director of astronomy and physics in 1973. In 1982, he took a two year leave of absence to help develop France's new national science museum, Cité des Sciences et de l'Industrie. When he returned to America in 1984, he became director of the New York Hall of Science. He planned and directed its growth from an operating budget of $300,000 and a staff of three to an annual budget of $6 million and a staff of 100. In 1985, he published *Einstein as Myth and Muse*, coauthored with Carol Donley.

The forum on health affairs was established by the late Zanvil A. Cohn as a venue for informal discussion on important issues in health research and public policy.

President Torsten Wiesel will introduce Friedman at 5:30 P.M. in the Abby Aldrich Rockefeller dining room. Sherry will be served at 5:00 P.M. All are welcome to attend.

Flash: University holds contest for holiday card

Cover art from the President's 1994 holiday card.

Members of the RU community are invited to submit photographs of the RU campus to be considered for the cover of the President's 1995 holiday card. Entries should depict a winter scene in black and white.

The contest is open to the entire Rockefeller community. Send entries to *News&Notes*, box 68, by Thurs., Mar. 30.

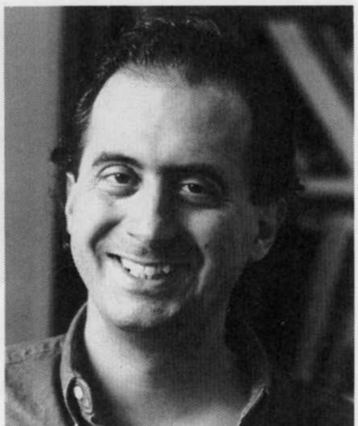
RU investigator to lecture on pneumococcus

Rockefeller Assistant Professor Robert Masure will speak on "Global Regulation in *Streptococcus pneumoniae*, a Model Gram Positive Pathogen" at the Friday lecture today (Jan. 27).

Pathogenic bacteria can infect a host by several avenues: through direct attack of the immune system, by concealing themselves within the host cell, or by adopting the appearance of the host. Masure studies the molecular mechanisms responsible for the dynamic interaction between bacteria and the human host during the course of infection. *Streptococcus pneumoniae* is the leading cause of community-acquired pneumonia and otitis media, and a common cause of sepsis. Today Masure will discuss the regulation of bacterial surface elements important for interactions with the host in disease.

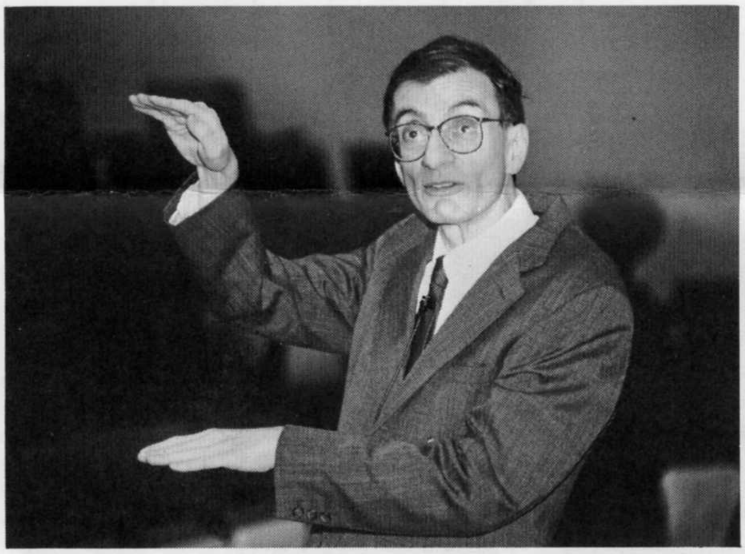
With new genetic technology, Masure has opened up an area of research in microbial pathogenesis that formerly excluded Gram positive bacteria. "Rob's laboratory has concentrated on the role of pneumococcal surface proteins in genetic transformation and virulence," said Professor Emil Gotschlich, who will introduce Masure. "His effort in this area is the most comprehensive program currently in

See **Masure**, page 4



Assistant Professor Robert Masure lectures today (Jan. 27).

An evening talk on population growth



Nearly 170 guests of the university gathered Wed., Jan. 25 in Caspary Auditorium to hear Professor Joel Cohen speak on "How Many People Can the Earth Support?" Hosted by the university's Board of Trustees and the Rockefeller University Council, the evening began with a welcome by David Rockefeller, chairman of the RU Council, and an introduction by President Torsten Wiesel. It culminated with a lively question and answer period and a reception in Abby Aldrich Rockefeller Lounge.

Notes from the underground

Rockefeller's tunnels link campus from north to south and past to present

by Kay Locitzer

With the arrival of winter, people on campus take to the tunnels, avoiding the cumbersome burden of coats, scarves, and hats.

"I'm definitely using the tunnels more now that it's colder," said Kristin Zier, secretary. "It's a great place to meet people when the weather's nasty," said Jeff Prout, assistant supervisor, carpenter shop.

In fact, protection from inhospitable weather is the original purpose of the underground walkways, which are common in facilities built at the turn of the century and later. In New York City, for example, Memorial Sloan-Kettering Cancer Center, Columbia Presbyterian Hospital, and New York Hospital all have extensive tunnel systems.

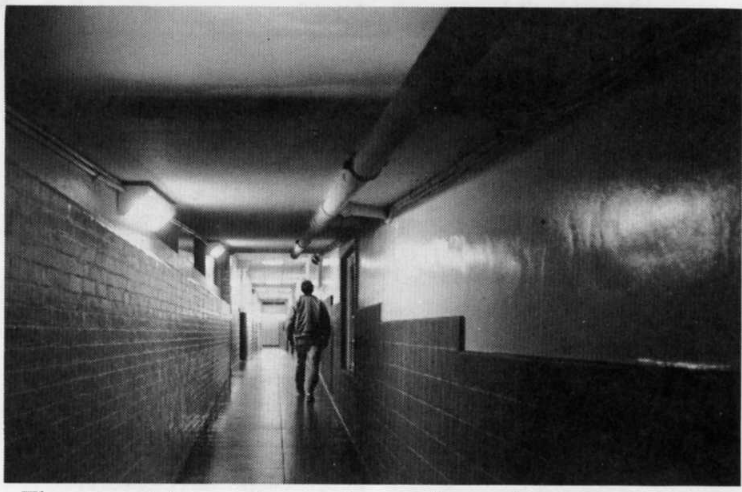
Rockefeller's tunnels link Smith Hall at the northernmost corner of the campus to Tower at the south and most points in between, with the exception of primarily residential buildings.

The very first building on campus, now called Founder's Hall, had a tunnel, according to Professor Emeritus Merrill Chase. It led to the building that housed research animals, which was located where Flexner now is. That first tunnel was unheated, Chase said, but when the Hospital was built, the tunnel link was heated because it ran over the steam tunnel, and all tunnels ever since have had heat. "Tunnels were extended further as new buildings went up," he continued.

Blasted through the tough Manhattan schist, Rockefeller's tunnels are well built, said Manuel Vargas, project manager in planning and construction. "They stay in good shape; we have to do very little to them." But newcomers do sometimes get momentarily lost, so planning and construction staff hope eventually to upgrade the signs, said Donna Zelle, furnishing and interiors manager.

Many people use the tunnels year round, for delivering materials and equipment. "It's a bit of a roller coaster for the carts, but easier than bringing things across on campus," said Prout. Those same inclines have been used in some unusual ways: A boy who grew up on the campus early in the century—his mother worked in the lab of Homer Swift and his father cared for the research animals—recently visited Chase and confessed that he often coasted through the tunnels on a skateboard, relishing the downhill curve between Founder's and the Hospital.

The tunnels now house warrens of offices, some of which, despite being down under, overlook the East River and are flooded with sunshine. The carpenter and glass blower's shops, maintenance services, plant operations, telecommunications, the glassware and laundry services, and several labs have tunnel addresses.



The university's tunnel system is more than a winter convenience; staff use it year round for delivering material and equipment.

En route, tunnel walkers can browse bulletin boards layered with notices—the usual variety about pianos for sale and roommates needed—and some unique to Rockefeller—scientific equipment for sale and chances to earn money as a research subject. One recent example: Anyone willing to spend three weeks in the Hospital as a volunteer in a study of the effects of caffeine on the intestine can earn $1,050 (contact Steven Shiff, x7458).

Parallel to the pedestrian walkways—alongside, above, and sometimes two levels below them—are service tunnels, where dozens of metal veins and arteries transport substances vital to the university's life. Two sets of pipes ferry two types of steam (low and high pressure) to the labs; other pipes supply vacuum, air, gas, and chilled air; and there are multiple telephone, water, and electric lines, both obsolete and new.

Practicalities aside, the tunnels have atmosphere. Among the artifacts from Rockefeller's past are directions to renamed buildings, such as South Lab (Bronk), dumbwaiters, and defunct skeleton keys in iron boxes on doorjambs. In some tunnel segments, footsteps reverberate in an eerie silence and create a haunted ambience that Edgar Allen Poe might have appreciated.

And in the Flexner to Caspary tunnel, a pedestrian can hear air. "The air is trapped by the doors and negative pressure," explained Vargas. Whatever the explanation, the air roars.

The halls are alive with the sound of music…
…every Tuesday night at 7:30 sharp

Leif Carlsson

David Labovitz (right) leads the Choral Symphony Society during their first rehearsal of Handel's Theodora*. The group, whose members come from the tri-institutional community and outside, rehearses Tuesdays in the Caspary music room. Michele Blum, postdoctoral fellow in the Hirsch-Leibel lab (left), is one of about ten Rockefeller singers.* Theodora *will be performed Sun., May 7 at Christ and St. Stephen's Episcopal Church. For information about the chorus or ticket availability, contact Labovitz at 864-7541.*

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PRO·BONO·HUMANI·GENERIS The Rockefeller University 1901

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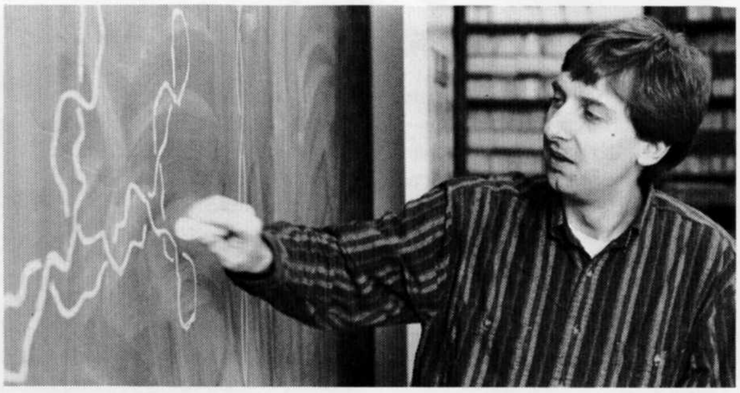
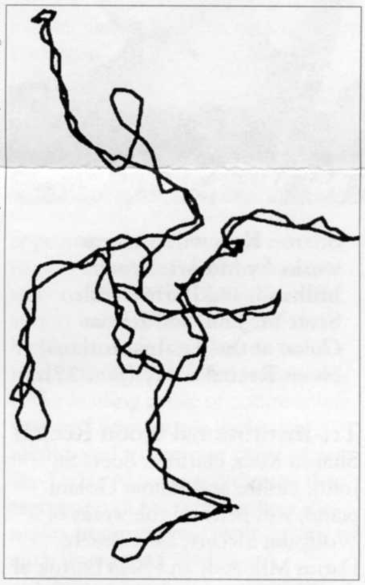
Rockefeller physicist unravels mysteries of supercoils

by Susan Blum



John Marko (*left*) and his colleagues study the shape of plectonemes, the branched and braided structures taken by circular supercoiled DNA. The plectoneme below was created via computer simulation.



Computer simulation by A.V. Vologodskii

Twisting a long, clear tube of plastic into a loopy circle, John Marko looks like an illusionist playing rope tricks. And, in a sense, he *is* a magician, transforming familiar things into something new. For Marko takes DNA—the tube serves as its model—and induces you to regard it not only as the well-known repository of genetic information, but also as an extremely interesting polymer.

Polymers are long macromolecules formed by joining many small, similar molecules together like beads on a string. Examples of polymers are proteins (strings of amino acids), carbohydrates (strings of sugar molecules), and the common synthetic polymers of everyday life, such as polyethylene and polystyrene (strings of various man-made compounds). DNA is another polymer, one composed of repeated units called nucleotides.

Though the subunits of various polymers may have dissimilar characteristics (amino acids, for example, are quite different from sugars) certain regularities emerge in the behavior of all long polymers. Simple laws describe many of these behaviors, particularly when the polymers are floating in liquid. Such regularities are the stuff of statistical mechanics, the science that studies systems with many molecules, all of them moving about.

For some time, polymer physicists have been investigating how thermal fluctuation—the intermolecular, Brownian motion we commonly call heat—generates enough of a force to bend long polymers into varied, random shapes. These studies have helped understand the properties of many types of polymers, including DNA. But, explains Marko, the first Meyer Fellow at the Center for Studies in Physics and Biology, DNA has an additional "incredible property" that is found only in a very few polymers. Because of its ladderlike structure—two backbones of sugar and phosphate linked together by base pairs—DNA's repetitive subunits cannot twist freely around a single bond, as can the individual components of polymers such as proteins or carbohydrates. Rather, twisting the double-helical DNA polymer requires energy, which is then stored in the macromolecule. This peculiarity of the DNA polymer prompted Marko and his collaborator, Eric Siggia of Cornell University, to pursue the issue of DNA supercoiling.

Serpentine supercoils

The most energetically stable form of the DNA polymer is the familiar Watson-Crick structure, in which the double-stranded DNA helix makes a complete turn every 3.4 nanometers, or approximately every 10.5 base pairs. In this configuration, the two DNA strands cross one another a particular number of times.

When the number of strand crosses (the "linking number") is greater or less than this standard, DNA forms supercoils. As Marko's plastic rope tricks demonstrate, supercoiled DNA can take a number of different paths, many of them resembling the serpentine divagations all too familiar in long phone cords or garden hoses.

Nearly all the DNA in cells is supercoiled to some extent. Supercoiling can result from DNA's winding around the protein spools, or nucleosomes, that package DNA in cells with a nucleus. It can result from the topological constraints imposed upon DNA that is closed up into a circle, as is the DNA of bacterial chromosomes and the plasmids inside yeast and bacteria. It can also result when regions of linear DNA are anchored down to form loops.

Supercoiled DNA is difficult to study. Its complex topology can be experimentally imaged via electron microscopy and simulated via computer models, but each method has disadvantages. As another approach, Marko and Siggia transformed ideas from statistical mechanics into a simple, mathematical description, using only paper and pencil.

The first issue they tackled was the structure of plectonemically supercoiled DNA. Plectonemes are complicated branched and braided structures taken by circular supercoiled DNA whenever heat is introduced into the system, as is the case at room temperature. Marko and Siggia found that the shape of plectonemes can be mathematically explained in terms of competition between the "elastic" energy of bending and twisting, which drives supercoiling, and thermal fluctuation, which favors disordered, unsupercoiled structures. "The nice thing about our work is that it allows us to understand a lot of the experimental observations and giant computer simulations of supercoils," Marko says.

Relating physics to biology

DNA supercoiling is important for many cellular processes of vital interest to biologists, including the replication of DNA, the readout, or transcription, of its encoded instructions, and the recombination events during which DNA regions are shuffled and rejoined in new ways. As Marko explains, recombination also is closely connected to fundamental problems of polymer reorganization that have been very difficult for polymer physicists to address. The statistical mechanics approach taken by Marko and Siggia allowed them to compute the friction involved in recombination in plectonemic supercoiled DNA, and to show that these events must occur on what Marko calls "really gargantuan time scales" on the order of hundreds of seconds, rather than the milliseconds more common for polymer fluctuations.

Astounding reorganizations

Another research direction linking biology to polymer physics is the study of the astounding reorganizations that occur in chromosome structure throughout the cell cycle of nucleated cells.

During interphase—the period between one cell division and the next—chromosomal DNA is stretched out, or decondensed, and organized into loops. These loops are formed when the DNA is attached to the nuclear envelope (and perhaps also the nuclear matrix) by protein anchors. In contrast, during mitosis and meiosis (two different forms of cell division, each involving the parceling out of replicated chromosomes) the DNA becomes condensed and reorganized into sausage-shaped chromosomes. Many cell biologists believe that the DNA is also shaped into loops during meiosis and mitosis. Such loops would be formed when the DNA is anchored to proteins (different from those used in interphase) that run down the central cores of the chromosomes.

"This is a beautiful model for polymer physicists," Marko says. "The beast at interphase would be completely different from what you get in meiosis, and probably from what you get in mitosis, too. But what's common to all these states, I think, is the anchoring of huge amounts of DNA to large objects in the cell, such as proteins. And between these anchoring points, you can think about how the polymers are affected by thermal fluctuations."

Marko is now collaborating with cell biologists at York University in Ontario who are studying chromosomal organization during meiosis. With the special dyeing techniques developed by that group, "you can see large, disordered, presumably fluctuating loops of DNA," he says.

"Many people are interested in questions of chromosome structure, but not too many have thought about them from the weird point of view of statistical mechanics," Marko sums up. "For us, the name of the game is to understand the role of thermal fluctuations in cellular processes, and that naturally stems from our long-term interests about how thermal fluctuations affect the shape of polymers."

Potpourri

Steven Spelioris

Sharon Kam will perform works by Mozart, Bruch, Milhaud, and Bartók with Scott St. John and Itamar Golan at the Tri-Institutional Noon Recital today (Jan. 27).

Tri-Institutional Noon Recital
Sharon Kam, clarinet, Scott St. John, violin, and Itamar Golan, piano, will perform the works of Wolfgang Mozart, Max Bruch, Darius Milhaud, and Béla Bartók at the Tri-Institutional Noon Recital today (Jan. 27). The concert, to be held in Caspary Auditorium at noon, is free. All are welcome.

Friday film
Distant Voices, Still Lives (Great Britain, 1985/87), directed by Terence Davies, will be shown today (Jan. 27). The film, an autobiographical chronicle of the lives of a Liverpool working-class family, will be shown at 8:00 P.M. in Caspary Auditorium. Admission is free. All are welcome.

Clinical Research Seminar
Jack Rogers, professor in the Hematology-Oncology Division at Brigham and Women's Hospital, will speak on "Translational Control during the Acute Phase Response, Implications for Alzheimer's Disease" at the Clinical Research Seminar Wed., Feb. 1 at noon in Nurses Residence 110B.

Super bowl
The Faculty and Students Club will open at 4:00 P.M. Sun., Jan. 29 for the Super Bowl.

Children's School applications
The RU Children's School and Infant-Toddler Center (I.T.C.) are accepting applications for the academic year beginning September 1995 for children from three months to five years old. Priority for members of the university community ends Tues., Jan. 31. For further information contact Marjorie Goldsmith, x8580.

RU Concert
The Chamber Orchestra Kremlin will perform at the Rockefeller University Concert Wed., Feb. 8 at 8:00 P.M. in Caspary Auditorium. The orchestra appears at the university on its first American tour. For ticket availability and information, contact Cathy Rogers, x8437.

Science Outreach

I. Call for mentors
Volunteers at Rockefeller are needed to mentor high school teachers and students on campus this summer and to visit schools, give workshops, and conduct lab tours.

II. Scientist in Residence Program
A children's museum in the city has asked for a scientist to spend two hours per week for up to 12 weeks, working with 10-14 year old children on science activities. You will be compensated and able to choose your schedule. All supplies, field trip expenses, etc., will be covered. Anyone interested in either of the above may contact Bonnie Kaiser, Director of Science Outreach Programs, x7431, email: bonnie.

Westinghouse semifinalists

This year, six high school students mentored by Rockefeller researchers submitted Westinghouse Projects and went on to the semifinals. They are:
Serena Chen (Cowburn Lab);
Annie Liu (Steinman Lab - Gilla Kaplan mentor);
Dan Steiglitz (Hanafusa Lab - Marius Sudol mentor);
Eugene Trogan (Breslow Lab - Jonathan Smith mentor);
Mary Wong (Alvarez-Buylla Lab - Christine Neyt mentor);
Pin Lee (Roeder and Heintz Labs - Cheng-Ming Chiang mentor).

Pool tournament
Anyone interested in competing in the next Faculty and Students Club pool tournament can sign up in the club.

Architecture lectures
The Architectural League of New York is presenting a three-part lecture series on the people, buildings, and issues that dominated architecture and urbanism in New York in the 1960s. Held on Thurs., Feb. 2, Mon., Feb. 6, and Thurs., Feb. 9 in Caspary Auditorium, beginning at 6:30 P.M., the series is presented on the occasion of the publication of *New York 1960: Architecture and Urbanism between the Second World War and the Bicentennial*, by Robert A.M. Stern. Stern and others will speak. A limited number of free tickets are available to members of the RU community; call x8967. For more information about the lectures, contact the Architectural League, 753-1722 or see the poster in Tower lobby.

A penchant for the past
Twenty-three years ago last month, playwright Sidney Kingsley gave a personal lecture at Rockefeller about his fascination with physicist and national scientific leader J. Robert Oppenheimer and his aborted efforts to write a play about him. The lecture, entitled "Why I Didn't Write this Play," was reprinted in the Fall 1994 issue of *The New Theater Review: A Lincoln Center Theater Publication*, which was devoted to the relationship between art and science. Professor Paul Cranefield, who had originally invited Kinglsey to RU in 1972, located the recording of the lecture in the Rockefeller archives for the magazine. The editors thanked Cranefield, Professor Stephen K. Burley, and President Emeritus Frederick Seitz for "generously sharing their ideas and time."

Arrivals
Postdoctoral Associate: Dan Zhang, Mauzerall lab.
Postdoctoral Fellows: Anura Rambukkana, Tuomanen lab; Enal Razvi, Steinman lab.
Guest Investigators: Frederic Desdouits, Greengard lab; Mary Glenn, Lederberg lab.

Masure

(continued from page 1)

progress."

Masure received an M.A. and a Ph.D. in physiology from Boston University in 1985. He spent four years as a postdoctoral fellow in the laboratory of D.R. Storm at the University of Washington, studying the calmodulin responsive *Bordetella pertussis* adenylate cyclase toxin. In 1989, Masure came to Rockefeller as an assistant professor in the laboratory of molecular infectious diseases.

Masure is an active member of the university's Science Outreach Program and is in charge of the Prokaryotic Lab Club's monthly seminar series. He has been the recipient of the Graduate Student Research Award (1983-1985) from Boston University's Division of Medical and Dental Sciences, and a training grant (1985-1986) and a postdoctoral fellowship (1986-1988) from the National Institutes of Health.

The lecture will be held at 3:45 P.M. in Caspary Auditorium and preceded by tea at 3:15 P.M. in Abby Aldrich Rockefeller Lounge. All are welcome.

Departures
Adjunct Faculty: Jesus Angulo, McEwen lab; Werner Graf, Wilson lab; Nadia Nogueira, G. Cross lab.
Visiting Professor: John Mundy, Chua lab.
Research Associates: Yuqun Cao, Gilbert lab; Klaus Schneider, Chait lab.
Postdoctoral Associate: Ivan Hrdy, Müller lab.
Postdoctoral Fellows: Laurent Bourdieu, Libchaber lab; Judith Goldberg-Berman, Hirsch lab; Theresa K. Neil, Kappas lab; Arie Rogel, Barbara Spellerberg, and Prem Sreenivasan, Tuomanen lab; Maria Sanchez-Vives, Wiesel lab; Eric Sinn, Roeder lab; Jeffrey N. Wiemann, Nottebohm lab.
Guest Investigators: Isabel Couto and M. Angeles Dominguez, Tomasz lab; Urba Gonzalez-Castro, Carter lab; Gerhard Heilig, J. Cohen lab; Marie Larsson, Steinman lab; Francesco Melis, Asanuma lab; Maria Yuste-Rojas, F. Cross lab.