


THE NEW YORK ACADEMY OF SCIENCES MAGAZINE



BUILDING INNOVATION ECOSYSTEMS

How Academy Initiatives Connect
Communities and Spur Progress

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On the cover: Kelp Forest by Lee Roth

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How We Catalyze Innovation Ecosystems

Nations, regions, mega-cities: all are trying to create “innovation ecosystems.” Their leaders know that their homelands won’t achieve social goals (in education, health, sustainability, etc.), nor will they thrive economically, if they remain predominantly manufacturing or financial hubs. The alternative path is to harness the talents of scientists and engineers to build a “knowledge-based economy.” And this can only be achieved by stimulating innovation on an unprecedented scale.

The New York Academy of Sciences offers a unique platform of expertise, services, and initiatives in this regard. Our special capacities have been employed not only in our home city and state but in Mexico City, London, Barcelona, Moscow, and Shanghai. In my last column I mentioned that we had been invited by the Prime Minister of Malaysia to help him create an innovation ecosystem. We are in discussions with other national leaders to do the same elsewhere.

Because Members and supporters of the Academy will want to know what this is all about, Editor Adrienne Burke has assembled this special issue to provide a lively glimpse of innovation ecosystems and the many programs and program directors at the Academy who are driving these exciting projects. At the core of everything we are doing is a set of very useful NYAS programmatic assets:

- » In a world of nationalism and regional competitiveness, we are neutral—born in New York but global from the beginning.
- » While local universities traditionally operate as if society is a zero-sum game, we are adept at building alliances where the whole is greater than the sum of the parts.
- » Because few cities—much less nations—can connect their financial

and scientific sectors, we are specializing in building unprecedented partnerships.

- » Because young scientists are rarely mentored in entrepreneurship, we have developed programs to provide them with role models and guidance in innovating.

The powerful drivers for these efforts are two extraordinary assets: our stellar staff with federal and regional innovation policy experience and our extraordinary network of non-staff experts. When the Russian Federation requested that the New York Academy of Sciences develop an insightful report on what works and what doesn’t in top-down national innovation strategies, our VP for Innovation & Sustainability, Dr. Karin Ezbiensky Pavese, put together a unique advisory panel of noted macroeconomists and people who had participated in national innovation efforts elsewhere (for a list, see p. ii of our Yaroslavl Roadmap, www.nyas.org/yaroslavlroadmap).

When Malaysian Prime Minister Najib requested that we create a Global Science & Innovation Advisory Council, we pulled together an extraordinarily knowledgeable group of 25 people who bring diverse and crucial experiences to the Minister’s table—not yet published, this group includes such notable leaders of innovation and entrepreneurship as Mikael Dolsten, Kiyoshi Kurokawa, Jeffrey Sachs, Annalee Saxenian, Vivek Wadhwa, and Nancy Zimpher.

Those are just two examples of our peerless network of experts who are driving national innovation policymaking. Another of our networks brought the experiences of the world’s foremost Knowledge Capitals to help Mayor Marcelo Ebrard develop innovation efforts in Mexico City. (A multimedia package of reports from the 2008 Science & Innova-

“The New York Academy of Sciences offers a unique platform of expertise, services, and initiatives... employed not only in our home city and state but in Mexico City, London, Barcelona, Moscow, and Shanghai.”

tion Week assembled by the Academy for the Mayor is still highly relevant: <http://bit.ly/mexicocityinnovation>). And yet a fourth network of leaders—one that we assembled from across New York to help the Governor develop regional innovation efforts—has led to our work developing an energy policy for the state.

Starting on page 19, you’ll see how each of the Academy’s programs contributes to a comprehensive package of assets that drives innovation—from our unique region-wide mentoring program, to the cutting-edge events that build relationships among diverse groups of scientists, to the investment network that is supporting entrepreneurs in our region. As the provocative innovation guru and friend of the Academy Vivek Wadhwa says, “The most important ingredient is the network.”

Ellis Rubinstein
President & CEO

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What Drives an Academic Entrepreneur?

New research seeks to understand a startup's definition of success.

by Christopher S. Hayter

As the developed world continues its slow climb out of the financial crisis, policymakers and companies increasingly look to research universities to generate new ideas and to contribute to innovation and economic development. Academic entrepreneurship—the formation of companies based on intellectual property generated by faculty members—is of particular interest given the publicized success of companies such as Lycos from Carnegie Mellon University and Silicon Graphics and Genentech from Stanford.

The recent and rapid growth of spinoffs is promising. According to the Association of University Technology Managers, the number of companies spun out of universities in the U.S. more than doubled between 1996 and 2005—from 200 to nearly 450. Research shows that these companies are not only more likely to attract venture capital and have an initial public offering, but, compared to non-university startups, they also have a higher propensity to survive over time. Consequently, numerous universities have created incubators, venture funds, and other programs to encourage spinoff establishment and growth.

While these developments are important, recent research exploring the motivations and growth aspirations of university academic entrepreneurs is cause to moderate our expectations of spinoffs for economic development.

Entrepreneurial motivation and ambition

Traditional economics research typically assumes that economic incentives—the so-called profit motive—are the primary reason why entrepreneurs establish and operate new companies. However, in the early 1970s a number of studies showed that individuals establish companies for multiple, interrelated, and non-financial reasons. For example, in surveys among female entrepreneurs in the 1990s, respondents were primarily motivated to establish a company for personal fulfillment, the desire to help others, and the flexibility to spend more time with their family.

Similar, albeit fewer, studies also examine the “growth ambitions” of entrepreneurs, asking, “to what extent do entrepreneurs make the choice to grow their company (or not)?” These studies also find that many entrepreneurs purposely do not grow their business in order to enjoy other, non-financial benefits of entrepreneurship such as independence and flexibility.

Very little research exists relating to the motivations and growth ambitions of academic entrepreneurs. A forthcoming article in the June edition of the *Journal of Technology Transfer*, a peer-reviewed scholarly publication relating to knowledge dissemination and commercialization, summarizes a year-long research project funded by the Ewing Marion Kauffman Foundation. The project sought to understand why academic entrepreneurs

within public universities across the United States establish their companies and their (post-establishment) definitions of success.

University research is far removed from the market and typically requires extensive development. Government and university leaders often assume that spinoffs are established to develop and commercialize this technology. The research project finds that the motivations and growth aspirations of nascent academic entrepreneurs are myriad and not solely focused on commercialization or financial gain.

Academic entrepreneurs in the sample were motivated to establish their business primarily as a vehicle to disseminate the results of their research beyond publication. As one respondent explained, “We are trying to get our technology out of the university.” Another unique faculty motivation for entrepreneurship is the influence of peers both within and outside a university. In addition to supportive faculty colleagues, professional managers, funders, technical assistance providers, and others provided influence.

Definitions of success

Other motivations mirrored faculty definitions of success. These areas include technology development, personal financial gain, public service, career enrichment, job creation, and skill enhancement. Academic entrepreneurs in the sample are certainly interested in finan-

cial gain but, unlike profit-maximizing actors, money is not their primary goal. They often see financial gain as compensation for the time they spend away from their academic jobs as opposed to an end in itself.

Interestingly, responses relating to technology development provide a more nuanced understanding of how academic entrepreneurs view spinoff success. One group of academic entrepreneurs describes “technology development” as an immediate emphasis on technology commercialization and the resources needed to do so. The other group describes it as a singular pursuit of funding not available within the university. Specifically, they see their spinoff as a platform for consulting and access to government grants, especially SBIR awards, but did not see a need for pursuing commercialization.

To be sure, building business systems and commercializing technology are complex endeavors subject to multiple in-

ternal and external factors. But related to the ambitions of academic entrepreneurs, it is important for policymakers to understand that many of the individuals in the study have little short-term interest in commercializing their technology.

Implications for policy

These findings do not diminish the actions of academic entrepreneurs uninterested in profit or rapid enterprise growth. After all, most of these individuals are productive public servants who attempt to balance the demands of establishing a company with their teaching, research, community service, and other faculty responsibilities within their respective non-profit educational institutions. However, these findings do hold important implications for spinoff support policies and programs that seek to spur economic development and job creation.

While recent policy discussions highlight the challenges of attracting seed and

venture capital, recruiting experienced, competent managers, and commercializing their technology, perhaps the most basic considerations are the motivations and ambitions of faculty entrepreneurs. It may be unrealistic to understand the motivations of academics in the early phases of spin off. However, among multiple entrepreneurial motivations and definitions of success, technology commercialization offers an attractive proxy for policymakers interested in innovation and economic development.

Christopher S. Hayter is Director, Innovation and Sustainability at the New York Academy of Sciences. Previously he was a visiting lecturer in public policy at the United States Coast Guard Academy. He holds a PhD in economics and technology policy from the George Washington University.

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— Paul Walker —

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— Paul Walker

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Probiotic Development and Regulation: The Science of Supplements



Probiotics have come a long way from humble precursors like Elie Metchnikoff's "sour milk diet," popularized in the early part of the 20th century. Today, the probiotic market already accounts for billions of dollars in global revenue and is poised for rapid and continued expansion.* Prompted by this groundswell, scientists, healthcare professionals, and government regulatory agencies have begun to more closely examine the process by which probiotics are validated, regulated, and, ultimately, marketed.

Probiotics: From Bench to Market presents an overview of a one-day conference held by the New York Academy of Sciences bringing together researchers and decision-makers from academia, industry, and government in efforts to foster greater multidisciplinary communication and collaboration within the probiotics industry. In particular, probiotics researchers and developers face a number of challenges including establishing standards for efficacy and evaluating health benefit claims. This report covers the basic mechanisms of action of microbiota on the body, includes cutting-edge research to quantify the effects of probiotics, outlines the regulatory procedures and practices for taking new probiotics to market, and summarizes the progress and research required to better understand gaps in our knowledge of probiotics. Preclinical research is important to set the stage for well-designed, hypothesis-driven human studies needed to fully understand the benefits of probiotics to human health, from both an industry and academic perspective. *Probiotics: From Bench to Market* underscores the need for further understanding of the role of probiotics in health and disease. Progress in the microbiology, physiology, and epidemiology of probiotics, paired with strong clinical trials, may result in novel probiotic-based treatment options for a variety of diseases.

The Science and Regulations of Probiotic Food and Supplement Product

Labeling provides detailed accounts of presentations and discussions from the eponymous symposium held June 12, 2010, at the New York Academy of Sciences. Partnering with the Academy to present the symposium were the U.S. Food and Drug Administration (FDA) and the U.S. Office of Dietary Supplements of the National Institutes of Health.

Orally administered probiotics may be marketed as dietary supplements, conventional foods, medical foods, and drugs (biologics). At present however, no probiotic product is licensed in the United States as a biological drug product for use in the treatment, prevention, cure, mitigation, or diagnosis of a specific human disease: foods and dietary supplements cannot carry these types of claims. However, researchers often study probiotic products—which are otherwise marketed as supplements and/or foods—for the purpose of treating or preventing a disease. Such products are considered therapeutic agents or investigational new drugs because dietary supplements and foods differ from therapeutic agents in how they are regulated by the FDA.

The Science and Regulations of Probiotic Food and Supplement Product Labeling addresses the current issues surrounding the substantiation of supplement structure and function claims and the appropriate labeling of supplement products. In addition to providing specific guidance from the FDA and other regulatory agencies, this report also includes discussion of the nomenclature for probiotic microorganisms and strains.

Together, *Probiotics: From Bench to Market* and *The Science and Regulations of Probiotic Food and Supplement Product Labeling* offer a timely and thorough examination of the current state of the science and regulation of probiotics. ◀

*www.prweb.com/releases/probiotics/food_supplements/prweb4494064.htm

Probiotics: From Bench to Market

By **Marguerite Klein** (National Institutes of Health, Bethesda, Maryland), **Mary Ellen Sanders** (Dairy and Food Culture Technologies, Centennial, Colorado), **Tri Duong** (Texas A&M University, College Station, Texas), and **Howard A. Young** (National Cancer Institute, National Institutes of Health, Bethesda, Maryland)
Volume 1212 S1, November 2010

The Science and Regulations of Probiotic Food and Supplement Product Labeling

By **Mary Ellen Sanders** (Dairy and Food Culture Technologies, Centennial, Colorado) and **Dan Levy** (U.S. Food and Drug Administration, College Park, Maryland)
Volume 1219 S1, February 2011

The Best of the Best in Pharmaceutical Science



The *Annals* volume *Pharmaceutical science to improve the human condition: Prix Galien 2010* includes scholarly summaries of scientific achievement by winners and finalist candidates of the 2010 Prix Galien USA, Prix Galien International, and Prix Galien Pro Bono Humanitarian Awards. Established in 1970 in honor of Galen, the father of medical science and modern pharmacology, the Prix Galien was created by the French pharmacist Roland Mehl, whose aim was to promote France's significant advances in pharmaceutical research. Mehl brought together a jury of eminent clinicians, toxicologists, pharmacologists, and pharmacists to select and honor the most important drugs introduced to the public and the most significant research teams in the field of pharmaceutical science. Since its introduction, the Prix Galien has expanded across Europe and Canada and is now the most prestigious award of its kind in eleven countries. In addition, an International

al Prix Galien is given each year, selected from previous winners. Regarded as the equivalent of the Nobel Prize in biopharmaceutical research, the Prix Galien recognizes outstanding achievements in improving the global human condition through the development of innovative drugs and other treatments.

Selected by a distinguished body of scientists including seven Nobel Prize laureates, winners and select finalists of the Prix Galien represent biotechnical advances poised to combat a wide range of diseases and viruses. The Prix Galien USA committee judges which among the candidates, independent of any category, is the Best Pharmaceutical Agent (i.e. small molecule), the Best Biotechnology Product, and the Best Medical Technology approved by the FDA in the past ten years. As few as one or as many as three prizes may be awarded in each of these categories. For the Pro Bono Humanitarian Award, the committee follows a century-old example set in Sweden by rewarding excellence and novelty in individuals who have served humanity. The Pro Bono Humanitarian Award brings a unique focus to the intersection between science, business, and politics by recognizing exemplary and innovative efforts to improve the human condition. In 2010, this award was presented by Elie Wiesel, a member of the Prix Galien Committee.

The Prix Galien is a movement with a mandate to foster, recognize, and reward excellence in scientific innovation aimed at improving the state of human health. Building on a stellar committee of Nobel laureates, the Prix Galien manages an independent, cross-functional, and geographically diverse program of events and sponsorships to brand the "the best of the best" in new medicines and diagnostics.* The scope is global and the com-

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Volume 1221, March 2011

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mitment to progress in medicine is both measurable and concrete. The Prix Galien expresses this through the establishment of productive relationships and lasting bridges between commercial research enterprises and local communities engaged in public policy, science, finance, academic research, and the media. The outcome is guided by the principle that underpins the conduct of science itself: successful innovation, where financing, physical assets, knowledge, and skills are combined from many sources to move new ideas quickly from the bench to the bedside, on behalf of patients everywhere.

Pharmaceutical science to improve the human condition: Prix Galien 2010

Volume 1222, March 2011 // ISBN 978-1-57331-835-8



Elie Wiesel, Ban Ki-moon, William J. Clinton, and Philippe Douste-Blazy at the 2010 Prix Galien ceremony at the American Museum of Natural History in New York City, September 28, 2010.

Contributions from the biopharmaceutical industry in *Pharmaceutical science to improve the human condition: Prix Galien 2010* include winners of the Best Pharmaceutical Agent (Novartis, Coartem™), the Best Biotechnology Product (Merck and Co, Inc., RotaTeq™), and the Best Medical Technology (Luminex Corp., xTAG™), winners of the Prix Galien International Award (Amgen, Nplate™ and Bayer Schering Pharma, Xarelto™), finalist candidates for these categories, and the esteemed Pro Bono Humanitarian award winners William J. Clinton, Former President of the United States and President of the Clinton Health Initiative, and Dr. Philippe Douste-Blazy, President of UNICTAID, with a special introduction by Secretary-General of the United Nations Ban Ki-moon. These individuals best embody humanitarianism and therapeutic promise in global healthcare problems.

The Prix Galien stands for a new generation of innovators representing diverse sectors in health and the emerging markets of the developing world who aim for better cross-cultural contacts, harmonized regulation, internal business process improvements, new information technologies, and effective public-private partnerships that remove barriers to the commercialization of good medicines

and expand access to these benefits to all who need them. ◀

*www.prix-galien-usa.com

Surveying the Landscape of Addiction



During the last few decades, a major shift has occurred in our understanding of ad-

diction, such that conditions like alcoholism are now characterized as significant, multi-componential disorders and disease states. Consequently, the addiction research field has broadened immensely to encompass work on epidemiology, typology, and, perhaps most importantly, the factors that lead to the development of addiction disorders.

Annals has published the third volume in its *Addiction Reviews* series, which chronicles advances in addiction research and treatment and documents the broad interest in multiple aspects of this complex field. Each year, *Addiction Reviews* brings together some of the very best minds in the field of addiction to present and review the latest ideas and issues on the topic.

The current volume consists of reviews that cover a range of subjects, with authorship from the United States, the European Union, and Asia. The 40th anniversary of the National Institute on Alcohol Abuse and Alcoholism (NIAAA) provided a great opportunity for a set of papers on the NIAAA, imaging, binge drinking, and models for alcoholic hepatic damage.

The volume also includes reviews exploring a spectrum of research paradigms from current, viable animal models of alcohol-related conditions to brain-based examinations of the monoaminergic neuronal and epigenetic influences to limbic system-level functioning and processing of reward. Providing a glimpse of the new horizon of treatment, this volume incorporates reviews of pharmacological advances in therapeutics for addictive disorders.

The authoritative reviews in the 2011 installment of *Addiction Reviews* are written from the perspectives of academia, U.S. and Asian government-sponsored laboratories, research institutes, and private companies. This series continues to map new territory in the substrates of addiction and provides a framework for future investigations in this swiftly developing field. ◀

Addiction Reviews

Edited by **George R. Uhl** (National Institutes of Health Intramural Research Program, National Institute on Drug Abuse, Bethesda, Maryland)

Volume 1216, January 2011 // ISBN 978-1-57331-812-9

Inside the Academy

Reports from the directors of Academy programs and news about Academy activities. Read more online at www.nyas.org/academynews.



Academy Gains Headway on New Nutrition Science Initiative

Following the announcement in November of the launch of The Sackler Institute for Nutrition Science, Academy executives report that they are making progress on several fronts. Inaugural members of the public-private partnership of the Institute convened and agreed to assemble steering committees to develop programming around three critical areas of nutrition science: overnutrition, undernutrition, and monitoring & evaluation of nutrition interventions. Scientists from various sectors across the globe have now been invited to participate on those steering committees.

Separately, in collaboration with the World Health Organization and other organizations, the Academy has organized a Nutrition Science Research Advisory Group and tasked it to scope the nutrition science arena, identify research topics immediately relevant to today's nutrition challenges, and leverage basic and applied research to create a strategic, prioritized agenda detailing critical nutrition science research topics. The group conferred for the first time in February and the first live meeting was scheduled for April. For each prioritized nutrition research area

identified by the group, a topic-specific Working Group will be assembled and tasked with developing and publishing roadmaps for researchers and drafting implementation strategies.

Academy scientists have also been busy coordinating events and creating nutrition science content for dissemination. Several nutrition-related eBriefings are now available on the Academy website, and two scholarly review articles on nutrition science meetings are available free to the public from the *Annals of the New York Academy of Sciences*: Volume 1212, The Year in Diabetes and Obesity, and Volume 1212 S1, Probiotics: From Bench to Market.

To find out more or to register for two upcoming nutrition science events—Brain vs. Gut: Can Appetite be Restrained? on May 2, and Diabetes and Oral Disease: Implications for Health Professionals on May 4—please visit www.nyas.org/sacklerinstitute.

Scientists Without Borders Awards \$10,000 Nutrition Challenge Prize

Scientists Without Borders announced three winning solutions in its \$10,000 Maternal Health and Nutrition open innovation challenge. Solvers located in New Zealand, India, and the US will share the cash prize for their innovative ideas for developing significantly more effective interventions to address the critical problem of folic acid deficiency in women of child-bearing age in the developing world, which contributes to high rates of infant mortality and birth defects. The Scientists Without Borders challenge, issued in November 2010, sought simple and low-cost methods to enable women to easily supplement or fortify staple foods with folic acid at the home or community level.

The winners were selected from among 64 submissions entered over a 30-day period from teams and individuals in 21 different countries—over a third of the submissions came from Solvers located in the developing world. The first place solu-

tion was submitted by Carlos Miranda of New Zealand, a manager at a pharmaceutical company, who proposed a method of triple fortifying salt. The second place solution was submitted by Pushpakaran K. Thiyadi of India, a freelance researcher and consultant, who proposed an idea for microencapsulation of folic acid. The third place solution was submitted by a team of graduate students from Northwestern University—comprised of individuals hailing from Albania, Canada, Russia, and Vietnam—who proposed leveraging microfinance networks as a distribution mechanism.

To develop the challenge and select the winners, Scientists Without Borders convened an independent Advisory Panel of three of the world's leading nutrition science and policy experts, and facilitated a novel collaboration among them. The panelists were Zulfiqar Bhutta of Aga Khan University in Pakistan; Eileen Kennedy, Dean of the Gerald and Dorothy R. Friedman School of Nutrition Science & Policy at Tufts University; and Ricardo Uauy, professor at the London School of Hygiene & Tropical Medicine, and former president of the International Union of Nutritional Sciences.

To harness the diverse insights and expertise of as many creative problem-solvers as possible, Scientists Without Borders disseminated the challenge on its unique, free web-based platform and to its worldwide network. It also partnered with InnoCentive, the leading company in open innovation, to access its pool of 200,000 expert Solvers. For sponsorship of the prize amount, Scientists Without Borders partnered with PepsiCo.

NYAS Network to Bring S&T Innovation Advice to Malaysia

The Academy is working with the government of Malaysia to improve innovation and prosperity within the rapidly growing nation. As part of the long-term partnership, the Academy is putting together a Global Science and Innovation Advisory Council to advise the Prime



Prime Minister Najib flanked by (from left) MIGHT President Yusoff, Science Advisor Zakri, NYAS President Rubinstein, and the Malaysian Academy of Sciences' retired VP Lee and President Tajuddin

Minister of Malaysia, Amat Berhormat Najib Tun Razak, his staff, and the Malaysian Industry-Government Group for High Technology (MIGHT). Comprised of more than 25 leaders and experts from industry, government, and academia including NYAS Governors Mikael Dolsten, Rajendra Pachauri, Jeffrey Sachs, Torsten Weisel, and Nancy Zimpher, the purpose of the Council is to strengthen the New Economic Model, a long-term strategy to develop the Malaysian economy, by building and leveraging the country's science and technology assets. The Prime Minister will convene the inaugural meeting of the Council on May 17 in New York. After the meeting, the Academy will play an active role in implementing the Council's recommendations.

NYAS K-12 Initiative Launches Science Educators' Portal

The Academy recently unveiled Pathways to Science (<http://education.nyas.org>), a web portal designed to provide science educators with access to stellar scientific content and to enable teachers to meet and converse online with science education colleagues worldwide. The portal will, for the first time, enable the science education community to freely access the proprietary digital resources of the New York Academy of Sciences, including hundreds of multimedia reports from cutting-edge scientific meetings. Users will have access to digital multimedia recordings of live events and discussion boards that extend the conversation from the Academy's auditorium to the web. Teachers can also use the site to register for Academy events and webinars. For easy searching and inspiration, scientific content from the

Academy is organized by subject area and grade level. Other areas of the web portal are designed to help parents, teachers, and afterschool programs find great science teaching resources for any setting.

The web portal also features 15 unique blogs authored by science education leaders, a Teachers Forum discussion board, links to additional resources for teachers, parents, and afterschool programmers, and an exhaustive calendar of upcoming science, math, technology, and engineering events for teachers in the New York metro region. The diverse group of bloggers includes teachers, teacher educators, and scientists discussing pedagogy, scientific content, professionalism of teachers, education policy, and other topics of global interest to science teachers. Guest bloggers will be invited to submit commentary about topical issues in science education.

Funding for the Science Education Initiative and Pathways to Science is provided by the Verizon Foundation, the philanthropic arm of Verizon. "The Pathways to Science program uses the extraordinary capacity of broadband to enhance the teaching and learning of science in New York," says Verizon New York Region President Jim Gerace. "Verizon is proud to partner with the Academy on this important mission."

Academy Staff Members Make News, Win Awards

The Academy bade a fond farewell to VP and Scientific Director **Stacie Bloom**, who has been appointed Executive Director of a Neuroscience Institute being created at NYU Langone Medical Center. Academy Director, Public Outreach, **Adrienne Burke** also moved on—to the Yale School

of Engineering & Applied Science as Director External Relations & Special Programs. Director, Innovation & Sustainability **Chris Hayter's** paper "In Search of the Profit-maximizing Actor: Motivations and Definitions of Success from Nascent Academic Entrepreneurs" was accepted for publication in the June edition of the *Journal of Technology Transfer*. VP Innovation & Sustainability **Karin Ezbiansky Pavese** accepted an appointment as adjunct professor at SUNY College of Environmental Science & Forestry where she will collaborate with faculty and staff on grant proposals, projects, and programs and take advantage of opportunities to teach and lecture. Pavese assumes the role in conjunction with her current NYAS position. **Shaifali Puri**, executive director of Scientists Without Borders, was included in Crain's New York Business 2011 "40 under Forty" list of superachieving young New Yorkers. The writers of the Academy's **Science & the City** Twitter feed were named by TIME Magazine among the World's Top Tweeters. For "shaping the conversation," @sciandthecity was listed among the top 140, and was ranked number one in health and science.

NYAS Partner PharmaMar Searches the Sea for New Cancer Therapies

Substances produced by living organisms found in nature—so-called "natural products"—have played a critical role in the development of drugs for life-threatening conditions. The anticancer agent Taxol was sourced from a tree, penicillin from a fungus, and a number of recent breakthroughs have resulted in the development and approval of anticancer drugs derived from marine sources such as coral and sponges.

To raise awareness about the vast potential of marine- and natural products-based biotechnology in the discovery and development of new drugs for human diseases, the Academy and the marine-based drug development company Zeltia S.A. recently established a partnership. Arising from this partnership will be the May 20 symposium **New Frontiers in Marine Drug Discovery**, addressing the tremendous potential of the marine ecosystem as a source for new therapeutically useful compounds.

To learn more about the pioneering efforts in the translation of small molecules of natural marine origin into first-in-class

and life-changing therapies, the Academy sat down with Roberto Weinmann, COO of the Zeltia subsidiary, PharmaMar.

NYAS: What inspired you to search underwater for medicines?

Weinmann: If you think about the number of species on earth, 75 percent of the biodiversity is underwater. In terms of evolution, not everything that was underwater made it to land, so you have much more variability in the sea.

NYAS: How do you find marine-based compounds?

Weinmann: We undertake 8-10 expeditions every year with a team of highly trained divers, zoologists, and botanists. They can go to a depth of about 200 feet. The samples are photographed on the boat, then photographed again on land, and they're frozen in dry ice. We know the exact GPS coordinates for every sample's source, as well as the temperature and time of day it was collected. We might stay for three weeks in a place like Indonesia or the Philippines collecting samples before shipping a big package to Spain.

NYAS: And then what?

Weinmann: We grind them up with different solvents to extract molecules which are more lipid containing or more aqueous soluble molecules. We make an extract, concentrate it, and then test it on cells. If it's potent we will make dilutions. Based on the dilutions, you can see whether a compound is potent or not—whether it has anti-tumor activity. Let's say a 10,000-fold dilution or a million-fold dilution of the compound is still active. Then try to purify the compound and use mass spectrometry methods to determine its exact mass in order to elucidate the structure.

NYAS: How many samples have you collected from the sea, and how many of those are potential therapies?

Weinmann: We have a library of about 100,000 samples stored at PharmaMar that we have collected through the years. Because we cannot depend on collecting any of those same samples again, we must be able to synthesize them in the lab. If we cannot make a compound synthetically, it's killed. Also, the compound must be

potent, we must be able to determine the structure, and we must be able to determine the mechanism of action and confirm that it does not already exist in another drug. Many fall overboard. After 20 years, we have six compounds in clinical trials right now.

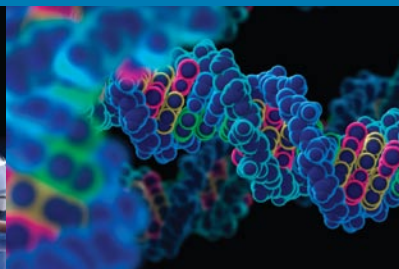
NYAS: But you've had success creating an ovarian cancer therapy from a marine compound?

Weinmann: Yes. Yondelis is a drug for ovarian cancer and soft tissue sarcoma extracted from the sea squirt *Ecteinascidia turbinata* that is being produced and used in Europe and is being evaluated by the FDA. Harvard chemist E.J. Corey was awarded the Nobel Prize for its synthesis. His process required 54 steps, which was not commercially feasible, but our chemists reduced its synthesis to 17 steps. That was a big breakthrough.

For more information on the May 20 symposium, *New Frontiers in Marine Drug Discovery*, see www.nyas.org/marinebiomed.

THE NEW YORK ACADEMY OF SCIENCES

UPCOMING 2011 CONFERENCES



New Frontiers in Marine Drug Discovery

May 20, 2011 | www.nyas.org/marinebiomed

Sixth International Congress on Shwachman-Diamond Syndrome

June 28–30, 2011 | www.nyas.org/SDS

Imaging, Visualization and Simulation: New Tools for Technology and Healthcare

June 17, 2011 | www.nyas.org/ImagingTech

Animal Models and Their Value in Predicting Efficacy and Toxicity

September 15–16, 2011 | www.nyas.org/AnimalModels

Cognitive Dysfunction in Multiple Sclerosis: New Approaches to Diagnosis and Treatment

June 21–23, 2011 | www.nyas.org/mscognition

Evolving Challenges in Promoting Cardiovascular Health

November 4–5, 2011 · Spain | www.nyas.org/Cardiovascular

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Academy eBriefings

*eBriefings are online multimedia reports documenting recent Academy events. Find new and noteworthy ones previewed here and more at www.nyas.org/eBriefings.
Compiled by Jamie Kass and Stephanie Kelly*

Building Better Brains: Neural Prosthetics and Beyond

Neural prosthetics offer the promise of what was once unthinkable, the restoration of perceptive or movement ability in those who have lost it. But these devices offer much more than that. From September 23 through 25, 2010, researchers in all areas of the neural prosthetics field converged at the Building Better Brains: Neural Prosthetics and Beyond conference to examine ongoing work and the future of this exciting research avenue.

Though promising, neural prosthetics, which interact directly with an individual's nervous system to enhance function, have not yet achieved widespread use as human therapies. Among other obstacles, an inadequate understanding of the fundamental mechanisms of brain action has so far hampered efforts to develop implantable neural devices. Some speakers at this conference presented their work aimed at advancing the basic neurobiological research that undergirds neural prosthetic applications. Their research has investigated, among many other areas, the mechanisms of neural plasticity, the utility of electrical signals in the high frequency range, and the defining features of signals involved in movement planning and even in high level cognitive behaviors such as emotional control and language use.

Technological and bioengineering hurdles also present a significant barrier to the widespread use of neural prosthetics in a clinical setting. Many of the conference speakers who work directly with neural prosthetics in non-human primates or in clinical trials lamented problems with the reliability and fidelity of neural recordings made with existing devices. Not only that, but current devices have an effective lifetime of only a few years. However, conference participants highlighted the great strides that have been made in recent years by improving existing electrodes to reduce damage to the surrounding cells and by moving in new directions to create wholly different types of recording



devices. Any devices that do meet these high benchmarks of functionality will also need to meet stringent safety criteria.

Throughout the course of the conference, it was clear that neural prosthetics have the potential not only to mimic “ordinary” motor function more closely than ever before, but also to restore neurobiological connections, to reanimate paralyzed limbs by stimulating muscles directly, to facilitate the reorganization of neural connections to “work around” damaged areas, to improve recovery from some neuropsychological disorders, and much more.

Researchers emphasized that these possibilities are only realized through the intersection of groundbreaking fundamental neuroscience research and innovative technological development, all of which must be grounded in critical analysis of the clinical, social, and ethical impact of the work. As presenters indicated during the conference, this analysis has already begun—with research into the histological impact of recording devices, the differential impact of ECoG- versus EEG-based brain-computer interfaces, the accuracy of yes or no responses from individuals in a vegetative state, and into the ethical ramifications of enhancing neural function in previously unimpaired individuals, to name a few areas speakers discussed.

The use and development of neural prosthetics will continue to raise difficult ethical and scientific questions, but, as the speakers in this conference demonstrated, these questions are often just as interesting, fruitful, and challenging as they are potentially confounding.

—Stephanie Kelly

On the Web

Full eBriefing by Dr. Heather Berlin at
www.nyas.org/BetterBrains-eB

Net Zero Energy Buildings: Moving from Demonstration Projects to the Mainstream



The green building community has made significant progress in designing and building energy neutral or ‘net-zero energy buildings’ (nZEBs), but these buildings are rare and are generally relatively low-intensity-use structures under 15,000 square feet. Now the community is developing strategies to scale up and to make the buildings more commonplace within the industry. On January 25, 2011, three speakers presented inspiring projects that are achieving new levels of sustainability in a challenging marketplace. They provided insights into metrics of success, best practices, trends, and prospects in the realm of low/net-zero energy building development.

Paul Torcellini, a commercial buildings researcher at the National Renewable

Energy Laboratory (NREL), described the goals and vision that guided the design of the NREL-RSF (NREL-Research Support Facility) building. NREL preferred a design-build bid that would meet as many goals as possible from NREL’s list of priorities. The energy goals held particular significance. According to Torcellini, the success of the NREL-RSF design-build process was that it provided performance-based guidelines rather than design solutions—thus allowing the design-build contractors to be creative and develop their designs within the performance guidelines. The resulting building, which represents a great step forward in the net-zero energy realm, was constructed with the budget typical for a regular office building. Most of that budget was spent on design and modeling rather than on construction.

The value of such front-loaded design process was echoed by Philip Macey who leads Haselden Construction’s sustainable building division. Macey noted that the design form and function of the NREL-RSF were modeled to meet the energy goal. This required designing the building’s components for synergistic roles and multiple uses. Macey explained that designing with a ‘multi-purpose’ concept for a building’s elements was not new: architects have been applying the same idea to work within space constraints, but the difference this time was that the constraint was an unequivocal and precise energy savings goal. Macey articulated that being goal-oriented from the beginning was crucial to maintaining control, achieving those goals, and reaching project completion within budget.

Bert Gregory, Chairman and CEO of Mithun, expanded the discussion to neighborhoods, which can offer benefits unavailable to single buildings. For instance, integrating water systems is better achieved at the district scale. Gregory outlined several sustainable urban design projects where the goals varied from car-

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www.nyas.org/WhatYouEat-eB

bon neutrality, to water neutrality, and, in the case of Mithun’s Lloyd Crossing project, to having a neighborhood that has an environmental footprint equivalent to that of a native Northwest forest by 2050. The Lloyd Crossing project aims to transform the Lloyd district study area, a 35-block area in Portland, Oregon, into an environmentally and financially sustainable community. In all his examples, the goals and performance metrics were stated at the outset and were followed by the development of strategies to achieve these goals within constraints such as zoning regulations, electricity demand reduction capabilities, renewable energy generation capacity, resource recovery, governance models, financing, and human behavior. According to Gregory, when it comes to achieving the energy saving goals of demand-side management initiatives, human behavior is the “final frontier.”

—Jamie Kass

On the Web

Full eBriefing by Michel Wahome at
www.nyas.org/NetZero2011-eB

The Future of Science Education in New York State



In 2011 New York State will need more than 2,100 science, technology, engineering, and mathematics (STEM) teachers. At its current rate of teacher training, however, the state will meet only a third of that demand. Beyond a shortage of teachers, stakeholders including policy makers, administrators, teachers, parents, and students alike must grapple with everything from outdated models of teacher education to the promise of new technology in the classroom. On January 11, 2011, at the New York Academy of Sciences, important education policymakers and administrators in the state participated in a panel discussion about the future of education in New York.

Panelists were optimistic about the possibilities represented by the state's recent injection of federal funds through the Race to the Top competition. They cited the investment in programs to improve teacher preparation and retention, focused especially in underserved schools in rural and urban areas, as an important outcome of the funding. However, change must occur on the cultural level as well as on the fiscal and policy levels, speakers stressed. Fundamentally improving the preparation and retention of science teachers will require the transformation of teaching into "a more appealing, rigor-

ous, and practice-based profession," noted one panelist.

Panelists also discussed cultural divides between K-12 and higher education and, in teacher education programs, between Arts & Sciences faculty and Education faculty. Structural changes will be needed to counter these long-standing divides and to facilitate much needed conversations between those who ensure science competency and those who certify teaching competency. Several panelists stressed that since "science instruction is a literacy problem and a numeracy problem as much as it is a science content problem," K-12 schools will also need to create space for interdisciplinary learning that emphasizes common skills across disciplines.

The discussion reached several questions fundamental to nationwide education reform. Panelists considered, among other important issues, how (and whether) to provide college preparation for students not already at that level, how to scale up good ideas from single-school models, and what the space of learning might look like in our technological future.

—Stephanie Kelly

Super-Sized World: The Global Obesity Epidemic



Overweight and obesity, risk factors for type 2 diabetes, cardiovascular disease, hypertension, stroke, and certain forms of cancer, are responsible for a significant portion of the global burden of chronic disease. These problems represent a difficult challenge to public health experts and

policymakers not just in the U.S. and other comparatively wealthy countries, but also in developing nations where their impact is compounded by the effects of poor infrastructure, persistent nutrient and even calorie deficits, and rapidly changing economic and demographic features accompanied by dramatic dietary adjustments.

On December 9, 2010, the New York Academy of Sciences, the Sackler Institute for Nutrition Science, and the Johns Hopkins Bloomberg School of Public Health convened a panel of experts in public health to discuss topics ranging from current scientific understandings of overweight and obesity to the clinical, economic, and health policy initiatives that might help to stem the tide of this dangerous epidemic.

In general, energy balance—the ratio of energy consumed to energy used—dictates how much fat a person's body retains. Disruption of energy balance can have a variety of causes. Genes and genetic variation can account for up to 80% of the variation in the amount of fat a person has relative to others with the same energy balance. Environmental factors, such as an abundance of cheap, high-fat, calorie-dense foods, also play a big role, and researchers believe these factors interact with a person's genes. Another crucial factor is the fetal environment. Epigenetic changes that may result from a lack of nutrients or calories during fetal development may later contribute to weight gain and obesity in an environment of excess calorie consumption.

Speakers emphasized the need for a reconceptualization of the way public health policy efforts are marshaled to combat the epidemic. They proposed multi-faceted interventions that recognize the intersections of various causes of disease, a new policy-oriented framework for scientific research, and policy measures to change the kinds of food and physical activity choices that are seen as the norm. All these efforts will require collaboration between public health experts, government officials, basic science researchers, and community representatives.

—Jamie Kass

On the Web

Full eBriefing by Dr. Meghan Groome at www.nyas.org/NewYork-eB

On the Web

Full eBriefing by Keith Mulvihill at www.nyas.org/SuperSized-eB

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Seth Berkley

Academy Governor and President, CEO and Founder of the International AIDS Vaccine Initiative, Seth Berkley, has been appointed CEO of the Global Alliance

for Vaccines and Immunization, an organization that increases access to immunization in poor countries. Since Berkley founded IAVI in 1996, the organization has mobilized \$897 million in resources for AIDS vaccine R&D, advocated to keep the development of an AIDS vaccine on the international agenda, established and maintained a network connecting clinical research centers in Africa and India, tested nine AIDS vaccine candidates in clinical trials in 11 countries, and made significant contributions toward solving the problem of how to design vaccines that elicit antibodies that neutralize a broad range of variants of HIV. Berkley is expected to remain in his position at IAVI through June.



Titia de Lange

An eight-year member and a fellow of the Academy, Titia de Lange has been awarded the \$100,000 Vilcek Prize for Biomedical Science. Honored for her work

with telomeres, de Lange is the Leon Hess Professor and head of the Laboratory of Cell Biology at the Rockefeller University.

The Vilcek Foundation's mission, formulated 10 years ago by Academy member Jan Vilcek and his wife Marica Vilcek, is to honor, celebrate, and publicize the contributions of foreign-born individuals in the United States. Says Vilcek, "Each year, as we honor the individual achievements of a small group of scientists and artists, by extension we also pay tribute to those who came before them and those

who will follow—the many thousands who made this country a leader in science and the arts, and will continue to do so into the future." Titia de Lange is a native of the Netherlands.

The Vilcek Prize winners each receive a \$100,000 cash award and a trophy created by noted designer Stefan Sagmeister. Sitting on the Vilcek Foundation's prize selection juries are experts and leaders in their fields. This year, the biomedical jury included eminent scientists from the New York University School of Medicine, the Massachusetts Institute of Technology, the Salk Institute, Rockefeller University, and the Memorial Sloan-Kettering Cancer Center.



Anthony Carpi

Academy member and John Jay College of Criminal Justice Professor of Environmental Toxicology Anthony Carpi was awarded the Presidential Award for

Excellence in Science, Mathematics, and Engineering Mentoring in a ceremony at the White House on January 27. Carpi was nominated by John Jay College and selected by the National Science Foundation for his individual mentoring work and for creating an undergraduate research initiative that creates opportunities for forensic science students to engage in faculty-mentored research projects.

President Obama named 11 individuals and 4 organizations as recipients of the prestigious Presidential Awards for Excellence in Science, Mathematics, and Engineering Mentoring. John Jay College President Jeremy Travis credited Carpi with having transformed the science program at John Jay and establishing strategies aimed at mentoring young scientists. Carpi is co-founder of the school's Math & Science Resource Center and science peer mentoring program that serves thousands of students per semester. Both programs have helped substantially to re-

duce attrition from the science program in the first two years of the major. Professor Carpi cofounded the Program for Research Initiatives for Science Majors, and has personally mentored 32 students, increasing the number of undergraduates, and especially minority students, who have moved on from John Jay to obtain master's and doctoral degrees.

Duong, Frye, Gibson, and Sanders

Several Academy members who presented during the Summer 2010 Academy conference "Probiotics: From Bench to Market" are featured in a new documentary film. *Microwarriors: The Power of Probiotics* was produced by Health Point Productions to take viewers "inside the world" of these beneficial bacteria, explaining their discovery in the early 20th century, how they're tested and produced, and the latest scientific research from some of the world's top probiotic experts. Scientists, including Academy members Tri Duong, Texas A&M University; Cary P. Frye, International Dairy Foods Association; Glenn Gibson, University of Reading; and Mary Ellen Sanders, Dairy and Food Culture Technologies, discuss the effectiveness of probiotics for digestive health and describe how probiotics support the immune system and lessen allergy symptoms, whether all probiotic strains are equally beneficial, whether probiotics are safe for infants and children, and their connection to maintaining weight and preventing obesity.

The Academy conference "Probiotics: From Bench to Market" was jointly presented by The Dannon Company and The Sackler Institute for Nutrition Science at the New York Academy of Sciences, with support from the National Institute of Allergy and Infectious Diseases. Materials available from the Academy include a conference eBriefing, a conference podcast, an open access Meeting Report in the *Annals of the New York Academy of Sciences*, and the conference print proceedings available for free download at www.nyas.org/Probiotics. See the movie trailer at www.microwarriorsmovie.com.

Building an Economic Engine? First, Overhaul Student and Teacher Education

by Marilyn Larkin



When Nancy Zimpher entered the one-room school house in the foothills of the Ozarks, she knew she was in trouble. “I was the sole teacher for four grades meshed into one classroom. The disconnect between how I had been prepared—as an English teacher—and what I was expected to do in the classroom couldn’t have been clearer,” Zimpher recalls.

“I hadn’t developed the disciplinary skills to stretch across that range of subjects. I didn’t know as much as I needed to know about managing a classroom. I also didn’t know enough about how young people developed cognitively and emotionally and socially at different grade levels. And I didn’t know how to provide for students the kinds of extracurricular and home life assistance that were required in what we now call a ‘high-needs’ school.”

That experience, in the early 1970s, helped shape Zimpher’s career, which ultimately took her out of the classroom and into the spotlight as a passionate advocate and respected leader in transforming education for students as well as teachers. In her current role as Chancellor of the State University of New York (SUNY), a post she accepted in 2009, Zimpher has continued her efforts to revitalize the educational system, focusing on New York State as a model for the nation.

“It’s not unusual for teachers to be teaching out of their depth and out of their discipline, often certified on some emergency basis to teach in some of the most challenging environments. This indicates that the supply chain is quite broken,” Zimpher says. “In terms of solutions, what started as a little ball rolling down the hill has become a huge issue that is coming together at this stage of my professional career through my work at SUNY, where we’re creating models that enable a very different approach to education.”

Education pipeline

At the heart of Zimpher’s vision is an “education pipeline” that encompasses “everything people are learning at home and in schools, from the time they’re born through college graduation and as they pursue a career,” she explains. “We need to make a more connected pathway, supporting students not only in the classroom, but outside of school, in their families, in their neighborhoods, and in the whole social structure of our communities,” she says. This systemic approach is exemplified in two recent initiatives she spearheaded: Strive and the National Cradle to Career Network.

Strive, which Zimpher helped launch in Ohio when she was president of the University of Cincinnati, has since been adopted by a number of other cities across the United States, including Houston, Richmond, and Portland, Ore. The initiative brings together, among others, teachers, school district superintendents, college and university presidents, business leaders, and early childhood advocates—experts who usually work in their own “silos,” she says.

By encouraging these individuals to work together across sectors, Strive aims to ensure that children are better prepared for school, supported inside and outside of school, succeed academically, enroll in some form of postsecondary education, graduate and embark on a career. Its most recent “report card” and other data (see “Further Reading”) show that in participating cities, Strive implementation has increased academic achievement, kindergarten preparedness, and college graduation rates.

The National Cradle to Career Network, launched in February 2011, is modeled after Strive, bringing together parents, teachers, administrators, and thought leaders from pre-kindergarten

through higher education, as well as representatives from industry, community organizations, and government. For the prototype network, which is being developed in and around Albany,

Nancy Zimpher

Chancellor, The State University of New York,
the nation's largest comprehensive public
university system

NYAS Governor since: 2009

PhD: teacher education and higher education
administration, the Ohio State University

Extracurricular activities: Water color painting
and playing music on the baritone ukulele,
dulcimer, and guitar

Further reading:

The Power of SUNY strategic plan:
http://bit.ly/nyasmagspring2011_0
Blue Ribbon Panel on Clinical Preparation and
Partnerships for Improved Student Learning:
http://bit.ly/nyasmagspring2011_1
Strive report card:
http://bit.ly/nyasmagspring2011_2
Strive data:
http://bit.ly/nyasmagspring2011_3

SUNY will collaborate with the Albany city school district, several regional SUNY campuses, and local governments and nonprofit organizations. Similar networks will soon be underway in Buffalo and in the borough of Brooklyn, in New York City.

“Clinical” curriculum

Zimpher emphasizes that teachers “are in a practice-based profession like doctors, nurs-

es, and clinical psychologists, and they need a whole series of on-campus laboratory experiences, simulations, and video demonstrations to begin to understand the culture of specific schools and classrooms. Even when they’re sent out to a school to observe, they typically don’t know what to look for. Therefore, they cannot see.”

Convinced that clinical preparation should be the “center-piece” of teacher education, Zimpher agreed to co-chair with former Colorado Commissioner of Education Dwight Jones the Blue Ribbon Panel on Clinical Preparation and Partnerships for Improved Student Learning, convened by the National Council for Accreditation of Teacher Education in November 2010. In line with Zimpher’s approach, the expert panel called for teacher education to be “turned upside down” and refocused on clinical practice; as in the medical preparation model, “teachers, mentors, and coaches, and teacher interns and residents [will] work together as part of teams.” Stronger oversight by states and accreditation agencies is also recommended to ensure that teacher-preparation programs become more accountable.

Thus far, New York, California, Colorado, Louisiana, Maryland, Ohio, Oregon, and Tennessee have agreed to implement the panel’s recommendations.

Power of SUNY...and NYAS

Shortly after she came on board at SUNY, Zimpher launched a strategic plan, called The Power of SUNY, with the goal of making the university system an “economic engine” for New York State. Not surprisingly, a “seamless education pipeline” is a key objective. The plan highlights the increasing need for workers with knowledge and skills in science, technology, engineering,

and mathematics (STEM)—the very areas in which performance drops as students move from elementary school through high school.

SUNY is the largest higher education system in the United States, with more than 467,000 students on 64 campuses. Its breadth, scope, and potential are what drew Zimpher to her current post. “Over my 40 years in higher education, I’ve seen a great deal of innovation, but it all had the look of a cottage industry—boutique innovations that are very difficult to take to scale,” she says. “I saw coming to SUNY as a one-of-a-kind opportunity to take innovation to scale at every level—in education, in the sciences, in art, and in health care. My greatest desire for an accomplishment is to realize the power of this complex, diverse system by implementing innovative ideas across multiple campuses.”

That aspiration propelled Zimpher to join the New York Academy of Sciences’ Board of Governors, largely because of the Academy’s “strong commitment to education and, in particular, to the STEM disciplines,” she says. “Linking SUNY’s many scientists, faculty, and graduate students to the Academy’s scientific community has the potential to yield mutual benefits on a huge scale.” (For more on how NYAS is helping Zimpher to strengthen the SUNY economic engine, see “How to Build an Innovation Ecosystem,” p.19.)

Zimpher also was attracted to the Academy’s international projects and connections. “These dovetail with our desire to better coordinate SUNY’s global affairs and outreach,” she explains. “Many people talk very vehemently about how America’s educational system lags behind those of other countries. Some of what ails our system is being taken care of in other systems. Nevertheless, as word got out about our cradle-to-career partnerships, people in other countries learned about them on the web, and have begun to solicit our advice. So, I’m thinking that all educational systems around the world get pieces of the comprehensive picture right. But the whole picture—the need to imbue the education process with academic, cultural, and social investments in our future—is something that everybody is challenged with. And that means we have an opportunity to be a model.”

Zimpher’s passion for teaching and revamping the educational system has deep roots. Although her experience in the one-room school house was a precipitating factor, the foundation was laid much earlier. Her father was a principal in a Herndon, West Virginia, elementary school when he met her mother, who came from Kentucky to teach “commercial” classes in the local high school. “Commercial classes were taken mainly by women who were not college-bound,” Zimpher notes. “Ironically, though, these classes included the one subject that has the most value for us in the 21st century—keyboarding [typing].”

“Another irony is that my mother placed students in cooperative internships in local businesses, and years later I learned that the city of Cincinnati was the founder of cooperative education, close to a hundred years ago,” Zimpher says. “And here I am now, working diligently to bring paid internships and cooperative education to scale in New York.”

Marilynn Larkin is an independent health, medical, science editor and writer in New York City.



Pulling Our Weight in This Sputnik Moment

How a NYAS STEM education partnership responds to the President's call

by Meghan Groome

When President Obama gave his State of the Union address on January 25 and referred to “our generation’s Sputnik moment,” I wondered how many viewers knew what he was talking about. To the digital natives, who might have Googled “spud nick” to figure it out, a space race with the USSR must seem quaint in an era of global warming, mass species extinctions, and hyperawareness of global famines, wars, and seismic events. But those who understand the reference know how exciting it is to have a President put STEM education at the center of federal economic competitiveness, national security, and education policies.

While the President’s support is imperative, improvements to STEM education require institutions and individuals to effect positive change in their own backyards. To this end, the New York Academy of Sciences and New York City’s Department of Youth and Community Development in partnership with almost all of the major research institutions in NYC created the Afterschool STEM Mentoring program in 2010. The initia-

tive recruits graduate students and post-doctoral fellows to volunteer in the City’s poorest neighborhoods through a network of community-based programs.

Young scientists, who commit one hour per week of their time for a semester, learn to teach engaging, hands-on science curriculum in a supportive and informal learning environment. By participating in the program, mentors gain unique experience, have the opportunity to give back to the community, and might be inspired to consider education-focused career paths.

Getting permission and encouragement from one’s Dean or lab head has proven vital. Many enthusiastic mentors don’t complete the training once their supervisor discovers what they have volunteered for. Other young scientists who haven’t been exposed to great science teaching hold misconceptions about how to engage a room full of middle school students.

While commitment and an excellent program design can get you far, the real work comes once the mentor comes face-to-face with kids who have already had a long school day and believe that science is inherently boring. In this regard, our pro-

gram is no different from the first time a regular teacher steps in front of the class. And like successful teacher education programs, support from an experienced educator can turn a bad first class into a successful second class.

The way I see it, there are two clear ways to answer the President’s call for a new Sputnik era. All scientific organizations, no matter the size, should dedicate a percentage of staff time to improving STEM education. And school districts, big and small, should open up paths to allow enthusiastic professional institutions to develop relationships with districts and schools. With 117 mentors working in 58 programs in all 5 New York City boroughs, the NYAS-NYCDYCD partnership greets the President’s call to action with a demonstration of what’s possible. ◀

Meghan Groome is Director, K-12 Science Education Initiatives at the New York Academy of Sciences. She completed her PhD at Teachers College Columbia University in Science Education with a focus on urban science education and reform.

How to Build an Innovation Ecosystem

For spurring science progress, an interconnected community is key.

by Adrienne J. Burke

Overlapping circles are a common convention for illustrating how the players in an innovation network are connected. It's a simple way to show how investors, academic researchers, private sector scientists, policymakers, and other constituents all play a role in driving science and technology progress.

But there's a reason innovation strategists often use a more complex metaphor—an ecosystem—to describe such a community. As in nature's ecosystems, no single actor in an innovation system functions in isolation. If one member is weak, everyone suffers.

Karin Ezbiansky Pavese, vice president of Innovation & Sustainability at the Academy, says, "Many people think if you invest money in scientific research that economic growth is guaranteed, but investment in research is not enough to stay competitive. You must have the infrastructure in place to support these research investments and maximize their impact." Pavese and her staff advise governments and institutions that are interested in fostering innovation and entrepreneurship. The New York State Energy Research and Development Authority, the Mayor of Mexico City, the Russian Federation, the Prime Minister of

Malaysia, and the State University of New York (see p. 16) are among the entities that have tapped her team for guidance.

It's easier for people to see how certain assets are important to generating innovation and, ultimately, economic growth, Pavese says. The importance of having strong R&D institutions, an industrial base, a deep talent pool, a strong physical and cyber infrastructure, and a business-friendly regulatory environment can seem obvious. But a system truly poised to innovate is one in which the barriers between organizations and individuals are broken down, where collaboration happens across disciplines and sectors, and where a diverse, democratized culture supports risk taking, tolerates failure, and celebrates success. Those concepts—network and culture—are less concrete, she says, so it's tougher for organizations and governments to understand the importance and necessity of supporting them. The regions and institutions that embrace their importance can gain the competitive advantage.

Innovation strategist Vivek Wadhwa, Director of Research at the Center for Entrepreneurship and Research Commercialization at Duke University's Pratt School of Engineering, says forget

about building a state-of-the-art science park and giving industry tax breaks to spur innovation. “Innovation is about people,” he says. “Once you remove the obstacles to entrepreneurship, the most important ingredient is the network.”

Wadhwa, one of dozens of outside experts the Academy taps for guidance on steering its innovation efforts, stresses the importance of fostering an environment that facilitates interaction among individuals. He points to Silicon Valley as the model: “It’s one giant network where you can go to a coffee shop any day and see people talking to each other, and every evening you can go to events where you can learn from people in your field, where experienced people mingle with newbies,” Wadhwa says.

Says Pavese, “A critical component to helping achieve our mission to advance science and technology is creating robust networks. The Academy’s programs are instruments for building and expanding these networks at every stage of innovation.” For instance, the Academy’s jam-packed calendar of scientific events is well known for its role helping to cross-pollinate the various stakeholders in science and technology. But convening events is just one element of a package of interdependent innovation-inspiring initiatives. From a program designed to inspire the next generation of scientists and engineers with graduate-student mentors to one that delivers investment capital directly to life sciences entrepreneurs, the Academy’s activities aim to nurture the entire innovation cycle. Academy programs also coach grad students and postdocs in entrepreneurship, connect solvers with progress-crippling science and technology problems around the globe, and engage the general public in conversations about science.

Indeed, established Academy programs have a long history of creating networks and supporting innovation. But even newer initiatives, such as the Afterschool STEM Mentoring Program and the Life Science Angel Network, as described in articles elsewhere in this issue (see p. 18 and p. 28), are bearing fruit.

To be sure, the Academy takes seriously the connection between innovation ecosystems and scientific progress, to the point that the concepts of innovation ecosystems permeate just about everything the Academy does. On the following pages, you’ll see exactly how the Academy creates networks and breaks down silos, as the directors of six Academy programs explain just how they walk the innovation talk.

K12 Science Education

Meghan Groome, Director

The Academy’s K12 Science Education initiative is a conduit connecting New York City’s stellar scientific community to science teachers and underserved school children by mentoring the city’s youth and networking with their science teachers. This program is effectively bringing teachers and students into the city’s innovation ecosystem, and nourishing the system from the bottom up.

One part of the K-12 program entails a public-private partnership among the Academy, the NYC Department of Youth and Community Development, almost every NYC-based university, and almost 60 afterschool programs in all five boroughs. The idea is to connect underserved middle school students with mentors from the city’s elite science graduate programs.

But first and foremost, the K-12 Science Education initiative is a professional learning network. Given the rate of scientific advancement, our program strives to expand the circle of professional contacts a teacher can call on to improve their knowledge or update their curriculum content. If your students are studying cancer and you don’t know a cancer researcher you can talk to, you’re just going to be Googling for answers. In one of our afterschool programs, a group of students has been working on a biomedical engineering robotics challenge to address brain cancer. Their mentor reached out to his professional network and arranged a conference call. The kids sat around a table and talked to a cancer researcher about cells and how we treat cancer.

We deliberately structure professional development programs and field trips in a way that a diverse set of people can interact. For example, on a recent field trip to the Harlem DNA Lab, a teacher from the Bronx got to know a postdoctoral fellow from the nearby Albert Einstein College of Medicine. That teacher now has access to scientists at Einstein whom she can turn to. On another field trip, one teacher mentioned that she’d really like to demonstrate gel electrophoresis for her class, but doesn’t have the right equipment. Others immediately jumped in with solutions.

We even use social networking to connect teachers to resources. A follower of our @nyask12 Twitter feed asked us whether you can see Earth spinning from outer space. I didn’t know, so I tweeted an astronaut I know. He had a conversation via Twitter with this third grade class in Virginia about what you can see from space. Expanding an innovation ecosystem can be as simple as that.

Scientific Programs

Brooke Grindlinger, Director

Successful innovation equates to a successful marriage of invention and commercialization, and that requires a free flow of information and technology among people and organizations. In particular, it requires three entities with fiercely independent and traditionally non-overlapping cultures—government, universities, and the private sector—to engage in meaningful dialogues with each other.

The academy’s portfolio of dozens of scientific meetings a year, including 15 conferences and 45 discussion groups along the spectrum of life sciences, is helping to dramatically optimize that three-way dialogue. Our in-house team of PhD and MD scientists works with key stakeholders from all of those sectors. As a neutral party, we’re ideally suited to facilitate the dialogue among them. It’s undeniable that our meetings help to break down the disciplinary and sector-specific silos and get these people talking to each other in a structured and productive manner.

One specific example is the way our Translational Medicine Initiative, through a multiyear partnership with the Josiah Macy, Jr. Foundation, has in just one year brought together more than 1,000 basic researchers, physicians, public health experts, and policy makers to examine recent breakthroughs in the life sciences and to explore ways to better integrate basic science and innovative teaching techniques into a medical curriculum that has been static for 40 years.



We're also trying to understand the social dimensions of innovation. What policy changes might be needed at federal and institutional levels to implement real working relationships among these three sectors? Our meetings often feature speakers from agencies such as the NIH, FDA, and the Federal Trade Commission, providing a rare opportunity for R&D professionals to engage with regulators and grantors.

Beyond networking, the Academy also supports a culture of innovation by recognizing and celebrating research and creativity. The Blavatnik Awards for Young Scientists celebrate innovative advancements from early career scientists. And our Aspen Brain Forum Prize recognizes innovators in the field of neurotechnology.

Finally, by virtue of the fact that so much of the content from our meetings is disseminated electronically, through eBriefings, podcasts, video interviews, and the *Annals of the New York Academy of Sciences*, we're contributing to the global scientific knowledge base, extending the innovation ecosystem far beyond the boundaries of our live events.

Science Alliance

Monica Kerr, Director

Science Alliance is focused on the human capital piece of innovation, supporting aspiring entrepreneurs and scientists who want to broaden the impact of their research. Creating a culture where scientists are encouraged to think about the practical application of their work and are equipped with the necessary resources to pursue entrepreneurial endeavors is critical to building an innovation ecosystem.

Two things that scientific graduate education lacks in this regard are training in how to move an idea from the lab to the marketplace and mechanisms to interact with the entrepreneurship community. We host two courses to fill those gaps—*From Idea to IPO* and *From Scientist to Entrepreneur*—and universities have welcomed our help. Through these courses we provide key information not typically available to scientists, such as: What kinds of inventions are patentable? What really has potential for an entrepreneurial endeavor? How can the university tech transfer office help you? How do you write a business plan? How can you obtain funding? We also connect them to the entrepreneurial community by bringing in speakers involved in tech transfer, patent law, venture capital, and company formation. Beyond listening to lectures the attendees are building networks.

And it's paying off. Two Science Alliance members were selected this year for the prestigious InSITE fellowship, a two-year entrepreneurial mentorship program designed to support New York entrepreneurs in the development of their businesses and pursuit of venture capital and angel investments. Historically only top business and law students were accepted for fellowships, but through my conversations with the chair, they opened the program up to PhD students and postdocs. Two of the five nontraditional candidates this year came from Science Alliance.

It's all part of building an environment where everybody is supporting innovation and startups. Ideally, some day the students from our Science Alliance courses will feed into the Academy's Life Sciences Angel Network and either find jobs with startups or have an opportunity to pitch their own business ideas.

Life Sciences Angel Network

Milena Adamian, Director

Put three scientists in a room and they can talk from dawn to dusk, but innovation will not come from their ideas without funding and someone who can execute on it. We launched the Life Sciences Angel Network four months ago with a very pragmatic goal: fuel innovation by putting entrepreneurs together with money.

We focus on a variety of areas—medical devices, healthcare IT, diagnostics, biotech, and pharmaceuticals. We're now look-

ing at companies that are improving on the current methods of treatment. These are products that are needed and that require a relatively short time to get to market. For instance, healthcare IT is a hot area that includes anything from improving how lab specimens are shipped to organizing virtual advisory boards. These businesses don't have to deal with FDA regulations or time constraints.

Any entrepreneur can apply for consideration through our website, and we review 20 or more proposals for every one company we invite to present. Three medical device companies presented at the first Life Sciences Angel Network pitch meeting, and we already have one healthcare IT company and two device companies lined up to present to investors at our next meeting.

We've had nearly 50 submissions in four months from entrepreneurs in the New York area. That seems like a lot until you compare it to California, which highlights an important element of an innovation ecosystem: entrepreneurship must be encouraged in academia. The West coast is known for a climate where professors and even students are involved in startups. In New York academia, that culture is still emerging. Even investment term sheets are structured differently on the West coast versus the East coast. In California, investors take the approach that an investment will succeed. In New York, terms are more often structured to protect the investor from failure.

We don't exclude based on geography, but we do prefer to help companies in New York. We're using a model that's been used in other cities to move technology forward and generate return for investors. This is a way of strengthening another part of New York's innovation ecosystem.

Innovation & Sustainability

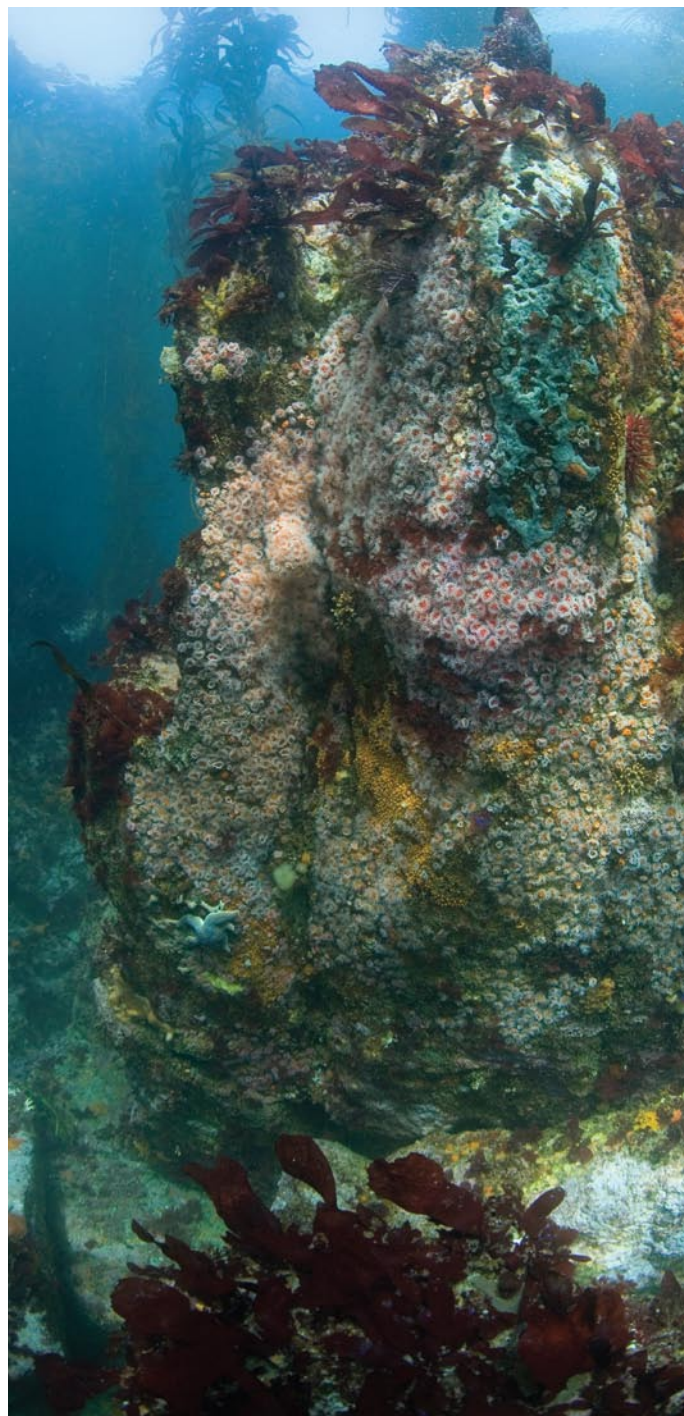
Karin Pavese, Vice President

When called on for guidance in fostering an innovation ecosystem, the Academy's Innovation & Sustainability group begins by looking at the asset base of science and technology to understand where a region or institution's strengths are. In order to maximize the return on investments that have been made, we recommend building an innovation system around those assets.

For example, if we look at a particular region and find that energy storage technology is a strength we would ask, "Does the available human capital support this?" If not, we would make a series of recommendations such as to infuse the grad programs with top notch experience, to hire professors, or to build a center.

Then we look at the strengths in financial capital and ask whether venture capitalists are familiar with this area. We would recommend establishing a program like the Academy's Life Sciences Angel Network to connect investors with entrepreneurs. We also conduct interviews with the leaders from every sector. If those reveal that the asset is disconnected from private industry, this is where the Academy's scientific programming expertise comes into play, hosting events to connect industry and academia, or creating an international conference to bring visibility to that area.

In New York State, our interviews with 50 academic and industry leaders made it clear to us that people were not talking to each other. The head of research at Xerox said he imagined there was pre-competitive research his team could be collaborating on with



GE and academic institutions in Albany, but he didn't know what they were working on. We heard that same story again and again. We recommended two sets of ongoing top-down workshops at the state level within each state region where academic research provosts and industry leaders could talk about their research needs and try to coordinate a more cohesive research agenda.

New York has now formed industry-academia consortiums in smart grid and battery technology to do exactly that. That's one step in building an innovation ecosystem.

Scientists Without Borders

Shaifali Puri, Executive Director

Scientists Without Borders enables a worldwide user community to collaborate to generate solutions to global development challenges requiring scientific or technological expertise or resources. Our web-based platform enables great ideas originated anywhere to be applied anywhere. We think this open and distributed model can accelerate breakthroughs while driving down the costs of innovation.

Nature provides abundant evidence that innovation thrives where diverse networks coexist—places like coral reefs and rainforests. I like to think of Scientists Without Borders as developing a coral reef for global development innovation. Our users consist of students, academics, industry scientists, NGO workers, policy-makers, and other interested parties from all over the

world, who can commingle their unique insights and resources and redeploy them in unanticipated ways.

People have always been inventive in low-resource environments—there's truth to the phrase, "necessity is the mother of invention"—and Scientists Without Borders is also committed to surfacing and scaling locally developed inventions. Users of our platform can broadcast specific challenges they face to our community and strategic partner networks. Other users can, in turn, post ideas or solutions, and collaborate to refine them. All of this is open and transparent so that a solution to one challenge may also generate a solution to an entirely unrelated one.

Users in Cameroon, Haiti, India, Kenya, Malaysia, and other countries have posted challenges on the platform. A user from Uganda recently posted a clean water challenge, and within a month 11 solutions, including several detailed scientific treatments, had been posted by users all over the world.

Similarly, we leverage our network to develop open innovation models, including challenges with prizes and incentives, to address large-scale challenges requiring multi-stakeholder participation. (See p. 9, "Scientists Without Borders Awards \$10,000 Nutrition Challenge Prize.")

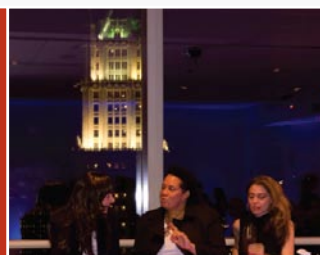
Innovation is not merely idea generation, of course. We're also focused on execution. We are working to help users like the one from Uganda assess which ideas have promise, and to connect them with others who can help them advance the idea to the next steps. We're committed to turning the output of our virtual coral reef into real world, high-impact interventions.

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Competing in an Innovation-intensive Environment

Engineer and innovation strategist Benoît Gailly explains how local infrastructure influences the ability to innovate.

Firms do not compete with each other in a vacuum. In particular, the way they are able to manage innovation will be influenced by the local environment in which they operate—their innovation system, and by their interactions with peers—their innovation networks, within their sector, their value chain, or based around specialized themes.

The characteristics of the socio-economic environment in which the firm operates strongly influence its ability and readiness to manage innovation, with regard to both the prevailing institutional arrangements and the local resource endowments.

The institutional arrangements relate first to the local regulatory and policy context. It concerns the management of property rights, in particular regarding IP but also investments and facilities, and how effectively these rights are defined and protected in practice. It also concerns local workplace and product regulations and norms, which might constrain how and where a firm is able to innovate. Finally, it conditions the firm's legitimacy and right to operate in its environment. Institutional arrangements also relate to prevailing technical standards and market mechanisms, which define how goods can be made, distributed, and sold. They can, in particular, strongly affect the rate of adoption of an innovation.

On the other hand, the local resource endowment relates to local or available suppliers, customers, investors, employees, and technologies. Local suppliers will influence input prices and available resources (for example, for raw materials or energy supply) while local customers' taste and needs will affect output prices. Locally active investors will influence both the risk profile and the funding of innovation projects, while the local human capacity will constrain the pool of competent human resources available. Finally, local technological sophistication will constrain the pool of available scientific and research competencies.

Taken together, these aspects will define the local innovation infrastructure that the firm can leverage or accommodate, and will affect the way it can develop knowledge, compete and create value. It is, for example, possible to rank countries according to their economic performance, government, and business efficiency as well as by the quality of their infrastructure; and to adjust the innovation strategy of the firm accordingly.

Adapting the way innovations are managed around these aspects is therefore critical, in particular for firms operating in environments with which they are not familiar, such as the subsidiaries of multinational companies active in emerging countries. While this is true for management processes and systems

in general, it is particularly the case when considering innovation management and its social, cultural, technical, and regulatory dimensions. How this innovation infrastructure affects the emergence of innovations and how it can impact on economic development and wealth creation has led many policy-makers to intervene proactively to attempt to manage this infrastructure. There is therefore an ongoing debate about how much the state should intervene regarding innovation, beyond enforcing basic rules of law such as property rights, and providing basic services such as education or communication infrastructures.

But public authorities have sometimes had a bad track record regarding their ability to anticipate innovation, define in advance which technology path should be explored, and in particular to "pick winners." This can be linked in some cases to the complexity of the expertise required, but also to the tension between the intrinsic uncertainty and fast pace of innovation and the relatively slow pace of policy-making. By the time priorities are negotiated, agreed on, translated into legal frameworks and implemented, and all stakeholders involved have adjusted their strategy, new knowledge that questions the initial assumptions often emerges.

There is, however, a strong case that, rather than trying to pick winners, public authorities have an important policy role to play regarding the development of innovation. This strong case relates to the existence of market failures and positive network externalities linked with innovation. It motivates the implementation of public support to innovation at regional and international level. Market failures arise when dealing with innovation opportunities because innovation projects are not simply goods that can easily be traded. Innovation opportunities often involve the development of knowledge that is a public good and cannot be appropriated easily (hence the need for IP rights and confidentiality or exclusivity agreements). Innovation also typically involves high uncertainties and irreversible commitments to specific assets which generate risk aversion, agency costs, and information asymmetries. Finally attractive innovation opportunities can relate to non-solvent markets—for example, in the healthcare or environment sectors.

Those market failures imply that, without adequate public intervention, some attractive innovation opportunities would not be pursued by autonomous economic agents (investors or managers) and therefore could be lost.

On top of these market failures, innovation opportunities can also involve positive externalities. The emergence of innovation contributes to welfare, as problems are solved and new needs

dealt with. Furthermore, independent innovation projects can benefit from economies of scope and network effects if they are coordinated or active on the same markets. Finally, the way an innovation is managed by one firm can have important positive spillovers for other firms, through, for example, the development of associated products and services or complementary assets.

Those positive externalities imply that some innovation opportunities that would have a positive socio-economic impact would not be pursued by autonomous economic agents, which are assumed to take into account only their own direct costs and benefits.

As a consequence, policy-makers have put in place a wide range of innovation support mechanisms, with varying levels of success in terms of take-up, effectiveness and positive impact. Those support mechanisms may be targeted at individuals, prospective entrepreneurs or specific social groups such as students, unemployed people or specific employment fields (engineers, scientists and so on). They may also be targeted at existing or emerging ventures, either high-potential small businesses such as start-ups, “gazelles” (fast-growing firms), spin-offs or more mature firms considering investment in innovation.

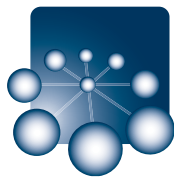
The innovation support mechanisms put in place by public authorities include financial support, either direct (such as grants, subsidies or loans) or indirect (such as market-making initiative or regulatory incentives). They also include logistics support, through the provision of infrastructure (such as science parks or research laboratories), expert services (in fields such as IP management or exports) or network-building initiatives (such as directories or special events and fairs). They can also

involve targeted advice, information or training services, either online or through dedicated programs.

While those support services might involve significant search and administrative costs and match more or less the needs of a firm, it is important for innovation managers not only to know about and use them, but also to influence their design, development and management—for example, through direct contact with policy-makers or through professional associations.

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Scientists Without Borders is a free online community that uses collaborative and open innovation to help solve the world's most pressing development challenges. On our platform, members from all over the world are posting challenges and openly sharing expertise, resources, and solutions.

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Disparities in Childhood Eye Cancer in Kenya

Enucleation (eye removal) is a simple, effective treatment for the childhood eye cancer, retinoblastoma (RB), which has disparately high mortality rates in the developing world. Many parents refuse enucleation treatment in rural African communities due to associated social stigmas. **The member who posted this challenge seeks ideas to reduce stigma and develop an integrated, culturally-sensitive approach to RB counseling, treatment, and management.**

Channel Water Purification In Uganda

In Kampala, Uganda, the Nakuvubo Channel passes through 56 slum areas and acts as a dumping site for domestic wastes by residences inhabiting the channel area. People living along this channel are impoverished and cannot afford to buy clean water for domestic use, so many suffer from waterborne illnesses. **Join today and collaborate with other members who are openly sharing creative ideas for simple, inexpensive ways to purify the Nakuvubo Channel.**

These users need your help and other users are ready to help you.

www.scientistswithoutborders.org

Lead
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Academy Calendar

For further details on meetings and conferences, visit our calendar at www.nyas.org/events.

April

Thu, Apr 21 • 1:00 PM – 3:00 PM
Lyceum Society: Origins of Life
The Lyceum Society is comprised of the Academy's retired and semi-retired members. Talks cover various scientific fields. All Academy members are welcome.

Tue, Apr 26 • 9:00 AM – 5:00 PM
Autism Spectrum Disorders: From Genes to Targets to Treatments
Autism spectrum disorders have wide-ranging symptoms, including impaired social interactions, communication deficits, repetitive behaviors and restricted interests. This symposium explores emerging research in the development of novel therapeutics.

Tue, Apr 26 • 6:30 PM – 8:30 PM
Fare and Toll Payment Technologies' Potential Benefits for Sustainability and Society
Transportation agencies are now developing and piloting the next generation payment systems with cash-less tolls and contact-less fare cards. This symposium will explore the implications of developments in how we price and pay for transportation.

Thu, Apr 28 • 7:00 PM – 8:15 PM
A Self-Fulfilling Prophecy: Linking Belief to Behavior
Philosopher Simon Critchley, cognitive scientist Shaun Gallagher, and physicist V.V. Raman will survey how the Self is shaped by interactions with the environment, how free will, responsibility, and other traits emerge, and how character and virtue become targets for constructing the Self.

May

Mon, May 2 • 9:00 AM – 5:00 PM
Brain vs Gut: Can Appetite be Restrained?
Energy balance reflects competition between energy-storing and -using processes, and an imbalance can lead to obesity. This symposium brings together scientists to discuss nutrient sensing, appetite regulation, eating disorders and bariatric surgery.

Mon, May 2 • 7:00 PM – 9:00 PM
Responding to HIV and AIDS in Brazil: Structural Violence, Social Movements, and the Local Politics of Global Health
The Academy's Anthropology Section is the crossroads for four-field anthropology in the greater New York area.
Wenner-Gren Foundation, 470 Park Avenue South, 8th Fl

Wed, May 4 • 7:30 AM – 6:00 PM
Diabetes and Oral Disease: Implications for Health Professionals
Medical, dental, and other health care professionals as well as basic researchers will convene to examine the bidirectional relationship between oral disease and diabetes and the need for interprofessional health care for this population.

Fri, May 6 • 5:00 PM – 7:30 PM
Systems Biology and New-Generation Sequencing Technologies
Systems and computational biologists collaborate to integrate high-throughput biological data and new sequencing technologies. This reveals previously unexplored genomic features such as functional intergenic regions, and copy number variations.

Thu, May 12 • 7:00 PM – 8:15 PM
Me, Myself, and I: The Rise of the Modern Self
Historians Gerald Izenberg and Jerrold Seigel, philosopher Raymond Martin, and sociologist Norbert Wiley will trace the evolution of the meaning of Self from antiquity to the present.

Mon, May 16 • 9:00 AM – 5:00 PM
Cracking the Safe: Advances in HIV / AIDS Prevention and Treatment
Researchers give an update on challenges and solutions in their quest for an HIV / AIDS vaccine. These include epidemiological challenges, developments in HIV virology and immunology, the search for HIV vaccines, HIV microbicides and PreP and HAART.

Wed, May 18 • 8:45 AM – 5:00 PM
Targeting Synaptic Dysfunction in Alzheimer's Disease
This conference will provide an overview of the mechanisms of synaptic plasticity in normal aging and in neurodegenerative disease, and outline therapeutic strategies to preserve vital neural connections.

Thu, May 19 • 11:15 AM – 3:00 PM
Lyceum Society: Biology of Aging - Part III
The Lyceum Society is comprised of the Academy's retired and semi-retired members. Talks cover various scientific fields. All Academy members are welcome.

Thu, May 19 • 7:00 PM – 8:30 PM
The Intersection of Data and Design: Mark Hansen
With the combination of sensors, math and creativity, data collection and visualization can engage students in new ways of seeing and reporting upon their world. Join Mark Hansen as he describes his work at the intersection of data and design.

Fri, May 20 • 8:00 AM – 7:00 PM
New Frontiers in Marine Drug Discovery
This 1-day symposium will overview the current state of the art in Marine Biomedicine and its role in the context of the drug discovery process – from the perspectives of both academia and industry.

Mon, May 23 • 6:30 PM – 8:00 PM
How to Make Conservation the People's Choice: An Evening with Peter Kareiva
Join Science & the City as we host Peter Kareiva, chief scientist at the Nature Conservancy, for a talk about his new book, *Conservation Science: Balancing the Needs of People and Nature*.

Tue, May 24 • 9:00 AM – 5:00 PM
The Biology of Apolipoprotein E: A Novel Pathway for the Treatment of Alzheimer's Disease?
Alzheimer's disease is the most common cause of dementia in the elderly. This symposium brings together experts to discuss the role of ApoE4 in Alzheimer's disease (AD), and to discuss potential strategies for prevention and treatment of AD.

Tue, May 24 • 7:00 PM – 8:15 PM
Who Am I? Beyond 'I Think, Therefore I Am'
Can we ever truly answer the question, "Who am I?" The final seminar, with philosophers Elie During and David Jopling, social psychologist Timothy Wilson, and ethicist Frances Kamm will examine the difficulty of achieving genuine self-knowledge and how the pursuit of self-knowledge plays a role in shaping the Self.

June

Wed, Jun 1 • 6:00 PM – 8:00 PM

Climate Change, Science and Society: A Multidisciplinary Discussion

This special event will explore the topic of climate change from diverse disciplinary perspectives.

Jun 2 – 3

Chronic Inflammatory and Neuropathic Pain

This 1.5-day international scientific conference will provide a neutral forum to explore new frontiers in our understanding, diagnosis, and treatment of chronic and neuropathic pain.

Mon, Jun 6 • 2:00 PM – 5:00 PM

Genome Integrity Discussion Group Meeting

The Genome Integrity Discussion Group provides a forum for interactions between basic and clinical research groups working on chromosome biology and function, and at the interface between chromosome integrity and onset and progression of malignancy.

Tue, Jun 14 • 5:00 PM – 7:30 PM

How Do Cells React to Drugs? A Systems Biology Perspective

Systems biologists and pharmacologists come together in the quest to develop new drugs. This symposium applies a systems biology approach to elucidate context-specific mechanisms of drug response and sensitivity.

Thu, Jun 16 • 11:30 AM – 3:00 PM

Lyceum Society: The Strange Shape of the Moon

The Lyceum Society is comprised of the Academy's retired and semi-retired members. Talks cover various scientific fields. All Academy members are welcome.

Fri, Jun 17 • 8:00 AM – 6:00 PM

Imaging, Visualization and Simulation: New Tools for Technology and Healthcare

Massive data sets are generated in technical, financial, medical and social arenas. The Technology Forum will feature cutting edge concepts and tools for data processing, integration, analysis and simulation that span diverse applications.

Jun 21 – 23

Cognitive Dysfunction in Multiple Sclerosis: New Approaches to Diagnosis and Treatment

This 2.5 day conference will convene physicians and scientists to discuss current challenges and potential solutions for improving diagnosis, treatment and management of the cognitive symptoms of multiple sclerosis.

Jun 28 – 30

Sixth International Congress on Shwachman-Diamond Syndrome

Explore the clinical features, current management, and treatment of Shwachman-Diamond Syndrome – a genetic disorder involving multiple organ systems and affecting hematopoiesis, leukemogenesis, and organogenesis in children and young adults.

Beyond

Sep 15 – 16

Animal Models and Their Value in Predicting Efficacy and Toxicity

Explore common hurdles and pathways forward to improving pre-clinical model systems for the evaluation of therapeutic efficacy and toxicity in the areas of metabolic and cardiovascular disease, inflammation, and pain.

Tue, Oct 14 • 9:00 AM – 5:00 PM

Brain Barriers: A Hurdle for Drug Discovery

Barriers protect the brain from toxins and infection, and maintain ionic and volumetric environments. Inefficient function can limit the treatment of neurological diseases. This symposium covers scientific advances and tackles therapeutic challenges.

Nov 4 – 5 • Spain

Evolving Challenges in Promoting Cardiovascular Health

Spearheaded by Dr. Valentin Fuster, this international, 2-day, scientific symposium will be focused on the promotion of cardiovascular health through molecular biology, clinical pathophysiology and population research.

Meetings Policy

» DATES, TIMES, AND TOPICS OF EVENTS LISTED HERE ARE SUBJECT TO CHANGE. For up-to-date information, including ticket prices, please visit our online calendar at www.nyas.org/events.

» Registration is required for most and strongly encouraged for all events. To register to attend an event, please use the Academy events calendar online at www.nyas.org/events or contact the meetings department at 212.298.3725 or nymetings@nyas.org.

» Unless noted otherwise, Academy events are held at:
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Going beyond the Back-of-the-Napkin Business Plan

Steve Hochberg has put NYAS in the position to help life-science entrepreneurs

by Adam Ludwig

Behind every medical technology breakthrough—whether it's a new drug that improves everyday life or a novel device that revolutionizes a surgical procedure—lies years of painstaking research, testing, verification, and investment. Transforming ideas into potentially life-saving innovations involves a diverse set of players that can include student researchers, physicians, lawyers, government regulators, and entrepreneurs. This complex interplay relies on a cross-pollination of expertise that can find businesspeople donning lab coats and cardiologists polishing their dress shoes for a fundraising luncheon.

NYAS Board Governor Steve Hochberg, a co-founder of 12 companies, believes entrepreneurial tenacity is the key to forging real-world applications from pure scientific ingenuity. He is co-founder of Ascent Biomedical Ventures, a company that has helped bring an impressive array of medical technologies and pharmaceuticals to market. Among the many products his firm has had a hand in developing: medical scaffolding for soft tissue repair, including tendons, hernias, and aneurysms; a minimally invasive cage for performing spinal fusions; and dermal absorption drug delivery techniques.

Hochberg has an impressive record of matching scientific ingenuity with money and management. Beyond being a generous donor to the Academy, throughout his four years serving as a NYAS Governor, Hochberg has also been active in recruiting new board members and raising funds, and he wondered how NYAS could get involved in furthering innovation in the greater New York area. So when Milena Adamian, an interventional cardiologist with Wall Street and venture capital experience, contacted him with the idea of creating an angel network to fund biomedical companies in the pre-institutional-financing stage,

Hochberg immediately suggested the Academy as a venue.

Thanks in part to seed funding that he provided, the NYAS Life Sciences Angel Network (LSAN) was launched in November 2010, with Adamian as Director and Hochberg chairing the Screening and Investment Committee. Together, they recruited physicians, academics, lawyers, entrepreneurs, and technical developers to serve on the Committee, which closely reviews each project before presenting it to LSAN's group of angel investors.

Taking a cue from Hochberg's work at Ascent, which produces safe and effective clinical data from new therapeutic ideas—with the ultimate goal of designing and implementing actual FDA trials—the Committee scrutinizes candidates' viability for clinical, regulatory, and commercial success before presenting them to potential investors in this notoriously risky field. Hochberg describes LSAN's role as "bridging the gap between the napkin stage and the clinical testing stage," with the scribbled-on napkin representing the earliest germ of an idea. A \$500,000 to \$2 million investment from LSAN's angels can lead to further research, helping to attract the next-stage institutional investment of between \$2 million and over \$10 million necessary to facilitate clinical trials. In short, LSAN can get companies over the hump before they receive the kind of investment necessary to bring innovations to market.

Hochberg is happy to report that the first three companies to submit proposals to LSAN all received financing offers. "We are looking for unmet clinical needs," he says. "That doesn't always mean that there isn't some existing therapy out there; just that it could be greatly improved on." For example, he points to hypertension, where new approaches are needed for people who aren't responding to existing drugs.



What excites Hochberg most is the possibility that a scientific meeting could be convened at the Academy to discuss a novel life-science question, and within months a company might get financing for an innovation that addresses this very question, with the entire process shepherded by NYAS. "There are a lot of stakeholders that make up the NYAS network," says Hochberg. "At the end of the day, we want to create great therapies using the science and technology that exists in New York."

Hochberg would never call himself a "renaissance entrepreneur," but in many ways the label fits. In addition to his on-the-job science training and his involvement in developing medical technology and care delivery, Hochberg is vice chair of Continuum Health Partners, a six-hospital health system in New York City, and sits on the board of the Sackler Institute for Nutrition Science at the New York Academy of Sciences. He is co-founder of the award-winning Evening Land Vineyards and has helped publish books on the medical implications of obesity and the benefits of the Mediterranean diet. He's also a professional positive thinker. When asked about the long-term prospects for the NYAS LSAN to foster life-changing innovation, he replies, "I'm a venture capitalist; I'm an optimist by virtue of what I do every day."

Adam Ludwig is a writer in New York City.

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Contribute to the Academy's programs in innovation and entrepreneurship by contacting Kiryn Haslinger Hoffman, VP Development at **212.298.8673** or khoffman@nyas.org.

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For more information, please contact the Academy's development department at development@nyas.org or 212.298.8675.



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