DOI: 10.2436/20.1501.02.130
ISSN (paper): 0212-3037
http://revistes.iec.cat/index.php/TSCB

La biologia d'ahir i d'avui. Reflexions amb motiu del centenari de la Societat Catalana de Biologia (Francesc Piferrer, ed.)

Treballs de la SCB. Vol. 63 (2012), p. 387-400

SCIENCE ACADEMIES IN THE 21ST CENTURY: CAN THEY ADDRESS THE WORLD'S CHALLENGES IN NOVEL WAYS?

Ellis Rubinstein

The New York Academy of Sciences

Corresponding author: Ellis Rubinstein. The New York Academy of Sciences. 7 World Trade Center, 250 Greenwich Street, 40th floor. New York, NY 10007-2157, USA. Tel.: +1-212-298-8686. E-mail: *erubinstein@nyas.org*.

SUMMARY

Challenged to speculate on what roles science academies might play in the 21st century, the author of this chapter, who heads a unique academy with many novel initiatives, acknowledges the important and diverse roles now played by the most successful academies. He then distinguishes these roles from those played by the earliest academies, whose efforts, he says, have surprising relevance today. The author propounds a theory that the complex challenges of the modern world can best be addressed through multilateral, multidisciplinary, multi-institutional and multi-sector partnerships. He provides some examples of innovative alliances, and posits that neutral and highly respected institutions are best suited to the tricky task of facilitating them. He describes examples whereby his academy has facilitated multilateral partnerships, and concludes that other science academies could make enormous contributions to the advancement of science by joining his academy in this role of respected, neutral facilitator of global alliances to address science and technology-related challenges.

Key words: academy, science, partnership, global, challenge.

LES ACADÈMIES DE CIÈNCIES AL SEGLE XXI: PODEN FER FRONT ALS REPTES DEL MÓN AMB NOVES MANERES?

RESUM

Desafiat a especular sobre quin paper poden tenir les acadèmies de ciència al segle XXI, l'autor d'aquest capítol, el director d'una acadèmia única amb moltes iniciatives noves, reconeix les funcions importants i diverses que compleixen les acadèmies més reeixides.

Rebut: 17/02/2011. Acceptat: 26/05/2011.

Llavors distingeix aquestes funcions d'aquelles que tenien les acadèmies més primerenques, els esforços de les quals, diu, tenen una sorprenent rellevància avui. L'autor manté que els complexos reptes del món modern poden ser més ben encarats a través d'aliances multilaterals, multidisciplinàries, multiinstitucionals i de diversos sectors. Proporciona alguns exemples d'aliances innovadores, i postula que institucions neutres i altament respectades proveeixen les millors garanties de facilitar la delicada tasca que comporten aquestes aliances. Descriu exemples en què l'acadèmia que dirigeix ha afavorit aliances multilaterals, i conclou que altres acadèmies de ciència podrien fer contribucions enormes a l'avançament de la ciència imitant la seva en aquesta tasca d'agent neutral i respectat facilitador d'aliances globals per fer front a reptes científics i tecnològics.

Paraules clau: acadèmia, ciència, aliança, global, repte.

PREFACE

In a world where scientific knowledge is cheap and wisdom is more important than ever, what is, or should be, the role of a scientific academy? How can an academy best serve society while advancing its mission? And, how can an academy remain relevant in an age when exchange among elites is no longer sufficient in itself, when information is distributed widely and often for free, and when the data at the heart of information wash over us like a continuous tsunami?

These hopefully provocative questions were inspired by Lluís Tort and Francesc Piferrer of the Societat Catalana de Biologia on the occasion of its centennial. In our challenging age, there could be many and varied answers. The US National Academy of Sciences could provide one answer: it is playing a more important national and international role than ever before, and it is financially thriving. The same could be said of the world's longest continuously operating national academy, the UK's Royal Society about which I will say more later.

Leaders of the Chinese and Russian Academies of Sciences also have a claim to make. Both actually manage thousands of laboratories within their scientific institutes. The Chinese Academy of Sciences, in particular, is fulfilling not merely its legacy roles of advising the government and advancing Chinese (and global) science throughout the nation, but it has also taken on some of the most novel and innovative elements of 21st century scientific life such as developing incubators for the creation of startup companies based on academic research.

Beyond these four "elephants" among science academies, many other, smaller national scientific academies are playing the vital role of advisor to national governments where scientific expertise is too often absent. In very recent times, many national academies have also formed consortia, achieving synergies and scale of effort to better address topical global issues from climate change to emerging infectious diseases to the manifold scourges afflicting the world's poorest. The InterAcademy Panel and its "cousin," the InterAcademy Council, are chief of these, but other alliances include the academies of sciences of the developing world (formerly the Third World Academy of Sciences, TWAS), the African academies of science, the Latin American Academy of Sciences, and the Islamic World Academy of Sciences. Why they are joining hands and what unmet need is met by

their collaboration is one of the principal points to be addressed by this chapter.

Even on a regional scale, some academies are thriving as never before. The California Academy of Sciences fulfills a dual role of offering science education to the general public through a natural sciences museum, planetarium, and aquarium while funding anthropological, zoological, and botanical research. And the 311-year-old Berlin-Brandenburg Academy of Sciences convenes scientists to drive multisectoral dialogues around the most exciting areas of research and social issues that can be impacted by science.

I have no doubt that the leaders and members of each and every one of the lively organizations named in this lightning tour of 21st century science academies would proudly cite their model as answering Tort and Piferrer's challenge. Within the constraints of what an academy can be expected to do, each of these has evolved into an institution that brilliantly fulfills the crucial challenges of the 21st century.

As the President and CEO of a truly unique science academy —the 194-year-old New York Academy of Sciences— I am not only honored to have been chosen to participate in the special 2012 edition of the TREBALLS DE LA SOCIETAT CATALANA DE BIOLOGIA; I propose to provide a set of answers that I hope will be regarded to be thought-provoking and perhaps even worthy of adoption, at least in part, by other academies.

COMMON CHARACTERISTICS OF ACADEMIES TODAY

Consider the characteristics of the majority of scientific academies in the world today. All can be described as honorary societies, with membership only by invitation. As a consequence, almost all are constituted entirely or almost entirely by *senior and retired* scientists. Every academy today also is either national or regional. Even if it permits "foreign" members or collaborates transnationally, it is geographically constrained at least by charter. Of course, there are strengths in having a narrow focus or selectivity of membership. But without special global initiatives in a globalized world, an academy is limited to being seen as a local player.

Finally, many academies are also club-like in their manner of operation or in spirit. In the case of some smaller and highly traditional academies, this clubbiness can prove an enormous challenge in a world that no longer values the prestige once conferred by membership in an elitest organization.

Beyond what academies have in common operationally, there are functional commonalities among them. What characteristics make the most successful contemporary academies successful? The most active of today's academies are striving to offer the wisdom of their elite members to their governments. And some work hard to promote science literacy among the citizens in their nations or regions. A few do both.

In general, academies don't attempt to drive science. Two of the principal exceptions have been mentioned: the Russian and Chinese Academies. Both have spawned scores of institutes that actually do research. But, by necessity, both have had to concern themselves with a very important function that almost all other national academies struggle to address: the "care and feeding" of *young* scientists.

Based on this superficial overview of the structures and roles of most science academies in today's world, what conclusions

can be drawn about the value of this model in our still young century?

Considering that science and technology increasingly lie at the heart of the grand challenges our society faces —sometimes as a cause and often as a solution— and considering the depressing proportion of citizens and leaders in every nation who are profoundly ignorant of the most basic scientific information (and even the capacity to reason about such crucial issues as risk and benefit), the dual roles of providing advice to government and knowledge to the citizenry are surely needed.

But it could also be said that academies of science were not founded for either purpose, were not conceived as closed-membership organizations, and were not principally devoted to these tasks. It could even be argued that the needs of the 21st century require more and different initiatives from these great repositories of elite scientists: the academies. So a few provocative questions might be: have today's science academies evolved successfully to meet today's challenges? Have they lost some valuable elements that existed at their founding? Are there entirely new roles that this age requires and that they should fulfill?

A TOUCH OF HISTORY

What better time than the occasion of the centennial of a scientific society to briefly review the history of scientific academies with respect to their role as envisioned by their founders? Indeed, such a review will surprise many.

Most scholars believe that the earliest scientific academy was founded in Naples in 1560: the Academia Secretorium Naturae (*http://en.wikipedia.org/wiki/Academia_Secretorum_Naturae*). While part of the founders' interest was in exploring magic, the distinction between magic and science (for example, between alchemy and metallurgy) was less important than the need to "secretly" look at the "provocations" of the "real" world rather than the orthodoxies of the Roman Catholic interpretation of the world (*http://faculty.ed.umuc.edu/~jmatthew/naples/dellaporta.htm*). Similar concerns drove the creation in the early 17th century of what became perhaps the first well-known academy: the Academia del Lincei (*http://www.interacademies.net/Academies/ByRegion/WesternNorthernEurope/Italy.aspx*). *Lincei* means *linxes* and the reason for the use of the word is that these animals were considered "sharp-eyed." Thus, the point of the founding members of this academy was that sharp eyes were needed to decode the real world's underlying mechanisms —a basic tenant underlying the scientific method. By the way, Galileo was a founding member.

Because the Academia del Lincei was shut down at various points in its history, only to be re-christianed the Accademia Nazionale de Lincei, the 351-year-old Royal Society is the oldest *continuously operating* academy. It arose from an informal club of "gentlemen" with an interest in science. In both England and France, such groups began to cohere in the 1640s as individuals came to wish to share discoveries that were carried out in private. Some of the founders of what were thought of as an "invisible college" of "natural philosophers" met at Wadham College in Oxford in the 1650s. And then in 1660, 12 men assembled at Gresham College in London after a lecture by renowned Gresham College professor of astronomy, Christopher Wren, who is today known as one of the greatest architects in history.

Among the 12 who gathered that day was also Robert Boyle, a philosopher,

physicist and inventor who, today, is known as the modern world's first chemist. Together, the group resolved to found a "Colledge for the Promoting of Physico-Mathematicall Experimentall Learning."

Three and one half centuries later, the leaders and members of the Royal Society remain proud of their academy's motto: "*nullius in verba*" or "take nobody's word for it." Their point: every member must ignore "authority" and verify all knowledge through experiment. This crucial principle led the members to organize weekly meetings to literally witness experiments and discuss scientific topics —that is, to do science and convene scientists.

One other interesting point about the founders: they weren't —as one might have thought from the original name of their "colledge"— only physicists and mathematicians. The first Curator of Experiments was Robert Hooke, the brilliant polymath called by some the British Leonardo. Hooke was the first person to use the word *cell* for that basic unit of life.

To complete this nano-historical review of the origins of academies, I will note that King Charles chartered the "colledge" in 1663 as "The Royal Society of London for Improving Natural Knowledge", and that the same charter permitted the Society to publish books and, within only two years, the first issue of *Philosophical Transactions* —a scientific journal!

Based on this brief review of the origins of scientific academies, what are some of the important lessons to be gleaned? First, the earliest, no-longer-extant academies were all about bringing together the brightest minds and the keenest observers to get at fundamental truths. This suggests that the founders of the concept recognized several fundamental truths that have only become more apparent today: "The world will be better off if greater insight can be brought to scientifically framed questions. The answers will come faster and in greater profusion in direct proportion to increases in the efficiency of the exchange of insight. And progress will be more likely through the development of multilateral transactional initiatives —among people (and institutions) who might be brought together through neutral convening or as a result of enhanced dissemination of knowledge and the new tools of 'social networking'".

In regard to these points, I would underline my observation that the primary goals of those original academies were *not* about better informing the public or its leaders in government. Rather, I believe the founders recognized that there was a need for neutral organizations —interestingly, not the universities of the time even though the academies often started inside colleges and universities (or in the case of the New York Academy of Sciences, inside a medical school) or may have been housed in them— to bring together the people who would otherwise not meet on a regular basis and to disseminate the results of these exchanges in order to —what else?— *advance science*.

Focusing for a moment on the oldest continuously operating national academy —the Royal Society— you will see that it started neither as an honorary club of senior, distinguished individuals nor as an organization devoted to advising government or educating the populace. The Royal Society (and, subsequently the French Academy and Germany's regional academies) saw their key role in society as *advancing* science even if it meant inviting (inducing?) experimentors to demonstrate their Eureka moments in front of live audiences of their peers to see if their purported insight was believable.

This was the precise impulse in the minds of the doctors working at New York City's first medical school, Physicians & Surgeons, who founded the New York Academy of Sciences. In that school's very first year of life, Samuel Mitchill and some colleagues decided to found The Lyceum of Natural History, later to be renamed The New York Academy of Sciences (Baatz, 1990). They wanted to create a kind of club —yes— but they were committed to including *young* science enthusiasts and experimenters. In addition, they weren't content to entice the most brilliant and influential scientists of the day; they also welcomed non-scientists with deep science passions —US presidents Thomas Jefferson and James Monroe were members— and even non-New Yorkers! Indeed, 10 European scientists joined The Lyceum within its first two years.

The key elements of the Lyceum: *a*) regular meetings bringing together speakers and audience members from different disciplines to hear talks and exchange ideas, *b*) creation of a rudimentary museum of artifacts to be studied, and *c*) dissemination of the proceedings of the talks in what was to become the longest continuously published scientific series in the United States, *The Annals of The New York Academy of Sciences.*

I bring this up for two reasons: first, it points to several of the characteristics of the New York Academy of Sciences that make it unique today: openness to all, interest in including young leaders of tomorrow, and a commitment to internationalization. Today, our Academy is the only "local" academy with a global membership —25,000 members in 140 countries with about 20% of the members outside the United States. Moreover, we are surely the only academy that can point to over 8,000 Student Members —largely post-graduate students and post-doctoral researchers.

As for the second reason for mentioning the conditions of the founding of the New York Academy of Sciences, the conditions of our founding also conform to those driving the creation of the European academies. For example, the mission of the New York Academy of Sciences, like that of the Royal Society a century and a half before, was to advance science through convening the best and brightest who might not otherwise meet, not merely nationally but globally, and to disseminate the fruits of their presentations as rapidly and as widely as possible. Today, I believe it is safe to say that perhaps only the Chinese and Russian academies of science organize as many events as we do – in our case, over 100 per year —in leading-edge, multidisciplinary science and engineering areas. And the reason our three academies do this is that our *primary* drive is what it was for us 194 years ago: to advance science and, at least in the case of the New York Academy of Sciences, to address global problems.

And it is this latter point —the commitment to advance science not merely for its own sake but to address global problems— that is an underlying theme of this chapter.

WHY WHAT WAS NEEDED IN 1660 AND 1817 IS STILL NEEDED TODAY

Two centuries later, the need to convene and disseminate are ever more crucial. There may seem something ironic in this statement considering that there surely have never been more seminars, meetings, and conferences in the history of mankind than there are in today's ultra-mobile, globalized world. And then add to that the extraordinary emergence of Skype video

conferencing and web-based social networking and you have a world in which the scale of interactions among scientists has increased exponentially. Indeed, when I first initiated some of the exciting new programs of the New York Academy of Sciences, one Nobelist told me: "Ellis, we don't need more meetings. We have too many already. We can't get our research done as it is."

A year later that same Nobelist told me that the New York Academy of Sciences was to be complimented for its unprecedented services to the young scientists of our city. What he was praising was a program of roughly 15-20 annual career-mentoring seminars and nearly 100 annual frontiers-of-science community-building "discussion group" seminars and full-blown conferences. What converted him?

Every scientist knows that progress comes most often from a serendipitous exchange. And every scientist has observed the barriers to such serendipity: the silo mentality inside institutions that divide disciplines and the zero-sum mentality of universities and academic medical centers residing in the same region that severely inhibits local collaborations between the best and brightest.

Let's take this point to a more global scale and then work back to the question of what might be the best role for an academy of sciences in the 21st century. I will start by offering an anecdote.

About 5 years ago, several years after the New York Academy of Sciences initiated its "Science Alliance" of all of the universities and academic medical centers of New York to create a scientific "whole that is greater than the sum of its parts," several leaders of the British academic community told me that UK Prime Minister Tony Blair had convened the rectors of Cambridge, King's, Imperial, and Oxford Universities and the University College of London in 10 Downing Street shortly before he left office. They told me that Blair excoriated the assembled rectors: how are we in the UK going to compete with Boston, the Bay Area and I hear lately New York if you people won't work together?

Within months of the meeting, the 5 universities had pledged to work together —and with the academic medical centers and hospitals of southwest England— to create the world's most powerful center of translational medicine: the Global Medical Excellence Cluster (GMEC).

Around the same time, two of the London universities' vice provosts independently told me that they wished that they could clone the New York Academy of Sciences. They had noted how we had transformed the science scene in New York by forcing collaborations of the institutions there. They expressed great frustration with the many people who assume that Cambridge and Oxford have a monopoly on the scientific talent of England. And they both pointed out in their own ways that if King's, Imperial and UCL universities in London could all work together as New York's institutions were now doing, they would demonstrate a greater talent pool than Oxford and Cambridge could produce as individual universities. But, they admitted, the three London-based universities had been unable to work together because they simply did not trust one another.

About 18 months later, in February 2008, the New York Academy of Sciences, at the invitation of the three London-based universities, organized an international conference on the frontiers in brain imaging that provided equal showcases of the best and brightest senior and junior researchers of each university combined with some of

the best from elsewhere around the world. Just two of the benefits of this unprecedented alliance of the 3 universities: *a*) the conference was supported by 7 global companies whose top researchers recognized and wanted to network with the unique talent pool that we had assembled by making it possible for the 3 universities to work together; and *b*) in 3 years, over 30,000 scientists the world over have visited the slidesets from that conference on the Academy's website (*www.nyas.org/publications/ebriefings/detail.aspx?cid=22ae7267-a1ca-4f9e-8607-f65ce39650ca*) permitting London to demonstrate the power of its neuroscience community when its best comes together.

The event became the launching ground for the GMEC —a neutral ground that had never existed in the UK and that, in this instance, permitted the 3 London universities to be joined even by their fiercest competitors, Cambridge and Oxford, to announce a truly bold initiative.

Lessons learned

a) We are better together.

b) The scale of today's challenges —as in moving research from the bench to the bedside and in so many other fields before climate change to poverty eradication— demands more than individual scientific collaborations and more than bilateral institutional partnerships (university to university or university to company). Neither can scale sufficiently and, in a globalized world where partnering is so much easier in principle, the headache of multiple bilateral requests proves that bilateral partnerships are simply too inefficient to serve the needs of our 21st century society.

c) What is the alternative to bilaterals? Multilateral partnerships and even public/private partnerships.

d) Left to themselves, individuals and institutions generally find it extremely hard to collaborate with their peers and, therefore too often, compete. So forging bilaterals is already hard and forging multilaterals can be a nightmare, unless *neutral brokers* can make multilateral partnerships possible on an unprecedented scale.

Proposition for the next segment of this chapter: *The best neutral brokers in the world of science, technology, and innovation might be academies of science. And if they concerned themselves with the global problems demanding complex multilateral solutions and if they were willing to open themselves to young scientists as the earliest academies did, they might play an extraordinarily valuable role in the world today.*

IS IT HAPPENING ALREADY? INKLING OF A PATH TO THE FUTURE

Because ours is the world's only global academy of sciences, I am fortunate enough to travel the world at the invitation of regional and national leaders, corporate executives, and university rectors and deans not simply to speak at conferences but to develop transactional alliances that can help them achieve the kind of multilateral, multisectoral, and multi-institutional alliances that can enhance their competitiveness in today's world. One benefit of this is that I can viscerally feel the increasing frustration of leaders —in the scientific, academic and government sectors— at the demand for ineffective bilateral partnerships. And I can also feel the increasing excitement at the prospect of exciting multilateral alliances to solve this problem.

To make vivid the potential of multilateralism before concluding with a concept for scientific academy consideration, I will

briefly touch on some groundbreaking alliances in academia, industry and even government.

Academia

For most of the 20th century, most of the collaborations between universities were between individual researchers looking to develop complementary strengths to solve scientific problems. If there was any twinning of universities on a formal level, it was likely to be between generous institutions in the north with ambitious but distressed universities in the south —take the alliance between the world famous Karolinska Institute in Stockholm and Makerere University in Uganda, for example.

Why would a great university such as Columbia in New York City consider a formal collaboration with a competitor for funding like NYU or the Sloan Kettering Cancer Center?

And, yet, as early as 1990, teams at two of the best universities in the world, Harvard and MIT, —neighbors who inevitably compete fiercely for city, state, national and private funding— came together to found the Whitehead Institute/MIT Center for Genome Research. The idea was powerful: combine the best biologists and chemists in the world from Harvard with the best engineers and physicists from MIT and you could do genomic medicine better than any place on Earth. Fourteen years later, the Broad Institute was founded out of that initial alliance with a $200 million gift that was later increased to $600 million from one family alone. The power of the concept is perhaps most vividly demonstrated by the fact that the world's richest individual, Mexico's Carlos Slim, chose recently to give $65 million to the Broad Institute.

Such alliances are beginning to transform the power of individual institutions to do research and address social problems. In the San Francisco Bay Area, 3 individually successful branches of the University of California —UC Berkeley, UC San Francisco, and UC Santa Cruz— joined hands to create the QB3, an unprecedented joint institute to do quantitative biology. Why? Berkeley has never had a medical school, a significant handicap to its researchers needing a patient base and clinical collaborators. UCSF, great as it is, is *only* an academic medical school and lacks basic science. And Santa Cruz lacks a medical school but contributes a world class group of computer scientists, mathematicians, and physicists, all needed in cutting-edge quantitative biology.

In Arizona, the Universities of Arizona and Arizona State worked together to assemble an unprecedented state-wide initiative involving the major academic medical centers and out-of-state partners to do world-class research in translational genomics. Without this alliance, Arizona would remain a backwater of translational medicine. With it, it can begin to recruit the best and brightest researchers from the world over.

Internationally, multilateral academic alliances are cropping up with increasing frequency. I have mentioned the GMEC in southwest England. In Scotland, the Universities in Edinburg, Glasgow, Dundee and Aberdeen tried something similar: to establish what they hoped would be the world's best multisectoral alliance in translational medicine —not just cancer but heart disease, neurodegenerative diseases and so on. But in this case, recent anecdotal reports suggest that the alliance is troubled, beset by jealousies that were not resolved by a sufficiently powerful or credible neutral body— a role perhaps that

could have been played to Scotland's advantage by the Royal Society of Edinburgh, Scotland's elite 228-year-old science academy.

In summary, why have people fought to create these bold and extremely difficult efforts to overcome the natural human and institutional jealousies and competitive drive that characterize academia? Because visionaries in Boston and the Bay Area, in London and Edinburgh, know that the 21st century is being characterized by a novel form of the city state competition that took place in Italy in the early Renaissance. Instead of trying to recruit the best and brightest artists and merchants, Beijing, Shanghai, Sydney, Singapore, Bangalore, Delhi, Jeddah, Doha, Moscow, London, Mexico City, Santiago, São Paulo and the leading cities of the United States all are struggling to be the leaders of what has been called the "Knowledge Economy." To do this, their academic sectors must reform, transform, and start to work together to make the "whole greater than the sum of the parts."

But this inspiring goal is extraordinarily hard to accomplish without the help of a respected neutral broker.

The Corporate Conundrum in Science

Meanwhile, the same challenge in a slightly different form faces industry. In increasing numbers of cases —in sector after sector— multinational companies have determined that they cannot achieve or remain in leadership positions in the 21st century based purely on the creativity and innovation of their in-house scientists and engineers. But the novel element of this realization is not the when but the how. Companies —especially in the chip and computer industries and, more recently, in the pharmaeutical industry— have been trying to establish academic-industry alliances for the last 30 years. The newer element to this picture: bilateral efforts are inefficient and cannot scale.

Whereas there has been a reasonable history of successful partnerships between companies and engineering schools, in the life sciences sector in particular, the effort to establish alliances has been frought with trouble —often beginning with the interactions taking place in the very place that was set up to make them possible: the tech transfer offices of the universities. Faced with a pitched battle in almost every case, corporations increasingly wonder how they can afford the inefficiencies of multiple one-on-one negotiations. So they now look for multilateral mechanisms.

In the experience of The New York Academy of Sciences, there have been three highly interesting forms of this search for multilateralism. The first has already been touched on, having been exemplified when 7 major companies leaped to support the conference on brain imaging in London because it would give them access to the best of not only London's top universities but other universities whose stars were "imported" for the meeting by the Academy.

The fact that industry hungers for someone to aggregate talent was not new to the Academy, however. From the day that our Academy began to organize New York's leading researchers into "discussion groups" —in Systems Biology, Neurodegenerative Diseases, RNAi, Chemical Biology, Soft Condensed Matter Physics, Green Buildings and 20 more— the heads of research of leading companies would happily provide support in exchange for involvement of their best scientists in communities of excellence of strategic corporate interest.

And a crucial point: these companies can find the lead scientists who we invite as speakers without our help. But how can they identify the best young scientists and see the best emerging work in a multi-institutional setting without having a neutral convenor organize the event for them?

A second form of industry interest in establishing multilateral alliances is exemplified by the requests of various companies for the New York Academy of Sciences to introduce them into a kind of leadership network of academia allowing them to approach multiple institutions over the heads of the lawyers to try to arrive at multilateral regional initiatives that will help the company, the institutions, and the region itself. Without discussing proprietary versions of this, I would draw the reader's attention to a remarkable regional development that would not have happened without the investment of time, money, and leadership by IBM, albeit supported by a passionate and financially generous Governor and clear-eyed leaders of the State University system: see *www.csne.albany.edu* to appreciate the etiology of the College of Nanoscale Science & Engineering which has, in less than a decade, engendered partnerships with hundreds of companies, universities and even non-US government agencies and over $5 billion in investments!

Finally, the third example is literally global in nature and thoroughly unprecedented. Inspired by the CEO, the Chief Scientific Officer, and chief health policy leader of PepsiCo, the New York Academy of Sciences undertook an assessment of the need for a global convenor of the entire nutrition science community to drive the field forward more rapidly in order to address one of the greatest challenges of our times: under- and over-nutrition. Three billion people suffer from one or the other of these twin plagues and the field needs prioritizing, new thinking, and new minds dedicated to advance the science in out-of-the-box ways. The single most advantageous development, all stakeholders agreed during the assessment, would be a pre-competitive alliance of the corporations, universities and government agencies engaged in this battle.

On November 15, 2010, this very notion came to fruition with the launch of a global public/private partnership at an event in New York City. Coming together under the neutral auspices of the New York Academy of Sciences were fierce competitors, Coca Cola and PepsiCo and Pfizer, Johnson & Johnson and Abbott. Other companies among the inaugural partners were Nestlé and DSM. On the academic side, the inaugural partners included the key people from Wageningen University and Research Centre, Cornell, Tufts, Columbia, Harvard, Johns Hopkins, and UC Davis. Governments that joined us included the US White House Office of Science & Technology Policy, the US Department of Agriculture, the science & technology institute of Mexico City, and the Ministry of Health of Qatar. NGOs included the Bill and Melinda Gates Foundation, The Global Alliance for Improved Nutrition (GAIN), and several family foundations, most especially the Mortimer D. Sackler Foundation which has created The Sackler Institute for Nutrition Science within the Academy to drive this initiative.

My ultimate point: this was not simply a meeting. It was the beginning of a robust series of transactional initiatives to advance the entire field of nutrition science through seminars, workshops, conferences, agenda-setting activities, new talent recruitment, community building, research funding and open innovation challenges

and prizes. How can such an initiative be organized without the creation of a neutral organization to make the partners comfortable and drive the agenda? And why create an untested organization if you can identify an already robust, scientifically unimpeachible and unbiased organization with a large net of experts already in hand to lead the effort?

Why not an academy of sciences to scale the collaborations we need to address global challenges like under- and over-nutrition?

Government

My concluding segment will address the fact that governments need dynamic, innovative and unimpeachable scientific NGOs as badly as academia and industry do. When the leaders of the bold new initiative created by Saudi Arabia's King Abdulla —to establish a world-class graduate school in science & technology from scratch (KAUST)— contemplated the extraordinary difficulties facing them, they understood that they would have an enormous capacity-building challenge unless they could create unprecedented alliances with the best universities in the world to help them attract the best faculty and students from scratch.

The government of Saudi Arabia was willing to fund such partnerships at extraordinary levels. But just witness the complexities encountered by the Singapore government in establishing its first foreign university/medical partnership with Johns Hopkins University and Qatar's challenging alliance-building exercise with Weill-Cornell Medical Center. How was the staff —or the nation— to establish 15 or more bilateral alliances in a short time when es-

FIGURE 1. Left, The College of Physicians and Surgeons. The Lyceum of Natural History held its founding meeting on 29 January 1817 in a room in the College of Physicians and Surgeons on Barclay Street near Broadway. The Lyceum continued to meet at the college until 21 April 1817 when it moved into a room at the New York Institution. [Courtesy of the New York Academy of Medicine.]. Right, Samuel Latham Mitchill, MD (1764-1831), Founder and President of the Lyceum of Natural History of New York City 1817-1823 [From oil painting attributed to Rembrant Peale, Courtesy of the Academy of Natural Sciences.]

tablishing any one of such alliances is extraordinarily hard?

The answer: Saudi Arabia contracted with an NGO in Washington that was founded and overseen by ex-science advisors to the President of the United States. Using the remarkable network of friends and colleagues, this NGO was able to assist the Saudis to organize the network they needed of world-class university partners willing to participate actively in the recruitment of students and faculty.

Based on the experience I have had in making agreements with the mayor of Mexico City, government leaders in Russia, the leadership in Qatar, the Prime Minister of Malaysia, and the Minister of Health of China —not to mention scores of conversations with political leaders in Argentina, Brazil, Germany, Nigeria, the Emirates, Saudi Arabia, and India— I can attest to the wide-spread awareness on the part of the savviest politicians of the following three truths:

a) In an increasingly competitive world, those entities that are best connected to individuals, institutions and, ultimately, networks of excellence will have the most chance to succeed.

b) Establishing such networks on a serial and bilateral basis is not a sustainable strategy.

Mechanisms —or shall we say, institutions— need to be identified that can substantially increase the efficiency of network-building on a multilateral basis.

In a world that desperately needs to address the challenges of complexity on an unprecedented scale with unprecedented speed, I ask again: why not academies of science as the neutral network builders and transaction facilitators?

This is what the New York Academy of Sciences is increasingly being challenged to do. It enables us to achieve our missions of advancing science and addressing global challenges amenable to scientific and technological solutions. And it offers us an unparalleled opportunity to partner with the best and brightest, young and old, as well as the best of the world's academic, industry, government, and NGO institutions. It is an honor and a grand challenge for our staff. And we hope we are making a contribution to the world in this way.

What more satisfying role could there be for a 21st century science academy?

NOTES

Regarding the Academia Secretorium Naturae, multiple websites recognize it as the first scientific academy. To consider two of these, see below:

http://en.wikipedia.org/wiki/Academia_Secretorum_Naturae

http://faculty.ed.umuc.edu/~jmatthew/naples/dellaporta.htm

In regard to the Accademia Nazionale de Lincei, information can be found on the website of the important Interaccademy Panel:

http://www.interacademies.net/Academies/ByRegion/WesternNorthernEurope/Italy.aspx

One important note about their history: They state that "Their dedication to the study of natural sciences and their approach to science based on the new experimental methods made the Accademia dei Lincei the first scientific academy in the world." But clearly, it wasn't quite the first and, interestingly, the founder of the first, della Porta, later joined the second.

To learn more about the Royal Society go to *http://royalsociety.org*. Their website states: "The Royal Society is a Fellowship of the world's most eminent scientists and is the oldest scientific academy in continuous existence."

REFERENCES

Baatz, S. (1990). "Knowledge, Culture, and Science in the Metropolis: The New York Academy of Sciences, 1817–1970". *Annals of the New York Academy of Sciences*, 584.

ABOUT THE AUTHOR

Ellis Rubinstein (New York, New York, 1945) is the President and CEO of the 194-year-old New York Academy of Sciences, home of 25,000 members in 140 countries with 28 Nobel Laureates on its President's Council. Under Rubinstein's leadership, the Academy has increased its membership and developed scores of alliances with universities, corporations and government agencies the world over. It has also developed path-breaking initiatives including Science Alliance; Frontiers of Science; Scientists Without Borders; the Sackler Institute of Nutrition Science; and its new innovation advisory services group which has provided advice for the President of Russia, the Prime Minister of Malaysia and the Mayor of Mexico City. Previous to the Academy, Rubinstein was Editor of *Science* for a decade, Editor of *The Scientist*, Senior Editor of *Newsweek*, and Managing Editor of *Science 86* and *IEEE Spectrum*. His journalism was honored by three National Magazine Awards, the Pulitzer Prizes of the US periodical industry. And he was the first Western journalist to interview Jiang Zemin and the first science journalist to interview then-President Bill Clinton. Among his many international activities, he is especially proud of the New York Academy of Sciences' multi-year partnership with Catalunya to organize cutting-edge international conferences.