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The Development of Global Science

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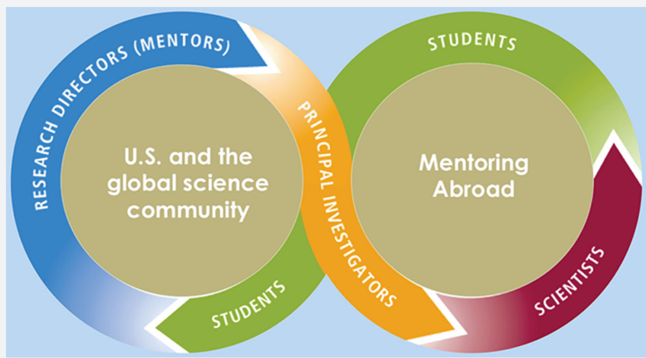
ABSTRACT: How do we build research capacity throughout the world and capture the great human potential? To us, the answer is rather straightforward: the time-honored tradition of scientific mentoring must be practiced on a wider scale across borders. Herein, we detail the necessity for expanding mentorship to a global scale and provide several important principles to be considered when designing, planning, and implementing programs and centers of research around the world.



INTRODUCTION

Historically, science has provided the strongest framework for addressing the challenges we face as a society as well as for enhancing the well being of all people. However, the ability to perform science at a high level is distributed unequally; only scientists from relatively few countries have the means and knowledge to address problems facing the world.[1] We predict that the longer this state of affairs continues the less likely humanity can achieve long-term solutions. The problems that transcend borders and affect quality of life can only be overcome by having a more equal distribution of scientific capacity.[2] Developing countries, in which world-class research is still in its nascent stages, undoubtedly have the talent and people to meaningfully contribute, but what they lack is the reliability of a rigorous scientific culture.[3,4] By and large, these countries' adoption of world-class practices and standards ensures their participation in capitalizing on the economic opportunities that scientific research provides.[3,5] Furthermore, it guarantees their capability in meeting the challenges affecting their local regions before these challenges become global.[3] This issue naturally raises the question: How do we build research capacity throughout the world and capture the great human potential? In this essay, we propose our approach to answering this question, which we have been implementing in Vietnam[6] and, to varying degrees, Japan, Korea, Jordan, and Saudi Arabia. Specifically, we attempt to distill the basic principles of developing global science, which allows for the development of emerging minds in distant countries in a sustainable and mutually beneficial manner.

The major challenge for many countries in implementing rigorous science programs is to recruit and to retain top-notch personnel who combine innovative thinking with personal integrity. Indeed, this challenge is compacted by students who seek scientific training abroad that leads to better employment opportunities than can be found in their home country. Even programs with state-of-the-art facilities and ample funding to support research projects face the classic dilemma: top professors and researchers are drawn to institutions where the most talented students populate the research laboratories, and the most talented students are drawn to those institutions that already have top professors in place. Without the ability to break this "chicken-and-egg" conundrum, even the most ambitious and highly funded new institutes struggle to attract quality talent.

IMPORTANCE OF THE MENTORING TRADITION

Beyond having fully developed science infrastructures in place—including high quality researchers—there is an additional aspect that factors into the assured, continuous success of

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the most established scientific institutions: mentorship. The mentoring relationship is so accepted in some countries that access to a mentor is an expectation of every scholar entering graduate school and a research program. This relationship is critically important to building and sustaining research capacity, as it perpetuates the values that are necessary for achieving excellence in research.[4,7] In our view, the mentoring relationship is the golden thread of innovation that helps create and sustain a vibrant science culture.

The practice of mentorship has been diligently honed over centuries of academic pursuit where generations of intellectuals and academics have committed their professional careers to the development of scholars as a result of their sincere investment in the outcome. In fact, this model is so well established that one can literally trace their training through a "scientific family tree". As an example, we trace our academic lineage from the most immediate mentor, Professor Walter G. Klemperer, to the mentors that his scientific training, in turn, is indebted to, Professors F. Albert Cotton and Sir Geoffrey Wilkinson before that (Figure 1). In principle, students who come under our

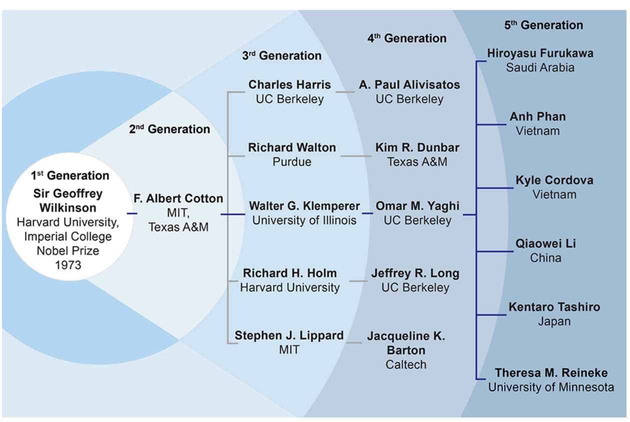

Figure 1. The time-honored tradition of mentoring affords a traceable scientific lineage dating back several generations of mentors and serves as a foundation for scientific excellence and innovation. Through mentoring on a global scale, we seek to extend our tradition to emerging scholars throughout the world. The dark outline traces the authors' academic lineage.

mentorship benefit from this history of scientific excellence that started with our scientific forefathers. This family tree and mentoring tradition extends to others, Professors A. Paul Alivisatos, Kim R. Dunbar, Jeffrey R. Long, and Jacqueline K. Barton (to name a select few) who are all descendants of a common scientific ancestry. Therefore, the onus lands squarely upon us to maintain this tradition and pass our training, experience, and resources to the next generation of future mentors.

To extend the tradition of scientific mentoring to a global scale, it is imperative to closely examine the nature of relationships created between mentors and students within the laboratory setting. In general, a mentor's role is to transform a student's formal education into a more comprehensive body of knowledge that can be applied to the real world. In the broadest sense, mentors help bring the information of science to life. The main avenue through which this transformation takes place is research, which, not coincidentally, is the primary component of most scientific graduate and other such research programs. Through the research experience, young scientists quickly learn the challenges of formulating significant and novel questions, shaping ideas to address those questions, carrying out well-executed studies and carefully made observations to understand the nature of matter and to advance the frontiers of knowledge, and finally, communicating their discoveries in both written and oral forms. It is noted that additional training in ethics, accuracy in reporting results, the value of collaboration, and a respect for differing opinions takes mentorship to a level of professional development that is rarely observed elsewhere.[8] Over the course of a typical graduate career, the relationship between mentor and student grows more intimate and multifaceted, often blurring the lines between colleague, friend, and even family member.[7b] Indeed, at the point of graduation, the student no longer holds the distinction of being the "the recipient of mentorship", but rather now is equipped with a more personalized form of the same training, knowledge, and education as the mentor. Although the mentorship bond is a lifelong one, a new distinction of mutual scientific respect and the status as a peer are granted.

■ EXTENDING MENTORSHIP GLOBALLY

Mentoring on a global scale is about extending this lifelong bond to students who do not otherwise have easy access to a mentor with experience in conducting world-class research. The easiest way to facilitate this process is by maintaining close collaborative relationships with former students and postdoctoral researchers (for the lack of a better word, let us call them "protégés") who choose to take positions abroad. When the relationship between mentor and protégé is extended globally, a new layer of complexity emerges. Geographical distance between a mentor and protégé is a natural obstacle that must be overcome. Furthermore, protégés traveling abroad must deal with cultural differences on a more comprehensive scale, gain familiarity with available resources, and navigate through bureaucracy.[8] Relationships outside of traditional academia also become relevant as these types of mentoring programs are more visible due to their ties with high-profile, international mentors. In fact, the typical direct line between mentor and protégé will incorporate players such as government officials and industry professionals.

Multiple strategies exist to ensure the success of this type of mentoring approach. One of the most common strategies is for a mentor to spend a portion of their time traveling to laboratories they are associated with around the world.[9] In a sense, this facilitates interactions and mentorship, but this strategy is considered to be more akin to a consulting role rather than a means of establishing a sustainable research environment for emerging scholars in their home country. We favor a different approach based on a two-tier mentoring system that is illustrated in Scheme 1. Under this plan, senior faculty members (i.e., mentors) keep their current institution as their home institution and develop parallel programs abroad where they serve as directors or codirectors. The mentors will help to identify talented, early-career protégés who are willing and able to move to another country to serve as principal investigators

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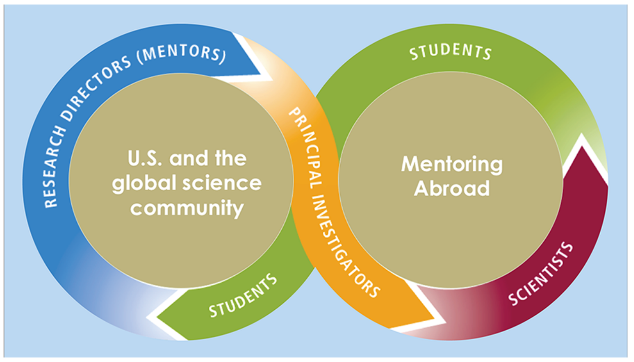
Scheme 1. Developing a Global Mentoring System[a]



[a]Growing a vibrant global scientific community using the concept of mentoring on a global scale. In this model, mentors serve as research directors who place their former students (protégés) or close associates as principal investigators abroad and help them to build research centers of excellence. The principle investigators (protégés) serve as mentors to rising scientists and young scholars at these newly established centers. This results in a sustainable model that ensures the continual transfer of knowledge and experience from one generation of scholars to the next.

and set up new research centers. The directors will subsequently serve as long-distance mentors, and the protégés will serve as in-house mentors for the emerging scholars who join the newly established centers abroad. This model also provides opportunities for the protégés to gain valuable independent experience while maintaining the support of the mentors. Additionally, the directors can also provide direct mentorship to the scholars abroad by hosting them in their own laboratories or by traveling periodically to the new site, especially during the founding stages to assist in establishing a solid framework for the program. In this way, emerging scholars benefit not only from the mentorship provided by the protégés on a daily basis, but also from the director over the course of their education.

It is important to note that international mentoring enterprises exist as programs, foundations, and fellowships. Examples of these include the Global Young Academy in Germany,[10] Marie Skłodowska - Curie actions - Research Fellowship Programme in the European Union,[11] Alexander von Humboldt Foundation - Georg Forster Research Fellowship in Germany,[12] National Science Foundation Graduate Research Opportunities Worldwide in the United States,[13] and USAID Partnerships for Enhanced Engagement in Research in the United States,[14] among others.[15,16] Our goal complements these efforts by developing global science through building of research centers and institutes and deploying one-on-one mentoring as a strategy for inspiring students, sustaining innovative research, and forming mutually beneficial relationships.

With these considerations in mind, we detail several important features and principles that an international mentoring program must take into account. These ensure that parallel bridges of knowledge and trust can be built together and, thus, provide the best possible framework for a successful mentoring venture.

■ PRINCIPLE 1: INCLUSIVITY

The success of a global mentoring venture must first rely on an open and inclusive culture of research and learning. This means the inclusion of qualified, underrepresented members of the society. For example, issues related to women in science and the workforce must be addressed honestly and forthrightly.[15e,17] Senior women scientists must be engaged as mentors in developing research centers and institutes around the world. If needed, this can be accomplished by way of introduction, support, and/or partnership from colleagues, or even former students, who have connections to universities in countries where women scientists can benefit. Furthermore, steps must be taken at the start of a mentoring program to underscore the importance of the inclusion issue. Nominating women as protégés as well as actively recruiting emerging women scholars to join these new programs are two ways.[15e] Mechanisms should be put into place to ensure that women scholars and other minorities have equal salaries, access to resources, and opportunities to succeed.

By placing minorities in leadership roles, a valuable example of inclusivity is immediately set. In such circumstances, other emerging scholars, who join these new centers, begin their scientific careers under the mentorship of a minority leader. From this mentoring relationship, a level of respect for the mentor's scientific leadership will be developed and instilled within the scholar. This assuredly influences the perspective of the next generation of protégés to see the scientific world as inclusive. Though it is true that each country has its own culture and customs, which must be respected, the omission of minorities in these research centers will only serve to hinder the progress that is being attempted. Mixing of researchers regardless of gender, ethnic background, nationality, creed, or race serves to strengthen idea generation and research innovation. This sends a loud and clear message that the researcher is valued based on the merit of his or her contribution rather than on other factors.

Economic disparity is also a formidable roadblock in many countries for achieving an inclusive environment. At the outset, it must be made clear that socioeconomic status cannot inhibit a prospective scholar from joining a global science program. Safeguards, such as free tuition and competitive salaries for emerging scholars, must be put in place to afford equal access to all.

The success of a global mentoring venture must first rely on an open and inclusive culture of research and learning.

■ PRINCIPLE 2: MUTUAL UNDERSTANDING

Any attempt to create a mentoring relationship must engage participants who are sincerely committed to a common goal. Mentor candidates must be experienced enough to understand the time, energy, and dedication required, and realistic enough to provide them. Clearly, both the mentor and protégé must be able to understand cultural differences and mutually agree on the best solution for effectively working in this environment. Furthermore, the pairing must acknowledge that communication issues, including English fluency, will arise.[18] Plans for overcoming such barriers are crucial for avoiding, as much as possible, potential misunderstandings that may occur. This is especially significant if the protégé is not native to the country in which the research center is being developed.

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An ideal situation is one in which the protégé is selected based on merit, and preferably, the mentor should have a long-term knowledge of the individual (i.e., former student, postdoctoral researcher, or close collaborator). In this scenario, academic lineage becomes increasingly beneficial—mentors and protégés from the same lineage typically have shared outlooks and common goals. By selecting a former student or postdoctoral researcher as a protégé, scientific and professional values have already been shared with the protégé as a result of their academic training under the mentor. This provides a foundation of mutual trust and respect moving forward. Additionally, recruiting protégés who are from the countries that these research centers are being established in can serve as inspiration to the emerging scholars who join these centers. In any case, it is true that a successful relationship results from a mentor−protégé pair that is able to work together in a way that brings out each other's best qualities in order to accomplish a common goal.

PRINCIPLE 3: ACCESSIBILITY

To ensure the lines of communication remain open, the mentor, protégé, and scholars must be able to freely move across international borders. Students benefit most from traveling abroad to their mentors' laboratories. In other cases, bringing the mentor and research opportunities to the students will help to establish local scientific infrastructures, which will strengthen and conform to a growing global network. Furthermore, protégés, serving as principle investigators, must have the ability to travel back to the mentor's home institution periodically for consultation and guidance regarding the progress of the new research center. Free use of the Internet also serves as a prominent source of accessibility. Researchers must be able to interact using electronic communications, such as email and video conferencing, on a routine basis. In principle 6, we mention that a contract must be put in place to govern scientific information sharing.

PRINCIPLE 4: WORKING FROM A POSITION OF STRENGTH

A new mentoring program must recognize and take advantage of the different strengths and needs that the mentor and protégé have over the course of their careers. Mentors should have the ability to offer the wisdom of their experiences without having to abandon well-established laboratories and resources in their home country. On the contrary, protégés are typically more willing and able to move abroad in order to establish vibrant research laboratories and may even value the opportunity to start their career in a new setting.

PRINCIPLE 5: A SOLID INFRASTRUCTURE

Sound infrastructure, which includes international safety standards,[19] is critical for achieving impactful and measurable success. First, researchers must have a clear vision for what the mentoring process entails, including the areas of research they will focus on, the goals they plan to accomplish, and a viable plan for how to be successful. Second, researchers must have the space, equipment, financial resources, and personnel that will enable them to conduct worthwhile research. Mechanisms for ensuring these issues are taken care of must be clearly defined before the endeavor is initiated. It is noted that there are a variety of international resources available to accomplish this task.[9b] These issues are often not easy nor straightforward to address with many challenges being presented based on the country involved, but with clarity and a concrete, viable plan they are achievable. Finally, traveling scholars should have access to a network of people who have gone through similar experiences that can be shared as advice. This calls for a mentoring network, which ensures that the connectivity between mentors, protégés, and students is defined and widely available.

The ultimate goal of this model is to create a sustainable cycle based on the protégé becoming the mentor who then transfers their knowledge to other emerging scholars.

PRINCIPLE 6: SUSTAINABILITY

The goals of creating a mentoring program should not rest solely on mentoring students; they must also ensure that the research center will continue to thrive for many years. With this comes the need to develop a program that is mutually beneficial, in which guidelines for success are determined at the outset. Intellectual property must be given proper consideration, but should not be an obstacle to the collaboration; rather, it is to be seen as an asset for both sides. Most established universities have in place equitable sharing arrangements that are successfully employed between laboratories across borders. We advise that a contract be put in place in which the parameters of the collaboration program are spelled out; this includes leadership matters, operation and management, intellectual property, conflict resolution, and if applicable, funding.

It is important to note that the ultimate goal of this model is to create a sustainable cycle based on the protégé becoming the mentor who then transfers their knowledge to other emerging scholars. Indeed, as these emerging scholars grow as scientists, they too will become the next generation of protégés and continue to pass on the mentoring relationship from one generation to the next, thereby constructing new lineages. Furthermore, networks of mentor−protégé pairings will expand by incorporating related researchers, potentially from the same academic institutions or the same academic lineage, who are willing to work together to produce collaborative laboratories on related research projects. As this occurs, researchers will have access to a continually larger pool of scholars who are grounded in the values and ethics of research and mentoring.

PRINCIPLE 7: FUNDING

In most partnering countries, start-up funds are available to support the creation of new centers of excellence, provided that a robust research agenda is prepared and a high profile team of mentors is assembled. However, in countries where such funds are not readily available, mentors must assist protégés in defining an achievable research agenda and in writing grant applications to make a convincing case for obtaining seed funds, which will demonstrate feasibility of the program. Once preliminary results are obtained, and with the direct involvement of the mentor(s), a credible case can be made for garnering further funding. It is noted that funding from

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private sources and industry (where applicable) can also be pursued in a similar manner with assistance provided by the mentor's experience as well as through exploration of the mentor's network of resources.

From a practical viewpoint, the protégé must have some degree of knowledge regarding the infrastructure and instrumentation costs that are required upon establishing a center. This is especially true given that many developing countries work through local vendors, who do not have the requisite expertise, rather than instrument companies directly. Equipment aging, malfunctions, and damage are inevitable, and funds must be allocated for when such circumstances occur. Additionally, this includes yearly facility and instrument maintenance costs, which are typically overlooked during the budget planning.

■ PRINCIPLE 8: INSTITUTIONAL AND INTERGOVERNMENTAL SUPPORT

The sustainability and expandability of such a mentoring program heavily rely on the level of support provided from the mentor's home institution as well as the mutual governments of the countries involved.[3] The mentor's institution can offer assistance to the partnering institution by taking advantage of their well-established infrastructures and executive support. The mutual governments of the partnering institutions should be informed and consulted with as the mentoring program is being organized, planned, and developed. This encourages transparency and allows researchers to collaborate and operate in a supportive atmosphere. Support from independent, external organizations and/or foundations (for example, programs such as the Global Young Academy[10] in Berlin, Germany) can be sought after in order to tap their rich experience and know-how in implementing similar ideas.

It is clear to us that mentoring on a global scale can accelerate knowledge transfer and development by providing top-quality training and education to emerging scholars around the world.

■ BENEFITS AND OUTLOOK OF DEVELOPING GLOBAL SCIENCE

The ability to provide global mentorship provides hope for the future of science. Scholars involved on either end of this relationship will be able to share and foster core values such as respect for the value of knowledge and acceptance of working with different cultures. On a practical level, the ability to extend mentoring relationships to a global stage *may* counteract problems such as human capital flight—sometimes referred to as "brain drain". No longer will emerging scholars be required to find opportunities outside of their borders to improve their quality of life. However, if emerging scholars do, in fact, choose to pursue opportunities abroad, the mentoring process established herein will outfit them with the skills and training to be successful, competent international researchers and provide visibility to their research on the international stage.

It is clear to us that mentoring on a global scale can accelerate knowledge transfer and development by providing top-quality training and education to emerging scholars around the world. The shift in viewpoint from a local community of researchers to a global one will infuse all areas of science with new ideas and skill sets, increase learning opportunities for scientists at large, and tackle informational and technological challenges that are associated with global problems. The vision of a global science network fueled by mentoring is ambitious, but much more achievable than one might imagine. At present, we have worked together to build centers of research excellence at the Center for Molecular and NanoArchitecture at Vietnam National University, Ho Chi Minh City, Vietnam, the Carbon Capture and Sequestration Technology Innovation Center at King Fahd University of Petroleum and Minerals, Saudi Arabia, and a collaborative research center at King Abdulaziz City of Science and Technology, Saudi Arabia. Additionally, we have initiated and maintained collaborative partnerships, based on the mentoring model, with the Reticular Materials Group at the National Institute of Materials Science, Japan, and Heterogeneity within Order (Energy, Environment, Water, and Sustainability Program) at the Korea Advanced Institute of Science and Technology, Republic of Korea. Plans for future research centers employing this mentoring model are being developed in Jordan and China.

Indeed, the idea behind building research capacity around the world to capture human potential is perhaps what we value most in our roles as educators. To us, the goal is not complicated: developing global science is simply about extending our experiences and knowledge to all people—a practice that has long been established in places with an extensive tradition of excellence in academia. Simultaneously, by providing our mentorship, we will be able to forge relationships based on trust and care for one another. This will allow us to expand the lineage of scientific excellence, break down barriers that separate people, and work together to address the challenges that face humanity as a whole.[20]

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Notes

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REFERENCES

(1) (a) King, D. A. The Scientific Impact of Nations. *Nature* **2004**, *430*, 311−316. (b) Annan, K. A Challenge to the World's Scientists. *Science* **2003**, *299*, 1485. (c) Rao, C. N. R. The Two Faces of Chemistry in the Developing World. *Nat. Chem.* **2011**, *3*, 678−680.

(2) Annan, K. Science for All Nations. *Science* **2004**, *303*, 925.

(3) *Inventing a Better Future: A Strategy for Building Worldwide Capacities in Science and Technology*; InterAcademy Council: Amsterdam, 2004.

(4) Tosatti, E. Nurturing Science in Developing Countries. *Nat. Mater.* **2006**, *5*, 843−845.

(5) Moreno-Borchart, A. One Problem at a Time. *EMBO Rep.* **2004**, *5*, 127−130.

(6) Service, R. F. Satellite Labs Extend Science. *Science* **2012**, *337*, 1600−1603.

(7) (a) Harris, E. Building Scientific Capacity in Developing Countries. *EMBO Rep.* **2004**, *5*, 7−11. (b) National Academy of Sciences, National Academy of Engineering, Institute of Medicine. *Adviser, Teacher, Role Model, Friend: On Being a Mentor to Students in Science and Engineering*; National Academies Press: Washington, D.C., 1997.

(8) Frank, H.; Campanella, L.; Dondi, F.; Mehlich, J.; Leitner, E.; Rossi, G.; Ioset, K. N.; Bringmann, G. Ethics, Chemistry, and Education for Sustainability. *Angew. Chem., Int. Ed.* **2011**, *50*, 8482−8490.

(9) (a) Fulbright Specialist Program Home Page. http://www.cies.org/program/fulbright-specialist-program (accessed February 2015). (b) Vuuren, R. D. J.; Buchanan, M. S.; McKenzie, R. H. Connecting Resources for Tertiary Chemical Education with Scientists and Students in Developing Countries. *J. Chem. Educ.* **2013**, *90*, 1325−1332. (c) Stone, R. The Force Behind North Korea's New Science University. *Science* **2009**, *325*, 1610−1611. (d) Stone, R. Crunch Time for North Korea's Revolutionary New University. *Science* **2011**, *334*, 1624−1625. (e) Solomon, T.; Åkerblom, M.; Thulstrup, E. W. Analytical Chemistry in the Developing World. *Anal. Chem.* **2003**, *75*, 106A−113A.

(10) Global Young Academy Home Page. http://www.globalyoungacademy.net/ (accessed February 2015).

(11) Marie Skłodowska-Curie Actions Home Page. http://ec.europa.eu/research/mariecurieactions/index_en.htm (accessed February 2015).

(12) Alexander von Humboldt Foundation − Georg Forster Research Fellowship Home Page. http://www.humboldt-foundation.de/web/georg-forster-fellowship-hermes.html (accessed February 2015).

(13) National Science Foundation Graduate Research Opportunities Worldwide (GROW) Home Page. https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=504876 (accessed February 2015).

(14) USAID Partnerships for Enhanced Engagement in Research (PEER) Home Page. http://sites.nationalacademies.org/pga/peer/index.htm (accessed February 2015).

(15) (a) The InterAcademy Partnership Home Page. http://www.interacademies.net/ (accessed February 2015). (b) Danida Fellowship Centre Home Page. http://dfcentre.com/ (accessed February 2015). (c) International Organization for Chemical Sciences in Development Home Page. http://www.iocd.org/ (accessed February 2015). (d) Seaborg, G. T. An International Effort in Chemical Science. *Science* **1984**, *223*, 9. (e) Organization for Women in Science for the Developing World Home Page. http://owsd.ictp.it/ (accessed February 2015).

(16) We note that there are also opportunities to reach undergraduate students. These programs are advantageous for developing a pool of globally minded scientists, who will be encouraged to one day participate in global science programs. (a) Linn, M. C.; Palmer, E.; Baranger, A.; Gerard, E.; Stone, E. Undergraduate Research Experiences: Impacts and Opportunities. *Science* **2015**, *347*, 1261757 DOI: 10.1126/science.1261757. (b) Clements, J. D.; Connell, N. D.; Dirks, C.; El-Faham, M.; Hay, A.; Heitman, E.; Stith, J. H.; Bond, E. C.; Colwell, R. R.; Anestidou, L.; Husbands, J. L.; Labov, J. B. Engaging Actively with Issues in the Responsible Conduct of Science: Lessons from International Efforts are Relevant for Undergraduate Education in the United States. *CBE Life Sci. Educ.* **2013**, *12*, 596−603. (c) National Science Foundation International Research Experiences for Students (IRES) Home Page. https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12831 (accessed February 2015). (d) European Undergraduate Research Opportunities (EUROScholars) Home Page. http://euroscholars.eu/ (accessed February 2015). (e) Amgen Scholars Home Page. http://www.amgenscholars.com/ (accessed February 2015).

(17) (a) Larivière, V.; Ni, C.; Gingras, Y.; Cronin, B.; Sugimoto, C. R. Bibliometrics: Global Gender Disparities in Science. *Nature* **2013**, *504*, 211−212. (b) Moss-Racusin, C. A.; Dovidio, J. F.; Brescoll, V. L.; Graham, M. J.; Handelsman, J. Science Faculty's Subtle Gender Biases Favor Male Students. *Proc. Natl. Acad. Sci. U. S. A.* **2012**, *109*, 16474−16479. (c) United Nations Educational, Scientific, and Cultural Organization. *Science, Technology, and Gender: An International Report*; UNESCO: Paris, 2007. (d) West, M. S.; Curtis, J. W. *AAUP Faculty Gender Equity Indicators 2006*; American Association of University Professors: Washington, D.C., 2006.

(18) (a) Eisemon, T. O. *Language Issues in Scientific Training and Research in Developing Countries*; World Bank: Washington, D.C., 1991. (b) Meneghini, R.; Packer, A. L. Is there Science Beyond English? *EMBO Rep.* **2007**, *8*, 112−116.

(19) Djerassi, C. Chemical Safety in a Vulnerable World − A Manifesto. *Angew. Chem., Int. Ed.* **2004**, *43*, 2330−2332.

(20) As a reviewer pointed out, there may be scientists who seek funding from developing countries in exchange for affiliation credit. This situation offers little merit for developing global science in a sustainable and *mutually beneficial* manner. The end goal for all global science programs is to initiate and develop, in the home country, research programs that benefit all partners in a meaningful way.