



Data-Enabled Life Sciences Alliance International (DELSA Global) Workshop

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A Workshop on “Science of Hows”: Cultivating 21st Century Innovation & Crowd-Funded DELSA Micro-Grants for Citizen Science

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Twenty-first century science: What has (ought) to change?

For time immemorial, science has been about discovery, a “*science of whats*”. Yet on a day-to-day basis, many of us do science that might feel more intangible than real. Working in a laboratory, students and senior scientists alike, often find it difficult to foresee the *material products* that will emerge from their valuable research, not to mention the multiple innovation future(s) ahead. The chain of data-*to*-analysis-*to*-knowledge-*to*-innovation remains opaque in daily institutional anxieties of many research and development (R&D) organizations, be they situated at a university, industry or government.

In the era of “Big Data” driven, interdependent, transdisciplinary and globally distributed 21st century science, there is a keen recognition that we can no longer continue to practice science as we have come to know it since Enlightenment in 16th century: the “one man and one microscope” model of science, confined within the walls of the laboratory space. A new “*science of hows*” is needed to *co-produce* knowledge and innovation as global society in the new century.

An alternative model of knowledge co-production, *collective open innovation* speaks to the whole (of innovations) being greater than the sum of its parts. This model has enormous pragmatic appeal especially in the case of Big Data R&D like proteomics where traditionally defined experts (e.g., those with a PhD) are simply outnumbered by the enormous scale of the task at hand: to harness the clinical, environmental and societal utilities of data-intensive 21st century science. Moreover, science and technology-based experts tend to suffer from professional blind spots, when it comes to identifying the real-life utilities of their own laboratory findings. Experts often under-appreciate the important contributions made by citizen scholars and lead users of innovations to design innovative products and co-create new knowledge.

Where to from here? Transforming hard science to agile, sustainable and responsible “liquid knowledge”

Twenty-first century science is expressly global. While many consortia exist around the globe, each tends to focus on discrete aspects of the scientific practice such as establishing data generation, reporting or analysis standards. There is a need for a new

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alliance of interested individuals and parties to examine the *entire innovation trajectory* to enable and link data-intensive life sciences to agile, sustainable and responsible innovation, termed here as “liquid knowledge”. This is much needed as the social and economic benefits of novel technology investments made in India are *not* automatic (i.e., “they do *not* flow inevitably from the marriage of biology and technology”). Looking back to the 1990s, it is interesting to note that India did not (initially) play a crucial role in genome sequencing projects in a manner that is commensurate with the extensive scientific investments made, and expertise available in the country. Learning from the past lessons in high-throughput and Big Data biology, India quickly realized, however, the importance of proteomics and similar emerging biotechnology research as a centrepiece of 21st century research. Indeed, in 2005 Dr. Abdul Kalam, the former President of India, aptly observed that “*India has the potential to tap research opportunities in proteomics and biochips to help understand the biological processes and treat diseases. This is possible even though the country has missed the opportunity to partner in the Human Genome Project*”. India’s rapidly growing bioeconomy and social policy innovations by the Department of Science and Technology, the Department of Biotechnology and other government funding agencies have helped further shape the large scale clinical proteomics research infrastructure in India.

More recently, to facilitate the progress from data to knowledge to action, leading members of the life sciences community formed the nonprofit DELSA Global (Data-Enabled Life Sciences Alliance International, Seattle; <http://www.delsaglobal.org>) in November 2011. The founding members of DELSA Global, including several colleagues from the Indian Institute of Technology Bombay (IITB), came together through a series of National Science Foundation (NSF)-sponsored workshops, as part of a search for Big Data solutions captured in a set of reports published by the US National Science Foundation Advisory Task Force for Cyberinfrastructure in 2011. It was evident, through the workshops and reports, that the innovation process as it had existed in the past was no longer adequate for the present or future. However, the push towards innovation and the need to solve our society’s problems expeditiously still exist. DELSA’s mission and vision were crafted with this in mind. DELSA’s **mission** is to *accelerate the impact of data-enabled life-sciences research on the pressing needs of our global society*, while its **vision** is, through interdisciplinary research and transdisciplinary engagement, that the life sciences community will move from a “single scientist-single project” model to collective innovation. At present, DELSA Global is involved in multiple strategic partnership collaborative alliances all over the world. They include, for example, NSF (engineering and allied sciences), NIH (National Institutes of Health) in the USA, DELSA Europe, DELSA China, DELSA India, and DELSA Russia.

Case study for the workshop: DELSA Global micro-grants for citizen science

Biomedical science in the 21st century is embedded in, and draws from, a digital commons and “Big Data” created by high-throughput Omics technologies such as genomics. As noted above, the classic Edisonian metaphors of science and scientists (i.e., “the lone genius” or other narrow definitions of expertise) are ill equipped to harness the vast promises of the 21st century digital commons. We believe there are a large number of users waiting to be mobilized so as to engage with Big Data as citizen scientists -- only if some funding were available. Yet many of these scholars may not meet the traditional criteria used to judge expertise, such as track record in obtaining large research grants or classic academic curriculum vitae. This paper describes a novel idea and action framework: micro-grants, each worth \$1000, for genomics and Big Data. Though a relatively small amount at first glance, this far exceeds the annual income of the “bottom one billion” - the 1.4 billion people living below the extreme poverty level defined by the World Bank (\$1.25/day).

We introduce here two types of micro-grants. Type 1 micro-grants can be awarded through established funding agencies and philanthropies that create micro-granting programs to fund a broad and highly diverse array of small artisan labs and citizen scholars to connect genomics and Big Data with new models of discovery such as open user innovation. Type 2 micro-grants can be funded by existing or new science observatories and citizen think tanks through crowd-funding mechanisms described herein. Type 2 micro-grants would also facilitate global health diplomacy by co-creating crowd-funded micro-granting programs across nation-states in regions facing political and financial instability, while sharing similar disease burdens, therapeutics, and diagnostic needs.

We report here the creation of ten Type 2 micro-grants for citizen science and artisan labs to be administered by the DELSA Global. We believe these micro-grants will spur novel forms of disruptive innovation and life sciences translation by artisan scientists and citizen scholars in both resource-limited and developed countries.

Keywords: Biotechnology, citizen science, citizen philanthropy, collective innovation, data-enabled science, DELSA Global, disruptive innovation, global health, OMICS and society.

References

1. Özdemir V, Badr KF, Dove ES, Endrenyi L, Geraci CJ, Hotez PJ, Milius D, Neves-Pereira M, Pang T, Rotimi CN, Sabra R, Sarkissian CN, Srivastava S, Tims H, Zgheib NK, Kickbusch I. Crowd-funded micro-grants for genomics and "Big Data": an actionable idea connecting small (artisan) science, infrastructure science, and citizen philanthropy. *OMICS: A Journal of Integrative Biology* 2013; 17(4): 161-172.
2. Reddy PJ, Jain R, Paik YK, Downey R, Ptolemy AS, Özdemir V, Srivastava S. Personalized Medicine in the Age of Pharmacoproteomics: A Close up on India and Need for Social Science Engagement for Responsible Innovation in Post-Proteomic Biology. *Current Pharmacogenomics and Personalized Medicine* 2011; 9(1): 67-75.
3. Kolker E, Stewart E, Özdemir V. DELSA Global for "Big Data" and the Bioeconomy: Catalyzing Collective Innovation. *Journal of Industrial Biotechnology* 2012 August; 176-178.