A conversation with Dr. Ruedi Aebersold, April 25, 2016

Participants

- Dr. Ruedi Aebersold – Professor, Institute of Molecular Systems Biology (IMSB) at the Swiss Federal Institute of Technology in Zürich, Switzerland (ETH Zürich), and Co-Founder, Institute for Systems Biology (ISB) in Seattle, WA
- Luke Muehlhauser – Research Analyst, Open Philanthropy Project

Note: These notes were compiled by the Open Philanthropy Project and give an overview of the major points made by Dr. Aebersold.

Summary

The Open Philanthropy Project spoke with Dr. Aebersold of IMSB as part of its investigation into early scientific field-building. Conversation topics included how systems biology emerged as a field and early keys to ISB's success.

Emergence of the systems biology field

The emergence of systems biology was mainly a natural progression from earlier work in biology. In part because the field seemed like an inevitable next step in the evolution of biological sciences, it was not difficult to secure funding from government agencies at its inception.

The field grew in part out of the already-established field of molecular biology. It also resulted from the increasing realization among scientists, primarily during the 1990s, that the paradigm in which molecular biology operated was not sufficient for understanding the complexity of biochemical systems in an organism and how they function to influence an organism's health and development. This was complemented by the "omics" revolution in the biological sciences in the 1990s, which refers to the development of fields (e.g., genomics or proteomics) that study molecules such as genes and proteins and their interactions at a systemic level. There was a need to understand not only how individual molecules, genes, and proteins behave, but also how they interact and cooperate to produce a phenotype.

Coining the term "systems biology" to encapsulate this natural progression was important. It allowed early proponents to explain their aims more easily to potential funders and build excitement for the field.

Recruitment

ISB did not find it difficult to recruit scientists in its early days. Many of those recruited from biological fields recognized the limitations of the current approach to biology and understood that this was a natural next step. These scientists tended to be somewhat adventurous and less risk-averse.

The skill sets among ISB's early recruits varied. Many of them had a technological background, often with strong computational skills. Many recruits were not

biologists at all. For example, a significant fraction of recruits were physicists with an interest in biological systems, who contributed both high-level analytical skills and an understanding of how systems work. ISB was able to recruit scientists in part by presenting a goal that could be achieved only through their combined expertise, not through individual efforts.

Training and materials

The development of courses and instructional materials (e.g., textbooks and tutorials) in systems biology, particularly for undergraduates, has tended to lag behind scientific advances in the field. One of the more exciting projects in this area was the development of an undergraduate program at the Lewis-Sigler Institute for Integrative Genomics at Princeton University.

Because it is not a university, ISB has not provided much formal instruction or developed many teaching and training materials. However, it has conducted tutorials so that advanced researchers can work together on projects, learn new skills, and learn how to communicate with one another despite their variety of backgrounds. Generally, ISB had a very highly developed tutorial and discussion culture internally.

Communication and cooperation between subfields

ISB's approach to helping scientists from different fields or subfields work together effectively tended to focus on communication in the context of a specific project or question. This provided more of an impetus to learn and communicate well, as the scientists were driven by the need to advance the project. Because ISB was also a fairly small institution, most of the scientists knew each other and what others were working on, which led to frequent casual communication.

Communication-focused building design

The first building that ISB occupied was designed to facilitate communication. ISB hired an architect, Ken Kornberg, to design the building so as to maximize the opportunity for scientists to interact in a casual, unstructured way (for example, by incorporating many corners with chairs where people could sit down and talk).

Keys to ISB's success

ISB was unusual at the time of its founding because it was the first organization whose sole agenda was the study of systems biology. Every scientist who joined it was there to study systems biology, which provided a unifying purpose. This helped build excitement among the first recruits and was one of the reasons for ISB's initial success.

In addition, because ISB was a new organization, it had a clean slate from which to begin recruiting scientists. The founders could recruit whomever they chose based on the skill sets they needed, as opposed to in a university setting, where recruiting must wait until a position opens or until space becomes available.

Other people to talk to

Other scientists who may be good resources on the early days of systems biology include:

- **Leroy Hood** – President and Co-Founder, ISB
- **David Botstein** – Anthony B. Evnin ’62 Professor of Genomics, Emeritus, and Former Director, Lewis-Sigler Institute
- **Andrew Murray** – Professor of Molecular Genetics and Director, FAS Center for Systems Biology, Harvard University
- **Alan Aderem** – Co-Founder, ISB

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http://www.openphilanthropy.org/research/conversations