Adam Arkin talks big data and big picture

Thoughts from Professor Adam Arkin, UC Berkeley, leading scholar in systems and synthetic biology.

There are a number of large global problems facing humanity today. Possibly the largest is food. By 2050 or 2060 we expect to have 9 billion people on the planet, and by some estimates to feed those people we need to increase our food production by about 40%.

At the same time, the amount of land we can use for cropping is going down, the quality of land and water are being degraded, and scarcity is an increasing problem. As we become more populous infectious disease becomes incredibly important.

If we’re going to solve those problems, which become very significant on the order of our lifetimes, and certainly in the lifetimes of our children, we have to get moving.

Biology represents a store of chemical, mechanical and physical activities unparalleled by
our human-made technology. Microbes, for example, encode enzymes with otherwise inaccessible chemical activities that open up new vistas for synthesis and production of novel and renewable chemicals, pharmaceuticals, materials, and even edible products.

What systems and synthetic biology is about is about trying to harness the genetic potential of the earth to solve some of these problems in soil quality, water quality, plant productivity, nutrition, and human-impacted health. To do that we have to evolve a series of technologies.

Given the pressing global problems mentioned above, we need to engineer plants and microbes that can survive in and clean filthy water, and that can better utilize nitrogen and phosphate, so we don’t have to overuse fertilizer and end up with these in our water supply or cause eutrophication of our lakes.

We’re also beginning to be able to understand how the microbiome affects health and behavior, and the rules for cultivating and feeding those microorganisms so that they become healthier, and for engineering them to do tasks that they wouldn’t do otherwise that are to our benefit.

Big Data
Because of the onslaught of the ability to measure everything, the amount of data we are producing is extraordinary. We are finally reaching the level where we can really and seriously call this big data.

In biology we have challenges that most big data problems don’t have, in that it’s not a uniform type. We have truly multi-instrument, massively structured data sets, which are very much informed by the context in which they are taken.

The data science to operate on that information is emerging as critical in every area of biology. Data management, data science, data analysis and visualization, are going to be absolutely key to almost every field going forward and is a huge area for growth.

Big Impact
And finally I think that because this engineering is so intimately attached to the ecology of the earth, getting a fine understanding of how things operate in situ is a big deal, and getting much finer understanding of the ecology is critical.

Many of the students from our program have ended up thinking about law, policy, economy, and sociology. They are really thinking about the impact this technology has on us as humans, and how laws should be made so this isn’t abused, so that we can co-design our solutions with better regulations and better distribution.
Because Berkeley is a public university and has public service at its heart, it is a place where we can bring together those resources for these large scale problems. We’ve also really supported a culture of academics who are engaged in the community and will ensure that we are serving that community well.

We’re able to take on problems of scale here that are interdisciplinary, that are far more than the sum of their parts. This is the perfect place to do this work if we can organize ourselves to do that.

This is just a taste, read the full story online

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**Mini Profile:**
**Kelly Gardner, 2013**

Gardner was recently named to the TR35, MIT Technology Review's annual list of top innovators under 35, and founded Zephyrus Biosciences, acquired by ProteinSimple.

**What do you do now?**
I am the Director of Marketing for the Single-Cell Western product family at ProteinSimple. I am responsible for the commercial success of the product within ProteinSimple.

**What is important to you, and how does your work have impact in that area?**
I am excited by new technologies and love working with biologists in a variety of fields to push the boundaries of what was previously possible in their research. The Single-Cell Western technology (invented in Bioengineering professor Amy Herr's laboratory) gives researchers brand new measurement capabilities and I have enjoyed leading the efforts to make this transformational technology accessible to the research community.

**What is one tip, trick or practice that helps you**

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**2016 Retreat**
The annual Bioengineering Graduate Program retreat will be held November 4-6, in Sonoma, CA.

Register now!

**Ford Fellowship for Tentori**
Recent PhD Augusto Tentori, of Professor Amy Herr's lab, has been awarded a prestigious Ford Foundation Fellowship for postdoctoral study at MIT.

**DeRisi elected to NAS**
Joseph L. DeRisi, chair of the Department of Biochemistry and Biophysics at UCSF, has been elected to the National Academy of Sciences.
Maharbiz and Carmena create implantable neural dust

Their wireless, batteryless implantable sensors could improve brain control of prosthetics, avoiding wires that go through the skull.

We're #6!

Our graduate program has moved up to 6th place in the latest rankings from US News & World Report.