Positive Gradients

The new associate vice chancellor of computational heath sciences at the University of California San Diego reflects on the coming era of big data in medicine.

Jill Mesirov is heading west, quite literally from Boston to San Diego and figuratively to the frontier, vast with potential, at the interfaces of biology, technology, data science, and healthcare. *Cell Systems* spoke with her as she wrapped up her tenure as associate director and chief informatics officer at the Broad Institute. In this edited interview, Mesirov speaks about uniting communities through biomedical rather than analytical challenges and four lessons for the computational health sciences.

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Cell Systems: Why San Diego?

Jill Mesirov: First of all, I spent a year on sabbatical there many years ago, and I find San Diego to be a young, energetic, growing place. I'm a mathematician by training, and there are a lot of places that have positive gradients, but I think UCSD is a place with a large positive second derivative. It's really accelerating. And you can play tennis and golf outside in January. What's not to like?

The other thing I think that's great about UCSD is that it's not just an academic medical center, but it's got this wonderful combination of a great medical school with associated hospitals, a terrific engineering school, and a large supercomputer center. Not so many places have that combination. It's also a very collaborative place.

Are there particular groups you hope to collaborate with?

It's interesting that you bring that up because UCSD has just announced a search to fill eight tenure track interdisciplinary positions that are joint appointments in health sciences and the Jacobs School of Engineering. It shows how serious the University's commitment is to its initiative in precision medicine to improve patient care. This search is targeting experts in both big data and biomedical research. I'm excited to participate on the search committee because the field is turning out these new kinds of scientists with strengths in biology and computation or engineering, and I think those are the people who are going to move things forward. We're looking for people who have that collaborative spirit and that interdisciplinary drive to advance research as a group but also develop interactions across the campus.

Why shift toward health sciences now?

We're acquiring all these big biomedical datasets, and there are all these new technologies, both laboratory technologies and computational methods, plus the momentum of what people call precision medicine or individualized healthcare. It's just a great time to pull it all together.

Not just in genomics but also metabolomics, the whole microbiome effort, proteomics is scaling up, imaging, the availability of pulling together phenotype data and clinical data from electronic health records. There's no comparison between the amount and variety of data that we have available to us now with what we had 20 years ago.

This makes for an incredible opportunity for people who have the computational skills and who are driven to make an impact on human health. It's not just about computer science. It's about improving the way we treat patients. That's very real and exciting to me. Talented and smart students are seeing what's happening in this area, and they realize, "I want to be there. I want to be part of this."

What if you're not a new trainee starting your career?

I don't have a magic roadmap for this. My experience has been with moving from analytic fields into biomedical research. The people who are successful are the ones who are really driven by the problems and by the biology or the biomedical challenge, not just the analytic challenges. For me, the analytic challenges came with it, of course, from the development of new methodologies and so on, but it was always with that end goal of the application.

Tell me more about uniting communities through shared biomedical challenges?

If you can pull together a group of investigators with similar scientific goals, you get more out of that than just the sum of the parts. It's not linear—so whether they're working all on the same project or just in the same area, then you have this sharing of ideas, of methods and technologies, and that's really key. I think that there may be ways that we can

increase those kinds of communities at UCSD.

There is a growing community at UCSD, for example, around the microbiome. These communities don't happen by accident but they do bubble up a bit. You get people together and they share ideas, and then you find that you're all thinking about the same thing, and that you're all facing the same challenge, and then that challenge becomes a goal for you as a broader group. This process is organic so it's hard for me to predict what the areas will be, say, in the next 10 years. Precision medicine is a likely one, but it will depend somewhat on the interests and scientific thrusts of who is hired.

Are you tracking particular computational challenges?

One is visualization. How do we visualize all this big clinical data, not just genomic data but other omic data and other clinical data and to make that data interpretable and usable clinically. I think that's a real challenge, and it's another reason that I'm looking forward to being at a medical center because there's a great opportunity for computational biologists and clinicians to sit together as patients' data are discussed. This would have a huge impact for visualization work.

What will be the keys to making big data useful to clinicians through software?

The way you develop good accessible friendly software, which has always been a religion of mine in many ways, is by living in the community that is going to use the software. What excites me about being in a place like UCSD is being able to link up with people who can help design the entire workflow of interactions between clinicians, patients, and the software and data. You have to really learn the domain, learn to speak its language, and understand people's thought processes.

There are also all kinds of regulatory issues that will need to be addressed. It may be that one develops the prototype by working closely with clinicians and then finds some way to pass it off to an organization that's going to make it more commercially viable and satisfy all the regulatory requirements.

Reflect on your 18 years at the Whitehead Genome Center and the Broad Institute. How have things changed?

When I came to the Whitehead Genome Center, there were four people in IT and a handful of bioinformatic analysts. The servers were people's desktop machines. The storage was a wire rack in the hallway of 2 gigabyte external disk drives. In the summer, the sun would shine in the window, and the disks would all go down because they would overheat. Today at the Broad, there are hundreds of people in computational biology and bioinformatics, which has permeated every single aspect of the organization. I've seen people who've been there a long time grow as scientists and become independent researchers. That's very satisfying to me.

What are a few lessons you've learned?

First, I've learned this lesson, that if you're going to do great computational biomedical research, you really have to understand the domain.

Second, this idea that you can gather a group of people together with similar scientific interests that becomes more than the sum of the parts.

Third, you can generate some very interesting hypotheses by mining big data, but you have to go back to the lab or the clinic to validate those findings. Without both parts of the process, both the computational and the experimental or the computational and the clinical, you haven't really pushed the work forward. You have to have people with both sets of skills, and sometimes those are different people and more and more, it can be the same person, but that's how you make it real.

Finally, we have this wealth of data, and we need to empower everyone to use it well. That's this whole idea of making accessible, usable software so that people have something that helps them do the things that are more straightforward, the analyses we now know how to do well, so that they can provide additional value where their expertise is.

Final thoughts?

The other thing I'm taking with me is that I have made such incredible relationships in the Boston area. People who have taught me things, people who've collaborated with me on projects, scientists and friends that I'll have for the rest of my life, and that's a really important thing to me. You spend 18 years in a community, you do that for a reason and a lot of that reason is the people. The people have been great, and I value every one of them that I've interacted with, and moving forward, I strongly believe that I will build that same network of collaborators and friends at UCSD.

And are you going to start surfing?

Not likely, tennis and golf are enough for me!

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