Arizona's Answer to Systems Bio

TGen's Jeff Trent bills the new Center for Systems and Computational Biology as the home of 'multi-investigator, multi-institute teams with multimillion-dollar budgets.' It hasn't exactly been a tough sell.

By Jennifer Crebs

Make room, Boston. Flush with cash dedicated to biosciences, Phoenix may be well on its way to becoming the biotech hotbed of the southwest. The latest in the Sun Belt arsenal is the Center for Systems and Computational Biology, a team solution to the challenge of team science.


The Center for Systems and Computational Biology is housed in Arizona State University's Biodesign Institute

Not yet even six months old, the center is the product of a close partnership between Arizona State University's Biodesign Institute and the Translational Genomics Research Institute. Its mandate is to jump-start advances in personalized medicine and diagnostics, a likely endeavor considering everything the center has going for it: top-tier faculty, both co-appointed and newly recruited especially for the job; access to one of the world's most powerful supercomputers; a roster of high-level genomic and proteomic technologies; and enviable funding streams from state, industry, and philanthropic sources. The only thing it lacks at the moment is a dedicated director.

In the interim, George Poste and Jeffrey Trent are jointly steering the center through its initial months. Trent, president and scientific director of TGen, was instrumental in rallying state and taxpayer support to build up Arizona's bioscience industry. Immediately prior to taking up his post at TGen, Trent spent nearly a decade as scientific director of the National Human Genome Research Institute. In 2004, he took on the lead role at TGen; not long after, George Poste was lured out of his retirement from SmithKline Beecham to man the helm at the Biodesign Institute. Trent says that the two have shared a good working relationship "for 25 years or so." Most recently, the two co-directors have concentrated on building the infrastructure and faculty to achieve "an endpoint of earlier diagnostics and smarter treatments."

To do so, the Center for Systems and Computational Biology is drawing on the strengths of both of its parent institutions. "TGen is unique from the standpoint that we have really focused on the translational window a little differently," Trent says. That is, instead of cobbling together an interdisciplinary program within the confines of a larger matrix, TGen has integrated its translational research efforts from the get-go.

This tack is complemented by a similarly cohesive strategy at the Biodesign Institute, which sports a research portfolio that defies standard classification schemes. The institute organizes its efforts around four key areas — biological systems, nanoscale systems, cognitive systems, and sustainable systems — and focuses on translating fundamental biological discoveries directly into real-world use. To this end, Biodesign works with ASU's commercialization body, Arizona Technology Enterprises, to strike up partnerships, license IP, and launch new companies.

Biodesign's commitment to commer-

cializing technologies is echoed by TGen's focus on translating basic research to the clinic, and the underlying emphasis on moving research findings out of the lab is a part of the center's mandate as well. "Given some of the spinoff organizations we have, we're trying to move toward developing diagnostics or getting preclinical testing done on therapeutic leads — toward building all of that into the fabric of putting this together," Trent says. The Molecular Profiling Institute is one such spinoff company that provides prognostic testing facilities, services, and resources for genomic and proteomic profiling.

FORMALIZING THE INEVITABLE

While it's clear that researchers at Biodesign and TGen have already forged extensive working partnerships among research groups, the new center gives them a formal framework. "What we're trying to do is work on bigger projects, and those require multi-investigator, multi-institute teams with multi-million dollar budgets," says Trent. "I see [the center] begin to take its shape in the ability to capture the people for some of these larger projects."

One such person is Michael Bittner, co-director of TGen's computational biology division and head of the measurement and inference lab. Bittner is interested in flushing out background assumptions made about complex systems, wherein the sheer number of possible relationships outpowers the human faculty of tracking them. Enter high-performance computing, which Bittner uses to model, predict, and generate reliability estimates about gene interactions. The end goal of his work is to develop new measurement systems capable of identifying valid relationships within complex systems. Bittner, who already collaborates with Sudhir Kumar, director of Biodesign's Center for Evolutionary Functional Genomics, says that it was natural for him to get involved in being one of the partners of the center. "Typically, projects that deal with complex systems or complex problems do much better when there's a larger mass of people simultaneously attacking various aspects of it," he says. "We think the center will give us the chance to recruit some very smart people who are going to help speed the plow."

John Carpten, director of TGen's integrated cancer genomics division, agrees that more is merrier when it comes to speeding discoveries to the clinic. Carpten's research focuses on developing more sensitive cancer biomarkers by way of generating comprehensive profiles based on multiple data points. "I don't think any one scientist or any one technology will win the war on cancer," he says. Instead, he believes that successful cancer research requires a team research approach and an integrated technology model — two things that the center promises to provide in spades. "Having an entire center dedicated specifically to helping us integrate different technology platforms is going to be critical to moving these discoveries into the clinic," he says.

Specific tools in Carpten's arsenal include microarray and high-throughput sequencing technologies, as well as the strong collaborations he's initiated with facilities boasting high-resolution mass spectroscopy platforms. Whereas a number of institutions have strong programs in genomics or proteomics, he says, very few are performing comprehensive studies using one data set on multiple technology platforms. Carpten says his "hope is to bring to bear gene expression profiling, copy number analysis, promoter methylation, DNA mutation, as well as proteomics" on cancer research. Having access to the center's resources and infrastructure will therefore be a "huge advantage," he says.

Next up for the center will be the installation of a new director, which Trent expects to happen by the end of the summer. Additional faculty are also being recruited, and these investigators will have joint appointments with the founding research institutes. Getting funding to attract talent is hardly a problem. "At the moment, Arizona has a ridiculous wealth of opportunities to build the biomedical sciences," Trent says. "The bottom line is that Arizona is one of these remarkable places that's really growing and for which there is a lot of funding to facilitate research." GT

InfoSpot

Name: Center for Systems and Computational Biology
Hosts: The Translational Genomics Research Institute (TGen) and Arizona State University's Biodesign Institute
Leadership: Jeffrey Trent and George Poste head the center right now, while a newly recruited director will take the reins by summer's end.
Staff: Currently, the center is populated with about a dozen faculty members from Biodesign and TGen. Eventually, plans are to outfit the center with 20 faculty posts.
Funding stats: The center is one of the latest fruits of Arizona's heavy investment in bioscience research. Taxpayers voted in 2000 to drive $1 billion to state university research support. The center also benefits from the state legislature's pledge of $150 million to foster bioscience research, which was matched by industry investment. To recruit a dedicated director, the center will use $5 million from the Virginia G. Piper Charitable Trust's outlay of $50 million to attract personalized medicine leaders.
Key research areas: Computational biology, integrated cancer genomics, genetic basis of human disease, clinical translational genomics, applied nanobioscience, evolutionary functional genomics, innovations in medicine, protein and peptide therapeutics.
Notable technology: The ASU-TGen supercomputer, a 1,024-CPU IBM cluster ranked as one of the top supercomputers in the world.