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# Roswell, Organovo & More: Xconomy Awards Innovation at the Intersection Finalists

Corie Lok
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**Xconomy San Diego** — [Corie Lok and Frank Vinluan co-authored this article.] Whether they're 3D printing human tissues, encoding data in DNA, or securing medical devices against cyber attacks, the **finalists** in the Innovation at the Intersection category of the **Xconomy Awards San Diego** are showing how to bring different disciplines to bear on tough problems in regenerative medicine, data storage, cybersecurity and more. Here are brief profiles of the finalists.

*This is part of a series of articles about the finalists for the **Xconomy Awards San Diego**. We've written about the **CEO** and **Commitment to Diversity** finalists, and stay tuned for coverage of the other finalists.*

**Rommie Amaro**

Proteins are like moving targets whose jiggling and gyration make them harder for scientists to study. The research of **Rommie Amaro**, a University of California San Diego professor of chemistry and biochemistry, employs computer simulations to yield atomic-level insight into how proteins function. That research is making strides in designing molecules to bind to the proteins as potential drugs.

In 2010 Amaro was among the scientists selected for the National Institutes of Health's New Innovator program, which provides funding for "exceptionally creative early career investigators." The following year, Amaro was recognized as one of 94 scientists who received the Presidential Early Career Award for Scientists and Engineers.

Amaro's lab has pointed its computing firepower toward neglected tropical diseases, influenza, chlamydia, and cancer. The research led Amaro to co-found a company, cancer drug developer Actavalon, in 2013.

Based in the Johnson & Johnson (NYSE: **JNJ**) JLABS incubator in San Diego, Actavalon is developing a drug that targets p53, a tumor suppressor protein inactivated in approximately half of cancers. P53 has proven to be a tough target to hit and a number of drug companies are taking different approaches to the protein. Actavalon is developing a small molecule drug that fits into a pocket of a malfunctioning p53 protein—a pocket first identified by Amaro's team. Actavalon's research is still preclinical, but if it works, it could lead to a drug that restores p53's tumor suppression activity.

**MedCrypt**

It's common these days for consumer technologies to rely on internet connectivity to function. Internet-connected pacemakers and other medical devices are moving healthcare in the same direction. But features that offer a way to collect data and remotely monitor patients also open the door to new security risks.

Founded in 2016, Encinitas, CA-based MedCrypt uses cryptography to protect data sent to and from medical devices. MedCrypt also provides remote, real-time monitoring that alerts device companies about suspicious behavior that could portend a security threat. Such threats could put patient data and privacy at risk, as well as the finances of medical device companies, MedCrypt CEO and co-founder Mike Kijewski **told Xconomy**.

The startup's growth comes as regulators adjust to the growing risks facing internet-connected medical devices. Last fall, the FDA issued **draft guidance** about the cybersecurity documentation device makers need to include in their submissions to the agency.

MedCrypt's technology is attracting notice. Last year, the company **won the Venture Connect award** at the annual conference of the Healthcare and Information Management Systems Society. This past winter, MedCrypt graduated from the Y Combinator tech accelerator program. MedCrypt has also **drawn interest from investors**, raising a total of $3 million in funding.

**Molecular Assemblies**

The world is running out of places to store the ever-growing amounts of data that humankind is generating, leading many, including the **US government**, to call for radically new ways of storing data. Enter DNA, which can be tightly packed together and potentially encode vast amounts of information using its long strings of As, Ts, Gs and Cs. The key is to be able to synthesize long strands of DNA quickly, accurately and cheaply.

Molecular Assemblies thinks it has the right IP in place to do this, using a method that harnesses

enzymes to piece together DNA. CEO Mike Kamdar says his company's method has advantages over existing, chemical-based methods of synthesizing DNA; it doesn't use toxic chemicals, is capable of making longer DNA strands, and requires fewer steps.

In 2018, Molecular Assemblies showed in a proof-of-concept study that it could encode, then decode, a text message using its enzymatically manufactured DNA. The startup, working at the intersection of biochemistry and information technology, is now focused on storing larger amounts of data in DNA.

Kamdar says he expects his company, which is currently raising its Series A round, to get to market sooner for synthetic biology and other life science uses of its DNA. But Kamdar (no relation to Xconomy Awards San Diego judge Kim Kamdar—and yes, they get asked that a lot) sees the opportunities in the data storage arena, although farther out, to be a much bigger potential market that he says is attracting more interest.

**Organovo**

We have yet to achieve 3D printed organs that replace damaged or diseased livers, lungs, and hearts. But the bridge to such organ transplant alternatives might come from Organovo.

Organovo (NASDAQ: **ONVO**) has developed a way to incorporate human liver cells into a printable "bio ink." This technology is now used to stand in for diseased livers, providing a testing ground for the safety and efficacy of experimental drugs. Nonalcoholic steatohepatitis (NASH), a type of fatty liver disease whose severe scarring of the organ has no FDA-approved treatment, is drawing attention from a growing number of drug developers. Organovo has **presented data** showing how its 3D bioprinted tissue can serve as a model for testing the safety and efficacy of drugs for NASH and other liver diseases.

Organovo wants to take its technology beyond tests of experimental drugs. The company is developing bioprinted implantable tissue patches intended to augment or replace damaged or diseased tissue. Organovo has reported encouraging results from preclinical tests of these patches. In fiscal **third quarter financial results**, CEO Taylor Crouch said the company is on track to ask the FDA next year for the go-ahead to start clinical trials testing the technology in patients with end-stage liver disease.

"We hope to serve as a 'bridge to transplant' for these patients with limited treatment options, with an ultimate goal of delaying or reducing the overall need for transplant," Crouch said.

**PvP Biologics**

People with celiac disease have no treatment options and have to avoid eating gluten. But about a third of them can still experience gastrointestinal and other symptoms—even when on a gluten-free diet. PvP Biologics aims to help these people by developing a drug that, when taken before a meal, breaks up gluten in the stomach before it moves into the small intestine and triggers autoimmune reactions.

PvP is commercializing technology spun out of the University of Washington, where the drug, dubbed Kuma062, was originally developed. Researchers there took a naturally occurring enzyme that can withstand highly acidic conditions (like in the stomach) and used protein design software to engineer it to specifically target and degrade the part of gluten that causes autoimmunity, even when the gluten is mixed in with other foods.

Takeda saw the preclinical data on the engineered enzyme and **signed a $35 million deal in early 2017**, just as PvP was launching, which gave the Japanese pharma the option to buy PvP based on results of a Phase 1 clinical trial. That funding got PvP, operating at the intersection of computational science and protein design, up and running quickly, without having to seek venture dollars. The startup began **two Phase 1 trials in September involving about 80 adults.**

**Roswell Biotechnologies**

Even as DNA sequencing costs have dropped dramatically in recent years, Roswell Biotechnologies is jumping in with molecular electronics technology the startup says can bring those costs down even further. In molecular electronics, molecules are used to create circuits that are much smaller than conventional silicon-based circuits. “The idea is that the molecule would be used to complete the circuit,” says Paul Mola, Roswell’s CEO and co-founder. “Think of it like a switch.”

For Roswell, the molecule it’s integrating into its circuits is DNA polymerase, which the cell uses to rapidly make DNA. The startup then uses those circuits to sequence DNA—reading each base, or “letter,” of DNA as it is being synthesized. Roswell does this by engineering each of the DNA bases to have a charge, so that as each base is added to the DNA strand, it generates a unique electronic signal that flows through the circuit and is read by an attached voltmeter.

These circuits, or “biosensors,” as Mola calls them, are then deployed onto standard complementary metal oxide semiconductor (CMOS) chips—the same sort used to run smartphones and other devices. The aim is to squeeze millions of these biosensors onto a chip for rapid genome sequencing.

Mola says that by bringing material science, nanofabrication, protein engineering, and other fields together, his company is on track to make a chip that has up to 10 million biosensors and can sequence a full genome for less than $100 in the next three years. (Current sequencing methods cost about $1,000 for a human genome.) One key facet in Roswell’s plan to achieve this price point is to use standard manufacturing processes to make its chips, Mola says.

Mola says by the end of this year, Roswell should have a chip with one million sensors. The company aims to be on the market by the end of 2020 with a chip that can sequence targeted parts of the genome.

**Roswell announced a $32 million Series A funding round** earlier this year, bringing the total funds it has raised since the company was founded three years ago to $40 million.

Roswell BIOTECHNOLOGIES

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