

Pharma



Stanley Crooke, of Isis Pharmaceuticals, announced a potentially big deal with Bayer AG for an antithrombotic drug that so far appears promising. **Page 5**

Law



Stephanie Conduff-Rogers brings her expertise to the Native American Law practice group at Procopio, Cory, Hargreaves & Savitch. She has extensive experience in tribal issues, governance and business. **Page 16**

The Lists

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Melissa Jacobs
Vaidehi Joshi, a senior research associate at Organovo, uses human cells as "ink" to build organ tissue with the company's 3-D printer, the NovoGen.

A 'TEST MARKET'

BIOTECH: Bioprinter Aims to Give L'Oreal Tissue for Product Testing

By BRITTANY MEILING

Organovo has landed a research partnership with beauty conglomerate L'Oreal to create 3-D bioprinted human skin to test cosmetics.

Testing beauty products on animals has been a controversial topic for decades, with images of blind rabbits and blistered guinea pigs driving public demand for cruelty-free beauty products.

L'Oreal stopped animal testing in 1989, and has been researching alternative meth-

ods to test products ever since.

"We developed a technology incubator to uncover disruptive innovations across industries that have the potential to transform the beauty business," said **Guive Balooch**, global vice president of L'Oreal's Technology Incubator. "Organovo has broken new ground with 3-D bioprinting."

Organovo CEO **Keith Murphy** said his company can build many kinds of tissue by using human cells as the "ink" in a 3-D printer.

"One of them of course is skin," Murphy said. "Naturally, a beauty company like L'Oreal has an interest in using three-dimensional skin to test potential cosmetic agents for their products."

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Kratos Is Exploring Strategic Alternatives

DEFENSE: Investment Bank Helping Co. Review Business

By BRAD GRAVES

Directors at **Kratos Defense & Security Solutions Inc.** are mulling some major changes.

The board of the \$868 million contractor is privately discussing strategic alternatives, which in corporate-speak often means some sort of sale. The business will make the decision public by June 30, CEO **Eric DeMarco** said.

DeMarco said Kratos (Nasdaq: KTOS) first

disclosed the internal discussions in November. He offered few other details, saying the alternatives might include the sale of a business unit — or the sale of the entire company.

Kratos "is continuing to work with an investment banking firm to assist the board in formally reviewing Kratos' businesses, markets and competitive positioning and in evaluating strategic alternatives, including the potential divestiture of certain of the company's businesses," Kratos said in its quarterly report May 7. The company did not name its investment banker.

Kratos, which has 240 employees locally, runs a number of defense and security businesses around the United States which employ 3,600.

Projects are as varied as high-speed target drones built for the U.S. Army, U.S. Navy and

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DTZ, Cushman Deal To Bring Changes

REAL ESTATE: Personnel Duplications Currently Exist

By LOU HIRSH

When the parent of commercial brokerage company **DTZ** took over **Cassidy Turley** earlier this year, it was tough to discern any local change in the former Cassidy Turley's business model beyond the new name.

That's mainly because Chicago-based DTZ was brand-new to the San Diego market and had little geographic service overlap with Washington, D.C.-based Cassidy Turley, thus

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Industrial Options Grow in N. County

PROPERTY: Spec Projects Aim to Meet Expected Demand

By LOU HIRSH

As the improving economy fills up industrial spaces in central San Diego, local companies such as **SR Commercial** are betting on continued rising demand in North County for manufacturing, warehousing and distribution properties.

The Solana Beach investment firm recently purchased an Escondido industrial building for approximately \$8.33 million and an 11.8-

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Special Report: Accounting

Consulting Firms Looking to Expand



Kenneth Weixel

The city's top accounting firms are reporting increasing demand for consulting services from a resurgent San Diego business community.

"We're growing in anticipation of a growing economy here in San Diego and a need for more services at our firm," said Kenneth Weixel, the San Diego managing partner for Deloitte LLP. That's not the case in all markets."

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The only source of knowledge is experience.

— Albert Einstein

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ORGANOVO HOLDINGS INC.

CEO: Keith Murphy

Revenue: \$379,000 in fiscal 2014

Net loss: \$25.8 million in fiscal 2014

No. of local employees: 49

Headquarters: Sorrento Valley

Year founded: 2007

Stock symbol and exchange: ONVO on the New York Stock Exchange

Company description: Does 3-D bioprinting to create human tissues for drug and product testing

Key factors for success: Potential in multiple verticals — drug testing, cosmetics testing and organ tissue patches

Organovo:

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The Partnership

Although beauty companies have been moving away from animal testing, current skin substitutes — such as cells in a petri dish or virtual skin models — have limitations.

The new product-testing medium proposed by Organovo would consist of real human cells assembled by machine into a three-dimensional tissue. Murphy said by layering various types of skin tissue, Organovo can better mimic the complexity of actual human skin. Then, L’Oreal could test anti-wrinkle cream or tanning lotion on the tissue to see if it actually gets smoother or changes hue.

The research partnership between the two companies includes three phases: development, validation and commercial supply, Murphy said. Their first goal is to develop artificially grown skin tissue that shares histological and biochemical characteristics with healthy native skin.

L’Oreal will fund the first two phases of research. If the skin tissue being developed is used for skincare products, the beauty company will have exclusive rights to the tissue. On the other hand, if the skin tissue is used for other medical purposes, such as prescription drug testing, then Organovo retains rights to the skin tissue.

“There are many opportunities in dermatologic projects,” Murphy said. “Pharmaceutical companies could use skin tissue to test for drugs with transdermal delivery (patches), for example. Eventually, it could even be an option for burn victims, or people with diabetic ulcers.”

Other Plans

Although this partnership is Organovo’s first foray into cosmetics, the company does have experience creating complex human tissue to test pharmaceuticals.

Just last year, the company launched the world’s first commercial line of 3-D printed human tissue called the exVive3D. The liver tissue was debuted first, and Organovo’s kidney tissue is on track for pharmaceutical use in 2016, Murphy said.

These complex tissues are meant to enable more accurate testing, replacing lab rats and petri dishes with more specific tissue types.

Organovo recently signed a deal with **Merck & Co.** that will give the pharmaceutical giant access to Organovo’s human liver tissue. The agreement will also involve a collaboration to develop multiple custom tissue models using Organovo’s proprietary NovoGen Bioprinting Platform for



Senior Research Associate Edwin Golez prepares the cells, or the “bio ink,” to go into the printer in Organovo’s bioprinting laboratory. Melissa Jacobs



Organovo is using bioprinting technology to provide an alternative to animal and in vitro testing. Melissa Jacobs



Real human cells can be assembled by a machine into a three-dimensional tissue. By layering various types of skin tissue, Organovo can better mimic the complexity of actual human skin. Melissa Jacobs

use in drug development.

Key financial terms of the agreement have not been released.

The Future

Applications for bioprinted tissue extend beyond product testing, Murphy said. He estimated that within four to six years the company will be able to 3-D print human organ patches to repair damaged organs.

The company spends about 10 percent of its research and development budget on organ patch bioprinting, Murphy said, and has just teamed up with researchers at **Yale School of Medicine** to develop 3-D tissues for transplant research.

“This field may provide a unique and new opportunity where we can print 3-D organs that can supplement or replace the shortage of organs out there world-

wide,” said Dr. **John Geibel**, vice chair and director of surgical research at Yale School of Medicine.

While the printing and use of 3-D tissues and organs in actual transplants has not yet occurred on any real scale, the field is advancing rapidly. At least in the short term, 3-D organ printing could be used to support a failing organ while the patient awaits a full transplant, Geibel said.