

## Organovo Describes First Fully Cellular 3D Bioprinted Liver Tissue

April 22, 2013 10:50 AM ET

SAN DIEGO, April 22, 2013 /PRNewswire/ --**Organovo Holdings, Inc. (OTCQX ONVO)** ("Organovo"), a creator and manufacturer of functional, three-dimensional human tissues for medical research and therapeutic applications, presented at the 2013 Experimental Biology conference in Boston, Massachusetts data on the company's *in vitro* three-dimensional liver.

"We have achieved excellent function in a fully cellular 3D human liver tissue. With Organovo's 3D bioprinted liver tissues, we have demonstrated the power of bioprinting to create functional human tissue that replicates human biology better than what has come before. Not only can these tissues be a first step towards larger 3D liver, laboratory tests with these samples have the potential to be game changing for medical research. We believe these models will prove superior in their ability to provide predictive data for drug discovery and development, better than animal models or current cell models," said Keith Murphy, Chairman and Chief Executive Officer at Organovo.

For the first time, human liver tissues have been generated that are truly three-dimensional, being up to 500 microns in thickness in the smallest dimension, and consisting of multiple cell types arranged in defined spatial patterns that reproduce key elements of native tissue architecture. The tissues, fabricated using Organovo's proprietary NovoGen™ bioprinting platform, are highly reproducible and exhibit superior performance compared to standard 2D controls.

Dr. Sharon Presnell, Chief Technology Officer and Executive Vice President of Research and Development, stated, "We've combined three key features that set our 3D tissues apart from 2D cell-culture models. First, the tissues are not a monolayer of cells; our tissues are approximately 20 cell layers thick. Second, the multi-cellular tissues closely reproduce the distinct cellular patterns found in native tissue. Finally, our tissues are highly cellular, comprised of cells and the proteins those cells produce, without dependence on biomaterials or scaffold for three-dimensionality. They actually look and feel like living tissues."

Key findings from Organovo's research include:

- NovoGen Bioprinting enabled reproducible fabrication of architecturally and compositionally defined 3D tissues into standard tissue culture formats, using a wide array of cellular inputs, including primary human hepatocytes and hepatocyte-like cells derived from stem/progenitor sources.
- Bioprinted 3D liver tissues exhibited several key features that remained stable over time:
  - Tissue-like cellular density
  - Controlled spatial positioning of specific cell types in x, y, and z axes
  - Multi-layered architecture reaching up to 500 microns thickness, with tissues comprised of up to 20 cell layers
- These novel 3D liver tissues possessed critical liver functions, including albumin production, fibrinogen and transferrin production, and inducible cytochrome P450 enzymatic activities, including CYP 1A2 and CYP 3A4. Cholesterol biosynthesis was also demonstrated for the first time in a multi-cellular 3D human liver system *in vitro*, suggesting utility in the study of interventional strategies aimed at regulation of cholesterol secretion.
- Albumin production by 3D bioprinted liver tissues was 5-9 times greater than matched 2D controls, suggesting superior functionality.

### About Organovo Holdings, Inc.

Organovo designs and creates functional, three-dimensional human tissues for medical research and therapeutic applications. The company is working in collaboration with pharmaceutical and academic partners to develop human biological disease models in three dimensions that enable therapeutic drug discovery and development. Organovo's technology can also be applied to create surgical tissues for direct therapy. Their three-dimensional bioprinting technology was selected as one of the "Best Inventions of 2010" by TIME Magazine. Organovo leads the way in solving complex

medical research problems and building the future of medicine. Visit [www.organovo.com](http://www.organovo.com).

### **Safe Harbor Statement**

Any statements contained in this press release that do not describe historical facts may constitute forward-looking statements as that term is defined in the Private Securities Litigation Reform Act of 1995. Any forward-looking statements contained herein are based on current expectations, but are subject to a number of risks and uncertainties. The factors that could cause actual future results to differ materially from current expectations include, but are not limited to, risks and uncertainties relating to the Company's ability to develop, market and sell products based on its technology; the expected benefits and efficacy of the Company's products and technology; the availability of substantial additional funding for the Company to continue its operations and to conduct research and development, clinical studies and future product commercialization; and the Company's business, research, product development, regulatory approval, marketing and distribution plans and strategies. These and other factors are identified and described in more detail in our filings with the SEC, including our annual report on Form 10-K filed with the SEC on March 15, 2013. You should not place undue reliance on these forward-looking statements, which speak only as of the date that they were made. These cautionary statements should be considered with any written or oral forward-looking statements that we may issue in the future. Except as required by applicable law, including the securities laws of the United States, we do not intend to update any of the forward-looking statements to conform these statements to reflect actual results, later events or circumstances or to reflect the occurrence of unanticipated events.

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