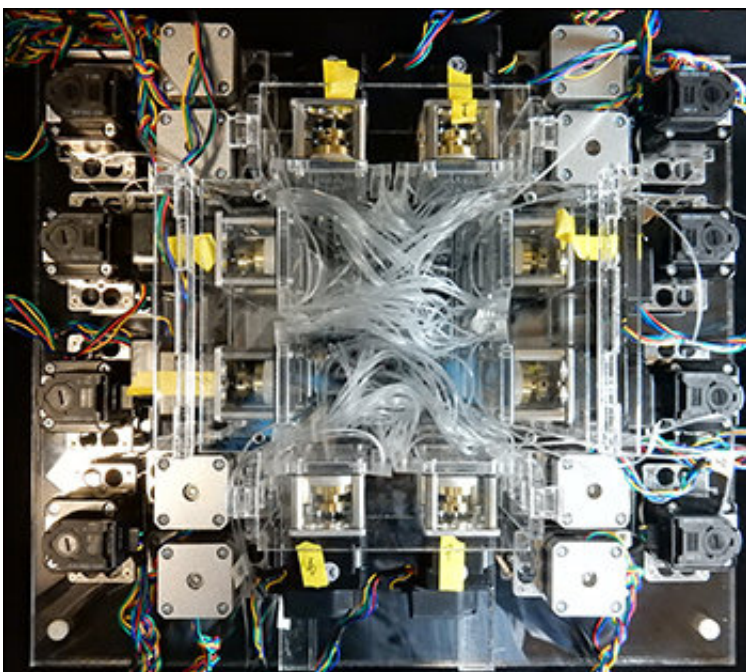


Vanderbilt researchers win an R&D100 Award for MultiWell MicroFormulator

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VIIBRE's first 96-Channel MicroFormulator as it is being prepared for shipment to AstraZeneca in January 2016. Credit: Vanderbilt University

A team of Vanderbilt University scientists and engineers led by Professor John P. Wikswo has won an R&D 100 Award for their MultiWell MicroFormulator.

The MultiWell MicroFormulator, developed at Vanderbilt and commercialized by CN Bio Innovations in the United Kingdom, provides

customized real-time formulation, delivery and removal of cell culture media to each well of a 96-well plate for drug delivery, toxicology research, and personalized medicine. The "96-well plate" is a standard tool in biomedical and clinical research and essential to a wide range of laboratory assays and applications. It is beginning to be used for organoids and organs-on-chips that aim to recapitulate human physiology.

"In 2015, Matthew Wagoner, then of AstraZeneca, approached me and said, 'I love your MicroFormulator, but I need one with 96 channels,'" Wikswo said. "Matt's request and the subsequent support from AstraZeneca changed the direction of my group's pump and valve development efforts, and the MultiWell MicroFormulator is the result."

The new, innovative technology offers a promising alternative to existing fluid-handling systems for long-term cell culture studies and greatly reduces the cost and footprint of such systems.

"This is an excellent example of translational research. Our work on pumps and valves began as an undergraduate research project, was then funded by the Department of Defense and the National Institutes of Health, and is now moving into pharma," Wikswo said. "It was great to attend the R&D awards ceremony and see all the other projects from industry and national laboratories - they really understand translation."

The R&D 100 awards—called the "Oscars of Innovation"—recognize the 100 most technologically significant products introduced into the marketplace each year. R&D Magazine's independent panel of more than 50 judges selects winners. Wikswo and his group won an R&D 100 Award in 1984 for a Neuromagnetic Current Probe.

Wikswo, the founding director of the Vanderbilt Institute for Integrative Biosystems Research and Education (VIIBRE), and Ronald S. Reiserer,

VIIBRE laboratory manager and leader of the engineering on the MultiWell MicroFormulator, accepted the award at R&Ds 55th annual awards ceremony in November. Wikswo is also Gordon A. Cain University Professor and A. B. Learned Professor of Living State Physics, and a professor of biomedical engineering, molecular physiology and biophysics, and physics.

Wikswo and his group have worked for the past seven years to develop micropumps and microvalves to provide automatic computer control of fluids in analytical instruments and between two or more human organ mimics. This work led to the MultiWell MicroFormulator, which provides long-term delivery and removal of fluid from a multiwell plate or microplate, each well of which can hold a minute amount of liquid, such as media for cell culture.

"In contrast to bringing lots of well plates to a large and expensive high-throughput screening (HTS) robot, we are bringing a small and low-cost robot to each well plate," Wikswo said. The MultiWell MicroFormulator also can simulate the function of organs that may be missing from multi-organ-chip systems, such as those that secrete vital hormones.

CN Bio Innovations Ltd., a biotechnology spinoff from Oxford University, has secured a combination of exclusive and non-exclusive rights to microfluidic technologies developed by Wikswo. On Nov. 1, the company announced a research collaboration with global biopharmaceutical company AstraZeneca to validate the MultiWell MicroFormulator as a new in vitro research tool to predict optimized drug dosing regimens for multi-drug therapies.

David Hughes, CN Bio's chief technical officer, said, "With these additional technologies, the precision and control we can achieve over conditions in each well of a 96-well plate and in vitro organ-mimics open up exciting new possibilities for modelling human biology and disease in

the laboratory."

The licensed technologies could replace studies that use mice by mimicking in vivo drug exposure in an in vitro system. The MultiWell MicroFormulator could be used to optimize the conditions for stem cell differentiation, according to CN Bio.

"We are delighted to know that John Wikswo and his team at Vanderbilt have been the recipients of a 2017 R&D award. We have had the pleasure of working with this group, being the first company to successfully test and use their microformulator platform in our internal research projects. It is a testament as to how great science can come from smart partnerships," said Kristin Fabre, MPS Development and Implementation Lead, IMED Biotech Unit, AstraZeneca.

The VIIBRE pump and valve technologies and the software that controls them have wider applicability. Under a small business innovative research grant from the NIH National Center for Advancing Translational Sciences (NCATS), CFD Research Corporation (CFDRC) and VIIBRE are developing "SmartLids."

Kapil Pant, vice president of Biomedical Technology at CFDRC, said, "Not only will the SmartLid allow multi-organ plates to become 'smart plates,' but it will also enable automated, high-throughput perfusion control of our SynVivo assays and multi-well printed skin and other tissue constructs."

Wikswo believes the introduction of low-cost pump, valve, and control systems can bring a level of automation to [basic science research](#) that previously was only available to pharmaceutical labs and major research universities that could afford HTS robots. "Biology, pharmacology and toxicology experiments that require long-term control of cultured cells can all benefit from this technology," he said.

Provided by Vanderbilt University

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