Cedars-Sinai and Emulate, Inc. Announce Patient-on-a-Chip Program Using Stem Cells and Organs-on-Chips Technology for Precision Medicine

Technology Integrates Stem Cells From Patients Into a New Approach to Predict Most Effective Disease Treatments Based on a Patient’s Unique Biology

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LOS ANGELES, Calif. & BOSTON, Mass. – Scientists at Cedars-Sinai and Emulate, Inc. are pioneering a Patient-on-a-Chip program to help predict which disease treatments would be most effective based on a patient's genetic makeup and disease variant—a new approach to precision medicine for improving patient care and health.

The collaboration leverages innovative stem cell science from the Cedars-Sinai Board of Governors Regenerative Medicine Institute and Emulate’s Human Emulation System, which uses Organs-on-Chips technology to re-create true-to-life biology outside the body. This technology creates an environment where the cells exhibit an unprecedented level of biological function, and provides control of complex human biology and disease mechanisms not possible with existing techniques.

Initial scientific findings, recently published in Cellular and Molecular Gastroenterology and Hepatology, a journal of the American Gastroenterology Association, mark a major milestone in the Patient-on-a-Chip program. Investigators from Cedars-Sinai and Emulate demonstrated how cells of a human intestinal lining created outside an individual's body mirror living tissue when placed inside Emulate's Intestine-Chips, opening the door to personalized testing of drug treatments.

The research points to a host of practical clinical applications that can benefit patients. By placing a patient's cells in Organ-Chips and exposing those cells to a particular drug or series of drugs, clinicians could gain more accurate information about how that individual would respond to treatment, avoiding the risk of administering a drug that may cause harm or is ineffective and costly.

*The medical potential of a Patient-on-a-Chip is extraordinary,* said Clive Svendsen, PhD, director of the Cedars-Sinai Board of Governors Regenerative Medicine Institute. *As examples, scientists could use Organs-on-Chips to create a living model of a patient with...
Parkinson's disease, amyotrophic lateral sclerosis or Crohn's disease, a debilitating inflammatory bowel disorder linked to several gene mutations. By flowing drugs through Organ-Chips containing the patient's own cells and tissue, we could predict which treatment is most beneficial for that patient."

Cedars-Sinai and Emulate each have contributed integral components to the Patient-on-a-Chip program.

Cedars-Sinai scientists can harvest cells from the blood or skin of an individual and reprogram them into induced pluripotent stem cells, which can be made into any organ cell (such as those from the lung, liver or intestine), each bearing the unique genetic fingerprint and characteristics of the person.

Emulate's Human Emulation System – which is made up of Organs-on-Chips, instrumentation and software apps – re-creates the natural physiology cells experience within the body. Each chip, which is approximately the size of an AA battery, features tiny channels lined with tens of thousands of living human cells, recreating the smallest functional unit of an organ. Air and fluid, such as blood, can be passed through the chips, creating a micro-engineered environment that is a "home-away-from-home" for cells, where they behave just as they do in the body.

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"By creating a personalized Patient-on-a-Chip, we can really begin to understand how diseases, medicines, chemicals and foods affect an individual's health," said Geraldine A. Hamilton, PhD, president and chief scientific officer of Emulate, Inc. "The goal of Emulate working with Cedars-Sinai is to advance and qualify the system for new clinical applications and ultimately democratize the technology so that it can have broad impact on patient healthcare."

In the future, a Patient-on-a-Chip also could be used to predict how a disease progresses in an individual, allowing for the design of personalized preventive medicine and treatment regimens to promote wellness and prevent disease, said Robert Barrett, PhD, an assistant professor of Medicine at Cedars-Sinai and senior author of the study in Cellular and Molecular Gastroenterology and Hepatology. Other applications include designing clinical trials to identify at-risk populations for adverse drug reactions.
“Cedars-Sinai’s world-class stem cell expertise and discovery, combined with Emulate’s pioneering Human Emulation System, is poised to reshape the future of medical care,” said Shlomo Melmed, MB, ChB, executive vice president, Academic Affairs, and dean of the medical faculty at Cedars-Sinai. “This project is an important initiative of Cedars-Sinai Precision Health, whose goal is to drive the development of the newest technology and best research, coupled with the finest clinical practice, to rapidly enable a new era of personalized health.”

About Cedars-Sinai

Cedars-Sinai is a national leader in providing high-quality, patient-centered healthcare encompassing primary care as well as specialized medicine and conducting research that leads to lifesaving discoveries and innovations. Since its beginning in 1902, Cedars-Sinai has evolved to meet the healthcare needs of one of the most diverse regions in the nation, continually setting new standards in quality and innovation in patient care, research, teaching and community service. Today, Cedars-Sinai is widely known for its national leadership in transforming healthcare for the benefit of patients. Cedars-Sinai impacts the future of healthcare globally by developing new approaches to treatment and educating tomorrow’s physicians and other health professionals. At the same time, Cedars-Sinai demonstrates a longstanding commitment to strengthening the Los Angeles community through wide-ranging programs that improve the health of its most vulnerable residents.
About Emulate, Inc.
Emulate, Inc. is a privately held company that creates living products for understanding how diseases, medicines, chemicals, and foods affect human health. Our Human Emulation System™ sets a new standard for re-creating true-to-life human biology and is being used to advance product innovation, design, and safety across a range of applications including drug development, agriculture, cosmetics, food, and chemical-based consumer products. Emulate continues to develop a wide range of Organ-Chips and disease models through collaborations with industry partners and internal R&D programs. Emulate is also working with clinical partners to produce Organ-Chips personalized with an individual patient’s stem cells, for applications in precision medicine and personalized health. Our founding team pioneered the Organs-on-Chips technology at the Wyss Institute for Biologically Inspired Engineering at Harvard University. Emulate holds the worldwide exclusive license from Harvard University to a robust and broad intellectual property portfolio for the Organs-on-Chips technology and related systems.

Disclosure
Cedars-Sinai owns a minority stock interest in Emulate, Inc. An officer of Cedars-Sinai also serves on Emulate's board of directors. Emulate provides no financial support for this research.

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Image 1 caption:
Emulate’s S-1 Organ-Chip technology.

Image credit: Emulate, Inc.

Image 1 caption:
Cells of a human intestinal lining, after being placed in an Intestine-Chip, form intestinal folds as they do in the human body.

Image credit: Cedars-Sinai Board of Governors Regenerative Medicine Institute

Image 2 caption:
In precision medicine, the expertise and experiential knowledge of doctors and clinicians will be supplemented with data produced by our living products that utilize induced pluripotent stem cells and the analytic power of AI.

Image credit: Emulate, Inc.