amazing things PODCAST

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DR. LUCIE LOW: HOW TISSUE CHIPS MAY CHANGE HOW WE DEVELOP AND TEST DRUGS

Tissue chips, which are created using the same "soft lithography" process as computer chips, just might change the course and speed of new drug development.

Approximately 30 percent of promising medications have failed in human clinical trials because they are found to be toxic despite promising preclinical studies in animal models. Additionally, about 60 percent of drug candidates fail due to lack of efficacy. These currently unavoidable facts of the drug development process are one reason why National Institutes of Health (NIH) Director Dr. Francis Collins calls tissue chips an "enormously exciting research opportunity."

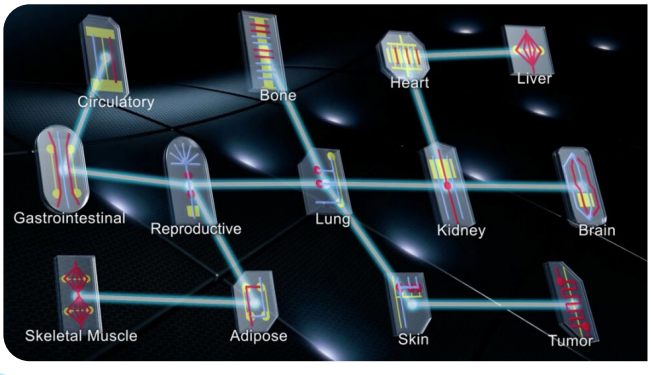
Because they can mimic the human condition much more closely than other current tools, such as two-dimensional cell models or animal models, and without putting humans at risk, tissue chips present a game-changing way to understand how the human body will respond to a particular drug and to speed up the drug development process.

To learn more about this technology and its potential, the Amazing Things Podcast spent time with Dr. Lucie Low, the scientific program manager of the Tissue Chip for Drug Screening program, a trans-NIH initiative within the National Center for Advancing Translational Sciences (NCATS).

According to Dr. Low, the soft lithography process allows researchers to experiment with the placement of channels and cells and find what best recreates how the human lung, liver or kidney would actually respond within the body. "Tissue chips are essentially bio-engineered micro devices that contain human cells in a three-dimensional cellular construct; they're designed to mimic your human tissues in a home away from home."

The ultimate goal of the program Dr. Low oversees is to accelerate the translation of basic discoveries into the clinic. By creating an integrated human body-on-a-chip, researchers can test the varied potential effects of a substance such as a drug across the entire body before any testing in humans.

Lucie A. Low, Ph.D.
Scientific Program Manager,
Tissue Chip for Drug Screening Program
CREDIT: DANIEL SOÑÉ PHOTOGRAPHY



Multiple tissue chips can be connected in a system to simulate a human-body-on-a-chip
CREDIT: NCATS

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TISSUE CHIPS
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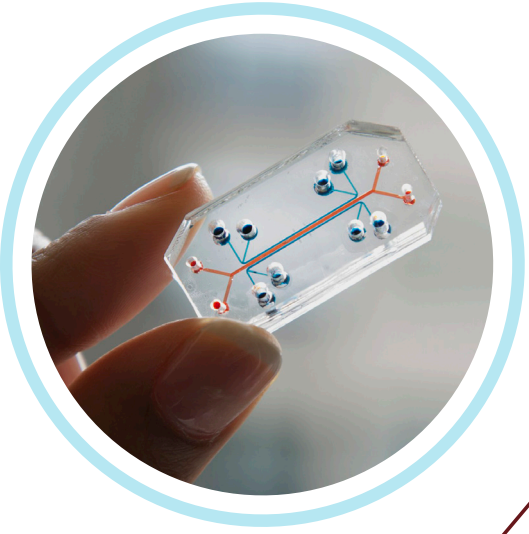
And, in the case of drug development, tissue chips offer the opportunity to not only test how the human body will respond to a particular therapeutic, but also how a specific sub-population — or even single individuals — will respond to that therapeutic. Imagine a scenario where a patient has a rare disease or isn't responding well to a certain treatment.

"The ability to then create tissue chips that actually model their responses before they're given a particular drug or treatment means that we can start actually changing, or altering, or adapting the treatments or the dosages they might get that would make it more effective," Dr. Low said. "Or if we knew for example, that a particular chemotherapeutic cocktail would be much more toxic for one subsection of patients, then we would know not to do that particular chemotherapeutic cocktail. But we could try something else instead. You could try it on a tissue chip first."

Given the great potential of tissue chips, NCATS is keenly focused on ensuring that its work (and that of the scientists it supports) is translational and translatable and that it is publicly accessible. In support of these goals, NCATS has created two independent Tissue Chip Testing Centers at Texas A&M University and Massachusetts Institute of Technology to test and validate the platforms that have been developed through the program. It has additionally created a central repository for all of the testing data to support drug development at the University of Pittsburgh.

These efforts will help promote the adoption of this technology by the broader research community and ensure wide-ranging availability of tissue chip technology, particularly for regulatory agencies and pharmaceutical companies.

A kidney-on-a-chip under the microscope
CREDIT: UNIVERSITY OF WASHINGTON



This lung-on-a-chip serves as an accurate model of human lungs to test for drug safety and efficacy
CREDIT: WYSS INSTITUTE FOR BIOLOGICALLY INSPIRED ENGINEERING, HARVARD UNIVERSITY

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