Microphysiological Systems at NCATS: Increasing the Predictivity of Translational Assays

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Microphysiological Systems: Bridging Human and Animal Research
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NCATS Mission

To catalyze the generation of innovative methods and technologies that will enhance the development, testing, and implementation of diagnostics and therapeutics across human diseases and conditions.
Improved (more predictive?) translational models/assays

- 2D
- Spheroids
- Organoids
- Printed Tissues
- Organ-on-a-chip

HTS compatibility

Physiological complexity
TOX21 Scientists Prioritize Compounds to Advance Research on Mitochondrial Damage

As part of the TOX21 collaboration, scientists developed an analytical approach to enable researchers to prioritize environmental chemicals for their ability to disrupt mitochondria, the power generators of cells.

ABOUT
TOX21

The Toxicology in the 21st Century (TOX21) Consortium is a federal collaboration between the U.S. Environmental Protection Agency (EPA), National Toxicology Program (NTP) headquartered at the National Institute of Environmental Health Sciences (NIEHS), National Center for Advancing Translational Sciences (NCATS), and Food and Drug Administration (FDA).

PARTNERS

Each of the partners in the TOX21 collaboration brings key expertise.

https://tox21.gov/
Building a tissue biofabrication capability for disease modeling and drug screening

NCATS 3D Tissue Biofabrication for disease modeling and drug screening

Native Tissue morphology, Physiology and pathology

Storage, analysis and sharing

Clinical Benchmarking/Integration into therapeutic development pipelines
Tissue Chips for Drug Screening Program

**IQ Consortium MPS Affiliate:** AbbVie, Alnylam, Amgen, Astellas, AstraZeneca, Biogen, Bristol-Myers Squibb, Celgene, Eisai, Eli Lilly, Genentech, GlaxoSmithKline, Hoffman-La Roche, Janssen Pharmaceuticals, Merck & Co., Merck KGaA, Mitsubishi Tanabe, Novartis, Pfizer, Sanofi, Seattle Genetics, Takeda, Theravance, Vertex

**US Food and Drug Administration**

- * DARPA $75 M*

2010 – 2012
Regulatory Science

- NIH – FDA Joint Leadership Council on Advancing Regulatory Science
- RFA-RM-10-006 - Heart and Lung Micromachine was one of 4 awards
- Common Fund $18 M
- FDA $2.25 M

2012 - 2017
Toxicity Studies

- NCATS Tissue Chips for Drug Screening
  - RFA-RM-11-022 - 10 awards
  - RFA-RM-12-001 - 8 awards
- NCATS $50 M
- Common Fund, NIBIB, NCI, NICHD, NIEHS, ORWH $25 M

2016 - 2021
Accelerated Aging Models

- Tissue Chips in Space
  - RFA-TR-16-019 - 5 awards $12 M
  - RFA-TR-18-001 (with NIBIB) - 4 awards $10 M

- Disease Models
  - Nociception, Addiction, and Overdose
    - RFA-TR-19-003 - 5 awards ($25 M HEAL)
  - Alzheimer’s Disease-Related Dementias
    - RFA-NS-19-027 - 1 award $7.5 M (NCATS $0.005 M)

- 2018 – 2022 Disease Models for Efficacy Testing

- 2016 – 2020 Building Confidence in MPS

- Tissue Chips Testing Centers and Database Center
    - 2 TCTCs and 1 MPS DbC $24 M

- 2010 – 2012
  - 13 awards $75 M (NCATS $32 M)
  - 3 awards $15 M (NCATS $0.015 M)

- Establishment of NCATS December 2011

Self-sustaining beyond NCATS support
Why non-human animal MPS?

• Reduce, refine, replace animal use in research
• Evaluate environmental chemical effects on wildlife species
• Advance animal health (veterinary) research
• Bridge animal and human data to allow more robust translational/drug development/regulatory applications of MPS data