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Microphysiological Systems at NCATS: Increasing the Predictivity of Translational Assays

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Microphysiological Systems: Bridging Human and Animal Research

National Academy of Sciences Roundtable on Science and Welfare of Laboratory Animal Use

January 19, 2021

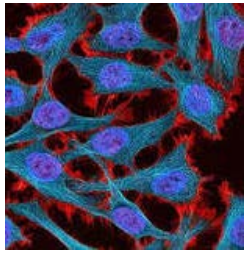
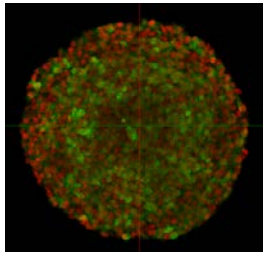
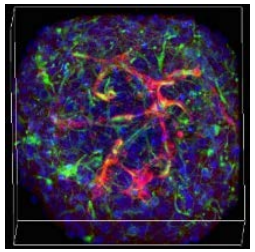
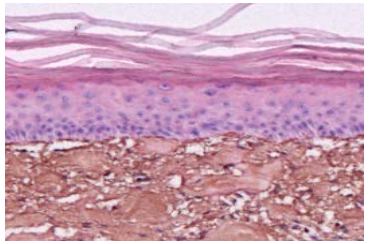
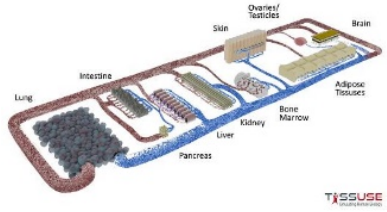
National Center for Advancing Translational Sciences

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

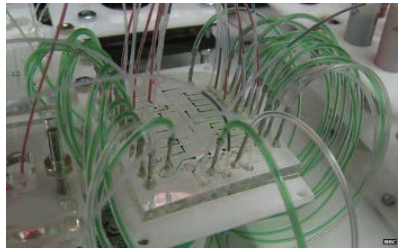






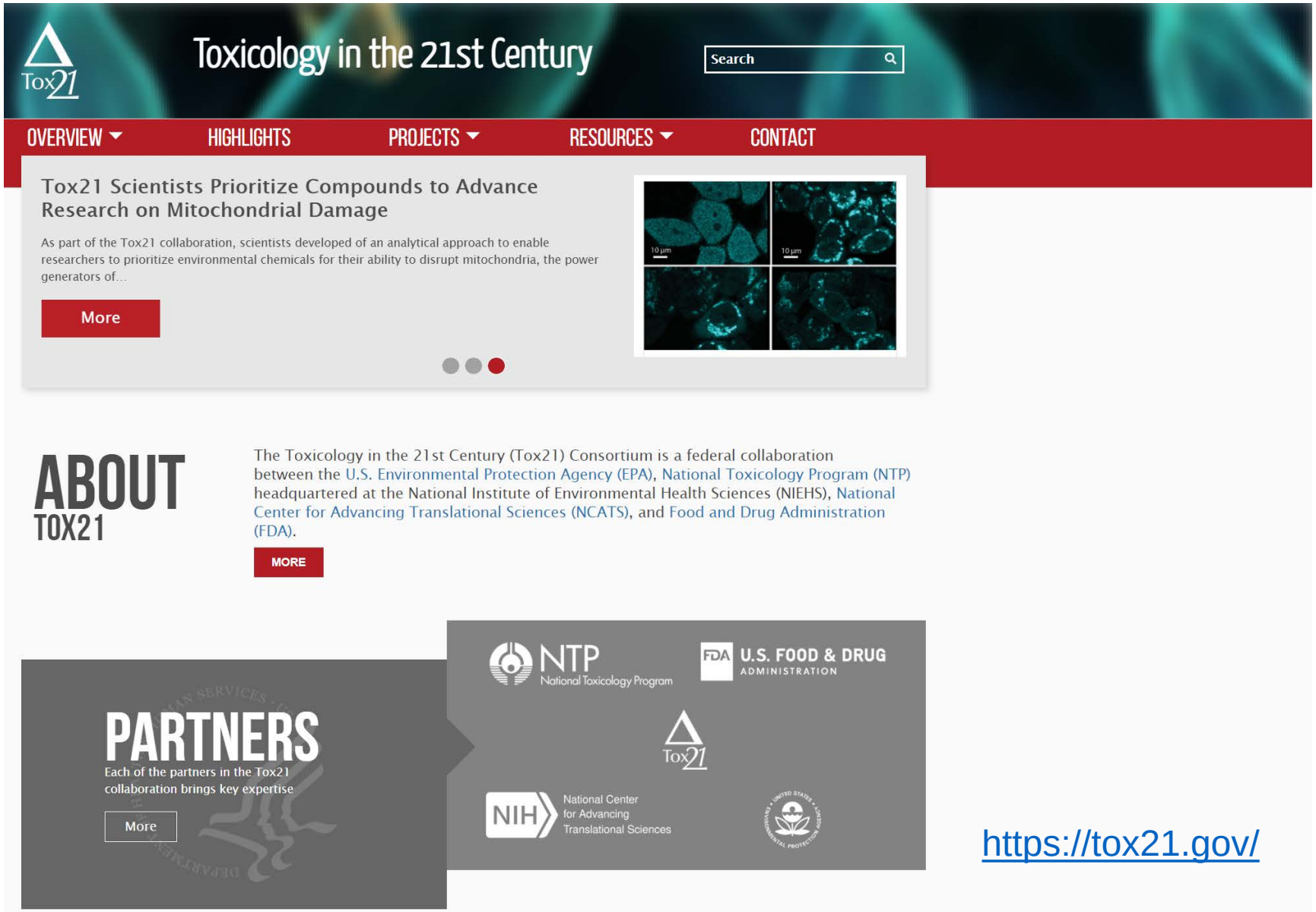
Physiological complexity

HTS compatibility



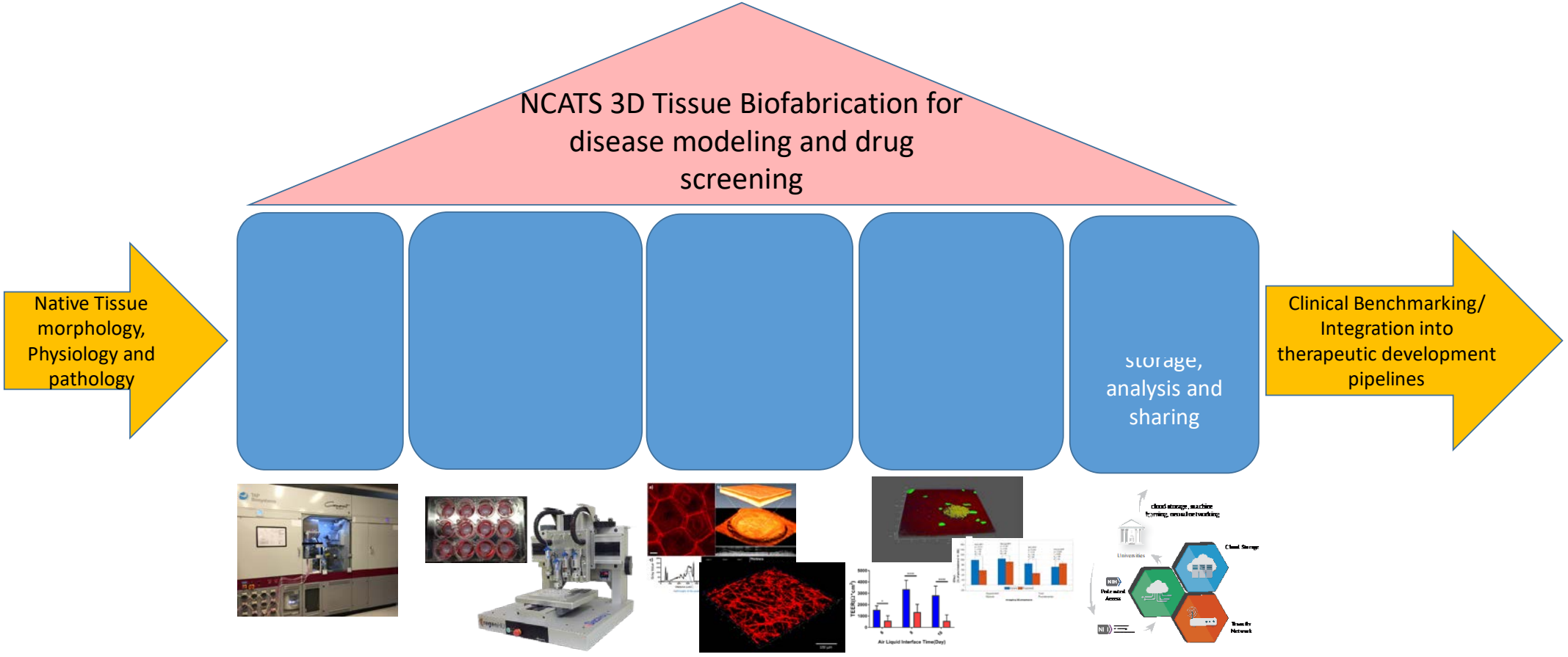






https://tox21.gov/

Building a tissue biofabrication capability for disease modeling and drug screening



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Tissue Chips for Drug Screening Program

Establishment of NCATS
December 2011

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

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

* DARPA $75 M

* AstraZeneca, GlaxoSmithKline and Pfizer Reference Set Compounds *(2014-2017)*

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

* Center for Advancement of Science in Space (CASIS) or International Space Station – National Laboratory
$8 M in kind per launch
* NASA task orders with implementation partners

Tissue Chips in Space

RFA-TR-16-019
- 5 awards $12 M

RFA-TR-18-001 (with NIBIB)
- 4 awards $10 M

2018 – 2022 Disease Models for Efficacy Testing

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)

Disease Models
RFA-TR-16-017
NHLBI, NIAMS, NIBIB, NICHD, NIDCR, NIDDK, NIEHS, NINDS, ORWH
- 13 awards $75 M (NCATS $32 M)

RFA-DK-17-035 Type 2 Diabetes
- 3 awards $15 M (NCATS $0.015 M)

2016 – 2020 Building Confidence in MPS

Tissue Chips Testing Centers and Database Center
RFA-TR-16-006, RFA-TR-18-005, RFA-TR-18-006
- 2 TCTCs and 1 MPS DbC $24 M

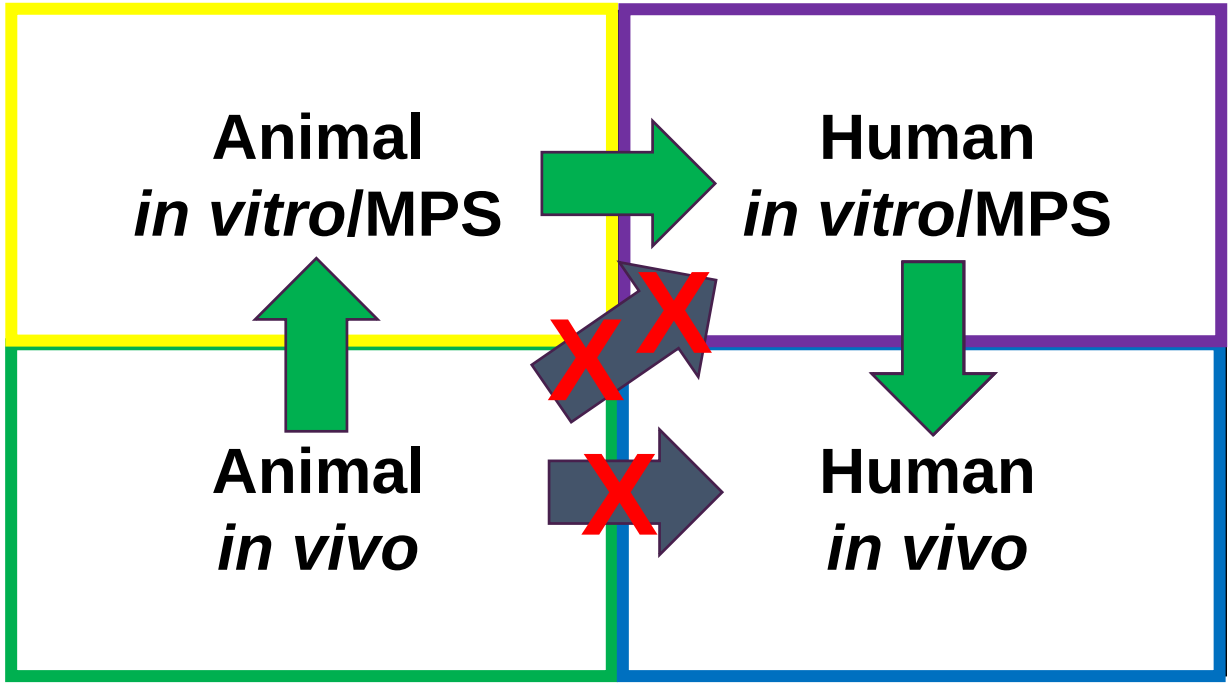
Self-sustaining beyond NCATS support

Tissue Chips Consortium

National Center for Advancing Translational Sciences

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



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