National Institute of Environmental Health Sciences
Division of Translational Toxicology

Facilitating Global Connections through the Microphysiological Systems for COVID Research (MPSCoRe) Working Group

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Highlights

MPS provide human-relevant platforms to study infectious disease mechanisms and test therapeutics.

MPSCoRe opens pipelines for communication and collaboration among key MPS stakeholders.

MPSCoRe promotes the use of MPS in research to improve human health and reduce reliance on animal models.

Introduction

- The emergence and spread of COVID-19 underscore the need for effective approaches to prevent, control, and treat infectious diseases.
- Animal models have historically been used to study infectious diseases, but human cell-based in vitro platforms known as microphysiological systems (MPS) or “organs-on-chips” may be better suited to modeling disease effects on human organ systems.
- The MPS for COVID Research (MPSCoRe) working group was organized to connect key MPS stakeholders from around the world and coordinate research investigations using MPS technologies for COVID-19 studies.

Founders/Leadership

National Institute of Environmental Health Sciences

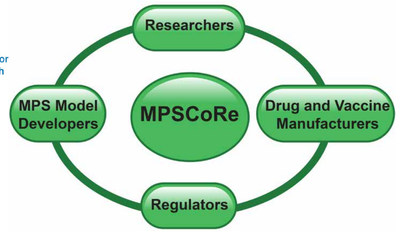
National Centre for the Replacement Refinement & Reduction of Animals in Research

National Institute of Allergy and Infectious Diseases

DEVCOM CHEMICAL & BIOLOGICAL CENTER

National Center for Advancing Translational Sciences

Membership

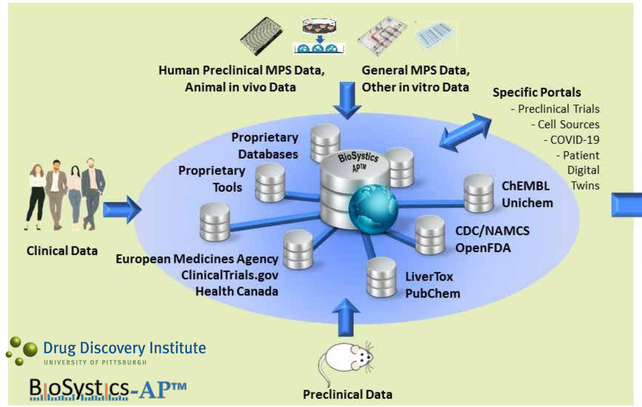


MPSCoRe Objectives

- Provide a neutral forum to facilitate engagement among international research efforts.
- Facilitate connections between MPS technology developers and potential end users.
- Work with global regulatory authorities to improve understanding of regulatory needs and decision contexts.
- Provide cross-discipline and -sector expertise in characterizing criteria for model performance and readiness.
- Support the assessment of novel MPS models against concurrently generated preclinical and clinical data.
- Ensure that the animal reduction and replacement opportunities these model platforms offer are recognized.

BioSystics Analytics Platform COVID-19 Portal

- Sharing data from MPS studies supports two MPSCoRe objectives: **connecting MPS technology developers and end users** and **characterizing criteria for model performance and readiness.**
- The University of Pittsburgh Drug Discovery Institute developed the BioSystics Analytics Platform™ (BioSystics-AP™; formerly the Microphysiological Systems Database) as a central resource to access, manage, analyze, share, and computationally model a variety of complex data sets to predict biological outcomes.



Information
- Experimental model reproducibility
- Compound safety and efficacy
- Mechanism(s) of disease progression
- Mechanism(s) of compound action(s)
- Computational models of ADME/tox and disease

Actionable Knowledge
- Optimized experimental model design
- Improved ADME/tox predictions
- Predicted drug/therapeutic candidates
- Preclinical trial outcomes
- Design of clinical trials
- Create patient digital twins

MPSCoRe supports expansion of the BioSystics-AP to include a COVID-19 portal that is designed to be a central repository for MPSCoRe data and allows users to easily access:

- General COVID-19 information and literature sources
- SARS-CoV-2 and COVID-19 disease biology databases
- In vivo and in vitro experimental models
- Vendors and other sources of components used in SARS-CoV-2 and COVID-19 studies
- Preclinical and clinical data
- Computational modeling resources

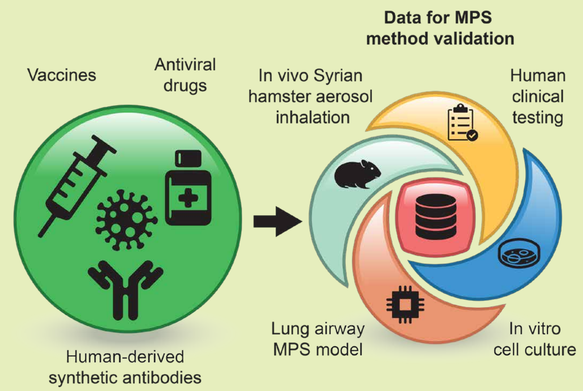
MPSCoRe members may access a **private** list of other member profiles, and share their own information about:

- Organization
- Areas of expertise
- Platforms in use (or of interest)
- Species and tissue types in use (or of interest)
- Applications for the model
- Focus of SARS-CoV-2 and COVID-19 research
- Availability of biosafety levels 3 and 4 facilities

Evaluation of MPS for Testing COVID-19 Therapeutics

- A key MPSCoRe objective is **the assessment of novel MPS models against concurrently generated preclinical and clinical data.**

- MPSCoRe supports the establishment of organ-on-chip technology for testing novel COVID-19 therapeutics and vaccines at the National Institute of Allergy and Infectious Disease (NIAID) Integrated Research Facility.
- An initial proof-of-concept study to test the safety and efficacy of novel therapeutics against COVID-19 in MPS models will enable parallel comparison of data from low and high complexity models.

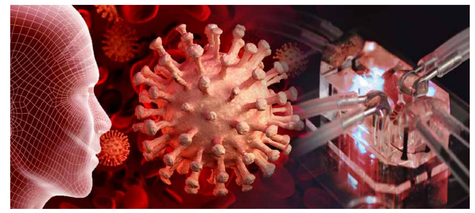


Additional MPSCoRe Activities/Resources

- Regular opportunities for member engagement via virtual workshops and webinars on specific topics of interest.
- Email contact list to facilitate connections between MPSCoRe members and to broadly distribute relevant information (e.g., literature, funding opportunities).
- Engagement with World Health Organization representatives to facilitate rapid response to research capabilities for COVID-19 variants of concern.
- Possible expansion of working group scope to include other emerging infectious diseases.

Summary and Conclusions

- MPSCoRe facilitates collaboration among MPS stakeholders from the research, method development, drug and vaccine manufacturing, and regulatory sectors.
- MPSCoRe members have exclusive access to relevant information and resources.
- Ongoing projects funded under MPSCoRe include development of a COVID-19 disease portal in the BioSystics-AP and establishment of organ-on-chip technology at the NIAID IRF.
- MPSCoRe efforts will accelerate the development and adoption of MPS in infectious disease research, thereby reducing the reliance on animal models in this space.



Acknowledgments and More Information

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Kleinstreuer and Holmes. 2021. Drug Discov Today 26(11): 2496-2501. DOI: 10.1016/j.drudis.2021.06.020
Schurdak et al. 2020. Lab Chip 20(8): 1472-1492. DOI: 10.1039/C9LC01047E

BioSystics Analytics Platform™:
https://mps.csb.pitt.edu/
https://www.biosystics.com

COVID-19 Research at the Integrated Research Facility at Fort Detrick:
https://www.niaid.nih.gov/research/covid-19-research-integrated-research-facility

NICEATM MPS activities: https://ntp.niehs.nih.gov/go/mps

NC3Rs MPS and alternatives activities: https://nc3rs.org.uk/resources/alternatives

NICEATM News email list: https://list.nih.gov/cgi-bin/wa.exe?SUBED1=niceatm-l&A=1