A Working Group Supporting Adoption of MPS in Infectious Disease Research

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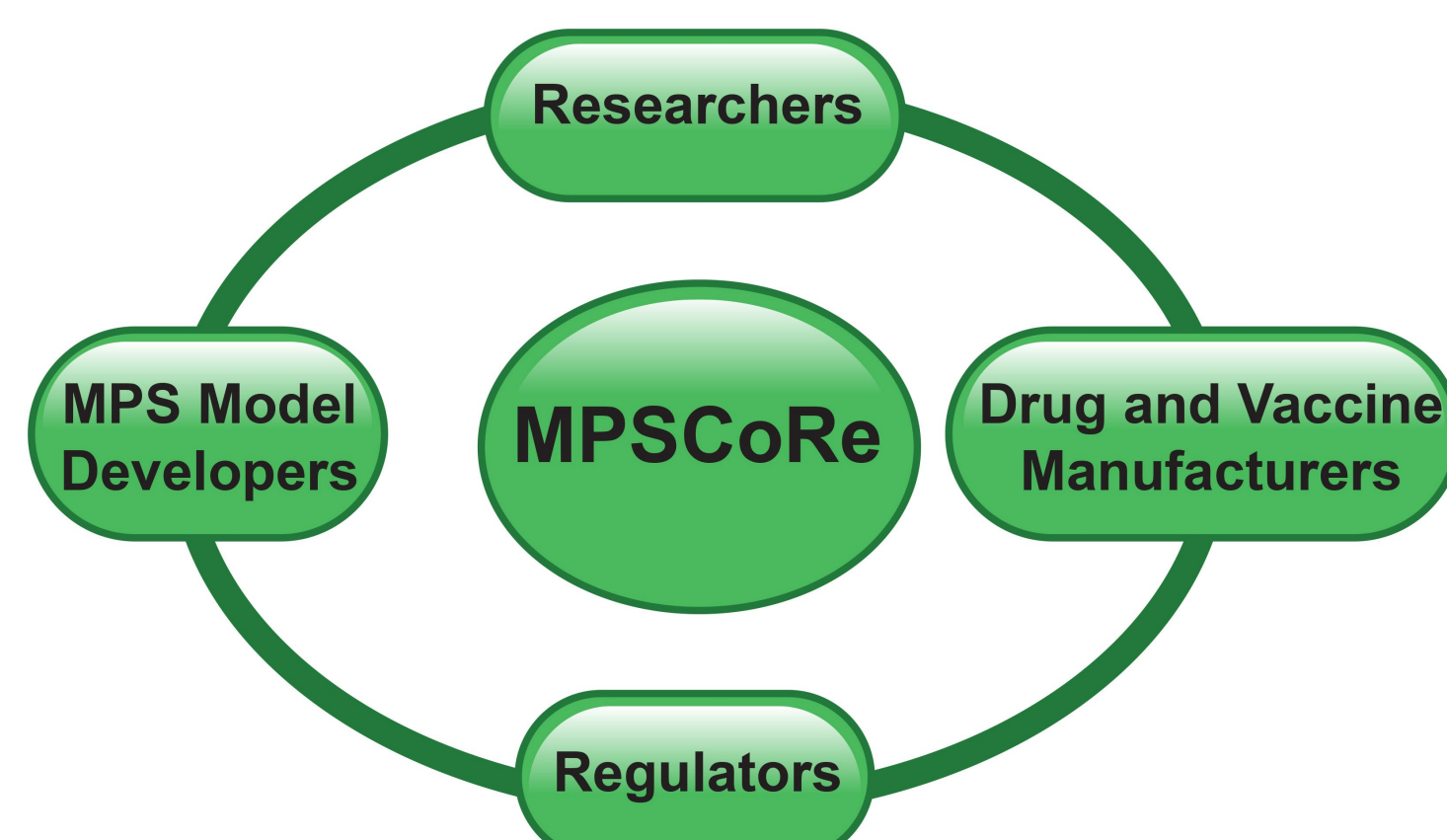
Introduction

- While animal studies have contributed to a foundational understanding of the biological processes involved in disease, the usefulness of animal models in understanding human health is limited, partly due to inherent species differences.
- Complex human cell-based in vitro platforms known as microphysiological systems (MPS) may be better suited to studying mechanisms of human physiology and disease by recapitulating human organs and organ systems in a dish.
- The emergence and global spread of COVID-19 prompted rapid and widespread endeavors for assessing the utility of MPS to study how the SARS-CoV-2 virus affects the lungs and other organs and to support development of therapeutics.
- The MPS for COVID Research (MPSCoRe) working group was organized to globally connect key MPS stakeholders to reduce the risk of overlapping investigations and duplication of COVID-19 research efforts.
- The MPSCoRe has since expanded its scope to consider other emerging and endemic infectious diseases, with the goal of reducing the reliance on animal models for studies of these diseases.

Founders/Leadership

National Institute of Environmental Health Sciences
NC3Rs — National Centre for the Replacement Refinement & Reduction of Animals in Research
National Center for Advancing Translational Sciences
DEVCOM CHEMICAL & BIOLOGICAL CENTER
National Institute of Allergy and Infectious Diseases

Membership

Researchers
MPS Model Developers
MPSCoRe
Drug and Vaccine Manufacturers
Regulators
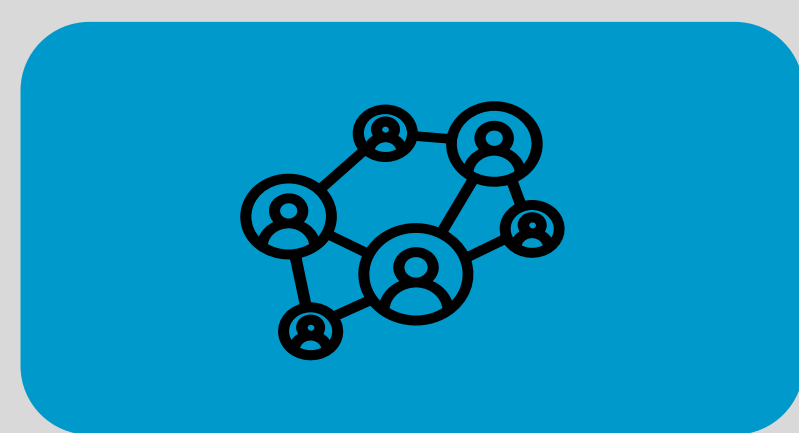
Summary and Conclusion

- MPSCoRe facilitates collaboration among MPS stakeholders from the research, method development, drug and vaccine manufacturing, and regulatory sectors.
- MPSCoRe supports access to relevant information and research resources.
- MPSCoRe has been successful in supporting COVID research using MPS.
- MPSCoRe efforts will accelerate the development and adoption of MPS in infectious disease research, thereby reducing the reliance on animal models in this space.
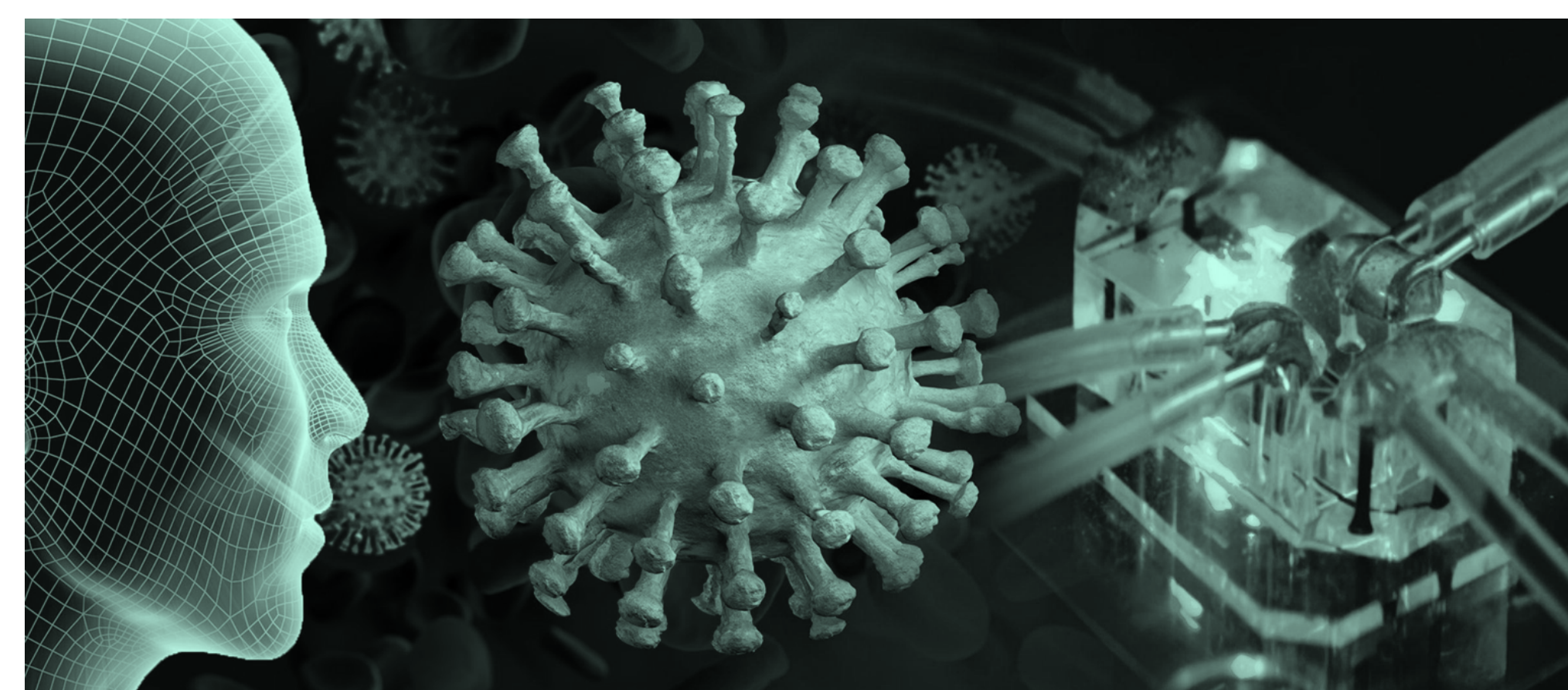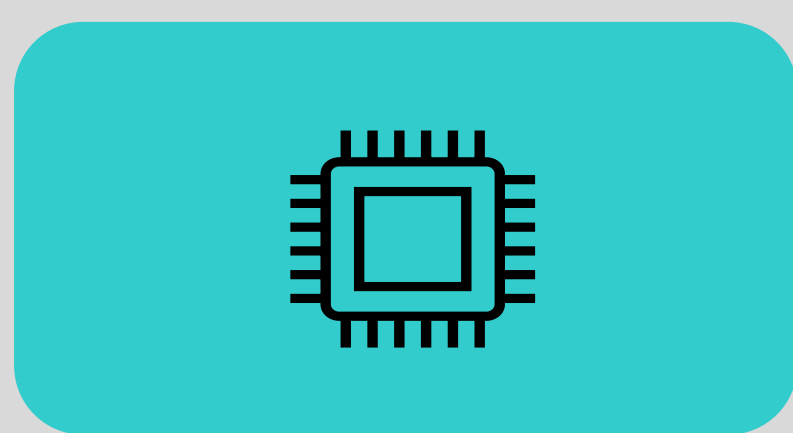
MPSCoRe Objectives
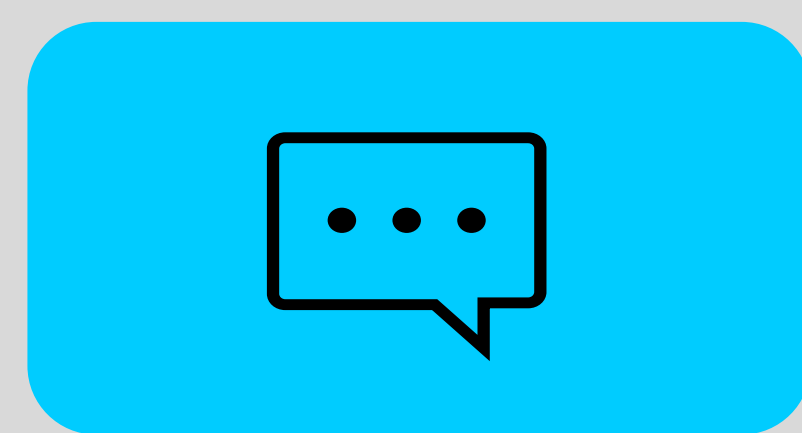
- Provide a neutral forum to facilitate engagement among international research teams.
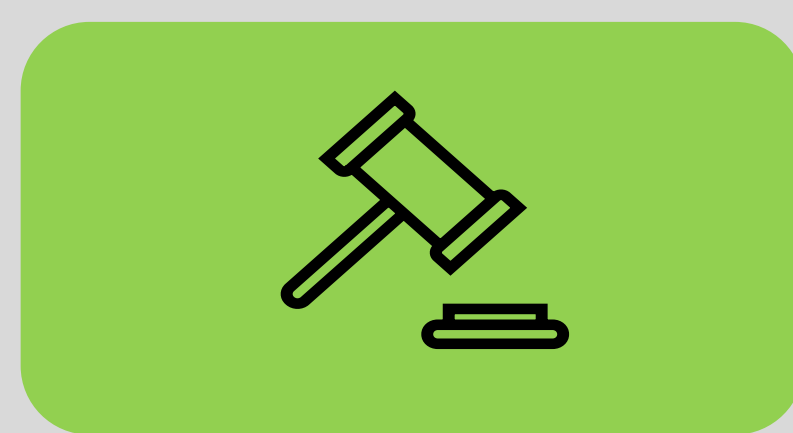- Facilitate connections between MPS technology developers and potential end users.
- Provide cross-discipline and -sector expertise in characterizing criteria for model performance and readiness.
- Support the assessment of novel MPS models against preclinical and clinical data.
- Work with global regulatory authorities to improve understanding of regulatory needs and decision contexts.
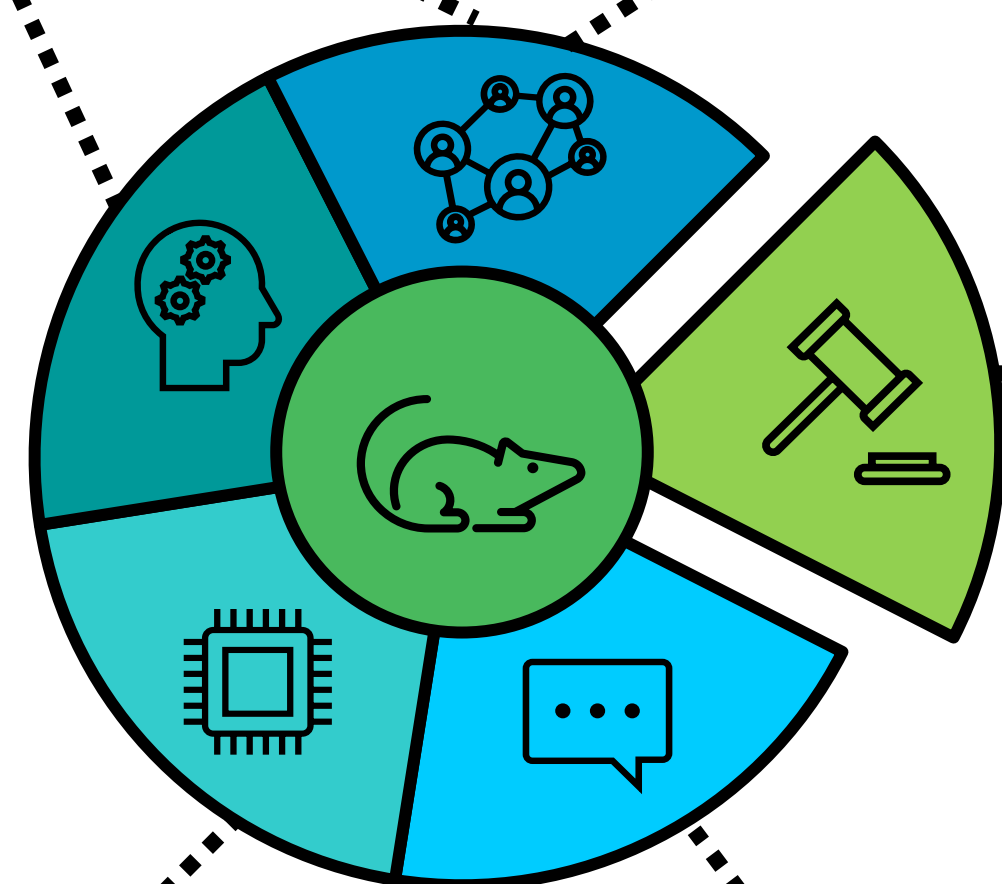- Ensure that the animal reduction and replacement opportunities these model platforms offer are recognized.

Activities to Coordinate MPS Efforts for COVID-19 and Other Infectious Diseases

The BioSystics Analytics Platform™ (BioSystics-AP™; formerly the Microphysiological Systems Database) is a central resource to access, manage, analyze, share, and computationally model a variety of complex data sets to predict biological outcomes.
- The BioSystics-AP was developed by the University of Pittsburgh Drug Discovery Institute, primarily via funding provided by the National Center for Advancing Translational Sciences (NCATS).
- The MPSCoRe supports expansion of the BioSystics-AP to include a COVID-19 portal that is designed to be a central repository for MPSCoRe data.
- The BioSystics-AP 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.
  - Preclinical and clinical data.
  - Computational modeling resources.

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.

The MPSCoRe engages with World Health Organization representatives to facilitate rapid response to research capabilities for COVID-19 variants of concern.

In May 2023, the World Health Organization lifted the public health emergency of international concern designation for COVID-19. Accordingly, MPSCoRe has expanded its purview to include the use of MPS for other emerging and reemerging infectious diseases. Since many MPS models for COVID-19 are at advanced stages of development, current MPSCoRe activities focus on the objective to work with global regulatory authorities to improve understanding of regulatory needs and decision contexts.

The MPSCoRe provides regular opportunities for member engagement.
- 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).

References and Acknowledgments

- 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

More Information

- BioSystics Analytics Platform: https://biosystics-ap.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

To receive announcements of NICEATM activities, visit the NIH mailing list page for NICEATM News at http://ntp.niehs.nih.gov/go/niceatm and click "Subscribe."