

# SARS-CoV-2 and COVID-19: An Evolving Review of Diagnostics and Therapeutics

This manuscript ([permalink](#)) was automatically generated from [miltondp/testing\\_rootstock\\_ai@f0648c8](#) on February 1, 2023.

## Authors

---

- **Halie M. Rando**

 [0000-0001-7688-1770](#) ·  [rando2](#) ·  [tamefoxtime](#)



Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Department of Biochemistry and Molecular Genetics, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America; Center for Health AI, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America; Department of Biomedical Informatics, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America · Funded by the Gordon and Betty Moore Foundation (GBMF 4552); the National Human Genome Research Institute (R01 HG010067)

- **Casey S. Greene**

 [0000-0001-8713-9213](#) ·  [cgreene](#) ·  [GreeneScientist](#)

Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Childhood Cancer Data Lab, Alex's Lemonade Stand Foundation, Philadelphia, Pennsylvania, United States of America; Department of Biochemistry and Molecular Genetics, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America; Center for Health AI, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America; Department of Biomedical Informatics, University of Colorado Anschutz School of Medicine, Aurora, Colorado, United States of America · Funded by the Gordon and Betty Moore Foundation (GBMF 4552); the National Human Genome Research Institute (R01 HG010067)

- **Michael P. Robson**

 [0000-0002-4859-0033](#) ·  [mprobson](#)

Department of Computing Sciences, Villanova University, Villanova, Pennsylvania, United States of America

- **Simina M. Boca**

 [0000-0002-1400-3398](#) ·  [SiminaB](#)

Innovation Center for Biomedical Informatics, Georgetown University Medical Center, Washington, District of Columbia, United States of America

- **Nils Wellhausen**

 [0000-0001-8955-7582](#) ·  [nilswellhausen](#)

Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America

- **Ronan Lordan**

 [0000-0001-9668-3368](#) ·  [RLordan](#) ·  [el\\_ronan](#)

Institute for Translational Medicine and Therapeutics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA 19104-5158, USA; Department of Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA 19104, USA; Department of Systems Pharmacology and Translational Therapeutics, Perelman School of Medicine, University of Pennsylvania; Philadelphia, PA 19104, USA

- **Christian Brueffer**

 [0000-0002-3826-0989](#) ·  [cbrueffer](#) ·  [cbrueffer](#)

Department of Clinical Sciences, Lund University, Lund, Sweden

- **Sandipan Ray**

 [0000-0002-9960-5768](#) ·  [rays1987](#)

Department of Biotechnology, Indian Institute of Technology Hyderabad, Kandi, Sangareddy 502285, Telangana, India

- **Lucy D'Agostino McGowan**

 [0000-0001-7297-9359](#) ·  [LucyMcGowan](#) ·  [LucyStats](#)

Department of Mathematics and Statistics, Wake Forest University, Winston-Salem, North Carolina, United States of America

- **Anthony Gitter**

 [0000-0002-5324-9833](#) ·  [agitter](#) ·  [anthonygitter](#)

Department of Biostatistics and Medical Informatics, University of Wisconsin-Madison, Madison, Wisconsin, United States of America; Morgridge Institute for Research, Madison, Wisconsin, United States of America · Funded by John W. and Jeanne M. Rowe Center for Research in Virology

- **Anna Ada Dattoli**

 [0000-0003-1462-831X](#) ·  [aadattoli](#) ·  [aadattoli](#)

Department of Pathology and Laboratory Medicine, The Children's Hospital of Philadelphia, Philadelphia, PA, USA; Department of Systems Pharmacology & Translational Therapeutics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, USA

- **Ryan Velazquez**

 [0000-0002-3655-3403](#) ·  [rdvelazquez](#)


Azimuth1, McLean, Virginia, United States of America

- **John P. Barton**

 [0000-0003-1467-421X](#) ·  [johnbarton](#) ·  [\\_jpbarton](#)

Department of Physics and Astronomy, University of California-Riverside, Riverside, California, United States of America

- **Jeffrey M. Field**

 [0000-0001-7161-7284](#) ·  [Jeff-Field](#)

Department of Systems Pharmacology and Translational Therapeutics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA 19104, USA

- **Bharath Ramsundar**

 [0000-0001-8450-4262](#) ·  [rbharath](#) ·  [rbhar90](#)

The DeepChem Project, <https://deepchem.io/>

- **Adam L. MacLean**

 [0000-0003-0689-7907](#) ·  [adamlmaclean](#) ·  [adamlmaclean](#)

Department of Quantitative and Computational Biology, University of Southern California, Los Angeles, California, United States of America

- **Alexandra J. Lee**

 [0000-0002-0208-3730](#) ·  [ajlee21](#)

Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America · Funded by the Gordon and Betty Moore Foundation (GBMF 4552)

- **Immunology Institute of the Icahn School of Medicine**

·  [ismms-himc](#)

Immunology Institute of the Icahn School of Medicine

- Fengling Hu**  
 ID [0000-0003-1081-5038](#) · [hufengling](#) · [hufengling](#)  
 Department of Biostatistics, Epidemiology and Informatics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America
- Nafisa M. Jadavji**  
 ID [0000-0002-3557-7307](#) · [nafisajadavji](#) · [nafisajadavji](#)  
 Biomedical Science, Midwestern University, Glendale, AZ, United States of America; Department of Neuroscience, Carleton University, Ottawa, Ontario, Canada · Funded by the American Heart Association (20AIREA35050015)
- Elizabeth Sell**  
 ID [0000-0002-9658-1107](#) · [esell17](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America
- Vincent Rubinetti**  
 ID [0000-0002-4655-3773](#) · [vincerubinetti](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Center for Health AI, University of Colorado School of Medicine, Aurora, Colorado, United States of America
- Jinhui Wang**  
 ID [0000-0002-5796-8130](#) · [jinhui2](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America
- Diane N. Rafizadeh**  
 ID [0000-0002-2838-067X](#) · [dianerafi](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Department of Chemistry, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America · Funded by NIH Medical Scientist Training Program T32 GM07170
- Ashwin N. Skelly**  
 ID [0000-0002-1565-3376](#) · [anskelly](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Institute for Immunology, University of Pennsylvania Perelman School of Medicine, Philadelphia, United States of America · Funded by NIH Medical Scientist Training Program T32 GM07170
- Marouen Ben Guebila**  
 ID [0000-0001-5934-966X](#) · [marouenbg](#) · [marouenbg](#)  
 Department of Biostatistics, Harvard School of Public Health, Boston, Massachusetts, United States of America
- Likhitha Kolla**  
 ID [0000-0002-1169-906X](#) · [likhithakolla](#) · [lkolla2018](#)  
 Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America · Funded by NIH Medical Scientist Training Program T32 GM07170
- David Manheim**  
 ID [0000-0001-8599-8380](#) · [davidmanheim](#) · [davidmanheim](#)  
 1DaySooner, Delaware, United States of America; Risk and Health Communication Research Center, School of Public Health, University of Haifa, Haifa, Israel; Technion, Israel Institute of Technology, Haifa, Israel · Funded by Center for Effective Altruism, Long Term Future Fund
- Soumita Ghosh**  
 ID [0000-0002-2783-2750](#) · [soumitagh](#)

Institute of Translational Medicine and Therapeutics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America

- **James Brian Byrd**

 [0000-0002-0509-3520](#) ·  [byrdjb](#) ·  [thebyrdlab](#)

University of Michigan School of Medicine, Ann Arbor, Michigan, United States of America · Funded by NIH K23HL128909; FastGrants

- **YoSon Park**

 [0000-0002-0465-4744](#) ·  [ypar](#) ·  [yoson](#)



Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America · Funded by NHGRI R01 HG10067

- **Vikas Bansal**

 [0000-0002-0944-7226](#) ·  [bansalvi](#) ·  [VikasBansal1989](#)

Biomedical Data Science and Machine Learning Group, German Center for Neurodegenerative Diseases, Tübingen 72076, Germany

- **Stephen Capone**

 [0000-0001-7231-1535](#) ·  [scapone01](#)


St. George's University School of Medicine, St. George's, Grenada

- **John J. Dziak**

 [0000-0003-0762-5495](#) ·  [dziakj1](#)

Edna Bennett Pierce Prevention Research Center, The Pennsylvania State University, University Park, PA, United States of America

- **Yuchen Sun**

·  [kevinsunofficial](#)



Department of Computer Science, University of Virginia, Charlottesville, VA, United States of America

- **YanJun Qi**

 [0000-0002-5796-7453](#) ·  [qiyanjun](#)

Department of Computer Science, University of Virginia, Charlottesville, VA, United States of America

- **Lamonica Shinholster**

 [0000-0001-6285-005X](#) ·  [LSH2126](#)

Mercer University, Macon, GA, United States of America · Funded by the Center for Global Genomics and Health Equity at the University of Pennsylvania

- **Temitayo Lukan**

·  [tlukan](#)

University of Pennsylvania, Philadelphia, PA, United States of America

- **Sergey Knyazev**

 [0000-0003-0385-1831](#) ·  [Sergey-Knyazev](#) ·  [SeKnyaz](#)

Georgia State University, Atlanta, GA, United States of America

- **Dimitri Perrin**

 [0000-0002-4007-5256](#) ·  [SystemsResearch](#) ·  [dperrin](#)

School of Computer Science, Queensland University of Technology, Brisbane, Australia; Centre for Data Science, Queensland University of Technology, Brisbane, Australia

- **Serghei Mangul**

 [0000-0003-4770-3443](#) ·  [smangul1](#) ·  [serghei\\_mangul](#)

Department of Clinical Pharmacy, School of Pharmacy, University of Southern California, Los Angeles, CA, United States of America

- **Shikta Das**

 [0000-0002-8291-2788](#) ·  [shiktadas](#) ·  [shikta\\_das](#)

C4X Discovery, London, United Kingdom; Medical Research Council LHA, Institute of Cardiovascular Studies, University College London, London, United Kingdom

- **Gregory L Szeto**

 [0000-0001-7604-1333](#) ·  [gregszetoAI](#) ·  [greg\\_szeto](#)

Allen Institute for Immunology, Seattle, WA, United States of America

- **Tiago Lubiana**

 [0000-0003-2473-2313](#) ·  [lubianat](#) ·  [lubianat](#)

Department of Clinical and Toxicological Analyses, School of Pharmaceutical Sciences, University of São Paulo, São Paulo, Brazil

- **David Mai**

 [0000-0002-9238-0164](#) ·  [davemai](#) ·  [lococyte](#)

Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, USA; Center for Cellular Immunotherapies, Perelman School of Medicine, and Parker Institute for Cancer Immunotherapy at University of Pennsylvania, Philadelphia, PA, USA

- **COVID-19 Review Consortium**

- **Rishi Raj Goel**

 [0000-0003-1715-5191](#) ·  [rishirajgoel](#) ·  [rishirajgoel](#)

Institute for Immunology, University of Pennsylvania, Philadelphia, PA, United States of America

- **Joel D Boerckel**

 [0000-0003-3126-3025](#) ·  [jboerckel](#) ·  [jboerckel](#)

Department of Orthopaedic Surgery, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, United States of America; Department of Bioengineering, University of Pennsylvania, Philadelphia, PA, United States of America

- **Amruta Naik**

 [0000-0003-0673-2643](#) ·  [NAIKA86](#)

Children's Hospital of Philadelphia, Philadelphia, PA, United States of America

- **Yusha Sun**

 [0000-0003-4835-3000](#) ·  [yusha-sun](#)

Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America

- **Daniel S. Himmelstein**

 [0000-0002-3012-7446](#) ·  [dhimmel](#) ·  [dhimmel](#)

Department of Systems Pharmacology and Translational Therapeutics, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America; Related Sciences · Funded by GBMF4552

- **Jeremy P. Kamil**

 [0000-0001-8422-7656](#)

Department of Microbiology and Immunology, Louisiana State University Health Sciences Center Shreveport,  
Shreveport, Louisiana, USA

- **Jesse G. Meyer**

 [0000-0003-2753-3926](#) ·  [jessegmeyerlab](#)

Department of Biochemistry, Medical College of Wisconsin, Milwaukee, Wisconsin, United States of America · Funded  
by National Institute of General Medical Sciences (R35 GM142502)

- **Ariel I. Mundo**

 [0000-0002-6014-4538](#) ·  [aimundo](#)

Department of Biomedical Engineering, University of Arkansas, Fayetteville, Arkansas, USA

✉ — Correspondence possible via [GitHub Issues](#)

## Abstract

---

The novel coronavirus SARS-CoV-2, which emerged in late 2019, has since spread around the world and infected hundreds of millions of people with coronavirus disease 2019 (COVID-19). While this viral species was unknown prior to January 2020, its similarity to other coronaviruses that infect humans has allowed for rapid insight into the mechanisms that it uses to infect human hosts, as well as the ways in which the human immune system can respond. Here, we contextualize SARS-CoV-2 among other coronaviruses and identify what is known and what can be inferred about its behavior once inside a human host. Because the genomic content of coronaviruses, which specifies the virus's structure, is highly conserved, early genomic analysis provided a significant head start in predicting viral pathogenesis and in understanding potential differences among variants. The pathogenesis of the virus offers insights into symptomatology, transmission, and individual susceptibility. Additionally, prior research into interactions between the human immune system and coronaviruses has identified how these viruses can evade the immune system's protective mechanisms. We also explore systems-level research into the regulatory and proteomic effects of SARS-CoV-2 infection and the immune response. Understanding the structure and behavior of the virus serves to contextualize the many facets of the COVID-19 pandemic and can influence efforts to control the virus and treat the disease.

## References

---