

Charles M. Rice, Ph.D.

MAURICE R. AND CORINNE P. GREENBERG PROFESSOR IN VIROLOGY, LABORATORY IN VIROLOGY AND INFECTIOUS DISEASE

Millions of people are infected with hepatitis C and B viruses (HCV, HBV), which cause liver cancer and liver failure. RNA viruses like Zika, yellow fever, dengue, chikungunya, and SARS-CoV-2 also cause significant morbidity and mortality. Rice's lab works to understand virus replication mechanisms and innate immune responses that limit infection. His group is also developing new in vitro culture systems and animal models to facilitate this work.

Many viruses, including HCV, are difficult to culture and require new approaches to study. Rice's group identified HCV sequences required for infectivity, demonstrated that HCV causes hepatitis, and pioneered methods to culture and study the virus. This work was seminal in developing drugs now used to cure HCV, although a vaccine is still needed. The group has established the first immunocompetent mouse model for hepacivirus infection using the Norway rat hepacivirus, which replicates key aspects of human HCV liver disease, including cancer. The lab also uses human liver chimeric mice to study diet and human genetics in fatty liver disease, yellow fever vaccine attenuation, and the genetic causes of rare but serious post-vaccine disease. Another focus is trained immunity, in which exposure to one pathogen confers resistance to an unrelated pathogen.

The lab also studies virus-host interactions that limit or facilitate virus replication, developing high-throughput screens to identify interferon-stimulated genes (ISGs) that restrict or, in some cases, enhance infection by viruses of global health concern, including HCV, HBV, influenza A, dengue, yellow fever, Zika, chikungunya, and coronaviruses. Genome-wide CRISPR knockout screens also reveal genes that influence viral infection. This biology may reveal therapeutic targets and improve prevention and treatment.

Research Associate Professor Margaret R. MacDonald investigates Powassan virus (POWV), a tick-borne flavivirus causing severe encephalitis in the U.S. Collaboratively, she also studies human antibody responses to flaviviruses to develop antibody therapeutics and inform vaccine design, and collaborates to develop nanobodies against POWV and the Lyme disease spirochete for diagnostics or therapeutics. Research Assistant Professor Hans-Heinrich Hoffmann investigates how mosquito-borne and tick-borne viruses infect vertebrate and invertebrate cells. He uses genome-wide CRISPR knockout screens to identify host factors essential for viral infection, then targeted knockdown screens in vector cells to characterize virus-host interactions and identify antiviral targets. He also builds tools to study virus-vector interactions and viral persistence in tick cells. Research Assistant Professor William M. Schneider investigates the molecular mechanisms by which viruses and endogenous genetic elements replicate and interact with host cells, focusing on HBV, a major cause of cirrhosis and liver cancer, and LINE-1 (L1), a mobile element active in the human genome. His team develops novel RNA based experimental systems and uses CRISPR screening and deep mutational scanning to dissect gene expression and genome replication and their consequences for host cells.

Visiting Associate Professor Liang Deng investigates poxvirus immune evasion and develops poxvirus-based cancer immunotherapeutics and vaccines. A dermatologist scientist specializing in melanoma and virus-associated malignancies at Memorial Sloan Kettering Cancer Center, she has advanced a recombinant modified vaccinia virus Ankara (MVA) into a Phase I trial for solid tumors.

Rice is a faculty member in the David Rockefeller Graduate Program, the Tri-Institutional M.D.-Ph.D. Program, the WCM Graduate Program in Physiology, Biophysics and Systems Biology, and the Tri-Institutional Ph.D. Program in Computational Biology & Medicine.

EDUCATION

B.S. in zoology, 1974
University of California, Davis

Ph.D. in biochemistry, 1981
California Institute of Technology

POSTDOC

California Institute of Technology, 1981–1985

POSITIONS

Assistant Professor, 1986–1990
Associate Professor, 1991–1995
Professor, 1995–2000
Washington University School of Medicine

Professor, 2001–
Scientific and Executive Director, Center for the Study of Hepatitis C, 2001–2018
Director, Stavros Niarchos Foundation Institute for Global Infectious Disease Research, 2023–
The Rockefeller University

AWARDS

Pew Biomedical Scholar, 1986

M.W. Beijerinck Virology Prize, 2007

The Rockefeller University Distinguished Teaching Award, 2010

Robert Koch Award, 2015

InBev Baillet Latour Health Prize, 2016

Lasker-DeBakey Clinical Medical Research Award, 2016

C. Chester Stock Award, Memorial Sloan Kettering Cancer Center, 2017

Nobel Prize in Physiology or Medicine, 2020

HONORARY SOCIETIES

National Academy of Sciences

American Academy of Arts and Sciences

Fellow, American Association for the Advancement of Science

SELECTED PUBLICATIONS

Batista, M. et al. An immunocompetent murine model of virus-elicited liver fibrosis and hepatocellular carcinoma. *J. Hepatol.* 84, 1062–1076 (2026).

Lewy, T. et al. Brain endothelial cells orchestrate a neuroprotective antiviral state in the CNS in response to peripheral viral pattern sensing. *Immunity* 59, 1825–1842 (2026).

Lercher, A. et al. Antiviral innate immune memory in alveolar macrophages following SARS-CoV-2 infection ameliorates secondary influenza A virus disease. *Immunity* 57, 2530–2546 (2024).

Yu, Y., Kass, M.A. et al. Deep mutational scanning of hepatitis B virus reveals a mechanism for cis preferential reverse transcription. *Cell* 187, 2735–2745 (2024).

Hoffmann, H.H. and Schneider, W.M. et al. TMEM41B is a pan-flavivirus host factor. *Cell* 184, 133–148 (2021).