Stanford



Karla Kirkegaard

Violetta L. Horton Professor and Professor of Microbiology and Immunology

Genetics

Bio

ACADEMIC APPOINTMENTS

- Professor, Genetics
- Professor, Microbiology and Immunology
- Member, Bio-X

ADMINISTRATIVE APPOINTMENTS

- Chair, Stanford University School of Medicine - Microbiology & Immunology, (2006-2010)

LINKS

- My Lab's Web Site: https://web.stanford.edu/group/kirkegaard

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

For many subcellular viruses and parasites, RNA, not DNA, is the carrier of genetic information. This has several interesting consequences for the genetics and biology of the virus. Poliovirus serves as a model to increase our understanding of positive-strand RNA viruses for which no vaccine is available and which remain a significant health hazard: examples include other picornaviruses, such as rhinoviruses, coxsackieviruses and the deadly enterovirus 71 as well as more distantly related positive-strand RNA viruses such as hepatitis C and Dengue fever.

Questions currently under scrutiny are posed below, and discussed in greater detail in our web site.

1. How does the biochemistry of RNA-dependent RNA polymerases affect the biology of RNA viruses?

2. How are the membranous structures on which viral RNA replication complexes assemble form, and from what intracellular organelles do they derive?

3. Why are the genetic properties of many RNA genomes different from DNA genomes? How does the error-prone nature of RNA-dependent RNA replication and the membrane association of the RNA replication complexes affect these genetic properties?

4. How does the inhibition of the protein secretory apparatus by the 3A and 2B proteins of picornaviruses such as poliovirus affect their pathogenesis? What would happen to the secretion of interferons, and to the presentation of antigens in the context of MHC class I molecules, if the host secretory pathway were not inhibited during infection by polioviruses, rhinoviruses and coxsackieviruses?

Teaching

COURSES

2026-27

- Genetics of Viral Emergence and Emerging Viruses: GENE 242 (Win)

2025-26

- Genetics of Viral Emergence and Emerging Viruses: GENE 242 (Win)

2024-25

- Genetics of Viral Emergence and Emerging Viruses: GENE 242 (Win)

2023-24

- Genetics of Viral Emergence and Emerging Viruses: GENE 242 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Zaria Contejean, Emma Esterman, Jodie Lunger, Micah Olivas

Postdoctoral Faculty Sponsor

Saptarshi Banerjee, Nicole Stark

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biomedical Data Science (PhD Program)
- Genetics (PhD Program)
- Immunology (PhD Program)
- Microbiology and Immunology (PhD Program)

Publications

PUBLICATIONS

- **A Computational Community Blind Challenge on Pan-Coronavirus Drug Discovery Data.** *Journal of chemical information and modeling*
  MacDermott-Opeskin, H., Scheen, J., Wognum, C., Horton, J. T., West, D., Payne, A. M., Castellanos, M. A., Colby, S., Griffen, E., Cousins, D., Stacey, J., Reid, L., Aschenbrenner, et al
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- **Evolution of viral genomes and their clouds of sequence.** *Proceedings of the National Academy of Sciences of the United States of America*
  Kirkegaard, K.
  2025; 122 (52): e2525457122
- **Combined crystallographic fragment screening and deep mutational scanning enable discovery of Zika virus NS2B-NS3 protease inhibitors.** *Nature communications*
  Ni, X., Richardson, R. B., Godoy, A. S., Ferla, M. P., Kikawa, C., Scheen, J., Hannon, W. W., Capkin, E., Lahav, N., Balcomb, B. H., Marples, P. G., Fairhead, M., Wang, et al
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  2025
- **Differential inhibition of intra- and inter-molecular protease cleavages by antiviral compounds.** *Journal of virology*
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- **The Picornaviridae Family: Knowledge Gaps, Animal Models, Countermeasures, and Prototype Pathogens.** *The Journal of infectious diseases*
  Andino, R., Kirkegaard, K., Macadam, A., Racaniello, V. R., Rosenfeld, A. B.
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- **Variant enterovirus A71 found in immune-suppressed patient binds to heparan sulfate and exhibits neurotropism in B-cell-depleted mice.** *Cell reports*
  Weng, K., Tee, H. K., Tseligka, E. D., Cagno, V., Mathez, G., Rosset, S., Nagamine, C. M., Sarnow, P., Kirkegaard, K., Tapparel, C.
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- **Mechanosensitive extrusion of Enterovirus A71-infected cells from colonic organoids.** *Nature microbiology*
  Moshiri, J., Craven, A. R., Mixon, S. B., Amieva, M. R., Kirkegaard, K.
  2023
- **Population-scale tissue transcriptomics maps long non-coding RNAs to complex disease.** *Cell*
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  2021
- **A Targeted Computational Screen of the SWEETLEAD Database Reveals FDA-Approved Compounds with Anti-Dengue Viral Activity.** *mBio*
  Moshiri, J., Constant, D. A., Liu, B., Mateo, R., Kearnes, S., Novick, P., Prasad, R., Nagamine, C., Pande, V., Kirkegaard, K.
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- **Full-length three-dimensional structure of the influenza A virus M1 protein and its organization into a matrix layer.** *PLoS biology*
  Selzer, L. n., Su, Z. n., Pintilie, G. D., Chiu, W. n., Kirkegaard, K. n.
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- **Modified cyclodextrins as broad-spectrum antivirals.** *Science advances*
  Jones, S. T., Cagno, V., Janecek, M., Ortiz, D., Gasilova, N., Piret, J., Gasbarri, M., Constant, D. A., Han, Y., Vukovic, L., Kral, P., Kaiser, L., Huang, et al
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- **An RNA-centric dissection of host complexes controlling flavivirus infection.** *Nature microbiology*
  Ooi, Y. S., Majzoub, K., Flynn, R. A., Mata, M. A., Diep, J., Li, J. K., van Buuren, N., Rumachik, N., Johnson, A. G., Puschnik, A. S., Marceau, C. D., Mlera, L., Grabowski, et al
  2019
- **Differential and convergent utilization of autophagy components by positive-strand RNA viruses.** *PLoS biology*
  Abernathy, E., Mateo, R., Majzoub, K., van Buuren, N., Bird, S. W., Carette, J. E., Kirkegaard, K.
  2019; 17 (1): e2006926
- **Differential and convergent utilization of autophagy components by positive-strand RNA viruses** *PLOS BIOLOGY*
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- **Detection and Differentiation of Multiple Viral RNAs Using Branched DNA FISH Coupled to Confocal Microscopy and Flow Cytometry.** *Bio-protocol*

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  2018; 115 (40): 10136–41

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  Constant, D. A., Mateo, R., Nagamine, C. M., Kirkegaard, K.
  2018

- **Investigating Ph-Induced Changes of the Influenza a Virus Matrix Layer**
  Selzer, L., Moshiri, J., Kirkegaard, K.
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- **The exoribonuclease Xrn1 is a post-transcriptional negative regulator of autophagy** *AUTOPHAGY*
  Delorme-Axford, E., Abernathy, E., Lennemann, N. J., Bernard, A., Ariosa, A., Coyne, C. B., Kirkegaard, K., Klionsky, D. J.
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- **Enteroviruses Future** *ENTEROVIRUSES: OMICS, MOLECULAR BIOLOGY, AND CONTROL*
  Kirkegaard, K.
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  van Buuren, N. n., Tellinghuisen, T. L., Richardson, C. D., Kirkegaard, K. n.
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- **Guidelines for the Use and Interpretation of Assays for Monitoring Autophagy (3rd edition) (vol 12, pg 1, 2015)** *AUTOPHAGY*
  Kliosnky, D., Seiliez, I.
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- **Suppression of Drug Resistance in Dengue Virus.** *mBio*
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- **Escape of non-enveloped virus from intact cells.** *Virology*
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- **Nonlytic spread of naked viruses.** *Autophagy*
  Bird, S. W., Kirkegaard, K.
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- **The ins and outs of viral infection: keystone meeting review.** *Viruses*
  Bird, S. W., Kirkegaard, K., Agbandje-McKenna, M., Freed, E. O.
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  Kirkegaard, K., Jackson, W. T.
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