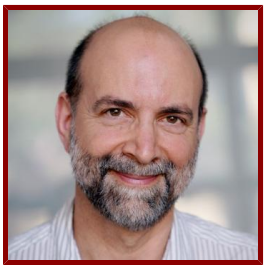
Stanford



Tim Stearns

Frank Lee and Carol Hall Professor, Senior Associate Vice Provost of Research and Professor of Genetics

Biology

CONTACT INFORMATION

- **Alternate Contact**

  Pam Hung - Administrative Assistant

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Bio

BIO

Tim Stearns holds the Frank Lee and Carol Hall Professorship in the Department of Biology at Stanford University and is Senior Associate Vice Provost of Research. He also holds appointments in the Department of Genetics, is a member of the Stanford Cancer Institute, and Bio-X, is a Faculty Fellow in Chem-H, and is an affiliated faculty member of the Center for International Security and Cooperation (CISAC). He is a member of JASON, a national organization that advises the government on matters of science, technology and national security. He has also been an advisor to the National Academies of Science and the President's Council of Advisors on Science and Technology (PCAST). Dr. Stearns received a B.S. from Cornell University, a Ph.D. from MIT, and did his postdoctoral fellowship at the University of California, San Francisco. His research concerns the mechanism and regulation of cell division, the organization of signaling pathways within cells, and cell biology of fungal pathogens. Stearns was named an HHMI Professor in 2002, for his work in science education, and has taught international workshops in South Africa, Chile, Ghana, and Tanzania. He is the chair of the NCSD Study Section at the NIH, and has served on the editorial boards of several journals.

ACADEMIC APPOINTMENTS

- Professor, Biology
- Professor, Genetics
- Member, Bio-X
- Member, Stanford Cancer Institute

ADMINISTRATIVE APPOINTMENTS

- Senior Associate Vice Provost of Research, VPDoR, (2020- present)
- Chair, Dept. of Biology, (2014-2020)

LINKS

- Stearns Lab Home Page: http://stearnslab.stanford.edu
- Stanford Center for Cell Biology: http://cellbiology.stanford.edu

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

The central question behind our work is how the centrosome and primary cilium control cell function and influence development, and how defects in these structures cause a remarkable range of human disease, ranging from cancer, polycystic kidney disease, and obesity, to neurocognitive defects including mental retardation, schizophrenia, and dyslexia.

The centrosome consists of a pair of centrioles and pericentriolar material and organizes the cytoplasmic microtubules of most animal cells. Most importantly, the mother centriole (the older of the two in the pair) nucleates the formation of a primary cilium in most cells in the body. First seen by cell biologists in the 1950's, the primary cilium was ignored for many years until a combination of human and model organism genetics revealed that it is a critical sensory organelle with functions in many important processes. Defects in primary cilium structure and function cause a set of human conditions, called ciliopathies, that share a set of phenotypes that reflect the importance of the cilium in signaling pathways.

There are three main projects in the lab:

1) Ciliary biogenesis and function. In addition to the microtubules making up the interphase array and the mitotic spindle, many animal cells make a specialized microtubule structure, the primary cilium. This is a single, non-motile cilium that is able to act as a transducer of mechanical and chemical signals - sort of a cellular antenna. The microtubules of the ciliary axoneme grow directly from a centriole at their base, this centriole is often called a basal body. Some epithelial cells in the trachea, oviduct and brain produce hundreds of motile cilia on their surface, each with a centriole at their base. We are studying both the primary cilium and multi-ciliated cells for clues into ciliary structure and function, and centriole formation.

2) Cell cycle control of centrosome duplication. We have shown that duplication of the centrosome, the microtubule organizing center of animal cells, is dependent on the cell cycle kinase cdk2, and on cell cycle-specific proteolysis. We are working to determine the molecular mechanisms of centrosome duplication and to understand how centrosome duplication is controlled so that it happens once and only once per cell cycle. Cancer cells often have aberrant centrosome numbers, and we are investigating the relationship between aberrant centrosome number and the genome instability that is common in cancer cells.

3) Microtubule nucleation and organization. Microtubules are polymers of tubulin, which is a heterodimer of alpha-tubulin and beta-tubulin. We have identified a remarkable complex of proteins associated with a third type of tubulin, gamma-tubulin. Gamma-tubulin and its associated proteins are localized to the centrosome and are critical for initiation, or nucleation, of microtubule assembly. The gamma-tubulin complex (gammaTuRC) is a very large, ring-shaped complex and contains at least 6 proteins in addition to gamma-tubulin. We are determining the role of gamma-tubulin and its associated proteins in microtubule nucleation and organization.

Teaching

COURSES

2020-21

- Genetics and Developmental Biology Training Camp: DBIO 200, GENE 200 (Aut)
- Introduction to Laboratory Research in Cell and Molecular Biology: BIO 45 (Aut, Win)

2019-20

- Frontiers in Biology: BIO 301 (Aut, Win)
- Genetics and Developmental Biology Training Camp: DBIO 200, GENE 200 (Aut)
- Introduction to Laboratory Research in Cell and Molecular Biology: BIO 45 (Aut, Win)

2018-19

- Genetics and Developmental Biology Training Camp: DBIO 200, GENE 200 (Aut)
- I, Scientist: Diversity Improves the Scientific Practice: BIO 52, CSRE 52H (Aut)
- Introduction to Laboratory Research in Cell and Molecular Biology: BIO 45 (Aut, Win)
- Science as a Creative Process: APPPHYS 61, BIO 61 (Aut)

2017-18

- Introduction to Laboratory Research in Cell and Molecular Biology: BIO 45 (Aut, Win)
- Science as a Creative Process: APPPHYS 61, BIO 61 (Aut)
- The Cell's Antenna: Cilia in Evolution, Development, and Human Health: BIOS 273 (Sum)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Yan Gong, Albert Hinman, Maia Kinnebrew, Kay Kobak, Katelyn McKown, Ariana Sanchez, Michael Tran, Eirini Tsekitsidou, Shizuka Yamada

Orals Chair

Patricia Nano

Postdoctoral Faculty Sponsor

Alex Long, Ali Salari, Jennifer Wang

Doctoral Dissertation Advisor (AC)

Garrison Buss, Katie Ching, KC Farrell, Emily Ho, Claire Venard

Doctoral Dissertation Reader (NonAC)

David Armenta

Doctoral (Program)

Katie Ching, KC Farrell, Claire Venard

Postdoctoral Research Mentor

Roshali De Silva

GRADUATE AND FELLOWSHIP PROGRAM AFFILIATIONS

- Biology (School of Humanities and Sciences) (Phd Program)
- Cancer Biology (Phd Program)
- Genetics (Phd Program)

Publications

PUBLICATIONS

- **Systematic Discovery of Short Linear Motifs Decodes Calcineurin Phosphatase Signaling.** *Molecular cell*
  Wigington, C. P., Roy, J., Damle, N. P., Yadav, V. K., Blikstad, C., Resch, E., Wong, C. J., Mackay, D. R., Wang, J. T., Krystkowiak, I., Bradburn, D. A., Tsekitsidou, E., Hong, et al
  2020
- **CRISPR/Cas9 treatment causes extended TP53-dependent cell cycle arrest in human cells.** *Nucleic acids research*
  Geisinger, J. M., Stearns, T.
  2020

- **Centrioles are amplified in cycling progenitors of olfactory sensory neurons.** *PLoS biology*
  Ching, K., Stearns, T.
  2020; 18 (9): e3000852
- **Transient Primary Cilia Mediate Robust Hedgehog Pathway-Dependent Cell Cycle Control.** *Current biology : CB*
  Ho, E. K., Tsai, A. E., Stearns, T.
  2020
- **Primary cilium loss in mammalian cells occurs predominantly by whole-cilium shedding.** *PLoS biology*
  Mirvis, M., Siemers, K. A., Nelson, W. J., Stearns, T. P.
  2019; 17 (7): e3000381
- **Regulation of cilia abundance in multiciliated cells** *ELIFE*
  Nanjundappa, R., Kong, D., Shim, K., Stearns, T., Brody, S. L., Loncarek, J., Mahjoub, M. R.
  2019; 8
- **Motional dynamics of single Patched1 molecules in cilia are controlled by Hedgehog and cholesterol.** *Proceedings of the National Academy of Sciences of the United States of America*
  Weiss, L. E., Milenkovic, L., Yoon, J., Stearns, T., Moerner, W. E.
  2019
- **Regulation of cilia abundance in multiciliated cells.** *eLife*
  Nanjundappa, R., Kong, D., Shim, K., Stearns, T., Brody, S. L., Loncarek, J., Mahjoub, M. R.
  2019; 8
- **Pocket similarity identifies selective estrogen receptor modulators as microtubule modulators at the taxane site.** *Nature communications*
  Lo, Y. C., Cormier, O., Liu, T., Nettles, K. W., Katzenellenbogen, J. A., Stearns, T., Altman, R. B.
  2019; 10 (1): 1033
- **Revealing Nanoscale Morphology of the Primary Cilium Using Super-Resolution Fluorescence Microscopy.** *Biophysical journal*
  Yoon, J., Comerci, C. J., Weiss, L. E., Milenkovic, L., Stearns, T., Moerner, W. E.
  2018
- **Cyclin-dependent kinase control of motile ciliogenesis** *ELIFE*
  Vladar, E. K., Stratton, M. B., Saal, M. L., Salazar-De Simone, G., Wang, X., Wolgemuth, D., Stearns, T., Axelrod, J. D.
  2018; 7
- **Cilium structure, assembly, and disassembly regulated by the cytoskeleton.** *The Biochemical journal*
  Mirvis, M., Stearns, T., James Nelson, W.
  2018; 475 (14): 2329–53
- **Quantifying Nanoscale Morphological Features of the Primary Cilium Membrane using Super-Resolution Fluorescence Microscopy**
  Yoon, J., Weiss, L., Milenkovic, L., Stearns, T., Moerner, W. E.
  CELL PRESS.2018: 268A
- **The ABCs of Centriole Architecture: The Form and Function of Triplet Microtubules.** *Cold Spring Harbor symposia on quantitative biology*
  Wang, J. T., Stearns, T.
  2018
- **Mitosis sans Mitosis: The Mitotic Oscillator in Differentiation** *DEVELOPMENTAL CELL*
  Stratton, M., Stearns, T.
  2017; 43 (4): 385–86
- **Using Yeast to Determine the Functional Consequences of Mutations in the Human p53 Tumor Suppressor Gene: An Introductory Course-Based Undergraduate Research Experience in Molecular and Cell Biology** *BIOCHEMISTRY AND MOLECULAR BIOLOGY EDUCATION*
  Hekmat-Scafe, D. S., Brownell, S. E., Seawell, P. C., Malladi, S., Imam, J. F., Singla, V., Bradon, N., Cyert, M. S., Stearns, T.
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- **Centriole triplet microtubules are required for stable centriole formation and inheritance in human cells.** *eLife*
  Wang, J. T., Kong, D., Hoerner, C. R., Loncarek, J., Stearns, T.

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- **Sperm Centrosomes: Kiss Your Asterless Goodbye, for Fertility's Sake.** *Current biology*
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- **Zeta-Tubulin Is a Member of a Conserved Tubulin Module and Is a Component of the Centriolar Basal Foot in Multiciliated Cells** *CURRENT BIOLOGY*
  Turk, E., Wills, A. A., Kwon, T., Sedzinski, J., Wallingford, J. B., Stearns, T.
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- **A High-Enrollment Course-Based Undergraduate Research Experience Improves Student Conceptions of Scientific Thinking and Ability to Interpret Data** *CBE-LIFE SCIENCES EDUCATION*
  Brownell, S. E., Hekmat-Scafe, D. S., Singla, V., Seawell, P. C., Imam, J. F., Eddy, S. L., Stearns, T., Cyert, M. S.
  2015; 14 (2)
- **Cell biology. Centrioles, in absentia.** *Science (New York, N.Y.)*
  Stearns, T.
  2015; 348 (6239): 1091–92
- **Probing mammalian centrosome structure using BioID proximity-dependent biotinylation** *CENTROSOME & CENTRIOLE*
  Firat-Karalar, E. N., Stearns, T.
  2015; 129: 153-170
- **Observing planar cell polarity in multiciliated mouse airway epithelial cells.** *Methods in cell biology*
  Vladar, E. K., Lee, Y. L., Stearns, T., Axelrod, J. D.
  2015; 127: 37-54
- **Cby1 promotes Ahi1 recruitment to a ring-shaped domain at the centriole-cilium interface and facilitates proper cilium formation and function** *MOLECULAR BIOLOGY OF THE CELL*
  Lee, Y. L., Sante, J., Comerci, C. J., Cyge, B., Menezes, L. F., Li, F., Germino, G. G., Moerner, W. E., Takemaru, K., Stearns, T.
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- **Cby1 promotes Ahi1 recruitment to a ring-shaped domain at the centriole-cilium interface and facilitates proper cilium formation and function.** *Molecular biology of the cell*
  Lee, Y. L., Santé, J., Comerci, C. J., Cyge, B., Menezes, L. F., Li, F., Germino, G. G., Moerner, W. E., Takemaru, K., Stearns, T.
  2014; 25 (19): 2919-2933
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  Firat-Karalar, E. N., Sante, J., Elliott, S., Stearns, T.
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  Firat-Karalar, E. N., Rauniyar, N., Yates, J. R., Stearns, T.
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- **Centrosome-kinase fusions promote oncogenic signaling and disrupt centrosome function in myeloproliferative neoplasms.** *PloS one*
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  Minear, S., O'Donnell, A. F., Ballew, A., Giaever, G., Nislow, C., Stearns, T., Cyert, M. S.
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2011; 13 (10): 1154-1160

- **STED Super-resolution Microscopy in Drosophila Tissue and in Mammalian Cells.** *Proceedings of SPIE--the International Society for Optical Engineering*
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  Lau, L., Lee, Y. L., Matis, M., Axelrod, J., Stearns, T., Moerner, W. E.
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  Hatch, E., Stearns, T.
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- **Primary cilia: Cellular sensors for the skeleton** *37th International Sun Valley Workshop on Skeletal Tissue Biology*
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