Stanford



Florentine Rutaganira

Assistant Professor of Biochemistry and of Developmental Biology

Bio

BIO

Dr. Rutaganira uses choanoflagellates—the closest living single-celled relatives to animals—to study the origin of animal cell communication. Dr. Rutaganira applies chemical, genetic, and cell biological tools to probe choanoflagellate cell-cell communication, with implications for understanding not only animal cell signaling, but also the origin of multicellularity in animals.

ACADEMIC APPOINTMENTS

- Assistant Professor, Biochemistry
- Assistant Professor, Developmental Biology
- Member, Bio-X
- Faculty Fellow, Sarafan ChEM-H

HONORS AND AWARDS

- Hanna Gray Faculty Fellow, Howard Hughes Medical Institute
- Investigator, Biohub, San Francisco
- Awardee, Hypothesis Fund

LINKS

- Lab Website: https://www.funrscience.com

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Although all organisms respond to external stimuli, the origins of multicellularity necessitated the evolution of specialized mechanisms to coordinate the actions of individual cells into a singular response. Cell-cell signaling is critical for the biology of animals and other multicellular organisms but key steps in the evolution of signaling are not understood.

Our research aims to address the origin and core mechanisms of animal cell signaling during the transition to multicellularity. In multicellular organisms, receptors facilitate intercellular communication and adaptor molecules link cell surface signaling with central regulators of intracellular growth and survival. Although animal, plant and fungi evolved through separate and independent transitions to multicellularity cell surface receptor genes expanded and diversified in each of these lineages, suggesting that the expansion and specialization of receptor-mediated signaling enabled complex multicellularity. Nonetheless, few studies have assessed the functional relevance of signaling receptors in evolutionarily-relevant model organisms.

To reconstruct how molecule sensing was integrated with core signaling pathways during the evolution of animals, and uncover core principles of animal cell signaling, we investigate how unicellular relatives of animals use cell surface receptors to detect extracellular signals. We use chemical genetic approaches by leveraging available genomics resources combined with targeted pharmacology, transgene expression, and genome editing. We use choanoflagellates, a phylogenetically-relevant and experimentally-tractable model system to study the evolution of receptor signaling in animals. Our goal is to uncover the ancestral functions of receptor signaling in animals and develop a framework to identify general principles of receptor signaling relevant to other multicellular organisms (e.g. plants, fungi).

Teaching

COURSES

2025-26

- Building Connections, Defining the Future of Biosciences: BIOS 420 (Aut)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Sofia Luengo-Woods, Cindy Sandoval Espinoza, Riley Togashi

Postdoctoral Faculty Sponsor

Julio Fierro Morales

Doctoral Dissertation Advisor (AC)

Mariann Guzman-Espinoza, Brianna Johnson, Maria Nguyen, Hannah Reeves, Jia Zheng Woo

Publications

PUBLICATIONS

- **Looks can be deceiving: discordances in phylogeny and morphology within loricate choanoflagellates.** *Open biology*
  Gàlvez-Morante, A., Rutaganira, F. U., Palenik, B., Richter, D. J.
  2026; 16 (2)
- **A stress-responsive p38 signaling axis in choanoflagellates.** *RSC chemical biology*
  Rutaganira, F. U., Coyle, M. C., Nguyen, M. H., Hernandez, I., Scopton, A. P., Dar, A. C., King, N.
  2025
- **Glycerol improves the viability of a cryopreserved choanoflagellate.** *Cryobiology*
  Chandra, S., Rutaganira, F. U.
  2024: 105183
- **Juneteenth in STEMM and the barriers to equitable science.** *Cell*
  Mays, A., Byars-Winston, A., Hinton, A., Marshall, A. G., Kirabo, A., August, A., Marlin, B. J., Riggs, B., Tolbert, B., Wanjalla, C., Womack, C., Evans, C. S., Barnes, et al
  2023; 186 (12): 2510-2517
- **Total Synthesis and Functional Evaluation of IORs, Sulfonolipid-based Inhibitors of Cell Differentiation in Salpingoeca rosetta.** *Angewandte Chemie (International ed. in English)*
  Raguž, L., Peng, C. C., Rutaganira, F. U., Krüger, T., Stanišić, A., Jautzus, T., Kries, H., Kniemeyer, O., Brakhage, A. A., King, N., Beemelmanns, C.
  2022; 61 (41): e202209105
- **Identification and structure of an extracellular contractile injection system from the marine bacterium Algoriphagus machipongonensis (vol 7, pg 397, 2022)** *NATURE MICROBIOLOGY*
  Xu, J., Ericson, C. F., Lien, Y., Rutaganira, F. U. N., Eisenstein, F., Feldmuller, M., King, N., Pilhofer, M.

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- **Identification and structure of an extracellular contractile injection system from the marine bacterium Algoriphagus machipongonensis.** *Nature microbiology*
  Xu, J., Ericson, C. F., Lien, Y. W., Rutaganira, F. U., Eisenstein, F., Feldmüller, M., King, N., Pilhofer, M.
  2022; 7 (3): 397-410
- **Structural and Functional Analysis of Bacterial Sulfonosphingolipids and Rosette-Inducing Factor 2 (RIF-2) by Mass Spectrometry-Guided Isolation and Total Synthesis.** *Chemistry (Weinheim an der Bergstrasse, Germany)*
  Leichnitz, D., Peng, C. C., Raguž, L., Rutaganira, F. U., Jautzus, T., Regestein, L., King, N., Beemelmanns, C.
  2022; 28 (8): e202103883
- **Using virtual interviewing to create a more accessible hybrid academic job market.** *Cell*
  Termini, C. M., Rutaganira, F. U., Palavicino-Maggio, C. B., Spriggs, C. C., Evans, C. S., McReynolds, M. R.
  2021; 184 (26): 6217-6221
- **Mentoring during Uncertain Times.** *Trends in biochemical sciences*
  Termini, C. M., McReynolds, M. R., Rutaganira, F. U., Roby, R. S., Hinton, A. O., Carter, C. S., Huang, S. C., Vue, Z., Martinez, D., Shuler, H. D., Taylor, B. L.
  2021; 46 (5): 345-348
- **Patching the Leaks: Revitalizing and Reimagining the STEM Pipeline.** *Cell*
  Hinton, A. O., Termini, C. M., Spencer, E. C., Rutaganira, F. U., Chery, D., Roby, R., Vue, Z., Pack, A. D., Brady, L. J., Garza-Lopez, E., Marshall, A. G., Lewis, S. C., Shuler, et al
  2020; 183 (3): 568-575
- **PI4KIIIβ is a therapeutic target in chromosome 1q-amplified lung adenocarcinoma.** *Science translational medicine*
  Tan, X. n., Banerjee, P. n., Pham, E. A., Rutaganira, F. U., Basu, K. n., Bota-Rabassedas, N. n., Guo, H. F., Grzeskowiak, C. L., Liu, X. n., Yu, J. n., Shi, L. n., Peng, D. H., Rodriguez, et al
  2020; 12 (527)
- **Phosphoregulation of the oncogenic protein regulator of cytokinesis 1 (PRC1) by the atypical CDK16/CCNY complex.** *Experimental & molecular medicine*
  Hernández-Ortega, S., Sánchez-Botet, A., Quandt, E., Masip, N., Gasa, L., Verde, G., Jiménez, J., Levin, R. S., Rutaganira, F. U., Burlingame, A. L., Wolfgeher, D., Ribeiro, M. P., Kron, et al
  2019; 51 (4): 1-17
- **Inhibition of Calcium Dependent Protein Kinase 1 (CDPK1) by Pyrazolopyrimidine Analogs Decreases Establishment and Reoccurrence of Central Nervous System Disease by Toxoplasma gondii.** *Journal of medicinal chemistry*
  Rutaganira, F. U., Barks, J., Dhason, M. S., Wang, Q., Lopez, M. S., Long, S., Radke, J. B., Jones, N. G., Maddirala, A. R., Janetka, J. W., El Bakkouri, M., Hui, R., Shokat, et al
  2017; 60 (24): 9976-9989
- **Long-term oral kinetin does not protect against α-synuclein-induced neurodegeneration in rodent models of Parkinson's disease.** *Neurochemistry international*
  Orr, A. L., Rutaganira, F. U., de Roulet, D., Huang, E. J., Hertz, N. T., Shokat, K. M., Nakamura, K.
  2017; 109: 106-116
- **Endosomal Phosphatidylinositol 3-Kinase Is Essential for Canonical GPCR Signaling.** *Molecular pharmacology*
  Uchida, Y., Rutaganira, F. U., Jullié, D., Shokat, K. M., von Zastrow, M.
  2017; 91 (1): 65-73
- **Multistep Compositional Remodeling of Supported Lipid Membranes by Interfacially Active Phosphatidylinositol Kinases** *ANALYTICAL CHEMISTRY*
  Tabaei, S. R., Guo, F., Rutaganira, F. U., Vafaei, S., Choong, I., Shokat, K. M., Glenn, J. S., Cho, N.
  2016; 88 (10): 5042-5045
- **Design and Structural Characterization of Potent and Selective Inhibitors of Phosphatidylinositol 4 Kinase III beta** *JOURNAL OF MEDICINAL CHEMISTRY*
  Rutaganira, F. U., Fowler, M. L., McPhail, J. A., Gelman, M. A., Nguyen, K., Xiong, A., Doman, G. L., Tayshanjian, B., Glenn, J. S., Shokat, K. M., Burke, J. E.
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- **Inhibition of Calcium-Dependent Protein Kinase 1 (CDPK1) In Vitro by Pyrazolopyrimidine Derivatives Does Not Correlate with Sensitivity of Cryptosporidium parvum Growth in Cell Culture.** *Antimicrobial agents and chemotherapy*
  Kuhlenschmidt, T. B., Rutaganira, F. U., Long, S., Tang, K., Shokat, K. M., Kuhlenschmidt, M. S., Sibley, L. D.
  2016; 60 (1): 570-9
- **Small molecule inhibition of Csk alters affinity recognition by T cells.** *eLife*
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- **Substrate recognition by the multifunctional cytochrome P450 MycG in mycinamicin hydroxylation and epoxidation reactions.** *The Journal of biological chemistry*
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- **Integrin α9β1 in airway smooth muscle suppresses exaggerated airway narrowing.** *The Journal of clinical investigation*
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- **Constraints on the use of lifespan-shortening Wolbachia to control dengue fever.** *Journal of theoretical biology*
  Schraiber, J. G., Kaczmarczyk, A. N., Kwok, R., Park, M., Silverstein, R., Rutaganira, F. U., Aggarwal, T., Schwemmer, M. A., Hom, C. L., Grosberg, R. K., Schreiber, S. J.
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