Stanford

Jonas Cremer

Assistant Professor of Biology

Bio

BIO

Jonas Cremer is an Assistant Professor in Biology. He is interested in the physiology and growth of prokaryotes. Jonas studied physics and biophysics in Munich. He was a postdoctoral research at the University of California, San Diego. Before joining Stanford, he was an Assistant Professor at the University of Groningen. His current research considers various scales of prokaryotic life (from the coordination of fundamental processes within cells to the collective behavior of cells in specific ecological settings), with a focus on gut bacteria and the model organism Escherichia coli.

ACADEMIC APPOINTMENTS

- Assistant Professor, Biology
- Member, Bio-X

HONORS AND AWARDS

- Research Fellowship, German National Academy of Sciences Leopoldina (2011)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Member, German Physical Society (2009 - present)
- Member, American Physical Society (2012 - present)
- Member, American Society for Microbiology (2016 - present)

PROFESSIONAL EDUCATION

- Master, Ludwig-Maximilians University , Physics and biophysics (2007)
- PhD, Ludwig-Maximilians University , Physics (2011)

LINKS

- Lab Website: https://cremerlab.github.io

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

We are a highly interdisciplinary research team, joined in our desire to better understand microbial life. To elucidate how bacterial cells accumulate biomass and grow, we work with the model organism Escherichia coli. Our approaches tightly combine quantitative experimentation with mathematical modeling to consider the coordination of major physiological processes across scales; from metabolism and protein synthesis, via cell-size control, to

swimming. We further focus on gut bacteria and their interactions with the human host. Our analyses include considerations of intestinal physiology and diet patterns on the host side, as well as metabolism, growth-physiology, and ecology on the bacterial side.

Teaching

COURSES

2025-26

- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)
- Quantitative Approaches in Modern Biology: BIO 165, BIO 265 (Win)

2024-25

- Advanced Seminar in Microbial Biology: BIO 346, CSB 346, GENE 346 (Aut, Spr)
- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)
- Quantitative Approaches in Modern Biology: BIO 165, BIO 265 (Win)

2023-24

- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)
- Quantitative Approaches in Modern Biology: BIO 165, BIO 265 (Win)

2022-23

- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)
- Quantitative Cell Biology - from Molecules to Evolution: BIO 165, BIO 265 (Win)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Eli Costa, Brianna Johnson, Riley Juenemann, Kelli Ann Lynch, Rachel Porter, Gowri Yathishchandran Subedar, Jiawei Sun, Mica Yang

Postdoctoral Faculty Sponsor

Theo Gervais, Franziska Mueller

Doctoral Dissertation Advisor (AC)

Jenna Ahn, Mathis Leblanc, Shaili Mathur

Publications

PUBLICATIONS

- **Abundance-weighted pathway mapping demonstrates family-level structure of butyrate and propionate production across the human gut microbiome.** *ISME communications*
  Christensen, R., Wang, Y. H., Arnoldini, M., Cremer, J.
  2026; 6 (1): ycag075
- **Maintenance of cytoplasmic and membrane densities shapes cellular geometry in Escherichia coli.** *Nature communications*
  Chure, G., de Silva, R. T., Sharma, R., Lanz, M. C., Cremer, J.
  2025
- **Community coalescence reveals strong selection and coexistence within species in complex microbial communities.** *bioRxiv : the preprint server for biology*
  Walton, S. J., Xu, Q., Sharma, R., Gellert, H. R., Yeh, C. F., Cremer, J., Xue, K. S., Petrov, D. A., Good, B. H.
  2025
- **Quantifying the varying harvest of fermentation products from the human gut microbiota.** *Cell*

Arnoldini, M., Sharma, R., Moresi, C., Chure, G., Chabbey, J., Slack, E., Cremer, J.
2025

- **Diurnal Variations in Digestion and Flow Drive Microbial Dynamics in the Gut** *PRX Life*
  Salari, A., Cremer, J.
  2025; 3

- **hplc-py: A Python Utility For Rapid Quantification of Complex Chemical Chromatograms** *Journal of Open Source Software*
  Chure, G., Cremer, J.
  2024

- **Conditionally unutilized proteins and their profound effects on growth and adaptation across microbial species.** *Current opinion in microbiology*
  Balakrishnan, R., Cremer, J.
  2023; 75: 102366

- **An optimal regulation of fluxes dictates microbial growth in and out of steady-state.** *eLife*
  Chure, G., Cremer, J.
  2023; 12

- **Changing Flows Balance Nutrient Absorption and Bacterial Growth along the Gut.** *Physical review letters*
  Codutti, A., Cremer, J., Alim, K.
  2022; 129 (13): 138101

- **Coordination of gene expression with cell size enables Escherichia coli to efficiently maintain motility across conditions.** *Proceedings of the National Academy of Sciences of the United States of America*
  Honda, T., Cremer, J., Mancini, L., Zhang, Z., Pilizota, T., Hwa, T.
  2022; 119 (37): e2110342119

- **Suboptimal resource allocation in changing environments constrains response and growth in bacteria.** *Molecular systems biology*
  Balakrishnan, R., de Silva, R. T., Hwa, T., Cremer, J.
  1800; 17 (12): e10597

- **A traveling-wave solution for bacterial chemotaxis with growth.** *Proceedings of the National Academy of Sciences of the United States of America*
  Narla, A. V., Cremer, J., Hwa, T.
  2021; 118 (48)

- **Chemotaxis as a navigation strategy to boost range expansion** *NATURE*
  Cremer, J., Honda, T., Tang, Y., Wong-Ng, J., Vergassola, M., Hwa, T.
  2019; 575 (7784): 658-+

- **An evolutionarily stable strategy to colonize spatially extended habitats** *NATURE*
  Liu, W., Cremer, J., Li, D., Hwa, T., Liu, C.
  2019; 575 (7784): 664-+

- **Cooperation in Microbial Populations: Theory and Experimental Model Systems** *JOURNAL OF MOLECULAR BIOLOGY*
  Cremer, J., Melbinger, A., Wienand, K., Henriquez, T., Jung, H., Frey, E.
  2019; 431 (23): 4599–4644

- **Spatiotemporal establishment of dense bacterial colonies growing on hard agar** *ELIFE*
  Warren, M. R., Sun, H., Yan, Y., Cremer, J., Li, B., Hwa, T.
  2019; 8

- **Bacterial growth, flow, and mixing shape human gut microbiota density and composition** *GUT MICROBES*
  Arnoldini, M., Cremer, J., Hwa, T.
  2018; 9 (6): 559–66

- **Effect of water flow and chemical environment on microbiota growth and composition in the human colon** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Cremer, J., Arnoldini, M., Hwa, T.

2017; 114 (25): 6438–43

- **Effect of flow and peristaltic mixing on bacterial growth in a gut-like channel** *PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA*
  Cremer, J., Segota, I., Yang, C., Arnoldini, M., Sauls, J. T., Zhang, Z., Gutierrez, E., Groisman, A., Hwa, T.
  2016; 113 (41): 11414–19
- **The emergence of cooperation from a single mutant during microbial life cycles** *JOURNAL OF THE ROYAL SOCIETY INTERFACE*
  Melbinger, A., Cremer, J., Frey, E.
  2015; 12 (108): 20150171
- **Mobility, fitness collection, and the breakdown of cooperation** *PHYSICAL REVIEW E*
  Gelimson, A., Cremer, J., Frey, E.
  2013; 87 (4): 042711
- **Growth dynamics and the evolution of cooperation in microbial populations** *SCIENTIFIC REPORTS*
  Cremer, J., Melbinger, A., Frey, E.
  2012; 2: 281
- **Evolutionary and population dynamics: A coupled approach** *PHYSICAL REVIEW E*
  Cremer, J., Melbinger, A., Frey, E.
  2011; 84 (5): 051921
- **Evolutionary Game Theory in Growing Populations** *PHYSICAL REVIEW LETTERS*
  Melbinger, A., Cremer, J., Frey, E.
  2010; 105 (17): 178101
- **Entropy Production of Cyclic Population Dynamics** *PHYSICAL REVIEW LETTERS*
  Andrae, B., Cremer, J., Reichenbach, T., Frey, E.
  2010; 104 (21): 218102
- **The edge of neutral evolution in social dilemmas** *NEW JOURNAL OF PHYSICS*
  Cremer, J., Reichenbach, T., Frey, E.
  2009; 11
- **Anomalous finite-size effects in the Battle of the Sexes** *EUROPEAN PHYSICAL JOURNAL B*
  Cremer, J., Reichenbach, T., Frey, E.
  2008; 63 (3): 373–80