Stanford



Naima G. Sharaf

Assistant Professor of Biology and, by courtesy, of Structural Biology

Bio

BIO

Dr. Naima Gabriela Sharaf earned her bachelor's degree in chemistry from the University of North Carolina at Chapel Hill. She completed her Ph.D. in Dr. Angela Gronenborn's laboratory at the University of Pittsburgh, where she used fluorine NMR to investigate inhibitor induced conformational changes in HIV-1 reverse transcriptase. She then completed her postdoctoral training in Dr. Doug Rees' laboratory at Caltech, where she combined x-ray crystallography, cryoEM, and biochemistry to elucidate the structure and function of the Neisseria meningitides LipoMetQ-LipoMetNI ABC transporter. This work catalyzed her interest in using bacterial lipoproteins as components of biomaterials.

Her laboratory pursues two complementary research areas. First, her laboratory investigates the molecular mechanisms by which bacterial lipoproteins mediate nutrient biosynthesis and transport in Borrelia burgdorferi, the causative agent of Lyme disease. Second, the laboratory develops novel ways to use bacterial lipoproteins as components of biomaterials. These efforts include the LipoCatch and LipoLoad platforms, which enable the modular attachment of proteins and the encapsulation of molecular cargo, respectively, with potential applications in targeted drug delivery and vaccine development.

Keywords: Biochemistry, bioengineering, biophysics, biotechnology, drug discovery, microbiology, protein engineering, structural biology, x-ray crystallography, cryoEM, nanoparticles

ACADEMIC APPOINTMENTS

- Assistant Professor, Biology
- Assistant Professor (By courtesy), Structural Biology
- Member, Bio-X
- Member, Cardiovascular Institute
- Faculty Fellow, Sarafan ChEM-H

LINKS

- My Lab website: http://www.sharaflab.com

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

Bacterial lipoproteins are characterized by a covalently attached lipid moiety that anchors the protein to cellular membranes. In bacteria, these lipoproteins play key roles in bacterial physiology, including signaling, nutrient acquisition, and host-pathogen interactions. Our lab is divided into two research areas related to lipoproteins:

Area 1: To characterize the structure and function of bacterial lipoproteins in the bacterium Borrelia burgdorferi, the causative agent of Lyme disease.

Area 2: To develop and characterize lipoprotein-based nanoparticles, materials, and therapeutics.

Keywords: Biochemistry, bioengineering, biophysics, biotechnology, drug discovery, microbiology, protein engineering, structural biology, x-ray crystallography, cryoEM, nanoparticles

Teaching

COURSES

2026-27

- Biology PhD Lab Rotation: BIO 299 (Aut, Win, Spr)
- How Bacteria Hunt for Food: BIO 17N (Spr)
- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)

2025-26

- How Bacteria Hunt for Food: BIO 17N (Spr)
- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)

2024-25

- Frontiers in Biology: BIO 301 (Aut)
- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)

2023-24

- Frontiers in Biology: BIO 301 (Aut, Win)
- Integrative and Experimental Microbiology: BIO 120, BIO 220 (Spr)

STANFORD ADVISEES

Doctoral Dissertation Reader (AC)

Hisham Alsohybe, Nana Akua Duah, Cesar Mena, Meghan Nolan, Jacob Summers, Chuofan Yu

Postdoctoral Faculty Sponsor

Qianqiao Liu, Claire Stewart

Doctoral Dissertation Advisor (AC)

Victor Nuñez, Francesca Starvaggi, Seiji Yokota

Publications

PUBLICATIONS

- **LipoLoad:RB: a nanocarrier comprising bacterial lipoprotein LipoMetQ and Rose Bengal.** *Scientific reports*
  Liu, Q., Arslanian, M. A., Treviño, M. A., Quispe Calla, N. E., Starvaggi, F., Sharaf, N. G.
  2026

- **Development and characterization of LipoCatch: a bacterial lipoprotein-based biomaterial that self-assembles into nanostructures.** *Nanoscale advances*
  Starvaggi, F. A., Stewart, C. J., Arslanian, M. A., Treviño, M. A., Weston, S. A., Sharaf, N. G.
  2026

- **Structural basis for selective thymidine binding by the Borrelia burgdorferi substrate-binding protein BmpA.** *The Journal of biological chemistry*
  Liu, Q., Nun Ez, V. A., Fernandez, D., Stewart, C. J., Sharaf, N. G.
  2026: 113206

- **Crystal structure and ligand-binding specificity of the Borrelia burgdorferi proteins BmpA and BmpB**
  Sharaf, N., Liu, Q., Fernandez, D.
  ELSEVIER.2025

- **Expression, Purification, and Characterization of Escherichia Coli Diacylated Lipoprotein Ycjn**
  Sharaf, N., Trevino, M. A., Amankwah, K., Fernandez, D., Weston, S., Stewart, C. J., Gallardo, J. M.
  WILEY.2024: 118-119

- **Expression, purification, and characterization of diacylated Lipo-YcjN from Escherichia coli.** *The Journal of biological chemistry*
  Trevino, M. A., Amankwah, K. A., Fernandez, D., Weston, S. A., Stewart, C. J., Gallardo, J. M., Shahgholi, M., Sharaf, N. G.
  2024: 107853

- **Characterization of the ABC methionine transporter from Neisseria meningitidis reveals that lipidated MetQ is required for interaction** *ELIFE*
  Sharaf, N. G., Shahgholi, M., Kim, E., Lai, J. Y., VanderVelde, D. G., Lee, A. T., Rees, D. C.
  2021; 10

- **SARS-CoV-2 neutralizing antibody structures inform therapeutic strategies.** *Nature*
  Barnes, C. O., Jette, C. A., Abernathy, M. E., Dam, K. A., Esswein, S. R., Gristick, H. B., Malyutin, A. G., Sharaf, N. G., Huey-Tubman, K. E., Lee, Y. E., Robbiani, D. F., Nussenzweig, M. C., West, et al
  2020; 588 (7839): 682-687

- **Structures of Human Antibodies Bound to SARS-CoV-2 Spike Reveal Common Epitopes and Recurrent Features of Antibodies.** *Cell*
  Barnes, C. O., West, A. P., Huey-Tubman, K. E., Hoffmann, M. A., Sharaf, N. G., Hoffman, P. R., Koranda, N., Gristick, H. B., Gaebler, C., Muecksch, F., Lorenzi, J. C., Finkin, S., Hägglöf, et al
  2020; 182 (4): 828-842.e16

- **NMR structure of the HIV-1 reverse transcriptase thumb subdomain** *JOURNAL OF BIOMOLECULAR NMR*
  Sharaf, N. G., Brereton, A. E., Byeon, I. L., Karplus, P., Gronenborn, A. M.
  2016; 66 (4): 273-280