




Annika Mari Kristin Enejder

Physical Science Research Scientist

T. H. Geballe Laboratory for Advanced Materials

 NIH Biosketch available Online

 Curriculum Vitae available Online

Bio

ACADEMIC APPOINTMENTS

- Physical Science Research Scientist, T. H. Geballe Laboratory for Advanced Materials

HONORS AND AWARDS

- "Women in Optics" - One of 15 leading female principal investigators in Optics worldwide, The International Society for Optics and Photonics - SPIE (2011)
- "Promising young scientists" at the Nobel festivities, Science school for young scientists/Nobel committee (December 1988)

BOARDS, ADVISORY COMMITTEES, PROFESSIONAL ORGANIZATIONS

- Chair, Applications of CARS microscopy, Photonics West, SPIE (2011 - 2014)
- Program Committee member, Photonic Applications in Biology and Medicine, The Conference on Lasers and Electro-Optics, CLEO (2015 - 2016)
- Chair/Coordinator, Innovative Training Network in Nonlinear Microscopy, The European Research Council (2013 - 2017)
- Chair, The European network for CARS microscopy "microCARS" (2006 - 2011)
- Member of the Review Board, Applied Physics, The Swedish Research Council (2004 - 2006)

PROFESSIONAL EDUCATION

- PhD, Lund University , Physics (1997)
- M.Sc., Lund University , Engineering Physics (1992)

Research & Scholarship

CURRENT RESEARCH AND SCHOLARLY INTERESTS

"A picture is worth a thousand words"; The mission of my research is to contribute with a visual understanding for how macromolecules assemble and form functional structures in living cells/organoids/tissues and innovative biomaterials by probing inherent molecular/electronic vibrations using nonlinear laser excitation in a microscope: Coherent Anti-Stokes Raman Scattering (CARS), Stimulated Raman Scattering (SRS), Second/Third Harmonic Generation (SHG/THG), and multiphoton fluorescence emission. With these emerging microscopy techniques, no artificial labelling or sample preparation are needed, hence, macromolecular assemblies and kinetics can be visualized under natural conditions and amounts can be given in quantitative numbers at sub-micron resolution and for extended periods of time at sub-second resolution.

Beside technical development and investigations of new approaches of nonlinear microscopy, my research interest is to use them to explore disease- and age-related changes in the extracellular environment and the cellular lipid metabolism, e.g. in different cancers, liver diseases and in the aging brain. In collaboration with experts on the different topics, I investigate cells grown in 3D tissue-mimicking matrices, living organoids, and tissues donated from

patients. Based on the mechanisms observed, we test new drugs, normalizing the extracellular environment and cell metabolism. By monitoring specific vibrations of the drug molecules, their distributions and cell responses can be investigated at cellular level versus time.

Publications

PUBLICATIONS

- **Polarized Distribution of Lipid Droplets with Long Acyl Chains and Unsaturation are Hallmarks of Human Intestinal Enteroid Differentiation.** *Analytical chemistry*
Johansson, P. K., Liu, Y., Klett, K. C., Heilshorn, S. C., Enejder, A.
2025
- **Reinforcement of Fibrillar Collagen Hydrogels with Bioorthogonal Covalent Crosslinks.** *Biomacromolecules*
Brunel, L. G., Long, C. M., Christakopoulos, F., Cai, B., de Paiva Narciso, N., Johansson, P. K., Singhal, D., Baugh, N. J., Zhang, D., Enejder, A., Myung, D., Heilshorn, S. C.
2025
- **Engineered Hydrogels for Organoid Models of Human Nonalcoholic Fatty Liver Disease.** *Advanced science (Weinheim, Baden-Wuerttemberg, Germany)*
Liu, Y., Gilchrist, A. E., Johansson, P. K., Guan, Y., Deras, J. D., Liu, Y., Ceva, S., Huang, M. S., Navarro, R. S., Enejder, A., Peltz, G., Heilshorn, S. C.
2025: e17332
- **Interpenetrating networks of fibrillar and amorphous collagen promote cell spreading and hydrogel stability.** *Acta biomaterialia*
Brunel, L. G., Long, C. M., Christakopoulos, F., Cai, B., Johansson, P. K., Singhal, D., Enejder, A., Myung, D., Heilshorn, S. C.
2025
- **Live Cell Imaging of Human Liver Fibrosis using Hepatic Micro-Organoids.** *JCI insight*
Guan, Y., Fang, Z., Hu, A., Roberts, S., Wang, M., Ren, W., Johansson, P. K., Heilshorn, S. C., Enejder, A., Peltz, G.
2024
- **APOE4/4 is linked to damaging lipid droplets in Alzheimer's diseasemicroglia.** *Nature*
Haney, M. S., Palovics, R., Munson, C. N., Long, C., Johansson, P. K., Yip, O., Dong, W., Rawat, E., West, E., Schlachetzki, J. C., Tsai, A., Guldner, I. H., Lamichhane, et al
2024
- **Bacterial outer membrane vesicles bound to bacteriophages modulate neutrophil responses to bacterial infection.** *Frontiers in cellular and infection microbiology*
Pennetzdorfer, N., Popescu, M. C., Haddock, N. L., Dupuy, F., Kaber, G., Hargil, A., Johansson, P. K., Enejder, A., Bollyky, P. L.
2023; 13: 1250339
- **APOE4/4 is linked to damaging lipid droplets in Alzheimer's microglia.** *bioRxiv : the preprint server for biology*
Haney, M. S., Pálovics, R., Munson, C. N., Long, C., Johansson, P., Yip, O., Dong, W., Rawat, E., West, E., Schlachetzki, J. C., Tsai, A., Guldner, I. H., Lamichhane, et al
2023
- **Elastin-like protein hydrogels with controllable stress relaxation rate and stiffness modulate endothelial cell function.** *Journal of biomedical materials research. Part A*
Shayan, M., Huang, M. S., Navarro, R., Chiang, G., Hu, C., Oropeza, B. P., Johansson, P. K., Suhar, R. A., Foster, A. A., LeSavage, B. L., Zamani, M., Enejder, A., Roth, et al
2023
- **Tuning Polymer Hydrophilicity to Regulate Gel Mechanics and Encapsulated Cell Morphology.** *Advanced healthcare materials*
Navarro, R. S., Huang, M. S., Roth, J. G., Hubka, K. M., Long, C. M., Enejder, A., Heilshorn, S. C.
2022: e2200011
- **A human multi-lineage hepatic organoid model for liver fibrosis.** *Nature communications*
Guan, Y., Enejder, A., Wang, M., Fang, Z., Cui, L., Chen, S., Wang, J., Tan, Y., Wu, M., Chen, X., Johansson, P. K., Osman, I., Kunimoto, et al
2021; 12 (1): 6138

- **Elastin-like Proteins to Support Peripheral Nerve Regeneration in Guidance Conduits.** *ACS biomaterials science & engineering*
Suhar, R. A., Marquardt, L. M., Song, S., Buabbas, H., Doulames, V. M., Johansson, P. K., Klett, K. C., Dewi, R. E., Enejder, A. M., Plant, G. W., George, P. M., Heilshorn, S. C.
2021; 7 (9): 4209-4220
- **Cancer-associated mesothelial cells promote ovarian cancer chemoresistance through paracrine osteopontin signaling.** *The Journal of clinical investigation*
Qian, J., LeSavage, B. L., Hubka, K. M., Ma, C., Natarajan, S., Eggold, J. T., Xiao, Y., Fuh, K. C., Krishnan, V., Enejder, A., Heilshorn, S. C., Dorigo, O., Rankin, et al
2021; 131 (16)
- **Tunable Control of Hydrogel Microstructure by Kinetic Competition between Self-Assembly and Crosslinking of Elastin-like Proteins** *ACS APPLIED MATERIALS & INTERFACES*
Wang, H., Paul, A., Duong Nguyen, Enejder, A., Heilshorn, S. C.
2018; 10 (26): 21808-15
- **Covalently Adaptable Elastin-Like Protein-Hyaluronic Acid (ELP-HA) Hybrid Hydrogels with Secondary Thermoresponsive Crosslinking for Injectable Stem Cell Delivery** *ADVANCED FUNCTIONAL MATERIALS*
Wang, H., Zhu, D., Paul, A., Cai, L., Enejder, A., Yang, F., Heilshorn, S. C.
2017; 27 (28)
- **Covalently adaptable elastin-like protein - hyaluronic acid (ELP - HA) hybrid hydrogels with secondary thermoresponsive crosslinking for injectable stem cell delivery.** *Advanced functional materials*
Wang, H., Zhu, D., Paul, A., Cai, L., Enejder, A., Yang, F., Heilshorn, S. C.
2017; 27 (28)
- **Maintenance of neural progenitor cell stemness in 3D hydrogels requires matrix remodelling.** *Nature materials*
Madl, C. M., LeSavage, B. L., Dewi, R. E., Dinh, C. B., Stowers, R. S., Khariton, M. n., Lampe, K. J., Nguyen, D. n., Chaudhuri, O. n., Enejder, A. n., Heilshorn, S. C.
2017; 16 (12): 1233-42
- **Hybrid elastin-like polypeptide-polyethylene glycol (ELP-PEG) hydrogels with improved transparency and independent control of matrix mechanics and cell ligand density.** *Biomacromolecules*
Wang, H., Cai, L., Paul, A., Enejder, A., Heilshorn, S. C.
2014; 15 (9): 3421-3428
- **Hybrid Elastin-like Polypeptide-Polyethylene Glycol (ELP-PEG) Hydrogels with Improved Transparency and Independent Control of Matrix Mechanics and Cell Ligand Density** *BIOMACROMOLECULES*
Wang, H., Cai, L., Paul, A., Enejder, A., Heilshorn, S. C.
2014; 15 (9): 3421-3428
- **Sequence-Specific Crosslinking of Electrospun, Elastin-Like Protein Preserves Bioactivity and Native-Like Mechanics** *ADVANCED HEALTHCARE MATERIALS*
Benitez, P. L., Sweet, J. A., Fink, H., Chennazhi, K. P., Nair, S. V., Enejder, A., Heilshorn, S. C.
2013; 2 (1): 114-118