Dr. Shambojit Roy

Assistant Professor
Department of Chemical Engineering
Indian Institute of Technology (IIT), Guwahati, Assam 781 039.

Career objective

To contribute towards the development of advanced targeted drug delivery platforms

Career Highlights

- Experienced in nanoparticle synthesis, surface modification, characterization, and analysis.
- Experienced in working with microfluidic devices, including insertion of mammalian cells, cellular transport.
- Proficient in protein engineering techniques and experienced in culturing human and mice breast, colon, and pancreatic cancer cells, for both 2D as well as 3D tumor spheroids and organoid models for *in vitro* studies.
- Experienced in monitoring cellular processes using immunochemistry (ICC) assays, immunofluorescence (IF) imaging, confocal microscopy and viability assays, receptor labeling for tracking payload movement.
- Experienced in monitoring migration of human and mice T lymphocytes through collagen to tumor spheroids using advanced imaging techniques.
- Proficient in drug delivery methods *in vivo,* including intravenous delivery, tumor implantation through subcutaneous injection, tumor measurement, anesthesia, and euthanasia in mice.

Professional and Research Experience

April 2025 – Present: Assistant Professor
Dept. of Chemical Engineering, IIT Guwahati, Assam, India

- Development of up-conversion nanoparticles (UCNPs) for deep tissue therapeutics.
- Development of affibodies as anti-cancer targeting agents.
- Development of 3D *in vitro* tumor models as therapeutic platforms.

April 2024 – March 2025: Assistant Professor
Dept. of Chemical Engineering, BITS-Pilani Hyderabad Campus, Telangana, India

- Development of gold nanoparticle assemblies as delivery vehicles for photodynamic therapy.
- Conjugating targeting ligands to the nano-assemblies for photosensitizer transport.

March 2022 – March 2024: Postdoctoral Associate – Advisor: Dr. Paolo Provenzano.
Dept. of Biomedical Engineering, University of Minnesota, Twin Cities, USA.
Funding agency: National Cancer Institute (NCI)

- Development of novel 3D *in vitro* tumor models such as spheroids and organoids.
- Defining key parameters to engineer T cells with better migration. (Velocity, cytotoxicity).
- Study of engineered T cell migration across the stromal barriers of a pancreatic tumor models.

August 2016 – February 2022: PhD - Advisors: Dr. Andrew Goodwin, Dr. Jennifer Cha.
Dept. of Chemical and Biological Engineering, University of Colorado, Boulder, USA.
Project funded by: National Institute of Health (NIH), USA.

- Point mutation of a site-specific photo-crosslinker on anti EGFR affibodies.
- Efficiency of affibody-enzyme fusion proteins, photo-conjugated to live cell receptors in cancer cytotoxicity.
- Study of long-term cellular quiescence, induced by photo conjugating affibodies to live cell receptors.
- Efficacy of anti EGFR fusion proteins, conjugated to UCNPs against colorectal tumors *in vivo*.
- Synthesis of 3D spheroids of cancerous and non-cancerous cells using programmable DNA interactions.

July 2015 – May 2016: Process Engineer.
Mangalore Refinery and Petrochemicals Limited (MRPL-ONGC), Mangalore, Karnataka, India

- Inspection, troubleshooting, designing and simulation of gasoline desulphurization unit.

June 2014 – April 2015: MTech Thesis – Advisor: Dr. Sudarsan Neogi.
Dept. of Chemical Engineering, Indian Institute of Technology, Kharagpur, West Bengal, India.

- Design and optimization of parameters for synthesis of magnetite (Fe_3O_4) nanoparticles.
- Synthesis of optimum sized Fe_3O_4 nanoparticles by co-precipitation method.
- Application of Fe_3O_4 nanoparticles in removal of hexavalent chromium from wastewater.

August 2012 – April 2013: Final year thesis – Advisor: Dr. Pinaki Bhattacharya.
Dept. of Chemical Engineering, Heritage Institute of Technology, Kolkata, West Bengal, India.

- Desulphurization of spent engine oil by microbes.

Education

August 2016 – December 2021 PhD, University of Colorado, Boulder. CGPA: 3.72/4.
August 2013 – April 2015 MTech, Indian Institute of Technology, Kharagpur. CGPA: 9.77/10.
August 2009 – May 2013 BTech, Heritage Institute of Technology, Kolkata. CGPA: 9.21/10.

List of Journal Publications

1. **Roy, S.**, Crist, E., Qian, G., Chen, Z., Provenzano, P. T cell movement through the complex obstacles of a 3D pancreatic tumor microenvironment. (***Under preparation***).
2. Zhang, H., **Roy, S.,** Qian, G., Chen, Z., Moriarity, S. B., Provenzano, P. P. Migration of RhoA engineered CAR T cells through pancreatic *in vitro* tumor models and tissue slices. ***(Under Preparation)***
3. Skeate, G. J., Slipek, J. N., Lahr, S. W., **Roy, S**., Wick, J. W., Stelljes, M. E., Gilkey, K. A., Thenge, P. P., Diers, D. M., Kar, B., Krueger, B. J., Lonetree, C., Kluesner, G. M., Provenzano, P. P., Webber R. B., & Moriarity, S. B. Polyfunctional Multiplex Immune Cell engineering with a single base editor. ***Nat Commun*** (Submitted).
4. **Roy, S.,** Curry, S. D., Bagot, C. C., Mueller, E. V., Mansouri, A. M., Park, W., Cha, J. N., & Goodwin, A. P. (2022). Enzyme Prodrug Therapy with Photocrosslinkable anti EGFR Affibodies Conjugated to Upconverting Nanoparticles. ***ACS Nano***, 16(10), 15873-15883.
5. **Roy, S.,** Curry, S., Bibbey, M. G., Chapnick, D., Liu, X., Goodwin, A. P., & Cha, J. N. (2022). Effect of covalent photo-conjugation of affibodies to Epidermal Growth Factor Receptor (EGFR) on cellular quiescence. ***Biotechnology and Bioengineering*****,** 119(1), 187-198.
6. Ganguly, S., **Roy, S**., Goodwin, A. P., & Cha, J. N. (2021). Generation of 3D cellular spheroids using DNA modified cell receptors and programmable DNA interactions. ***Biomaterials Science,*** 9(23), 7911-7920.
7. Harris, A. W., **Roy, S.,** Ganguly, S., Parameswar, A. V, Lucas, F. W. S., Holewinski, A., Goodwin, A. P., Cha, J. N. (2021). Investigating the use of conducting oligomers and redox molecules in CdS – MoFeP biohybrids. ***Nanoscale Advances***, 3, 1392–1396.
8. **Roy, S**., Cha, J. N., & Goodwin, A. P. (2020). Nongenetic Bioconjugation Strategies for Modifying Cell Membranes and Membrane Proteins: A Review. ***Bioconjugate Chemistry***, *31(11)*, 2465–2475.
9. Harris, A. W., Harguindey, A., Patalano, R. E., **Roy, S.,** Yehezkeli, O., Goodwin, A. P., & Cha, J. N. (2020). Investigating Protein-Nanocrystal Interactions for Photodriven Activity. ***ACS Applied Bio Materials***. 3(2), 1026-1035.
10. **Roy, S.,** Brasino, M., Harguindey, A., Chapnick, D. A., Liu, X., Cha, J. N., Goodwin, A. P. (2020) Enzymes Photo-Cross-Linked to Live Cell Receptors Retain Activity and EGFR Inhibition after Both Internalization and Recycling. ***Bioconjugate Chemistry***, 31(1), 104-112.
11. Harguindey, A., **Roy, S.,** Harris, A. W., Fairbanks B. D., Goodwin, A. P., Bowman, C. N., & Cha, J. N. (2019). Click Nucleic Acid Mediated Loading of Prodrug Activating Enzymes in PEG-PLGA Nanoparticles for Combination Chemotherapy. ***Biomacromolecules***, 20(4)*,* 1683-1690.
12. Brasino, M., **Roy, S.,** Erbse, A. H., He, L., Mao, C., Park, W., Cha, J. N., Goodwin, A. P. (2018). Anti-EGFR Affibodies with Site-Specific Photo-Cross-Linker Incorporation Show Both Directed Target-Specific Photo-

conjugation and Increased Retention in Tumors. ***Journal of the American Chemical Society***, 140(37), 11820–11828.

13. Yildirim, A., Shi, D., **Roy, S.,** Blum, N. T., Chattaraj, R., Cha, J. N., & Goodwin, A. P. (2018). Nanoparticle-Mediated Acoustic Cavitation Enables High Intensity Focused Ultrasound Ablation Without Tissue Heating. ***ACS Applied Materials and Interfaces***, 10(43), 36786-36795.

Conference Publications

1. **International Conference on Frontiers in Nanomaterials Science: Aspects in Biotechnology and Chemical Engineering**. Use of therapeutic proteins against *in vivo* breast cancer tumor models. (Invited Talk), NIT Patna, India, December 2024.
2. **CompFlu, 2024**. Study of T cell migration on advanced *in vitro* tumor models. (Invited Talk), IIT Hyderabad, India, December 2024.
3. **American Association of Cancer Research (AACR) Conference: Pancreatic cancer**. Development of T cell migration assays in advanced in vitro pancreatic tumor models. (Poster), Boston, USA, September 2023.
4. **Centre for Multiparametric Imaging of Tumor Immune Microenvironment (C-MITIE) Retreat**. Migration of engineered T cells through the pancreatic spheroid stroma. (Invited Talk), Minneapolis, USA, August 2023.
5. **2023 National Cancer Institute (NCI) – Cellular Cancer Biology Imaging Research (CCBIR) Annual Investigators Meeting**. Development of design criteria for T cell engineering for better transport through tumor stroma. (Poster), Minneapolis, USA. June 2023.
6. **8th Annual Midwest Tumor Microenvironemnt (TME) Meeting**. T cell movement through complex obstacles presented by the tumor microenvironment. (Poster), West Lafayette, USA. May 2023.
7. **ACS National Fall 2022 Meeting**. Photocrosslinkable affibodies conjugated to upconverting nanoparticles used for *in vivo* prodrug therapy. (Accepted), Chicago, USA. August 2022.
8. **ACS National Spring 2021 Meeting**. Induction of quiescence in breast cancer cells using photo-conjugating affibodies. Virtual (Oral). April 2021.
9. **ACS National Fall 2019 Meeting**. Photo-conjugating affibodies to their receptors prevent their proteolytic degradation and preserves their activity. (Oral) San Diego, USA. August 2019.
10. **Schemcon 2014**. Synthesis, characterization, and optimization of magnetite nanoparticles. (Oral), Haldia, India. September 2014.
11. **Schemcon 2011**.Study of pressure drop in a packed bed for sugar solution of different concentraion. (Oral), Kolkata, India. September 2011.

Achievements, awards, and fellowships

- Graduate Assistance in Areas of National Need (GAANN) Fellowship**,** University of Colorado, Boulder, 2019**.**
- Mukhopadhyay Graduate Fellowship, Dept. of Chemical and Biological Engineering, University of Colorado, Boulder, 2019**.**
- CU-Boulder Dean's Graduate Assistantship, College of Engineering and Applied Sciences, University of Colorado Boulder, 2016-2017.
- ChBE Doctoral Fellowship, Dept. of Chemical and Biological Engineering, University of Colorado, Boulder, 2016-2020.
- AFST (I) Kharagpur Chapter Anurag Kanti Award for Best Master's Thesis, Indian Institute of Technology, Kharagpur, 2015.
- Ministry of Human Resource Development (MHRD) Fellowship, Indian Institute of Technology, Kharagpur, 2013-2015.
- **First** position in the Inter College Quiz Competition, Students' Chapter of Indian Institute of Chemical Engineers, India, 2013.

Declaration

I hereby declare that all the information provided above are true to the best of my knowledge and belief.

Date: May 5th, 2025
Place: Guwahati, India

Shambojit Roy
Signature