



Aditi Mukherjee, Postdoctoral Researcher

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Current Position and Education

Nov 2023- Present	Harvard T. H. Chan School of Public Health, USA Postdoctoral Researcher Yonatan Grad's lab; Department of Immunology and Infectious Diseases
Dec 2019- Nov 2023	Public Health Research Institute, Rutgers University, USA Postdoctoral Researcher Hee-Sook Kim's lab; Department of Microbiology, Biochemistry and Molecular Genetics
2019	CSIR Indian Institute of Chemical Biology, India PhD in Biochemistry (<u>Defense on 2nd September 2019</u>) Subrata Adak's lab; Department of Structural Biology and Bioinformatics
2011	Banaras Hindu University, India MS in Zoology (Specialization in Biochemistry)
2009	Burdwan University, India BS in Zoology

Publications

- **Mukherjee, A. (2023)** Tailored Drug Delivery against Leishmaniasis: Unleashing the Potential of Engineered Extracellular Vesicles. *IJPES* **4(4)**, 124-125.
- **Mukherjee, A.**, Hossain, Z., Erben, E., Ma, S., Choi, ZY. & Kim, HS (2023) Identification of a small-molecule inhibitor that selectively blocks DNA-binding by *Trypanosoma brucei* Replication Protein A1. *Nature Communications* **14(1)**, 4390.
- Das, P., **Mukherjee, A.**, & Adak, S. (2021) Glyceraldehyde-3-phosphate dehydrogenase present in extracellular vesicles from *Leishmania major* suppresses host TNF-alpha expression, *J Biol Chem* **297(4)**.



- Biswas, S., Adhikari, A., **Mukherjee, A.**, Das, S., & Adak, S. (2020) Regulation of *Leishmania major* PAS-domain containing phosphoglycerate kinase by cofactor Mg⁺² ion at neutral pH, **FEBS J 287(23)**, 5183-5195.
- Adhikari, A., Biswas, S., **Mukherjee, A.**, Das, S., & Adak, S. (2019) PAS domain containing Phosphoglycerate kinase deficiency in *Leishmania major* results in increased autophagosome formation and cell death. **Biochem j 476(8)**, 1303-1321.
- **Mukherjee, A.**, Adhikari, A., Das, P., Biswas, S., Mukherjee, S. & Adak, S. (2018) Loss of virulence in NAD(P)H cytochrome b5 oxidoreductase deficient *Leishmania major*, **Biochem biophys research commun 503**, 371-377.
- Roy, J., Sen Santara, S., Adhikari, A., **Mukherjee, A.** & Adak, S. (2015) Control of catalysis in globin coupled adenylate cyclase by a globin-B domain. **Arch biochem biophys 579**, 85-90.

Awards and Honors

2023	NIH Postdoc position
2019	NIH Postdoc position
2013- 2017	Research fellowship by Council of Scientific and Industrial Research (CSIR), India
2011	Graduation Aptitude Test for Engineering (GATE) for Life Sciences conducted by Indian Institute of Technology (IIT), Bombay, India

Presentations and Workshops

- Attended the “**Boston Bacterial Meeting**”, 3-4th June 2024.
- Presented a poster on “**Identification of a small-molecule inhibitor that selectively blocks DNA-binding by *Trypanosoma brucei* Replication Protein A1**” in the “**Molecular parasitology meeting XXXIV**” in Marine Biology Laboratory, Woodshole, MA, USA, 17th-21st September 2023.
- Selvan, N.P., **Mukherjee, A.**, Cruz, E., Campo, V., Erben, E., Kim, H.S. “**Identification of a novel regulator of the antigenic variation in *Trypanosoma brucei***”. A talk was delivered by NPS in the “**Molecular parasitology meeting XXXIV**” in Marine Biology Laboratory, Woodshole, MA, USA, 17th-21st September 2023.
- **Mukherjee, A.**, Selvan, N.P., Erben, E., Kim, H.S. “**A genome-wide overexpression screen to identify proteins that inhibit the growth of *Trypanosoma brucei*, the causative parasite of human and animal African trypanosomiasis**”. A poster was presented by HSK in the “**Molecular parasitology meeting XXXIV**” in Marine Biology Laboratory, Woodshole, MA, USA, 17th-21st September 2023.
- **Mukherjee, A.**, Hossain, Z., Erben, E., Ma, S., Choi, J.Y., Kim, H.S. “**Identification of a small-molecule inhibitor that selectively blocks DNA-binding by *Trypanosoma brucei* Replication**



Protein A1". A poster was presented by EE in the "XXXVIII Annual Meeting of the Brazilian Society of Protozoology" in Brazil, 4th-6th September 2023.

- Delivered a talk in PHRI, Rutgers in-house seminar on "Identification of a small-molecule inhibitor of *T. brucei* Replication Protein A1" on 17th May 2023.
- Delivered a teaser talk and presented a poster on "Structure-guided discovery of a small-molecule inhibitor targeting *T. brucei* Replication protein A1" in the "Kinetoplast Molecular Cell Biology Meeting (KMCB)" in Marine Biology Laboratory, Woodshole, MA, USA, 13th-17th September 2022.
- Attended the "Molecular parasitology meeting XXXIII", conducted virtually, 18-22nd September 2022.
- Delivered a talk on "Replication protein A as a therapeutic target for African trypanosomiasis" in PHRI, Rutgers in October 2021 and May 2022.
- Attended virtually, the "Molecular parasitology meeting XXXII" conducted in Marine Biology Laboratory, University of Chicago, 5th-9th October 2021.
- Delivered a talk on "Molecular targeting of Replication protein A induces cytotoxicity and increases the efficacy of DNA-damaging chemotherapeutic agents" in PHRI, Rutgers in March 2021.
- Attended the "Molecular parasitology meeting XXXI", conducted virtually, 21-24th September 2020.
- Attended the hand-on training "3rd Advanced School in Genetic Manipulation of Parasitic Protozoa: Recent advances in CRISPR-CAS9 genome editing" jointly conducted by CSIR-IICB, Kolkata and The University of Durham, UK held in Kolkata, 11th-15th March, 2019.
- **Mukherjee, A., Adhikari, A., Das, P., Biswas, S., Mukherjee, S. & Adak, S. Loss of pathogenicity in *Leishmania major* is associated with the deficiency of linoleate synthesizing enzyme, NAD(P)H cytochrome b5 oxidoreductase.** Poster presentation delivered in the 87th Annual Conference of Society of Biological Chemists (India), organized by School of Life Sciences, Manipal Academy of Higher Education, Manipal, November 2018.
- Roy, J., Sen Santara, S., **Mukherjee, A., Adhikari, A. & Adak, S. The role of proximal His 161 in the ferrous-dioxy complex of *Leishmania major* heme containing adenylate cyclase.** Poster presentation delivered at the Indo-Brazil symposium on Biochemistry of kinetoplastid parasites, organized by CSIR- Indian Institute of Chemical Biology, Kolkata-700 032, September 2016.
- Attended "Training Program on Laboratory Safety: Biosafety, Chemical Safety & Radiation Safety" organized by CSIR-Indian Institute of Chemical Biology, Kolkata on 16th September 2013.
- Attended a Flow Cytometry Workshop organized by **BD Biosciences** held at CSIR-Indian Institute of Chemical Biology, Kolkata on 25th January 2013.
- Attended an International Symposium on "Brain Ageing and Dementia: Basic and Translational Aspects" held at Dept of Zoology, Banaras Hindu University, Varanasi, India, November 2010.
- Delivered a seminar on "Osteogenesis Imperfecta- A collagen Disorder" at Dept of Zoology, Banaras Hindu University, Varanasi, India, October 2010.



Teaching and Mentorship

- Directly trained a masters rotation student for two months in Dr. Kim's laboratory in PHRI, Rutgers University followed by providing her a recommendation that helped her secure a job as a "Research technician" in Mount Sinai, NY.
- Worked as a guest lecturer for 3 months in Vivekananda Mahavidyalaya, Burdwan, India.

Peer Review Experience

- Worked as a **co-reviewer** with Dr. Hee-Sook Kim in "Review Commons" for reviewing one research article.
- Worked as a **reviewer** in "International Journal of Medical Parasitology and Epidemiology Sciences" to review an article.
- Worked as a **reviewer** in "Open Life Sciences" to review four articles.
- Worked as a **reviewer** in "Star Protocols" to review an article.
- Worked as a **reviewer** in "Open Research Africa" to review an article.
- Worked as a **reviewer** in "Microbiology and Infectious Diseases" to review an article.
- Worked as a **reviewer** in "American Journal of Cancer Research" to review an article.

Skills and Techniques

- **Biochemical and Biophysical techniques:** Protein purification, High Performance Liquid Chromatography (HPLC), Size-exclusion Chromatography (SEC), Micro-Scale Thermophoresis (MST), Thin Layer Chromatography (TLC), Electrophoretic Mobility Shift Assay (EMSA), Mass Photometry (MP), Mass Spectroscopy (LC-MS/MS), Spectrophotometry, Fluorimetry etc. Biochemistry is my specialization, and I am thoroughly acquainted with all the biochemical techniques mentioned above. In the last few years, I have been intensely involved in the process of screening small-molecule inhibitors against trypanosomes.
- **Molecular Biology and Genetics:** Molecular cloning, Site-directed mutagenesis (SDM), Real-time PCR, CHIP sequencing, DRIP sequencing, dot/slot blot, gel electrophoresis (both native and SDS-PAGE) etc. I have worked on generation of mutant and recombinant cell lines in *T. brucei*.
- **Cell Biology and Immunology:** Mammalian (human) and trypanosomatid (*Trypanosoma* and *Leishmania*) cell culture, Fluorescence and Confocal microscopy, colorimetric assays, western blotting, ELISA, Immuno-precipitation (IP), Flow-cytometric assays etc.
- **Animal work:** Worked on Cutaneous Leishmaniasis mouse model (BALB/C) to isolate *Leishmania* parasites and determined footpad infection in mice. Also worked on *Leishmania donovani* infected mice, and isolated parasites from mouse visceral organs.
- **Software:** Adobe photoshop, Adobe Illustrator, GraphPad Prism, DNASTAR, ImageJ, Bio render, Origin etc.



Narrative report

I am currently working as a postdoctoral researcher (5th year) in Harvard T. H. Chan School of Public Health, Harvard University, USA. My current research focuses on the mechanisms of antibiotic resistance in *Neisseria gonorrhoeae*, a bacterial pathogen that causes deadly sexually transmitted disease gonorrhea. Before joining Harvard University, I worked as a postdoctoral researcher in Public Health Research Institute (PHRI), New Jersey Medical School, Rutgers University. I pursued my PhD in Biochemistry in CSIR-IICB, a renowned Institute in India for Scientific Research. During my PhD, I worked on the host-pathogen interactions in *Leishmania major*, a parasite that causes cutaneous leishmaniasis. During the initial period of PhD, I was a part of the research on *L. major* (*Lm*) Adenylate Cyclase protein. Our group analyzed the mechanism of control of catalysis by the globin B domain in heme-containing Adenylate cyclase (**ABB, 2015**). My main goal was to characterize the role of *Lm*NAD(P)H Cytochrome b5 oxidoreductase in host-parasite interactions. NAD(P)H Cytochrome b5 oxidoreductase enzyme is important for the catalytic conversion of oleate to linoleate and I used microscopic and flowcytometric assays to establish the absolute requirement of fatty acid linoleate for the survival of the promastigote parasites. NAD(P)H Cytochrome b5 oxidoreductase knock-out parasites showed increased expression of COX-2 and TNF α in ELISA and real-time PCR assays, also they showed reduced toxicity in mouse model. This provides strong evidence of the essentiality of de novo linoleate synthesis in *Lm* in both extracellular stage and within the host (**BBRC, 2018**). I also worked on the characterization of *Lm* Phosphoglycerate kinase (PGK), a PAS domain containing novel protein that was active on acidic pH and was found to be involved in autophagosome formation and cell death (**Biochem J, 2019**). Later we also showed the regulation of this protein by Mg⁺² ion at neutral pH using spectrophotometric and ITC-based assays (**FEBS, 2020**). I also contributed significantly to another publication (**JBC, 2021**) where we showed that *Lm* Glyceroldehyde 3-phosphate dehydrogenase (GAPDH) inhibits host macrophage TNF α expression via post-transcriptional repression. During this study, I generated the knock-out cell lines, purified recombinant *Lm*GAPDH protein, and performed mouse infection studies.

After completing my PhD in Biochemistry, I joined Rutgers University as a postdoctoral researcher. During my postdoctoral research, I got acquainted with a wide range of Biochemical, Biophysical, Molecular Biology, Cell Biology and Molecular Genetics studies. I have done characterization of *Trypanosoma brucei* Replication protein A (*Tb*RPA), both biochemically (protein purification, size-exclusion chromatography, mass spectrometry and mass photometry) and genetically (by generating knock-down cell lines). I have worked on developing and testing small-molecule inhibitors (SMI) against *Tb*RPA protein using assays like Electrophoretic Mobility Shift Assays (EMSA) and Micro-Scale Thermophoresis (MST). I also generated mutant recombinant RPA proteins as well as mutant cell lines to confirm the active residues involved in the interaction of the compound to *Tb*RPA. My studies have discovered a novel SMI that can selectively target the parasite RPA. The SMI is highly toxic to the parasites but not to the host, making it a remarkable approach to develop inhibitors that are specific against the parasites. This opens a new era against testing and developing inhibitors against other parasites as well. This work has been published recently (**Nature communications, 2023**).

I also worked actively on another putative novel protein in *T. brucei* that significantly increases the Variant Surface Glycoprotein (VSG) switching in the parasites, a mechanism to escape the host immune system. I have characterized the localization of the protein using sub-cellular fractionation and Immuno Fluorescence (IF), also have generated the knock-out, knock-down, over-expression (OE) and



mutant cells line for that protein that are actively being studied in our laboratory. The manuscript preparation for this study is in process.

On top of that, my studies also include generation of OE library in *T. brucei* and screening of genes that show toxicity. I also work on histone modification in the parasites and formation of R-loop that involve experiments like chromatin IP as well as NGS studies (DRIP and ChIP sequencing).