

STATEMENT OF PURPOSE
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Chemical and Biomolecular Engineering Ph.D., Fall 2022

Growing up in a country where personal and public healthcare is still inadequate, I have always apprehended the need for universal modern healthcare. Severe morbidity and death are prevalent in most developing and underdeveloped countries like mine. Then came the COVID-19 pandemic as a wake-up call that exposed some of the terrible deficiencies in the global health sectors, including those of developed countries. Seeing all these flaws in the global medical systems made me realize that I have a responsibility to perform in this field. I hope to contribute to the cause by removing various associated impediments and making healthcare more affordable and accessible to everyone.

My undergraduate degree in chemical engineering with a biochemical engineering specialization provided me with an unparalleled opportunity to learn about a diverse range of subjects. Among these, the ones related to biotechnology, protein engineering, and biophysics piqued my interest the most. Especially, the biophysical investigation of protein folding-unfolding and the study of diseases associated with protein aggregation intrigued me the most. I am currently using molecular dynamic simulations to investigate the conformational changes that occur in various structural proteins of disease-causing viruses because of protein-therapeutic peptide conjugation. In the future, I wish to conduct my researches at the experimental level using NMR, cryo-EM, and X-ray diffraction and eventually develop therapeutic proteins against the currently incurable and deadly diseases. Biophysical methods for drug delivery systems fascinate me as well, and the opportunity to work on this topic is equally appealing. A Ph.D. in chemical engineering with a focus on biomolecular engineering would be an ideal stepping stone for me in this regard.

My first research opportunity came early in my sophomore year where we developed a low-cost, easily fabricated quaternary ammonium chloride-based antibacterial paper. The project exposed me to topics like microbial growth kinetics, cross-linking chemistry, and bioactive papers. During my work, I learned about bacterial cell culture, surface imaging, and characterization. Currently, I am working in the SEER Group, BUET on developing a mathematical model for hydrothermal carbonization kinetics. I designed, built, and tested a highly pressurized batch reactor as part of the kinetic study. In the same group, I am doing my undergraduate thesis: A noble geo-location optimization model for establishing a municipal solid waste-based biomass processing industry in Bangladesh. For the last two years, I have been working as a research assistant at RGRC, a voluntary organization focused on computational chemistry, biology, and bioinformatics. Here I have had the opportunity to design therapeutic peptides computationally and explore their biophysical stability under various conditions. Based on my research, I presented a poster entitled "A Molecular Docking Approach to Identify Effective Stilbene Derivatives against the Main Protease of SARS CoV-2" at the 2020 AIChE Annual Conference, where it was awarded as the runners-up of AIChE Undergraduate Student Poster Competition under the category of Food, Pharmaceutical, and Biotechnology-1. It was my first encounter with such a prestigious global scientific community and receiving such recognition motivated me to continue further pursuit in the field. I went on to attend the 6th AIChE Bioengineering & Translational Medicine Conference, where the contemporary cutting-edge bioengineering researches stuck in my mind.

In my undergraduate studies, my approach has been to connect concepts from various courses to gain a more holistic understanding of the course at hand. This approach helped me see the connections between various topics I studied and relish them to the fullest. I found it easier to apply the topics to various real-world problems and research issues because I had a firm grasp of how they worked and interacted. For academic achievements at the national level, I have received numerous awards and scholarships. I have maintained a GPA of 3.87 in my undergraduate studies and was conferred with various awards from time to time for my excellent results. The enjoyment I got from my undergraduate studies, as well as the knowledge, outlook, and skills I gained, far outweigh any accolades.

I have always enjoyed interacting with people and working in groups to achieve a common goal. However, it was during my junior year that I realized my inherent management and leadership abilities after being elected vice-president of the BUET AIChE Student Chapter. The chapter experienced a period of massive growth during that time and soon became the best student chapter of AIChE South-Asian Student Regional Conference, 2020. I was elected president of the chapter for the following academic year due to my outstanding performance and contribution to it. For the first time in its history, the chapter got the honor of being an "AIChE Outstanding Student Chapter" under my leadership. Besides that, I have been a vice president of Badhan, a voluntary organization of blood donors.

The faculty diversity and the possibility of engaging in highly integrative multidimensional research drew me to the Chemical and Biomolecular Engineering Ph.D. program of Georgia Institute of Technology. I want to develop my technical base and understanding of protein engineering and biophysics, which aligns with the research on self-assembling peptides and protein aggregation at Paravastu Research Group. I am eager to work and exchange ideas with Dr. Mark Prausnitz, Dr. John Blazeck and, Dr. Ravi Kane because their research interests coincide with mine in part or in full.

After graduation, I intend to pursue a career in teaching and research. I've always wanted to be a part of the illustrious scientific community, which works tirelessly to solve the world's many problems and disseminate academic knowledge to create tomorrow's scientific heroes. I am confident that this program will help me bridge the gap between my current academic aspirations and my long-term academic goals. Finally, I would like to draw your attention to my ardent determination to further strengthen my technical background and genuine research interest, rather than my excellent research experience, academic history, leadership quality, or awards. I hope that you find me a deserving and befitting student for the Ph.D. program at your university.