Personal Statement

“Research suits you perfectly.” This is how one of my mentors evaluated me.

My name is Sijie Li, a junior student majoring in Biomedical Engineering at Southern University of Science and Technology. My aspiration is to build first-principles-based mathematical models to simulate complex cellular systems by leveraging systems biology and integrating existing frameworks. I would like to further develop these models to simulate complex human systems, accelerating experimental research and addressing the challenge of senescence. This vision has driven me to develop a strong interdisciplinary foundation, reflected in my academic excellence **(GPA 3.93/4.00, ranked 1/70)**, extensive research experience, and technical proficiency in **Python, Linux, AWK, and MATLAB**.

Objective of the Summer Research

I aim to apply the interdisciplinary knowledge and prior research experience to contribute to a specific project focused on quantifying cellular-level processes through the summer research. This opportunity will allow me to gain practical experience directly related to my research aspirations and knowledge in a project-oriented way.

Early Inspirations and the Shift from Wet Lab

My journey into research began with a fascination for longevity and drug development during my freshman year. Under the mentorship of Professor Zhi Luo, I acquired wet-lab skills such as **RAW264.7 cell culture, and RAFT polymerization**. However, I realized the inherent limitations of wet-lab approaches in addressing the complexity of aging. The compensatory effects in biological systems often rendered single-pathway research insufficient. Inspired by the book Ageless, I envisioned leveraging computational tools to simulate entire biological systems, thereby improving research efficiency and accelerating the development of anti-aging therapies. This realization marked a turning point in my academic path, prompting me to pivot toward computational and systems-level approaches.

Building the Foundation: Machine Learning and Proteomics

Recognizing the power of machine learning in analyzing complex systems, I began my exploration of computational approaches through self-learning and relevant coursework. In the course ***Machine Learning and Its Applications in Medical Engineering***, I **completed an innovative project using fMRI data to segment brain regions** by extracting the complexity of data before clustering, which enhanced my coding skills and understanding of machine learning principles. Concurrently, I explored proteomics in Professor Chris Soon Heng Tan’s lab, mastering techniques like **SILAC, Western blotting, and TPCA workflows**.

And the idea to combine the theory of physics comes from last summer. At that time, I attended the **PEBBLE BioFusion Camp** held by Westlake University and the **Chemical Biology Summer Training Course** held by Peking University, where I was introduced to **complex systems** research and multiscale simulation approaches. These exposures helped me recognize the importance of integrating physical principles and quantitative modeling to tackle challenges in aging research and have led to my current research interest.

Recent Work: Advancing Toward Quantitative Simulation

Currently, I am focusing on enhancing my modeling and computational abilities to lay the groundwork for my long-term goal. Since my university lacks cellular-level simulation projects, I joined Professor Ju Liu’s lab, where I am **developing a multi-layered fibrous wall model of the aorta and simulating hemodynamics using fluid-structure interaction techniques**. This project involves integrating imaging data with finite element modeling to address clinical needs, such as predicting blood flow in aortic dissections.

To deepen my theoretical knowledge, I have undertaken coursework beyond my major's standard training, including ***Thermodynamics and Statistical Mechanics*** and ***Computational Biology***. Additionally, I have been **self-studying *Fundamentals of Systems Biology* and math tools** such as ordinary differential equations and partial differential equations.

Beyond Academics: Discipline, Collaboration, and Creativity

My journey is not confined to academics. I maintain a disciplined lifestyle, running regularly and I have won multiple awards in track events. As the Director of Publicity for my university's Red Cross Society, I organized over 30 campaigns and delivered emergency rescue lectures to promote public health awareness. These experiences have honed my organizational and communication skills, essential for collaborative research settings. My creativity extends to the arts—my early passion for drawing earned recognition in international competitions for teenagers, resulting in my work being included in exhibitions around the world. This creative spirit complements my scientific endeavors, fostering innovative thinking in problem-solving.

Throughout my journey, I have explored multiple fields and faced challenges that required me to learn new techniques, adapt to unfamiliar domains, and step out of my comfort zone. These experiences have fostered my ability to quickly master new areas—an essential skill for today's rapidly evolving research environment.

I believe my interdisciplinary training, research experience, and passion for quantitative biology position me as an excellent candidate. I look forward to making any possible contribution!

Sincerely,
Sijie Li