

Structured Statement of Purpose  
In Pursuit for Advanced Knowledge and Skills  
In Bioinformatics, Biochemistry, Molecular Biology and Biomedical Research

My passion for scientific research was ignited during my undergraduate studies at the University of Cape Coast, where I pursued a Bachelor of Science in Biochemistry. Throughout my academic journey, I have developed a deep interest in bioinformatics and molecular biology, driven by my hands-on experience in the laboratory and computational research. My experiences in both areas have been instrumental in shaping my career ambitions to pursue a PhD in Cell and Molecular Biology, where I can contribute to cutting-edge research in these fields.

Being on the brink of my journey into the exciting world of Biochemistry focusing specifically on cancer immunotherapy, I am drawn by these compelling questions that lie the intersection of these disciplines: Does synthetic immunology have the potential to control and create human immunity? What is behind the immune system's remarkable ability to identify and kill malignant cells and how can the innate powers be harnessed to conquer cancer? These questions have driven my curiosity in pursuit for PhD Biochemistry.

#### Research Experiences

During my undergraduate studies, I was involved in several research projects that allowed me to apply theoretical knowledge to practical problems. My exposure to bioinformatics tools and laboratory techniques gave me the confidence to engage in interdisciplinary research. I gained proficiency in experimental design, data analysis, and the use of bioinformatics software, such as PyRx, Rasmol, and AutoDock Vina, which were essential in my research endeavours.

One of the most significant research projects I contributed to was my undergraduate research project, where I investigated the bioactive compounds of *Azadirachta indica* (Neem) as potential inhibitors of phospholipase A2, a key enzyme involved in snakebite envenomation. The aim of the study was to explore the potential of natural products in developing snakebite treatments, a critical issue in many developing countries, including Ghana. I was responsible for designing the study, which included virtual screening of bioactive compounds from *Azadirachta indica* using computational methods to identify their binding affinities with phospholipase A2.

I used various bioinformatics tools, including PDB and molecular docking software, to analyse the interaction between these compounds and the target protein. My contribution was central to the project as I led the data analysis, interpretation, and presentation of our findings. The study's results were encouraging, showing the potential of neem compounds as phospholipase A2 inhibitors, which could pave the way for the development of affordable snakebite treatments. This research project not only deepened my knowledge of molecular interactions but also fostered my interest in exploring natural products as therapeutic agents. In addition to my undergraduate research, I was involved in another mini-project focused on brain enhancers of the *Shox2* gene, using the VISTA enhancer browser. The project aimed to compile all brain enhancers of *Shox2* from both published data and enhancer browsers. My role included designing and executing the experiments, analysing data, and contributing to the final

presentation. Through this project, I developed a strong understanding of enhancer regions and their implications in gene regulation.

Additionally, I had the opportunity to assist professors and lecturers with laboratory work and research projects, which gave me a solid foundation in both theoretical and practical applications. This experience extended beyond the classroom when I interned at the Kintampo Research Centre, I collaborated with doctors and researchers on various projects. During my time there, I contributed to sample collection, analysis, and a range of laboratory techniques. I gained hands-on experience with advanced methods such as PCR, Gene Xpert, HPLC, and electrophoresis. Additionally, I assisted hospital and laboratory staff in executing these procedures, which sharpened my skills in diagnostics and molecular biology. This exposure to real-world research and clinical settings was invaluable, and it deepened my understanding of laboratory protocols and research methodologies.

### Research Output

The research on *Azadirachta indica* and phospholipase A2 was presented at the Department of Biochemistry at the University of Cape Coast, earning recognition for its potential impact on the field of biochemistry. Although the project did not result in a formal publication, the opportunity to present my findings at the departmental level was a significant milestone in my academic career. This experience allowed me to develop my presentation skills and gain valuable feedback from my peers and professors.

In addition to my research experience, I also gained valuable teaching and work experience in biochemistry and biomedical science. I worked as a teacher and head of students' leadership association at Divaid (Divine Aid) International School from 2017 to 2018, where I taught the pupil of class five (5) as well as junior high school. I also completed two internships as a laboratory scientist at Kintampo Health Research Centre and Tetteh Quarshie Memorial Hospital Laboratory, where I performed various tasks such as sample preparation, collection and processing, quality control and assurance, media preparation for bacteria culture, tissue processing for diagnosis, and molecular diagnosis using ELISA and PCR. Through these experiences, I improved my communication, inter-personal relationship, leadership, and problem-solving skills, as well as my knowledge and passion for biochemistry.

### Reflections and Future Aspirations

My research experiences have not only equipped me with technical skills but also fuelled my desire to pursue advanced research at the PhD level. The opportunity to explore complex biological problems through bioinformatics and molecular biology has strengthened my resolve to contribute to scientific knowledge in areas such as disease mechanisms, drug development, and therapeutic interventions. I am particularly motivated to address challenges faced in healthcare, especially in under-resourced regions, by leveraging my knowledge of bioinformatics and molecular biology to develop innovative solutions. The PhD program in Cell and Molecular Biology offers the ideal platform for me to deepen my expertise and contribute to scientific advancements. With my background in computational biology and hands-on laboratory experience, I am confident that I am well-prepared to undertake the rigorous research required at the doctoral level. I look forward to collaborating with faculty and fellow researchers to address pressing biological questions and make meaningful contributions to the field.

## Professional and Leadership Experiences

Throughout my academic and professional life, I have honed valuable skills in time management, teamwork, problem-solving, and resilience. During my undergraduate studies, I served as the program representative for my biochemistry class for four consecutive years, a role that demanded leadership, coordination, and effective communication. I organized group tutorials, collaborated with lecturers, and provided support to classmates, which strengthened my ability to work within a team and manage multiple responsibilities simultaneously. These skills are directly transferrable to graduate-level research, where collaboration, leadership, and time management are crucial. In addition, I received recognition for my leadership and academic contributions. I was named the Program Representative of the Year (2019/2020) by the Ghana Biochemistry Students Association (GHABSA). These Honors reflect my dedication to both my academic and extracurricular commitments. I also served as the President or Personnel representative for the National Service Personnels at the Tetteh Quarshie Memorial Hospital Laboratory.

Moreover, my role as Event Organizer for the Ghana Biochemistry Students Association (GHABSA) allowed me to demonstrate my organizational and leadership capabilities on a larger scale. I coordinated events, workshops, and educational programs, which involved liaising with various stakeholders. Despite my aspirations for the presidency of GHABSA being curtailed due to my GPA, this experience provided me with valuable lessons in perseverance, adaptability, and the importance of maintaining a balance between academics and extracurricular activities.

## Life Experiences and Resilience

My greatest motivation stems from the personal challenges faced by my family, which have profoundly influenced my career aspirations. The tragic loss of my younger sister to cancer and my mother to diabetes and chronic ulcers ignited a deep determination to find solutions for chronic diseases through research in molecular biology and bioinformatics. These personal experiences, coupled with professional and leadership roles, have developed transferrable skills that will support my success in graduate school.

The loss of my sister to an aggressive form of cancer and my mother to diabetes has been a driving force behind my research interests. My sister's battle with cancer sparked a keen interest in cancer genomics, propelling me to explore the identification of driver mutations, biomarker discovery, and personalized medicine approaches. This personal tragedy remains a poignant reminder of the urgent need for advancements in cancer research, and it fuels my desire to contribute to this field.

Similarly, my mother's death from diabetes solidified my commitment to understanding the molecular basis of chronic diseases and exploring gene therapy and drug discovery. I am determined to contribute to research that seeks affordable and effective therapeutic solutions for diseases like diabetes, which disproportionately affect low-income populations. These experiences have fostered resilience, empathy, and a strong sense of purpose, qualities that will support me as I pursue a PhD in this field.

During my national service or internship period at the Tetteh Quarshie Memorial Hospital, I had the privilege to participate in voluntary and community services like blood donations, health screening as well as health talk, and many more. This led to the realization that many

people (thus, the people of Mampong, at Akuapem-North, Eastern Ghana) were having or infected with the hepatitis 'B' and 'C' viruses without their knowledge, since these viruses at the acute stage are mostly asymptomatic. Using these people as sample for the whole Ghana's population, then statistically, I can infer that about 65 - 70% of Ghanaians are having these viruses. It is known from literature that these viruses have greater influences, mainly on liver and kidney functions. In order to help minimize or eradicate this problem, it became part of my research interest to also focus on "In vitro and in silico studies of natural products as potential targets of Hepatitis C virus and Hepatitis B virus to minimize cirrhosis and liver cancer and promote liver health". So, I can design drugs affordable, accessible and have the full potential to clear these viruses, for Ghanaians and if possible nation-wide.

### Challenges and Overcoming Adversity

In addition to personal loss, my academic journey was significantly impacted by financial challenges. After my mother's passing, I became the primary support for my younger brother, while relying on my great-grandmother, a small-scale farmer, for support. During the COVID-19 lockdown, I started a mobile money vendor business to support my family and fund my education. Although the business was initially successful, it was tragically cut short by armed robbers, leaving me financially devastated, which further compounded my financial struggles.

Despite these setbacks, I remained determined to continue my education. I sought employment with the Ghana Statistical Service for the 2021 Population and Housing Census (PHC) as a Field Officer (Enumerator) and also engaged in tutoring colleagues in computer programming, as well as repairing phones and laptops. These activities helped me manage my debts. This period taught me invaluable lessons in resilience, resourcefulness, and the importance of perseverance as well as practical data collection and analysis on a large scale. Although I graduated with a second-class lower division and a GPA of 2.83, I am confident that my academic performance would have been stronger under more stable circumstances.

### Transferable Skills and Future Aspirations

My experiences in research, leadership, and overcoming adversity have equipped me with essential skills that are highly transferrable to graduate-level studies. My ability to manage time effectively, work collaboratively, and solve complex problems will enable me to navigate the challenges of a PhD program. Additionally, my exposure to research through undergraduate projects and my growing expertise in computer programming, bioinformatics, data science, and molecular biology as well as my laboratory skills from various internships or attachment have provided a solid foundation for advanced research. I am confident that these experiences have prepared me well for the demands of a PhD in Cell and Molecular Biology. My personal and professional journey has instilled in me a deep sense of purpose and a commitment to contributing to scientific advancements that can improve health outcomes for people in under-resourced regions. I am eager to apply the skills I have developed, both in and outside of the lab, to tackle complex scientific questions and make meaningful contributions to the field of molecular biology.

### Challenges and Overcoming Adversity

Over the course of my undergraduate studies, courses that played pivotal roles in shaping my academic preparation for a PhD are Biostatistics, Molecular Biology and Biocomputing. The Biostatistics course exposed me to logical and statistical reasoning, Molecular Biology course

introduced me to fundamental concepts such as gene expression, DNA replication, transcription, and translation, which are essential for understanding cellular processes. This course laid the groundwork for my interest in studying the molecular mechanisms underlying diseases like cancer and diabetes. The rigorous coursework and laboratory sessions helped me develop critical thinking and problem-solving skills, which will be invaluable as I engage in more complex research projects in graduate school.

My introduction to bioinformatics came through Biocomputing, a course that exposed me to the application of computational methods in biological research. It was during this course that I realized the potential of combining programming with biological research. I learned to use bioinformatics tools such as PyRx and AutoDock Vina for molecular docking, which I later applied in my final year research project. This experience not only strengthened my research skills but also sparked my interest in using bioinformatics for drug discovery and molecular medicine.

My goal is to acquire advanced skills in Bioinformatics, Molecular Biology, Biotechnology, and Biomedical research through an MSC, MPHIL or PhD program.