Cover Letter

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Being from a hamlet in the outskirts of the city Kolkata, where people still live their whole lives without having big dreams, goals and ambitions, for me also the normal question had come up five years back, after high school, when I had to choose between pursuing engineering on the one hand, which in my country is an easy gateway to a comfortable job after four years, and pursuing higher study in fundamental sciences, on the other. Surprisingly, I had no hesitation in choosing the fundamental sciences, for I was already falling in love with Chemistry. Now five years later, coming again at the important junction of life, choosing Ph.D. as my next step in career has so many reasons behind it. When I asked myself "Why should I go for Ph.D. instead of getting a job?, among all the reasons my inner voice pointed out two major points, 'motivation' and 'self-satisfaction'. In so many years, I have made some basic observations about myself. One of such observation is that I always want to follow my heart; live a life in which every next day will be surprising, exciting and uncertain. A secure certain life is disinteresting one for me since after some time life becomes monotonous. Instead of a certain life getting stagnant, I want a journey of life, associated with failure and success, where every day will be challenging to me. Actually, the field of research will give me exactly that kind of environment which I am looking for. In that long unknown journey, there will be numerous new challenges. While facing them I might fail many times. But I have enough self-confidence that taking lessons from my failure surely I will be successful one day. This way Ph.D. will give me 'self-satisfaction' which I will not get in any kind of 'job'.

Chemistry always appealed to me from the school level mainly because of its ubiquitous nature. I can remember that during the 12th standard in my school, one of our chemistry teacher used to give problems on organic transformations, and I was able to solve those before any other student most of the time. One day after the class, that teacher suggested me personally to read the famous book "A Guidebook to Mechanism

in Organic Chemistry by Peter Sykes". That was the first initiation to fall in love with Organic Chemistry.

During my undergraduate degree I was highly motivated to delve into the wonders of Organic Chemistry by Dr. Tripathy, one of our professors. His words "Nothing in life is permanent except change" still resonates in my ears. Through this line, he opened up new vistas of Chemistry where nothing can be generalized into a single category, each and every reaction is unique and every reaction is unique and everything is forever changing. Everything needs to be scrutinized to its very core. What might be true today may not hold so tomorrow, so we should never abandon the eternal quest for knowledge in Chemistry. According to him,

Chemistry was like a vast ocean where the knowledge we hold are like miniscule droplets. His inspiration has always been my guiding force and an important factor driving my predilection towards my interest in Chemistry and medicine. He tried to instill in me the "joy of discovery"- as he used to say. The fondness with which he used to talk about research, his work and science as a whole captivated my interest and made the prospect of a career in research all the more riveting.

The role of my Alma mater is unforgettable in moulding me with a unique personality and sowing seeds of excellent education. With a strong interest in Chemistry and securing 91% and 90.4% (with 95% in Chemistry) in the two major school termination examinations. I successfully secured a position among the top 1% students in the country, so that I was awarded DST-Inspire scholarship. Then, I joined Midnapore college (autonomous), one of the premier institutions in the country for undergraduate studies with a specialization in Chemistry.

The excellent pedagogical skills of the professors together with the rudimentary course ranging through all major disciplines of Chemistry gradually inspired me to accomplish my aspiration of being a scientist. During this period, I developed a keen interest in the field of organic synthesis, mainly retrosynthetic approach. I always found the challenges scintillating and was eager to use my chemical intuition in solving them. I was fascinated by the limitless boundaries of Chemistry and its huge applications in Biology and how it can shape human life. I graduated from Midnapore College (autonomous) with first class (**77%**).

With an All India Rank **206** amongst **12000** students in the national Joint Admission Test for Chemistry (JAM) I secured admission at IIT Guwahati, one of the leading institutions in India. In my M.Sc. I have gone through a lot of courses on Organic Synthesis and the

professors who taught the courses also made me more and more curious for this subject by their approach of teaching. I was able to secure the highest grade 'AA' in Organic Chemistry courses like 'Principles of Organic reactions', 'Organic reactions and mechanisms', and also in 'Inorganic reaction mechanisms and organometallics'.

Actually from B.Sc. I became very much interested in chemical application to the biological field. So, when I was thinking to do a summer project, I had applied to Prof. Debashis Mukhopadhyay, department of Biophysics and structural genomic, SINP, Kolkata. It was a great experience to work in a bio-lab. I was working on a project named "*Establishment of an Alzheimer's Disease cell model using human neuroblastoma cell line*". I have successfully prepared the cell model and to prove the model preparation is successful, I have to do some study in RNA as well as protein level, of various genes which can alter their expression in disease condition. There, I have learnt many biological experiments and techniques, like cell culture, PCR, RT-PCR, Western Blot etc. and became more motivated towards the genes and how it regulates the disease condition and normal condition in our body.

In the third semester we have been taught 'Chemical Biology', where I got my highest motivation. I was really surprised and want to know more about the mystery behind how the body is playing with the DNA, RNA, proteins and other small molecules (Metabolites). We had "Graduate Seminar" course in which I gave one presentation on "**Stapled Peptide".** During this period, I had
gone through lots of research papers and while digging the literature I became interested in applications of Chemistry Particularly Organic Chemistry in solving the problems of Biology. In last semester we were introduced to one more new topic, i.e., "Supramolecular Chemistry". It also attracted me a lot.
Then when it comes to select the lab for master's project, I thought to do something in the overlap region of chemistry and biology. I went to Prof. Bhubaneswar Mandal, IIT Guwahati to do something new and valuable work in bio-organic field. I joined his lab from December, 2019. It was really a great opportunity for me to explore the research field of Biochemistry. I was working on a project: *"Development of a cyclic peptide as a therapeutic tool against Alzheimer's Disease"*. The culprit behind Alzheimer's Disease is amyloid-beta(Aβ) peptide. Under diseased condition, this peptide undergoes slow transformation from soluble monomer to oligomer, protofibrils and gradually develops into mature fibrillar aggregates. The core hydrophobic region (LVFF)of the peptide is self-responsible for amyloid aggregation. In this project, my job was to first design the cyclic peptide keeping the main hydrophobic

interaction site constant, and then applying standard SPPS protocol, we have developed the cyclic peptide and characterize them by Mass Spectrometry and investigate their inhibitory efficacy over A-beta peptide (culprit of Alzheimer's Disease) by in vitro study using various biophysical tools, fluorescence, CD, IR, TEM etc. The best I have learnt is perseverance and time management specially when working with a several stuffs and these are actual reasons behind the success of a research scholar. Chemical synthesis while working in a new designed one, can sometimes be like the success story of an under achiever. The moment when a compound is synthesized and characterized behind which there is a lot of hard work and dedication is of unexplainable joy and priceless too. Chemistry in that way, always surprises me and making me more and more curious about it.

I have a CPI of 8.92 out of 10 in my M.Sc. and in my M.Sc. project I got highest point, 10. During the projects, I have learnt various techniques to perform reactions in an inert atmosphere, PCR, RT-PCR, Western Blot, handling highly air and moisture sensitive chemicals, column chromatography, HPLC and interpreting various kinds of spectra like NMR (1D,2D), FT-IR, UV-VIS, Fluorescence, Mass etc.

I have always been fascinated by the way how chemistry works in Nature. Almighty Nature synthesizes molecules in a perfect, specific yet intricate way. And, I have always been eager in carrying original research which will have a direct benefit to society. We are still far from that level of precision and control what Mother Nature has. There are lots of important biochemical reactions and interaction taking place in our body but we have very little understanding of their mechanisms. To unravel these mechanisms, we need to combine the power of chemistry with biology and apply them to improve our therapeutic field, and here the field of Chemical Biology and bio-organic chemistry comes into the business.

The project entitled, "Using waste products to sustainably
produce peptide hydrogels for health care applications" is a dream project for me. Environment is burning due to pollutions made by us, and many chemicals from industry as well as research labs, are waste products, which can cause the pollution. If we solve the pollution problem also by maintaining proper rules, there can be another factor of wasting the chemical products. So, to use the waste product is always highly appreciated. if we can use this waste products for our good, that will be a great achievement. And the application in medicinal field always attracts me. A gel is a semi-solid that can have properties ranging from soft and weak to hard. And hydrogel is a network of crosslinked polymer chains that are

hydrophilic, recommended for wounds that range from dry to mildly exudating and can be used to degrade slough on the wound surface. Hydrogels have a marked cooling and soothing effect on the skin, which is valuable in burns and painful wounds. Peptide-based hydrogels are mainly formed by supramolecular self-assembly of peptides or peptidomimetics, based on several secondary structural motifs that include α-helices, β-sheets, etc. Peptide hydrogels can be obtained by maintain proper temperature, pH, concentration etc. can be used for different applications including drug delivery, scaffolds for wound healing, bioimaging etc. So conversion of waste product to peptide based hydrogels having health care applications, has influenced me a lot.

My goal is to use chemical tools to understand biochemical reactions, biochemical interactions and phenomenon in molecular details. Understanding these intricate and sophisticated class of reactions will help to develop better therapeutics and efficient biocatalyst which are need of the hour. My aim of serving society through my work will be fulfilled in this way. I firmly believe that the future of science lies in interdisciplinary fields. I want to work at the interface of Chemistry and Biology. A Ph.D. degree in Chemical Biology/bio-organic chemistry will equip me with all the techniques and knowledge which will be required to investigate and understand complex biological phenomenon with the help of chemical tools.

My future goals would be to choose a challenging post-doctoral study and eventually to engage in teaching and research as a career option. I would love to see myself being a professor nurturing and educating young minds, stimulating the next generation to become lifelong learners. Also, I feel research and teaching go hand in hand, doing cutting-edge research where I can push the boundaries of science by continually surpassing the challenge of determining critical knowledge which would lead to the advancement of society as a whole is my cherished dream. I believe that I can satiate my thirst for the subject and provide an opportunity to scale the ladder of success and establish myself as scientist. If given a chance to work in a lab of my choice, I am sure I will not only successfully complete my doctorate but also can be serve my country as well.

I sincerely want to thank you again for giving your precious time for going through my letter of motivation.