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A long journey to be as an organic chemist

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I did my schooling from Uripok Boys' Junior High School and Ram Lal Paul High School, Imphal. I was found to be a sincere and obedient student during my school days. Then I was admitted to the D.M. College of Science for Pre-University and graduation courses. I found a lot of changes from the school life to the college life. During school days, student life was confined and could not get much free time, as the Headmaster, Shri (L) R. K. Shitaljit Singh, was very strict. I remembered when I was first admitted to Ram Lal Paul High School as a new student and was interviewed after first terminal examination by the teachers and the Headmaster for giving school scholarship. I got nervous in front of the teachers; when the Headmaster asked me why my name was 'kshechri' (mixed name) of English and Sanskrit. He said my name should be either War Conquerer or Lal Ngamba, and asked me who gave my name. I meekly replied in a weak voice 'by my father' and he shouted to speak louder, I repeated the same answer in a loud voice, all the teachers laughed.

There were many teachers who inspired me during those school days; late Oja Ksh. Modhuchandra Singh who taught us Mathematics and Mechanics, late Oja Yumnam Nilo Singh who taught us Additional Mathematics and he never laughed. I remembered when he taught us about recurring numbers, he wrote the repeated number on the black board in full and then outside the blackboard on the wall. We, in the class, all laughed but he did not show even his smiling face. Overall, we had late Oja R.K. Shitaljit Singh who was very strict and he used to check every class after each bell. Whenever he found a class having no teacher, then he used to come to the class and started teaching some lessons. I was very much afraid of him during those days as he always used to scold and shout with a stick.

I got a lot of freedom during college days as if I was freed from a prison and moreover, the college was co-educational. I had many turning points in my life; first was that I opted for general line instead of technical line such as, medical, engineering, etc. after passing the P.U.Sc. exam. (G.U.). It was influenced by one of my cousins who was a renowned doctor. Second turning point was that I shifted from B.Sc. Physics (Hons.) to B.Sc. Chemistry (Hons.) due to some influences and circumstances. Actually I had already attended the classes for Physics Hons. and bought books for the same. During my graduation days (during the two years), I found a lot of changes in my study as I was more interested in bunking classes and chatting with my friends during college periods. The syllabus for the Honours courses could not be covered on time, even one paper of Industrial chemistry was not touched at all, as there were strikes called by students and teachers. Moreover, most of the teachers would bring either their old class notes or books, they read from those notes or books and we wrote down the same. I could not get satisfaction during the Honours classes; teachers could not give me satisfaction whenever I raised some questions for the clear picture of the lessons. However, I appreciated the teachers of the Chemistry department of the College who gave me advices and inspired me, particularly Oja Sanjenbam Nirmalashasi. She gave a lot of advices and once she said that what she scolded during those days, would be remembered forever. I really still remember those scolded words that helped my route future. I bought books of chemistry and studied self at home. I graduated with Hons in Chemistry under Gauhati University in the year 1978, getting good marks and I was the only fresh student out of three.

I found the real chemistry and love for chemistry during my post-graduation days. For post-graduation, I was admitted to the North Eastern Hill University (NEHU), Shillong, which was then recently established, and most of the faculty members were from IIT, Kanpur and well-trained. During those period, I studied very hard as it was semester system and two or three

internal examinations were held for every week. I remembered Prof. Mihir K. Choudhury, the Bhatnagar Awardee, used to come to the classroom wearing Lab. coat with a piece of chalk stick no duster and walked in front of the blackboard to and fro, saying think and think. Prof. S.N. Bhat who taught us spectroscopy, was very strict and he would not allow us to enter the laboratory for practical classes if we did not submit the practical note-book what we had done in the last classes. I learnt my teaching technique and about the reaction mechanism from Prof. H. Junjappa who used to come to the classroom without any class notes and taught us how to push arrow in reaction mechanisms. Actually, I wanted to opt for Physical Chemistry as Specialization subject in the fourth semester, but during the third semester while we were having organic chemistry practical classes, Prof. H. Ila came to my bench and asked me to opt for organic chemistry as specialization subject. She taught me many techniques for preparation of compounds and recrystallization of samples during the practical classes. Thus, I opted for Organic chemistry as specialization subject in the fourth semester. During the fourth semester, I had a project work on “**Development of newer methodologies using Ketene dithioacetals**” and I got a research paper in the journal **Synthesis** from my project work of the fourth semester. I got M.Sc. Degree with specialization with Organic Chemistry from NEHU, Shillong.

The final turning point of my life was when I decided to do research and publish papers. After Post-graduation, I got a regular Govt. lecturer job at Imphal College. Actually, my parents applied for the post on my behalf as I was out of station. I was not expecting this job as I did not get any correspondence from the Education Department, Govt. of Manipur. One day, when I visited one of my friends (late H. Bikramjeet Singh) at Yaiskul police lane, his cousin told me that at Imphal College, teachers and students were talking that I did not turn up for joining as lecturer at the college. The news was a surprise to me, and immediately myself with my friend went to the Education Department and took the Appointment letter. Then, I went to the Imphal College and submitted the appointment letter to the Head clerk who bluntly stopped me not to disturb him, thinking me as one of the college students. I told him that I came to join as a new lecturer in Chemistry and handed him the appointment letter. After reading the letter, he apologized to me and offered me a chair to sit. He then went to the Principal room holding the letter and came back asking me to join immediately. We together met the Principal and there were some students with the Principal in the room. Offering me a seat, the Principal told the students that they were asking for some funds but I was coming to join as lecturer. The Head clerk told me to sign in the attendance register of the teachers, which was kept in the common room of the teachers. Next day, I went to sign for attendance in the teachers' common room

and open the register to search my name. While opening the attendance register, one of the teachers sitting in the room shouted to me not to touch the register as it was for teachers only (he had mistaken me for a student). I served the college only for four months as I left the job for further research.

While serving the lecturer's job, I got a telegram as well as a letter from Prof. H. Ila informing me that I was selected for Junior Research Fellowship (JRF) and to join immediately. Before leaving the lecturer job, there was a detailed discussion with my family. My parents and my elder brother told me not to leave the job as it would be difficult to get the job in future and moreover, I could apply for MCS/MPS job which would be advertised very soon. I argued with my family that if I served an official job, I could not find chemistry among those official files and for that job I would not have taken chemistry. I told them that I liked chemistry as I did B.Sc. (Hons) in Chemistry and M.Sc. in Chemistry. My aim was to do research on drugs, to publish research papers, to visit foreign countries as post-doctoral fellow. Finally, I decided to accept the JRF and left the lecturer's job at the college.

I joined the research group of Prof. H. Junjappa and Prof. H. Ila at the department of chemistry, NEHU, Shillong as JRF. I did my Ph.D. under Prof. H. Junjappa as Supervisor and Prof. H. Ila as Co-supervisor and the title of my thesis is "**Synthetic and Mechanistic Investigation on Polarised Ketene Dithioacetals for the Development of Newer Synthetic Methods**". Prof. Junjappa (1936-2021) was the founder Head of the newly established department of chemistry, NEHU and built one of the best chemistry departments of the country with many facilities including library and instrumentation facilities. Prof. Junjappa's significant contributions have been mainly in the area of synthetic organic chemistry/heterocyclic chemistry. He together with Prof. Ila developed a new method for regio-specific construction of a large variety of substituted and fused polycyclic aromatic hydrocarbons. This reaction is now widely known as 'Junjappa-Ila (JI) aromatic and heteroaromatic annulation' in synthetic organic chemistry.

I have published eight research papers from my Ph.D. work mainly in **Synthesis** (five papers), **Journal of Chem. Soc. Perkin Trans. I** (two papers) and one paper in the **Indian Journal of Chemistry, Sec. B**. For writing the paper, first I showed the drafted paper to madam Ila and then to Sir Junjappa for finalization. In a paper, when I showed the madam's corrected draft paper to sir, he commented about the madam's writing, 'Ila thinks in Hindi and writes in English, so many mistakes are here and there'. He cut those writing of madam and he corrected the paper. Then, I showed the same corrected paper to madam again and she commented, 'What

Junjappa is doing, he has changed the main theme of the paper. Don't show the paper again to him'. Finally, I sent the paper which was finalized by madam. During my research period, I enjoyed fellowships from the Council of Scientific & Industrial Research (CSIR) as JRF (1982-1984), SRF (1984-1987) and RA (1988).

For Post-doctoral fellowships, after submission of my thesis, I contacted many professors of Germany, UK, Japan and USA by sending mails on which I spent a lot of money on buying envelopes and stamps (there were no internet system during those days). I got the Alexander von Humboldt Fellowship under Prof. Richard R. Schmidt, University of Konstanz, Germany on the topic, "Intramolecular glycoside bond formation through O-glycosyl phosphites and nitroglycals". But I did not enjoy the fellowship as I had joined the Manipur University as Assistant Professor in the later part of 1988 and was in probation period (during that time there were three years for probation period as framed by the Manipur University). Once Prof. Ila got very angry with me as I didn't join the fellowship, she asked me to leave the job and join the fellowship. Prof. Richard R. Schmidt visited NEHU for viva and gave lectures, stayed three days as guest of Prof. Ila. Prof. Schmidt was one of my thesis examiners (during those days, there were rules for NEHU to examine the theses by two examiners – one national and other international).

During the first three years after joining as Assistant Professor in Chemistry Department, Manipur University, I could not do any independent research work (due to University rules) but I helped the research students of other faculties in the organic research laboratory. After the probation period, I applied for research project and guided research students. During the tenure of my profession, I have published 96 research papers on organic synthetic chemistry and natural products Chemistry, have undertaken 17 (seventeen) research projects, 22 (twenty-two) research students are awarded for the Ph.D. degree under my guidance and three research students are pending. In my group, there are two research groups – one working on the synthetic organic chemistry and other on natural products chemistry. I got the idea of working on natural products chemistry after the Commonwealth Fellowship (Oct. 1997-Sept. 1998). During the Commonwealth Fellowship (one year), sponsored by the Association of Commonwealth Universities, London, UK, a project on "**Towards the total synthesis of Natural Product - Pamamycin, an antibiotic**", was taken in the University of Manchester, UK. Two papers were published from the project work. During the fellowship, I learnt a lot of techniques on natural products chemistry using those facilities available. I took up the research works on medicinal plants of Manipur using those ideas – think globally, act locally. Our group has done substantial

research works on medicinal plants, natural dyes, natural fumigants, natural pesticides, etc. I got two patents from natural products chemistry and published five books. I have visited many places (abroad) giving invited lectures such as Venice, Rome (twice), Osaka (Japan), Montreal (Canada), Singapore, Bangkok, Manchester, Leeds, Oxford, etc. Visited IICB, Kolkata (one month, December 2001) as Visiting Scientist sponsored by NER, Shillong and three universities of UK (Leeds, Manchester and Oxford) as Visiting Scientist sponsored by Royal Society, London (five months – from January to May 2006).

There is a big difference between the synthetic organic chemistry and the natural products chemistry on structure determination of the compound isolated. In the case of synthetic organic chemistry, one may know the tentative structure of the isolated target compound and so, easier to determine the structure of the isolated compound. However, in the case of compounds isolated from natural products, the structure may not be known and have to elucidate the structure using many techniques, moreover compounds may be of complex type. For natural products chemistry, isolation and characterization of compounds are a lengthy process. The processes for isolation and characterization of bioactive compounds are – collection of materials, preparation for extraction, extraction of compounds using various chromatographic techniques, pharmacological screening of the crude extracts, phytochemical screening of the crude extracts, separation and fractionation of the biologically active extract, pharmacological screening of the pure isolated compound, phytochemical screening of the pure isolated compound, and finally, identification & characterization of the isolated compound. To determine the structure of compounds isolated from natural products, one should have sound knowledge of spectroscopic techniques, particularly NMR spectroscopy. The structure of the isolated compound should be confirmed by matching with spectral data, such as IR, UV, NMR and Mass spectral data of the isolated compound. But manipulation on the structure of compounds isolated from natural products should not be done.

I retired from my service on February 28, 2023, but my enthusiasm for research work is still going on. In our laboratory, we have investigated nearly twenty plants which are used as medicines and as natural dyes. There are many medicinal plants in Manipur which require further research works, and could be patented. I encouraged the young researchers to search the medicinal plants for drugs and other proposes. For developing a drug from natural products, a collaborative work among the biologists, organic chemists and biotechnologists is necessary. I have many collaborative works with the Central Drugs Research Institute (CDRI), Indian

Institute of Chemical Biology (ICB), IIT (Kanpur), NIPER (Chandigarh), Indian Institute of Toxicology Research (IITR), etc.