

INTERVIEWS

A PhD candidate's passion for Chemistry and pursuit of vaccine research

CAMPUS DESK

Momota Akter is currently pursuing a PhD in Organic Chemistry in the Department of Chemistry at Michigan State University (MSU), where she is conducting vaccine research under the supervision of Prof. Dr Xuefei Huang and also serves as a graduate teaching and research assistant in the same department. She also serves as the General Secretary of the Bangladesh Chemical and Biochemical Association in North America (BACABANA), Michigan Chapter, a non-profit organisation dedicated to supporting students and professionals in chemical and biochemical sciences.

Campus sat down with Momota to talk about her research and life as a PhD candidate.

Campus (C): Chemistry is a difficult subject, one that's feared by many, especially in school. What made you pursue this subject for your higher studies?

Momota Akter (M): Chemistry often seemed intimidating—its equations and formulas appeared complex and overwhelming. Yet, that very challenge drew me toward the subject and sparked my determination to explore it deeply.

Over time, I realised that chemistry is not confined to textbooks; it is intricately connected to everyday life. I have always been curious about how medicines are developed, how materials are created, and how small scientific changes can have a profound impact on the world around us. This realisation inspired me to pursue chemistry in higher studies, believing that if I could master it, I would not only build my career but also contribute meaningfully to society and my country.

Even though my school lacked sufficient resources, I nourished my curiosity by watching science programmes on television, which deepened my fascination with the subject. That curiosity, coupled with a desire to understand the science behind everyday life, drove me toward a career in research chemistry.

My parents, especially my father, played a pivotal role in nurturing this passion. He often shared stories of remarkable inventions and ground-breaking discoveries, and those stories fueled my resolve to follow this path.

C: What's a typical day like as a PhD candidate who is also having to balance graduate teaching and research assistant roles?

M: Being a PhD candidate means constantly balancing lab work, teaching, and personal life. The most interesting part is that no two days ever look the same. The workload can be intense, but with good time management and a clear sense of purpose, it is possible to maintain a healthy balance and still enjoy the journey.

There are weeks when deadlines and experiments demand extra hours, but I try to offset that with breaks, family time, or hobbies to recharge. The reward is worth it because you're not only doing research; you're also building resilience, discipline, and the ability to manage multiple responsibilities at once. I prioritise tasks based on urgency and impact, and I follow a structured schedule that allows me to dedicate time to both research and teaching.

C. We understand that you are currently working on a vaccine at MSU. Could you tell us what this vaccine is and what it aims to do?

M: Enterobacteriaceae is a large family of gram-negative bacteria. These bacteria are associated with both intestinal and extraintestinal diseases, including urinary tract infections, bloodstream infections, pneumonia, and, in some cases, diarrhoea. Alarmingly, several strains of Enterobacteriaceae have developed resistance to antibiotics. Of particular concern is Carbapenem-resistant Enterobacteriaceae (CRE), which is resistant to carbapenems, often considered the drug of last resort.



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The rapid rise of CRE highlights the urgent need for new preventive strategies.

Enterobacteriaceae produce a polysaccharide known as the Enterobacterial Common Antigen (ECA), composed of repeating trisaccharide units. This polysaccharide helps protect the bacterial outer membrane, serving as a virulence factor that enables infection. These unique features make ECA an attractive target for vaccine development. My research focuses on synthesising this antigen to develop a universal vaccine against Enterobacteriaceae, with a particular emphasis on combating antimicrobial resistance (AMR).

AMR is a growing global health crisis, increasing healthcare costs, patient morbidity, and mortality rates. CRE represents one of the most dangerous examples of drug-resistant infections. My goal is to address this challenge by creating innovative, scalable, and cost-effective vaccine platforms. This work aligns with global health priorities, including the World Health Organisation's (WHO) call for equitable vaccine access, and offers solutions for both advanced healthcare systems and resource-limited settings.

C: Do you think it is possible to work on similar vaccines in Bangladesh?

M: I firmly believe that similar vaccine projects could be undertaken in Bangladesh. For instance, the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) has played a significant role in vaccine research and infectious disease control.

Moving into glycoconjugate or bacterial vaccine research is feasible, but several factors need to be considered: investment in synthetic chemistry and bioconjugation facilities—a major gap currently in Bangladesh—collaboration with international research groups for technological support, and support from the government and non-government organisations (NGOs) for funding and regulatory guidance.

C: When applying for your PhD at MSU, what were the things you highlighted in your application?

M: In 2021, I applied to several universities in the US but received an offer letter from only one institution. Due to personal reasons, I did not join at that time. The following year, I applied to eight universities and received multiple offers. Ultimately, I accepted the PhD offer from MSU, which came with full financial support, because of the university's

ranking and the fact that the research work of Prof. Dr Huang aligned closely with my interests.

After completing my master's in Organic Chemistry, I decided to pursue research in bio-related fields. Initially, I identified potential research areas and supervisors by thoroughly exploring the websites of American universities. I sent emails to professors outlining my research interests, experience, CV, and brief proposals. Several professors expressed interest and conducted discussions via Zoom meetings, providing guidance for my applications.

I then carefully prepared and submitted the required application documents according to each university's guidelines. Following the submissions, I was invited for online interviews by several universities. During these interviews, I discussed my research plans, interests, and future goals. After evaluation, I received offers from multiple universities.

In an SOP, it is essential to highlight academic achievements such as undergraduate performance, GPA, honours, awards, or scholarships. More importantly, research experience must be emphasised—detailing specific projects, technical skills, and any conference or symposium participation. Applicants should also mention professors whose research aligns with their interests and explain their motivation to contribute to global scientific progress while also making a meaningful impact in Bangladesh.

C: What advice would you give to aspiring PhD candidates from Bangladesh?

M: My advice is to remain persistent and dedicated while building a strong foundation in core subjects such as Mathematics, Physics, Chemistry, etc. Engage in research projects, internships, and scientific competitions early to gain real-world exposure and sharpen problem-solving skills.

For Chemistry students, go beyond memorisation—focus on understanding the principles behind reactions, developing hands-on laboratory expertise, and cultivating critical thinking. Stay curious, keep up with the latest scientific advancements, and strengthen your ability to communicate research clearly through writing and presentations. Most importantly, embrace both successes and setbacks as part of the journey, stay resilient, and never lose your passion for discovery.