INTERVIEW
WITH BEENA D B

Beena D B works as a Resource Person at the School of Arts and Sciences, Azim Premji University, Bengaluru. In this interview, she shares her experiences and insights on a life in science.

Tell us about your current role

I work as a Resource Person for the Biology laboratories at the School of Arts and Sciences, Azim Premji University, Bengaluru. In this role, I focus on managing the lab, standardising or modifying protocols and processes related to it, and teaching practicums for biology-related courses. I am also involved in guiding students in group projects.

What is a typical day at work like?

Work on the practicums for biology courses starts long before an academic term begins. Each faculty shares a list of concepts that they'd like to design lab exercises for. We discuss the concept and potential ideas for experiments. This is followed by a search for standardised lab protocols from online and offline resources. In the next round of discussions, we go through these protocols

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One of the ethics related to my role is to modify protocols and use cost-effective alternatives to conserve resources.

to finalise ones most appropriate for the course. I conduct a test-run for each protocol, assessing it using a variety of criteria. For e.g., does the protocol work, can it be completed within the time-frame allotted for practicums, does it lend itself to group work (usually with 2-3 students per group), are the materials required for it easily available, etc. If needed, it is at this stage that I tweak the protocol to meet specific needs. I also ensure that all the materials (~ chemicals and apparatus) required for the protocol are stocked and ready-to-use before the semester begins.

What are some rewards of your profession?

The opportunity to engage with both research and teaching. My role gives me the autonomy to design and demonstrate lab exercises on specific concepts relevant to the undergraduate biology curriculum at the university, which includes courses like Introduction to Biology, Molecular Biology, Genetics, Biochemistry, and Understanding Plants. While my expertise is in biotechnology, I keep learning new concepts and skills from other fields like ecology, animal behaviour etc. For e.g., I have learnt how to start and maintain cultures of *Planaria sp.*, Hydra, *C. elegans*, as well as observe the behaviour of ants and spiders from my colleagues at the University. Research doesn't always lead to an invention, it could also lead to an innovation that improves or modifies an invention. I also enjoy teaching students. For e.g., all student group projects include some basic lab exercises. Each group performs these techniques but gets results that vary with the specific nature of their projects. This variation not only fascinates students, but also allows us to observe something new and ask ourselves: "*Why does this happen?*".

Some important ethical aspects of your profession?

I strongly believe that 'everyone is born with the ability to change someone's life', and conserving resources is one of the ways in which I can do this. This is an ethic that guides my work in the lab. To the extent possible, I modify protocols to use less expensive alternatives. This means that we (the students and I) prepare our own solutions instead of purchasing expensive teaching kits with ready-made solutions. This not only reduces costs but also allows every student the opportunity to perform each technique themselves, and learn first-hand from the experience. For e.g., a single teaching kit for protein isolation and identification costs around Rs. 7000/- for five tests. This kit provides a single column, which means that only one test can be performed at a time. Since each test runs for more than four hours, a teaching kit can only be used for a demonstration of the technique to a large group of students. By playing around with reagents and trying out alternatives for the column, I managed to get the same result in three hours using a syringe to replace the column.

While my expertise is in biotechnology, I keep learning new concepts and skills from other fields like ecology and animal behaviour. For e.g., I have learnt how to observe the behaviour of spiders from my colleagues.

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The modified protocol not only allows us to perform 20 tests for ~ Rs. 1000/-, each student gets a chance to try this method out for themselves. The money we save in the process can be used to educate many more students.

Another ethic that I try to impress upon my students is the necessity to ensure order and cleanliness in the lab. This ethic, I believe, is essential not only for safety and successful experimental results, but also to help students grow up as integrated and productive members of society. I would like students to learn to see that it is their duty and responsibility to leave any space they use clean for others to use after them. This is one aspect of learning that goes beyond what we learn from textbooks to influence every aspect of our lives. However, inculcating this ethic poses a big challenge. Often, students do not see the mess they leave behind. A common excuse when they work in groups is that: "*this does not belong to me*". I don't let anyone leave unless the entire lab is clean again. This means that all the supplies have to be in order and each work-bench has to be clean and dry. I'd like to see each accessory given to students at the beginning of a lab session being put back in its place at the end of every session. Some students take to these practices quite easily, but most have to be given specific instructions.

When and why did you decide to pursue a career in science?

To be honest, the decision was made for me. Science was perceived to be a choice most suited to 'intelligent' (high-scoring) students. I had applied for admission to the commerce track at the pre-university level. However, the principal of the college changed this entry in my application form to science, saying: "*you are capable of doing science*". As it turned out, biology became my favourite subject.

My first experience of research was pushed by the need to work on an independent project to complete a compulsory requirement of the 2nd year of my post-graduation degree. I got the opportunity to work on a project involving gene transfer in plants at Indo American Hybrid Seeds, Bengaluru. This experience encouraged me to pursue research in biology.

Could you share your perspective on science education at the school level?

I would say that with advances in technology, methods used to teach science today are different from those used before. However, there is still scope for improvement. For e.g., there are still many under-qualified teachers with little or no motivation to teach, teachers being forced to teach disciplines other than their own, an unavailability of basic resources, as well as many other systemic issues. The most important of these problems could be resolved by offering better pre-service teacher education programmes as well as regular opportunities for in-service teachers to upgrade their skills as and when they need to.

What do you think teachers could do to encourage an interest in science?

Observation is fundamental to science, and each individual has her own way of observing, thinking and interpreting. Every observation paves the way to further study. So there are no positive or negative results in science. To develop this attitude, it may be important for both students and teachers to not be biased about the kind of result they expect, but continue thinking about the reasons for the results they observe. Even when it is likely that a student has made an error in an experiment, it is important to ask them why they've got a different result rather than telling them that their result is wrong. This encourages curiosity, and helps develop their reasoning skills and self-confidence. For e.g., amylase enzyme is known to work best at 37°C and become

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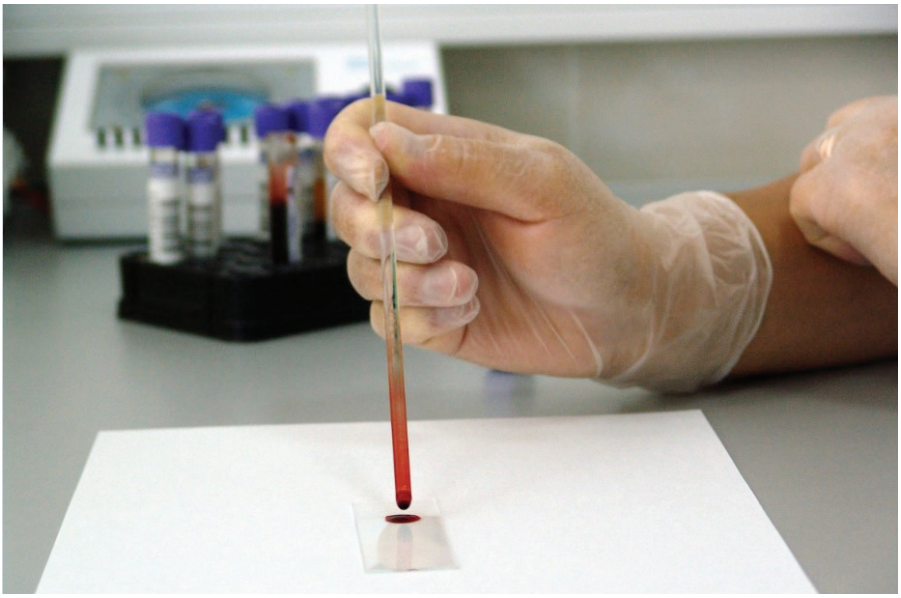
inactive at -20°C. Let us suppose that some students report that they have seen this enzyme being active even at -20°C. Ask these students to think of and discuss reasons for this observation. Then, encourage them to repeat the experiment to confirm the reason they'd arrived at their initial incorrect observation. This approach can be useful in helping students understand their mistakes and design a more accurate model of 'parameters that affect amylase activity at -20°C'. It may also be important to help students appreciate the fact that 'no change' is also a valid result, and 'nothing happens' can also be used to build a valid model.

Ask students how they would grow a plant inside a bottle. From where would the plant get nutrients and oxygen? Which part of the plant is likely to have meristematic tissues?



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When what we teach appears vague and irrelevant to students' lives, many of them lose interest in science. It is important to teach science at the school level keeping in mind what may hold a student's interest. It may help to encourage natural curiosity, connect science to everyday activity, design some fun and interesting hands-on experiments, and expose students to new concepts and opportunities. For e.g., ask students how they would grow a plant inside a bottle. From where would the plant get nutrients and oxygen? Which part of the plant is likely to have meristematic tissues? This is particularly helpful in teaching concepts that are so abstract that students cannot observe them with their own eyes. For e.g., students are introduced to the concept of chromosomes and DNA in grade VIII but it's difficult for them to imagine how DNA looks. This could be taught by doing a simple hands-on activity that involves the isolation of DNA from tissues using readily available household chemicals. This experience will allow students to not only enjoy 'seeing' DNA, but also help build their curiosity to learn more about it.