

## **Advice to PhD students**

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You would have chosen your PhD advisor on the basis of your research interest, after doing your homework beforehand. You would have known what different areas of research you are interested in when you join a PhD program. You would have read a lot. You would have identified your specific interests by knowing what you read the most about. You would have selected your lab on the basis of the problem, and not on the basis of the techniques.

### **General**

1. A PhD is not a picnic. You are committing 5-6 years of your life to being an apprentice. You have to be interested in what you are doing.
2. Students have a sense of timelessness - lose that fast. After your MSc, consider yourself an adult in the real world. Work for your stipend; set deadlines for yourself and meet them.
3. Develop confidence in yourself. You can do this by being systematic and using your common sense: first get the simple experiments and projects to work, and then only proceed to progressively more difficult experiments and projects and get them to work.
4. Self-confidence is of paramount importance. You must have faith in yourself and believe that you can learn anything that you need to, be it a technique or some theory. Anyone could do it, but be ready to put in the effort. New technologies are continuously evolving - you are going to have to be a life-long learner.
5. Read, read and read. You should know the literature in your area better than your mentor. You should be pointing out to him/her the papers they should be reading. Take ownership of your problem.
6. Remember it is your PhD. Your mentor already has one. Your mentor will not put in effort on your behalf if you don't put in sufficient effort yourself; your fellow students will not bother about you if you show insufficient interest and motivation in your work. Do not expect to be spoon-fed.
7. Your mentor is losing his/her neurons much more rapidly than you. What do you do? Make your brain compensate for his/her brain. You cannot allow yourself to be limited by your mentor's intellectual limitations.

8. Remember your designation. Research scholar. Who is a scholar? No, he is not someone who gets a scholarship. But someone who is knowledgeable and thoughtful and an expert in his field.
9. And always remember: *bolne se kya faida, karke dikhao.*

## **Beginnings**

1. Attitude is as important, if not more important than aptitude.
2. Do not expect your advisor to run after you. You have to go to her/him with your data, for her/his advice. You cannot afford to hesitate to do so. Often, having to articulate your problems, itself makes you understand things better.
3. Your advisor is also not a policeman. Be a good lab citizen. Be conscientious. Be honest.
4. You have started attending seminars. You realize that you understand only 5% of what is said. Do not be disheartened - this happens to everyone, and you will gradually understand more and more. Make all possible efforts to learn fast.
5. The internet gives you information; you need to assimilate it so that it becomes knowledge, i.e., information you can use. Learn from books as much as possible - they are more reliable.
6. Do not worry about making a fool of yourself. Ask questions. You will soon realize that many of your peers also don't know things, but are scared to ask.
7. Organize yourself. You should be able to cope with lab work and coursework if you do so. Try and do well in both, but there is no excuse for not doing well in at least one of the two areas.
8. As a beginner student, especially, you must read. Ask yourself: how many papers have you read in the past month? The past six months? Know that many papers have to be read and reread.
9. When you start using a new instrument, make sure you get to know it better than the student teaching you. Otherwise the quality of your data will never match that of your teacher.
10. Keep a proper lab notebook; successful students are those who keep a good lab notebook. Your lab notebook should be understandable to anyone who reads it. It should indicate that you are thinking about your experiments. Write down your thoughts on what has worked, and, as importantly, on what has not worked.
11. Be your own quality-control expert. Once you know that you can get data of a certain quality (at least as good as that of anyone else in your lab), do not be satisfied with

any of your experiments which do not match the standard that you have set for yourself. Repeat.

12. There are two kinds of experiments: Experiments that don't work, and experiments that are made to work. In other words, you will get nowhere without applying yourself and using your mind well.
13. Your experiment will have a mind of its own if you don't have a mind of your own. Focus.
14. Passion is not a substitute for hard work. Work bloody hard. Otherwise choose another career.
15. Rigor (not rigor mortis) is the key to success.
16. Establish a good work ethic for yourself. If you don't do it at the beginning, you never will. In which case, you might as well quit research now.

### **The Long Years**

1. Plan experiments as if you are planning a battle - don't let anything come in the way of your battle plan. Think of nothing else while executing it.
2. The most successful student is the one who perseveres in the face of difficulty. Not the brightest one.
3. Bright students very often don't put in the requisite effort. They sometimes use their intelligence to figure out reasons why not to do something. Often, a less bright student leaves the brighter one behind. There is nothing more frustrating to the student or the mentor. Be clever enough not to waste your intelligence.
4. Become familiar enough with the literature pertaining to your problem, so that you know what is state of the art, and what would constitute a completed project.
5. Learn to be logical in your thoughts. Read some papers just to learn the logic of how a case is presented. Writing well is a difficult skill, and you need to master it.
6. Similarly, learn to give talks in a manner that shows that you have organized your thoughts wisely. Target your audience appropriately.
7. Do not be sloppy in preparing any research presentation. If you are, then your audience might think you were also sloppy in doing your experiments.
8. You need to decide whether you want a good thesis or an average thesis. Surprisingly, the outcome is very much in your own hands.
9. Take every opportunity to train others in your lab. Do it for selfish reasons - when you teach, you test your knowledge.

10. Play games. Have fun. A PhD can be stressful. Sweat is the best antidote to stress. Sweat, not just in the lab, but also on the playing field.

## **Endings**

1. Do not unnecessarily prolong the completion of your PhD. Remember you will be paid much more as a postdoc for doing essentially the same thing.
2. Finish with the same enthusiasm that you began with. Only then will you find the whole experience rewarding.
3. Finishing the last 5% is the most difficult part of doing a project. You have overcome its difficulties, and your experiments all work now; but now is not the time to skip doing the extra experiments, which can often change the outcome from good to very good.
4. When you give your PhD seminar, remember that the idea is not to show people that you can collect data. You are not a technician. You have to convince the audience that you have learnt to think well. There is nothing worse than presenting a lot of data and little evidence of a functional brain.
5. You will have learnt your limitations as you complete your PhD. Only a small fraction of you are cut out to be faculty members. Ask yourself whether you are. Be honest with yourself.
6. You will have also learnt your strengths, and of possible alternative careers. Think carefully about industry, think of science communication, think of science administration, think of becoming a facility manager, think of teaching in a college. Think well. You might be making the most important decision of your life.
7. Choosing a postdoc: choose on the basis of your interests. Choose a problem that is important and will remain so for at least the next 10 years. It is important to go to a place where your postdoc peers are very good, both in the lab you choose, as well as in the department as a whole. They are your future competition; you need to know how your future competition works. Choose a mentor in a good university. The quality of postdocs can fall drastically when you go from a Tier 1 to a Tier 2 university, with exceptions in individual labs, of course.
8. You have to be happy in life. You have to make your life meaningful to yourself. Being good at what you do is an important pre-requisite for that.