



## All the world's a lab .... at first, the graduate student

Dear Willie

I was so pleased to hear from your mother that you have been accepted as a graduate student by Professor Julius at the University of Calpurnia. Although his group is quite modest — with only fifty people, I believe — you will find an interesting range of topics in molecular and cellular genetics. Of course, you will not be starting research for some time as you have courses to complete; try to get through these as quickly as you can. The essence of scientific research is to get to discover new things and not to spend too much time learning about what has already been done. You will be told that it is good discipline to learn a subject properly and you will have to read fat books called *The Molecular Biology of Something or Other*, but I have found that quite a lot of ignorance is useful in research, because once you think you know everything you won't attempt anything new. Your mentors will teach you how to do experimental research and they will insist that a logical argument is given for every step of the process, from formulating the experiment to interpreting the results. All of this is fine, but don't forget that you can also use your imagination and that a little dreaming is helpful as well.

Many years ago I invented what I call the OSPE experiment. I supposed that there was a mythical scientist working in the Oklahoma School of Poultry Engineering, who lacked all our knowledge and our powers of logical thought, but used his deficiency and ignorance to great effect by performing experiments that nobody else would think sensible and, in so doing, made major discoveries. Therefore, if you want to be a clever scientist you need to be the first to conduct such OSPE experiments, thereby pre-empting our OSPE friend and making sure that he does not receive the acclaim and make fools of the rest of us.

In my time, I have carried out several OSPE experiments, mostly in the dead of night. One of these was to plate out tobacco mosaic virus on *Chlorella* to see whether it would make plaques. The rationale (if it can be called that) is typically OSPEsque; tobacco mosaic virus grows on plants, plants are green, therefore the virus might grow on a green alga, which is, after all, a kind of plant. It did not. Come to think of it, none of my other OSPE experiments worked either. But the beauty is that if it works, you are famous for having a penetrating insight, and if it doesn't, you know that nobody else can be famous either. As it happens, my *Chlorella* OSPE experiment served me well some years later when I had to review a grant based on a weak claim that some growth of tobacco mosaic virus had occasionally been detected in *Chlorella* cultures — the proposer argued with OSPE clarity that the virus needed to grow in chloroplasts.

However, I ramble. Once you have finished your course work you will start on your own project. Alas, you may find it to be a small part of somebody else's research and there may even be several of you working on different aspects of the same problem. Your first experiment is likely to be a mess even if you have followed each step of the protocol designed by your supervisor. Your gels will not run properly and your autoradiographs will be either totally blank or totally black; but don't worry too much, this has happened to everybody and acquiring experimental skills is part of the craft of research.

With practice, you will gain confidence because you will have learned to discriminate between the regularities of an experiment and the vagaries and contamination of the outside world. One of my students once came to me excitedly carrying a Petri dish covered with bright yellow colonies. When I told him to autoclave it immediately, he was most upset and said that I was preventing him from making a discovery like Fleming's discovery of penicillin. I could bet him ten billion dollars that this was contamination and without interest simply because this happens all the time, whereas Fleming's experience is very rare, and I urged him to get back to his research and to try to repeat Watson and Crick's discovery.

You will find that every experiment contains one point that does not accord with the rest. Do not become over impressed by this anomaly. It is usually not a new natural phenomenon. More probably, you either forgot to do something or used a dirty tube, that frequent intruder from the entropic universe. Above all, do not mention it to your supervisor as he might take off into orbit, seeing in it the glimmerings of future fame and making you an unwitting collaborator in this fantasy.

After a while you will find that nobody knows as much about the subject of your research as you do; you will have become the world's expert in it. Your professor will have too much to do to pay attention to such trivia as the work in his laboratory, and he will certainly have no time to keep up with the subject as a whole, only knowing what he hears at meetings or what other people tell him, most of the time over the telephone. You will learn most from the other students, many of whom will become friends for life. Students may be the lowest of the low in a laboratory, but I have to warn you that, sadly, this may be the only time in your career when you can enjoy research as an individual scientist.

Good luck

Uncle Syd