

Magazine

My word

How to ask questions (in 10 easy steps)

Mark M. Davis

In learning to navigate a particular field of science, students are continually fed large chunks of information and asked to solve problems, but little or no time is spent learning how to ask questions, at least in any formal way. This may just be a pedagogical oversight, but I suspect it reflects the fact that questioning is an inherently subversive activity and deeply resented in most societies, especially by the elites as they have the most to lose if things get out of hand. In any event, I have compiled my own idiosyncratic list of rules to live by and hope others may join in.

1. "Don't follow leaders (watch the parking meters)" – Bob Dylan

The 'leaders' in any given field have their own agendas and blindspots. There are also invariably crowds of people following them and the competition is fierce. At the same time you don't have all day to get going on developing alternatives.

2. Don't follow the crowd.

While most people and sheep are more comfortable in herds, in science it is very difficult to do anything interesting when you're trampling over the same ground as everyone else. Best to formulate a unique question and/or approach.

3. Don't ask 'What's the next step?', ask 'What's missing from this picture?'

The next step is already being done by the leaders and their followers, so unless things have ground to a halt over some technicality (as they frequently do) you're better off working on something completely different.

4. "To make important discoveries, ask important questions" – Peter Medawar

This means doing your homework and really finding holes in dogma or in The Big Picture that need attention.

5. "Leave your stepping stones behind, you'd better use your sense. Forget what you have gathered from coincidence." – Bob Dylan

Generals fight the last war, scientists recycle the last 'big' experiment. When I was a student, the cloning of antibody genes answered many of the outstanding questions in that field, leading some to think that cloning any gene would answer all the questions associated with that protein.

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When the first MHC protein was crystallized and revealed at a glance what 'antigen presentation' and 'MHC restricted recognition' was all about, there arose a similar belief that X-ray crystal structures would reveal all. Neither of these conclusions held up under scrutiny at the time and they are patently ludicrous in retrospect.

6. Expect opposition to any really important question if it falls outside of 'conventional wisdom'.

"Are we lost, Dad, I arsked sweetly. Shut up he explained." – Ring Lardner Jr

It seems to be human nature to resent the questioning of fundamental assumptions. Thus you must expect trouble, even in science, if you're on to something really important. The good news is that a really convincing experiment or three can turn the tide, whereas a half-baked one will have the

opposite effect. Again careful study and experimental design are key.

7. Know your tools, know yourself.

Especially now in the era of 'kits' for all occasions, it is tempting to not really know the basis of many procedures or technical areas. While no one should try to master everything, it is very important to know the technical nuts and bolts (and the ancient literature) of a few techniques that are central to your interests. Thus when the kit fails or you want to go beyond it, you can at least try some things. (The later part of the title is self-explanatory).

8. Failure is educational.

Getting acquainted with an area of experimental science can be likened to beating your head against the wall in a darkened room — one emerges bruised but reasonably knowledgeable about the rough features of the wall. In science our only sensory tool is experimentation and 'failed' experiments, if executed properly, provide insight into what is productive for a particular 'wall'. Eventually one gets an 'intuition' as to which approaches are likely to be productive and which are not.

9. Don't subscribe to 'the technique-of-the-month club'.

Use what is appropriate to solve a problem that you care about, whether high or low tech, brute force, or whatever.

10. 'The art of the possible'

Science, as well as many other things, makes progress based on what is possible versus what might happen in a dream world. If available or long-term approaches cannot answer at least one question definitively in the area of interest, don't waste your time.

Address: Howard Hughes Medical Institute and, Department of Microbiology and Immunology, Stanford University School of Medicine, Stanford, California 94305, USA, but presently visiting the John Radcliffe Hospital Institute for Molecular Medicine in Oxford, UK.