Freedom to fail

My teaching life at the University of Edinburgh is divided about 50/50 between science and medicine. The curricula to be taught are of course different. So is the way that most of us teach, something I have long accepted without ever really thinking about why. Only very recently, thanks to an almost chance turn in a conversation, have I noticed the deep underlying reason that our teaching styles are so different when we are in front of scientists or medics. The reason is something so huge it was, in an odd way, too large to see clearly through the bustle of day-to-day lecture planning.

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The penny dropped with me during a recent chat with my colleague Karen Fairhurst, Director of Year 4 of the medical course. We had met for over coffee at *1505*, the cafe at Edinburgh's famous Surgeon's Hall, to discuss issues around planned changes to medical teaching (I look after years 1 and 2). At one point, the conversation turned to our need to prepare medical students for their Honours year, in which they take a year out from the main medical course to study another subject at Honours level, usually choosing to read a medical science such as pharmacology, anatomy, physiology etc. Many of our most able students students have been doing this for years but, from next year, all Edinburgh medical students will study for Honours. We were therefore focusing on making sure that even the least strong students of the cohort would make the transition smoothly. Given the very strong academic strength of people admitted to study medicine, that may seem a strange sentence to write, but the medical students enter Honours with two main disadvantages compared to their BSc scientist colleagues. One challenge is their level of scientific knowledge – the BSc students will have been studying science for three years before entering their honours year,

while the medical students will have been spending some of their time studying medically relevant science but spending a lot of their time on clinical and sociological topics. And they will have done this for only two years before they enter Honours, not the scientists' three. They therefore know less about science than the BSc cohort. The other challenge, harder to frame, is about attitude. It was while discussing this attitudinal difference with Karen that I suddenly saw (I think) the thing that makes attitudes to learning so different in the two 'tribes'. It's all about failure.

Medical courses train students to be professional doctors; they will one day have patients' lives in their hands and it is critical that they give to every patient the best possible care. A very large part of medical training therefore focuses on safety: some of our exams even include the word in their titles, such as *Safety In Prescribing*. Having a doctor or a surgeon who does an excellent job on half his patients and completely messes up the care of the other half would not be good at all. Training therefore emphasizes reliability and the avoidance of failure, and medical students become very averse to making mistakes. Sometimes this is made explicit but for much of the time it is implicit, and permeates the whole structure of training and assessment. Reliable competence to do the right, evidence-based thing well is prized. Acting on whims, hunches and crazy ideas is absolutely discouraged because, if medics did that, real people would get hurt. Obviously, for any of us who ever need the help of a medical professional, this is a Good Thing.

Research science, or "discovery science" as it seems to have been renamed recently, is different. Doing well and reliably exactly what has been done before by many people is, in general, not going to result in the discovery of anything new. Of course there is a need for a scientist to perform technical skills with reliability, to use a microscope or a telescope, for example, or to use a computer to do some statistical analysis, but this is not enough. If a scientist is going to discover something for the first time, she will have to include something new in her approach either to the experiment or to the analysis. Doing something new usually involves making guesses. Sure, we may dress that up in fancy language about 'formulating a hypothesis based on possible indicative patterns in existing data' or some such pompous phrase – especially in a grant application – but this boils down to intelligent guessing. That usually means guessing about the nature of some natural mechanism (a physiological response system, the cause of a disease etc) and also some degree of guessing about which kinds of experiment will yield the clearest evidence. Most of our hunches are wrong, most of the time. And that's fine. Our scientist can keep 'failing' time and time again and it does not matter – her occasional success can be a discovery valuable enough to make all of the

failures completely worthwhile. What matters is that the scientist has the imagination to think of questions that have never been asked before, and of elegant ways of answering them. Guessing and failing is part of the discovery process and carries no disgrace. What must be avoided at all costs is an imagination so conservative that it only takes little steps into the already-known, for that way no worthwhile discoveries will be made at all.

When we are training scientists, therefore, we will (if we are doing our jobs well) encourage imaginative thinking; introducing a problem and letting a white-board fill up with crazy ideas from excited students is very much part of the atmosphere we create. Of course this is followed by a calmer reflection that evaluates which of these ideas should be given priority, but this evaluation balances risk and gain: an approach with a high risk of failure but with the potential for a really important discovery can easily trump a low-risk experiment that promises at most only a trivial advance. All the way through scientific training, from Fresher to PhD, students will (or should!) be encouraged to use their imaginations and not to fear making a mistake. Even around the lab, the cartoons pinned to the wall celebrate our acceptance of things not working out. One of my favourites, torn out of a biochemical catalogue, features a scientist peering into a flask glumly and asking his colleague “What’s the opposite of ‘Eureka’?”. We scientists have all been there, from time to time. I have a season-ticket.

This, then, is the deep difference between the learning environments of the different kinds of student, the BSc kind being encouraged to imagine, to take risks, and to accept failures simply as learning opportunities, and the MBChB kind, in their medical course itself, being encouraged to be safe, reliable, risk-averse and to regard failures as potentially career-ending (and life-ending, for a patient).

No wonder, when the two cultures mix at the start of their Honours year, it takes a while for everyone to adjust. Don’t get me wrong – the medical students come with a rich variety of skills and experience, for example of teamwork and communication, that can benefit the scientists and each community can learn from the other. But I think that we could help our medics more by designing activities that introduce them, in a dramatic way, to the very different way that risk and failure are viewed in science, not as terrible things to be avoided but as lessons on the path to discovery. In short, to succeed, they should feel free to fail.

Jamie Davies
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