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ESSAY

The importance of character development in scientific research

Martin A. Schwartz[1,*] and Alpha S. Yap[2]

One of the fundamental pleasures of our jobs as professors running university research labs is to see young people come, not quite knowing who they are, and grow into scientists. They acquire knowledge and skills; sure, you can't do without those. But that has little to do with the small thrill we get the first time they see something we missed, bring a new idea, tell us why we're wrong or take charge of their projects. And it has nothing to do with the bigger thrill we get when they see that science is the life path for them, or that it isn't but something else is. To witness and perhaps even facilitate this growth is a privilege as well as pleasure.

We live in an era that has professionalized science training. Biomedical researchers in the US are called the 'NIH workforce'; in Australia we justify our work by its impact on our future 'scientific workforce'. Young scientists are called trainees and encouraged to sign up for career development workshops, where people like us give PowerPoint presentations on how to write grants, give job talks and build careers. Most of this is well meaning, but in attending to the mechanics of careerism, it seems to us that we have forgotten some important things.

One is that the job description for research scientist reads: 'Use existing tools or invent new tools to discover something new. When possible, this work should alter perspectives in a wider field and have unforeseen repercussions'. There is no instruction manual for this process, and the people who do it are not 'the workforce'.

Another is that science started as a branch of philosophy (fossilized as the Ph in Ph.D.). That makes it one of the liberal arts. The goal of a liberal education is to develop the whole person. In the Humanities it usually means reading great books or encountering great art and doing one's own writing, discussion, debate or art. But these are only the outer shell. The core process involves a kind of mirroring, recognizing and exploring one's inner world in the context of messages from those who came before. Literature and art enrich because they offer a path for growth and self-discovery. The goal is a productive, informed, connected, happy life.

By contrast, training to be a member of the workforce principally involves mastering a body of knowledge and techniques. The trainee learns to cite the literature, go into the laboratory to properly execute experimental methods, interpret their results and design the next round of experiments. The process is objective, outward facing. Beyond the logic of deduction and inference, there is little concern for one's inner processes.

It seems to us that this view does an injustice to scientific education. Perhaps some recognition of a different kind of learning might make us all better students and better mentors. A small personal example: M.A.S. is not a naturally patient person (something that A.S.Y. finds surprising). Depending on the circumstances, you might even catch him thinking that patience is an over-rated virtue. As a graduate student, he could ask a scientific question, propose an experiment, imagine multiple outcomes and see how each might lead to a fuller story... and then, in his hurry, mess up the experiment so that he got no answer at all. He needed to develop the discipline to pay proper attention to detail before he could get at least a reasonable fraction of interpretable experiments. For him, that meant recognizing and quieting the internal voice that was greedy for answers and success, and learning to take pleasure in doing each step well. That's a life lesson as well as a science lesson.

Some might argue that personal growth is a fine thing, but not enough to justify the investment that goes to support educating a scientist. Rather, we'd argue that our current focus on professionalization runs the risk of homogenizing science, to its detriment. It fails to recognize that we all come to science with different talents and predilections. Am I a mainly visual thinker? Analytical? Mathematical? This individuality is important: every field benefits from people who approach problems from different directions, indeed, who ask different questions from the start. In a time that acknowledges the virtue of working across disciplines, it is first necessary to understand our talents, choosing a problem and approach that fits them. Recognizing my strengths and weakness, exploiting the former and correcting the latter is another. But how do you find your talent?

Science is done by whole people. There are many things that machine learning can do immeasurably faster than humans – once the problem is chosen. Choice of problem to solve, approach, technique, interpretation… these all reflect our predilections and perspectives, fears and ambitions. Our sense of what's beautiful is central, perhaps the surest guide to what we work on and how we work on it. Great work requires digging deep into reserves of imagination and commitment. Learning those things about ourselves is as much a part of our growth as learning the methods and materials. Oddly enough, we do it through observation: how do we react to new information, advice or criticism, expected or unexpected results, complex or contradictory results? (We can also gain insights by observing how our colleagues and mentors work.) These internal observations apply to every step of the process. Does it feel most satisfying to open a door to a new area or to solidify the field by filling in gaps to complete the picture? How do we balance the drives that come from curiosity versus ambition? How do we do important work without succumbing to the perils of ego? How do we fulfill what we need to build a professional career without forgetting why we got chose this path in the first place? How we feel doing the work is also a part of the learning process that guides our development. The scientific method just in the opposite direction.

There are talented scientists who reach an acceptable level early on and stay there, applying comfortable approaches perhaps to a new problem but never growing beyond that. And there are scientists whose work grows steadily better, broader in scope and deeper in insights over the span of a career. Growing as a scientist can be as inexhaustible as the scientific fields we seek to understand. Give it a try and see where it takes you.

[1]Yale Cardiovascular Research Center, Departments of Internal Medicine (Cardiovascular Medicine), Cell Biology and Biomedical Engineering, 300 George St., New Haven, CT 06511, USA. [2]Institute for Molecular Bioscience, The University of Queensland, St. Lucia, Queensland 4072, Australia.

*Author for correspondence (martin.schwartz@yale.edu)