

Succeeding in Science: Some Rules of Thumb *by J.D. Watson*

Adapted from 2 March 1993 talk at Cold Spring Harbor Laboratory during a symposium honoring the 40th anniversary of the Watson/Crick discovery of the DNA double helix.

To have success in science, you need some luck. Without it, I would never have become interested in genetics. I was 17, almost 3 years into college, and after a summer in the North Woods, I came back to the University of Chicago and spotted the tiny book *What is Life* by the theoretical physicist Erwin Schrödinger. In that little gem, Schrödinger said the essence of life was the gene. Up until then, I was interested in birds. But then I thought, well, if the gene is the essence of life, I want to know more about it. And that was fateful because otherwise, I would have spent my life studying birds and no one would have heard of me.

Instead, I became absorbed with one of the defining questions of the 20th century: What was the gene? And then I got a second break – I got turned down for graduate school by Caltech. Why would they be interested in someone whose principal college work was in birds? So I went to Indiana instead, and my professor was none other than Salva Luria. His belief in me gave my early interest in genetics a big boost. And unlike Pasadena, Bloomington provided girls and basketball.

But to succeed in science, you need a lot more than luck. And it's not enough to be smart – lots of people are very bright and get nowhere in life. In my view, you have to combine intelligence with a willingness not to follow conventions when they block your path forward. For me, that meant giving up Luria's way of doing things, even before I had finished my Ph.D., and searching for my own way. And it meant doing lots of other things a little differently than most people. And these have become my rules for success.

Learn from the winners. Take the first rule: To succeed in science, you have to avoid dumb people (here I was still following Luria's example). Now, that might sound inexcusably flip, but the fact is that you must always turn to people who are brighter than yourself. It's like playing any game – tag or tennis. Even as a child, I never liked to play tag with anyone who was as bad as I was. If you win, it gives you no pleasure. And in the game of science – or life – the highest goal isn't simply to win, it's to win at something really difficult. Put another way, it's to go somewhere beyond your ability and come out on top.

Take risks. Which brings me to my second rule: To make a huge success, a scientist has to be prepared to get into deep trouble. Sometime or another, people will tell you that you're not ready to do something. Take my early career. The zoologist Paul Weiss, from whom I had learned about invertebrates, had a good brain but he was lacking in vision. That didn't help me, because he was in charge of my fellowship in Europe. He took away my stipend when I decided to move from Copenhagen to Cambridge. In his mind, I was not prepared for crystallography as a biologist. He was right, of course. But the only way I was going to make the next breakthrough in genetics was through x-ray diffraction analysis, even though most of its practitioners thought DNA to be an unrealistic goal. If you are going to make a big jump in science, you will very likely be unqualified to succeed by definition. The truth, however, won't save you from criticism. Your very willingness to take on a very big goal will offend some people who will think that you are too big for your britches and crazy to boot.

Now this act of ignoring the assessments of those who seem to have the power to control your fate can be traumatic. Often it entails rejecting your mentor, your lab head, or your department chairman. But to get where you want to go, you even have to be prepared to

give up your second parents. You've probably already given up your real parents – that was a hard one – and now you have to give up your scientific heroes. This can be more than just personally upsetting. You can, if you're not careful, develop deep anxieties.

Have a fallback. And that brings me to my third rule: Be sure you always have someone up your sleeve who will save you when you find yourself in deep s—.

Francis Crick and I were both in trouble at various times in our careers, but that never really stopped us, because we always found someone who would save us. In Cambridge, both Max Perutz and John Kendrew stood behind us. John, for example, promised to let me live for free in his Tennis Court Road house after Paul Weiss had cut off my stipend. But I think of many bright scientists (our DNA hunting competitor, Rosalind Franklin, was one) who, when they found themselves in trouble, had no one who would or could save them.

Luria first saved me when, as a mere graduate student, I outraged a prominent professor, Ralf Cleland, who wanted to make me take histology. I considered that course a waste of my time. And I said just that with Cleland in the room as part of my thesis committee. Luria was, of course, very upset with my bluntness. But he didn't join forces with Cleland and force me to waste my time doing silly drawings when I could be having fun with phages. So I went out into the world ignorant of histology.

Have fun and stay connected. Which brings up my fourth rule: Never do anything that bores you. My experience in science is that someone is always telling you to do things that leave you flat. Bad idea. I'm not good enough to do well something I dislike. In fact, I find it hard enough to do well something that I like. And that brings up another reason for having people around who care about you – you have to have people you can go to for intellectual help. Francis frequently went for assistance to his more than bright philosopher/mathematician friend, George Kreisel, who then was not noted for any respect for conventions. He seemed to have no close friends except Francis. But Francis frequently turned to him when the mathematics got difficult.

Constantly exposing your ideas to informed criticism is very important, and I would venture to say that one reason both of our chief competitors failed to reach the Double Helix before us was that each was effectively very isolated. Rosalind Franklin found small talk awkward and until it was too late did not realize how much good advice Francis would willingly have given her. Had she started to talk to him, Francis would have led her to use her facts to find the base pairs. And then there's Linus Pauling. Linus' fame had gotten himself into a position where everyone was afraid to disagree with him. The only person he could freely talk to was his wife, who reinforced his ego, which isn't what you need in this life.

While it is tempting as a young person to dream about going into science because you think ideas will let you escape dealing with people, once you are a scientist you must change your attitude. It can be very comfortable, when you are in high school, to say to yourself: Why should I be with those kids that are commonly awful? But here's the truth – it's very hard to succeed in science if you don't want to be with other scientists – you have to go to key meetings where you may spot key facts that would have escaped you. And you have to chat with your competitors, even if you find them objectionable. I did that a lot. I knew almost everyone I needed to know no matter whether they exuded goodness or badness. And it paid off.

So my final rule is: If you can't stand to be with your real peers, get out of science.