Some scientists are truly extraordinary mentors. Take, for example, professor Charlotta Turner, a chemist at Lund University in Sweden, who in 2014 received a text from her Ph.D. student telling her that he might not finish his thesis in time. When she learned that her student, Firas Jumaah, was in fact hiding with his family in an Iraqi factory as armed members of the Islamic State group roamed the streets outside, she leapt into action and worked with the university’s security chair to arrange a daring rescue operation.

But for every heroic mentor, there are just as many horror stories about bad ones. Unfortunately, most mentors don’t always have the tools or training to provide the proper support to their mentees (and, unfortunately, some just don’t care).

One way to address this issue is by learning the science behind great mentoring, as Jay and colleagues discussed on a panel recently. Instead of relying solely on personal anecdotes or their own gut intuitions, the panelists described theories and research on how to manage the most important relationship in science: the one between a mentor and mentee. Here, we share three lessons from that event.

Becoming a better mentor should be a central concern for new faculty members starting their own labs, but also for graduate students and postdocs mentoring research assistants—and even for more senior faculty members who are continually striving to improve their mentoring. Our capacity for growth as mentors is a lifelong journey.
Lesson No. 1: Take cues from research on parent-child relationships

A career in science is often stressful. A 2018 study found “strikingly high rates of anxiety and depression” among graduate students. Yet, the authors write, the “data indicate that strong, supportive and positive mentoring relationships between graduate students and their [principal investigator]/advisors correlate significantly with less anxiety and depression.”

So, how can students and mentors build a relationship that will buffer rather than contribute to those stresses? According to Geoff MacDonald, a professor at the University of Toronto in Canada, research on attachment and parent-child relationships can offer some important clues. This research points to three related but distinct approaches: authoritativeness, which is defined by both high expectations and high attentiveness; offering a safe haven in times of distress; and fostering a secure base to promote exploration.

Authoritative parenting—which tends to produce positive outcomes for children—is both firm and supportive, with parents maintaining boundaries while being reliably available to the child when needed. Scientists can cultivate similar relationships with mentees by being engaged and maintaining high standards while providing consistent support and encouragement. By setting challenging yet achievable goals, mentors signal their confidence in their students’ potential. Great mentors go a step further by providing the necessary guidance and support to help their mentees succeed.

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Students also need someone they can turn to when they are struggling with the challenges and setbacks that are an inevitable aspect of science. This may be especially true for underrepresented minorities, first-generation students, and women. Mentors should ask themselves whether they provide a safe haven for their students. Are they comfortable coming to you when they have a problem or encounter an obstacle? Do you listen and provide support?

Finally, research suggests that providing a secure base is critical for promoting exploration, risk-taking, and discovery—all critical elements of successful science. Mentors need to take an interest in their students’ goals and encourage them to accept challenges and take risks, as well as provide guidance on how to overcome obstacles. But, much like parenting, it is also critical that mentors accept and encourage students’ sense of independence by, for example, letting them take the lead.
on projects or sending them to a conference on their own when the time is right. Mentors should be constantly creating opportunities that allow trainees to become more independent—not micromanaging them or refusing to let them go.

Lesson No. 2: Convey belief in students' abilities and potential

Students watch mentors very carefully—not only because they are looking for scientific role models, but also because they are trying to understand what their mentors think about them and others. If students think their professors believe that only a few special people have intellectual potential, it can harm their sense of belonging and their performance, as London Business School professor Aneeta Rattan discussed.

Women and underrepresented minority scientists are particularly impacted. For instance, one recent study found that science, technology, engineering, and math professors who believe that ability and talent are malleable have smaller racial achievement gaps in their classes than professors who believe that ability and talent are fixed. Another study found that Ph.D. students are more attracted to scientific and technology careers when their professors believe that everyone has the potential for success, and women and minorities may benefit the most from this belief.

Mentors and institutions who want to promote a sense of diversity and inclusion on campus should think hard about the types of values and beliefs they communicate to students, both verbally and nonverbally. To make their beliefs explicit, mentors should share them openly—particularly if it is the belief that everyone has the potential for success. They should also act on that belief: If everyone in their lab has potential, that could mean equalizing the level of time and effort that students receive, rather than pitting them against one another in an academic version of The Hunger Games. It could also mean planning out student goals, explaining what they need to do to get there, and providing these guidelines and support early. Throughout this process, it will help if the mentor expresses confidence that their student has the potential to achieve these high standards.

Lesson No. 3: Help your mentees embrace failure as growth

From rejected papers to unfunded grants to unsuccessful job applications, failure is a natural part of life for seasoned academics. But mentors often forget what this feels like for people who are new to the field, many of whom have excelled consistently at previous stages of their education. To make matters worse, these days it is easier than ever to see success stories in science—people are posting publications, announcing awards, and celebrating new grants and positions on social media. But just like celebrities who post airbrushed selfies on Instagram, it masks the true pathway people take in science. That's why mentors need to remind students that critical feedback and failure are a normal part of the process.
One way to do this is to cultivate a **growth mindset** among your trainees, as both Jay and Anne Wilson, a professor at Wilfrid Laurier University in Ontario, Canada, proposed. Praise hard work, effort, and improvement, and reward things mentees can control rather than outcomes that hinge more on outside forces and chance. For example, mentors can praise improvements in the scientific method even if the results are not promising, or reward the submission of papers to journals even if they are ultimately rejected. By focusing on growth—and the inevitable process of failure—we can normalize how science works, which can make the entire field seem far less daunting. It is also critical to talk about failure if we ever hope to learn from our mistakes.

Another great example of how scientists can openly acknowledge and discuss failures and setbacks is New York University’s weekly discussion series “Growing up in Science,” hosted by professors Wei Ji Ma and Cristina Alberini. Guests—including Jay—send around their official bio along with an unofficial bio that unveils their honest, winding path, illustrating the challenges and struggles that each of us face. It is incredibly refreshing to learn that eminent colleagues faced the same series of setbacks and failures that trainees are grappling with for the first time.

This thirst for honesty may be why **failure CVs**—in which people list all the rejections and setbacks they have experienced—have gone viral. As Princeton University professor Johannes Haushofer wrote at the top of his, “Most of what I try fails, but these failures are often invisible, while the
successes are visible. I have noticed that this sometimes gives others the impression that most things work out for me. As a result, they are more likely to attribute their own failures to themselves, rather than the fact that the world is stochastic, applications are crapshoots, and selection committees and referees have bad days.”

Stories of failure are often written by people who have already had success and feel safe to share their setbacks, but this doesn’t need to be the case. By making this process transparent, we can help mentees understand that failure is a natural part of science.

There are no simple answers or formulas to address the countless challenges of mentoring. Any model requires constant evolution and tailored feedback to support the specific needs and background of each trainee—even if that requires sending armed mercenaries to extract them from a war zone. But it’s well worth the investment. When mentors help their trainees flourish, it not only manifests in a more productive scientific environment; it is also the most rewarding aspect of the job.

Send your thoughts, questions, and suggestions for future column topics to letterstoyoungscientists@aaas.org and engage with us on Twitter.

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