LETTERS TO YOUNG SCIENTISTS

How to be an ethical scientist

By William A. Cunningham, Jay J. Van Bavel , Leah H. Somerville | Aug. 5, 2020 , 10:45 AM

True discovery takes time, has many stops and starts, and is rarely neat and tidy. For example, news that the Higgs boson was finally observed in 2012 came 48 years after its original proposal by Peter Higgs. The slow pace of science helps ensure that research is done correctly, but it can come into conflict with the incentive structure of academic progress, as publications—the key marker of productivity in many disciplines—depend on research findings. Even Higgs recognized this problem with the modern academic system: "Today I wouldn't get an academic job. It's as simple as that. I don't think I would be regarded as productive enough."

It's easy to forget about the "long view" when there is constant pressure to produce. So, in this column, we're going to focus on the type of long-term thinking that advances science. For example, are you going to cut corners to get ahead, or take a slow, methodical approach? What will you do if your experiment doesn't turn out as expected? Without reflecting on these deeper issues, we can get sucked into the daily goals necessary for success while failing to see the long-term implications of our actions.

Thinking carefully about these issues will not only impact your own career outcomes, but it can also impact others. Your own decisions and actions affect those around you, including your labmates, your collaborators, and your academic advisers. Our goal is to help you avoid pitfalls and find an approach that will allow you to succeed without impairing the broader goals of science.

Be open to being wrong

Science often advances through accidental (but replicable) findings. The logic is simple: If studies always came out exactly as you anticipated, then nothing new would ever be learned. Our previous theories of the world would be just as good as they ever were. This is why scientific discovery is often most profound when you stumble on something entirely new. Isaac Asimov put it best when he said, "The most exciting phrase to hear in science, the one that heralds new discoveries, is not 'Eureka!' but 'That's funny … .'"

When you stumble across an unexpected finding, your first reaction might be to feel defensive. It is possible you made a mistake, and if that's the case it's important to figure that out. But it is also possible that it's a real finding—and as you move forward with your career it's important to be willing to revise your thinking. Indeed, many of the greatest discoveries in science, from the discovery of penicillin to Viagra, came as complete surprises. In another case, physicist Stephen Hawking made his greatest scientific discovery when he proved himself wrong in a debate about black holes. Rather than being seen as a disgrace, these scientists were applauded for their work.

When designing studies, consider the possibility that your hypotheses are wrong. Will a null or contradictory result mean your findings are unpublishable? Or will they still be interesting? Can you design a study to test alternative hypotheses? If you take that approach and one hypothesis isn't supported by your findings, you leave open the possibility of discovering something interesting. For example, Jay recently started a project with his lab and he warned his group members that "someone is going to hate us no matter how these data come out." That might sound horrifying, but it meant that the research team was testing an important, contentious question that was going to be interesting regardless of the findings.

The previous Letter to Young Scientists

The team-written Letters to Young Scientists column offers training and career advice from within academia.

What I've learned about being a Black scientist

Read more Letters to Young Scientists

Don't overstate your findings

Most journals will be much more interested in a paper that has made a giant discovery or overturned conventional wisdom. If you can pull that off honestly, that is a great way to build prestige and may even help you secure a job or grant. But there are risks that come with exaggerating your research. The Higgs boson was a classic case of this: It became known as "the God particle" after the term was coined in a famous book. But most physicists hated the term. Even Higgs said, "It sends out all the wrong messages. It overstates the case. It makes us look arrogant. It's rubbish."

Although it might be tempting to proclaim your own God particle, we strongly advise against overstating your results. If you become fixated on making a groundbreaking discovery, it could lead you to overanalyze your data, ignore inconvenient findings, or neglect alternative explanations. You'll mislead readers in the process—and you may even mislead yourself as you try to defend against every attack on your pet explanation for the data.

If you fail to present an unbiased interpretation and you land a big publication, you may benefit in the short term. But in the long term, you may open yourself up to greater scrutiny. In fact, high-impact journals have more retractions than lower impact journals. Facing a retraction can be devastating for early career researchers. It is far better to remember that "extraordinary claims require extraordinary evidence." If you truly want to make a breakthrough, ensure you have the data to back it up. Otherwise, aim to acknowledge limitations and boundary conditions of your work. You are more likely to build trust in your work, and it will allow you to establish a reputation as an honest and effective scientist.

Solicit critical feedback

When submitting your paper for publication, knowing who to recommend as reviewers is an important part of the process. It may be tempting to suggest members of your professional social network. But think twice. Not only is it unethical to suggest someone with a clear conflict of interest—you may fail to get the critical feedback that you need to improve the paper.

Each of us has had the experience where a tough but thorough reviewer has forced us to reconsider parts of our research, and eventually produce a publication that was more impactful. For example, Leah and her Ph.D. student received a tough set of reviews on a manuscript, along with a rejection from the journal. After the initial disappointment wore off, they rewrote the paper, incorporating the (seemingly endless) constructive feedback provided in the reviews. The improvements reshaped the paper so dramatically that they decided to submit it to a higher impact journal, where it was accepted.

In fact, research has shown papers that have been rejected at least once are cited more than papers that were accepted on first submission. So, when you're thinking about reviewers, ask yourself who is qualified to give it a thoughtful review. Your work will be far better for receiving their critical feedback.

Be transparent

A final way you can build trust in your work is to be transparent with other scientists. Depending on norms in your field, you may want to preregister your hypotheses in advance of starting your work. Once your work is done, you can also share your papers, materials, data, and analysis code—for instance, using platforms such as Open Science Framework and GitHub. Naturally, it takes additional time and energy that you could be dedicating to another project. But scientists who go through the trouble to make their research open access find that their work is more highly cited. Transparency signals to others that you are committed to the scientific process and allows science to move forward faster than ever.

The big picture

These are, of course, just a few steps you can take toward shoring up your own research while building your career. In our view, it's useful to step away from your work from time to time and consider your role in the broader scientific ecosystem. Think about the big picture. Are you doing the type of work that you care about? Is it likely to make a lasting impact? Or do you feel like a rat in a wheel, churning away for your next slice of cheese? Keeping your eyes on the bigger picture can ensure that your work feels meaningful and fulfilling, even if it feels like others are just trying to "play the game."

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

Read more from Letters to Young Scientists

Posted in: Letters to Young Scientists, Column, Non-disciplinary
doi:10.1126/science.caredit.abe1882

William A. Cunningham

William A. Cunningham is a professor of psychology at the University of Toronto in Canada.
Twitter

Jay J. Van Bavel

Jay J. Van Bavel is an associate professor of psychology and neural sciences at New York University in New York City.
Twitter

Leah H. Somerville

Leah H. Somerville is a professor of psychology at Harvard University.
Twitter

More from Careers

When sound science meets imperfect grammar

Don't erase undergrad researchers and technicians from author lists

When my Ph.D. adviser moved her lab, I had to decide: Do I stay or do I go?

Top articles in Careers

How to (seriously) read a scientific paper
BY ELISABETH PAIN | MAR. 21, 2016

Science's English dominance hinders diversity—but the community can work toward change
BY RODRIGO PÉREZ ORTEGA | OCT. 28, 2020

How to review a paper
BY ELISABETH PAIN | SEP. 22, 2016

My colleagues treat me badly. I wish I could tell my Ph.D. adviser
BY ANONYMOUS | OCT. 29, 2020

Related Jobs

Faculty Positions at Institute of Physics (IOP), Chinese Academy of Sciences: Beijing, China
Institute of Physics, Chinese Academy of Sciences
Zhongguancun, Haidian, Beijing (CN)

ASSISTANT or ASSOCIATE PROFESSOR
Symphony Talent
New York City, New York (US)

Physical and Biological Sciences: Assistant Professor in Materials Theory
University of California, Santa Cruz
Santa Cruz

MORE JOBS ▶