Scientists are Perpetual Students of Nature

By Avi Loeb on March 30, 2021

My past students and collaborators are starting to organize a scientific conference for my 60th birthday in a year. Their gesture reminded me of Rabbi Hanina's words: "I have learned much from my teachers, more from my colleagues, and the most from my students."

We all started as students. Early on, we put skin in the process of learning out of curiosity. Just like kids who bump into objects which cross their path to new knowledge, many of us have scars and bruises from early encounters with mentors. Conflicts arise when seniors attempt to establish authority by forcing respect for traditional thinking. Memories of these events should encourage us to do better as we change roles and mentor others later in life.

The first advise I received from my postdoctoral mentor was to develop specialized skills and focus them on a narrow niche where I would establish myself as the world expert. I stopped short of following this advice as soon as I recognized that by drilling down narrowly one often encounters the bedrock of a subject, where no further progress can be made. Under these circumstances, the potential for a breakthrough improves with a broader perspective which identifies the boundary of the bedrock and enables "out of the box" opportunities for drilling deeper around it. This is especially helpful after the discovery of unexpected anomalies that cannot be explained within the prevailing paradigm, as discussed in my new book, *Extraterrestrial*, about the first interstellar object spotted near Earth, `Oumuamua, which did not behave like anything we had seen before.

Keeping in mind the fallacies of indoctrination into a narrow expertise, I encourage my students and postdocs to think broadly and independently about the most exciting problems in astrophysics, such as "what happened before the Big Bang?"; "what will happen in our distant cosmic future?"; "what is the nature of dark matter?"; "what happens when one gets close to a black hole singularity?; "when did life start in the universe?"; or "how can we find relics in space from other technological civilizations?".

It is customary to consider a student's raw potential as a standalone commodity whose value can be gauged through examinations. But my experience taught me that young scientists do not blossom into exceptional researchers unless they are supported by encouraging words and inspiration; these ingredients are as essential as nutrients and water are for seeds of flowers. Accomplishments are sometimes self-fulfilling prophecies; without the initial belief in the potential of a student to become a successful scientist, this outcome may not come to fruition. As chair of the Harvard Astronomy department for almost a decade, I witnessed multiple examples of students who were initially very slow to make progress but as soon as they selected a different advisor and a new topic for their PhD they blossomed academically. A good mentor identifies the strengths of the mentee and tailors the collaboration accordingly. As a result, a successful mentoring experience

often reflects a good interaction between a fledgling scientist and an advisor. They should both be congratulated for their shared academic DNA.

On the one hand, mentors get a kick from Oscar Wilde's insight: "imitation is the sincerest form of flattery". But on the other hand, they should allow students to break free from the beaten path with creativity. It is not easy to identify the circumstances that justify a rejection of the pattern of imitation, because mentors tend to think highly of their own choices. But the rule of thumb is to give young scholars just enough space to maneuver freely and learn from their mistakes without damaging their reputation or the direction of their future careers. The learning curve could be steep; some of my fifty students over the past few decades started slow but eventually rose to the greatest heights. Patience is key.

Throughout my personal career as a researcher, I encountered many gates along my path and was fortunate to be allowed in by the gatekeepers. I therefore keep in mind that there must be others with similar qualifications who were not as lucky. My continuing resolution for life is therefore to help young scholars realize their potential. In committing to write my latest book, I told the publisher that I will be satisfied if a single person throughout the world will decide to become a scientist after reading my book. Last month I received an email from a woman in Malawi who wrote "great book… I have never looked through a telescope… I hope more women get inspired with the book for research…". I told her about my early exchange with the publisher, and asked: "might you be the special person I was hoping for by writing the book?". She replied: "yes, that would be me", and so I encouraged her to apply for graduate studies in astronomy at Harvard university.

Scientific research is fundamentally a learning experience, and therefore scientists are perpetual students of nature. Experimental clues and their theoretical interpretation constitute a classroom setting for our two-way dialogue with reality. When evidence does not conform with our pre-conceived notions, we learn something new. A couple of years ago, I attended a colloquium by my colleague from *Space Telescope Science Institute*, Amaya Moro-Martin, about `Oumuamua. After the lecture, a colleague of mine - who worked for decades on rocks within the solar system, muttered: "`Oumuamua is so strange … I wish it never existed". Speaking as a dogmatic thinker, he would have preferred to stay in his comfort zone by hearing only supporting evidence for familiar rocks. This is different from the state of mind of a perpetual student, where surprises are exciting because they hold the potential for increasing our knowledge base. Historically, the evidence for quantum mechanics took classical physicists out of their comfort zone, including Albert Einstein - who had an issue with its "spooky action at a distance". Subsequent experiments proved Einstein wrong and maintained our anxiety about the proper interpretation of the quantum world. Nature is under no obligation to make us feel comfortable. It is the way it is. The Earth moved around the Sun and caused seasons to change, even as Aristotle was asserting that we are located at the center of the Universe and everything revolves around us.

In view of my permanent status as a student of nature, I prefer to reformulate René Descartes' insight: "I think, therefore I am", into: "I am a scientist, therefore I learn by observing nature". The emphasis here is on observing nature rather than my colleagues.

ABOUT THE AUTHOR

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