

*Observations | Opinion*

# Advice for Young Scientists: Be a Generalist

A narrow focus on the latest hot topic can be rewarding—but it's not necessarily a good long-term strategy

By Avi Loeb on March 16, 2020



Credit: Johnny Greig Getty Images

As a fledgling postdoc, I was advised by my senior mentors to focus on a narrow research topic and become the world expert in that specialized niche. The counsel was presented in good faith as sound, practical advice. By digging deep into a narrow,

trendy frontier, I would have improved my chances for securing a tenured academic appointment.

But my scientific passions swayed me away from following this advice. Driven by curiosity rather than pragmatic considerations, I developed broad interests across a wide range of topics. My research was initially anchored in fundamental physics and not guided by popularity. This was the result of turbulent circumstances: I was interested in philosophy, received my PhD in plasma physics but was offered a new career in astrophysics. Just as I was debating which strategy to adopt in the long run, I had a fortunate dialog with a prominent astrophysicist.

Martin Schwarzschild (the son of Karl who derived the black hole solution just months after Albert Einstein formulated general relativity) was an emeritus professor at Princeton when I was pondering my career strategy. Finding a trendy niche to lift myself up in academia felt like a fantasy, similar to the tale about Baron Münchhausen pulling himself out of the mire by his own hair. Martin confirmed that popular niches are as unsettling as mire. Their popularity is seductive but of temporary nature. One can flirt with but never maintain a long-term relationship with fashions that come and go.

He gave me the example of binary star systems, which were very popular in his time and then lost their appeal. His perspective convinced me to avoid transient fads and instead explore a diverse collection of topics tied together by the unifying theme of common physical principles. Unlike phenomenological trends that could be gone with the wind, fundamental principles are here to stay. They offer a stable launchpad for a career engaged with diverse interests.

Was broadening my interests a worse career choice than specializing on a trendy topic? Over the past three decades since my postdoc years, the landscape of astrophysics changed dramatically. Topics that were regarded as speculative, such as theoretical cosmology, exoplanets, or gravitational wave astrophysics, became the mainstream and even received Nobel Prizes. In retrospect, my breadth was not a bug but a feature that allowed me to adapt to changing circumstances. There is no doubt that Darwinian survival in an evolving research environment selects for breadth of interests. Martin's perspective was a blessing.

One of the main drawbacks of specialization is that after digging narrowly for a while, one reaches down to the impenetrable bedrock of the topic. Subsequently, there are only subtleties to explore, but no fresh substantive ground. At this phase of maturity, the niche is ripe for a summary in a textbook but is no longer intellectually stimulating. There is little room left for innovation. Under these circumstances, a broad range of interests enables a sideways shift in research focus to territories where the bedrock was not exposed as of yet and where creative thinking still has an impact.

Although adaptation to changing circumstances is easier with a diverse knowledge base, “Renaissance people” or polymaths are rare, because specialization is rewarded more generously in the short term. By crediting focused accomplishments, the existing reward system of grants, awards and promotions creates silos of knowledge with suppressed cross fertilization. This unfortunate backdrop only highlights the essential role played by generalists. Those who cross boundaries of disciplines act as butterflies that pollinate flowers unintentionally by carrying pollen stuck to their bellies. Occasional random winds can accomplish the same outcome but with a reduced efficiency and vigor.

By now, decades after securing a tenured appointment, my advice to postdocs is different from the one I had received early in my career. I still admit that it is important to demonstrate excellence by developing a unique set of skills for solving specialized problems. But this skill set should be supplemented by a broad knowledge base. A foundation of general education enables wide maneuvers and unexpected discoveries. It provides the tools needed to venture into unexplored territories or to correct misguided specialists based on general principles.

A classic example is Richard Feynman’s own investigation as an independent member of the Rogers Commission in 1986, which revealed the misunderstandings between NASA’s engineers and executives regarding the O-rings safety factor in the Space Shuttle *Challenger* disaster, using elementary physical reasoning.

But most importantly, a broader view offers a better appreciation of the full landscape of our humbling learning experience. It is easy to become arrogant based on a narrow focus simply because of its limited field of view. However, the vast universe is so rich in stunning details that a narrow view misses its full splendor. There is much more for us to treasure by looking up into the full sky than by looking down at each other.

## ABOUT THE AUTHOR(S)

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