Why are Negative Results Crucial in Science?

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Similar to any other discipline, scientific success is rejoiced while failure is shoved to the background and rarely admitted. Journals report success in academic research as discoveries that shape the science community. Rewards in science are tightly connected to publishing and journals such as *Nature* only report positive results. There appears to be a standard: scientists are judged on the number of papers published. The academic community continues to ignore negative results. Is it really justified to treat negative results this way, as if they do not contribute anything to the large and extensive body of research?

Failure in Science: What Can We Learn from It?

Common sense would dictate that failures teach us things that did not work and help us avoid future mistakes. Instead of focusing on the failure, the academic community should see failure for what it is; namely, that it enriches the community through the admission that other methods should be explored. After all, Samuel Beckett wrote that one must fail, but fail better. Through failure, we learn that some research approaches are too simple. This serves as a guiding post for others attempting to study the same phenomenon. The scientific community should not focus solely on groundbreaking

research. Instead, we should rejoice when methods are improved because the researcher knew *how* to fail.

Price of Ignoring Failure

From the moment we gain consciousness, we are taught not to fail. Failure is considered as a disappointment, something to be shy about and in science and other disciplines, failures are embarrassments. This is problematic in many ways. Ignoring failure in science by not publishing findings takes away crucial lessons that we can learn from failure. Take the biomedical sciences, for instance, where negative results are common, and constantly discussed in the media. Under the umbrella of this discipline are the drug trials, of which 90% of drugs never make it to FDA approval.

Failure in science is not always failure as we know it. Failure, in this case, may mean that science is working as it should be in verifying that a particular approach is ineffective. The price of ignoring failure incurs repetitive methods used in research, all aiming to succeed. The obsession with success is costly, especially when negative results already show that there is no evidence to support a particular claim. Another price to pay for ignoring failure is the plethora of poorly conducted studies that cannot be replicated. These become obstacles that impede success. Lastly, failure in science makes it easier to detect attempts to discredit science in the name of political gain. The BICEP2 experiment is one example wherein failure can be used to detect phonies.

How Can We Benefit from Negative Research?

While the mass of scientists will argue that science benefits only from successful trials, I will argue that there are benefits from negative research. Failure is part of the scientific method and thus produces benefits in various areas. Every failed experiment confers changes to the researcher's perspective. As such, the researcher is able to hone his skills and become better at researching. Failure also helps to change the experimental design by showing researchers what works. This is critical to the success of science because other experimental designs can be crafted, which also informs the scientific community about *why* the previous approach failed. These changes in perspective and experimental design eventually lead to a more refined approach and increase the chances of a successful study.

Becoming a Risk-Taker in Research

Since scientists are ingrained with the fear of failure, few are willing to take the risk of researching a topic that has already yielded negative results. While this is understandable, given the current climate of scientific research, it helps to understand the factors that can help scientists become risk-takers.

One significant step that scientists can take is to recognize that failure is an option, contrary to what society teaches. Without failure, science cannot progress. There are numerous instances where failed experiments led to groundbreaking research, such as

the Michelson-Morrey experiment. Another step is to recognize how failure contributes to the success of science in and of itself. Becoming creative in the scientific field entails taking risks. Instead of asking ourselves whether an experiment will likely become successful, we should instead focus on its potential to contribute to knowledge, successful or not. Indeed, there is only so much that a scientist can do, and one of them is ensuring that he can fail, and rise up again.

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