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The Call of Science

The scientific vocation is rooted in non-authoritarian, evidence-based discovery.

Robert T. Pennock

It is a curious thing to be called to a life of science. To the uninitiated, the disciplined practices of researchers may seem mysterious and even odd, like those of an unfamiliar, cloistered, religious sect. Much lab work is done silently; picture hushed chemists at the bench. Field observations are often done in solitude; think of Jane Goodall watching chimps in the Gombe. The deliberate motions of data collection may appear ritualistic; consider limnologists drawing daily water samples from a vernal pond. A detached observer might watch these researchers for weeks and get no more than a superficial sense of what they are doing, let alone an appreciation of why. What compels their strange devotion? What does it mean to feel the call of science?

A Curious Calling

The pioneering 19th-century German sociologist Max Weber wrote of science as a calling—a vocation—in quasi-religious terms, noting that science requires a "passionate devotion" and "enthusiasm," terms that suggest being possessed by a god. If you would never feel like the fate of your soul rests upon whether you have made the correct scientific conjecture, Weber said, you will never understand the personal experience of science.

Not everyone appreciates the scientific vocation. Nor should we expect them to; people's diverse backgrounds attract them to diverse ends. To those who do feel its call, science provides a life of meaning and purpose, of passion and adventure. But its source and meaning may at first be hard to articulate.

Unlike the archetypical religious calling, which in scripture often comes as a commandment from God, the scientific calling is not verbal. Many of the pioneers of the scientific revolution were religious and saw scientific research as complementary to their spiritual vocation. But the call to science can have a different source. It is beyond words. Or, more precisely, it is prior to words.

We are built by evolution to explore the contours of the world into which we are born. The call of science originates in a genetic drive to discover.

We cannot, of course, avoid words when writing about science, but to circumvent the misleading focus on language, one might turn to a physical analogy. One could say that some feel not called, but drawn to science, as though pulled by the gravitational force of an invisible body. That description is better, but misleading in a different way, as it is only metaphorical. It is perhaps more accurate to see the call of science as rooted in a biological compulsion. It is instinctual. We are built by evolution to explore the contours of the world into which we are born. The call of science originates in a genetic drive to discover. We are, by our nature, curious creatures.

The Silence of High Mountains

Albert Einstein spoke of this scientific mindset in a speech he gave at a celebration of physicist Max Planck's 60th birthday in 1918. Beginning with a biblical reference, he noted that in the "temple of science are many mansions" and that within it, some scientists ambitiously seek to express their intellectual superiority, whereas others offer the products of their brains at its altar for some utilitarian purpose. However, he went on, should an angel drive all of these individuals from the temple, there would yet remain some like Planck who seek only to understand the world as truly as they are able to.

Referencing Greek philosopher Diogenes and his lantern, with which he said he was searching for an honest man, Einstein described these exemplary scientists as seeking only to develop the perseverance, honesty, and objectivity needed to ascend "into the silence of high mountains, where the eye ranges freely through the still,

QUICK TAKE

Humans by nature are curious, and when we feel called to the vocation of science, it is rooted in this biological impulse to explore the contours of the world.

To capture a true picture of the world, science became a disciplined practice driven by observation and empirical evidence, instead of by reference to an authority.

Scientific values determine the collective ethos of science, and include character virtues such as skepticism, honesty, objectivity, persistence, and humility to evidence.

The Royal Society

The Marble Hall of the Royal Society in London has the society's motto chiseled into the tympanum above the door. The motto, *Nullius in verba*, translates colloquially to "Take nobody's word for it." The motto captures the central principle of the evidential imperative of science: Evidence takes priority over authority. These and other values form the distinctive ethos of the community of science.

pure air and fondly traces out the restful contours apparently built for eternity." There, Einstein went on to say, by patient and meticulous rigor, these scientists may find a "simplified and intelligible picture of the world."

The call of science is this wordless compulsion to discover. Marie Curie expressed it in a way that seemed to recognize its biological source, speaking of curiosity and its "spirit of adventure" as something she saw as evident in all that is vital. Curiosity, according to Curie, is a life force.

What Einstein, Curie, and other scientists are describing is the urge to explore the unknown and emerge from the mists to the mountaintop of a discovery. In its 1886 constitution, Sigma Xi connected this feeling to the value of friendship and camaraderie among researchers and the admonition to encourage and support all who would try to solve the great problems of nature, with the phrase "Come up higher!"

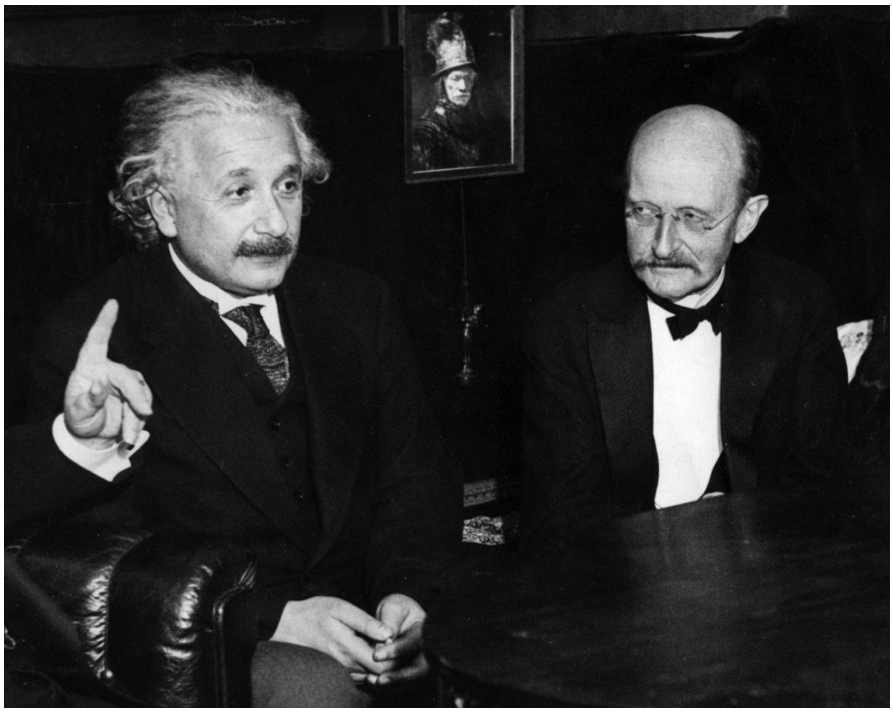
Making discoveries is what scientists feel called to do. Their shared goal is to get a truer picture of the world and a firmer grasp of the causal processes that govern it. This drive is borne of curiosity.

Nullius in Verba

What transformed this basic instinct into a disciplined practice was the radical idea that whatever problem of nature one seeks to solve, the way to do it is by observing the world itself and explaining its workings only by testable natural laws. Indeed, the ruling principle of modern science is that empirical evidence is the sole acceptable basis for conclusions about the natural world. This prime directive is what might be called the *evidential imperative* of science.

What was revolutionary in this simple but profound notion of empirical justification was its utter rejection of the ancient method of justification by reference to an authority. According to the standards of science, matters of fact may not be determined by the say-so of someone in power. This priority of evidence over authority was most succinctly expressed by the premier scientific society during the 17th century's scientific revolution.

The Royal Society of London for Improving Natural Knowledge was founded in 1660 as a learned society of natural philosophers, as they then called themselves. Enter its offices today and look to the arch above the door of its exquisite Marble Hall. Chiseled into the tympanum is the motto the society adopted to articulate this core idea: *Nullius in verba*. Colloquially translated as "Take nobody's word for it," it expresses the virtue of scientific skepticism—don't tell me; show me. The motto referenced a line from the Roman poet Horace, *Nullius addictus iurare in verba magistri*, which translates as "Not bound to swear allegiance to the words of any master." At its very root, science is emancipatory. To be called to science is to stand in quiet opposition to the idea of submission to authority, bowing only to evidence garnered from nature itself.



Science Source

Albert Einstein sits at a dinner party with Max Planck in 1931. Einstein had spoken at Planck's 60th birthday celebration in 1918, where he had exalted scientists whose main drive was to simply understand the world as truly as they could. Einstein and other scientists have described this urge to explore, borne of curiosity, in order to get a firm grasp on the causal processes of nature.

The Greatest Enemy of Truth

As Einstein put it once, "Unthinking respect for authority is the greatest enemy of truth." The evidential imperative was and remains truly revolutionary. In a time when political polarization threatens the common bonds of democracy, it behooves us to renew the scientific commitment to the impartial search for truth. Authoritarianism in whatever form it takes must be eschewed.

Dogmatic opposition to the facts of biology, for example, is just one case in point. It is fitting that the Royal Society's Marble Hall includes a display case about Charles Darwin's discovery of the law of evolution by natural selection. Ideological rejections of and attacks upon evolution have come from both the political left and the political right; think of the political dogmatism of the Soviet antigenetic Lysenkoism movement in the 1930s to the 1960s, or the recent cases of incorporating creationist language into various American far-right party platforms. For democracy to work, facts have to be ascertained without partisanship. Scientists must cultivate the courage to reject the power plays of political operatives and activists on both ends of the political spectrum.

The current concern about being "cancelled" for holding "incorrect" political views is minor compared with what scientists had to face in the past. Upon being shown the instruments of torture during his 1633 trial by the Roman Catholic Inquisition for vehement suspicion of heresy, Galileo Galilei was compelled to recant his conclusion that the Earth moved around the Sun. And yet, it moves! Ideologues may attack evolutionary science and its explanations of the origin of species and their adaptations. And yet, life evolves!

Skepticism, honesty, objectivity, perseverance, and humility to evidence are mental traits that are conducive to research excellence, thereby increasing our chance of making discoveries.

Skeptical Inquirers

Might does not make right, nor does it determine truth. In rejecting authoritarianism, scientists must be skeptical not only of dogma, but also of individuals or groups who claim singular power to determine facts by their say-so. Base appeals to special privilege, standpoint, or even personal lived experience are just other forms of authoritarianism. Much as I may be invested in "my truth," I do not author the world; my untested perspective may or may not connect to reality. The evidential imperative applies to oneself as much as to others. Confirmation bias, the tendency to focus on information that is consistent with one's existing beliefs and to ignore countervailing data, is a danger that scientists must strive to overcome.

The reason to cultivate the scientific virtues of skepticism and objectivity is to make it less likely that our search to discover the truths of nature will be thwarted by biases. What I claim to see, others should be able to check. The evidential imperative ensures that scientific discoveries are public; others must be able to climb the peaks as well. In science, there are no private mountains and no privileged ownership of any mountaintop discovery. When properly understood and implemented, scientific skepticism and related values provide the most secure basis for the fact-finding needed to ensure just, democratic decision-making.

Scientific Virtues

Besides noting skepticism as a bulwark against authoritarianism, I have also mentioned the importance of honesty, objectivity, perseverance, and humility to evidence. Being called to a life of science involves cultivating these and other mental traits that are conducive to research excellence, thereby increasing our chance of making discoveries. To those who feel the call of science, such values are constitutive of their vocational identity. All these elements are virtues—traits that constitute the ideals that structure science as a disciplined practice and that provide its motive drive. Such character virtues are among the normative elements that give the community of science its distinctive ethos. We usually think of science only in terms of facts, but its systematic methods are grounded in values that unite epistemology and ethics. It is for good reason that science was originally known as natural philosophy.

The role of the philosopher of science is to identify, analyze, and systematize such normative structures. The physicist Richard Feynman once quipped that philosophy of science is

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as useful to scientists as ornithology is to birds. That statement shouldn't be seen as disparaging. Ornithology has utility not just for curious birders but for what its systematic study might uncover about birds' habitats and habits that may contribute to helping them flourish. Philosophy of science can be useful to scientists in the same way, delineating the features of their mindset and methods so that these might be better understood and improved to advance a flourishing research culture.

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Einstein likened practicing science to an ascent into high mountains. The idea of science as a climbing of peaks invokes the idea of the evidential imperative, in that discoveries should be based not on authority, but on testable evidence: No scientific discovery should be hidden on a private mountain, but somewhere free for all to climb and check.

Mind the Gap

Everyone knows that scientists do not always live up to the ideal. Even members of the Royal Society sometimes failed to heed its own motto. The story is told that King Charles II once invited the Society's researchers to explain to him why a dead fish weighs more than the same fish alive. They obliged by offering various possible explanations, only to then have the king tell them that the weight was actually the same. These unprepared scientists had fallen into a trap by accepting the word of an authority rather than checking the facts themselves.

Had they followed their Society's wise prescription, such observations would have saved them from a deserved embarrassment. As it turns out, a study of weight changes in fish after death was carried out in the early 1950s by aquatic biologist R. Weldon Larimore of the Illinois Natural History Survey to address a practical measurement problem for fisheries research and management. Its finding? Varying with temperature, the weight of dead fish actually does increase over their live weight, for a period of up to a week. The reason? The absorption of water through the skin. Subsequently, their weight drops as autolysis and bacterial action cause disintegration of the body. The Royal Society scientists could have proven themselves twice had they responsibly done the requisite fact-checking.

The philosophical undertaking is to identify and investigate the ideals that make such knowledge possible. One reason for doing this work is to better light the path forward, knowing how difficult it is to approach these ideals. This task involves the difference between a merely descriptive investigation and a prescriptive one. Teasing out the scientific virtues helps provide a guide of the ideals to strive for, so we might have a better chance of truly satisfying the impulse to discover.

Heeding the Call

So, what does it mean to feel the call of science? It is, indeed, a curious thing. It is rooted in biological instincts we share to discover the contours of our common world. It is an urge to explore an endless frontier and to ascend its mountaintops. It is the courage to stand up to the power of authority and to bow only to nature's evidence. It is the drive to conduct research responsibly and to strive ever upward. If you feel it, heed the call. Come up higher!

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Robert T. Pennock is Sigma Xi Senior Fellow for Science and Engineering Values. He is a University Distinguished Professor at Michigan State University, where he is on the faculty of Lyman Briggs College, the departments of philosophy and computer science and engineering, and the ecology, evolution, and behavior program. His research involves both empirical and philosophical questions that relate to evolutionary biology, cognitive science, and the scientific character virtues. Email: pennock5@msu.edu