

Albert Einstein himself agreed with them. A second reason stems from Lodge's research into psychic and spiritual phenomena, epitomized by his 1916 book *Raymond, or Life and Death*, which details communications beyond the grave with his youngest son, who was killed during World War I in 1915.

Here, too, we should celebrate Lodge, for despite his belief that communication with the deceased was possible, he nevertheless warned the public about how many mediums took advantage of people's vulnerabilities. During his day, it was commonplace even for educated people to hold spiritualist beliefs; it is largely due to Lodge that most everyone now tends to distrust those who allegedly communicate with the dead. Moreover, his advocacy of science education, his public lectures, and his willingness to test wild claims are key reasons why many spiritualist beliefs were checked against the best science of the era. Mussell argues in his chapter that Lodge's studies on psychic phenomena are as much a part of his scientific legacy as his research on telegraphic systems, loudspeakers, and microphones.

Setting himself apart from the scientific trends of his day, Lodge warned of the dangers of going off on a theoretical limb without experimental support. For him, physics was about "hands-on laboratory work," to be followed by a theoretical apparatus based on "tangible physical concepts, not symbols." Such knowledge would lead to a better, "full-blooded" understanding of the universe—one in which it was much easier to know why we should care about knowing. Lodge also played a key role in the successful struggle to incorporate science into the general curriculum at British universities; previously, it was relegated to polytechnical schools.

One of the most interesting claims in *A Pioneer of Connection* is that Lodge was self-conscious of his tendency to damage his own reputation. He left accolades for others to collect, just as many talented untenured lecturers, adjuncts, and laboratory scientists do today. His life demonstrates that second place in science should receive more attention. What use are first observations if they are not confirmed? In science, the inclusion of less prestigious lives matters.

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THE FIRST IMAGES taken by NASA's *Solar Dynamics Observatory* are presented during a press conference in Washington, DC, in April 2010.

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A researcher's how-to manual

Even the most groundbreaking scientific research is of little use if it can't be communicated to the broader scientific community, and to the general public, in a cogent and timely manner. Nevertheless, many scientists struggle to disseminate their results successfully. *Effective Science Communication: A Practical Guide to Surviving as a Scientist*, by Sam Illingworth and Grant Allen, aims to help researchers do just that. Both authors are successful researchers, and they base their narrative on their extensive personal experience. Comprising nine chapters that work both independently and as a whole, *Effective Scientific Communication* is a useful handbook for anyone in the scientific world.

The book's introduction highlights the importance of scientific communication and offers advice on how to use the book. The authors then discuss how to prepare research findings for journal publication—the way in which most scientific results are disseminated to the broader community. They begin with tips for choosing an appropriate journal, advice on writing the manuscript, and explanations of the peer review process and metrics like impact factors and citations. According to

Effective Science Communication A Practical Guide to Surviving as a Scientist

**Sam Illingworth
and Grant Allen**
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Illingworth and Allen, when sitting down to write a journal article, authors should first identify the key message they wish to share. Additionally, they note that publishing more papers on a topic as opposed to fewer is not always advisable—the oft-quoted “publish or perish” can be a misleading mantra.

Chapter 3 details how to secure funding to establish and sustain scientific research. Gone are the days of Isaac Newton and Albert Einstein, who required little or no research funding. Nowadays, a successful research career requires continuous funding, so learning how to craft grant proposals is a vital skill for researchers. The authors give quality advice on conceptualizing a good research

idea, detail the components of a grant proposal, and discuss how to select appropriate funding agencies.

Oral presentations to specialist audiences are the subject of chapter 4. The authors emphasize that crafting a clear message is key to presenting effectively, as are audiovisual elements like images and PowerPoint slides, which should be chosen carefully. They emphasize as well how important it is to respect the time limit when presenting and responding to questions. The chapter also offers practical advice on overcoming nervousness when presenting to unfamiliar audiences: Researchers should know their content, know their audience, and practice rigorously to develop confidence.

Although scientists are accustomed to speaking to technical audiences, in today's world that is not enough. Researchers also need to communicate their findings to the public at large, as evidenced by the COVID-19 pandemic and the global spotlight it has brought to epidemiology and vaccine science. Possible venues include press conferences, news articles, public lectures, panel discussions, and book clubs. *Effective Science Communication* de-

scribes how narratives must be sculpted with both the idea and target audience in mind. Engaging with the public requires extra preparation and training, but it also molds public thinking and creates a well-informed society.

The next two chapters cover how to communicate science in the mass media and online. Writing popular scientific works and giving radio and TV interviews remain viable methods for communicating with the public. But researchers today have the opportunity to develop an online presence using blogs, podcasts, and social media networks such as Facebook, Twitter, and ResearchGate. YouTube is a great platform for sharing laboratory demonstrations and live lectures. All of these options can be beneficial and even lead to unexpected collaborations—but, the authors warn, they can also be distracting!

Chapter 8 addresses how science shapes public policy and vice versa. Many researchers undoubtedly enter the scientific world out of a desire to improve our quality of life and to preserve the health of our planet. Ideally governments base their decisions on reliable scientific infor-

mation and, in turn, promote good science by way of increased funding. In that scenario, regulators, governments, university presidents, and citizens all have collective ownership of science, which reduces the risk of forming policies based on skewed or one-sided viewpoints.

The final chapter discusses other components of a researcher's tool kit, such as time management, professional networking, teamwork, mentoring, and scientific integrity. Some discussion about managing stress would have been useful here.

The authors did a commendable job outlining effective writing and speaking techniques. I also enjoyed the quotations at the opening of each chapter—the cartoons included there are simply delightful! One gap that could be addressed in future editions is a discussion of listening and reading techniques, which take up much of a researcher's time and complete the circle of scientific communication. Nevertheless, this text is a solid manual for novice and established researchers alike.

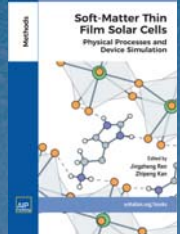
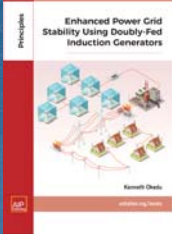
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