Student's Corner

communicating your research in lay language

Cristian A. Linte

Today, it's not enough for scientists to be experts in research and research methods. It is becoming more and more apparent that scientists need to be entrepreneurs, with skills in finance, business, and even communications to be successful.

If you are not able to communicate your research and the results of your work effectively, it will be impossible to expect others to understand and apply your research. As a matter of fact, more and more scientific journals are recognizing the importance of appropriate communication, requiring that articles submitted must be edited into a more readable, understandable format: "The writing has become more and more technical and only a few scientists in a particular niche can understand any given article," cites the *Ottawa Citizen* in December 2007. Moreover, the journal *Science* now requires articles to be submitted in plain language: "Cross-fertilization of ideas from one field to another is a huge source of new ideas, and this process ends up being cut off if people can't understand each other's work."

The society learns the current scientific matters mostly through the news media, and, therefore, we have a duty to ensure that our work is accurately represented. To maintain proper dissemination, we need to be conscious of finding the right voice to address to the media, such that the public's understanding is not sacrificed. When addressing a wider public, we need to take initiative in putting forward good science, while minimizing any potential distortion being presented to the lay audience.

From Lay Audiences . . .

Most of you may ask yourselves what constitutes a lay audience or how do you know whether your presentation or piece of writing is adequate for a particular audience. As a starting point, a group of people who have no specific knowledge of the issue under consideration may be classified as a lay audience. You can still talk science face to face with a lay audience and keep it interesting. However, it is rather different from presenting your work at a scientific conference.

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A good analogy would be to imagine yourself at a party where people ask you what your work is about or present your work to the community at the local public library; better yet, imagine yourself at a family gathering, where your aunts, uncles, or grandparents ask you to tell them about your day-to-day work. When talking to the uninitiated, "you have to ask yourself: what is it that makes your work interesting?" says Gina Kolata, a science and medicine reporter for *The New York Times.* Despite their very little, if any, background knowledge on biomedical engineering, you still need to explain to them what you do and make sure they understand how your findings may one day make a difference in the world. Do keep in mind that complex equations and convoluted drawings would not interest them; needless to say, you would lose them before you connected the first line.

. . . To Lay Summaries

A lay description is a clear, plain-language explanation of a research project or its outcomes. It provides a bigger picture context for the research and why it is important. A lay summary can be understood by the general public (and researchers from other fields of study). Typically, a lay summary is composed at a grade ten level language. Writing in plain language is not dumbing down the research, as some people may argue. In fact, it is a rather distinguished skill to be able to articulate difficult scientific terms and concepts in a way that a non-scientific audience (or researchers from a different discipline) can understand.

Lay Communication As Seen by Funding Agencies

Besides the media and general public, there are many different audiences to whom you might need to convey your research: funding agencies, industry, health-care practitioners, and researchers from other disciplines to name a few. For funding agencies such as the Heart and Stroke Foundation of Canada, supporting research is the cornerstone of their mission. "Our ability to fundraise and raise more dollars for research hinges on our ability to communicate to the public (our donors) about the research we support, and its importance," says Jennifer Campbell, assistant director, Research and Strategic Initiatives at the Heart and Stroke Foundation of Canada. In fact, the foundation is placing such a high priority on this aspect, that it requires a structured lay summary as part of each application to be eligible for funding. "The foundation also has lay reviewers on each of its peer-review panels who assess the quality of the lay summary and the relevance of the research to the foundation's mission. The onus is on the researcher to communicate

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their work effectively and convey how it impacts heart disease and stroke."

The Heart and Stroke Foundation is on a crusade to boost plain-language writing skills among the researchers it funds. "In the workshops and exercises we have conducted over the years related to communicating research to a lay audience, we have found this task is much more difficult for researchers than we had anticipated," advises Campbell. "Researchers are accustomed to the scientific terminology within their area of specialty. To them, the scientific terminology is everyday language. Scientists are highly trained and focused, and writing in plain language requires that they step outside of this zone and consider their work from an entirely different vantage point."

The Litmus Test: How Lay Is Lay Enough?

If you want to test out whether a lay summary is indeed suitable, pass it on to a friend or a family member (your mother, brother, or grandmother). Have them read through it and point out the phrases and concepts that they don't understand. "It is often an iterative back and forth dialog with numerous revisions to get the text just right," states Campbell. Different worlds come together to create the final product. The trick is to use commonly used phrases and explanations of what key scientific terms mean, if there are no alternative terms. Also vitally important is situating your research in the context of the bigger health problem or concern that the average person can relate to. What impact is your research likely to have? What piece of the larger research puzzle is your research trying to address?

Tips on Lay Communication

If you are in the position to prepare a lay description of your work, first and foremost, try to use smaller, shorter words wherever possible. "Use reasonable vocabulary words, but never talk down to anyone," says Bill Nye, a one-time Boeing engineer and stand-up comic, who also produced *Bill Nye the Science Guy* for KCTS public television in Seattle [1]. "If you treat them like they are not as smart as you are, they will not listen to what you have to say."

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"Be careful of complex, logical arguments," advises James King [1] in his 1999 article that appeared in *The Scientist.* In conversation, most people have a hard time following convoluted arguments that require them to mentally process what you have to say. Make it simple, otherwise they will lose the motivation and give up listening. In general, short sentences and brief arguments will make your research much easier to digest.

Although the focus of your work may go beyond the big picture or a simple scientific principle, always start by placing your work in a larger context. Introduce the audience or readers to the issue that you are trying to solve; this approach will help them better to connect the facts and understand how your findings may eventually make a difference in the field.

Don't be afraid to use analogies and relate science to everyday life. In fact, this approach seems to work best, as many people like to learn by examples. After all, "a real public understanding of science will only come from scientists willing to communicate face to face with the public. Use analogies to describe concepts," states King.

If you need to prepare a written lay summary and choose to do so using Microsoft Word, take advantage of the Flesch-Kincaid grade formula and Flesch-Reading ease formula to assess your writing level. The Flesch-Kincaid grade formula calculates an overall reading grade level, whereas the Flesch-Reading ease formula calculates a score of reading ease from 0 to 100, with 100 being the easiest to read. Both formulae use average sentence length (number of words divided by the number of sentences) and average syllables per word (number of syllables divided by the number of words) to assess the ease of reading. Hence, to lower the grade level of your writing, try to use smaller words such as "tell, show, and merge" rather than "identify, illustrate, and integrate." Moreover, use large technical words only when absolutely necessary; simplify your grammar, use active voice, and omit sentences that add no meaning.

Finally, when you think you've got it all under control, go back to the litmus test: ask a friend or family member who

is not familiar with your research to review it and give you feedback. Most importantly, try to take their criticism in a constructive way. What they tell you may not be what you wanted to hear, but that's the purpose of the entire exercise.

To conclude, this article is not meant to act as a set-in-stone rule on lay communication, but rather to open your eyes and make you think how you would go about writing or talking about your research to the community. If you are looking for more advanced tools on how to improve your ability to communicate with the public in general, feel free to refer to the National Institutes of Health (NIH) online plain-language training program [2] and the Heart and Stroke Foundation of Canada Web site [3], which has examples of well-written lay summaries.

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References

[1] J. King, "Talking science with nonscientists: A personal communication," *Scientist*, vol. 13, no. 7, p. 12, 1999.
[2] National Institutes of Health plain language training program [Online]. Available: http://plainlanguage.nih.gov/CBTs/PlainLanguage/login.asp
[3] Heart and Stroke Foundation of Canada [Online]. Available: http://www.hsf.ca/research/en/open-competitions/competition-faqs.html#6

From the Editor

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As a matter of fact, I should not be so bold as to think that I am the only biomedical engineer who holds a dream job, for I think we all do. Being able to take techniques, devices, and knowledge from other fields of engineering and apply them to the life sciences and clinical fields such as medicine, dentistry, and other clinical areas is what we all do. We can look back on our careers and see how we have contributed to the health of the world's population and improved our understanding of basic biomedical processes. We can also look forward to future contributions that our profession will be making. We can proudly observe the rapid growth of biomedical engineering and its increasing recognition around the world. We in the United States are especially proud of the fact that our profession was recognized by the establishment of the National Institute of Biomedical Imaging and Bioengineering (NIBIB) at the National Institutes of Health just ten years ago. This institute continues to grow and support biomedical engineering researchers in academia and industry.

Further recognition of the growth of our field is seen in the explosion of publications in this area. Not only has our own IEEE Engineering in Medicine and Biology Society (EMBS) expanded the number of scholarly publications we produce, but this is happening in the rest of the world as well. The number of published pages devoted to biomedical engineering has become enormous and continues to grow at an accelerated pace. It is exciting that this is going on, but it is also a concern that there is just too much literature for anyone to follow, understand, and keep current. Even so, new media for publication are being explored. Digital versions of most major archival journals are now available, and some journals exclusively publish digital editions. We are seeing new types of publications and means of communication such as blogs and social networks popping up, and those of us "long in the tooth" are having trouble keeping up with these latest methods, but are excited (at least in my case) that they are occurring.

Those of us in academia, but by no means limited to us, have a special opportunity to train the next generation of biomedical engineers who will further develop our field. Being able to excite young, eager, and open minds about our field and to help direct their energy through research participation, writing and speaking opportunities, and humanitarian projects at home and in the developing world is a special opportunity that we have as educators. Observing these young people mature as biomedical engineers has always been a special aspect of my dream job, and hearing from or perhaps even meeting them after graduation is a very gratifying experience even when remembering their names can be a challenge.

As readers of this column, I am sure that you also consider your jobs to be dream jobs. I would like to hear from you and learn why your occupation offers excitement, challenges, satisfaction, and accomplishment or, in other words, fun. Let me know why you should appear in *IEEE Spectrum's* dream jobs issue. Even though I will probably have no influence in getting you there, perhaps we can run our own dream jobs feature here in *IEEE Engineering in Medicine and Biology Magazine.*

So my message to the editors of *IEEE Spectrum* is "what about including biomedical engineers in your descriptions of dream jobs?" There is great excitement in our field; it covers an area of interest to everyone: our health. We have more than 8,000 members of EMBS who would qualify as potential featured subjects, and we think that biomedical engineering offers some of the best jobs in engineering.

Michael R. Neuman