EMBO reports

viewpoint

Training scientists to be journalists

Clear and accessible writing is not good enough for the public. Above all, it has to have sparkle • *by John Wilkes*

The accident at the Three Mile Island nuclear power plant in Harrisburg, PA, in 1979 was a watershed not only for the debate around the safety of nuclear energy, but also for science journalism in the USA. CBS anchorman Walter Cronkite dubbed the media coverage of the accident the 'most confused day in the history of news media.' The main reason for this disarray among the more than 300 reporters gathered in Harrisburg was the unclear and often contradictory statements from the various experts. But it was also exacerbated by the fact that only a small handful of these journalists possessed a basic knowledge of nuclear physics and the workings of a nuclear power plant. One reporter, seeing harmless steam coming out of a cooling tower, reported that he could almost feel his gums starting to bleed and his hair falling out. The vast majority of reporters were utterly baffled by all the experts' talk about primary and secondary cooling systems, the differences between rads, rems and roentgens and the health risks of exposure to various isotopes. They were left scrabbling for a primer on nuclear energy in order to make sense of all these incomprehensible details.

Consequently, the US news media and various journalism programmes at US universities realised that there was a genuine need for specialised reporters to cover science and engineering-related events in the media. In the early 1980s, some universities thus established dedicated science journalism programmes, where aspiring students were equipped with a basic knowledge of all the natural sciences and taught the particular requirements and pitfalls of covering science in the news. The first of such programmes was the programme in science writing at the Massachusetts Institute of Technology, established in 1979, followed by the science communication programme at the University of California, Santa Cruz, in 1981 and New York University's Science and Environmental Reporting Programme, in 1982. These were soon followed by many other graduate and undergraduate science writing programmes all over the USA.

But despite these specialist courses, scientists in the USA and Europe have long complained about what they see as the poor quality of science stories in the newspapers. They accuse reporters of inaccuracy, sensationalism and a host of other journalistic crimes and misdemeanours. While the quality of science reporting and writing has grown noticeably better over the past 20 years, scientists note that there is still a lot of room for improvement. They offer a remedy, one that seems obvious to them: replace the ordinary, non-scientist reporters with a scientist when a development in science warrants a news story. Give these scientists some rudimentary training in journalistic techniques, of course, and the problem will vanish, or at least sharply diminish.

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Indeed, the proportion of science-trained reporters in the news media is rapidly growing, and a few have reached the higher ranks of journalism. These reporters—among them immunologist Laurie Garrett at *Newsday*, physicist Kenneth Chang at the *New York Times,* molecular geneticists Rosie Mestel at *The Los Angeles Times* and Sue Goetinck Ambrose at the *Dallas Morning News* in the USA—have in recent years made significant contributions to the average citizen's understanding of science. In Europe, some scientists have similarly made it to the top of their profession, such as physicists Pallab Ghosh at the BBC and Rangar Yogeshvar at the ARD, one of Germany's public television channels. Nevertheless, in both the USA and Europe, non-scientists still hold sway in the upper echelons of the mass media.

At the same time, the tension is mounting between scientists and journalists. As ever-larger numbers of scientists scramble more aggressively for shrinking governmental research funding, they are more tempted than ever to exaggerate the importance of their work. Secondly, universities, particularly in the USA, are not above mildly taking in innocent science reporters. After all, US universities depend increasingly on research grants to finance non-research activities on their campuses. Traditional sources of general funding for US universities—state governments and private philanthropic foundations—are slowly drying up. To succeed, they need all the good publicity they can get. In this fund-raising game, science is the universities' trump card and, not surprisingly, 90% of the news that comes out of US universities is science news.

To play this card well, that is, to generate publicity for their own research, universities and other tax-funded research organisations have established their own internal news offices. Virtually all US research organisations above a certain size employ one or more full-time science writers who prepare popular, newspaper-style stories describing a research project. These stories are sent to journalists in the hope that they will eventually be printed or broadcast. With a growing number of abundantly available science stories, one would think that journalists with science backgrounds would be perfectly suited to

sort through all the press releases, separate the wheat from the chaff and direct the coverage of science in the media.

In practice, it does not work quite that way. While a higher proportion of scientists work as journalists in Europe, the people who control the media in the USA still prefer that generalists report on science. This bias is deeply entrenched and, in my opinion, it is unlikely to change soon, if ever. The reason is that the culture of US journalism demands that scientists must go far beyond simply learning journalistic techniques. They must transform themselves, heart and soul, into journalists. To accomplish this, they must learn to care more about their readers than they care about anyone or anything else, including science itself. If they do not, they are likely to fail as journalists.

In addition, science-trained journalists face their own special problems. One is the fact that they are narrowly trained in a tiny subfield of science. Outside their expertise, which required years of single-minded effort to master, they are in some ways less prepared to write for a newspaper about science than a skilled reporter with a general education and a large fund of randomly acquired knowledge. These latter, who comprise nearly all editors and ordinary journalists, tend to see the scientist-journalist hybrids as 'eggheads', abstracted intellectuals who have little practical idea of how the real world works, and who can thus play only a very small role in the hurly-burly of the newsroom.

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Scientist-journalists often need to overcome another hurdle in that they usually awaken collegial expectations in the scientists they interview. 'You're not like other journalists,' scientists respond to science-trained journalists. 'You won't ask the usual stupid questions, and you'll understand what I tell you.' What scientists mean by that, of course, is that they expect the journalist to act as a secretary and write the story as the scientist dictates it. When the journalist shows scepticism, talks to competitors, and does not show an investigator a story before publication—all of which are good and proper practice for a reporter—the scientist often feels betrayed and often reacts with exaggerated animosity.

Still another condition diminishes the value of a science-trained reporter: the continuous acceleration of news dissemination. The internet, cable news networks, satellite phones and other forms of data transmission are moving news ever more quickly to the public. This leaves the scientist-reporter, who is trained to be careful and deliberate, less time to make the telephone calls necessary to investigate a story. In today's red-hot news market, being first into print is more important than being entirely accurate. Errors can be corrected later, editors say. Needless to say, this attitude is anathema to a scientist.

Given this difficult, even adversarial intellectual climate, can scientists contribute to the improvement of science reporting in the mass media? Or, can academic programmes in science writing, whether for scientists or others, contribute much of value at all? I think the answer to both questions is a tentative 'yes', but only under certain circumstances. In the discussion that follows, I will explain, on the basis of my own experience as Director of the Science Communication Program at the University of California, whether and how professionally educated science writers can help to bridge the gap between science and the media.

First, it is crucial to understand how the different forms of the US media gather, shape and distribute science stories, and where these come from. Most science stories, including the important breakthrough stories, are nearly always reported first by the nation's top newspapers: *The New York Times, The Washington Post, The Wall Street Journal, The Los Angeles Times, The Chicago Tribune* and a few others. Wire services, such as the Associated Press, sometimes break science stories, but more often they repackage and redistribute, with additional reporting, those that appeared in daily newspapers. Radio and television usually take their news from the national newspapers and wire services.

Science news in the USA is thus orchestrated largely by a handful of reporters at the most influential newspapers. Apart from the few exceptions mentioned earlier, these journalists tend to have similar backgrounds, usually a bachelor's degrees in liberal arts. Noted astronomy writer and TV documentary producer Timothy Ferris has a B.A. in history. The late *New York Times* science writer Walter Sullivan, for decades the grey eminence of the nation's science media, had a B.A. in music. Jerry Bishop of *The Wall Street Journal* and John Noble Wilford of *The New York Times* have bachelor's degrees in journalism. To be sure, some nationally prominent science writers have science backgrounds, but they are few and far between.

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More importantly, nearly all newspaper editors and TV producers are non-scientists, and it is they who, among others, choose which science stories reach the public and how to present them. Furthermore, despite the existence of many distinguished graduate-level journalism schools in the USA, editors still prefer on-the-job training as the best way to prepare journalists—including science journalists—for the rigours of the profession. Some of the more cynical editors say they use the journalism schools merely as 'prescreeners,' to separate the committed and talented neophyte journalists from the hordes of young people that approach

The Science Communication Program at UCSC

Students: The science writing programme accepts ten applicants per year with at least six months full-time research experience. No experience in writing for the mass media is expected. The median age of students is between 27 and 30 and usually half of them have a Ph.D. Foreign students must show excellent English abilities and a comparable research background.

Curriculum: The programme lasts 12 months and has a strong focus on the practical aspects of science writing and reporting. Formally, students take six graduate subjects over the academic year, with the two subjects per semester approaching a single focus from different angles. In the fall the focus is straight news reporting and writing for newspapers and weekly news magazines. Winter is devoted to feature writing for newspapers and magazines and the spring trimester emphasises reviews, essays and opinion writing for newspapers and magazines. There is no instruction in writing for broadcast media. Journalistic ethics are not taught as an abstract subject but taught on a story-by-story fashion during the six courses. Students are expected to write about subjects as far outside their areas of expertise as possible—biologists write about astronomy, mathematicians about environmental issues, chemists about wildlife.

Internships: All students have to serve part-time internships during the course. These internships take place at local newspapers and public relations offices at research institutions, including Stanford University or the NASA Ames research center. Following the academic year, students complete the programme with a full-time, closely mentored internship at any media site in the USA or Europe.

Science Illustration Programme: In addition to science writing, the science communication programme also includes an illustration track. The ten students selected each year for this programme enter it with considerably more experience as illustrators than the writing students have in writing for non-scientists. The illustrators study all the traditional techniques—pencil, pen and ink, watercolour, oil, and various other media—and learn to use the latest computer programmes for producing images and animations. In the final quarter, illustrators team up with the writers for magazine features where they also illustrate physiological and molecular processes. The curriculum focuses on black and white techniques in the winter, colour techniques in the winter and specific subject matter—mostly in the domain of natural history—in the spring.

newspaper offices in search of entry-level work. This situation is even more abundant in Europe where only a few journalism schools exist and where journalists usually learn the profession on the job.

In any event, the stars of the US science writing firmament, whatever their academic background, all claw their way up through the same gruelling apprenticeship in reporting the news. Typically they work for several small and medium-sized newspapers in succession. They report on not only science but nearly every other subject covered in the paper: crime and the courts, local politics, sports, schools, entertainment—in brief, just about anything of interest to the reader. The career path from a small newspaper to a major metropolitan daily takes about six years for those few who are sufficiently talented and hardworking.

Editors, for their part, prefer to hire reporters who have covered a wide variety of 'beats', especially when the job is covering science or another specialised area. They believe that a seasoned generalist reporter's approach to a new subject will be fresher and more closely attuned to the reader's interests than that of a person with specialised training. Editors are even sceptical of former general assignment reporters who have become deeply knowledgeable in a specialised area. Such a reporter, in their view, can get too familiar with the beat, and they even routinely reassign the reporters they view as overly seasoned to unfamiliar beats, a fate that can equally befall science writers as well.

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Editors believe, in brief, that an intelligent, experienced general assignment reporter with a liberal arts background can produce a more appealing science story than a person with a Ph.D. in science can. Indeed, editors consider research scientists to be among the people least able to talk about how a research development might affect the average citizen. After all, they say, the test of newsworthiness is not, 'How importantly will a development influence the course of science?' It is rather, 'How will this development affect my reader's life?' Most scientists are not as interested in the latter question as they are in the former. Nor, typically, are they much interested in the over-the-horizon medical, social, political, economic or ethical issues that a development may raise. But if they wish to become the mediators between science and the public, they must care about these things, from the bottom of their heart. They cannot simply put on the correct attitude as they would a jacket. The problem is especially acute if these scientists disdain the mass media as sensationalistic and inaccurate. Neophyte science writers of this persuasion must undergo a resocialisation process as radical as military training.

US journalism schools do try to expose their students to this world of the news media. But the exposure takes root in some and not in others and there is no formula to guarantee a positive result. We have learned, painfully, that an applicant well-trained in science can possess an extremely high level of verbal skill and yet fail at writing about science for the general public. Those who fail share a single characteristic. They prove unable, despite great effort, to empathise with non-scientist readers. Consequently, their writing, far from inviting the skittish, even science-phobic general reader in, rather deters the reader by seeming overly intellectual, stuffy and condescending—not the sort of writing a non-scientist would read for fun. We drill into our students the dictum that the general reader reads only for pleasure. Any popular prose that looks like it will require effort will languish unread. Thus, we look in an applicant's writing for a hard-to-define quality we call 'sparkle', for compelling writing, writing we simply cannot put down. Successful applicants show us they can invest their hearts as well as their minds into their writing. They

Useful Websites

National Association of Science Writers: http://www.nasw.org/
Association of British Science Writers: http://www.absw.org.uk/
American Association for the Advancement of Science: http://www.aaas.org/
Science Communication courses in the UK: http://www.absw.org.uk/courses.htm
Boston University Science Journalism Program: http://www.bu.edu/com/jo/science.html
Columbia University Earth & Environmental Science Journalism: http://www.columbia.edu/cu/gsas/depts/eesj.html
Metcalf Institute for Marine & Environmental Reporting, University of Rhode Island: http://www.gso.uri.edu/metcalf/main.html
University of Missouri Science Journalism Center: http://science.jour.missouri.edu/
MIT Graduate Program in Science Writing: http://web.mit.edu/sciwrite/
New York University's Science and Environmental Reporting Programme: http://www.nyu.edu/gsas/dept/journal/serp/
Johns Hopkins University Writing Seminars: http://www.jhu.edu/~writsem/
University of Washington's Department of Technical Communication: http://www.uwtc.washington.edu/

tell us stories that live in our minds long after we read their words.

After 20 years of training some 200 graduate students, I can report some progress in convincing editors that properly trained scientists can do the job of reporting on science for general readers. However—and this is a big however—editors still insist that these scientists must, no matter what their qualification in science, move through some version of the traditional gauntlet of disparate beats at small and medium-sized newspapers before assuming a high-profile science writer position at a national newspaper. No matter how well grounded one is in science, there are no shortcuts to becoming a nationally prominent science reporter.

Indeed, all I can say to scientists who are considering science writing as a career is this: succeeding in science journalism is no easier than succeeding in science. One must be called to it, almost as one is called to a religious life. Our students have, in part perhaps for mystical reasons, done well. Nearly all those we have trained have moved into jobs in newspapers, magazines, museums, zoos, aquariums, and news offices in universities and government laboratories. A few have gone into the more specialised fields of technical writing or medical writing. Not a single one, interestingly, has gone back to the laboratory bench.

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Immunology at the crossroads

As decades of research have resulted in few clinical applications, it is time to think about new research strategies to understand the workings of the immune system • *by Antonio Coutinho*

Ever since Niels Jerne introduced the Darwinian principles of 'variation and selection' into immunology in 1955, the field has truly flourished. Immunologists can now claim an impressive record; during the past 40 years, they have deciphered a significant number of intricate molecular and cellular mechanisms. Indeed, the names of many immunologists enrich the list of Nobel Prize winners, confirming that this field has been at the forefront of biological research for many decades. Nearly 30 years ago, in a lecture at the Institut Pasteur in Paris, France, Jerne estimated that the number of immunologists in the world had tripled every 20 years from the late 19th century, to reach about 10 000 in 1970 (Jerne, 1974). This number is now likely to be above 40 000, and a paper in immunology is published, on average, every 15 minutes. Today, not only do we know many of the cell types, molecules and genes that protect us from disease-causing agents, but immunology has also made a remarkable contribution to general biology. Jerne used to say that lymphocytes are the *Escherichia coli* of eukaryotes, and many advances in cell differentiation, the cell cycle, signalling, intracellular protein trafficking, DNA recombination and repair, and the regulation of gene expression owe their discovery to this extraordinary cell type. The study of the immune system has also contributed to an

The paradox of today's immunology is that tremendous progress in basic science has been matched by only a few clinical applications