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Text by: Mark Peplow (https://www.markpeplow.com/)
There may be small differences between the final delivered talk and this text

Thanks for the kind introduction. And thank you for inviting me to The Mary Ann Mansigh Conversation, I'm genuinely honoured and delighted to be here.

I'll confess that I had not heard of Mary Ann Mansigh before being invited to give this talk. So I was really interested to read about her pioneering work in programming at the Livermore Laboratory, particularly in the area of molecular dynamics – and also how she was long denied scientific credit for her work, and paid lower wages than men in equivalent positions.

I think that science journalism actually has a really important role to play in highlighting the true contributions of scientists, both historically and in the present day. This increasing focus on recognising the work of underrepresented groups in science has really become a major topic in newsrooms over the past 10 to 20 years, and it's something that I'll return to later in the talk.

But before that, I'm going to give you a whirlwind tour of science journalism – what it is, how it works, and why it matters. I'm going give you some insights about how science journalism is done at Nature; and I'll look in particular at some of the issues surrounding journalism about your areas of science, including modelling and materials science. And then I'm going to wrap up with a look at how science journalism is changing, and what's driving that.

First, though, I ought to give you a very brief overview of how I got here. I did a PhD in chemistry at Imperial College, and a 1-year postdoc in Canada. But I'd always loved talking and writing about science, so I went back to Imperial to do a masters in science communication. My first job after that was as a press officer, but in 2004 I went to work for Nature as an online news reporter, covering all the physical sciences. I was then the editor of Chemistry World magazine for a couple of years, which is published by the Royal Society of Chemistry. I went back to Nature in 2008, and was their chief news editor for about 5 years. And I've been a freelance science journalist since 2013.

I think it's worth explaining some of those job titles. Firstly, what's a science journalist? Well, this is someone involved in telling stories about science, through writing, audio, TV or other media. Some journalists are reporters, who have conversations with scientists called interviews – they digest them and use that information in weaving the story together. Journalists called editors make decisions about what stories should be told, and how they should be told – at the most basic level, that might involve moving words round on a page. Other editors, called subeditors, are involved in checking facts in the story, and making sure it's going to be understandable to an average reader or listener.

Some of these journalists are staffers – they are full time employees of a publishing company. But a lot of reporters and editors, like me, are freelance – they can do this work on a story by story basis, for any outlet. I typically write about chemistry, materials, clean-tech and pharmaceuticals, from science and policy and business points of view. Writing takes up about half of my time – the rest is freelance editing, on any scientific topic. I do that work for Nature, Nature Biotech, Chem & Eng. News, PNAS, and a few other magazines.

I also mentioned press officers – these are people employed by universities, businesses, governments, etc to liaise with journalists and put their organisation's point of view into the media. The press officer's work will include writing a press release – which is itself might be a story about science – and distributing that to journalists, in the hope they will write about it.

So while press officers serve their *institutions*, journalists are primarily concerned with serving our *readers* – giving them something that is interesting, enlightening, as true as can be, and hopefully even entertaining to read.

That focus on the reader was nicely described years ago by a venerable science editor of the Guardian newspaper called Tim Radford, who set down a 'manifesto for the simple scribe', made up of 25 commandments for journalists. I just want to read you the first few, which I've abridged a little.

"When you sit down to write, there is only one important person in your life. This is someone you will never meet, called a reader. You are not writing to impress the scientist you have just interviewed, nor the professor who got you through your degree. You are writing to impress someone sitting on a train, who will stop reading in a fifth of a second, given a chance. So the first sentence you write will be the most important sentence in your life; and so will the second, and the third. This is because, although you may feel obliged to write, nobody has ever felt obliged to read it."

For a national newspaper, most of the readers are not scientists, so science stories are often written at a level that would be understandable by a bright 14 or 15 year old [an 11 year old for a tabloid]. At a publication like Nature, we write at a level that can be understood by someone who has studied high-school science up to the age of 17 or 18.

We pick this age because although our readers are mostly scientists, they might be ecologists reading about cosmology; or astronomers reading about genetics. So although our coverage has to be meaningful, important, accurate, and insightful for people who are world-experts in the topic we're covering – it also has to be accessible enough so that *any* scientifically literate person can read it.

So what's the point of science journalism? For any commercial publication, part of the reason is, bluntly, to sell newspapers, or magazine subscriptions. But there are nobler purposes – maybe you just want to shout from the rooftops about an amazing new discovery. Maybe you want to make it easier for scientists from diverse disciplines to communicate and collaborate with each other. Maybe you want to expose wrongdoing in the scientific community. Maybe you want to highlight deficiencies in science funding. Maybe you want to shine a light on a fascinating academic dispute, in a way that might actually help to resolve it, and enable science to progress. These reasons, and more, all motivate the journalists at Nature.

Back in 2009, Nature did a special issue about science journalism, and the editorial in that issue was headlined with a question: 'Cheerleader or watchdog?'. Clearly, the answer is that journalism at Nature is a bit of both.

So what does that actually look like in detail? What does a reporter at Nature actually do all day?

First, they look for a story. If it's a straightforward story about a new scientific discovery, they might find that in a press release in their email inbox, or posted to a media website such as Eurekalert, which is run by the AAAS. They host press releases under embargo, so they're only visible to registered journalists, and they often say things like:

"Researchers in the University of Utopia have discovered a way to achieve faster-than-light travel, reverse global warming, and cure all forms of cancer. The paper will be published next Thursday in the Journal of Frankly Astonishing Results." This press release will be about 500 words long, contain a few quotes from the researchers, maybe an image or two that are free to use, contact details and so on.

In mainstream media, some journalists will take that text, adapt it a little, and that's pretty much all they do to prepare their story. Others will actually pick up the phone and talk to the lead scientist. Some will even talk to an 'outside source' – that's someone who is an expert in the field, but not involved in that research, so they can offer a very informal kind of peer review.

At Nature, journalists would take that press release as just a starting point – a flag for some new and *potentially* interesting science. The reporter will have the expertise to know how this result sits in the broader context of the field; whether it's likely to be controversial or disputed; and they'll have a sense about what the future implications of the research might be.

Press releases aren't the only starting point for a science story. Journalists have a 'beat' – a set of topics that they cover regularly – and so they will scan the major journals in those areas to keep up with the literature. Or we might be contacted directly by researchers, to let us know they have a new paper coming out.

However they arrive at it, if the paper sounds like something the readers would find interesting and important, the reporter goes to their editor and spends a few minutes 'pitching' the story – explaining what it's about, and why we should cover it. The editor loves it: she wants 600 words, including a quote or two from interviews with one of the lead researchers, and a couple of outside sources.

So you read the paper in more detail, and approach all those possible sources — mostly by email these days, but maybe via socials, or just by phoning them up. The interviews might take 10-20 minutes each. Then you write the story, including relevant web links, references, suggested images, and file to your editor.

The editor then finds ways to improve the story – they might make it more concise, remove jargon, change the order that you give the reader certain chunks of information. They will also ask a lot of questions: Why didn't the scientists do it this way instead? Why had nobody thought of doing it this way before? These two sources contradict each other – so who's right?

You deal with the questions, sometimes going back to the people you interviewed to clarify things. Then the story goes to a sub-editor – who checks facts, and makes sure the story is in house style. They also ask more question. Once all that is resolved, its ready to publish.

Some of these stories are turned around in 24 hours, others might spread over a few days, alongside other work. For longer feature stories, which are about 2500 words – maybe about 3 or 4 magazine pages - that may take several weeks of work — and perhaps even a reporting trip to an exotic location if you're lucky.

So what types of stories are the commissioning editors looking for? At Nature, the news stories broadly fall into four categories. The first, which I've just described to you, is a straight science story: here's an interesting new paper.

The second category is a community story – stuff that's actually happening to people within a scientific community. For example, 'Iran frees conservation scientists who spent 6 years in jail'. Often, journalists find community stories because they have really good contacts with people in that scientific field – they might meet up at conferences for a catch up, they might email each other about issues in that scientific field, and it's a symbiotic relationship. The journalist hears about things that scientists are concerned about that can become stories; while the scientist gets to flag issues that would benefit from wider scrutiny.

The third category is a policy story – that may be a new government policy that affects science, or it may be about how science is informing a government policy. For example, 'Canadian science gets biggest boost to PhD and postdoc pay in 20 years'.

The final category is what I'd call a 'behind the headlines' story that looks in depth at something being covered in the mainstream media, and the tone here is quite didactic. For example, 'Countries are cracking down on tobacco use and vaping — let's take a look at how it could save thousands of lives and billions of dollars.'

[All of those are examples from the past couple of weeks.]

There are three main news editors at Nature who commission these stories, and they cover specific regions: Europe, Americas, and Asia-Pacific. These days, all the news goes online first – and then stories that are more popular, based on web stats, or especially important, are recycled into the print edition. That's actually one of the biggest changes from when I started at Nature 20 years ago, because the online and print news teams were almost entirely separate back then.

As a freelancer, I can pitch to lots of different editors, not just those at Nature. So if a story is a really nice bit of chemistry, that will be fascinating for chemists but not really of wider interest outside of that community, I pitch it to Chemical & Engineering News. And because I've been in the business for a long time, I know quite a lot of editors – that means that they sometimes come to me with a story idea, and ask if I can cover it for them. Maybe it has been suggested by a staff reporter who is tied up on another story; maybe they just need someone in my timezone; or maybe I just happen to have just the right expertise for that topic. Whatever the reason, more than half of my writing work comes to me that way, rather than from me pitching it.

I've been talking about news and features, and they are certainly at the heart of Nature's journalism, but there's also editorials, research highlights, opinion pieces, and 'news and views' articles that are written by scientists but edited by journalists – these offer a perspective on a hot new paper, often one that is being published in Nature. Collectively, all of these sections make up the 'front half' of Nature – the so-called 'magazine' section, ultimately controlled by a Chief Magazine Editor – which stands separate to the 'back half', where all the academic peer-reviewed papers are published.

Nature prides itself on the fact that the front-half – the journalism – is editorially independent of the back-half. What that means in practice is that we can report on controversies *about* Nature papers without being influenced by the manuscript editors, or other parts of the academic publishing business.

So why should you care about any of this? Well, a few of you might have ambitions to be a science journalist, and I'm happy to talk to you afterwards about how to follow that career path. One of the broader reasons, though, is that it's quite likely that sooner or later you might find yourself being contacted by a science journalist for an interview – maybe about your own work, or to comment on someone else's work, or about something that's going on in academia, or the wider world.

When a journalist contacts you, I would urge you to engage with them. It's not only a way to make yourself and your work known to the wider scientific community – it's crucial to help that journalist get the facts right about what they're writing. I've also had scientists tell me that the discussions we've had during an interview has actually sparked ideas for new research directions; or the story has prompted new collaborations.

Some scientists use news stories about their work to support grant applications, or tenure applications; and talking to journalists actually forms part of a broader class of academic work that's often called 'outreach', which these days can be a requirement of funding agencies.

Some scientists can be a little suspicious of journalists, assuming they're trying to catch them out, or get them to say something controversial. In 99% of cases, that is just not true – and if the journalist works for a reputable organisation like Nature, or Scientific American, I'd say its pretty much never the case. We just want to write a true and interesting story for our readers.

Also, just ignoring a journalist's interview request doesn't mean they won't write the story. It's already been commissioned – they're writing that story, whether you engage with them or not. So really, if you can spare 15 minutes or so, it's always better to engage with them, because you can help to shape the tone of the story and make sure that it accurately represents your field.

So let's talk about your field, which I think has some specific challenges for journalists covering your area, especially mainstream journalists.

If we look at materials science, for example, any story about a new discovery will inevitably ask: what is it good for? Is this material going to be a better catalyst, or an amazing battery electrode component … what are the applications? And the truth is, with basic research, often we don't really know whether it's going to be *practically* useful for anything, because that depends on so many other factors beyond physical properties – the availability of materials, their cost, incumbent technologies already in the market, and so on. So there is always a risk for scientists *and* journalists of over-hyping a discovery — just think how often you've heard graphene, or perovskite photovoltaics, described as 'miracle materials'.

My advice is to be clear about what properties it has that might be exploited in applications – but also be clear about what the hurdles might be to achieve that. That way, the journalist is more likely to write a nuanced story that more accurately reflects the true situation, with all the necessary caveats.

Another issue for your area is about the computer side of things — modelling, machine learning, AI, and so on. Almost every journalist you ever talk to will treat these things as a 'black box' – they don't understand it, and they don't care what's going on inside the algorithms. At best, they just want to know what you fed into it, and what came out of the other side.

Now, on the one hand this is entirely understandable – most of the journalist's readers are simply not interested in the inner workings of an algorithm or computational modelling. And since it's not going into the story, the reporter doesn't need to ask you about it.

But on the other hand, I do worry that too much of this stuff is just being taken on trust by journalists. They have no way of telling whether this or that AI system is producing meaningful and useful results, or of comparing different AI approaches. And since AI is now being used more and more in research, I think this 'black box' problem is only going to get worse. If you'll permit me to offer some advice, I think it would be helpful for you, as a community, to start to think about ways to explain what is going on inside models, simulations, algorithms – maybe by thinking of helpful metaphors, or analogies – so that those sorts of details *can* start to creep into broader media coverage of your work.

This is not just about fostering a deeper understanding of your work. I think it's important because it's also a way to demonstrate transparency about your work — and transparency engenders trust.

I want to wrap this up by looking at how science journalism is changing. First, let's look at the technology side. As I've already explained, Nature is now an 'online first' magazine, and that's true of the vast majority of mainstream and specialist magazines out there.

But there's also a lot more technology used in the newsroom. 10 years ago, I used to have daily in-person news meetings every morning to hear reporters' pitches and decide the day's news agenda. Now, a lot of that collaborative work is done remotely, using systems like Slack and Trello. The editors also use tools like Chartbeat to see what stories are resonating most with readers that will go into print.

Since about 2020, they have also had story traffic goals, so they do like to pick hot topics that get a lot of readers. In general, cool new science gets more clicks than climate policy, but it's obviously important to cover both areas – that's just one example where an editor's commissioning judgement is really important to get the right balance of stories.

Social media is obviously used more and more to drive traffic to magazine websites, but it can also play a big role in commissioning decision – if a topic is generating a lot of discussion on Twitter, like the supposed room-temperature superconductor LK-99 for example, you can visibly see that it's something the community is interested in, so Nature – and science journalists more generally – want to play a role in that conversation.

On the community side, representation has rightly become a much bigger issue for science journalists over the past 20 years. ‘Women in science’ has been a topic for much longer, of course, but Diversity, Equity & Inclusion more generally really is at the forefront of a lot of journalists’ thinking nowadays.

Let me give you an example. Some of you may have heard of a science writer called Ed Yong, who has written books like ‘I contain multitudes’, about the microbiome. He was a staff writer at the Atlantic for several years, and he’s also written for Nature. About 10 years ago, Ed starting looking in detail at the gender ratios of scientists quoted in his stories, and found that on average, women were really underrepresented – some of the stories looked like those dreaded all-male conference panels. Around the same time, other journalists and publications were doing similar surveys, and it showed that this was a widespread problem.

This really prompted a rethink in science journalism, and since then, most of the magazines I work for explicitly ask reporters to find diverse sources for their stories – more women, more people of colour, more LGBTQ scientists, and so on. Broadly, I would say that effort is working – but slowly, and there’s still a long way to go.

One of the most helpful things for journalists who are trying to take action on this issue are online resources that act as directories for scientists who are from underrepresented groups: sites such as Diverse Sources, Gage, Diversify Chemistry, and many more. I’d encourage people to sign up to these kinds of directories, because I know journalists really do use them.

It’s also important that we hear more from young scientists – the people who actually do the lab work. I often try to interview the PhD or postdoc who led the experimental work on a paper, but sometimes they will defer to their boss, or their boss won’t let them do the interview. I say: please, let us hear the voices of young scientists, because they are the future of your field, and they are your best recruiting tool for the next generation of scientists. If you’re nervous about doing an interview, ask your institution’s press officer for some media training – most will be able to provide it.

The shift to online over the past 20 years that I’ve been talking about has certainly made science journalism more visible, and more interactive with its readers. But it also means the money that magazines make from print advertising has gone down significantly, while the income from online advertising has not risen enough to take its place. Nature’s journalism is somewhat insulated from that, because it has always been regarded as a ‘loss leader’ — it’s added value in the journal that helps drive subscriptions and also maintain existing subscriptions, but it doesn’t have to make a profit on its own.

But elsewhere, science journalism is really suffering from the decline in advertising revenues. National Geographic laid off all its staff reporters last year; a few years ago, Popular Science stopped publishing its physical magazine, which had existed for 150 years, and went online only, accompanied by job cuts; Wired laid off 20 staff journalists; and many more.

Clearly, this is a problem for my profession. But it's a problem for scientists too. Without specialist science journalists, the quality of coverage of your field will decline, or it might disappear altogether. And that leaves a big gap where disinformation about science can flourish. There's a danger that all this has the knock-on effect of damaging public trust in science, which is bad for all of us – just look at the growth in anti-vaccine rhetoric.

So, once again, I urge you to engage with science journalism: as a reader, as a source, or as a contributor.

It can sometimes seem like science and the media are in opposition – that journalist took my quote out of context, they hyped those dubious results … it's all fake news! So I want to end with an observation from that Nature editorial I mentioned earlier, about science and the media. Here's what it said:

"Science and journalism are not alien cultures. They are built on the same foundation — the belief that conclusions require evidence; that the evidence should be open to everyone; and that everything is subject to question. Both groups are comprised of professional sceptics."

So, here's to professional scepticism! And thanks very much indeed for your attention.

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