

CAREERS

INCLUSION Women comprise just 9% of UK chemistry professors **p.389**

MOBILITY Decline in foreign graduates studying in the United States **p.389**

PODCAST NIH grant review process explained go.nature.com/fundingNIH

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Producer Alison Ballance (centre) interviews scientists in Antarctica for the radio show and podcast *Our Changing World*.

OUTREACH

Listen up

Science podcasts are on the rise — and researchers are producing many of them.

BY ROBERTA KWOK

During a sabbatical in 2016, Liz Haswell binged on podcasts such as the journalism-storytelling shows *This American Life* and *Serial*. Haswell — a plant biologist at Washington University in St Louis, Missouri — loved the informal, conversational style of the medium, and the convenience of listening while doing other tasks. She started discussing the idea of making a science podcast with a friend. But the idea didn't take hold until the editor-in-chief of *The Plant Cell*, a journal published by the American Society of Plant Biologists (ASPB), that Haswell helped to edit, asked if she wanted to assist in putting together a journal club.

Haswell and her friend, plant biologist Ivan Baxter at the Donald Danforth Plant Science Center in St Louis, instead proposed creating and co-hosting a podcast. The ASPB agreed,

and Haswell and Baxter found six scientists to be guests in the first season of their show, called *The Taproot*. Episodes explore the backstory behind plant-biology studies; for instance, one researcher described asking other scientists on Twitter for help analysing genomic data he had posted online to study a fungal-disease outbreak.

Episodes of *The Taproot* have been collectively downloaded about 36,000 times, and the team launched its third season in December. “I really love the conversations we have with people,” Haswell says.

She's not alone in her auditory endeavours. In 2005, Apple's podcast platform offered more than 3,000 active shows; by 2018, that number had surpassed 600,000. Although science shows make up a small fraction of the total number of shows, they are on the rise, according to a study by Lewis MacKenzie, a biomedical physicist and science communicator

at Durham University, UK (L. E. MacKenzie *R. Soc. Open Sci.* **6**, 180932; 2019). The number of English-language science podcasts that MacKenzie identified grew from around 200 in 2010 to 952 in 2018, and 38% were independently produced. Around 10–15 years ago, “everybody was starting a blog”, Haswell says. “Now everybody's doing a podcast.”

That is in part because podcasts have become easier to produce and access. In the past, podcast creators generally needed studios with recording equipment, and audiences had to download audio files to computers and transfer them to MP3 players to listen on the go, notes Kat Arney, director of First Create the Media Ltd., a science-communications consultancy in Maidenhead, UK. Now, decent recording devices are inexpensive, editing software is available for free, and online services make distribution straightforward. “There's virtually zero barrier to entry,” Arney says. ►

► And listeners can download episodes onto their smartphones with a tap of the finger. But the lack of barriers can also make it challenging to find audiences. “You have to realize it’s a really busy market,” says Alison Ballance, a senior producer at Radio New Zealand in Wellington. In his study, MacKenzie found that roughly half of science podcast series did not last longer than two years.

Also, only 24% of science podcasts seem to actually earn an income, which comes in the form of advertisements, donations or merchandise, according to MacKenzie’s study. For many researchers who use audio mainly as a science-communication tool, making money isn’t the main point. “I’m doing something that I love doing,” says Haswell. “There’s nothing better than an outreach activity about which you feel truly passionate.”

Some scientists note that podcasting can lead to tangible career benefits. Inviting senior researchers as guests is a good way to meet them and can be less intimidating than, say, approaching them at a conference without a particular reason, says Hugh Osborn, an astronomer at the Laboratory of Astrophysics of Marseille, France, and co-host of the podcast *Exocast*. Haswell says that *The Taproot* raised her profile among plant biologists. At an ASPB meeting, other researchers recognized her from the podcast. In 2017, she was elected as a council delegate for biological sciences for the American Association for the Advancement of Science in Washington DC, and she suspects that listing the podcast in her biography helped.

Early-career researchers can point to podcast production as evidence of outreach. Marcos Vinicius Dantas-Queiroz, a PhD student in plant sciences at São Paulo State University in Brazil, co-produced the independent science podcast *Dragões de Garagem* for almost three years. He lists the work on his CV and hopes that the communication skills he’s gained will increase his chances of landing an academic job. “I think it’s going to be opening doors in my career,” he says.

FINDING A NICHE

Podcasts are frequently described as intimate. Many people listen alone on their headphones, and hosts and guests can tell stories informally in their own voices. “You get all that spark and energy,” Ballance says. Listeners often tune in while commuting, exercising, doing chores or conducting lab work.

Some researchers use the medium to provide perspectives that they feel are lacking from science news. *Exocast*, which averages about 500–600 downloads per episode, tries to offer balanced, in-depth discussion of results that receive uncritical media attention, Osborn says. For instance, observations of a star nicknamed Tabby’s Star sparked media speculation in 2015 that alien megastructures were circling it; Osborn threw cold water on that idea during an episode of the podcast.

And podcasts can provide valuable guidance in the research community. *The Taproot* aims to show that research struggles are common and to highlight challenges that its guests face. One such guest told a story from her graduate-student years about the difficulty of getting senior collaborators to agree on nomenclature for a gene family.

Scientists who want to start a podcast should have a unique niche in mind, MacKenzie says, such as knowledge of an under-covered field or an unusual format such as science comedy.

Alex Lathbridge, a PhD student in biochemistry at the University of Bath, UK, knew his target listeners when he started the podcast *Why Aren’t You A Doctor Yet?* in 2017. He wanted to create a show with more culturally diverse perspectives than those often seen in science-related media and that would appeal to the people that he — a millennial Londoner and a child of Ghanaian expatriates — had grown up with. The show would cover general science and technology topics aimed at a multicultural audience aged 18–34.

To do so, Lathbridge recruited three co-hosts who were also members of minority ethnic groups, and the team often covered topics relevant to those populations. In one episode, the hosts discussed the London Metropolitan Police’s process for identifying possible gang members to be added to a database — a system that critics have said disproportionately targets young black men — and use of a formula scoring each person’s risk of committing violent crimes. The group talked about both the technology and their personal perspectives on the issue, Lathbridge says. The podcast has been featured on iTunes’ front page, and each episode is downloaded an average of about 1,500 times during the first week after release.

Some researchers have found large audiences by by-passing the stiff competition in the English-language market. In Brazil, there

are relatively few science podcasts, Dantas-Queiroz says. His friends started *Dragões de Garagem* in 2012 to cover science-related issues in Portuguese. The show, which has an informal style and uses frequent pop-culture references, now averages about 19,000 downloads per episode.

Finding the right balance between layperson and technical language can be tricky for podcasts on specialized topics. *Exocast* is aimed at anyone interested in exoplanets. Although the team wants the show to be accessible, explaining basic astronomy concepts in every episode would probably be too dull and repetitive for regular listeners, Osborn says. He notes that the hosts try to give general overviews of terms that are fundamental to the discussion, but if they refer to a subject only briefly, they might point listeners to a previous episode or external resource for more information.

LAUNCH TIME

To get started on making a podcast, scientists can consult online tutorials. Emily Roberts, who was trained in biomedical engineering and founded the company Personal Finance for PhDs in Seattle, Washington, felt intimidated when she set out to create a podcast with the same name in 2018. But she found advice about how to start a podcast through a free online tutorial that covers basic topics, such as microphones and episode distribution, and is produced by Pat Flynn, host of the business show *Smart Passive Income Podcast*. Audio quality is a crucial component of a podcast (see ‘Sound advice’). If the podcast has distorted sounds or odd volume changes, “for me, it’s a deal-breaker”, Arney says.

Producers use a variety of methods to connect hosts and guests in different locations. Haswell and Baxter rely on an online podcast-production system called Cast, and Roberts uses Zoom videoconferencing software. Osborn and his co-hosts, who live in different cities, talk over Skype, and each person records a separate audio track on a smartphone or laptop; later, they edit the tracks together. But

“There’s virtually zero barrier to entry.”

SOUND ADVICE

Tips for creating your first podcast

Here are some tips for getting started on podcast production:

- Invest in a good microphone. Some brands suggested by podcast hosts include Audio-Technica and Blue.
- Record in a quiet room with soft furnishings to maximize recording quality. Universities often have recording studios.
- Limit the number of people in a conversation to about four. Introduce guests at the beginning of an episode and keep mentioning names and identifying details, such as their line of work, to help listeners to

distinguish voices.

- Each person should record a separate audio track, and these can then be edited together.
- During each episode, give a preview of future episodes.
- Use editing software. Popular options include Audacity (free) and REAPER (US\$60–225).
- Consider online services such as Libsyn and Blubrry.com which can help producers to distribute shows to podcast aggregators.

R.K.



The hosts of the podcast *Why Aren't You A Doctor Yet?* aim to reach a multicultural audience.

STEVE CROSS

Lathbridge's team meets in person to record shows together. "We feed off each other's energy," he says. "It's like having a conversation with your mates, and so getting us all into one room, I think, is paramount."

To reach listeners, creators should promote their podcasts through social media and post show notes or transcripts on the podcast website to increase the chances of being found through Google. Scientists with their own podcasts can ask producers of similar podcasts to mention their show and offer to do the same in return. Osborn adds a slide about *Exocast* to the end of most of his conference presentations. And inviting guests with large social-media followings can boost exposure.

New podcast creators might get disheartened by low download numbers, but "it's important to remember why you're doing a podcast in the first place", Arney says. Some scientists want to improve communication skills, work with friends or just have fun. In those cases, Arney says, researchers can measure success on the basis of whether they feel proud of their episodes, have improved the podcast over time and are enjoying the process.

Encouraging audience feedback through social media or e-mail can motivate podcast producers to keep going, even if the number of listeners is relatively small, MacKenzie notes. After *The Taproot* released an episode about mental-health issues among graduate students last May, some researchers expressed appreciation on Twitter that the show had addressed the topic. And criticism can spur improvement. One listener tweeted about the lack of ethnic diversity featured on *The Taproot*, which prompted Haswell and Baxter to increase the range of guests in the next season.

REVENUE

Some creators get funding or other support for podcasts. The ASPB pays expenses such as the Cast recording-service subscription, Haswell says. Lathbridge's team won a £1,000 (US\$1,300) outreach grant from the Biochemical Society in London. The team used some of the funds to produce five episodes with biology themes. In 2018, Arney started a podcast for The Genetics Society in London called *Genetics Unzipped* and decided to host it on Acast, a podcast platform that takes care of securing advertisers and gives creators a cut of the revenue. (*Working Scientist*, the *Nature Careers Podcast*, and the *Nature Podcast* are also on Acast.)

There are a few avenues open to researchers who want to pursue podcasting professionally. After her PhD programme in developmental genetics, Arney got a job in science communications at Cancer Research UK in London; her duties included making a podcast. She now works as a freelance writer, broadcaster and podcast producer. Ballance, who was trained in zoology, started as a researcher for wildlife documentaries, worked her way up to producing and directing and then switched to radio. As for pay, \$250–500 a day is typical for freelance audio production, Arney says. Ballance estimates that radio journalists in New Zealand make about \$35,000–40,000 per year.

Scientists might feel intimidated by the thought of entering the booming podcast market. But there is still space for more voices, Haswell says. "I don't feel like we've reached saturation," she says. "Nobody should feel like there isn't room for another point of view." ■

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GRADUATE STUDIES

Foreign enrolment falls

The number of international students enrolling in US graduate programmes is falling, according to reports from the US Council of Graduate Schools (CGS) in Washington DC and the Institute of International Education (IIE) in New York City. In a survey of 619 institutions, the CGS found that the number of international students enrolling in US graduate studies for the first time in autumn 2017 was 3.7% lower than the equivalent number in 2016. The IIE, which tracks data from the US National Center for Education Statistics, found that the total number of international students, both new and continuing, in US graduate programmes had fallen by 2.1% between the 2016–17 and 2017–18 academic years. CGS president Suzanne Ortega describes the decline as worrying and thinks that the current policy climate regarding US visas and immigration might have contributed to the falling numbers. The decline could impair the global research enterprise by hindering institutions' efforts to attract top talent and by limiting exposure to diverse ways of thinking, she adds. Continuing declines in international enrolment — which comprises about 20% of graduate intake nationwide — could take a toll on institutional budgets.

DIVERSITY

Barrier breaking

The Royal Society of Chemistry (RSC) in Cambridge, an association for chemical researchers in the United Kingdom, aims to plug the "leaky pipeline" of women in academia. The society's plan is to help more female chemists to remain in the enterprise and to progress to senior positions. In its *Breaking the Barriers* report, the RSC says that female chemical scientists tend to leave academia at early-career stages — and that those who remain do not ascend to senior grades in the same proportion as their male counterparts. Women comprise just 9% of UK chemistry professors. The RSC notes that female chemists receive mostly short-term funding and contracts; that the academic culture is opaque about recruitment and promotion practices, and allows bullying and harassment; and that there is a lack of part-time and flexible working options to accommodate carers' responsibilities. Among other strategies, the RSC aims to launch grants this year for those who are carers, establish a helpline for reporting bullying and harassment, and annually recognize chemistry departments that significantly improve their inclusion and diversity practices.