CAREERS

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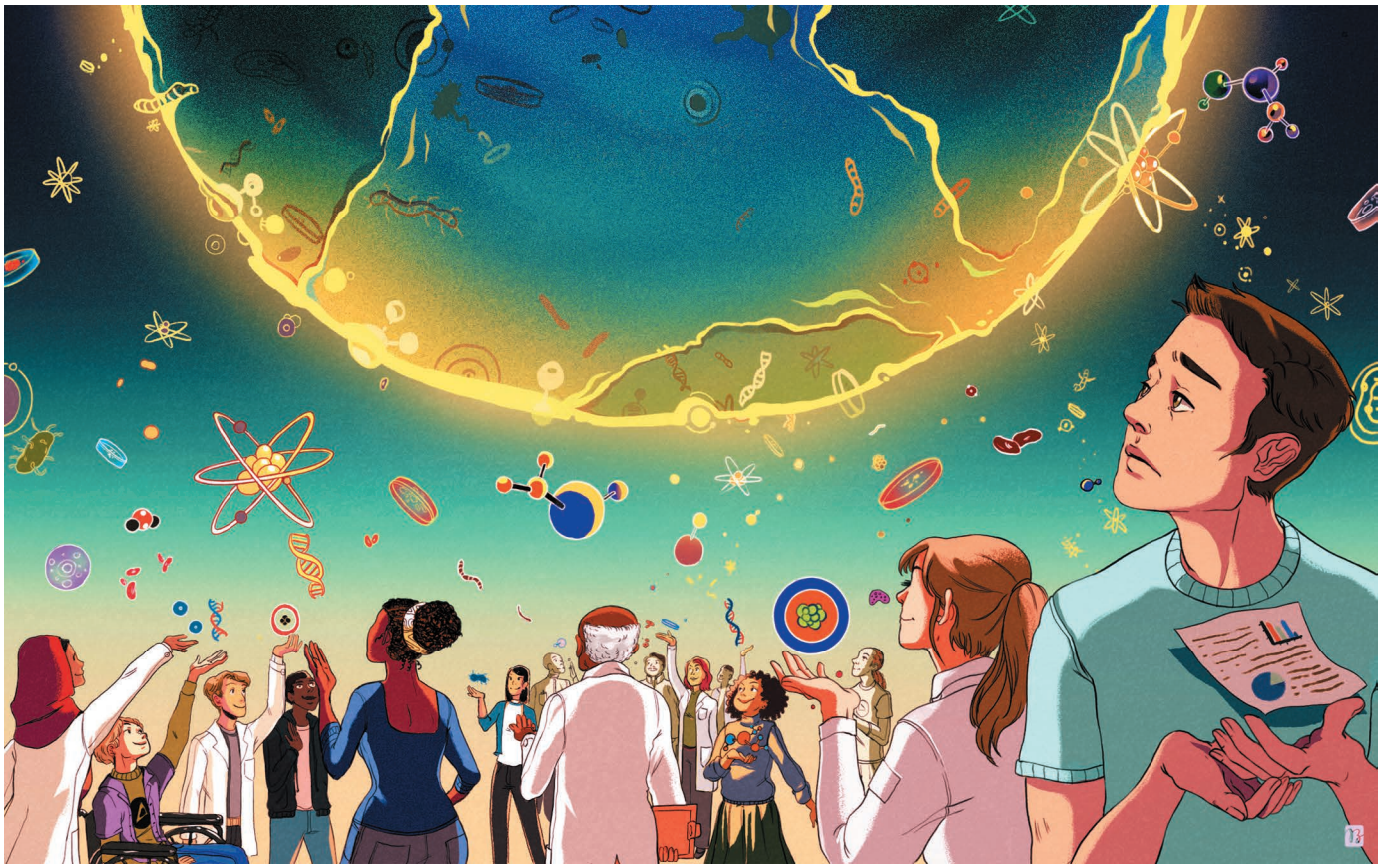

LAB LIFE

The path to purpose

Early-career researchers should persevere to find meaning in their work.

BY JACK LEEMING

When Melissa Craig realized that biological matter such as algae might slow the speed of powerful underwater landslides by releasing chemicals that help to glue sea-floor mounds together, she failed to share her colleagues' enthusiasm around the discovery. The group, based at Bangor University, UK, built miniature versions of those landslides in water tanks, changing the composition and amount of material that made up the mounds to model the sea floor at its most violent.

Craig's finding was unprecedented. "There had been nothing before her experiments that found the same results," says ocean scientist Jaco Baas, Craig's supervisor at Bangor. But Craig, then a PhD student who was visiting from the University of Adelaide in Australia, couldn't see how her algal discovery would be of interest to anyone beyond her immediate academic circle. "I struggled to appreciate the impact of what I was doing," she says. So, in late February this year, Craig started working as a geologist with Oil Search, an energy company based in Papua New Guinea. She's hoping to conduct research that has clear practical applications.

Long before they embark on PhD programmes, potential scientists are told by teachers and the media that their work will have a lasting impact. Whether it's by helping to cure diseases, build clean-energy infrastructure, or even provide food or water for communities affected by famine or drought, many early-career researchers hope that they can somehow make a difference. "We grow up thinking that we're going to solve the world's problems," says Florie Mar, a scientific-communications director at Genentech in South San Francisco, California. She earned her PhD in cancer biology in 2015 from the University of California, San Francisco.

Although researchers are often motivated by a sense of curiosity and the drive to explore how the world works, some also see science as a way of making the world a better place. ▶

It's widely acknowledged that the scientific endeavour works as an accumulation of small discoveries. "Your knowledge — however unpredictable and however useless it may appear — will be valuable," says Philip Blower, a cancer-imaging chemist at King's College London. But Mar and Craig say that they had hoped to obtain more tangible results during the course of their research. "I wanted something that I could measure," explains Mar. Craig reaches for a similar thought: "I wanted something visual — like seeing someone walk around with something that you know you made or helped with."

Both now feel that they're using their scientific skills to do meaningful work outside academia. Mar, for example, instructs doctors and pharmacists on the clinical uses of Genentech's drugs — information that she anticipates will go on to help patients.

The need to find deeper meaning in their work plagues many scientists, who can feel stuck in an often cut-throat system that's more concerned with bibliometrics than transferability. Many also say that they can't see how their research is contributing to society in a meaningful way. A 2016 report by professional-networking service LinkedIn (see go.nature.com/2i2srtc) notes that 41% of research professionals — compared with 37% across all sectors — say that they are mainly driven by purpose rather than by money or status.

Employers should sit up and take notice: the same report found that purpose-driven employees had greater job satisfaction and were more likely to stay at their company for at least three years. To help maintain an interest in their work, researchers can try a variety of ways to stay motivated. Some seek out laboratories that are engaged in highly translational research or that collaborate with partners in industry. Others look for research posts in industry. And more commercially focused scientists might even launch start-up companies to find the impact and value that they require.

KEITH ARKINS

The creation of Almac Diagnostics in Craigavon, UK, required funding from outside academia.

IMPACT THROUGH INDUSTRY

For many early-career researchers, the sheer size of the scientific endeavour, as well as an increasing pressure to win grants and to publish results, can be discouraging. "When I talk to postdocs and PhD students, they often feel like cogs in a massive machine," says Jason Blackstock, a lecturer in public policy and engineering at University College London, who trained as a physicist. "There's tremendous pressure to publish in whatever the direction the UK research councils are funding in."

Dolores Del Prete, a postdoctoral researcher who studies the role of certain cells in the brain in psychiatric disorders at BioMed X, a contract research organization in Heidelberg, Germany, agrees that the system can feel overwhelming. During her first stint as a postdoc, in which she investigated a protein linked to Alzheimer's disease at Albert Einstein College of Medicine in New York, Del Prete decided that she needed to move into an environment that conducted more-applied research. "I was doing really basic research," she says. "I liked it, but I had this pressure that was all about publishing — to get more papers, to get more grants, to keep going. It was frustrating." She thinks that the publish-or-perish hamster wheel in which she became stuck will be a concept familiar to many researchers in academia. "It was research led by papers and grants, not papers and grants led by science," she says.

At BioMed X, Del Prete can see the results of her work more clearly. "In the future, industry can develop our drug," she explains.

For some, the ability to stave off frustration and to find meaning in their work can come from developing a side project. When Mar noticed her PhD research turning from an enjoyable endeavour into a three-year chore, she started to make videos that combine voice-overs and whiteboard illustrations to explain complex topics such as genetic variation, neuroscience and diabetes to the public. So far, she's posted more than 60 videos on YouTube as a way to engage with her audience, track interest, teach science — and find real-life, immediate impact. She has since launched Youreka Science, an independent science-communication company.

Mar says that the skills she acquired during her PhD, including critical thinking and communicating scientific ideas to the public, have supported her new career direction. "It's a way to utilize your scientific training," she says.

TRANSLATIONAL SCIENCE

Blackstock says that early-career scientists who want their research to have wider societal impact should seek to work and study at institutions that nurture this drive through programmes that focus on transferability. "If you really want to change the world, just learning the technical stuff still leaves you trying to figure out how anything you've learned matters," he says. Instead, "Find programmes that have really strong practical levels of engagement. Or, at the very least, programmes whose projects have real-world partners" that can teach students to apply their findings in a practical way outside academia. As an example, Blackstock cites University College London's 'How to Change the World' training programme, which he directs, and which pairs engineering students with representatives from industry and government to examine issues such as water quality and public transport. Partners have included the UK Department of Transport and London-based engineering company Atkins.

He also suggests that students should find PhD programmes that collaborate directly with industry. Germany's Fraunhofer Society, for example, receives 70% of its research funding from contracts with external partners and operates institutes that focus on topics such as lasers and wood technology. Developing a device or procedure that people need is an integral component of the research programme rather than a bonus.

After Atma Ivancevic completed her PhD in bioinformatics at the University of Adelaide, she realized that she would need to take care in selecting a lab for her postdoctoral work. Ivancevic had studied mobile elements in DNA — sequences that move around the genome across generations to drive evolution — and found it enjoyable, but says that its transferability was not obvious to her at the time. "It was hard to see how it could be applicable to something these days," she says. "The sorts of effects we're talking about take millions

of years to come to fruition."

She knew that she had found the right lab when, during an interview, a potential supervisor tilted his computer screen towards her. "He showed me four or five e-mails he'd got that day from families — not from other scientists," says Ivancevic. One asked about his research on the genetics of severe epilepsy in women and whether there had been any recent advances. "It didn't matter if he published a paper that year or not," she says. "He still would have answered those e-mails. That's real-life impact right there."

Ivancevic thinks that luck, as well as design, might play a part in determining the impact of scientists' work. "Maybe they just haven't found out how it is applicable yet." Blower also believes in scientific serendipity, and therefore advocates for research that doesn't always set out to solve a specific problem or address a specific issue. "You turn over loads of stones and, with most of them, there's nothing underneath, but occasionally there's something. If you don't turn over the stone," he says, "you don't find the thing."

One such stone revealed the gene-editing technology CRISPR. Rachel Haurwitz did her PhD and worked as a postdoc in Jennifer Doudna's lab at the University of California, Berkeley — one of the birthplaces of CRISPR. Haurwitz, now chief executive of Caribou Biosciences in Berkeley, which aims to commercialize the technology, sees the rise of CRISPR as evidence to support the continued funding of basic research, alongside more translational work. "I think this story further cements the tremendous value and need for investing in basic research," she says. "To pretend that we know exactly where to go to discover or invent the next big thing is incredibly naive."

"When I talk to postdocs and PhD students, they often feel like cogs in a massive machine."

She suggests that scientists who want to see the impact of their work should seek out labs and companies that do translational research. "Actively find a way to put yourself there," she says. "There are some labs in academia that are closer to that boundary, and there are lots of companies in industry who use life science and technologies to try to solve a problem."

REAL-WORLD MOTIVATION

For some researchers, launching their own business can provide the meaning that they seek. In 2000, Paul Harkin, a molecular oncologist at Queen's University Belfast, began to realize that to extend his work on the gene *BRCA1*, which is implicated in hereditary breast cancer, he had to move away from academia.

Harkin had recognized that preserved samples of tumours stored at labs and hospitals worldwide would be an invaluable source of data that links genetic information with patients' outcomes, if clinicians had the tools to reliably extract partially degraded RNA from the tissue. But he was unable to launch the project from his lab at Queen's. "I needed to bring in substantial funding and additional expertise to get to commercial application," explains Harkin.

So, in 2004, he co-launched a company — now known as Almac Diagnostics and based in Craigavon in Northern Ireland, UK — to take his work to market. "I've never been disillusioned," he says, "but I was very pragmatic about what could be achieved in an academic environment."

The company's focus has since pivoted to providing clinical-trials support to the pharmaceutical industry. And Harkin notes that at least one of the drugs that it has worked on has been marketed in the United States.

Although he draws satisfaction from knowing that the company he built is directly involved in getting medicines to patients, Harkin highlights the positive effect that Almac Diagnostics has had on the scientific-employment landscape of Northern Ireland. He estimates that around 50% of Almac Diagnostics' employees hold PhDs; and its parent company, the Almac Group, employs more than 3,000 people in the province. "There are now alternatives in the scientific arena in Northern Ireland — it's not just jobs in academia," he says.

Harkin thinks that early-career researchers who want to make an impact should seriously consider accepting a position in industry. "Young scientists coming through don't understand the potential in industry," he says. "You may not own a project in its entirety, but you're part of that team that gets something into the clinic."

Yet many scientists maintain that curiosity is enough to justify investigating a research question. Baas's interest in sea-floor deposits is driven by a wonder at how the world works. "What motivates me is discovering things, really," he says. "I have questions in my head all the time; I want to find answers to those questions. Research is the ideal vehicle to do that. My work is my hobby."

Ivancevic is set to begin another postdoc in August. She says that even if she had left academia, she would have stayed up to date with research in her field, and understands the drive of curiosity. "I can see how it can consume you," she says. "You just want to find out why."

Craig also expects to keep track of her academic field. "It's almost like a hobby — it's so cool and significant to the geoscience community," she says. "But I'm still drawn to other pursuits that apply my science." ■

Jack Leeming *is the editor of Naturejobs.*

INTERNATIONAL STUDENTS

A shift in interest

A report that gauges the preferred destinations of prospective students from around the world suggests that the United States and the United Kingdom are losing their appeal for students from some regions. 'Applicant Survey 2018: What Drives an International Student Today?' — conducted by London-based educational-marketing group Quacquarelli Symonds during the 2016–17 academic year — finds that more students than before are aiming for Canada, Australia or elsewhere. Overall, 48% of the 16,560 students surveyed listed the United States as one of their preferred destinations. The United Kingdom came in second at 42%, followed by Canada at 34%, and Australia and Germany at 28% each. The survey found that Canada had risen in popularity with prospective students from all regions, and had replaced the United Kingdom as the second most popular destination for respondents from Latin America and the Middle East and Africa. The United States had declined in popularity in some countries in Africa and the Middle East. The report speculates that the election of Donald Trump as US president and the UK Brexit vote might have influenced respondents' indications of interest.

UNIVERSITIES

Fewer women at the top

Female leadership at 200 of the top-ranked universities worldwide fell this year to 17%, according to a report. Just 34 of the universities named in the 2018 *Times Higher Education* World University Rankings have female presidents, compared with 36 last year. Among the listing's highest-ranked institutions across 27 nations are the University of Oxford, UK; Harvard University in Cambridge, Massachusetts; Imperial College London; the University of Pennsylvania in Philadelphia; and the University of California, Berkeley. The rankings consider research, teaching and international outlook among other factors. In Sweden, 4 of the 6 institutions that made the list are led by women. The United States has 11 female-led universities in the rankings, the report's highest number. Janet Metcalfe, head of Vitae, a UK-based advocacy group for researchers, expressed concern at the figures. "More women in leadership positions provides positive role models for female academics," says Metcalfe, "and can encourage better gender balance and diversity at all levels."