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BRIAN A JACKSON/SHUTTERSTOCK

Finishing one PhD programme is challenging enough — but some academics go the extra mile and complete two.

## DOUBLE DOCTORATES

Some scientists earn two PhD degrees to expand their skills, cross fields or create a niche research programme.

**D**espite pandemic-related university cutbacks and rising inflation in many countries, the PhD pipeline still churns. In 2020, more than 55,000 people received a PhD in the United States, which produces more doctorates than any other country. Roughly 1.1% of the population in the 38 countries in the Organization for Economic Co-operation and Development (typically democracies that support free-market economies) obtained a PhD in 2021. And the percentage of doctorates awarded in science, technology, maths and engineering (STEM) has steadily increased over the past decade. In 2020, 12,561 life-science doctorates were awarded in the United States — 23% of all PhDs granted in the country that year, and nearly double the number awarded in 1990.

China, however, is projected to overtake the United States by 2025. At present enrolment rates, Chinese universities will produce more than 77,000 STEM PhD graduates per year by then, according to a 2021 report from the Center for Security and Emerging Technology at Georgetown University in Washington DC ([see go.nature.com/3uwj9](https://see.go.nature.com/3uwj9)).

Earning one PhD is difficult enough — but there are the rare individuals who opt to swim extra laps in the stress pool to secure a second one. Some do it to carve out a distinct research niche for themselves, others to access resources that are unavailable in their home countries. Some might simply be overachievers. *Nature* spoke to three 'double doctors' to ask what they gained — and whether it was worth it.

### VICTOR DIKE RESOURCES ELSEWHERE CAN ELEVATE YOUR SCIENCE

As a requirement of my first PhD programme, which was in atmospheric physics at Imo State University in Owerri, Nigeria, I did a three-month stint at the International Centre for Climate and Environment Science in Beijing. The centre had computing power that wasn't available in Nigeria. I realized that I would need more technical skills in meteorology to stand out in climate research. During my initial visit, I was always in the laboratory, from 8 a.m. to 11 p.m. — I wanted to get all the experience I could during my time in China.

I didn't plan to earn two PhDs. Before I

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returned to Nigeria, I learnt about a Chinese Academy of Sciences programme that grants scholarships to international students. In 2014, I applied, got funding and started my second PhD, which was in meteorology at the Institute of Atmospheric Physics at the Chinese Academy of Sciences in Beijing. Using climate models, I designed and implemented experiments to simulate how ocean conditions trigger extreme precipitation over West Africa and throughout the tropical climate region.

I don't want anyone to assume that my first PhD in Nigeria was 'not good enough'. I had incredible mentors who empowered me to find the resources to take my research to the next level. I had planned to return to Nigeria, but China had the supercomputers I needed to run complex weather models – so I, like many scientists, moved to continue making progress in my field. Access to advanced equipment is a problem that will not be resolved without more effort. Once I earned my second PhD, I started a postdoc position in the same lab, where I continued studying extreme weather events on shorter, seasonal time scales.

I'm the only African in my 34-floor apartment building, but there are more than 500 Nigerian students, mostly in science and engineering, in Beijing. We have social organizations and a group on the messaging app WeChat, which we use to discuss science, with subgroups for people in the same fields. I spend a lot of time mentoring other Africans.

I have learnt some Mandarin, but my lab mates prefer using English, so they can practise it. I have finished my postdoc, but I remain at the same institute with funding from the National Natural Science Foundation of China. My expertise is in predicting severe weather events, such as seasonal precipitation extremes in different parts of the world, to help authorities mitigate disaster risk.

I wouldn't do anything differently. I've been in China for almost eight years. Although I would like to go back to Nigeria to help train the next generation of scientists, the security situation related to recent terrorist activity is making me rethink that. Even now, I'm looking for opportunities anywhere in the world to continue my work. I want to contribute to science without risking my personal safety.

**Victor Dike** is a climate scientist at the Institute of Atmospheric Physics in Beijing.

### **RAFAERTS** **PUT A HUMAN** **FACE ON ECOLOGY**

I've long been fascinated by tropical ecology. After I spent two years as a forest-restoration project coordinator in northern Ethiopia, I applied for a Flemish Interuniversity Council

programme in 2003, which offered funding to conduct research in developing partner countries. The money supported my PhD work, conducting international forest-restoration research at Ethiopian sites I knew well.

Following my first PhD, which I learned at the Catholic University of Leuven in Belgium in 2006, I did a postdoctoral project on how agricultural intensification affects Arabica coffee (*Coffea arabica*), a plant native to Ethiopian forests. In total, I spent ten years as a postdoc. I also studied ecosystem impacts of invasive species, such as the American black cherry tree (*Prunus serotina*), in Germany, France and Belgium.

Then, in 2016, one of my colleagues obtained a grant to study the impacts of biodiversity on human health. Working with what was then called Belgium's Scientific Institute of Public Health, I was offered a four-year postdoctoral contract to study human exposure to biodiversity, pollen and air pollution, and how that affected people's allergy symptoms.

At that time, the institute did not have a full-time ecologist, but there were several projects looking at the public-health benefits of green spaces, which aimed to inform policymakers. It needed someone who could manage the research projects with a goal of producing high-level international publications to inform policy.

I decided to earn a second PhD, in environmental epidemiology at Hasselt University in Belgium, so I could 'speak the language' of epidemiologists. For example, the statistics used in epidemiology, such as survival statistics, differ from those used in ecology. I found an adviser who was keen to support my research on residential green spaces and human health. I will officially graduate in September 2022.

I've carved my own niche in research – I am

now in a good position to compete for funding in the One Health domain, a transdisciplinary field of study involving all the interactions between plants, animals, the environment and human health.

First-time PhD students often ask me why I would do this twice, given the stress of being a graduate student. Honestly, the second time was much easier. Field experiments are prone to failure. In the first PhD programme, some of my seedlings got trampled by animals or taken by farmers. That's not the case when you work in epidemiology, although we do work with human participants, which come with their own challenges. For my second PhD, I largely worked with existing data, such as pollution maps and socioeconomic variables, that were available from the national census, medication sales or government reports. The data are there, and I just analyse them.

I've noticed that human-health aspects offer a new way to convince policymakers to conserve biodiversity both inside and outside urban habitats. Now that I'm also an epidemiologist, I think my arguments might be stronger.

**Raf Aerts** is an ecologist and epidemiologist at the Catholic University of Leuven and Sciensano, Belgium's national public health institute, in Brussels.

### **UMA KARMARKAR** **CREATE A UNIQUE** **RESEARCH NICHE**

I have always struggled to 'stay in my academic lane'. As an undergraduate, I was interested in neuroscience in the broadest



**Ecologist Raf Aerts is pursuing a second PhD in epidemiology to open new opportunities.**

ROBSTEVEN



**Uma Karmarkar pursued two PhDs to tie her passion for neuroscience to the field of business.**

sense of the word. I was curious about how we process information in the world. In 2004, I completed my first PhD, in neuroscience, in an interdisciplinary programme at the University of California, Los Angeles. I specialized in how our brains encode time. At the end of my coursework, I cracked a bottle of champagne because I assumed I would never take another exam.

Later, in 2004, I took a postdoc position at University of California, Berkeley. I studied learning and memory at the cellular level. But I started to feel that I'd gone too far into biology, and I wasn't doing enough to explore my interests in psychology. I couldn't attach my love for the field to my day-to-day science, which is crucial to being successful. It was extremely disorienting. I had funding, a supportive adviser and an interesting project – but I wasn't content. I decided to find a way to regain the connection to psychology research.

Through family ties, I learnt that business schools were extending their longstanding interest in consumer decision-making into probing the brain for insights. At Stanford University in California, I began talking to people pioneering a field called decision neuroscience, or neuroeconomics. Studying consumer behaviour at the neural-systems level was just starting to happen in business schools, which gave me an avenue to study brain mechanisms while connecting it to everyday human behaviour. It was a tricky transition. Business schools rarely offered postdoc positions in 2005, so it became clear that I would need to do a second PhD in consumer behaviour at Stanford. I needed to learn the new academic culture and pursue the neuroimaging experiments that I wanted to do. It was a culture

clash coming and going – for example, business schools don't have labs that you can join – but I finished in 2011.

I wanted to ask questions about how we process information, from both a psychological and practical perspective. I needed the models and methods that come from brain science. In 2017, I applied for a tenure-track interdisciplinary position at the University of California, San Diego, which required applicants be appointed in two schools. During the interviews, I showed exactly how I would combine neuroscience and business. I presented behavioural research and brain imaging data to demonstrate that 'feeling confident' about risk has financial value to consumers – and is something companies should be aware of to effectively communicate with customers.

Throughout my career, I was fortunate to get some enviable positions at fancy institutions, but my career path felt messy. It seemed riskier at the time, but, retrospectively, I see value in the journey I took. I don't necessarily recommend earning two PhDs, especially if you can integrate those interests into one project – and avoid some messiness. Different institutions vary in how comfortable they are with that level of flexibility, but getting a second PhD is doable if you can find a place that is receptive to the research you want to do.

**Uma Karmarkar** is a neuroeconomist at the University of California, San Diego.

#### Interviews by Virginia Gewin.

Interviews have been edited for length and clarity.

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