CAREERS FROM BIOLOGY

BigPicture

ISSUE 16 | SUMMER 2012

BRINGING CUTTING-EDGE SCIENCE INTO THE CLASSROOM

A free resource for teachers and learners

GET CONNECTED

Where could studying biology lead?

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BigPicture

This issue of *Big Picture* is a bit different to usual. We've scoured the UK to find people to tell us what they spend their working lives doing. We hear how biology – and the transferable skills developed through studying and doing science – plays a part in their careers today.

We've gone beyond the doctors, vets and other science-related careers you might have read about elsewhere and have found people working in a wide variety of sectors doing diverse jobs. From radiographer to entrepreneur and researcher to brewer, our case studies show how people's careers – which can involve science in many different forms – are rarely linear and how important it is to seek out opportunities and grab chances when they arise.

With each case study, we've given a typical starting salary; however, this is only a guide, and salaries can increase. What you can go on to earn depends on many things, including your career path and your approach to working life.

The case studies also show how different jobs make different demands on people. What's important to you? Would you mind working shifts or antisocial hours, or do you want a nine-to-five job? Do you want to work indoors or based in one place, or do you want a job that involves working in the open and travel? What will be important for you to fit in alongside your work – a busy social life? Having a family? Further study or travel? In the *Big Picture* team, some of us had clear ideas of what we wanted to do for a living when we were at school, and others didn't. Some of us have jobs now that we didn't even know existed when we were studying.

Whether you are a teacher looking to advise students or a student deciding which subjects to take at school or college, choosing a university course or just curious about careers that involve science, we hope this magazine and the accompanying online resources will give you valuable information, inspiration and a few more ideas about the incredible – and varied – places that biology can lead.

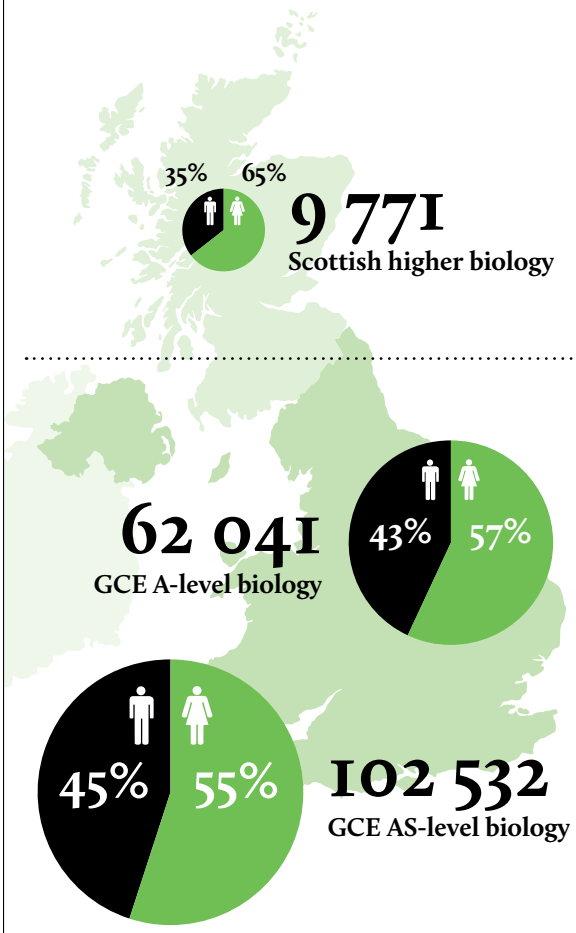
INSIDE

WWW.WELLCOME.AC.UK/BIGPICTURE/CAREERS

Careers

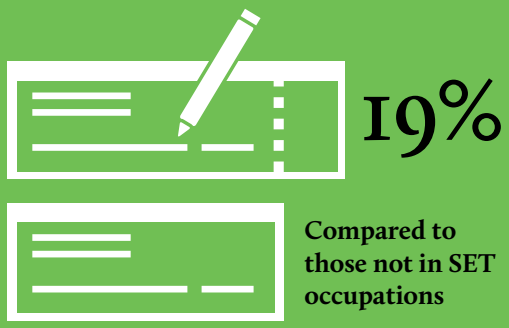
Biology careers in the UK by numbers

NUMBER TAKING POST-16 BIOLOGY IN 2011



Sources: www.jcq.org.uk/national_results/index.cfm and www.sqa.org.uk/sqa/47250.html

WAGE PREMIUM FOR SCIENCE, ENGINEERING OR TECHNOLOGY (SET) OCCUPATIONS



Sources: www.raeng.org.uk/news/publications/list/reports/STEM_WageReturns.pdf

THE NUMBER OF DEGREE COURSES FOR WHICH A BIOLOGY A LEVEL IS SPECIFIED AS A REQUIREMENT OR ADVANTAGE

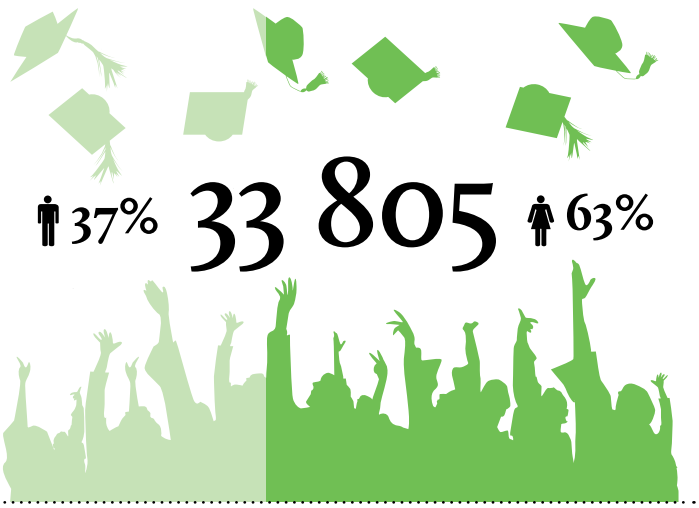
25

Geography, Optometry (opthalmic optics), Geology, Medical science, Environmental science/studies, Biochemistry, Medicine, Biology, Dietetics, Orthoptics, Materials science, Science dentistry, Sports science, Biomedical sciences, Biomedical materials, Physiotherapy, Veterinary science, Midwifery, Pharmacy, Speech therapy, Physical education, Psychology, Earth sciences, Nursing, Archaeology

Biology is valued on many other courses in addition to these.

Source: russellgroup.org/Informed%20Choices%20final.pdf

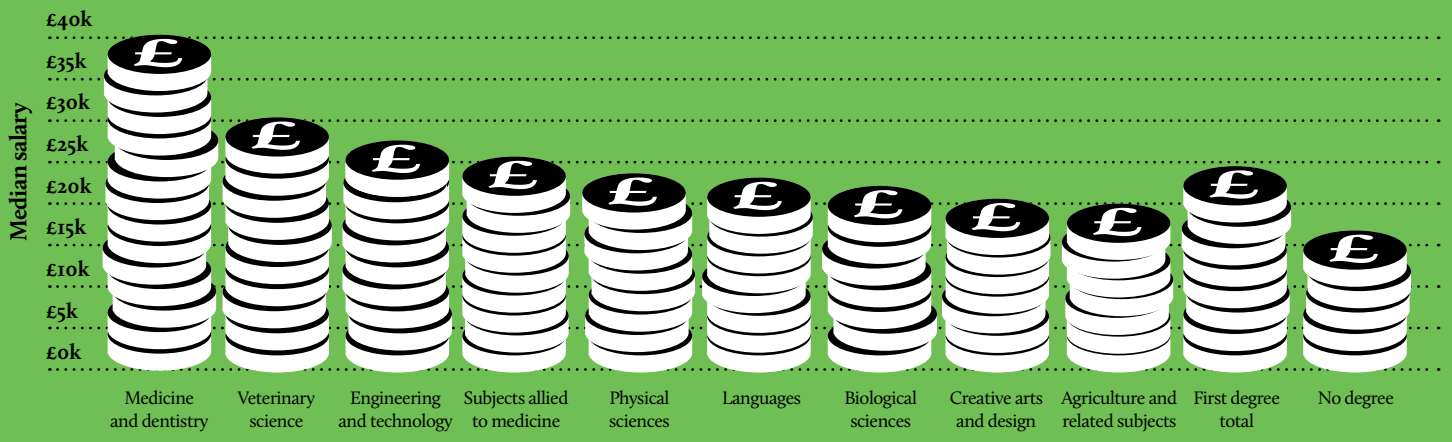
UK BIOLOGICAL SCIENCES GRADUATES IN 2010/11



This includes biology, genetics, sports science, psychology, biochemistry, zoology and botany, among others.

Source: www.hesba.ac.uk

EARNINGS 3.5 YEARS AFTER LEAVING UNDERGRADUATE STUDIES



Source: www.ons.gov.uk/ons/rel/lmac/graduate-earnings-over-the-last-decade/2011/graduate-earnings-over-the-last-decade.html

PEOPLE EMPLOYED IN SCIENCE-BASED OCCUPATIONS IN THE UK

5.8m

1 in 5 of the UK workforce

Projections show that if increases continue, 7.1m people will be employed in a science role by 2030.

Source: www.sciencecouncil.org/sites/default/files/UK_Science_Workforce_FinalReport_TBR_2011.pdf

FINDING DATA

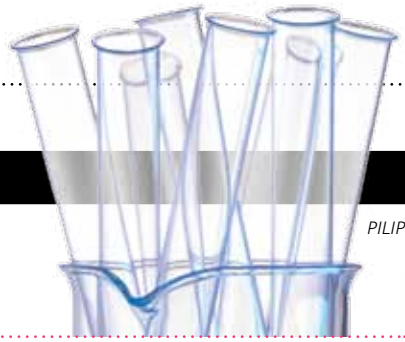
Putting this diagram together, we found that different sources gave different numbers for the same thing. Why don't they match?

Well, data can be interpreted in different ways, and estimates can be made using different methods and/or baseline data. Definitions matter, too – different sources might define 'biology' or 'science' differently.

Which should you choose? The source itself is important – is it reliable? Are the figures recent? How might an organisation's 'agenda' affect how it calculates and presents data?

Inside pages: notepad, *fatmayilmaz/iStockphoto*. Top row: graduation, *archana bhartia/iStockphoto*. Left: UK map, *johnwoodcock/iStockphoto*.

Science



PILIPIPA/iStockphoto

GIFT NAMBELA

Molecular biologist

What do you do?
I do genetic tests for several conditions, including cystic fibrosis and HIV, at a private pathology company. My job involves extracting and preparing DNA from biological samples for PCR [polymerase chain reaction] assays. This process makes lots of copies of the DNA. We can do this manually or by machine: it's becoming more automated, but it's important to understand the science behind it.

What does a typical day entail?
I start every day by running a worklist on the computer to see what tests need to be done. Knowing how long each step takes, I can prioritise and plan my day, and fit in all the tasks. Next, I get the samples I need and prepare them. The HPV (human papillomavirus) assay takes longest, so I extract the DNA from those samples first. I regularly crosscheck against the worklist to make sure the right tests are being done on the right samples. I then prepare the DNA for PCR. We test for several conditions here, including chromosomal abnormalities (e.g. Down's syndrome), coeliac disease, cystic fibrosis and HIV.

What did you study?
I did A-level biology, chemistry and maths, and I wanted to be a doctor. From a young age, I knew I was going to do something in science: out of nine, I'm the baby of the family, but my brother, who is a computer scientist, gave me the belief that I could achieve anything I wanted to. During my degree, I realised there's more out there than being a doctor. Although I applied for graduate entry to medical school and was disappointed not to get in, I had back-up plans – it was not the end for me.

I am using the biology I learned from A level and even my O levels, which I did in Zambia. I remember learning standard operating procedures in my first week at university and thinking 'Will I ever use these?' Now I use them every day!

Was it hard to find your current role?
It took a few months to find this job. I saw it on the last day it was open, which gave me about two hours to apply! I wanted it because it related to my degree course, so I knew what it was all about. Also, I'm not a doctor, I can't help people face-to-face, but I can be the person providing support in the background. I always have in my mind that there is a patient at the end of this.

TOP TIP

There are so many ways of becoming a clinical or healthcare scientist. You don't have to have a degree, for example – after A levels, you can start at the practitioner level and work your way up.

What would you like to do next?
I hope to become a registered clinical scientist. It will take about six years to qualify for the exam to register with the Health Professions Council. One of my colleagues started out just like me and is now a principal clinical scientist.

QUALIFICATIONS
- A levels: biology, chemistry, maths (2006).
- BSc biomedical science, De Montfort University, Leicester (2010).

CAREER HISTORY
- Teaching children maths and English, Explore Learning (2010–11).
- Molecular biologist, The Doctors Laboratory (2011–).

SALARY GUIDE
- Qualified healthcare scientist (genetics) in the NHS: £25 500–£34 200. Salaries in the private sector vary. (**www.nhscareers.nhs.uk**)

ESSENTIAL SUBJECTS
- Clinical scientists are no longer being recruited into the NHS in England. Instead, the Practitioner Training Programme requires at least two A levels including science. The Scientist Training Programme to become a healthcare scientist requires a 2:1 or better BSc Honours degree in a relevant science. (**www.nhscareers.nhs.uk**)

MORE INFORMATION
- Health Professions Council (**www.hpc-uk.org**)
- Institute of Biomedical Science (**www.ibms.org**)

FAST FACT
The UK's programme to vaccinate girls against HPV was launched in 2008. In its first three years, more than 65 per cent of females born between 1 September 1990 and 31 August 1998 completed the three-dose course. Source: **immunisation.dh.gov.uk/annual-hpv-vaccine-coverage-in-england-in-201011-report/**

IngramPublishing/iStockphoto

DR ANN HARVEY

Arthritis researcher

TOP TIP

If you want an academic career, you've got to be patient and determined and take opportunities when they come. If you work hard enough, you will get your break, but sometimes you have to wait for it.

What do you do?
I'm a researcher who works in biomedical imaging at Cardiff University School of Medicine. In one of my projects, I'm using functional magnetic resonance imaging [fMRI] to study patients with osteoarthritis, which is a degenerative joint disease. I'm trying to understand why some patients with osteoarthritis continue to suffer pain after they've had surgery to replace the diseased joint (e.g. after knee replacement) but others don't.

My research combines physics, maths, biology and medicine, and I work with several university departments and as part of the Arthritis Research UK Biomechanics and Bioengineering Centre of Excellence in Cardiff.

What skills do you use in your work?
I use a lot of the biology that I learned as a student, and I've had to learn a lot more since starting this job. I do quite a lot of basic computer programming to analyse our MRI images. I use maths on a daily basis, but it's probably mostly A-level standard. Some of my colleagues use much more advanced maths.

What does a typical day entail?
It varies. After we've designed and performed an experiment, I spend most of my time analysing bulky datasets. I often discuss data and results with colleagues and students in our group, and interact with clinicians and patients when appropriate. We also attend various scientific meetings and seminars throughout the week.

What are the most challenging and satisfying things about your job?
Occasionally, the pace of research can be frustrating, especially if you're like me and want everything to happen quickly. Sometimes my enthusiasm gets me sidetracked, so there can be a long time between having an idea and performing the experiments.

I love the intellectual challenge of trying to figure out what research has already been done and what we still don't know, and then designing an experiment to find out more. You can feel a bit lost or isolated sometimes, because you don't always know how to find the answers, but that's partly why it's so exciting. You're doing something that no one has ever done before, which could make a difference to people's health in the future. I also love working as part of a team with lots of different people.

What did you want to be at school?
A professional footballer, although I've always loved science too! I've been lucky to find ways of combining my passions. For example, in my DPhil I used MRI to investigate anterior cruciate ligament injuries, knee damage that typically happens while playing sport.

www.cardiff.ac.uk/arcbbc/medicine.cf.ac.uk/en/infect-immun/

QUALIFICATIONS

- International Baccalaureate, including higher-level chemistry, biology and German and maths methods, UK (2000).
- BA psychology with physiology, University of Oxford (2004).
- MSc computing (conversion course), Oxford Brookes University (2005).
- DPhil, Department of Engineering Science, University of Oxford (2009).

CAREER HISTORY

- Part-time football coaching and statistical analysis for Manchester United Soccer School.
- Postdoctoral researcher, University of Oxford (2009–10).
- Cardiff Academic Fellow, Cardiff University, (2010–).

SALARY GUIDE

- Postdoctoral researcher: £29 000–£35 000. (**prospects.ac.uk**)

ESSENTIAL SUBJECTS

- For psychology, a few courses ask for one from biology, chemistry, mathematics and physics. (Russell Groups Informed Choices)

MORE INFORMATION

- Vitae (**www.vitae.ac.uk**)

FAST FACT

The Brazilian footballer Sócrates completed doctorates in medicine and philosophy. He was also a trained paediatrician. Source: **blog.sport.co.uk/Football/382/Top_Ten_Educated_Footballers.aspx**

Read more about medical imaging, including fMRI, at **www.wellcome.ac.uk/bigpicture/careers**

Healthcare

LUGO/iStockphoto

GAVIN FERGIE

Health visitor

What do you do?
I'm a qualified health visitor. I work for a health visitors' professional organisation, supporting health visitors in Scotland and Northern Ireland. Health visitors are specialist nurses that focus on the health of children from birth to five years old and their families.

What did you study at school?
I started studying biology at school but switched to an anatomy, physiology and health course. At 23, I decided to go into nursing. It wasn't a degree course at the time, so I studied at a college of nursing.

What did you want to be when you were at school?
I first wanted to be a policeman, and later a vet. I think it all comes down to wanting to help the vulnerable.

Was it hard to find a job?
It's harder now. Scotland, Wales and Northern Ireland's health services are devolved from England's. Job opportunities there are markedly reduced. The more mobile you're prepared to be, the better chance you have of getting a job.

What skills from your biology background do you use in your work?
You need a good understanding of how the body works and strong observational skills so that you can spot when something's not right. You use analytical thinking and problem-solving skills on a daily basis.

What does a typical day entail?
Each day involves interacting with families in your community, usually in their homes, and checking on a child or the child's parent or carer, perhaps helping with breastfeeding, behaviour or emotional issues. You'll work with other professionals, such as a GP, social worker, schoolteacher or hospital nurse. There is some paperwork: it's very important that records are kept, as you can't afford any mistakes.

My work–life balance is good. There are set hours, although you might be at a family's house at 6pm. It's absolutely a job you can have alongside having a family of your own – it may even help you.

What are the most challenging and satisfying things about your job?
Unfortunately, abuse and death are not far away from our work. However, when you can help people make positive changes in their own lives and their children's, it's a real joy.

What prospects for progression are there?
Plenty. You can become a team leader or a nurse manager, or get a postgraduate qualification in education and educate the health visitors of tomorrow. Or, like me, you can go down the support and advocacy route, helping other health visitors to do their job well.

www.nhscareers.nhs.uk/details/default.aspx?id=807

QUALIFICATIONS

- Scottish O-grades: anatomy, physiology and health; physics; and chemistry (1980).
- Registered General Nurse (adult) (1989), Registered Sick Children's Nurse (1992) and neonatal nursing qualification (1995), all College of Nursing.
- Degree: community health (health visiting), Queen Margaret's University, Edinburgh (2001).

CAREER HISTORY

- Bank officer, RBS (1981–86).
- Student nurse (1986–89).
- Nurse, then senior staff nurse (including sick children's qualification) (1990–2000).
- Health visitor (2001–06).
- Professional Officer, Community Practitioners' and Health Visitors' Association (2006–).

SALARY GUIDE

- Health visitors: £25 528–£34 189. (**www.nhscareers.nhs.uk**)

ESSENTIAL SUBJECTS

- For nursing, usually biology or another science. (**www.russellgroup.ac.uk**)

MORE INFORMATION

- CPHVA (**unitetheunion.org/cphva**)

TOP TIP

You can't become a health visitor straight from school – you must qualify as a nurse or midwife first. Before starting a health visiting degree, engineer an opportunity to shadow someone, perhaps a health visitor in your GP practice.

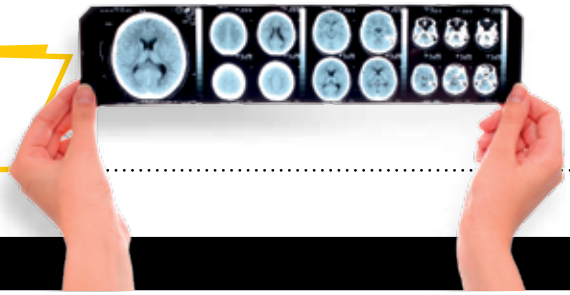
FAST FACT

The NHS aims to recruit and educate 4200 new health visitors in England between 2011 and 2015. Source: **www.nhscareers.nhs.uk/healthvisiting**

Read more examples of careers involving science at **www.wellcome.ac.uk/bigpicture/careers**

TOP TIP

For insight into how hospitals work, get some work experience.



LUGO/iStockphoto

KATY COOPER

Assistant practitioner – radiography

What did you study at school?
I wanted to be a nurse, so I left school at 16 and did an NVQ in health and social care at college. When nursing didn't work out for me, I got a job working on reception at a cancer centre. I was really interested in what the assistant practitioners were doing and liked the patient contact, so I decided to become one.

How did you train?
The department was sponsoring people to do either a full-time degree in radiography or a foundation degree in radiotherapy and oncology practice. I applied to do both. I had to do a biology A level to do the full degree, but didn't get the grade I needed, so I did the AP foundation degree instead. It was a two-year, online, distance learning course with Anglia Ruskin University. I worked four days a week on set – that's what we call working on the X-ray machines here – and had one study day a week to do my coursework. I got a Foundation Degree (FDSc) at the end of it.

What does a typical day entail?
The work is very varied. We do CT scans of patients and work on different radiotherapy machines treating them. You're on your feet a lot. An important part of our role is to talk to the patients and answer their questions.

What's the difference between you and a radiographer?
There are certain things we're not qualified to do. We take images during treatment and we can look at an image and say it looks fine, but it's the radiographer who decides to continue treatment. There's very little difference between an assistant practitioner and a radiographer, though – except the pay band and the fact that we can't progress. If I wanted to become a radiographer, I'd have to do the full degree.

What's the work–life balance like?
You work shifts: the earliest starts at 7am and the latest ends at 7pm. You work as a team, so you have to be conscious of other people if you need to take time off. But it's possible – lots of people have families.

What are most challenging and satisfying parts of your job?
It's not always plain sailing. Machines break down and things get hectic. But knowing that you've managed to help someone is very fulfilling.

QUALIFICATIONS

- NVQ: health and social care (2000).
- A level: biology (2003).
- FDSc: radiotherapy and oncology practice (2004).

CAREER HISTORY

- Healthcare assistant at Addenbrooke's Hospital, Cambridge (2000).
- Office administrator (2000–02).
- Receptionist and administrator at Addenbrooke's, Radiotherapy Department (2002–04).
- Trainee assistant practitioner at Addenbrooke's, along with Anglia Ruskin University (2002–04).
- Assistant practitioner at Addenbrooke's (2004–).

SALARY GUIDE

- £18 652–£21 798 (**www.nhscareers.nhs.uk**)

ESSENTIAL SUBJECTS

- Entry requirements vary by post.
- Assistant practitioners may need an NVQ III qualification or a BTEC higher diploma or foundation degree in a relevant subject (e.g. science or health and social care).

MORE INFORMATION

- NHS Careers (**www.nhscareers.nhs.uk**)

THE SCIENCE OF... CT SCANS

CT (computed tomography) is used to look inside the body. It uses X-rays to build up cross-sectional views. Read about other forms of imaging online at ***www.wellcome.ac.uk/bigpicture/careers***

Advantages of CT

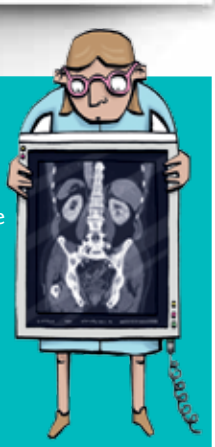
- non-invasive (no cutting into body)
- generally quicker than MRI
- suitable for patients with metal (implants, etc.) in their body
- less expensive than MRI
- good for looking at bones.

Disadvantages of CT

- needs expensive, specialised kit
- some people are allergic to the 'contrast' drunk before a scan
- uses radiation (more than a typical chest X-ray), and exposure to certain levels of radiation can lead to cancer.

FAST FACT

There are two kinds of radiographers. Diagnostic radiographers help diagnose diseases or injuries, including broken bones, in hospitals and surgeries. Therapeutic (radiotherapy) radiographers use radiation to help treat people with cancer.



skyhawk/Shutterstock

Communication

eremm/iStockphoto

DR HANNAH DEVLIN

Science editor

What do you do?
I'm the science editor at *The Times*. I spend most of my time writing news stories for the newspaper.

What did you study?
I was very keen on science at school, particularly physics. I studied physics at Imperial College London and decided to do a PhD in brain imaging using MRI (magnetic resonance imaging).

TOP TIP

Be very persistent and keep asking people for opportunities. People won't see you as unpleasantly pushy – if anything, they'll see your persistence as proof you've got what it takes to be a good journalist.

How did you get into journalism?
I was considering going into a career in research but wanted to explore some other options. Halfway through my PhD, I got a summer placement at *The Times*, and I loved it! It was through a scheme run by the British Science Association that aimed to give scientists an insight into how the media works that they could take back to science. What I did was not what was supposed to happen, but it worked out very well for me!

What other jobs have you had?
I really enjoyed my PhD but decided a career in research wasn't for me. I got a job at a magazine called *Research Fortnight*, which is quite specialist and is aimed at senior academics, research managers and politicians interested in science. I worked there for about 18 months, then I was lucky enough to get a job back at *The Times* to work on a new science magazine called *Eureka*. I started as a reporter, and I got made science editor at the end of 2011.

What are the most challenging and satisfying things about your job?
It's a very energetic job. You don't usually have days where there's nothing on – it's a continual output, and there's always time pressure. I don't necessarily see that as a negative thing, but it can be a challenge. The best thing is being in the extremely privileged position of being able to phone up some of the best scientists in the world and get them to answer your very simple questions! They might be talking about a [scientific journal] paper that they've been working on for years with a big team, or a clinical trial involving hundreds of patients. It's about being there at the end of that and sharing in the excitement in some way.

What's the work–life balance like?
There's not a typical day – sometimes I'm in the office, but sometimes I'm out at press conferences or going to visit people in their labs. Generally, on the days I'm in the office, I get in at 10am and leave anywhere between 6pm and 9pm. I don't find the work–life balance too bad. I work Monday to Friday and one in four Sundays, to prepare the Monday paper, but you get a day off in lieu of that.

www.thetimes.co.uk/tto/public/profile/Hannah-Devlin

QUALIFICATIONS

- A levels: French, general studies, maths, physics (1999).
- MSci physics, Imperial College London (2003).
- DPhil, University of Oxford (2007).

CAREER HISTORY

- Summer placement, *The Times* (2006).
- Reporter, *Research Fortnight* (2007–08).
- Science reporter, *The Times* (2008–11).
- Science editor, *The Times* (Dec 2011–).

SALARY GUIDE

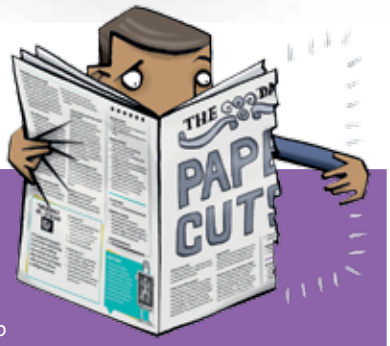
- The average starting salary for a science writer is £18 000–£22 000, but salaries vary widely between regions and publications and rise with experience. (**www.prospects.ac.uk**)

ESSENTIAL SUBJECTS

- For journalism, specific subjects are not usually required, but English is preferred. Politics and history are looked upon favourably. (**www.independent.co.uk**)

MORE INFORMATION

- National Union of Journalists (**www.nuj.org.uk**)
- Association of British Science Writers (**www.absw.org.uk**)



FAST FACT

The circulation figures for UK national daily papers fell by 21.5 per cent between January 2007 (11 824 647) and January 2012 (9 039 691). By contrast, online newspapers are booming: three national papers reported all-time web traffic highs in October 2011. Source: **www.guardian.co.uk/media**

Find out more online, including Hannah's favourite science story, at **www.wellcome.ac.uk/bigpicture/careers**

galdzer/iStockphoto

ELLIOT LOWNES

Camera assistant

TOP TIP

Save up your money, buy a camera and make your own film. It's the only way to improve your technical skills.

What do you do?
I work at Ammonite, which specialises in filming animals at night, and I assist cameramen on location.

What kind of locations?
Last year, we went to the Masai Mara National Reserve in Kenya and drove around after dark. It was pitch black. I was poking out of the sunroof in night vision goggles, looking for animals and giving 'one o'clock', 'two' o'clock' directions to the cameramen in the car. We also spent two months in the Azores, going out in a boat at night to hunt for the giant squid with a camera on the end of a 500-m fibre optic cable. And in Belize, we filmed tiny crustaceans called ostracods, which produce jets of bioluminescence. That was phenomenal, like a fireworks display under water.

What did you study?
I did physics, chemistry, biology and psychology A levels, then a degree in zoology at Newcastle University. After, I completed a Master's in wildlife documentary production in Salford. As part of that, I made a ten-minute film about the tansy beetle (see right).

How did you get your first job?
On the back of my film, I got a job in Bristol doing admin at an independent company called Tigress. Then I heard there was a camera assistant role going at Ammonite. It's a competitive field, but I had a recommendation from someone who worked at Tigress, got my CV in at the right time and made a good impression at the interview.

What prospects are there for progression?
Most cameramen in the industry work as freelancers, but I've got lots to learn before I do that, as I need to be sure I can get the shots that people require.

What is your work–life balance like?
It's tricky being away for long stretches of time, as I don't always manage to keep in touch very much with my girlfriend and friends. We've got quite a fair policy here – for every week we're away on location, we get a day off in lieu when get home, so that gives you some time to catch up.

What are the most challenging and satisfying things about your job?
We're developing new specialist tools and technology, so I've had to learn how to do detailed technical drawings and learn practical metalworking and woodworking skills on the job.

The best thing is that this job gets you beyond the red tape, so you can see things you'd never normally see. At the Masai Mara, for example, tourists have to leave at dusk, but we got a special permit allowing us to stay in the reserve. One night after a torrential downpour, we saw hyenas jumping into a flooded ditch and swimming, playing and interacting. They're nocturnal animals and rarely swim because the rivers are full of crocodiles, so it was a unique sight. Those things are very memorable – they stay with you.

www.ammonite.co.uk

QUALIFICATIONS

- A levels: biology, chemistry, psychology (2005).
- BSc zoology, Newcastle University (2008).
- Master's in wildlife documentary production, University of Salford (2009).

CAREER HISTORY

- Office administrator, Tigress (2009–10).
- Camera assistant, Ammonite (2010–).

SALARY GUIDE

- Camera assistant: £214 per day (excluding holiday pay); camera operator: £285 per day (excluding holiday pay). (**www.bectu.org.uk/advice-resources/library/977**)

ESSENTIAL SUBJECTS

- For film production, most courses require at least two A levels. (**www.ucas.com**)

MORE INFORMATION

- International Association of Wildlife Filmmakers (**www.iawf.org.uk**)
- Bectu trade union (**www.bectu.org.uk/**)

FAST FACT

Staff and students at Askham Bryan College near York are working to create an 'ark' where the tansy beetle can feed on its sole food source, the tansy plant.
Source: **www.askham-bryan.ac.uk/news/"tansy-ark"-set-up-to-help-save-endangered-beetle**

Political and business

EMMA GREENWOOD

Policy manager

bioraven/Shutterstock

What do you do?
I talk to decision makers in government and try to influence them to make decisions that will create the best environment for UK research.

What did you study?
I did biology, French and German A levels, and English and chemistry AS levels. Initially, I wanted to be a languages teacher. I got increasingly interested in biology, so I did a BSc in genetics at York University. Afterwards, I knew I didn't want to do a PhD, but I wanted to work with the wider ethical and communication aspects of science, so I did an MA in biotechnological law and ethics. I then worked in science publishing, which allowed me to stay in science and establish that I wanted to work in the medical charities sector, where I felt I could have more of an impact. In 2008, I joined Cancer Research UK.

What skills from your biology background do you use in your work?
I use a lot of analytical thinking to work out the main aspects of an issue, to help formulate Cancer Research UK's position on it, and then communicate that in a simple and easy way, whether through a report, speaking to the press or in a blog. I also often meet with MPs, usually as part of lab tours where we showcase some of the work that Cancer Research UK funds, which means I meet lots of different people and get to keep up to speed with the latest developments in science.

How would you get a similar job today?
Increasingly, when recruiting, we look for people who have had an internship or work experience in policy. Cancer Research UK has a three-month internship scheme that has placements three times a year, as well as a two-year graduate trainee scheme, and a lot of our interns and graduates end up getting jobs here afterwards. The most important thing is to demonstrate your passion for policy and the organisation.

What's the work–life balance like?
I don't have a family yet but definitely hope to. I know lots of people working in this field who have families – very successfully. There's so much flexibility that it's possible to have a really good work–life balance.

What are the most challenging and satisfying things about your job?
It regularly involves analysing long, technical pieces of legislation to work out what they would mean in practice. Policy is a slow process and change doesn't happen that often, so you have to be dedicated to stick with an issue. However, one of the recommendations in a report I wrote was recently taken forward by the Government, which was very satisfying – a career highlight. I also really enjoy going to working dinners in Parliament and having early breakfast meetings with MPs or people from other organisations.

info.cancerresearchuk.org/publicpolicy/

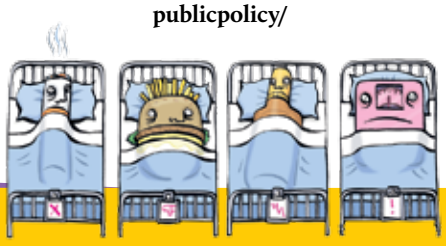
QUALIFICATIONS
- BSc genetics, University of York (2005).
- MA biotechnological law and ethics, University of Sheffield (2006).

CAREER HISTORY
- Assistant editor, Nature Publishing Group (2006–08).
- Associate editor, Springer Publishing (2008).
- Policy researcher, then policy manager, Cancer Research UK (2008–present).
- Secondment (policy officer), Academy of Medical Sciences (2010–11).
- Lay peer review for the National Institute for Health Research (2010–present).
- Member, STEMNET Ambassador programme.

SALARY GUIDE
- Entry-level science policy job: £20 000–£23 000, rising to around £40 000. (Personal correspondence, science policy officers)

ESSENTIAL SUBJECTS
- None – but at least one science is preferable, as are subjects that require analytical skills. (Emma Greenwood)

MORE INFORMATION
- CaSE (**www.sciencecampaign.org.uk**)
- Academy of Medical Sciences (**www.acmedsci.ac.uk/p46.html**)



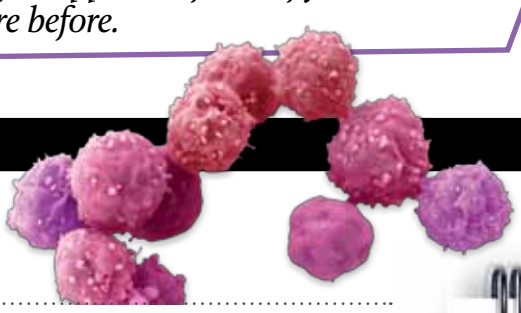
FAST FACT
More than 100 000 cancers – equivalent to one-third of those diagnosed in the UK each year – are caused by smoking, unhealthy diets, alcohol and excess weight. Source: **scienceblog.cancerresearchuk.org/2011/12/07/the-causes-of-cancer-you-can-control/**

TOP TIP

Develop your communication skills: you have to be able to take a piece of information and turn it into a message that will influence people with different agendas and backgrounds.

Starting a biotech company is like slashing through a jungle: you never know what's going to appear in front of you. Talk to explorers who have been there before.

TOP TIP



Steve Gschmeissner/Science Photo Library

DR YEN CHOO

Entrepreneur

What do you do?
I'm the executive chairman of Plasticell and CEO of Progenitor Labs, a spin-off company of Plasticell (**www.plasticell.co.uk**). These companies are developing stem cell technologies and using them to create drugs that regenerate human tissues. Put simply, I start biotech companies and oversee their business and scientific strategy. The first biotechnology company I started, Gendaq, developed a technology to create zinc finger proteins (see box, below, and online for more on these).

What did you study?
I did all three sciences: biology, chemistry and mathematics at higher level and physics, English and French at standard level, and then did biochemistry at university. At first, I thought wanted to be a lawyer, but later, after having an exciting biology teacher, I wanted to be a medical doctor.

Why did you choose this role?
The way the body develops is one of the fundamental problems of biology. I develop technologies because I've always been fascinated with how to do things faster, because research can be so slow and frustrating. After several years in academic research, I decided to do something different.

What does a typical day entail?
It's partly science (talking with the research director and the individual scientists, and reviewing reports) and partly business (procuring finance, business development, protecting intellectual property, promoting the company and talking to shareholders).

What skills from your biology background do you use in your work?
I use all of my scientific learning. Without a deep understanding of how cells and genes work, I wouldn't be able to do that. The practical skills include forming hypotheses, planning experiments, doing research and analysing findings.

What's your work–life balance like?
I have a healthy work–life balance, but the job never leaves you. You'll think about it all day and sometimes all night. On the other hand, if I decide that I need to go to look at the sea, I'll just do it (while thinking about intellectual property)!

What are the most challenging and satisfying things about your job?
Multitasking: juggling the science and the business and taking responsibility for everything, whether it's raising £10 million or buying paperclips. Biotech research is demanding and keeping even one of these little companies afloat is very difficult, so if you do a good job then it's very, very satisfying.

QUALIFICATIONS

- International Baccalaureate, United World College of SE Asia, Singapore (1988).
- BSc biochemistry, University of Bristol (1991).
- PhD, molecular biology, University of Cambridge (1995).

CAREER HISTORY

- Staff scientist, MRC Laboratory of Molecular Biology, Cambridge (1995–2000).
- Founder and chief scientific officer, Gendaq (1999–2000). Sold in 2001.
- Vice president of research, Sangamo Biosciences (2001–02).
- Founder, CEO and now executive chairman, Plasticell (2002–).
- Founder and CEO, Progenitor Labs (2010–).
- Steering Committee member, UK Stem Cell Bank and Use of Stem Cell Lines (2007–).

SALARY GUIDE

- The median salary for a CEO (chief executive officer) in UK biotech is £180 000. As an entrepreneur, Yen has always taken a substantially smaller salary.

MORE INFORMATION

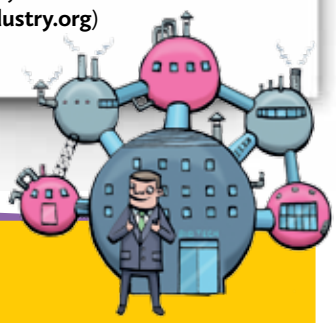
- UK Bioindustry Association (**www.bioindustry.org**)

THE SCIENCE OF... ZINC FINGERS

Zinc fingers:

- are found in proteins in animals, plants and yeasts
- are a type of protein supersecondary structure
- fold around zinc atoms bound by cysteine and histidine residues from the protein chain
- bind to DNA, RNA or other proteins, helping the protein interact with other molecules
- are transcription factors, proteins that bind DNA to affect transcription.

Read more online at www.bigpicture.ac.uk/bigpicture/careers



FAST FACT

In 2010, the UK medical biotechnology sector contained 942 companies that employed 36 700 people and had a combined turnover of £5.5bn. Source: **www.bis.gov.uk/assets/biscore/business-sectors/docs/s/10-p90-strength-and-opportunity-bioscience-and-health-technology-sectors**

Find out more about Yen, including the prizes he's won for his work, at **www.wellcome.ac.uk/bigpicture/careers**

Environment

aluxum/iStockphoto

DR HANNAH RIGBY

Environmental engineer

What do you do?
I'm a postdoctoral researcher in the beneficial use of biowastes. I'm looking at the sustainable use of organic waste: finding ways to reuse it without causing damage to the environment. The waste can be from households, agriculture, the food industry or the pharmaceutical industry.

What did you study?
At A level, I did biology, chemistry and English literature. I wanted to do biology research, although then I was thinking more of population science or genetics. I took English literature to keep my options open. I did a biology degree and then a Master's in oceanography [the study of the oceans], focusing on coastal ecosystems. The subject of my research project was using waste from fish farms to create a product that could be fed back to the fish, and that led me to environmental engineering. I'm interested in sustainable methods of food production and reducing pollution.

What skills from your biology background do you use in your work?
I still use aspects of plant growth and nutrition that I learned in biology A level, and the general skills of designing experiments and interpreting results. The fieldwork I did at A level has transferred to my career, too: I remember a project on plant growth on sand dunes that inspired me. I still enjoy going out and doing fieldwork, as well as lab experiments.

What does a typical day entail?
My work varies from day to day, but when I'm doing fieldwork, I'll first identify the organic wastes I want to study and visit the sites. It's smelly, dirty work, although the wastes have sometimes already been treated. I bring the waste back to spread in controlled plots in the field before sowing seeds at the site.

How do you study the waste's effects?
There are regular sampling trips as we monitor the site and check for weeds and pest damage, before we harvest the crop, analyse the soil and compare the effects to inorganic [carbon-free] fertiliser. Although there are many nutrients in the organic waste we study, not all of the nutrients are 'available' in the soil in a form plants can use. We assess the available nutrients so that farmers can know how much of a particular material to use as fertiliser.

What are the most challenging and satisfying things about your job?
Short-term contracts and finding funding are challenging: you don't really get permanent positions at universities at this stage. I love the variety of my work, though, and it never really seems like a job because I'm doing something I'm interested in.

FAST FACT
In 2008, the UK produced 288 million tonnes of waste. Nearly 15 per cent of it came from households. Source: **www.defra.gov.uk/statistics/environment/waste/wrfg01-annsector/**

QUALIFICATIONS
- A levels: biology, chemistry, English literature (1999).
- BSc biology, UCL (2002).
- MSc oceanography, Southampton University (2003).
- PhD, environmental engineering, Imperial College London (2008).

CAREER HISTORY
- Research assistant, Royal Botanic Gardens, Kew (2004).
- Research fellow, Curtin University, Perth, Australia (2008–10).
- Visiting academic, Imperial College London (2010–).

SALARY GUIDE
- Postdoctoral researcher, straight after PhD: £27 000; 4–5 years' experience: £35 000. (Hannah Rigby)

ESSENTIAL SUBJECTS
- For environmental engineering, most courses want at least two technical or science subjects, often maths and physics or chemistry. (**www.ucas.com**)

MORE INFORMATION
- Society of Environmental Engineers (**www.environmental.org.uk/**)

TOP TIP

This job is multidisciplinary, so it's important to be able to network with people in various sectors. Get to know the relevant people in government and industry, too – they can give you advice, ideas and letters of support.

Work placements not only give you a taste of the job but can be great opportunities to see the world – I did one at Carlton United Brewers in Melbourne.

TOP TIP

CHRIS COOKE

Junior brewer

nndemidchick/iStockphoto

What do you do?
I make beer.

What did you study?
I did chemistry, biology, physics and general studies at A level, then I did a BSc in brewing and distilling at Heriot-Watt University in Edinburgh. After university, I went and taught English as a foreign language in China for three years. When I came back to Britain, I applied for this job as junior brewer at the Griffin Brewery in Chiswick, which is owned by Fuller, Smith and Turner.

How do you use biology in your work?
You have to know about bacteria and yeast and how easy it is to contaminate your beer. Historically, breweries have jealously guarded their yeast strains, because it's such a major factor in defining the taste and character of the beer. Some years ago, Fullers bought Gales Brewery, and we brew the Gales beer on the same site, so we have two separate yeast strains (the Fullers' and Gales' strains). We have to make sure that never the twain shall meet.

What does a typical day entail?
It varies. I could be mashing in and running the brew, which means mixing the germinated malt with hot water, or pumping the hot wort – the sugary solution at the bottom of the mash tun – from the coppers into the fermentation tanks. I could be cleaning and refilling the storage tanks that we use for repitching, or reusing, the yeast from one batch to the next, or I could be doing routine checks and maintenance of the equipment.

How has the technology changed?
The general processes of brewing have been the same for hundreds of years. Nowadays, the equipment is made of stainless steel, and it's on a slightly larger scale and more automated. That's the only difference.

What are the most challenging and satisfying things about your job?
It's a batch process, so the biggest challenge is to stay constantly on the ball so that we produce beers of a consistent quality. The quality of the raw materials changes, so we always have to make adjustments for that. If the colour from a particular variety of malt changes, we alter the amounts of different malts in the grist to maintain a consistent colour. The temperature and amount of time it takes to ferment the beer also have to be consistent. If you ferment a beer at a high temperature, very quickly, the yeast produces different metabolic by-products, which give you fruitier flavours, like apple, banana and raisin.

The best thing? Making something that is enjoyable to drink.

QUALIFICATIONS

- A levels: biology, chemistry, general studies and physics (1998).
- BSc brewing and distilling, Heriot-Watt University (2002).
- Evening classes studying accountancy (2008).

CAREER HISTORY

- Gap year, working in a garden centre and as a surveyor's assistant (1999).
- Work in the packaging and bottling department, Scottish & Newcastle Brewery, Edinburgh (2003).
- Teaching English in China (2004–06).
- Junior brewer at Fuller, Smith & Turner (2009–present).

SALARY GUIDE

- Typical starting salary: £17 000–£24 000. (**www.prospects.ac.uk**)

ESSENTIAL SUBJECTS

- For brewing and distilling, at least one science (for Scottish Highers). Biology or human biology is required if applying with A levels. (**www.ucas.com**)

MORE INFORMATION

- Institute of Brewing and Distilling (**www.ibd.org.uk/careers/career-guide/**)

THE SCIENCE OF... BREWING

Fermentation is an anaerobic process in plants and some micro-organisms that produces ethanol (alcohol) and carbon dioxide from glucose. The process is catalysed by enzymes that are contained within yeast, a vital ingredient in brewing and baking. See more at **www.wellcome.ac.uk/bigpicture/careers**

kunzendorfdk/iStockphoto

Glucose → ethanol + carbon dioxide

FAST FACT

In the UK, 28 million pints of beer are consumed every day, which equates to 100 litres per person every year.
Source: **www.beerandpub.com/beer_facts.aspx**

Read more about the science of brewing at **www.wellcome.ac.uk/bigpicture/careers**

Get going

We hope you've found some ideas and inspiration in the case studies you've just read. Whatever it is you're interested in doing, find out more about how to get there below and in our online articles, videos and web links at www.wellcome.ac.uk/bigpicture/careers.

FIVE TOP TIPS FOR CAREER CONTENTMENT

1. **GRAB THOSE CHANCES!** Work placements and internships can offer an invaluable chance to 'try before you buy' and give you an opportunity to impress a potential employer, which can give you an advantage over the other candidates.

2. **BE PERSISTENT** If there are no opportunities for work experience available, try to create some. Find the name of someone at the place you're interested in working at and write to them or email them to see if you can come in, and talk to your teachers, friends and relatives to see whether they have any connections in the industry.

3. **BE PROFESSIONAL** From how you look to how you express yourself, remember that potential employers will be considering you from all kinds of angles. This doesn't mean you have to be bland, though: you can still let your personality, enthusiasm and intelligence shine through!

4. **DON'T JUST LIKE IT, DO IT** Try and make whatever it is that gets you excited – writing, gardening, baking, engineering – part of your personal life if it isn't already. For example, if you apply for a writing job, one of the best things you can have is a varied portfolio of articles, a blog (but make sure it has more than one post!) and examples of how you find opportunities to write in everyday life. Remember, anyone can say they love something. How can you show it?

5. **IT'S NOT JUST ABOUT YOUR PERSPECTIVE** When you're applying for jobs or courses, it's easy to talk about how you'll benefit from the opportunity. That is important, but put yourself in the shoes of the people selecting a candidate. What will they get from you working or studying there? What skills, characteristics and experience can you provide?

Find out how to find work placements and more with our online agony aunt at **www.wellcome.ac.uk/bigpicture/careers**.

WWW.WELLCOME.AC.UK/BIGPICTURE/CAREERS

FILMS

In our specially made film, 16-year-old Ahmed Mahbub explores some career options in law and animal science. Plus, watch films on some additional careers.

AGONY AUNT

Also online, our careers agony aunt addresses some common questions and concerns about careers.

ARTICLES

We've collected stories from people working in all sorts of jobs – from a deaf DJ and a bee biologist to a stand-up comedian/mathematician and a robotics engineer – from previous issues of *Big Picture* and other Wellcome Trust magazines. You can also read interviews with people working within the Wellcome Trust, the charitable foundation behind *Big Picture*. Read more about the science of some of the careers featured in this magazine, too.

IMAGE GALLERIES

There's an image gallery of different occupations and a set of short films showing a range of different scientists at work, including the team whose work led to a new treatment for diabetes in newborn babies.

RELATED LINKS

Our related links section has all you need to find out more about what you might do in the future, no matter what stage of education or employment you're at.

Top to bottom: *Barry Gibb/Wellcome Images, YanLev/Shutterstock, Brett Syfert/Wellcome Images, Rowan McOnegal/Wellcome Images, wragg/iStockPhoto.*

FAST FACT

Facilitating subjects at A level are those required more often than not for degree courses. They include biology, chemistry, maths, physics, geography, history and some languages. Source: **russellgroup.org/Informed%20Choices%20final.pdf**

See our web links listings for further sources of ideas, advice and inspiration at **www.wellcome.ac.uk/bigpicture/careers**

GLOSSARY

Baffled by BScs? Perplexed by PhDs? This quick guide, tailored to the UK system, will help clarify the terminology used in this issue.

ACADEMIC: Relating to higher education and study. For example, a researcher at a university may be described as an academic, or as working in academia.

BACHELOR'S DEGREE: A course of study that leads to a qualification such as a BSc (Bachelor of Science) or BA (Bachelor of Arts). Generally, these take three to four years' full-time study, although medicine degrees can take six years. Some universities, including Oxford, Cambridge and Dublin, award a BA regardless of the subject studied.

DOCTORATE: A qualification involving a piece of original research, usually at a university. These courses take at least three years full time. The best-known doctorate is a PhD or DPhil – short for doctor of philosophy. People with this qualification can be called 'doctor', but are not to be confused with medical doctors (who may also choose to take a PhD).

FOUNDATION DEGREE: A university-level qualification that equips a person for a particular area of work, typically an FdA (Foundation Degree in Arts) or FdSc (Foundation Degree in Science). These degrees combine learning in the workplace with academic study and are equivalent to the first two years of an honours degree. Formal qualifications are not always required to enrol on a foundation degree course.

GRADUATE: Relating to someone who has completed a university degree, usually a Bachelor's. Many employers offer graduate training schemes.

POSTDOCTORAL (POSTDOC): The period after a doctorate. Often used to describe a paid research job you can do after completing a PhD. Both the positions and the people that do them can be called postdocs.

POSTGRADUATE QUALIFICATIONS: Qualifications that require someone to have a Bachelor's degree. They include postgraduate certificates, postgraduate diplomas, Master's degrees and doctorates.

RESEARCHER: A general term for someone paid to do research. They may work in universities or for private companies, such as those in the pharmaceutical industry, which develop drugs and therapies for disease. There are different career stages for researchers, which often include fellow, lecturer and professor.

UNDERGRADUATE QUALIFICATION: A course that leads to a Bachelor's degree (or equivalent). In England, Wales and Northern Ireland, many students start undergraduate degrees at university at 18 after completing A levels or the International Baccalaureate. In Scotland, most students start university at 17 and complete an extra year. Someone studying at this level can be known as an undergrad.

Find out more about qualifications at **www.direct.gov.uk/en/EducationAndLearning/QualificationsExplained/index.htm** and about the UK academic system at **www.compbio.dundee.ac.uk/ftp/pdf/The_UK_Academic_system.pdf**.

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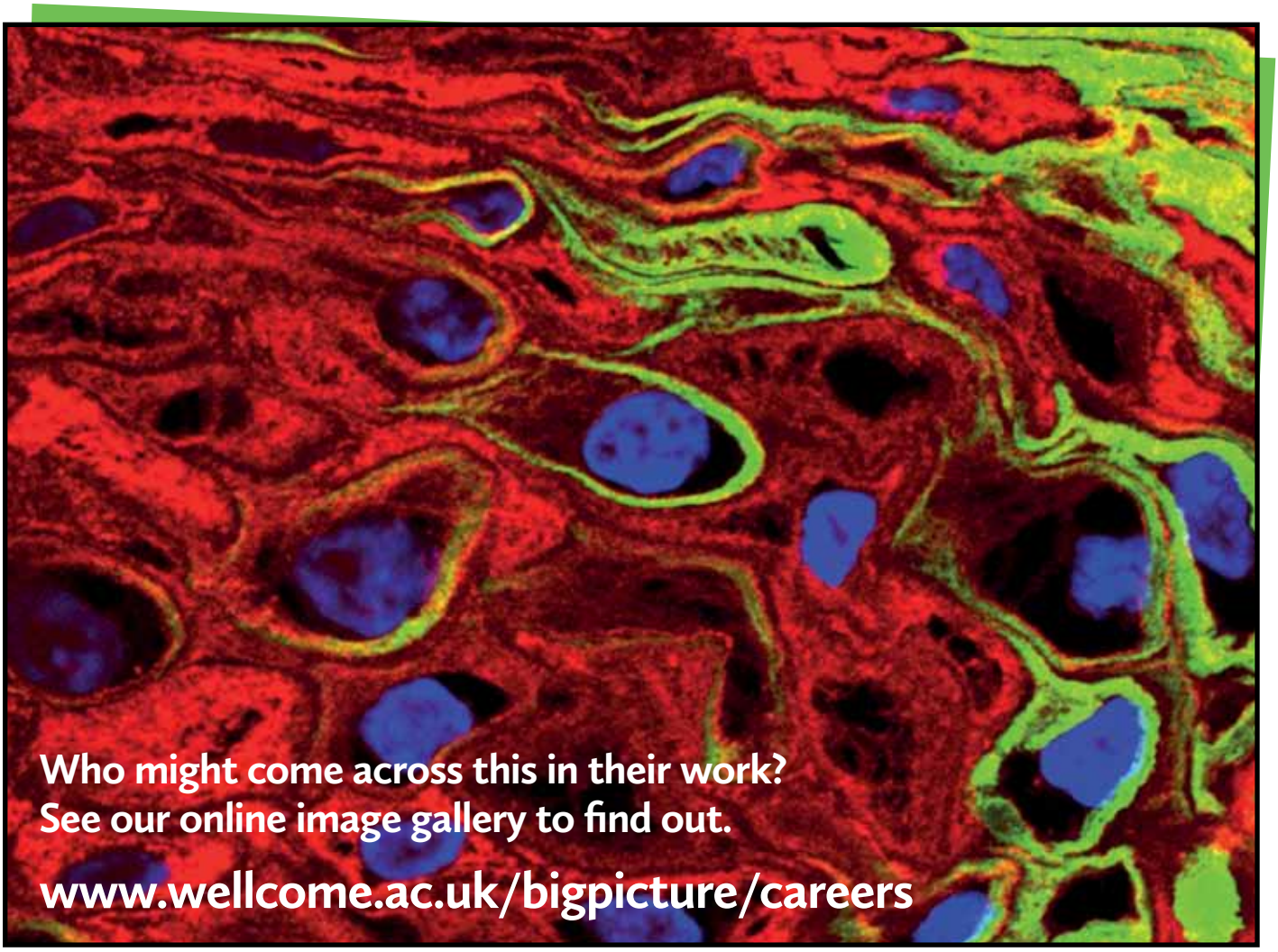
The future of science depends on the quality of science education today.



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