



Part of the conference series
Breakthrough science and technologies
Transforming our future

Future skills for the life sciences

Conference report

Supported by AstraZeneca

THE
**ROYAL
SOCIETY**

Executive summary

This conference considered initial training, from work experience in schools to apprenticeships and doctoral training schemes, retraining for multiple careers and returning to work. Talks also explored movement of people in the UK and Europe, to and from bioscience clusters, and between small and large companies, as well as the development of entrepreneurship and business skills.

The following common themes emerged during the day:

- Science is a team endeavour and trained people must be able to both work in and lead teams, as well as collaborate internationally and across sectors. Meanwhile, the right team will ensure the success of a research project or start-up, and diverse teams ensure new ways of thinking and new discoveries.
- Careers are supported by focussed development programmes, networks and individual mentors. It is important to make use of friends, teachers and colleagues, and to nurture the support of inspirational mentors.
- There is a need for greater mobility of staff between academia, industry and SMEs.
- Work experience and school visits are an important way to expose young people to different sectors. Companies value graduates who have had work experience, but need to be willing to offer work experience themselves. Large companies could help SMEs provide work experience by supporting them administratively and financially.
- Robust entrepreneurship training is necessary to ensure companies grow, rather than leaving this skill to chance and to those to whom it comes naturally.
- Careers are no longer for life and people are likely to switch sectors. There is a need for tailored career guidance, to raise academics' awareness of careers beyond academia, and for continuous training of post-doctoral researchers.
- Data science and digital skills permeate all areas of the life sciences, so all scientists must have data expertise. There is a fundamental need for informaticians and data scientists.



Image: Steve Rees (left) and Sir Patrick Vallance FMedSci FRS.

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“Fascinating talks ranging from overviews of the life sciences skills landscape, to uplifting personal stories and great insights from employers about their approaches to recruitment and retention.”

Professor Dame Julia Goodfellow DBE FMedSci, Public Health England, the Royal Society of Biology

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Introduction

On 12 March 2019 the Royal Society hosted a conference on the skills needed to ensure the future success of the life sciences sector. The conference brought together experts from academia and industry to discuss skills requirements and gaps, training and re-training, movement of people, entrepreneurship and business skills.



Image: Conference delegates networking.

This conference was supported by AstraZeneca and forms part of a series organised by the Royal Society entitled Breakthrough science and technologies: Transforming our future. These meetings address the major scientific and technical challenges of the next decade. Each conference covers key issues including the current state of the UK industry sector, the future direction of research and the wider social and economic implications. The conference series is organised through the Royal Society’s Science and Industry programme which demonstrates our commitment to integrate science and industry at the Society, promote science and its value, build relationships and foster translation.

This report is not a verbatim record, but a summary of the discussions that took place during the day and the key points raised. Comments and recommendations reflect the views and opinions of the speakers and not necessarily those of the Royal Society.

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“The skills in the workforce are crucially important and will lead to either success or failure. It is definitely a team sport across all areas of the life sciences, and this is all about people.”

Sir Patrick Vallance FMedSci FRS, UK Government

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The UK has a very strong base in life sciences. It is home to the largest biotech cluster outside the US, and the UK life sciences industry has an annual turnover of around £70 billion, employing 250,000 experts. Pharmaceuticals is the most productive area of the UK economy (above construction and financial services). The UK's emerging biotech sector holds around 40% of the venture capital money in Europe, while circa 70% of life science technology jobs are outside of the Southeast and the 'Golden Triangle' of London, Cambridge and Oxford.

To meet the Government's ambition to increase R&D spending from 1.69% of GDP in 2017 to 2.4% by 2027, the UK life sciences sector needs around 125,000 more people with appropriate skills by 2025. Recommendations made in the 2017 Life Sciences Industrial Strategy to meet this include:

- Continuing to strengthen the science base in the public sector, including supporting higher risk science.
- Helping to scale up innovative companies.
- Building capacity for the discovery and manufacture of new generation therapeutics: viral vectors, cell and nucleic acid based therapies.
- Creating new industry in the UK to fill opportunities over the coming decades, taking advantage of the UK's competitive lead in genomics, digital health and early diagnosis.

In an increasingly global market, it is important to bring skilled people into the UK and for the UK to remain attractive to the international science community. However, immigration policies, the speed of the visa system and Brexit all influence the ability to bring in talent. Apprenticeships are a valuable way to bring other types of people into the sector and provide industry-tailored training.



Image: Sir John Irving Bell GBE FMedSci FREng FRS.

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“Our skills base for the life sciences goes back to our ability to deliver a strong STEM programme in schools in the UK. We need to get children excited about science in schools: if we don't get this right, then the rest of it falls over.”

Sir John Irving Bell GBE FMedSci FREng FRS, University of Oxford

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Early career researcher discussion workshop

A discussion workshop for early career researchers at the Royal Society on 11 March explored the hopes and concerns of scientists in industry and academia at the start of their careers.



Image: Sir John Skehel FMedSci FRS summarises the discussion by early career researchers.

And concerned by:

- The lack of job security and clear career path in academia, as well as a lack of personalised careers advice.
- The need for research culture to move away from its focus on the individual and evaluating scientists based on the number of publications.
- The fact that leaving academia can be seen as a failure. While UK academic training is world leading, a cultural shift is needed to encourage junior scientists to embrace a range of careers across the academic, biotech and industry sectors within UK life sciences.
- The pressure to attract private and public funding.
- The perceived focus of opportunities in the 'Golden Triangle'.
- The lack of public trust and understanding of science.
- The impact of Brexit on funding, as well as where they and their collaborators are able to work.

These scientists are excited by:

- The idea that the greatest discoveries are ahead of us.
- The potential to use and communicate science to improve the future.
- The opportunity to apply their skills across a range of sectors and to mentor the next generation.
- The scope to collaborate with a range of people across diverse sectors.
- The commercial application of their research to deliver value.
- The changing culture of academic research.

Initial training

Work experience

Young companies create most net new jobs, however, companies find they cannot grow as there is a lack of skilled people to hire. Meanwhile, the skills gap is growing as schools and universities struggle to meet the demand of the increasing number of highly skilled jobs. Businesses can be part of the solution in skills training. It was suggested that businesses visit schoolchildren as young as six, and provide the work experience that is particularly important to encourage girls into scientific careers. Work experience is highly valued by hiring teams, but many companies are not willing to offer it. Incentives could be introduced for teachers to make sure each student hears from several industries every year. While it is beneficial to gain work experience at small companies as well as large corporations, this needs to be at a convenient time for employers.

“Most of my entrepreneurship training was by serendipity and osmosis, but some of those skills would have been very useful very early on.”

Professor Janet Hemingway CBE FMedSci FRS, Liverpool School of Tropical Medicine

“Experience in the work place will be vital to fill the skills gap, and businesses have to be part of the solution in skills training.”

Sherry Coutu CBE, Founders4Schools, Workfinder, the Scaleup Institute



Image: (left to right) Sherry Coutu CBE, Professor Jeanette Woolard, Clare Viney, Adam Isle, Sarah Scott, Charlotte Hughes and Professor Janet Hemingway CBE FmedSci FRS (Chair).

Academia

There has been a 20% increase in postgraduate and post-doctoral researchers since 2013, but there are not enough academic jobs for those who want to stay in academia. Raising researchers' awareness of the opportunities beyond academia, and providing experience in these sectors, would help open up opportunities elsewhere. Researchers who leave academia report high job satisfaction, stating that they are valued more for their research skills than in-depth expertise.

To prepare researchers for the future they require teamwork and leadership skills, emotional intelligence and the ability to be intellectually mobile to adapt to an unknown future. The standard academic approach has a one-to-one focus with the supervisor, and there is a need to develop early career researchers as better team thinkers to prepare them for the workforce.

PhDs foster innovation and development, however, broader training beyond the specialised field of research is required. Ten days spent in industry per year could provide training in areas including Intellectual Property law and HR, ethics and project management, providing the rounded education that employers seek and allowing students to interact with people in different departments. Industry-funded PhDs ensure that researchers complete their degree with the skills necessary for employment. However, this is not a 'quick fix' as it takes time for researchers to enter the workforce. There is also value in collaborative PhDs across universities culminating in industrial placements, and industrial visits for Higher National Diploma students that build mutual interest in the sector and the placement.

The culture of academic research needs to move away from traditional individual and small team scholarship towards 'team science'. All team members must be valued for their contribution, including technicians and statisticians. Less weight should be placed on first and last author position, the named Principal Investigator and the Co-Investigator, as this impacts workload and funding allocations. Programmes like COMPARE¹ ensure that early career researchers engage all Principal Investigators, build links with multiple groups, and expand their network beyond their institution (eg to Learned Societies) to prepare them better for future careers. Allowing post-docs to apply for undergraduate summer students gives them direct supervisory experience and their first grant, gives undergraduates academic experience and gives the host institution a trial of a future PhD student.

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“We need more quantitative and qualitative data to make the case to invest in people, developing and valuing the researcher, not just the research.”

Clare Viney, The Careers Research and Advisory Centre

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“An apprenticeship provides an environment where you don't feel silly asking questions, a support network of kind people, mentoring and coaching, and development opportunities - including speaking at events like these.”

Charlotte Hughes, GSK

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1. The Centre of Membrane Proteins and Receptors, a collaboration between the Universities of Birmingham and Nottingham.

Graduate schemes and apprenticeships

When graduates join graduate schemes, they can struggle to anticipate and plan for challenges as they have not yet been part of a longer-term project. They may lack the confidence to fail and to bring their own opinions to discussions, and can struggle with stakeholder and project management. Solutions include:

- Earlier work experience and industrial placements, to expose students to challenges before graduating.
- Workshop-based learning, providing the safety to fail amongst peers.
- One-to-one mentoring and meeting with senior leaders who value the graduate's input.
- Poster sessions to practice communicating science.

Apprenticeships provide an opportunity for companies to train their workforce with the specific desired skills, while young people help to invigorate the workforce. Meanwhile, voluntary and work experience helps build confidence and the specific skills needed to take a non-degree route into science after school.



Image: Sarah Scott.

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“Doing work experience and voluntary jobs really helped me learn the skills I have. It’s important to be positive, and people really do help you.”

Sarah Scott, Adaptimmune

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Re-training for multiple careers

There is a need for continuous training for all people in STEM, and all jobs and training provide different skills that can be brought to future roles.

Post-docs teach researchers deep science, how to write grant applications, present work and teach. Close work between employers, Principal Investigators and post-docs would allow co-development of a post-doctoral training programme that cultivates skills that align with industry needs, and ensures that post-docs do not leave academia feeling like a failure.

Industry teaches the workforce how to take risks, approach regulatory and commercial challenges, plan milestones and project manage, think strategically as part of or leading a team, work with other skillsets and get buy-in from other people. Those taking a job instead of a degree gain skills that will help them in any future training or employment, including the ability to manage their time and the motivation to focus.

Life sciences is increasingly seen as a creative industry – as defined by activity concerned with the exploitation of information, or exchange of finance for IP rights. Life sciences companies will benefit from staff who work creatively, including hiring people from the creative sector.

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“The development of the next generation of scientists - and their continuous development - is absolutely critical for the UK’s business. Creating a thriving ecosystem in the UK is even more important in a highly competitive and rapidly changing world, and it is up to us to take advantage of the depth of opportunity that this brings to successfully drive science forward.”

Steve Rees, AstraZeneca

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Images: (top) Dr Katie Perry, (bottom) Professor Chas Bountra.

Returning after a career break

As well as addressing skills shortages, there is a business case for hiring returners: they are qualified for the role with transferable skills acquired during their career break, highly motivated and help diversify teams for better results. However, the barriers preventing people returning to work after a career break include:

- Lack of confidence.
- Lack of a recent relevant track record.
- Shortage of part time and flexible posts.
- Cost and availability of childcare.
- Lack of understanding and tolerance of health issues.

This makes programmes and fellowships that allow people to return to scientific careers - such as those from the Daphne Jackson Trust, Wellcome Trust, and British Heart Foundation - valuable. However, there are not currently many such programmes available. Generous individuals taking a chance can also be vital in supporting people returning to science careers.

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“I passionately believe that life science is the new creative industry and that the big problems we are currently facing will be solved by science through interdisciplinary collaboration.”

Jonny Ohlson, Touchlight

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“There is a strong business case for hiring returners, who bring skills back into the workplace that they’ve had through life experiences.”

Dr Katie Perry, the Daphne Jackson Trust

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Images: (top) Professor Simon McQueen-Mason, (bottom) Jonny Ohlson.

Movement of people



Image: (left to right): Professor Anthony Hollander, Dr Andy Williams, Aidan Courtney, Professor Dame Julia Goodfellow DBE FMedSci (Chair), Dr Delyth Morgan and Roger Kilburn.

Attracting talent

In the face of competition and increasing R&D investment in China and USA, it is particularly important for the UK to be able to attract, develop and retain skilled people - including entrepreneurs and leaders. Meanwhile, it is difficult to match the skills need with availability in fast-developing technologies. Greater Government investment in universities and early stage UK biotech companies could help retain talent.

The UK is good at developing new ideas but there is scope for improvement in translational science. Efforts to strengthen translation of science in Scotland include the establishment of innovation centres that help industry to better use academic assets. The Industrial Biotechnology Innovation Centre (IBiolC) aims to build industrial engagement to create community where none exists, fund university projects on industry problems, and provide a skilled workforce to meet future university needs.

The Ser Cymru programme aims to bring talented scientists to Welsh universities, particularly in areas with skills gaps (clinical medicine, physics, maths, engineering and biosciences). The creation of National Research Networks in Wales has helped to attract researchers, while Structural Funds and Horizon 2020 have helped build capacity. There remains a need to increase commercial relevance by building public, academic and private sector collaboration, including through commercial fellowships.

Small versus large companies

Small companies can offer a clear company vision as well as less bureaucracy, a greater ability to listen to employees, and greater diversity of experience and skillsets than large organisations. However, they struggle to attract staff in the face of limited resources, administrative support and formal training.

There is attrition of employees in small companies as people want to move from the lab into management. The ability to broaden the company's output to place individuals where they want to be, or move employees elsewhere in the workflow, can help accommodate this.

Bioscience clusters

Bioscience clusters offer the opportunity to be close to dynamic companies of the same type, to collaborate with other high quality individuals and to scale-up. The organisations often offer high salaries and support (eg lobbying for improved transport infrastructure), facilitating a high quality of life.

However, there is concern that industry clusters cause overheating of the local economy and place considerable demands on infrastructure with immediate effect on staff. This could be solved by growing research clusters outside the 'Golden Triangle', such as in the North. Bioscience clusters can avoid drawing talent already in the local area by targeting recruitment campaigns elsewhere.

Impact of Brexit on movement and funding

British universities are internationally competitive and important to the economy, contributing 2.9% of the UK's economic activity in 2012-2014 and providing 940,000 jobs. Over 25% of the UK's university staff are from outside the UK, and this underpins the excellence of university teaching, research and innovation. As such, there is concern for future arrangements for international colleagues and students. The current European temporary leave to remain scheme allows researchers to stay in the UK for three years. This is unlikely to provide enough time to complete a PhD, and there is no guarantee that students would find someone else to sponsor them to remain in the UK.

It is crucial for the UK to remain part of EU funding schemes. The UK Government underwriting part of the Horizon 2020 funding has given the UK some security, but this does not include the European Research Council and Marie Skłodowska-Curie Actions funding. Without these funding strands, UK researchers will lose out on an estimated €1.3 billion, and world-leading academics are likely to relocate to countries where they can access this financial support.

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“Science is becoming personal and there will be more data than we can ever imagine. We will have an increasing challenge with ethics and management of data.”

Aidan Courtney, Censo Biotechnologies

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“The Golden Triangle could be overcome by overheating of the economy and huge demands on infrastructure, with an immediate effect on the quality of life of academic staff. We need to grow other research clusters and I would advocate for the North.”

Professor Anthony Hollander, University of Liverpool

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Entrepreneurship and business skills

Robust entrepreneurship training is necessary to ensure companies grow. There is a need to ignite interest in entrepreneurship training and to embed this training in the education system early, rather than leave this skill to chance and those it comes to naturally.

Entrepreneurship education can take several forms:

- Fellowships that set aside time to focus on developing a company alongside training.
- Talks by serial entrepreneurs who can pass on their learning and enthusiasm.
- Entrepreneurship training courses.
- Embedding entrepreneurship education policy in government.

UK universities tend to be market-driven, and if students request entrepreneurship training alongside their degree the universities will deliver the modules. Programmes such as the International Genetically Engineered Machine (iGEM) competition enable students to develop ‘real’ science skills beyond the lab bench, including project management, fundraising and balancing strengths within a team.

Start-ups

Teams behind science-based start-ups benefit from a combination of specialist technical and non-technical skills:

- **Commercial skills.** An understanding of the unmet need for a product and its competition.
- **Technology.** A deep understanding of innovative science, specific technical skills and how to protect Intellectual Property.
- **Team.** Resilience, complementary skills and the ability to evolve.
- **Finance.** The ability to source and manage funding.

When working with investors, start-ups must be able to validate their business model and answer commercial questions. It helps if start-ups have seen the development process from start to finish before. This experience can be gained as a graduate in large companies, learning to pre-empt and avoid problems. Strong leadership is needed to keep teams together and convince stakeholders – from investors to the board and regulators – of the team’s competence. Meanwhile, reliability can be proven by outlining milestones to investors and demonstrating when they are achieved in a fast-paced environment.

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“Investors invest as much into people as they do technologies. A really brilliant team will find a way to make something of value from a technology, even if the technology isn’t really the best.”

Barbara Domayne-Hayman, the Francis Crick Institute

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“No experience is ever wasted, but gives you transferable skills. I find I use everything I’ve ever done in what I’m doing today.”

Ned Wakeman, Alderley Park Accelerator

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Image: (left to right): Dr Romeo Rácz, Professor Tim Dafforn, Matthew Foy, Barbara Donmayne-Hayman, Steve Bates OBE (Chair), Zoe Ford, Zoe Catchpole and Ned Wakeman.

Accelerators can help get start-ups running but in order to progress, follow-up support has to be found elsewhere. Intensive support from mentors, one-to-one meetings and boot camps have the biggest impact on company growth and employee retention. Networking is also vital and connections made now may be helpful later. Speakers recommended talking to everybody and making cold calls, as people are generally happy to offer their advice.

Teams behind Technology Transfer Offices benefit from past industry experience where they further develop a realistic understanding of a technology's market potential, the ability to work promptly and negotiation skills.

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“The UK has the diversity, creativity, and entrepreneurial spirit to meet some of the biggest challenges we still see - in life sciences and in human healthcare. We have the spark, excitement, and can-do attitude.”

Steve Bates OBE, BioIndustry Association

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Acknowledgements

Organisers

Steve Bates OBE

BioIndustry Association

Professor Dame Julia Goodfellow DBE FMedSci

Public Health England, the Royal Society of Biology

Professor Janet Hemingway CBE FMedSci FRS

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Professor Chas Bountra

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The Careers Research and Advisory Centre



The Royal Society is a self-governing Fellowship of many of the world's most distinguished scientists drawn from all areas of science, engineering, and medicine. The Society's fundamental purpose, as it has been since its foundation in 1660, is to recognise, promote, and support excellence in science and to encourage the development and use of science for the benefit of humanity.

The Society's strategic priorities emphasise its commitment to the highest quality science, to curiosity-driven research, and to the development and use of science for the benefit of society.

These priorities are:

- Promoting excellence in science
- Supporting international collaboration
- Demonstrating the importance of science to everyone

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