The only university in the UK to focus exclusively on science, medicine, engineering and business.

Ranked 3rd in the UK for Materials Technology.

In the top 10 best universities in the world.

The Complete University Guide University League Table 2019

The Times World University Rankings 2019
Welcome to Imperial College London and the Department of Materials. Our highly skilled and sought-after graduates have been at the forefront of world-leading industry and groundbreaking research for more than 165 years.

By joining the Department of Materials you will become part of an academic community focussed on finding solutions to the world’s most pressing problems, from energy and the environment, to healthcare and economic sustainability. You will be able to share insights and knowledge with other like-minded people across Imperial’s Engineering, Natural Sciences, Medicine and Business faculties.

Curiosity, creativity and the exchange of ideas are vital to the development of our students. We are committed to making sure you leave us equipped with all the skills and values a modern Materials Science engineer requires.

Get ready to reshape the world.

A world-class reputation for excellence

Visit our website: imperial.ac.uk/materials
Today, advances in microscopy and equipment are enabling us to observe what is happening on these length scales in unprecedented ways. Innovative experimental approaches give us the ability to directly construct nanoscale objects with increasing control. New theoretical methods are bringing quantum mechanics and theoretical physics ideas away from single atoms and molecules, and into the nano-world and to engineer solutions to our benefit.

Materials are being created and improved at a faster rate today than ever in our history, making MSE not only a key discipline in the global economy but also a key player in the evolution of our environment and lives.

Many of the technological advances that have transformed our lives are founded in MSE. Modern life would be impossible without the thousands of manufactured items we use every day, from the clothes we wear, to our phones, cars, computers and the buildings we inhabit, as well as more advanced and life-changing technologies like biomedical devices and satellite communications.

The way a material behaves – its mechanical response, electrical conductivity or optical properties – must be carefully considered in every engineering project. What determines these properties are structures at the nanometer and micrometer length scales.

Today, advances in microscopy and equipment are enabling us to observe what is happening on these length scales in unprecedented ways. Innovative experimental approaches give us the ability to directly construct nanoscale objects with increasing control. New theoretical methods are bringing quantum mechanics and theoretical physics ideas away from single atoms and molecules, and into the nano-world and to engineer solutions to our benefit.

The motivation to invent or improve materials comes from our need to solve real societal problems, from energy storage to replacement organs and waste disposal. The incentives may be dictated by manufacturing or business needs, but public policies, new scientific advancements, even national or global security threats are also driving forces.
Materials Science and Engineering is more than just making something. It determines the kind of world we live in and the kinds of lives we lead.

All technologies are limited by the materials from which they are made.
Five Materials Science challenges of the future

1. Energy
The challenges relating to energy generation, storage and conversion are some of the most pressing. Materials scientists are at the forefront of the push to create economical and sustainable alternatives to fossil fuels with work on solar cells, fuel cells and nuclear fusion reactors.

2. Nanomaterials
These materials are designed at the scale of a billionth of a metre. At this scale they demonstrate unique properties. These are finding uses in almost all engineering fields: electronics, computing or photonics, pharmaceuticals.

3. Circular economy
Beyond the traditional recycling industry lies a potentially waste-free future. A circular economy is an industrial closed loop system that allows for the extraction of maximum value during the life of a product and then recovers materials and regenerates products when that life comes to an end.

4. Smart materials
Smart materials have properties that react to the application of any external stimuli, such as stress, light, temperature, moisture, pH or electric and magnetic fields. Many of these are already commonly used – shape-memory alloy, piezoelectric materials and quantum-tunnelling composites for instance. Innovations are expected in aerospace, civil engineering and mechatronics, as well as the development of wearable tech.

5. Additive manufacturing
Additive manufacturing and 3D-printing are set to revolutionise engineering, replacing the need for large production runs with the production of bespoke parts for specific applications, such as patient-specific prosthetics. 3D-printing is extending into new areas including as advanced biomaterials for tissue growth and high-performance metal components for aerospace.

Seven innovations that are closer than you think
Thanks to research in Materials Science and Engineering these innovations are close to becoming a reality, or already exist:

- Foldable wide screen TV
- Artificial muscles made with conducting polymers
- Photocatalysts that produce hydrogen from water
- Nanoparticles to deliver chemotherapy drugs directly to tumours
- Self-healing concrete that cure cracks as they appear
- Transparent wood
- Night-vision contact lenses
Case study: ThinAir

ThinAir is a start-up developing surfaces that harvests water from the atmosphere. It was founded by five Imperial undergraduates, all during their third year of study.

Their inspiration was the Namib desert beetle. The beetle’s back is decorated with unique structures whose chemical properties allow it to condense water from desert air. By combining the disciplines of biochemistry, biomimicry and materials science and engineering, the team developed the concept of a highly efficient, water-condensing membrane that could, like the beetle, harvest water from the atmosphere – even in dry environments.

Materials science played a vital part. From lightweight and transparent polymers that could be used to generate water on the move, to metallic surfaces that radiate heat quickly in large water generators, the team used materials science to identify and harness the different properties needed.

Studying the performance of their product required the team to make use of materials characterisation techniques, such as scanning electron microscopy to observe microscale features on the surface, and contact angle analysis to record the surface’s interactions with water droplets.

Since forming the team in 2016 ThinAir has raised over £200,000 through competition wins and grants. This money has been used to fund lab space, equipment, marketing efforts, and protect intellectual property.

They are now in the process of finalising their technology, working with experts to maximise its efficiency and identify potential applications. Ideas include locating the technology in the redundant space beneath solar panels to provide water for crops, using it to help refugees on the move, and employing it as a water recycling system during space exploration.

ThinAir is currently demonstrating their technology in the UK and is one of five finalists in the Global XPRIZE Water Abundance Competition, with a chance to win the coveted $1.75 million prize fund. Over the next few months the team will continue to speak with potential customers about how best to bring the tech to market. Their intention is to operate two branches of the company. The first will cover commercial applications with profits being reinvested in a humanitarian branch.

The hope is that this structure will help serve the ultimate goal of the company – providing access to clean water for the communities that need it most.
Materials possess a kaleidoscope of properties, opening new frontiers for industrial, technological and medical advancement.

Why do Materials Science and Engineering with us?

You know you like science but would like to apply your knowledge in practical ways to help preserve the environment, build devices that save lives, advance space exploration, or preserve priceless historic artefacts... whatever your reason for wanting to understand how things around us work and how to improve them, we offer an interdisciplinary, inspirational and supportive education at the cutting-edge of science and engineering.

You will be taught and supervised by a range of staff, from internationally renowned professors and established lecturers, to graduate teaching assistants, each involved in researching their specialist fields which include: regenerative medicine, biosensing, nanotechnology, communication technologies and nuclear energy, to name just a few. This partnership ensures that our teaching is informed by an up-to-date understanding of the research frontier. More importantly, we aim to enable the development of your own creative ideas and problem-solving abilities.
Supporting your training all the way

Our students have direct access to dedicated undergraduate facilities, including extensive sample preparation and materials testing laboratories and our data processing suite.

Our Materials characterisation laboratory enables students to perform their own research. The lab contains a table-top scanning electron microscope for imaging microstructure, as well as new equipment for chemical analysis of materials (X-ray fluorescence), and for analysing the stability of nanoparticles in liquids such as model salt solutions that imitate body fluids. Teaching Fellows are available to train and assist you every step of the way.

Career opportunities

Imperial College organises a year-round programme of employer events where you can meet leading recruiters face to face. Through our industry sector forums, annual careers fairs and extensive programme of company presentations and skills workshops you will have access to many potential employers on campus.

You'll find a wealth of guidance and information to help you embark on your career and, as a student at Imperial, you'll be able to use our Careers Service from your very first day, right up to three years after you graduate.

Find out more: imperial.ac.uk/careers

Become part of the materials community

The Department has its own Materials Society, called MatSoc, which will help you make the most of your time with us.

You will be able to attend seminars led by industry professionals, visit companies across the UK and Europe, meet prospective employers looking for materials engineers, and network with our alumni – all thanks to events organised by the MatSoc.

Find out more: union.ic.ac.uk/rsm/matsoc

Haldrian Iriawan, MEng Materials Science and Engineering, year 2

My first year in the Department of Materials at Imperial has been exceptional: the academic challenge that comes with every lecture keeps me intellectually stimulated, while the hands-on laboratory sessions allow me to put my theoretical knowledge into use to solve real-world problems.

While the field of Materials Science and Engineering itself is exciting, what I like the most is the way the subject is taught here: the people lecturing you are likely the ones at the forefront of world-class research, and they always make an effort to integrate their research expertise into their lectures, making the subject relevant to our daily lives. The lecturers and professors are also extremely approachable, allowing me to develop meaningful relationships and mentorships with them.

Aside from the academics, I love to hang out with friends and participate in socials. I love that there are many avenues at Imperial where students can explore their passions in even the most niche fields (badminton, ice-skating, drone-flying, you name it)… I am happy and excited to be here.
By diving into the microscopic world of Materials and understanding the very building blocks with which they are made, scientists are able to make game-changing breakthroughs.

**Careers**

With a degree in Materials Science and Engineering you will find global opportunities in both established and newly developing industries.

Graduates go on to pursue careers in academia and as policy makers and scientific advisors to national governments, or in entrepreneurial roles.

There will always be a need for materials scientists and engineers in traditional industries such as automotive, aerospace manufacturing, chemical engineering or the nuclear industry.

There are also many roles for materials scientists as product developers, process scientists and technical sales engineers.

New opportunities are growing in areas such as biomedical engineering, 3D printing, robotics and quantum computing. Research and development firms are always looking for materials engineers to solve some of the most urgent problems facing society, including food production, communication, transport and energy storage.

Another important area of development is computer modelling and simulation to predict the performance and integrity of new materials. This is being used to replace expensive, complex and time-consuming lab experiments and is ideally suited for those with an interest in physics and computing.

Many industries employ materials scientists and engineers.
Healthcare

Materials Science and Engineering and healthcare are intrinsically linked from the development of blood bags, or biocompatible implants to life-changing advances like instant disease detection tests, bone and cartilage regeneration, or 3D-printed organs. The healthcare industry offers unique challenges and the need for materials to perform and behave at the highest standard and with absolute precision.

Nanotechnology

Materials scientists observe and study substances at the atomic scale to understand their properties and interactions. Most material properties will change at the nanoscale and understanding these changes can be useful in the discovery and manufacture of nanomaterials for applications in medicine, electronics or energy storage, to name just a few.

Aerospace

Materials scientists provide essential expertise to achieve lighter, faster, safer and more economic aircrafts, satellites or spacecraft. They understand the relationship between performance and the extreme environments materials will encounter in aerospace applications. They work on technologies from high performance alloys, or composites to coatings.

Oil and energy

The ability to generate, use and store energy, or extract resources very much depends on the materials the technologies used are made from. The development and performance of batteries, fuel cells, nuclear reactors or solar cells, for example, all very much depend on advances made in Materials Science and Engineering. These progresses can also have a huge impact on sustainability, and the preservation of our environment.

Manufacturing and technology

Materials scientists have always been at the forefront of new technological developments. Collaborating as part of a team, they conceptualise, design and test lighter, stronger, safer, more durable and economical materials that are integrated in a whole range of devices and applications from toys to touch screens.

Automotive

Racing cars, commercial, hybrid or electric vehicles all have one thing in common: they need to always be safer, more efficient and perform better. Materials scientists can create or manipulate the properties of materials to achieve these objectives and help with the development of displays, electronics, batteries, optical sensors, or body frames. They also work with catalytic materials to reduce the impact of environmentally harmful chemical processes.

IT and telecommunications

The increasing demand in ever-faster communication solutions and the increasing volume of data traffic require the development of performance components to improve reliability, durability and high-power transmissions in devices. Materials scientists can offer innovative solutions like the use of graphene in key components for optical and radio communications, or holographic data storage.

Materials scientists are central to technological innovation and offer potential for future growth and prosperity
Our network

Our research extends across many disciplines and our staff are involved in many research groups and institutes at Imperial. These cover a variety of areas, from climate change and plasmonics to biomedical engineering and security.

The Henry Royce Institute

The Royce Institute brings together 900 world-leading academics from across the UK and works closely with industry to ensure commercialisation of fundamental research.

The Institute has research activities taking places at its partner universities of Manchester, Sheffield, Leeds, Liverpool, Cambridge, Oxford and Imperial College London, as well as the UK Atomic Energy Authority (UKAEA), and the National Nuclear Laboratory (NNL).

Imperial is involved in the Atoms to Devices research theme that has potential application areas in almost all industrial sectors, but particularly computing, healthcare and energy.

Find out more at: royce.ac.uk/
Industrial partners
Our expertise is sought by industry. Some companies go beyond project-based collaborations and invest in research centres. These include the Shell-Imperial Advanced Interfacial Materials Science (AIMS) Centre, which focuses on research that links nanoscale processes to large-scale materials behaviour, and the Rolls-Royce Nuclear University Technology Centre, which addresses nuclear engineering research of relevance to Rolls-Royce in the areas of micromechanics, structural integrity and thermal hydraulics.

Push the boundaries of your knowledge and integrate other disciplines
With the new I-Explore (launched in 2019/20) you will have an even wider range of modules to choose from. You will be able to develop transferable skills such as communication, team-working, problem-solving, business and organisational awareness. You will be able to develop your entrepreneurial acumen with modules delivered as part of our ‘Business for Professional Engineers and Scientists’ programme. Or choose to explore a specific topical issue (e.g. ‘cybersecurity’, ‘gene editing’, ‘microfabrication’ etc.), or gain an introduction to an area of a discipline not currently accommodated in the core curriculum (e.g. ‘essential hacking concepts for chemistry’, ‘gendered robotics’ etc.)

MIT Exchange
Some MEng Materials Science and Engineering students have the opportunity to spend time at the Massachusetts Institute of Technology (MIT) as part of their course.

Option 1: 10-week summer research project
Each year four students on the MEng Materials Science and Engineering programme are able to carry out a 10 week research project at MIT over the summer between years 3 and 4. Two go to the Department of Materials Science and Engineering at MIT, and two to the Department of Nuclear Science and Engineering.

Option 2: Autumn Term at MIT
Two students on the MEng Materials Science and Engineering programme can spend the Autumn Term of the 4th year studying at MIT.

Find out more about our network: imperial.ac.uk/materials/about/our-network/

Helen Tan, MEng Materials Science and Engineering, year 2
Choosing Materials as my course of study is the best choice I have ever made in my life. Before even applying to university, I thought to myself that I would like to make a connection between different subjects and learn the beautiful combination between theory and real-life application. Materials is the perfect course for me... I am constantly awed by the enthusiastic lecturers as they always teach to inspire us.

Science is about always being curious about the unknown and having a unique understanding of what is known. I feel that the approach in the Department of Materials is to teach exactly what science is about. Other than that, it is always fun living in such a vibrant city as London.
Degree course information

We offer a range of undergraduate programmes over three or four years leading to both BEng and MEng degrees. All our courses are accredited by IOM3, The Institute of Materials, Minerals and Mining, and are recognised by the Engineering Council as qualifications leading to Chartered Engineer status.*

*Chartered Engineer status is achieved based on an accredited academic qualification and engineering experience post-graduation.
Full courses details and modules listings: imperial.ac.uk/materials/courses

Materials Science and Engineering

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<tbody>
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<td>3</td>
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<tr>
<td>MEng</td>
<td>JFM2</td>
<td>240</td>
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As our flagship degree programme, the core modules taught across the first 3 years underpins the foundations of the discipline: processing, structure, properties and performance, with opportunities in the finals years to tailor make your own studies by choosing optional modules that map onto the department’s research themes.

Biomaterials and Tissue Engineering

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<tr>
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In the third year of this degree and in addition to core Materials topics, you study cell biology, biocompatibility and biomaterials for hard tissue restoration. In the final year there are specialist modules covering biomaterials for soft tissue restoration, tissue engineering, and artificial organs, including many detailed case studies.

Materials with Nuclear Engineering

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<tr>
<td>MEng</td>
<td>JSH8</td>
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Materials are central to the nuclear industry, both in designing reactor parts that are safe under irradiation, and in handling and processing waste. This degree combines modules in metals, glasses and ceramics with a focused introduction to nuclear engineering taught by specialists from across Imperial. You will be expected to conduct a research project that should be nuclear focused.

Materials with Management

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<tr>
<td>BEng</td>
<td>JSN2</td>
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This course combines the common core of all our degrees, with a final year that combines a choice of Materials options with business and economics teaching provided by Imperial College Business School.

Entry requirements

Total expected intake 2020/21: 105

Minimum requirements are: AAA including Maths and at least one of Physics and Chemistry.

Typical offer: A* A A

Our typical offers are:
- IB: 38 points overall, with 6 in Higher Level Mathematics and 6 in at least one of Higher Level Physics and Higher Level Chemistry
- Scottish Advanced Highers: AAA including Mathematics and at least one of Physics and Chemistry

We also require an English Language qualification that meets the requirements set out at: imperial.ac.uk/study/ug/apply/requirements/english/
First and Second year
Core
– Engineering Practice I/II
– Fundamentals of Processing
– Materials Characterisation
– Mathematics and Computing I/II
– Performance of Functional Materials
– Performance of Structural Materials
– Properties I/II
– Structure I/II

Third year
Core
– Business for MSE
– I-Explore (Compulsory – see p13)
– Materials Processing
– Processing Laboratory
– Research Techniques
– Theory and Simulation of Materials

Indicative options
– Biomaterials
– Ceramics and Glasses
– Engineering Alloys
– Entrepreneurship
– Innovation Management
– Introduction to Nuclear Engineering
– Mathematics and Quantum Mechanics
– Nanomaterials
– Nuclear Chemical Engineering
– Optoelectronic Materials
– Surfaces and Interfaces

Fourth year
Core
– Individual Project

Indicative options
– Advanced Biomaterials
– Advanced Engineering Alloys
– Advanced Nanomaterials
– Advanced Structural Ceramics
– Advanced Tissue Engineering
– Density Functional Theory
– Electroceramics
– Nuclear Materials for Reactor Systems
– Nuclear Thermal Hydraulics
– Reactor Physics

After your first two years, your course will vary according to the degree you choose. You can specialise in your own personal and professional interests – in Management, Biomaterials and Tissue Engineering or Nuclear Engineering.

‘Be prepared to be challenged, and let your curiosity drive you.’

Abigael Bamgboye, MEng Materials Science and Engineering, Year 3

I chose to study Materials Science and Engineering due to my innate childhood desire to understand the way the world works, and why different materials behave differently under the same environments. Two years on from starting my degree, and I feel the skills, knowledge and exposure to the world I have been able to gain have been well-worth the rigorous academic study.

A lesson I would impart to incoming students is this: be prepared to be challenged, let your curiosity drive you, and explore your abilities outside of the course. You won’t regret it.

Abigael Bamgboye, MEng Materials Science and Engineering, Year 3
Optional summer placement (MEng degrees only)
We encourage all MEng students to carry out a science/engineering work placement during the summer period between the third and fourth year. Typically, this placement is at an external organisation such as an industrial company or a UK or international university.

Assessments
You can expect a variety of assessment types, such as:
– Performance in the Teaching Laboratory
– Laboratory reports
– Online programming tests
– Written coursework
– Group project reports
– Written examinations
– Poster presentations
– Research thesis
– Oral presentations

The MEng year (year 4, MEng degrees only)
The highlight of the 4th year is a major experimental or theoretical research project based in one of our research themes. You will aim to carry out Materials Science and Engineering at a genuine professional level and may well find yourself addressing a novel and outstanding problem in your chosen field.

The exact balance of the assessments through the programme depends upon which elective modules are taken, but is likely to be:

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<tr>
<th>Year</th>
<th>Coursework</th>
<th>Examination</th>
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<tbody>
<tr>
<td>Year 1</td>
<td>40%</td>
<td>60%</td>
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<tr>
<td>Year 2</td>
<td>35%</td>
<td>65%</td>
</tr>
<tr>
<td>Year 3</td>
<td>38% – 45%</td>
<td>55% – 62%</td>
</tr>
<tr>
<td>Year 4</td>
<td>67% – 74%</td>
<td>26% – 33%</td>
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Maths Skills
You will use principles of calculus, linear algebra, statistics and other advanced mathematical topics, both to help you with analysis and design in your work, and also to help bring together concepts in chemistry, physics and engineering.

Analytical skills
Materials scientists work on complex problems across many disciplines, you must be able to identify and define these problems, and determine and implement the best possible solution.

Team working skills
Cross-functional engineering teams work together by bringing complementary skills and experience to collectively understand and solve issues in project management, product development, or in a manufacturing process. Effective communication, trust and mutual support are crucial in leading to success.

Communication Skills
Although a technical occupation, engineers and scientists are required to clearly express complex concepts and give clear directions. You are also required to produce reports and plans, not only to your peers, but also often to people who do not have an engineering background, or come from other disciplines.

Problem-solving skills
You must be able to understand the products and projects you are working on through their entire life cycle. You must understand the product itself and also external factors that may affect it. You will very likely work as part of diverse teams and be required to identify collaborative solutions.
Help with your fees and funding

If you’re resident in the UK you may be eligible to apply for help with tuition costs from the UK government. You won’t need to repay any loans until after you’ve left College and are earning above £25,000 (this has been confirmed for English and Welsh students, Scottish and Northern Ireland students will repay once they are earning over £18,330 – please see website below for details). As a Home student, you may also be able to get help with your living costs. This depends on your family’s income, so we recommend using the Student Finance Calculator on the Imperial website to see if you’re eligible. Tuition fee loans are available for EU students starting in 2019 and for the duration of your course. Arrangements for 2020 have not yet been confirmed by the UK government. The College also offers numerous scholarships to students showing exceptional academic merit and potential.

To find out more about financial support offered by Imperial and the UK government (including scholarships), please visit: imperial.ac.uk/study/ug/fees-and-funding/

Materials scholarships
The Department of Materials offers five scholarships:

- Four £1,000/year scholarships to applicants who exceed our standard entry requirements and who excel at their interview.
- one £5,000/year scholarship – Ceres 5000 – to a student who also demonstrates an interest in Energy. To continue with the scholarship into years 3 and 4 you will need to achieve a 70% average in each of the previous two years, and to choose energy related modules. Applicants to the Ceres scholarship will be selected through a second interview with one of our Admissions tutors.

Deadline: to be eligible for these scholarships, UCAS applications must be submitted by 15th October. Note that there is no need to apply separately for these scholarships, as all applications submitted to UCAS by this deadline will be automatically considered.

About Ceres Power
Ceres Power is a world-leading alternative energy company based in the UK. They are a leading fuel cell business, committed to providing alternative energy solutions to address the global challenges of reducing emissions, increasing fuel efficiency and improving energy security.

For more scholarship and funding options, please visit: imperial.ac.uk/study/ug/fees-and-funding/

‘Choosing Materials as my course of study is the best choice I have ever made in my life.’

Helen Tan, MEng Materials Science and Engineering, Year 2
Find out more

Open days
To find out more about Materials Science and Engineering at Imperial, and what it is like to be a student here, come along to one of our Science and Engineering Open Days in June or September.

To find out more, visit: imperial.ac.uk/study/ug/visit

Come and meet us
Visit our website to find out more about our school visits, departmental tours and conventions and to learn about our summer school and work experience opportunities.

imperial.ac.uk/materials/undergraduate/ways-to-meet-us-

Any questions? Get in touch or come and visit us
By post: Department of Materials, Imperial College London, Exhibition Road, Royal School of Mines, London SW7 2AZ, UK
By email: materials@imperial.ac.uk
Website: imperial.ac.uk/materials

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Additional photography:
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Page 14: Dr Sam Humphry-Baker, Dr Esther Garcia-Tuñon Blanca, Imperial College London
Page 16: Nor Ezzaty Ahmad, Imperial College London
Page 17: Dr Mark Oxborrow, Imperial College London

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