Your complete guide to this year’s Festival

6–29 October 2023
if-oxford.com
Welcome to the 2023 Science and Ideas Festival

IF Oxford returns as a social way for you, your family and your friends to connect with science and ideas. Events across Oxford, and online, are created for you to meet and question experts, have fun and experiment with something new. The collection of articles in this magazine should get you in the mood for hundreds of activities and conversations awaiting you this October.

Technology, art, or even Oxford as a place, are not static and represent unlimited perspectives, with IF as a starting point for a journey of discovery. The Festival encourages you to take a different viewpoint, with events designed to bring a smile to your face while setting those neurons firing in your brain.

Orient yourself with the Festival map and calendar of events (pages 42 and 43) and search, filter and book your events online.

IF Oxford is run by an independent charity and its hundreds of volunteers want you to have a good time. All events have age recommendations and are tagged as WORKSHOP, TALK, TOUR, PERFORMANCE and more.

The blue pages show interactive zones, where you can get up-close to experiments while meeting scientists and creative professionals in a safe and friendly place.

Most events need to be pre-booked and use Pay What You Decide (PWYD) ticketing, which means you can choose to pay whatever you want, or can afford. You can make your donation during booking or after the event and the amount you pay is up to you, all supporting next year’s Festival.

Keep up-to-date and share your experience of #IFOx2023 on social platforms, and for information and tickets, visit: www.if-oxford.com
Fri 6 – Sun 29 October
Tue – Sun: 9.30am – 5.30pm (daily during half term)

📍 The Story Museum, OX1 1BP
Under 7s / Age 7-12  Tickets £12 / £9

Brilli-ANT: how someone small changed a big story

Put on your ant-ennae and step into The Story Museum’s giant cardboard anthill. Or maybe sample the series of themed talks and events running alongside the Museum’s current exhibition. Discover together how small changes can make a big difference in helping to save the planet. Full event list, exhibition details and prices online.

EXHIBITION

Fri 6 October | 8 – 10pm
📍 The North Wall Arts Centre, OX2 7JN
Teenage / Adult  Tickets £12

Jericho Comedy presents: Stand-up Science

Love science x Love comedy = Laugh smart! Stand-up Science presents comedians talking about their favourite scientific topics. If you’ve followed Jericho Comedy’s sell-out shows on nature, bacteria, evolution and insects in Oxford or Edinburgh, come back. If not, factor some Stand-up Science into your Festival. Hosted by scientist Matt Hobs and Jericho Comedy founder Alex Farrow.

PERFORMANCE

Sat 7, 14, 21, 28 October
10am – 12pm, 12.30 – 2.30pm and 3 – 5pm
📍 Science Oxford Centre, OX3 8SB
Age 7 – 12  Tickets £7.50

Live Lab Family Days

Four weekend Family Days with guest researchers in the Live Lab along with the Science Oxford Centre’s regular favourite activities. Discover and have fun experimenting with the air table, giant magnetic ball run and planetarium. Outdoors, the Water Lab and 15 acres of woodland and ponds give space to unleash your inner explorer.

INTERACTIVE

Sat 7 October | 10.30am – 12pm and 1 – 2.30pm
📍 Avenue 2, Covered Market, OX1 3DZ
Age 7-12 / Teenage / Adult  FREE

My city, your city: postcards from home

Oxford has seven twin cities, with cultural, academic and social links throughout the globe. This captivating project of cultural connections uses postcards from people in Oxford’s twin cities to share the essence of these vibrant destinations. See personal handwritten messages, in an intimate display in the Covered Market, and add your own.

EXHIBITION

Supported by Mills & Reeve

Sat 7 October | 2 – 2.30pm and 3 – 3.30pm
📍 Wesley Memorial Church, OX1 2DH
Under 7s / Age 7 – 12  PWYD

Air: how do we know it’s there?!

Join Festival favourite Dr Sarah Bearchell for an interactive, multi-sensory exploration of air, where the audience are the scientists. We’ll be observing and experimenting together to gather lots of evidence, proving that air really is there!

PERFORMANCE

Sat 7 October | 12 – 1pm
📍 Meet Oxford Castle, OX1 1AY
Teenage / Adult  PWYD

Oxford’s railways, past and future developments

From the first trains to Oxford in 1844 to present day redevelopments, railway engineering has centuries of stories. Join former Railway Manager David Mather for a short tour to explore the history and future rail industry around the city including the unique and newly restored Rewley Road swing bridge.

GUIDED WALK

Sat 7 October | 2 – 5pm
📍 New Road Baptist Church, OX1 1LQ
Age 7 – 12 / Teenage / Adult  PWYD

Sonic Spider: music from an arachnid’s world

Listen to the world’s first eight-legged musical instrument, played by a team of musicians, and delve into a spider’s world. Sonic Spider performances take inspiration from the lives of spiders, sitting quietly in their webs awaiting the drama of visitors – a tasty fly perhaps, or a nervous suitor. Explore the science of spider senses with story-telling and hands-on activities and let your imagination travel to a different world.

PERFORMANCE / INTERACTIVE

Supported by Association for the Study of Animal Behaviour

Pre-book all events online  www.if-oxford.com

IF Oxford uses Pay What You Decide (PWYD), see p3
Explorazone

Saturday 7 October | 11am – 5pm
Wesley Memorial Church,
New Inn Hall Street, OX1 2DH

Pre-book, PWYD
Age 7-12 / Teenage / Adult
INTERACTIVE

See some of the most exciting science and meet the best and friendliest inventors in town for free. Try out dozens of interactive activities and demonstrations suitable for all ages.

From 11am, for an hour, Explorazone will be open for the families of adults and children with autism spectrum or other neurodivergent conditions to explore and discuss science and ideas in a quieter and less crowded space.

Harnessing the power of T cells to develop new therapies
Take a journey of drug discovery and explore how the body’s immune system is being used to develop new medicines to treat cancer, infectious and autoimmune diseases. Will your new medicine have what it takes to target a diseased cell? Immunocore

Banana equivalent dose
Radiation is used in medical imaging procedures like X-rays and CT scans. Learn about radioactive substances and behaviour through quizzes, games and videos, and find out what bananas have to do with measuring radioactivity. Blue Earth Diagnostics Ltd

Superconductivity and MRI
Explore the insides of the machines used in hospitals around the world to diagnose tumours, clots and tissue damage. Take a look at the curious and cool world of cryogenics, the low-temperature technology used in the design and manufacture of superconducting MRI magnets in Oxfordshire. Siemens Healthineers Magnet Technology

Shaping Destiny
Your genes shape your body, but other factors influence your sense of self, relationships and destiny. Young dancers from Oxford worked with choreographers and digital artists to interpret research on human embryo formation and medieval perceptions of the human, creating a VR experience for you to try. Dept of Physiology, Anatomy and Genetics / The Oxford Research Centre in the Humanities, University of Oxford

Hidden environmental hazards in the home
What environmental hazards could be inside your home? How can you protect yourself and your loved ones? Have fun learning about a range of risks and explore what you can do to look after your health, with a storyline corner on environment and health. UK Health Security Agency

Fighting antibiotic resistance
Antibiotics were the greatest medical breakthrough of the 20th century. Before their discovery, a simple cut or ear infection could lead to death. Join researchers to find out what they are doing to tackle antibiotic resistance, to prevent a return to the pre-antibiotic era and protect this precious resource! Ineos Oxford Institute

I’m a patient, get me out of here
When did you last visit a health professional? The health care system is not just about doctors and nurses. Follow different patients’ journeys to discover the diversity of people who keep the system running. How does the NHS work this out (or not) to provide good quality of care? Health Systems Collaborative, University of Oxford

Battling the bugs
Taking antibiotics when you don’t need them may lead to bacteria becoming resistant to treatment. That’s why it’s important to limit the spread of bugs that cause infections to help us stay well. Learn how to prevent infections, beat the bugs and keep antibiotics working. Dept of Primary Health Care, University of Oxford

Pre-book all events online    www.if-oxford.com
Sensing volcanoes

Imagine living on a volcanic island. Could you tell when something was up, and using your senses predict what might happen next? Explore the Caribbean volcanoes of Montserrat and St Vincent, experience the sensations of restless volcanoes, and play 'The Floor is Magma' to test your decision-making skills.

Dept of Earth Sciences, University of Oxford

Chemistry in the environment

Enter the world of environmental pollution and learn how climate change is linked with ocean acidification. Discover tools scientists use to test the health of rivers, how microplastics move through the environment and sources of air pollution.

Royal Society of Chemistry, Environmental Chemistry Group

Engineering your future

Explore the fascinating and creative world of engineering. Test out your dexterity with a robot arm, learn about nuclear fusion with a vacuum chamber and plasma ball, and find out how 3D printers are helping to solve real-world problems.

Oxfordshire Advanced Skills

Diamond origami

Diamond isn’t just a gemstone; it’s an amazing material that is used in a wide range of industrial applications such as machining of smartphones, purifying water and enabling communication networks. Learn about diamond’s atomic structure through hands-on experiments and attempt to build the world’s largest diamond origami atomic model.

Element Six

The pancreatic whisperers

Your pancreas is a remarkable organ, extracting energy from the food you eat and making hormones that regulate your blood sugar and appetite. Discover how scientists study these processes, get hands-on with some experiments and make your own glow-in-the-dark pancreatic islet cell.

Radcliffe Department of Medicine, University of Oxford

Bones

A haiku

Bright white in colour,
Safeguarding the inside parts,
Sculpture of crystals.

by
Oliver Cross-Monaghan,
Poetry of Science finalist 2022
Age category: school years 3–6

Pay What You Decide (PWYD) donations

Pay What You Decide (PWYD) donations help ideas take off.

Oxford Science + Ideas Festival

Oxford University Press
**Perceiving things differently: psychosis**
What is psychosis?... you can explore it today with Kathy Sykes, in a friendly discussion with psychiatrists Paul Harrison and others who have experienced psychosis. Compare perspectives, share tips on supporting people with psychosis and explore signs and symptoms informed by the latest research.

**Science Wonder discovery evening**
Discover research and innovation from Begbroke Science Park and across Oxford University, helping to create a better world. Exciting changes are underway with emerging technologies and research spaces alongside new art and science collaborations. Meet scientists at spin-out labs and explore the Begbroke Innovation District arts programme.

**Unwanted pain and wanted pleasure (18+)**
Adults concerned about unwanted female pain during consensual sex are invited to this frank and open discussion chaired by BBC Radio Oxford's Sophie Law. Hear from experts to discuss endometriosis, vaginismus, menopause, chronic pelvic pain and associated psychological aspects, with tips for open and safe conversations with partners. Questions are encouraged so grab a drink and join in 18+ only.

**Experimental drawing: immerse yourself in plants**
Led by artist Julia Thaxton, this outdoor, multisensory workshop will use botanic DNA and the evolutionary quirks of plants to offer a new way to appreciate and draw the natural world. No drawing experience required – this immersive event will explore the healing effect of nature and creativity on the human body.

**Glow Your Own (1 of 6)**
Get ready for the Oxford Light Festival by creating your very own moving lantern. This weekly workshop series will help you build your own creative circuit with sensors that control LEDs and motors. Receive an Arduino starter kit (sent to UK addresses by post) and use tools like Tinkercad to combine art and engineering. Six live video sessions recorded to watch again on if-oxford.com.

**Language café**
Cześć! Merhaba! Bonjour! Olá! Bongu! Share stories and swap languages from around the world. This session is friendly and informal, with most of the learning happening through speaking and listening. Everyone is welcome, whether you have a native language to share, are a professional linguist, or you are just starting to learn about a new language or culture.

**Pokémaths: the numbers behind the video game**
How many Pikachu does it take to power a lightbulb? How much does a Charizard eat? And why does the world of Pokémon seem to ignore the basic laws of physics? Dr Tom Crawford looks at the maths of one of the world's favourite video games.

**Have you thought of a career in medical research?**
Join a conversation with three researchers from different University of Oxford medical departments. Ask your questions about what it's like to study medicine today and how others started their medical journey. This session and others in the series aim to highlight the wide range of different careers available in medical research and some of the surprising ways that people have got there.

**TIP**
Pre-book all events online www.if-oxford.com
Thu 12 October | 6 – 8.45pm
Ashmolean Museum, OX1 2PH
Teenage / Adult  
Empowering healthcare with AI: explore the future  
FREE

Various dates | 11 – 11.30am
Oxfordshire County Library, OX1 1DJ
Teenage / Adult  
Rhymetime: songs and rhymes for under-5s

Fri 13 October – Space and Robots: travel into space with a cosmic theme and have fun with robots.
Fri 13 October – Weather and Seasons: from rain to sunshine, hot to cold, all year round.
Mon 23 October – Animals and Flight: explore the animal kingdom.
Children must be accompanied by an adult.

Fri 13 October, 6 – 7.30pm
Sat 21 October, 4 – 5.30pm
Meet at Martyrs’ Memorial, Magdalen Street, OX1 3AE
Teenage / Adult  
Haunted Oxford: wandering ghost stories

Join Uncomfortable Oxford and tour Oxford’s spectral past. Explore historic truths behind ghost stories embedded in the city’s medieval landscape and architecture. Question the origins of ghost stories and spine-chilling tales, asking what they mean, why stories persist into the present and how and who we remember as ghosts.

Can you square the circle of modern life?

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Guided Walk

Sat 14, 21 and 28 October
11am – 12pm
Oxfordshire County Library, OX1 1DJ
Teenage / Adult  
Origami club

Learn how to fold paper through the ancient art and simple pleasure of origami. Make birds, fish, dragons, stars, flowers and use your skills for endless creativity. Come with friends, bring family or join solo to work with and forge friendships among fellow folders.

Sat 14 October | 1 – 2.30pm
Oxfordshire County Library, OX1 1DJ
Teenage / Adult  
Origami: maths within the art

Have you ever made a paper boat or a crane? Origami folds follow mathematical rules to create geometry and dimension from a flat piece of paper. Peter Buchan-Symons is an origami artist who reveals hidden geometry and shows how a little bit of maths can help you create pleasing origami designs.

Supported by the Institute of Materials, Minerals and Mining

Sat 14 October | 1.30 – 2.30pm
Somerville College Chapel, OX2 6HD
Teenage / Adult  
Reclaim your life in a tech-obsessed world

You’re constantly getting the message that you’re being controlled by technology – but do you actually have far more agency than you think? Psychologists Elaine Kasket and Ulrik Lyngs discuss how to get back in the driver’s seat in your interactions with tech, in a conversation that will help you align your technology use with the kind of life and relationships you want.

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Sun 15 October | 5.30 – 6.30pm
Somerville College Chapel, OX2 6HD
Teenage / Adult  
Choral Contemplation

Hear the Somerville College Choir alongside an undenominational thought-provoking service in the Chapel, described as ‘A House of Prayer for all People’. Choral Contemplation takes place year-round and this special event offers a unique perspective on the challenges faced by our society.

Pre-book all events online www.if-oxford.com
Tech Works

Saturday 14 October | 11am – 5pm
Oxford Works, ARC Oxford
(formerly Oxford Business Park), OX4 2SU

Pre-book, PWYD
Age 7-12 / Teenage / Adult
INTERACTIVE
Free parking

The Festival is returning to Oxford’s growing knowledge quarter with activities that take on the smallest, hottest, most detailed and carefully constructed science for you to see. Visit Oxford Works and meet the experts at the heart of science and innovation in the city.

Star power: energy for the future
In the heart of Oxfordshire, scientists and engineers are working to harness the power of stars to generate sustainable electricity. Find out how they use robots, magnets and the fourth state of matter to build a star on Earth using fusion energy machines.

UK Atomic Energy Authority

Cutting-edge research
Have a go at cutting-edge science. Become a trainee surgeon and try your hands at surgery to discover more about the exciting research from two global medical research groups right here in Oxford.

Nuffield Dept of Surgical Sciences / Nuffield Dept of Orthopaedics, Rheumatology and Musculoskeletal Sciences, University of Oxford

Pandemic detectives
Unravel the puzzle of a new disease outbreak in this interactive, immersive experience. You will become one of the ‘Pandemic Detectives’, working with other scientists to identify clues and analyse real data to solve the mysterious cause of a new outbreak before it turns into a new pandemic.

Pandemic Sciences Institute, University of Oxford

Instructions to make you!
Your genes are the instructions to make you, but did you know that you have fewer genes than a potato? Find out how so few genes can make something as complicated and wonderful as a human!

Dept of Psychiatry, University of Oxford

Colour in your body
Discover how the organs inside your body can be monitored with advanced scanning techniques. Visualise the heart, liver, lungs and more with a rainbow colour-map and explore how doctors work with scientists to keep your insides healthy.

Perspectum

Science magic at your fingertips
Learn simple tricks using everyday materials, then discover the science that makes the magic work. Could you be a genius magician? With Richard Robinson, author of Oxford University Press’s Science Magic series.

Brighton Science Festival

The hidden world of microscopy
Adventure into the fascinating beauty and complexity of the microscopic universe and discover the fundamental building blocks of life. Scientists will guide you through the mesmerizing world of cells, bacteria, and other wonders beyond the naked eye. Prepare samples, operate microscopes, and even capture your own captivating microscopic images.

Royal Microscopical Society / STEM Global Scientific Society
Super Science Sunday

Sunday 15 October
10am – 1pm and 2pm – 5pm
Science Oxford Centre, OX3 8SB
Pre-book, PWYD
Age 7 – 12 / Teenage / Adult
INTERACTIVE

Spend a special day at the Science Oxford Centre in Headington to meet researchers, presenters and publishers. Learn about the design of medicines, the importance of natural ecosystems and how engineers tackle big problems with lots of fun hands-on activities. Includes access to the Exploration Zone, woodland and Water Lab.

Lab challenge: fight the virus!
Can you develop the next antiviral drug and prevent a pandemic? Step into a drug discovery lab to perform experiments and solve puzzles to find a drug to fight a new virus.
Faculty of Health & Life Sciences, De Montfort University

Oceans and rainforests for curious young minds
What’s it like to dive down into the ocean depths or clamber up into a rainforest canopy? Join award-winning science writer Isabel Thomas for a talk and hands-on activities on the sights, sounds and smells of Earth’s most spectacular habitats, and meet some of the curious creatures that live there.
Oxford University Press

Engineering your future
Explore the fascinating and creative world of engineering. Test out your dexterity with a robot arm, learn about nuclear fusion with a vacuum chamber and plasma ball, and find out how 3D printers are helping to solve real-world problems.
Oxfordshire Advanced Skills

Monday 16 October | 6 – 7.30pm
Somerville College, OX2 6HD
Teenage / Adult
PWYD

Communicating care
Whether in treatment or diagnosis, when it comes to how doctors talk to you about health and health behaviours, language matters. Researchers in clinical communication and health behaviours share methods of communication science and reveal often hidden mechanisms of conversation through talks, dance and poetry. Where will language lead you?
PERFORMANCE / DISCUSSION

Tue 17 October | 8.30 – 9.30pm
The Bullingdon, OX4 1UE
Teenage / Adult
PWYD

The Breakup Monologues: friendship
Rosie Wilby returns for the next chapter of relationship psychology. Dubbed ‘the queen of breakups’ on BBC Radio 4, Rosie is known for her comedic reflections on the human condition. In this podcast recording of The Breakup Monologues, also available as a book, expect humour, heartache and of course science. Grab a drink and join guests Robin Dunbar and Max Dickins to discuss the beginnings and endings of platonic friendships.
PERFORMANCE

Tue 17 October | 7 – 8pm
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Improbable research: scientific answers to ridiculous questions
The Ig Nobel Prizes are awarded annually to celebrate unusual and seemingly trivial achievements in scientific research. Tonight, Dr Tom Crawford, creator of Tom Rocks Maths shares some of his personal favourites, from constipated scorpions to obese politicians, and delves deeper into the comedic world of 'award winning' research.
PERFORMANCE

Wed 18 October | 5 – 6.30pm
Online event
Age 7 – 12 / Teenage / Adult
PWYD

Glow Your Own (2 of 6)
Get ready for the Oxford Light Festival by creating your very own moving lantern. This weekly workshop series will help you build your own creative circuit with sensors that control LEDs and motors. Receive an Arduino starter kit (sent to UK addresses by post) and use tools like Tinkercad to combine art and engineering. Six live video sessions recorded to watch again on if-oxford.com.
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WORKSHOP
Thu 19 October | 4 – 7pm
Oxfordshire County Library, OX1 1DJ
Teenage / Adult (Rating U)  FREE

Pandemic board games
A special edition of Oxfordshire County Library’s weekly Board Game club. Meet medical science researchers from the University of Oxford while playing a selection of disease and pandemic related board games. This will run alongside the regular club session. Other Board Game clubs: Thursdays 12 and 26 October, 4 – 7pm. Suitable for age 16+.

WORKSHOP

Wed 18 October | 7.30 – 9.30pm
St John’s College, OX1 3JP
Teenage / Adult  Tickets £10 - £22

Answer Machine Tape 1987
Pianist Zubin Kanga performs with technology transforming the piano into a typewriter able to tell tender stories. Music combines knitting needles and MiMU sensor gloves to create cavernous sounds and intertwines synthesisers with brain data in a tribute to Ada Lovelace. Featuring Answer Machine Tape 1987, which explores the ’80s New York art scene, queer history and the AIDS crisis through tragic and playful sound worlds.

PERFORMANCE
Presented by Oxford Contemporary Music

Fri 20 October | 5.30 – 6.30pm and 7 – 8pm
Oxford University Museum of Natural History, OX1 3PW
Teenage / Adult  PWYD

A story in stone
The polished columns within the Oxford University Museum of Natural History were specially selected to illustrate the diverse geology of Britain. Join geologists Philip Powell and Nina Morgan for a colourful and informative tour of the building interior and learn a lot about architectural geology along the way.

GUIDED TOUR

Sat 21 October | 10am – 1pm and 2 – 5pm
Culham Science Centre Abingdon, OX14 3DB
Teenage / Adult  PWYD

Powering the future: UKAEA open day
Come to the UK’s biggest door and look around the world’s largest operating fusion machine. This open day is a rare chance to tour the facility and see equipment developing sustainable fusion energy. Start with the basics of fusion physics and power-up conversations with engineers, scientists and technicians currently working on the record breaking Joint European Torus (JET) experiments.

GUIDED TOUR / TALK

Fri 20 October | 6.30 – 8pm
Wig and Pen, OX1 2AU
Teenage / Adult  PWYD

NeuroTales: journeys in neuroscience research
Science is a team effort and it is a lifelong journey. Hear from four people involved in neuroscience research at the University of Oxford, each with a story to tell. Link personal milestones with the global quest to understand the brain. Discover more about their journeys – how did they get here and where are they going?

PERFORMANCE

SciFest all events online ▶ www.if-oxford.com
Science @ the Shops

Saturday 21 October
Sunday 22 October
10am – 4pm
Templars Square Shopping Centre,
Pound Way, Cowley, OX4 3XH

Unticketed, PWYD
Age 7-12 / Teenage / Adult
INTERACTIVE

From geology to genetics and medicine to magic, there’s a celebration of science at Banks Court in Templars Square shopping centre this weekend. Take part in exciting activities for all ages and meet the people shaping tomorrow’s future today. Where might your shopping trip take you?

Can you hear your baby’s heartbeat?

How can a baby inside their mother’s tummy tell us if they are feeling OK? Discover what researchers and midwives are doing to understand unborn babies better, using the heartbeat patterns of 100,000 babies. (Saturday only).

Dept of Women’s & Reproductive Health, University of Oxford

Weight a moment!

Visit the Museum of Weight Change! See how people tried to lose weight through history (tapeworms? I hope!) Bust some myths and find out how your gut talks to your brain. Help researchers tip the scales: what worked and what didn’t on your weight journey? (Saturday only).

Dept of Primary Health Care, University of Oxford

There’s a volcano in my backyard

Communities on the Caribbean islands of Montserrat and St Vincent who live under the shadow of volcanoes have made creative responses to volcanic eruptions in their neighbourhood. Be inspired to paint a picture, make a mask, write a poem, or create your own volcanic story! (Saturday only).

Dept of Earth Sciences, University of Oxford

Be part of research

Health and care research helps to find new and better treatments for future generations and can save lives. Learn how research is developing new medicines and vaccines, supporting mental health and improving disease diagnosis. Find out how you can take part in research studies near you. (Saturday only).

National Institute for Health and Care Research

Genome detectives

Take a trip down the double helix of DNA and become a genome detective. Help researchers classify important features of genes from more than 100 disease-causing bacteria. You can really contribute to the prevention and treatment of infectious disease. (Sunday only).

Dept of Biology, University of Oxford

Quantum computing and you

What is a quantum computer? How is it different from a regular computer? How might quantum computing impact your life? Learn how an ion trap quantum computer works, create your logic gates and explore quantum algorithms with hands-on activities. (Sunday only).

National Quantum Computing Centre

Nuclear energy: the sustainable option?

Nuclear energy is one of several low-carbon options to fuel our future. Play Energy Top Trumps to compare the pros and cons of various energy sources including nuclear, fossil fuels and renewables like wind and hydro. What factors would you need to consider to create your own net-zero vision? (Sunday only).

Supporters of Nuclear Energy

Science magic at your fingertips

Learn simple tricks using everyday materials, then discover the science that makes the magic work. Could you be a genius magician? With Richard Robinson, author of Oxford University Press’s Science Magic series. (Sunday only).

Brighton Science Festival

My Body is Amazing

Stomach, heart, bones and toes,
Bottom, blood, brain and nose.
The science I love is biology,
Because it’s what makes me, me!

by Megan Wallington,
Poetry of Science winner 2019
Age category: school years 1–2

There are many ways to get involved in the Science + Ideas Festival. Follow the links below to find out more.

Pre-book all events online • www.if-oxford.com

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IF Oxford uses Pay What You Decide (PWYD), see p3
**Plastic Drastic Fantastic!**
A contemporary dance theatre performance for children and their families from South Asian dance company Akademi. Explore our complex relationship with plastics – the fantastic possibilities they offer, as well as the drastic consequences to the environment. Plastic Drastic Fantastic! is an inclusive experience, accessible for D/deaf young people and children.

**PERFORMANCE**
Part of Dancin’ Oxford’s Family Dance Festival

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**Star Soup**
We’re all made of stardust, but what makes a star? The UKAEA fusion machine has the power to make a real star just south of Oxford. This family science show shares the recipe, using spectacular demonstrations, with a chance for you to help perform experiments on stage. Set the temperature to 150,000,000°C and let’s get cooking.

**PERFORMANCE**

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**Geology in a cemetery near you**
An urban cemetery is a great place for amateur, student or professional geologists to carry out scientific fieldwork at leisure, right on the doorstep and at no cost. Join geologists Nina Morgan and Philip Powell on a guided geological walk through an Oxford cemetery. You’ll never look at cemeteries in the same way again.

**GUIDED TOUR**

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**Connecting the past, present and future**

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**BLAST!**

**Monday 23 October | 11am – 5pm**

**The Barn, Nightingale Ave,**
**Greater Leys, OX4 7BU**

Pre-book, PWYD
Age 7 – 12 / Teenage / Adult

**INTERACTIVE**

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**Quantum computing and you**
What is a quantum computer? How is it different from a regular computer? How might quantum computing impact your life? Learn how an ion trap quantum computer works, create your logic gates and explore quantum algorithms with hands-on activities.

**National Quantum Computing Centre**

**Engineering: the world around us**
Look around for a moment – engineering is all around you. If you enjoy solving puzzles, building or fixing things, have a go at some engineering challenges. Discover the role that engineering plays in the world we live in and in the future we want to build.

**The Engineering Trust**

**The wonderful world of water**
What critters live in a river? What happens to everything that goes down the drain, and what shouldn’t you flush down the loo? The Evenlode Catchment Partnership team reveal what affects our waterways, and what impacts citizen scientists are making on protecting them.

**Cotswolds National Landscape**

**The story of fusion**
Journey from the early 1900s to today and discover the story of fusion energy. Explore how superconductivity, magnetic fields, cryogenics, plasma physics and materials science come together to create both the hottest and coldest places on Earth within a metre of each other.

**Tokamak Energy Ltd**

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**IF Oxford uses Pay What You Decide (PWYD), see p3**
Among Us: a game of teamwork and betrayal

Have you heard of this social game but never had the chance to play? Join a session of the hit computer game Among Us in Oxford’s central Makerspace Suite. A perfect opportunity to mix subterfuge with bluffery, with or without your friends and family. Under 16s must be accompanied by an adult.

Breakdance: introducing the Solar System

The Universe is vast and mysterious, containing all of space, matter, energy and time (including you)! This dance workshop gives a brief overview of our Solar System and what makes it special. Watch breakdancing and push against the Earth with your own hands and feet to explore the identity of home and our neighbour planets and understand why they all are so different!

Warning Notes by Mark Anderson

A captivating sound-world that comes alive through an ever-changing outdoor live performance. Using an ensemble of visually striking ‘instruments’ - gongs, bells, whistles and explosive events - Warning Notes gives a voice to the social and ecological alarm rippling across our planet. A hypnotic and playful invitation to contemplate our future together. Workshop and accessible performances available.

Deep science: the search for dark matter

85% of the Universe’s mass is missing, possibly hidden as sub-atomic particles that can’t be directly seen. The global race to prove (or disprove) this theory on, with Australia, USA, China and others in the running. Sean Paling from STFC’s Boulby Underground Laboratory will give an update on the search for this dark matter, with an overview of life, science and work 1.1 km deep beneath the Yorkshire Moors.

Pre-book all events online ▶️ www.if-oxford.com
Sat 28 October | 10 – 11.30am
Meet at Carfax Tower, OX1 1ET
Teenage / Adult  PWYD

Women in science
Explore the history of female researchers in Oxford during a walking tour. Retrace significant moments when women at Oxford University were first allowed to study (1879) and first awarded the University degrees (1920). Join an inspiring walk to discover the powerful story of some of these women, from chemist Dorothy Hodgkin to vaccinologist Sarah Gilbert, and their pivotal achievements in science.
WALKING TOUR

Sat 28 October | 10am – 12pm
Oxfordshire County Library, OX1 1DJ
Teenage / Adult  PWYD

Watermelon Lullaby
Rootical Folklore is an exploration of African and Caribbean Folklore through plants from storyteller Natty Mark Samuels. Rootical means the generation of an idea, and emphasises the spiritual significance of plants, rather than them simply being sources of food and medicine. Watermelon Lullaby is an interactive workshop using tales, chants, dialogues, poetry and monologues.
WORKSHOP

Sat 28 October | 11am – 12pm and 2 – 3pm
Pegasus Theatre, OX4 1RE
Age 7 – 12  Tickets £11 / £8
Surprising science
A family show packed with science tricks, stunts and puzzles with Dr Matt Pritchard. Discover scientific secrets behind gravity-defying illusions and impossible-looking balances to flex your scientific enquiry and creative thinking. Learn new science tricks, using household objects, that you can use to amaze your friends!
PERFORMANCE

Sat 28 October | 2 – 4pm
Oxford University Museum of Natural History, OX1 3PW
Teenage / Adult  Tickets £10
Experimental drawing: evolution & creativity
How do creative ideas grow and evolve? Artist Julia Thaxton leads this experimental drawing workshop, using exhibits within the Museum of Natural History to inspire a journey of creative exploration. No drawing experience necessary, just bring your curiosity and imagination. Return to continue your practice when the museum is open throughout the year.
WORKSHOP

Sat 28 October 3 – 4.15pm
Oxford Playhouse, OX1 2LW
Teenage / Adult  Tickets £12 / £10
Feedback Loops
Words alone cannot always describe inner thoughts and feelings. The rhythm of ambient electronica builds dance performance in a unique production. Heart-rate, blood pressure, skin conductance and movement data can track episodes of depression, epilepsy and multiple sclerosis in clinical settings, and Feedback Loops represents these biometric data through music generated from a performer’s body metrics. Join the creators for a post-performance panel discussion to explore lived experiences in new ways.
PERFORMANCE / DISCUSSION

Sat 28 October | 11am – 3pm
Iffley Road Sports Centre, OX4 1SR
Age 7 – 12 / Teenage / Adult  PWYD
Robot racing
Robot racing returns! Control mini robots in races, watch bigger machines tackle obstacles on the Roger Bannister track and find out why robots go places you wouldn’t want to go yourself. Scientists and engineers from UK Atomic Energy Authority and Oxfordshire Advanced Skills will be on hand to answer questions and show that playing Jenga is a useful skill when working on fusion machines.
INTERACTIVE

Sun 29 October | 11am – 3pm
St Sepulchre’s Cemetery, OX1 2HD
Sun 29 October | 2 – 3pm
Holywell Cemetery, OX1 3TP
Teenage / Adult  PWYD
Geology in a cemetery near you
An urban cemetery is a great place for amateur, student or professional geologists to carry out scientific field work at leisure, right on the doorstep and at no cost. Join geologists Nina Morgan and Philip Powell on a guided geological walk through an Oxford cemetery. You’ll never look at cemeteries in the same way again.
GUIDED TOUR

Sun 29 October | 11am – 12pm
Pegasus Theatre, OX4 1RE
Age 7 – 12
Surprising science
A family show packed with science tricks, stunts and puzzles with Dr Matt Pritchard. Discover scientific secrets behind gravity-defying illusions and impossible-looking balances to flex your scientific enquiry and creative thinking. Learn new science tricks, using household objects, that you can use to amaze your friends!
PERFORMANCE
This year’s IF Oxford cover illustration is designed by Oxford artist Lisa Curtis, who created a character looking into (or out of) a mirror or concealing their face with a mask. And while it’s impossible for ink to move on the printed page, the cover of this magazine has pinwheel eyes that appear to turn and textures that pulsate.

Lisa commented: “I love creating images of nature that people enjoy, and it was fun to develop patterns, perspectives and arrangements of images that seem to shift and morph before our eyes. These Japanese illusions add a new interactive dimension to artwork so people can experiment with visual perception.”

What are we really seeing and how does it deceive our brains? The creator of many optical illusions, Akiyoshi Kitaoka, works in a unique place within the worlds of art and science. Based in Osaka, he is a professor of psychology and has long been fascinated by the power of visual deception, using optical illusions to challenge the viewer’s perception.

“Optical illusions are fascinating phenomena, as we perceive things as something they are not,” Akiyoshi comments. “Understanding the patterns of light that reach our eyes takes lived experience and requires assumptions about the physical world. What we believe we are looking at is the result of the brain's analysis of information from our eyes, interpreted with context, prior knowledge and past experiences. These assumptions are usually accurate but can also lead to errors in perception, causing curious optical illusions, demonstrating that perception is a construct shaped by our efficient biological processing mechanisms, conveniently giving scientists insight on these mechanisms.”

By expanding the types of information we have access to, whether optical illusions on paper, or by experiencing the world in new and surprising ways, we can gain insights into ourselves and how we fit within this world. During the Festival, Dr Matt Pritchard, a professional science magician who was previously an atomic physicist and now blends science with creativity on stage, will be looking at some of the sneaky scientific secrets behind surprising stage illusions. In a family show at Pegasus Theatre (Sat 28 October), packed with science tricks, stunts and puzzles, you’ll discover how to hide a 3D object in plain sight, defy gravity and make an invisibility cloak. Matt not only encourages you to look carefully and think outside the box to figure out how he tricks your brain with his illusions; he also asks what can we use this for in the future?

“Science is a way of looking at the world around us in many different ways and interpreting what we see to build a picture of truth.” Dane Comerford, Director of IF Oxford says: “Every day we humans take onboard and process conflicting views of the same thing, or we might spot familiar patterns across a range of natural systems, like a spiral of a leaf shape, a snail shell, or turbulence within clouds. Sometimes, we’ll even see the impossible. During the Festival we will be looking forward and looking back, into our bodies and brains, and out to the world around us. It’s often when we look at things from different angles that new ideas reveal themselves or we discover something unexpected.”

The brain is an extraordinary organ, yet it doesn’t always get it right and in an interactive game show event at the Oxford Playhouse, Your Irrational Brain (Fri 27 October), Ginny Smith of Braintastic! Science uses demos, experiments and quizzes to show how our brains trick us not only into seeing the world incorrectly, but into making irrational decisions every day. Elsewhere in the Festival there’s an opportunity for you to consider psychosis, a complex mental health condition characterised by a loss of contact with reality, hallucinations and false perceptions. On Monday 9 October, broadcaster and physicist, Professor Kathy Sykes, chairs a discussion with psychiatrist Paul Harrison to explore experiences of psychosis, sharing perspectives while examining the latest research.

There’s so much contained within our minds that is unknown, and with hundreds of opportunities for thousands of conversations and connections, why not experiment with something new to you this October?
The Science of Friendship!

This year, IF Oxford asks the question: how many friends do we each need?, inviting visitors to explore the science of friendship.

In The Breakup Monologues: friendship, award-winning comedian, Rosie Wilby discusses how our platonic relationships begin and end. Known for her books and appearances on BBC Radio 4 programmes ‘Women’s Hour’ and ‘Four Thought’, she is joined by special guests Professor Robin Dunbar, a well-known anthropologist and evolutionary psychologist, and Max Dickins, comedian and author of the book Billy No-Mates. Rosie who has both written and spoken about her difficulties in initiating friendships, will be quizzing Robin on the psychological strategies she should be employ to do better and asking him to help devise new experiments to aid her in her quests to make new friends.

Robin Dunbar spent the first 25 years of his career studying the behaviour of wild animals – including the klipspringer, an African miniature antelope, feral goats and monkeys to better understand why different species have particular social systems.

“Monkeys,” he says, “were the most interesting. Sitting in front of a group of monkeys was like watching a TV soap opera. You’d see all of life playing out in front of you. This impressed upon me how intensely social primates are in a way many species are not.”

Watching the social behaviours of primates, and their well-documented habit of grooming one another, Dunbar could see how much relationships within their social groups mattered to monkeys and apes from the time devoted to this task. “There was both a dynamic and a subtlety in their relationships comparable to that seen in human societies,” he continues.

Dunbar then turned his mind to human interactions, researching what friends do for us and why we have them, before considering whether there are there limits on the number of friends we can have.

WHAT DO FRIENDS DO FOR US AND WHY DO WE HAVE THEM?

Biologists define a friendship as a positive bond that elicits feelings of well-being. It is characterised by longevity and stability, by reciprocity and cooperation, a mutual exchange and support.

“We enjoy the company of our friends, finding them interesting and entertaining,” says Dunbar, “but this experience is not the ‘end point’: whilst we believe we spend time together simply to have fun and share experiences, natural selection – the ‘menu’ of evolution – has engineered us to have a predisposition to behave in these ways and to enjoy that feeling of warmth we get when we spend time and laugh with someone with whom we are close. Behind the scenes, the consequence of this behaviour improves our ability to survive and reproduce. By cultivating friendships, individuals establish a network of reliable companions upon whom they can depend when in need.”

“People are lucky enough to sail through life without one crisis or another, and we spend years building a strong network to help us through difficult times,” he continues. “You can’t wait until you need them to make friends: it takes a long time to grow a lasting friend.”

Humans are social creatures and while to declare ‘I could die of loneliness’ might sound like melodrama from a gothic novel, loneliness is a genuine modern killer. “Friendship and loneliness are two sides of the same coin and we lunch through life from one to the other,” says Dunbar, explaining that medical researchers have been surprised by the effects of friendship not only on a person’s mental well-being, but on their physical health and even longevity. There’s compelling evidence that the most friends we have, and the more time we have invested in them, the less likely we are to succumb to disease, and the better able we are to recover from it. So, if this is the case, surely we all want as many friends as possible?

ARE THERE LIMITS ON THE NUMBER OF FRIENDS WE HAVE?

Friends Reunited – arguably the first large social media platform launched in 2000, and the rapid growth of Facebook, Instagram and other virtual networks over last two decades appears to have changed the face of friendship: some characters have, or appear to have, thousands of on-line friends’. Can they really have a real friendship with all of them? Unsurprisingly, the answer is no.

“We have to devote time to our true friends [and in ‘true friends’, I’m including both the family members and friends we choose to spend time with] in order to keep them,” explains Dunbar, “and there are cognitive and biological limitations to the number of meaningful relationships that an individual can maintain.”

The brain is a computer, a huge chunk of which is dedicated to managing our relationships with others. He continues. “Friendship is not simply memorising others’ characteristics. It’s managing complex relationships with others and being able to use that knowledge about their lives and interactions with others and being able to use that knowledge to our advantage.”

“Of course, we don’t all have exactly the same number of friends. The brain simply provides the capability; individuals then make what they will of it. It’s rather like providing someone with the white lines of a football pitch and the rule book. In theory they have the tools they need to play in the league, but it doesn’t win them any games without lots of experience on the pitch.”

“Friendship is not computationally easy. It is enabled by two psychological mechanisms – ‘mentalising’ which allows us to see the consequences of our actions on our friends and members of our social network, and ‘inhibition’ which allows us to suppress a natural inclination to do something that would damage the relationship.”

Extrapolating from an analysis of social group and brain sizes in monkeys and apes and using data on human brain size, Dunbar estimated that a person can comfortably maintain approximately 150 stable relationships with real friends – from bes tees to acquaintances – those about whom you know their history, interests, their children and pets.

Within this set, our friends are not homogenous. We invest more time in and keep some closer than others and it’s quality over quantity that’s most important. Dunbar models this in concentric circles with, typically, 5 close friends at its core with whom we have a strong emotional commitment: they’d drop everything for you in an emergency. The surrounding circles suggest 15 best friends, 50 good friends and 150 acquaintances whom we’d still class as loose friends.

Interestingly, Dunbar explains, the natural group size of human historic communities, from villages recorded in the 1086 Domesday Book – which listed every household and field, cow, house and plough in the land – was around 150 people in a typical 11th century English village. Similar patterns are seen with the Hutterites, an ethnoreligious branch of Anabaptists with communal lifestyles living in Dakota and southern Canada in the mid-nineteenth century, and modern-day subdivisions of large companies into efficient groups. Social groups hovering around 150 have led to the term Dunbar’s Number. Despite technological advances in the way we manage friendships today, and the comic escapades of Rosie and Max, it remains surprisingly similar the world over.
OTHER MINDS:

The Music of the Sonic Spider

The Oxford science and ideas Festival always offers unusual and unexpected ways to see things, and this year’s Sonic Spider is a delight for the senses. Close your eyes and experience an alternative ‘view’ of the world through vibrations, listening to sounds around you as a spider might perceive the vibrations from their web and in the air around them.

“A spider’s web is both a net for catching prey and a giant ear, an extension of their body, produced from within them that stretches out many body-lengths into the distance,” explains Alun Anderson, who researched insect senses at the University of Oxford’s Department of Zoology and later became Editor of New Scientist magazine. “As a human, imagine lying face down in the middle of a football field with your arms and legs stretched out: the web of your silk extension of your body, covering the whole field so that you can sense its whole huge area as though it were a part of yourself.”

Although the world may look broadly the same to most of us, every creature lives in a sensory and bodily world of its own. Insect sciologists call this ‘umwelt’. From the German meaning ‘environment’ or ‘surroundings’, umwelt combines two things: what an animal experiences through its senses, which can be very different from our own, and what it can do through its body, which again can be very different from our own. A spider’s umwelt is profoundly different from ours, but I’m hoping that the spider musical instrument might help transport you into it.”

Sound is the form of vibration that humans are best adapted to perceive and process, so the world of vibration translates into music very nicely. It is with the music of the giant Sonic Spider instrument that composer and musician Camilla Saunders takes you into the imagined sensory world of this fascinating minibeast. Many of Camilla’s recent musical works have taken inspiration from the lives of other creatures, including The Bug Lover’s Song Book – eighteen songs with piano accompaniment, published last year. The Sonic Spider represents a giant female orb-web spider – slim-limbed and industrial in its design – created by designer-welder Charlie Beresford, who is one of four musicians who ‘play’ her. Along each of her 2m-long legs, a taut piano wire is stretched, plucked or played using a bow or drumsticks, to create acoustic sound, whilst wired-in microphones pick up broader frequency harmonics. The multi-layered percussive sounds include short staccato drops, taps, clunks and rhythmic sounds along with longer sustained notes that hang in the air. The resulting rhythm and metallic melody are eerie and conjure an almost familiar sense of drama.

With our busy lives, bombarded by advertising messages, political news, personal drama or the stillness of nature, maybe this artwork can teach us all about how to choose to listen, how to ignore, and how to respond: “We hope this artistic interpretation of a spider’s experience takes people’s minds to a very different place and raises their consciousness of other life forms on our planet in a particular and novel way.”

At the IF Oxford event, alongside the spider music, displays explain the latest in spider science, and the very strange sensory and bodily world of this eight-legged creature that can leap into space on a thread of silk. The audience can circulate freely around the instrument, and between short performances can talk to the musicians or try playing the instrument. Additionally, the Association for the Study of Animal Behaviour will provide hands-on spider-related activities and storyteller Jules Pottle, the author of a children’s book about the lives of spiders will tell Jasper the Spider’s story and offer crafts for younger visitors.

© Charlie Bernard
Combining new research, cutting edge technology and artistic creativity can generate music and dance that captures the essence of the science at its heart while offering innovative and thought-provoking ways to appreciate different lived experiences. As part of IF Oxford, two striking and very different performances bring unusual ideas and insights to the stage.

On Wednesday 18 October, Oxford Contemporary Music (OCM) present Answer Machine Tape 1987 by composer Philip Venables, performed at St John's College by Zubin Kanga, a pianist, composer, and technologist. A lecturer in Musical Performance and Digital Arts at Royal Holloway University, Kanga is at the forefront of curating and creating interdisciplinary music that explores interactions with new digital technologies. As Director of Cyborg Soloists, he unlocks new possibilities in composition and performance through interactions with AI and machine learning, interactive visuals and VR, motion and biosensors, and new hybrid instruments.

Using technology in music, in Answer Machine Tape 1987, Kanga and Venables are enabling a greater understanding of humanity. The piece is a sensitive, absorbing and intriguing immersion into the life of David Wojnarowicz, a visual artist and AIDS activist in New York during the tumultuous period leading up to the passing of Peter Hujar – Wojnarowicz’s former lover, close friend, and fellow artist – from an AIDS-related illness in 1987. The taped messages on Wojnarowicz’s answering machine tape left by other artists, friends, and lovers during the days preceding Hujar’s death were transcribed and are the focal point of the work. Through them the audience is immersed not only in this period of Wojnarowicz’s life, but also the vibrant New York art scene, queer history, and the AIDS crisis of that era, which includes messages from Hujar. Edited to an hour in length, the performance tells the very touching story of friendships in an emotional journey that ranges from funny moments to a heart-wrenching end. “I first saw this piece performed last year, at Huddersfield Contemporary Music Festival, the UK’s largest international festival of new and experimental music, and it really stood out. It was beautiful, different, and so clever, that I was totally captivated. I just had to bring it to IF Oxford,” enthuses Lauren Spiceley, Programme Producer of OCM.

“Kanga commissions new pieces of music that use technology to augment the piano and for Answer Machine Tape 1987, he and Venables are using amazing sensor technology called Keyscanner, developed by the Augmented Instruments Laboratory. This sensor maps each note to a letter so that as he plays, he is also typing, and text appears on a big screen above the piano. You see the words emerging as he strikes the keys, and there are notes for the punctuation too.”

“It’s extraordinary! As the notes transform into phrases and Kanga writes the words in real time, you’re pulled right into the heart of the events of 1987 just as if you were watching a play or a film; each of the characters in the story is created by the music and brought to life so that this engaging performance tells the story in a tangible way.”

“I can’t think how many permutations the composer, Philip Venables, must have tried before he settled on this perfect combination of notes to letters,” Lauren continues. “A piano has 88 keys, the top half of which serves as the alphabet and the lower half, he uses to flesh out the words and create a harmony from the full range of the instrument. It’s masterful the way that the characters even have musical motifs based on the different phrases they use as they leave their messages on the answer machine, which highlights how we all use language differently.”

“Interestingly, we never hear the voice of the two main characters – the artist on whose answer machine the messages are left and his partner who is in hospital – but we come to understand them through the voices of the people who make up their world. It’s an intimate inside view of their life from their friends which will resonate with everyone.”

In addition to Answer Machine Tape 1987, the evening’s line-up also includes Vesticinos, Love You – a series of studies for keyboard by Oliver Leith in which he uses a TouchKeys keyboard connected to a synthesiser to create a set of intimate microtonal preludes and a performance of Deviance by Emily Howard. Inspired by Ada Lovelace it combines neuroscience and AI – using brain data collected from participants using EEG sensors to inform the piano writing and video, as well as electronics derived from machine-learning, exploring multiple connections between music and mind. The use of motion-sensor elements incorporates a third type of new technology into Shiel on Bone, a six-minute piece by Zubin Kanga which morphs the sound of steel knitting needles inside the piano, using MiMU sensor gloves.

Biological data has also been collected and used as the basis for an interdisciplinary dance-tech performance, Feedback Loops, at the Oxford Playhouse on Saturday 28 October, which conveys the way it feels to experience episodes of illness through dance, with music generated from live body data and snippets of conversations with people who have lived experience as well as quotes from research participants.

Curator and producer Alina Ivan was inspired by an international research study, that looks into how wearable technologies and mobile phones can track symptoms of depression, epilepsy and multiple sclerosis.

“This show tells the story of the mind and body and aims to give life to real honest lived experiences, sometimes invisible, misunderstood or hard to put into words,” Alina explains.
"Some are easy to relate to – the experience of not knowing what tomorrow will bring for example, others are the unseen side of a patient’s journey and are harder to imagine. Say, with multiple sclerosis, the feeling that your limbs aren’t connected to your brain (as described by an MS patient): “In the study, wearable devices recorded and provided continuous objective biomarkers on sleep, heart rate and physical activity which, over up to three years and combined with traditional study methods and questionnaires, enabled researchers to see what was happening in the body. If we can discover what is changing in the body when someone feels well or isn’t feeling so good, and uncover the triggers that cause these to resurge, we have a chance to break the cycle,” she continues.

The answers to big questions are often found at the intersections of different disciplines. Music and dance are time-proven ways to express ourselves when words don’t suffice. Combined with physiology they can give a more immersive understanding of certain conditions.

“We began by asking what’s the best way to communicate a message when words are not enough,” Alina adds. “Dance is one of the most visceral primal ways to express feelings, thoughts and experiences so dance, accompanied by music, seemed the perfect way to transport the audience into other people’s shoes. There’s a single dancer, Anna Spink. The accompanying music is atypical in that it is generated by her body in real time. She wears a medical wrist device that tracks movement, pulse and sweating and these biometrics are incorporated into a narrative of conversations as an original composition. As it’s different every time, the show keeps alive that element of the unknown.”

Dan Wimperis, the composer, is both a musician and a mathematician. He sees both maths and music as languages which you learn from the external world and then use to communicate ideas. Using an algorithm, the data is coded into music; the data points are spread across a 10-octave keyboard, to which information from heart rate and other biological signals are applied within set parameters to create the musical language for the show. Dan’s generative music draws on hand movements which influence the speed, pitch and the texture of the sound. Movement in the three dimensions translate into different instruments; heart rate data influences how hard a note is hit on a piano and the probability of particular notes being played meanwhile electrodermal activity changes – increased skin conductivity resulting from sweat – gradually alters how an instrument sounds.

Some sections are more melodic whilst others may have an uncomfortable vibe, but all are moving, and almost meditative as clever combinations of chords instil different emotions in the audience.

## Feedback Loops

**Answer Machine Tape 1987**

St John’s College, OX1 3JP

Wednesday 18 October, 7.30 – 9.30pm

**Feedback Loops**

Oxford Playhouse, OX1 2LW

Saturday 28 October, 3 – 4.15pm

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**Volcanoes: THE FIRE BENEATH THE EARTH’S SURFACE**

Throughout the ages, the drama of volcanic eruptions has captivated the human imagination, from the eruption of Vesuvius in 79 CE, its ash freezing Pompeii in time forever, to the photogenic Greek island of Santorini, where iconic white and blue buildings cling to the cliffs above a giant underwater volcanic crater.

**David Pyle sampling the pumice of Santorini’s great Bronze Age eruption**
instrument had probably detected the absorbed heat of the sun in the rock rather than boiling water in the lake in the volcano’s crater: the volcano didn’t erupt again until 1979. This raises questions of our belief in technology and reminds us that science is only as good as both our current understanding and the tools we are applying to the environment. However good their measurements in real time, however, they don’t address the challenges of making decisions on the basis of science in the face of future uncertainty.”

Over recent years the Seismic Research Centre of the University of The West Indies in Trinidad and Tobago, via a project VolcanoReady, has worked to reduce the inhabitants’ vulnerability to volcanic activity with a series of activities designed to enhance community early warning procedures, to encourage adaptation to the ever-present risk and strengthen responses. When scientists correctly predicted the latest eruption on St Vincent in April 2021, the entire population was safely evacuated.

Volcano scientist Michal Camejo is one of the researchers who was monitoring the volcano prior to the eruption, using ground deformation measurements from remote sensors. When the eruption began, she was deployed to St Vincent. During 2020, she explains, the measurements available were not optimal because the regular physical monitoring of the instruments in St Vincent had declined during COVID, because of the dual difficulties around international travel and financial restrictions in a resource-constrained context. Following this experience on the ground, Michal came to Oxford in 2022 as a Royal Society Newton International Fellow. She is currently leading research on how to best optimise the resources available to both maximise understanding of the magma beneath the surface, its position and its movements, and to translate this into the best positioning for seismic instruments (or seismometers) to keep local populations safe.

Another project with the Montserrat Volcano Observatory on the neighbouring island of Montserrat is developing similar volcano awareness. There, the Soufrière Hills volcano began erupting in 1995 and has been active since. In 1996 the entire population was relocated to the north of the island, and Montserrat’s capital Plymouth was completely buried under volcanic ash. The volcano continues to steam and the south of the island remains an exclusion zone today. Within five years of the eruption, three-quarters of the island’s population left as environmental refugees. The population today is recovering and has grown used to living alongside the ever-potent threat of an active volcano. Working with the University of Oxford researchers, local teenagers created the first of a series of murals which describe this story visually, and the artwork has been recreated on a printed gazebo into which visitors to IF Oxford can enter for a moment’s immersion in the story of Montserrat and its volcano. (Science @ the Shops, Saturday 21 October, Templars Square shopping centre)

As part of a Sensing Volcanoes exhibit at the Festival’s family Explorazone on Saturday 7 October, you can step onto an interactive floor which lights up in different colours. In blue and green, the floor represents the topography of a volcanic island on which youngsters choose a square in which to ‘live’. However, threatened by geological events, including earthquakes, the emission of volcanic ash and small eruptions, game-players must choose whether to move or stay, given limited financial resources, judging the danger they’re in and making decisions with which, we hope, they survive to the end of the game!

Alongside, visitors will be able to discover more on the geological, historical and social perspectives of volcanos and handle pieces of volcanic rock and examples of scientific instruments, including one developed by Frank Perret, an early electrical engineer and inventor. In the 1930s, Perret built a wooden earthquake-measuring instrument which consisted of a series of different-length pendulums: the relative shaking of each indicated the frequency of the earth’s shocks. Another of his inventions looked rather like a gramophone trumpet and could be used to listen to the tone of the steam vents in the earth. “Fortunately, in recent years, geologists have worked out ways of taking measurements in hot, acidic and uncomfortable environments using drones or robots for remote measurements, rather than putting your ear to the ground,” Michal and David laugh.

A Science Career for Everyone

Science is for everyone, it’s everywhere – in the ground below us, the air around us, the cells inside our bodies and throughout the Universe. It expands beyond the limits of our comprehension – and we can all be involved with science and discovery, or STEM (science, technology, engineering and maths / medicine) whatever our backgrounds. You don’t need to have been an academic whiz-kid at school with a certificate in biology, chemistry or physics. Nor do you need to wear a lab coat and peer down a microscope or clutch a test tube – people involved in STEM work in fields as diverse as farm management and space technology. You could be a product designer or developer, a patent attorney who safeguards inventors’ intellectual property rights, a writer or even a performer.

We talk to three very different people who are making a success of a career in science locally. They explain the paths they followed to get where they are today.
I want to show my kids that if you're focused and work hard, you can achieve anything.

The Engineer

Mum-of-two Anisha Roberts is an inspirational apprentice at the Oxfordshire Advanced Skills (OAS), a centre at UKAEA in Culham on the Thames near Abingdon. OAS offers training from the Manufacturing Technology Centre for apprentice engineers and technicians through collaborative partnerships with technology businesses. Like many STEM organisations, they encourage diversity among their apprentices and actively look to attract students from sectors of the population that are currently underrepresented in the STEM sector. Could this be for you?

Anisha joined the level 3 programme in 2021 to finally follow her dream. ‘I’ve always been a practical person with an interest in engineering, fixing things for my friends, but as a young mum, university didn’t feel like a realistic choice for me,’ she explains. “I’d researched engineering apprenticeships probably every year since I left school, but there was always a reason not to go for it. I was working as a Teaching Assistant at a Special Educational Needs (SEN) school when one of my colleagues left to become a police call handler – she was 60! I thought if she could do it at 60, I can definitely do it at 30!” says Anisha.

“I want to show my kids that if you’re focused and work hard, you can achieve anything,” she smiles.

“I thought of my apprenticeship as an investment in my future and was expecting to be pretty poor for a few years, but I’m actually paid more now than when I was a teaching assistant. I didn’t want to become a teacher, which at the time for me meant no job progression, whereas now I have a whole career ahead of me.”

The Patent Attorney

Hannah Thorne is a Chartered Patent Attorney, a legal expert who specialises in protecting and defending intellectual property rights. Hannah studied physics as an undergraduate, initially thinking she would become an academic. However, she realised that this would involve becoming increasingly specialised in the discipline and having an increasingly narrow research focus.

“Jobs in industry also seemed to focus on developing an expertise in a single area,” she explains, “and yet I realised that I would most value a career which gave me a broad awareness and understanding of STEM interests.

Being a patent attorney was perfect as it gives me the opportunity to be involved with new ideas and cutting-edge technology. I was able to join Marks & Clerk as a new graduate and trained on the job, a process that takes 4-6 years, and from the outset, I was excited to be working on projects ahead of time, before they are in the general domain.”

“It’s also great to see the results of new ideas and products in use afterwards, making a difference. One solar-powered water pump, in which the pump works in an innovative way, was invented for developing countries by a small company locally. It is now in use in farms across Africa, for example, and has doubled their potato harvest! It’s great to see a tangible impact like that.”

“Oxford is, of course, a global hotspot for forward thinking and lots of the ideas and products we safeguard are developed both within the university environment and by corporate clients. Many are software and AI-based, including neural network applications for diagnosing disease or assessing the stage of a disease from a microscopic image of part of the body. Technology really can be incredible!”

The Science Writer and Presenter

Following a very different path, science writer and presenter Dr Sarah Barrass specialises in primary science and with lots of energy and enthusiasm built her own freelance role. Sarah studied biological sciences at university, as a mature student I got a PhD in agricultural technology at Royal Holloway, running the greenhouses, and as a mature student I got a PhD in agricultural botany at the University of Reading. It was clear that a 9-5 job wasn’t for me!”

“Once I had three small children it was a challenge to keep working, but volunteering to help with science at the local primary school set me thinking. The children loved my hands-on approach and the staff were enthusiastic too, so I started taking my activities to festivals and conferences. Now I go to schools and events across the country.”

“After seeing one of my shows at a festival, the editor of Aquila Children’s Books asked me if I was interested in science writing – I’ve been working for them for nearly ten years now! I also write for the children’s science magazine Whizz Pop Bang, helping readers answer readers’ curious questions. It’s brilliant because I have to research the answers on a huge range of topics, so I’m always learning.”

“This year I’m looking forward to bringing my latest show Atv: how do we know it’s there? to IF Oxford where the audience take part in a series of experiments looking for scientific evidence to prove it exists.” (Sat 7 October, Wesley Memorial Church, 2.20-3pm & 3.30-3.50pm)

Discover more about apprenticeships with Oxford Advanced Skills at: www.oas.ukaea.uk/apprenticeships/ and meet their team during the Festival at:

- Explorezona: Wesley Memorial Church, OX1 2DH, Sat 7 October, 11am – 5pm
- Super Science Sunday: Science Oxford Centre, OX3 8BB, Sun 15 October, 10am – 5pm
- Robot racing: Iffley Road Sports Centre, OX4 1SR, Sun 29 October, 11am – 3pm

Explore medical science careers at a Zoom event: Have you thought of a career in medical research? Wed 11 October, 4 – 5pm
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For more venue information, visit [www.if-oxford.com](http://www.if-oxford.com)
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