

CHELTENHAM

Science Festival

5–10 June 2018

Box Office 01242 850270
cheltenhamfestivals.com
#cheltscifest

in association with



 UNIVERSITY OF
GLOUCESTERSHIRE
at Cheltenham and Gloucester

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A very warm welcome to #chelthscifest 2018. This year we've got even more questions to ask and big ideas to explore. In a world that is more connected than ever before, our Connected:Divided theme looks at what brings us together and what pushes us apart.

We've invited four fabulous guest curators to help us pull together a packed programme of events for all ages – turn to pages 7-8 to find out what **Maddie Moate**, **Olly Mann**, **Jessica Barker** and **FC** have in store for you.

Our MakerShack is back by popular demand and we have a brand new Cyber Zone exploring the digital world. With more free activities than ever before, there's plenty to fill a day.

“*The brilliance of the Cheltenham Science Festival is the breadth of what's on offer, but how do you choose from so much? My tip is to book your faves but try at least one thing that's completely new to you. Who knows – you might be connecting to something that really speaks to you. Enjoy!*”



Vivienne Parry
Chair of Cheltenham Science Festival



Current Affairs

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How Do We Solve The Plastic Problem? page 21
Should We All Become Vegan? page 22
Can Democracy Survive Social Media? page 30
The Science Of Donald Trump page 31
How Do We Stop Social Media Trolls? page 40



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The Truth About Exercise page 30
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Jury Live: DNA In The Dock page 36
What Does The Internet Know About You? page 42

Cutting Edge

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Checkmate: How AI Conquered Games And Why It Matters page 33
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Big Thinkers

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Frank Close: A Life Scientific page 29
Adam Rutherford: The Dark Side Of Genetics page 34
Demis Hassabis: The Future Of AI And Science page 35
Sheila Rowan: Gravitational Waves page 35



Art & Music

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Evening Entertainment

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FESTIVAL VILLAGE

KEY ■ Free interactive zones ■ Free activities ■ Ticketed event venues

Free interactive zones *All Ages*

EDF Energy Zone

8–10 June, 10am–5pm

Careers evening, 8 June, 5–7pm

Late opening for adults, 8 June, 8–10pm

See page 12 for details.



GE Pavilion

5, 7 & 10 June, 10am–6pm

6, 8 & 9 June, 10am–8pm

Careers evening, 8 June, 5–7pm

See page 13 for details.



Discover Zone

Daily 10am–5pm

Late opening for adults, 8 June, 8–10pm

See page 11 for details.

Supported by



MakerShack

Daily 10am–5pm

Late opening for adults, 8 June, 8–10pm

See page 10 for details.

Cyber Zone

Daily 10am–5pm

Careers evening, 8 June, 5–7pm

Late opening for adults,

8 June, 8–10pm

See page 9 for details.

Supported by



The Sphere

Daily 10am–5pm

Create your own unique art inspired by your heartbeat, get hands-on with Lego genome editing, make a microbe, get a glimpse of what living in a "Quantum City" might be like, create your own vegan smoothie and more...

← Cheltenham Ladies' College,
Parabola Arts Centre GL50 3AA

🚶 5 minute walk



Careers Evening
8 June, 5–7pm
see page 30

Hartpury Science Hub
5–10 June, 10am–5pm
Careers evening, 8 June, 5–7pm

Drop in to take part in exciting experiments, explore pioneering research and find out more about sport and exercise, equine performance, animal welfare and agriculture.



Free activities

Conversation Corner

Have our speakers got your brain whirring? Share ideas, be inspired and join other audience members for an informal chat at Conversation Corner in the Festival Café. Places limited, unreserved seating.

Science Trail

Daily All ages

Collect your quiz sheet from the Science Trail starting point and follow the Trail around Imperial Square.

Supported by



Cyber Trail

Daily Ages 10+

Become a code-breaker as you follow the Cyber Trail around Imperial Square. Begin your quest in the Cyber Zone and gather clues to unlock this cryptic challenge.

Women in STEM Photo Installation

Daily All ages

Find out more about amazing women in science, technology, engineering and maths in our photo installation, new for 2018. Visit our photo booth in the Cyber Zone to add your own photo to the display.

Women in Innovation Photography Exhibition

Town Hall

Representing UK's most promising female entrepreneurs, recognising their differences and the diverse ideas they bring forward.

Portraits provided by Innovate UK.

Woodland Trust

Daily All ages

Learn more about how woods and trees benefit the environment around us with some hands-on activities and fun from the people behind Nature Detectives!



WOODLAND
TRUST

Stargazing In The Gardens

7 & 8 June, 9.45–11pm
Meet at the Holst Statue

Join members of the Cotswold Astronomical Society for a supervised evening of stargazing using members' telescopes.

RAF Falcons Display

Look to the sky and you may be surprised by an exciting sky diving display by the RAF Falcons on Tuesday and Wednesday. *Weather dependent.*



Food & Drink

Stop to refuel between Festival events at our Festival Café, Imperial Garden Bar or Regency Café – vegetarian and gluten free options available!

Large Animal Dissection

10 June, 10am–4pm
Hartpury Science Hub

Following the success of last year's horse investigation, Hartpury Scientists will be performing a detailed dissection of a wallaby.



HARTPURY

2018 THEME

Connected:Divided

One of the unique things about us humans is the way that we communicate and connect with each other. These connections can be strengthened through our similarities, tying us together and uniting us. But they can also reveal our differences: if our lines of communication break down, we can become divided, separated and isolated from each other. Thanks to technology, we live in a world that is more connected than ever before, yet division and conflict are rarely out of the headlines.

At this year's Festival, we dive into psychology, biology, technology, engineering, anthropology, health, current affairs and so much more to ask what it is that connects and divides us as a species, both locally and around the world.

Events to look out for:

**The Evolution Of
Communication** *page 17*

**The Value Of Human
Contact** *page 17*

Connected Yet Divided
page 18

The Rise Of Extremism
page 22

**Boredom: The Upside of
Downtime** *page 23*

**Is Cyber War The New Cold
War?** *page 25*

**The Future of Human
Communication** *page 30*

**Connections: Belief And
Community** *page 33*

What Is Attraction? *page 35*

**The Art And Science Of
Conversation** *page 39*

Olly Mann
Current Affairs Programme Curator



Presenter, columnist and media commentator **Olly Mann** is host of Radio 4's *Fourthought* and *The Male Room*. His podcasts, including *The Modern Mann*, *The Media Podcast*, *The Week Unwrapped* and the Sony award-winning series *Answer Me This!* have achieved over 40 million downloads.

“As well as exploring the latest news and current affairs, I’ll be asking about the unintended consequences of our dependence on technology and trying to get to the truth behind the subject. It’s incredibly revealing when a broad range of experts who are completely immersed in their individual topics can be challenged by the audience and each other. Cheltenham Science Festival provides the perfect opportunity for this.

Events to look out for:

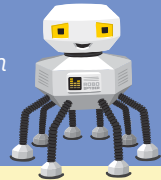
- Is Your Tech Bad For You?** page 22
- Podcast LIVE: The Week Unwrapped** page 27
- The Science Of Donald Trump** page 31

Maddie Moate
Family Programme Curator



Maddie Moate is a BAFTA-award winning television presenter and a prominent ‘Edu-tuber’, amassing over 20 million views on her YouTube videos across multiple science and technology channels. Her popular CBeebies series *Do You Know* explores how everyday objects are made and work.

“I’ve been working with the Cheltenham programming team to help develop new and exciting events for the Festival’s youngest fans. I’ll be sharing my passion for beekeeping and space travel as well as exploring how our bodies work. And it’s always a fantastic time to meet other science communicators and watch and learn from my peers in action.



Come and see Maddie in these events:

- Maddie’s Mission To Mars** page 36
- How Does Your Body Work?** page 37
- Busy Bees** page 43

GUEST CURATORS

Jessica Barker & FC

Tech & Cyber Programme Curators



Jessica Barker is a leader in the human nature of cyber security. She is frequently called on by the broadcast media for her clear and engaging communication of technical subjects and is passionate about encouraging young people to become more engaged with cyber security.

“We’re looking forward to demystifying cyber security and sharing this exciting and fast-paced world with the Science Festival audience. Through live hacking demonstrations, inspiring talks and amazing hands-on activities in the Cyber Zone, we will be helping to bring cyber security to life at this year’s Festival.



FC is a well-known ethical hacker and social engineer. Having worked closely alongside intelligence agencies, he has helped steer governments to take correct courses of action against national threats and ‘broken into’ hundreds of banks, offices and government facilities to assist organisations to improve their security.

FC and Jessica are co-founders of Redacted Firm – one of Europe’s only privately owned and vendor agnostic security consultancy firms.

Events to look out for:

How To Hack A Human page 39

Cyber Surgery: Ask the Experts
page 40

How To Hack A Bank: LIVE page 41

**What Does The Internet Know
About You?** page 42

Cyber Zone

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Daily 10am–5pm

Free Entry All Ages

Late opening for adults

Friday 8 June, 8–10pm

Step into a fascinating digital world in the Cyber Zone, our new interactive space for 2018.

Try your hand as an ethical hacker, crack puzzles, pick locks, and see what the future might look like as you come face-to-face with artificial intelligence. Find out more about how to defend the web, get hands-on with new technology and hear from top experts in our packed programme of free activities and talks throughout the week.

Look out for our Capture-The-Flag hacking challenges; suitable for teams and individuals of all ages and abilities.

Find out more on pages 30 & 37

NEW FOR 2018!

FREE INTERACTIVE ZONE

Workshop **Becoming A Chess Grandmaster**

Friday 8 June, 4–5pm

**Saturday 9 June, 3.30–4.30pm,
4.45–5.45pm**

Free no ticket required.

Places limited, unreserved seating.

Whether you're a complete beginner or a chess Grandmaster, find out how Artificial Intelligence is transforming the game of chess.



Cyber Talks

Saturday 9 June, 1.30–2.30pm

Sunday 10 June, 1.30–2.30pm

Free no ticket required.

Places limited, unreserved seating.

Come and hear leading experts give an introduction to some of the hottest topics in cyber security in our free Cyber Talks.

Cyber Surgery: Ask The Expert

Sunday 10 June, 3.15–4.15pm

Free no ticket required.

Places limited, unreserved seating.

How would you know if your emails had been hacked and how can you keep your kids safe online? Join Festival Guest Curators and leading cyber security experts **Jessica Barker** and **FC** as they offer practical advice and answer your questions.

MAKERSHACK

Daily 10am–5pm
Free Entry *All Ages*

Enter a carnival of creativity in the MakerShack. Explore marvellous materials and discover traditional and futuristic technology with our host of makers, engineers, craftspeople and researchers.

Code a robot to read a bedtime story, enter the Slime Factory to make your very own slime, get your hands dirty making felt, discover forever re-moldable thermoplastics, carve a path for a river, squidge clay into curious creations and so much more.

**FREE
INTERACTIVE
ZONE**

Friday 8 June, 8–10pm

Late opening

Over 16s only. Free Entry





**FREE
INTERACTIVE
ZONE**

**Daily 10am–5pm
Discover Zone**

Free Entry *All Ages*

A huge, free interactive space to get hands-on with the latest exciting research and technology. Find out more about the world and how it works; with virtual reality, aeroplane engineering, chemistry, cyber security, quantum computing and so much more!



**Friday 8 June, 8–10pm
Late Opening
For Adults**

Free entry

Don't miss our special late opening for adults, the perfect opportunity for the curiously minded to explore after hours. Grab a drink at the bar and drop in to try all the activities, without kids.



Safran Landing Systems is the world leader in the design, development, manufacture and support of aircraft landing and braking systems. We are proud to support Cheltenham Science Festival and inspire the next generation of scientists and engineers as lead partner for the Discover Zone.





**FREE
INTERACTIVE
ZONE**



8–10 June, 10am–5pm
EDF Energy Zone
.....
Careers evening, Friday 8 June, 5–7pm
Late opening for adults, Friday 8 June, 8–10pm
Free entry
.....

EDF Energy is delighted to be the Associate Title Partner of Cheltenham Science Festival

Come and find out about our programmes to inspire the next generation in Science, Technology, Engineering and Maths (STEM): visit us in the EDF Energy Zone in Imperial Square to find out how we are encouraging the scientists, engineers and thinkers of tomorrow.

As the UK's largest producer of low carbon electricity, EDF Energy is committed to helping young people understand the great career opportunities available in a STEM related industry. Currently only one in five people working in core science, technology, engineering and maths fields is female. Our Pretty Curious campaign aims to change this.





**FREE
INTERACTIVE
ZONE**

**5, 7 & 10 June, 10am–6pm
6, 8 & 9 June, 10am–8pm**

GE Pavilion

Careers evening, Friday 8 June, 5–7pm

Free entry

Transport yourself to GE's Digital Pavilion and connect with a world of Science, Technology, Engineering and Maths.

Exploring various hands-on engineering activities, you'll connect with GE engineers who are solving big technology challenges and working on things that really matter to each of us: to come home and spend time with family, to see loved ones who are far away, to be healthy and become strong and to follow our dreams.

During the Festival there will be a number of talks and activities to introduce young people to possible career paths, demonstrating how personal aspirations, interests and passions can go hand in hand with world industry and business needs.

Visit the GE Digital Pavilion to find out about career opportunities and how GE is solving engineering challenges by connecting the world.

GE is on a mission to build, move, power and cure the world. We achieve this through the communication of ideas between our 295,000 employees who work in over 170 different countries. Our diversity of ideas is one of our greatest strengths, and connectivity brings us together. GE transforms industry by introducing brilliant new solutions to the world's challenges. All of the GE success and innovation that you see around you is a result of the enthusiastic and creative people that work at GE.

SUPPORTING EMERGING TALENT

As a registered charity we are committed to offering inspirational opportunities for young people through our year-round science education programme which runs alongside the Festival. Each year we engage over 6,000 pupils and hundreds of teachers and our world famous FameLab project is supporting the next generation of science communicators across the globe.

SCIENCE FOR SCHOOLS

On-Site Events

Shows, workshops and interactive zones will engage and encourage the scientists, technologists, engineers and mathematicians of the future.



FameLab Academy

Over 1700 pupils have participated in the flagship outreach programme for Year 9 students this year. The project develops confidence, increases communication skills and encourages STEM enquiry.

LabLive

Reaching out beyond Gloucestershire, our national tour brings the best of Cheltenham Science Festival to teenagers across the UK.

To find out more visit
cheltenhamfestivals.com/education

CREATING OPPORTUNITIES

FameLab International

Who will win the science showdown? Find out at FameLab, the global science communication competition. Watch 29 national finalists from across the globe battle it out to become the FameLab International Champion 2018.

Free Semi-Finals

Wednesday 6 June page 20



International Final

Thursday 7 June page 27

Look out for previous FameLab contestants in:

An Introduction To

Nanotechnology page 17

Smart Materials page 26

Born To Sum page 31

How To Find Dark Matter page 33

The Element In The Room page 34

Science Of Star Wars page 38

Nature's Secret Patterns page 43

FameLab
TALKING SCIENCE

BRITISH
COUNCIL

With thanks to our Education Programme Partners:



...around town

FREE

brought to you by Cheltenham BID



Thursday 7 – Sunday 10 June 2018

Look out for free activities and hands-on fun for all the family in our Festival Village and across Cheltenham town centre! From experiments to pop-up performances, you will find incredible science and geeky entertainment out on the street, in local bars and pubs!



Keep an eye on our website for the full ...around town programme – to be announced in May! cheltenhamfestivals.com/around-town

Family EVENTS

Join us on Saturday and Sunday for a bucketful of family fun! Go on an explosive and bizarre journey to discover the science of sweets with **Stefan Gates** and **Andrea Sella**, fly to Mars with **Maddie Moate**, join marvellous mathematicians **Katie Steckles** and **Zoe Griffiths**, and much more!



Introducing Spyder! This super special secret agent will be popping up throughout the brochure and at the Festival on a secret mission to help families find fun activities to enjoy. Her spy-kit is packed with binoculars, a top-secret laser pen and... a cup of tea. Where will you spot her on site?

Programme details on pages 36–37 and 42–43.



3.30–4.30pm S003

Connected:Divided The Value Of Human Contact

Cheltenham Ladies' College,
Parabola Arts Centre
£7*

Loneliness has been shown to have a major impact on our mental and physical health and lifelong wellbeing. How does a lack of human interaction affect us? Psychologists **Rory O'Connor** and **Manuela Barreto** join population health researcher **Aparna Shankar** to explore why social relationships are so important and how we can help ourselves and others stay connected.



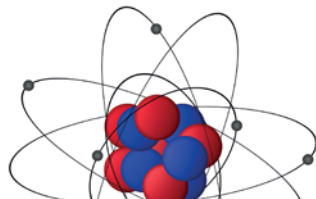
The British Psychological Society
Promoting excellence in psychology

4.45–5.45pm S004

An Introduction To Nanotechnology

Helix Theatre
£7*

All around us a hidden world is taking over, strange and alien, where nothing is as it seems – the world of nanotechnology. Materials scientist **Jamie Gallagher** shrinks down and gets hands on with the tiny tech that is changing our phones, food, sport and health. Delve into a world where pencils are stronger than steel, metal becomes transparent and robots become doctors.

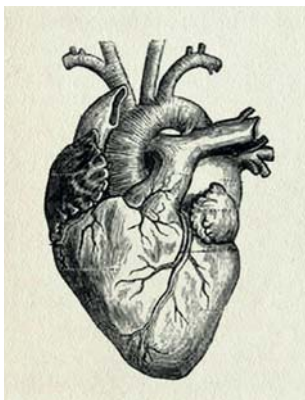


4.45–5.45pm S005

Connected:Divided The Evolution Of Communication

The Crucible
£7*

From singing and dancing to connecting through touch, human interaction has developed over centuries. Why is it that we've acquired the remarkable capacity for language, and how do social systems and communicative behaviours found in the animal kingdom differ from our own? Linguist **David Adger** and psychologist and primatologist **Zanna Clay** trace the evolution of communication and explore how social interaction has enabled us to form diverse and complex societies.



5.45–7.15pm S006

7.45–9.15pm S007

Workshop The Heart: Inside And Out

ExperiTent
£12* Ages 16+

Small but strong, the average heart weighs only 300g but beats a staggering 100,000 times in a day to pump over 6,000 litres of blood around the body. Anatomists from the **University of Bristol** take you on a guided tour of this incredible organ: work in groups to dissect a heart as you find out how they develop and function, and discover the anatomy behind common heart conditions.



6–7pm S008

Hunted: How Not To Get Caught

The Arena
£9*

Would you have what it takes to go on the run? Channel 4's *Hunted* experts, cyber lead **Paul Vlissidis**, forensic psychologist **Donna Youngs** and former military intelligence operative **Steve Cottam** join **Dallas Campbell** to explore the cutting-edge techniques and covert tactics used by police and surveillance officials to hunt wanted criminals and consider their best tips for survival if they were forced to go off-grid.

6-7pm

S009

Current Affairs

How Science Got Women And Men Wrong

Cheltenham Ladies' College,
Parabola Arts Centre
£8*

For centuries, we've been told men and women are fundamentally different, caused by an unholy alliance of genes, hormones and neurons. But maybe biological sex isn't the diverging force we've been led to believe. Psychologist **Cordelia Fine** and science journalist **Angela Saini** join TV presenter **Javid Abdelmoneim** to explore the ferocious gender wars in biology, psychology and anthropology to separate fact from fiction.



6-7pm

S010

The Secret Lives Of Octopuses

The Cube
£8*

Octopuses are the smartest and strangest spineless creatures on earth. With big brains, eight arms that think for themselves, three hearts, blue blood and stealth camouflage, they're the closest we have to intelligent aliens living right here on earth. Marine biologist **Helen Scales** explores their remarkable lives and what they can tell us about other intelligent life forms we might be sharing our universe with.

6-7pm

S011

An Introduction To Cracking Codes

The Pillar Room
£8*

From Bletchley Park's Enigma to Easter Island's bewildering Rongorongo, codes can help to win wars, conceal state secrets and protect privacy. Join writer **Mark Frary** as he dives into the mysterious world of cryptography, revealing the secrets behind cracking different codes and ciphers and sharing the incredible stories of some of the most famous codebreakers in history.



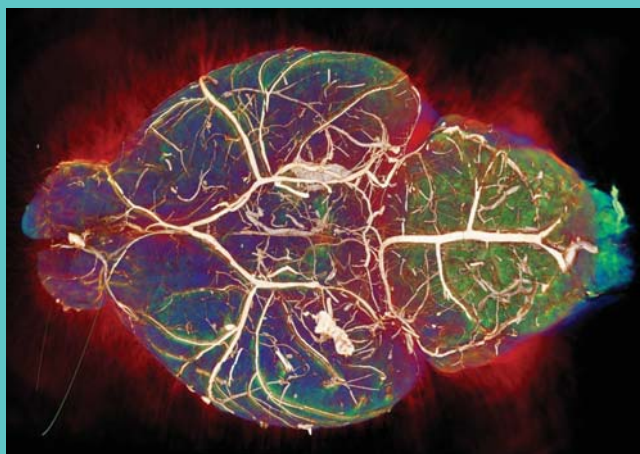
7.15-8.15pm

S012

Connected: Divided Connected Yet Divided

The Crucible
£8*

Free movement has led to the emergence of diverse societies, and the internet has given us a window into the lives of others around the world. Despite this increased connectedness, it seems that hatred and intolerance is on the rise, with tribal politics taking centre stage. Barrister **Hashi Mohamed** joins the Runnymede Trust's **Zubaida Haque**, intergroup relations expert **Dominic Abrams** and political psychologist **Emma O'Dwyer** to explore what is driving this crisis of division and to consider how we might bring local and global communities together.



8.30–9.30pm S016

Connected: Divided
The Great Tax Dilemma

The Cube
£8*

Tax revenue from both businesses and individuals is essential to pay for the public services we all want and need. But who's paying tax and are they paying too much? Who should be paying more or less? Tax economist **Helen Miller** explores how our tax system underpins feelings of fairness in our society and asks whether we can ever make progress if we don't all agree on what makes a 'fair' system.

7.15–8.15pm S013

Your Unbelievable Brain: Wine, Sleep And Exercise

Helix Theatre
£8*

Is it possible to cleanse your brain with alcohol, detoxify the mind with sleep or even run the blues away? Faced with the discovery of a revolutionary new brain pathway, the glymphatic system, neuroscientists **Mark Lythgoe**, **Jack Wells** and **Ian Harrison** look at the impact this has on how we look after our minds and whether this is a game-changer for the discovery of new medicines.

8.30–9.45pm S014

The Science Of Cider

The Pillar Room
£12* *Over 18s only*

Whether you like it dry or sweet, still or sparkling, enjoy a delicious selection of ciders as the technical team from local Herefordshire cider maker **Westons Cider** take you on a fascinating tour of the cider-making process. From fruit pressing to fermentation, discover the science behind the perfect pint in this sure to be scrumpy-tious event.

With thanks to **Westons Cider**.



8.30–9.30pm S015

Secrets Of The Teenage Brain

The Arena
£9*

Our adolescent years may be a time of vulnerability, risk taking and erratic outbursts, but they also represent a period of enormous development and creativity. Neuroscientist **Sarah-Jayne Blakemore** explores the brain changes responsible for the hallmarks of teenage behaviour and shows why this period of our lives should be acknowledged, nurtured and celebrated as the time when we truly invented ourselves.



8.30–9.30pm S017

Cellular Dynamics

Cheltenham Ladies' College, Parabola Arts Centre
£10*

Blending live musical performance and spectacular scientific images, bioscientist **Dan Lloyd** and pianist **Matthew King** embark on a journey of discovery. The music of Philip Glass, Tarik O'Regan, Claude Debussy and others accompany spectacular image and video projection in a performance exploring the fundamental processes within living cells.



	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
CLC, Parabola Arts Centre				S021 THE FUTURE OF FLIGHT			S024 LIVING WITH ELEPHANTS		S028 A CLIMATE OF CHANGE?			S025 CAN MATERIALS SAVE US?		
GE Pavilion								ENGINEERING DIGITAL FUTURES						
The pillar Room									S027 THE RISE OF EXTREMISM			S032 THE RISE OF THE DINOSAURS		
The Cube								S026 OUR WIRED WORLD			S024 IS YOUR TECH BILDFOR YOU?			
Helix Theatre	S018 FAMELAB INTERNATIONAL SEMI-FINALS			S019 FAMELAB INTERNATIONAL SEMI-FINALS				S020 FAMELAB INTERNATIONAL SEMI-FINALS				S023 UNDERSTANDING POVERTY		
The Crucible					S022 PRSD-100 YEARS ON			S025 HOW SPECIALIST SOULS STEER?			S030 SHOULD WE ALL BECOME VEGAN?			
The Arena							S023 HOW DO WE SOLVE THE ELASTIC PROBLEM?		S029 GARDEN WILLBILITIME			S034 ROBERTO: THE END OF DOWNTIME		

WEDNESDAY 6 JUNE PLANNER

10am–12pm S018
1.15–3.15pm S019
4.30–6.30pm S020

Entertainment **FameLab International Semi-Finals**

Helix Theatre
Free *no ticket required*

The world's greatest international science communication competition returns! With only three minutes to enlighten and entertain judges and audience, the pressure is on for our contestants. Join our 29 national finalists from across the globe as they battle it out for a coveted place in the FameLab International Final. Hosted by **Quentin Cooper**.

See the final ten compete for the grand prize in the FameLab International Final on 7 June, 8.45pm.



1–2pm S021
The Future Of Flight

Cheltenham Ladies' College, Parabola Arts Centre
£7*

Throughout history, aircraft have helped us protect our lands and expand our horizons. 100 years since the foundation of the RAF, **Nicholas Lawson** from the National Flying Laboratory Centre, RAF Squadron Leader and engineer **Tim Lenaerts** and GE Aviation's **Peter Silverthorne** explore what the future holds for aviation, from hypersonic military jets to electric passenger aircraft.



*Plus booking fee: charged at £2 per order.

2.15–3.15pm S022

PTSD: 100 Years On

The Crucible

£7*

Whether it's soldiers engaged in combat or survivors of car accidents, post-traumatic stress disorder can be devastating.

Marking 100 years since PTSD was first recognised in the trenches of World War One, psychiatrist **Simon Wessely**, cognitive scientist **Martina Di Simplicio** and *A Brave Face* Director **Rachael Savage** reflect upon how far our understanding of this disorder has advanced, and consider how we can continue to better support those affected.

For details about *A Brave Face* visit vamostheatre.co.uk

BAP
British Association for
Psychopharmacology



3.30–4.30pm S023

How Do We Solve The Plastic Problem?

The Arena

£7*

300 million tonnes of plastic are produced globally each year, with only 15% being recycled. With our oil reserves rapidly depleting and the plastic waste pile growing larger every minute, something needs to change. Materials engineer **Mark Miodownik** looks for solutions with designer **Sophie Thomas** and Recycling Technologies **Adrian Griffiths**.

 ROYAL ACADEMY OF ENGINEERING



3.30–4.30pm S024

Living With Elephants

Cheltenham Ladies' College,
Parabola Arts Centre

£7*

Join wildlife biologist **Lizzie Daly** to explore the realities of elephant conservation from her time in Laikipia, Kenya, where the blurring of elephant and human habitats can lead to fatal clashes between both species. Hear Lizzie's tales of wildlife, places and people and find out how her experiences on the ground have shaped her research.

5–7pm

Engineering Digital Futures

GE Pavilion

Free no ticket required

Pop into the GE Digital Pavilion and sign up for our programming workshop! You will have the chance to work with GE engineers to design and build your own program, then watch it come to life. A great workshop for everyone from enthusiastic programmers to computing novices.



4.45–5.45pm S025

How Special Is Our Solar System?

The Crucible

£7*

Over 3,700 planets have been discovered orbiting around other stars, and there could be as many as 100 billion in our galaxy. But what do we know about our own Solar System and what are the chances of finding another Earth-like planet? Looking at planets near and far, astronomer **Dhara Patel** asks – how special is our corner of the Universe?



5–6pm S026

Connected: Divided Our Wired World

The Cube

£7*

How is our increasingly connected world changing the way we live? Discover the digital technologies that are wiring our world from smart office buildings to power plants, as digital transformation enthusiast **Deborah Sherry** talks to **Dallas Campbell** about her mission to deliver the next industrial revolution.



6–7pm S027

Connected: Divided The Rise Of Extremism

The Pillar Room

£8*

The UK has seen a sharp rise in both far-right and Islamist violence, from hate-crime to devastating attacks that have claimed innocent lives. How much do we know about the psychology of extremism, and what are the triggers that put people at risk? Barrister **Hashi Mohamed** joins far-right extremism specialist **Vidhya Ramalingam** and terrorism expert **Andrew Silke**, as they examine the common characteristics of extremist behaviour and consider how we might better respond to and prevent radicalisation.

7.15–8.15pm S030

Should We All Become Vegan?

The Crucible

£9*

Many argue that cutting meat from our plates will not only improve our health, but will help save the planet from harmful emissions caused by animal farming. Chatham House's **Rob Bailey**, food climate research expert **Tara Garnett**, livestock sustainability adviser **Jude Capper** and chef and *The Angry Chef* author **Anthony Warner** deliberate over whether the surging number of vegans really do have the answer to our search for a sustainable, ethical and nutritious diet.

6–7pm S028

A Climate Of Change?

Cheltenham Ladies' College,
Parabola Arts Centre

£8*

Why is so little being done to secure the future of our planet? Around the world, a newly-engaged millennial generation is taking to the streets and to social media to demand change and a better future. The renowned environmental campaigner **Jonathon Porritt** explains why a sustainable world still seems such a difficult concept for our political leaders, and investigates the possibility that the next generation will succeed where we have failed.



6–7.15pm S029

Garden Wildlife Question Time

The Arena

£9*

Our gardens form a vital part of a vast living landscape, linking green spaces in towns and cities with nature reserves and the countryside. Join wildlife gardener **Kate Bradbury**, amphibian enthusiast **Jules Howard** and bug-botherer **Adam Hart** to find out how you can create a haven for wildlife in your own garden – with lots of time for questions.

Send your questions in advance to sciencequestions@cheltenhamfestivals.com

7.15–8.15pm S031

Is Your Tech Bad For You?

The Cube

£8*

Could you imagine a world without screen time? From mobile phones to social media, technology has transformed our lives beyond recognition. Yet our reliance upon digital devices is rarely out of the headlines, and concerns are frequently raised about the negative impacts of the tech we hold dear. Guest Curator **Olly Mann** is joined by online behaviour specialist **Adam Jinson** and other leading experts as they deliberate over the true implications of our dependence on all things digital for society's values, privacy and behaviour.



8.30–9.30pm S032

The Rise Of The Dinosaurs

The Pillar Room
£8*

We've heard the end of the dinosaur story – but what about its beginning? How did these prehistoric giants rise to dominate the planet for 150 million years? Join paleontologist **Steve Brusatte** to discover how a new generation of dinosaur hunters armed with cutting edge technology are piecing together the whole story.

8.30–9.30pm S033

Understanding Poverty

Helix Theatre
£8*

Headlines reveal millions of people are living in poverty in the UK. But what does being poor mean in the 21st century and how are individuals affected by their inability to afford to participate in society? Barrister **Hashi Mohamed** joins researchers **Joanna Mack** and **Suzanne Fitzpatrick** and economist **Stewart Lansley** to go beyond the hype and headlines to reveal the truth about poverty, homelessness and inequality.



8.30–9.30pm S035

Royal Society Michael Faraday Lecture Can Materials Science Save Us?

Cheltenham Ladies' College,
Parabola Arts Centre
£9*

Imagine a world in which buildings harvest their own energy, bridges repair themselves and the clothes you wear can make you live longer. In his landmark Michael Faraday Prize lecture **Mark Miodownik** argues that only a proper understanding of materials science will allow us to navigate the future successfully, bringing huge benefits to society as a whole.

THE
ROYAL
SOCIETY



8.30–9.30pm S034

Connected: Divided Boredom: The Upside Of Downtime

The Arena
£9*

When was the last time you daydreamed or had a truly empty weekend? In our hyper-connected society with a world of entertainment at our fingertips, we've been taught to fear boredom when it is in fact a vital catalyst for reflection, creativity and inspiration. Psychologist **Sandi Mann** shows us how to learn to embrace boredom and appreciate the upside of our downtime.

1-2pm

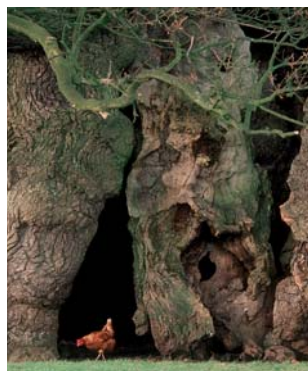
S036

The World's Strangest Brains

Cheltenham Ladies' College,
Parabola Arts Centre

£7*

From the man who thinks he's a tiger to the doctor who feels the pain of others, science writer **Helen Thomson** has spent years travelling the world tracking down incredibly rare brain disorders. Delving into the rich histories of these conditions and exploring the latest research, she considers how the brain can shape our lives in unexpected and, in some cases, brilliant and alarming ways. In discussion with **Dallas Campbell**.



2.15-3.15pm

S037

Our Ancient Woodlands

Helix Theatre

£7*

If trees could talk, they would say history was built on their branches. Full of character and sometimes centuries old, they are a legacy of how we've used the land and have been an economic necessity for generations. But why and how should we nurture the next generation of ancient trees? Join ancient tree enthusiast **Saul Herbert**, and landscape historian **Tom Williamson** for a lively discussion.



WOODLAND
TRUST

*Plus booking fee: charged at £2 per order.

THURSDAY 7 JUNE PLANNER

	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
The Arena							S041 WHEN WE GOT CROSSO WRONG		S040 THE SCIENCE OF MARVEL			S056 FRAMEAB INTERNATIONAL FINAL		
The Crucible							S040 THE HUMAN ANIMAL BOND		S048 WILL POWER HOLD YOU TO GUN EUP			S054 DEEP BRAIN SURGERY		
Helix Theatre					S037 OUR ANCIENT WOODLANDS			S042 THE TRUTH ABOUT FASTING		S052 PODCAST LIVE: THE WEIR UNWRAPPED				
The Cube								S043 THE BIRTH OF IVF		S051 SMART MATERIALS				
The Pillar Room							S038 THE TH TH MOBILE PHONES		S047 WHAT IS ADDICTION?			S055 A VERY VEGAN TASTING MENU		
ExpertTent									S044 CSI: CAN YOU CATCH THE DIAMOND THIEF?	S045 CSI: CAN YOU CATCH THE DIAMOND THIEF?	S046 CSI: CAN YOU CATCH THE DIAMOND THIEF?			
CLC Parabola Arts Centre				S056 THE WORLD'S STRANGEST BRAINS			S039 IS CYBER WAR THE NEW COLD WAR?		S050 SCIENCE AND SUPERHERO CELEBRATION			S053 THE SCIENCE OF SWEARING		

3.30–4.30pm S038

The Trouble With Mobile Phones

The Pillar Room
£7*

Whether we like it or not, mobile phones are an integral part of modern life. There are concerns about their effect on our health and worries that the mainstream technology all looks and acts the same. Could developments from the slums and townships of India, Kenya and South Africa inspire new technology? Computer scientist **Matt Jones** explores ideas and prototypes with the potential to change the way we think about our mobiles.



Swansea University
Prifysgol Abertawe

College of Science
Coleg Gwyddoniaeth

EPSRC

Engineering and Physical Sciences
Research Council

3.30–4.30pm S039

Connected:Divided Is Cyber War The New Cold War?

Cheltenham Ladies' College,
Parabola Arts Centre
£7*

From claims of Russian interference in the US election to the string of recent attacks launched by North Korea, there can be no doubt that the threat of cyberwarfare is growing. International security expert **Beyza Unal** and Professor of Cybersecurity **Sadie Creese** consider the catastrophic effects that would result from an attack on a nation's critical infrastructure, and explore how experts are working to defend against hostile actors in the virtual world.



3.30–4.30pm S040

Connected:Divided The Human-Animal Bond

The Crucible
£7*

Whether loved as family pets or providing therapeutic support, the role of animals in our lives can be traced right back to our ancient ancestors. Anthrozoologist **John Bradshaw**, Pets As Therapy Chair and former mental health nurse **Anne Clilverd** and her therapy dog **Cesc** explore the very special relationship that we share with the animals living among us.



3.30–4.30pm S041

Why We Got GMOs So Wrong

The Arena
£8*

Many across the globe still see genetically modified food as bad for their health or the environment. Journalist and environmental activist **Mark Lynas** was one of the original GM field wreckers – descending on trial sites of genetically modified crops at night to hack them to pieces. Join him to find out why he has made a complete U-turn and now champions their use.

4.45–5.45pm S042

The Truth About Fasting

Helix Theatre
£8*

Can banishing breakfast boost your metabolism? Could cutting calories increase concentration? Intermittent fasting is never far from the headlines, with many suggesting that going hungry for short periods can have a positive impact on your health. Join nutrition specialist **James Betts** and brain expert **Jeff Davies** as they discuss the latest research into metabolism and attempt to sort fasting-facts from fasting-fiction with **Ginny Smith**.

4.45–5.45pm S043

The Birth Of IVF

The Cube
£7*

In the year that the world's first test tube baby turns 40, we celebrate the pioneering technique that led to this moment. Andrologist **Allan Pacey** is joined by Chair of the British Fertility Society **Jane Stewart**, scientist **Kay Elder** and bioethicist **John Harris**, as they discuss how fertility treatments have advanced and developed and consider what the future holds for IVF.

With thanks to **Progress Educational Trust**

5.30–6.30pm S044
6.45–7.45pm S045
8–9pm S046

Workshop
CSI: Can You Catch The Diamond Thief?

ExperiTent
£10*

The Bear-Eye Diamond has been stolen from a safe in the Duchess of Goldthorn's bedroom and someone is missing! Can you help forensic scientists from the University of Wolverhampton crack the case? Try your hand at infrared analysis, blood pattern analysis and other forensic techniques in the race to identify the thief and kidnapper.



6–7pm S050

Science And Suffrage: A Centenary Celebration

Cheltenham Ladies' College, Parabola Arts Centre
£8*

The dark years of World War One led many extraordinary women to enter conventionally male domains, including science and medicine. To celebrate 100 years since some women first received the vote, historians **Patricia Fara** and **Sarah Richardson** join broadcaster **Vivienne Parry** to explore the legacy of the suffrage movement, and to celebrate those whose achievements and discoveries bravely paved the way for today's female scientists.



CHELTENHAM LADIES' COLLEGE

7.15–8.15pm S051

Smart Materials

The Cube
£8*

You've heard of smart phones, smart watches and even smart fridges. Now it's the turn of smart materials: solid objects that can react, sense, change and move in response to their environments. Embark on a smart materials safari with engineer **Anna Ploszajski** as your guide, find out what exists today and discover the futuristic material world of tomorrow.



6–7pm S049

Entertainment
The Science Of Marvel

The Arena
£10*

As the scientific advisor for movies including *Thor: Ragnarok* and *Avengers: Infinity War*, **Clifford V. Johnson** uses his knowledge of space travel, black holes and theoretical physics to help bring the Marvel Universe to life on the big screen. Join him as he explores what happens when the worlds of science and comic books collide in what is sure to be a blockbuster event.



6–7pm S047

What Is Addiction?

The Pillar Room
£8*

Coffee, chocolate, exercise, gambling, work, smart phones... they can all be described as addictive. But when do bad habits, cravings and excess become true 'addiction'? Is there such a thing as having an addictive personality? Psychologist **Mark Griffiths** uncovers the myths and mysteries surrounding addictive behaviour.

6–7pm S048

Willpower: How Not To Give Up

The Crucible
£8*

We often complain about having no willpower when it comes to eating healthily, doing more exercise or sticking to a budget. Sometimes it may seem all too easy to give up, but is there a better way to ingrain new behaviours so that we're more likely to make them habit? With psychologists **Chris Armitage** and **Ian Taylor**.



The British Psychological Society
 Promoting excellence in psychology

7.15–8.15pm S052

Current Affairs
Podcast LIVE:
The Week
Unwrapped

Helix Theatre

£8* This event is being recorded for the podcast. Latecomers may not be admitted.

Join Guest Curator **Olly Mann**, **Arion McNicoll** and **Rebecca Gillie** for a live podcast recording with special guest, geneticist and broadcaster **Adam Rutherford**. Delving into three important news stories that haven't had the attention they deserve, the team behind *The Week Unwrapped* digs below the headlines to discuss the issues that could affect our lives in years to come.



8.30–9.30pm S053

Entertainment
The Science of
Swearing

Cheltenham Ladies' College,
Parabola Arts Centre
£9*

Not only has some form of swearing existed since the earliest humans began to communicate, it has been shown to reduce physical pain and help stroke victims recover their language, benefiting us both physically and emotionally. **Timandra Harkness** joins swearsy scientist **Emma Byrne** to dig deeper into the fascinating facts behind F@#!, B*!#!*CKS and S*%£ in this hilarious defence of our most cherished naughty words.



8.45–10.15pm S056

Entertainment
FameLab
International
Final

The Arena
£10*

They are charismatic masters of rhetoric and really know their stuff: watch the world's best and brightest science communicators fight for the title of FameLab International Champion 2018 live at the Festival. Get your mind blown, roll on the floor with laughter and learn some new science facts as our finalists deliver their three-minute performances in front of a distinguished panel of judges. Hosted by **Quentin Cooper**.



8.30–9.30pm S054

Deep Brain
Surgery

The Crucible
£8*

Brain surgery is complex and at times dangerous. Combining neuroscience with hi-tech nanomagnets, **Mark Lythgoe** and his UCL team have devised a way of replacing surgeons with remote control nano-scalpels, automatically removing cancers, or altering the fine circuits that create our mind. Speaking about the technology for the first time, they test the boundaries of what is practical, possible, ethical or even desirable.

8.30–9.45pm S055

A Very Vegan
Tasting Menu

The Pillar Room
£15*

From dairy-free cheese and ice cream to seaweed caviar – whether you've gone meat free or are just curious about the alternatives, vegan foods can make a tasty addition to your diet. Try a range of innovative and delicious foods yourself with vegan chef **Day Radley** and astronaut **Stefan Gates** as your guides, in an event that is sure to leave your taste buds tingling.

With Thanks to



1-2pm S059

Resilience

The Crucible
£7*

Whether it's coping in a crisis or overcoming serious illness, we can gain valuable insights into resilience from those who are trained to perform in the face of adversity, stress and pressure in the most extreme conditions. Polar adventurer **Antony Jinman**, performance scientist and Olympic coach **Steve Ingham** and psychologist and neuroscientist **Elaine Fox** discuss the science behind succeeding when your mind and body are pushed to the limit.

2.15-3.15pm S060

How Predictable Are You?

Helix Theatre
£7*

What aspects of human behaviour can we predict? And how accurate can these predictions be? Psychologist **Bradley Love**, mathematicians **Hannah Fry** and **Aoife Hunt** and research scientist **Jonathan Beber** discuss what data can and can't tell us about ourselves – exploring the worlds of online dating, crime, crowd behaviour, shopping habits, terrorism and more.

3.30-4.30pm S062

High Blood Pressure And The Body

The Pillar Room
£7*

Affecting approximately 15 million people in the UK, high blood pressure can lead to a range of serious health conditions including heart disease and stroke if left untreated. **Mark Lythgoe** is joined by blood pressure monitoring specialist **Richard McManus** and other leading experts to discuss the latest research and advice, and to consider what individuals can do to help prevent or manage a diagnosis of hypertension.



3.30-4.30pm S064

Frank Close: A Life Scientific

The Crucible

£8* This event will be recorded for Radio 4's *The Life Scientific*. Latecomers may not be admitted.

In his 1983 best-seller *The Cosmic Onion*, physicist **Frank Close** introduced an entire generation to the idea of quarks, one of the elementary particles that make up matter. From neutrinos and antimatter to hadrons and 'glueballs', his work and writing has led to a better understanding of the foundations of the physical world. He talks to **Jim Al-Khalili** about his remarkable career as a particle physicist, science communicator and author.

4-5pm S065

Workshop Becoming A Chess Grandmaster

Cyber Zone

Free Places limited, unreserved seating

Whether you're a complete beginner or a champion player, join this session to discover how artificial intelligence is transforming the game of chess. Learn about the brand new chess strategies created by AlphaZero with just four hours of play. And then put its most creative moves to the test, guided by chess Grandmaster **Matthew Sadler** and Women's International Master **Natasha Regan**.



4.45-5.45pm S066

Life Inside The Hospital

Helix Theatre
£8*

In the corridors and consulting rooms, by the bedside and through the eyes of porters, junior doctors and consultants: in his new novel *Histories*, doctor and writer **Sam Gugliani** tells the powerful story of life in one hospital. He lifts the lid on the emotional and physical world of medicine and explores what it means to be a doctor.

2.15-3.15pm S061

Antidepressants: Are They The Answer?

Cheltenham Ladies' College,
Parabola Arts Centre
£8*

Antidepressant drugs receive a lot of bad press, with suggestions that they are ineffective, over-prescribed and that their use is based on biased research. Yet every day they help millions of people and can even save lives. Neuroscientist **Dean Burnett**, mental health expert **Ann John** and GP **Clare Gerada** explore whether we can lift the stigma attached to the use of this medication.

3.30-4.30pm S063

Connected: Divided Mapping The Human Journey

The Arena
£8*

Over the last 100,000 years, we have gone from the nursery of Africa to the people we are today – a journey that's seen us spread around the globe and morph from hunter-gatherers to farmers to city dwellers. Join anatomist **Alice Roberts**, geneticists **Adam Rutherford** and **Pontus Skoglund**, and archaeologist **Brenna Hassett** to explore how we are mapping our journey via cutting edge genetic research and studies of human remains from around the world.



4.45–5.45pm S067

How Safe Is Our Food Supply?

The Cube
£7*

One of the biggest threats to our food security is disease of our livestock and crops. Disease affects our economy and the availability of food in our shops.

Don King, Head of the World Reference Lab for Foot-and-Mouth Disease, chemical ecologist **John Pickett** and food systems researcher **John Ingram** join climate scientist **Tamsin Edwards** to explore the risks to the UK's food supply and how preventing and controlling these diseases keeps our store cupboards well-stocked.



4.45–5.45pm S068

Connected: Divided The Future Of Human Communication

Cheltenham Ladies' College,
Parabola Arts Centre
£8*

How will we socialise in the future? Thanks to advances in technology, it is as easy to talk to someone on the other side of the world as it is to speak to a neighbour. Yet despite its many benefits, concerns have been raised about the decrease of face-to-face interaction in our increasingly wired world. Professor of Social Interaction **Elizabeth Stokoe**, neuroscientist **Sophie Scott** and internet sociologist **Bernie Hogan** explore what the future of communication might hold with **Timandra Harkness**.



5–7pm S069

Careers Evening

Various Venues

Free Suitable for ages 14+

Tomorrow's science could be in your hands! Explore some of the amazing careers on offer in STEM with recent apprentices and graduates from EDF, GE, Hartpury College, the University of Gloucestershire and others. Whether you are considering GCSEs, A Levels, apprenticeships or degrees, discuss your aspirations and the different pathways available to fulfill them. Pick up an event map from our Box Office and discover four of our interactive zones.

6–7pm S070

Current Affairs Can Democracy Survive Social Media?

The Pillar Room
£8*

Facebook and Twitter have been labelled as minefields of misinformation, amplifying political divisions and disrupting democratic processes. Yet online activism can be an unstoppable force, holding those in power to account. **Quentin Cooper** joins political communications specialist **Natalie Fenton**, social media analyst **Carl Miller**, security expert and Bellingcat contributor **Dan Kaszeta** and freelance writer and Head of Product at Factmata **Martin Robbins** to consider whether democracy can be protected in the age of the internet, or if social media really spells its end.

6–7pm S071

Entanglement, Teleportation And Wormholes

The Arena
£10*

What does the quantum entanglement of particles have in common with the structure of space and time inside a black hole? Answer: wormholes. Maybe. **Jim Al-Khalili** explores this new idea, known as ER=EPR. It may well be wrong, but if right could turn out to be the fundamental idea in 21st century physics. So maybe it's just too delicious an idea not to consider!?

6–10pm S072

Capture-The-Flag: Hacking Challenge

Cyber Zone

£6* Ages 18+

Are you good at solving problems and cracking puzzles? Then come and test your skills in our Capture-The-Flag hacking evening. Work in teams to unravel cyber challenges ranging from easy to brain-busting, and win points as you attempt to top the leaderboard. Who will successfully solve the most challenges and leave victorious? Join us to see if you've got what it takes to become a Science Festival hacking champion.



6–7pm S073

The Truth About Exercise

The Crucible
£8*

10,000 steps every day, high intensity interval training – whatever your fitness goals, advice about exercise can be overwhelming. So what are the most effective ways to stay fit, healthy and motivated? Physiologist and Olympic trainer **Steve Ingham**, performance and clinical dietician **Renee McGregor** and exercise psychologist **Ian Taylor** cut the fads from the facts and share their top tips for workout success.



7.15–8.30pm S074

Pandemic Live

Helix Theatre
£8*

A deadly new virus has hit British farms and scientists are worried it may soon spread to humans. As this fast-changing situation develops, our panel need your help to decide what to do next. Virologist **Pip Beard**, entomologist **Simon Carpenter** and biofinance expert **Richard Hatchett** join mathematician **Hannah Fry** to navigate this worrying outbreak.



7.15–8.15pm S075

Born To Sum

The Cube
£8*

From Bob Dylan and Beyonce's algebraic song titles to Kate Bush's (near) perfect recital of pi to fifty decimal places, pop stars have been dropping maths references for decades. It just takes a certain kind of maths pedant to notice them – enter folk mathematician and 2016 FameLab UK Champion **Kyle D Evans** and his trusty guitar to lead you on a comedic musical tour.

7.15–8.15pm S076

Beyond Einstein: The Future Of Physics

Cheltenham Ladies' College, Parabola Arts Centre
£9*

Albert Einstein's theories about gravity, space and time have formed the backbone of physics for over a century. Experimental results seem to keep confirming his ideas – but theoretical physicists are raising questions and pushing for a rethink. Could Einstein have got it wrong? What could a new theory explain? **Andrew Pontzen** ponders this with theoretical physicist **Clifford Johnson** and cosmologists **Erminia Calabrese** and **Clare Burrage**.

7.30–9.30pm S077

Workshop The Maths Behind Board Games

ExperiTent
£12*



Want to brush up on your board game skills? Join marvellous mathematician **Katie Steckles** for a games night with a difference. Game theory, calculation, strategy and probability will all come into play (pun intended) as you shake, roll and move your way to victory. Try your hand at a selection of board games kindly provided by Proud Lion.



8.30–9.30pm S078

An Impractical Guide To Leaving The Planet

The Crucible
£9*

For almost all human history we have been firmly rooted to the Earth. But what if you want to get off? From the history of early rocket science to Elon Musk's wild plan to inhabit Mars, **Adam Rutherford** joins **Dallas Campbell** for some expert advice and eclectic space travel stories. For anyone who has looked up in wonder at the stars... and then wondered how to get there.



8.30–9.30pm S079

Current Affairs The Science Of Donald Trump

The Arena
£10*

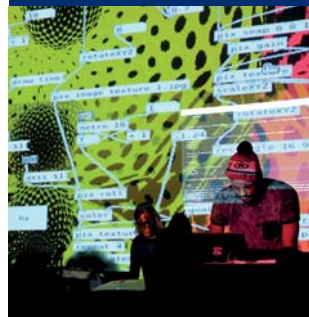
From hot-headed Twitter outbursts to his withdrawal from the Paris climate deal, Donald Trump's Presidency has changed the face of politics. Neuroscientist **Dean Burnett**, freelance writer and Head of Product at Factmata **Martin Robbins**, security specialist **Dan Kaszeta** and climate scientist **Tamsin Edwards** attempt to unravel the impact of Trump's personality and policies on our people, our planet and our global democracy with Festival Guest Curator **Oly Mann**.

8–10pm

Discover Zone, Cyber Zone & MakerShack Late Opening

Free no ticket required

Don't miss our special late opening for adults, the perfect opportunity for the curiously-minded to explore after hours. Grab a drink at the bar and drop in to try all the activities, without kids.



Algorave S080

The Pillar Room

Free no ticket required

The bar will be open during this event.

An Algorave is a party where electronic music is generated live from algorithms. The word was coined around 2012, initially as a joke, but has since taken hold with Algoraves taking place in over 40 cities around the world.

8.45–9.45pm
Drop in Live Coding

Computer programming is often portrayed as a solitary activity, but it can also be used to express yourself and build social connections through a shared experience of music. Drop in and have a go yourself.

10–11.30pm
Festival Party Night

Alex McLean, **Joanne Armitage** (from Algotabaz) and **Joe Wilk** write the code to make you dance, with **Antonio Roberts** on visuals.





11.15am–12.15pm S081

The Great Animal Escape

The Cube
£8*

From exotic parakeets in London and scorpions living in a Kent dockyard, to a freed army of frogs once used in pregnancy testing, the UK is home to some tenacious animals who aren't really meant to be here. Zoologists **Jules Howard** and **Hana Ayoob** share some of these animals' hilarious (but true) stories, and the tales of the humans responsible for their escape – and their survival.

11.15am–12.15pm S082

The True Cost Of Humans

Cheltenham Ladies College,
Parabola Arts Centre
£8*

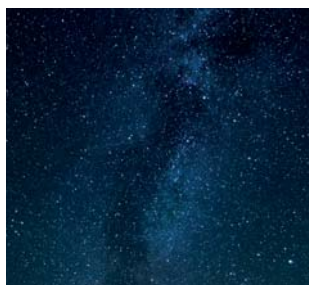
In 2018, few places on Earth remain untouched by us humans. What impact have we had on our planet and the living things we share it with? What lies in store for future generations? **Alice Roberts** leads a discussion between biologist **Adam Hart**, geographer and geologist **Mark Maslin** and ecologist and conservation scientist **Georgina Mace**.



*Plus booking fee; charged at £2 per order.

SATURDAY 9 JUNE PLANNER

	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
The Arena	SF01 THE SCIENCE OF SWEDIS		S083 HOW TO FIND DARK MATTER		S089 CHECKMATE		S093 THE DARK SIDE OF GENETICS		SF01 DENISE: THE FUTURE OF ALIEN SCIENCE					
The Crucible	SF02 MADRID'S MISS TO MARS		SF16 HOW DOES YOUR BODY WORK?		S090 THE HISTORY IN OUR GENES		S099 WHAT IS ATTRACTON?		S012 GRAVITATIONAL WAVES			S040 QUIR LIVE DNA IN THE DOCK		S008 SCIENCE FESTIVAL VARIETY NIGHT
Helix Theatre	SF03 RAINMEN -ANATOMY		S084 CONNECTIONS: BELIEF AND COMMUNITY		S091 THE GREAT FESTIVAL ART SECRETS		S097 THE SCIENCE OF SPECIMEN CONSERVATION		S014 AUTISM AND THE SENSES			S016 CAN SCIENCE EXPLAIN ART?		
The Cube		S081 THE GREAT ANIMAL ESCAPE			S088 THE GREAT FESTIVAL PUZZLE CHALLENGE		S096 THE ELEMENT IN THE ROOM		S015 THE SCIENCE OF GIN					
The Pillar Room		SF04 BUILD YOUR OWN UNIVERSE		SF13 BUILD YOUR OWN UNIVERSE										
ExpertTent		SF05 BUILD YOUR OWN UNIVERSE		SF14 BUILD YOUR OWN UNIVERSE										
Cyber Zone	SF04 CAPTURE THE FLAG: HACKING CHALLENGE				S087 CUBER WALKS		S093 BECOMING A CHESS GRANDMASTER		S094 BECOMING A CHESS GRANDMASTER					
CLC, Parabola Arts Centre		S082 THE TRUE COST OF HUMANS			S087 THE HAPPY BRAIN		S098 BUILDING A BETTER HUMAN		S103 FRANKENSTEIN					
CLC, Parabola Dance Studio	SF05 COLOURFUL GEMS IN THE	SF06 COLOURFUL GEMS IN THE	SF07 COLOURFUL GEMS IN THE											
Family Events	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm



12–1pm S083

How To Find Dark Matter

The Arena
£8*

One of the biggest unknowns in the Universe is dark matter. We believe it makes up a quarter of the cosmos but we have little idea about its real nature. How do we know it is there at all and what technologies are we developing to find it? Particle physicist **Jocelyn Monroe** joins cosmologist **Andrew Pontzen** and theorist **Doddy Marsh** to discuss their search for answers with **Jim Al-Khalili**.

12.30–1.30pm S084

Connected: Divided Connections: Belief And Community

Helix Theatre
£8*

What are the connections between structures of faith and the structures of society? Organised religion can tell us much about the evolution of social complexity: throughout history, patterns of belief have helped to hold communities together, shaping the way that people think of themselves as part of a collective identity. Anthropologist **Pieter Francois**, author and science teacher **Alom Shaha** and the Bishop of Gloucester, the Right Revd **Rachel Treweek** dig deeper into these patterns and explore how, with secularism now prevalent in modern society, we can maintain a sense of community both locally and globally.



1.30–2.30pm S085

Cyber Talks

Cyber Zone

Free no ticket required
Places limited, unreserved seating

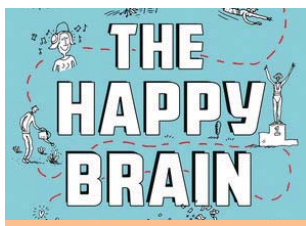
Grab a seat and hear from our leading experts about some of the hottest topics in the world of cyber.

1.30–3pm S086

The Great Festival Puzzle Challenge

The Pillar Room
£8*

Pit your wits against the clock in a fast and furious puzzle battle with puzzle ninja **Alex Bellos** and GCHQ's **Mike**. All ages welcome, top tips provided (but bring your own pencil and paper), participate yourself or just cheer others on. There's only going to be one Cheltenham Puzzle Champion. **Vivienne Parry** adjudicates.



1.45–2.45pm S087

The Happy Brain

Cheltenham Ladies College,
Parabola Arts Centre
£9*

Most of us will spend our lives in the pursuit of happiness. Neuroscientist **Dean Burnett** explores what it actually means to be happy, and whether lasting happiness is possible. Unravelling our complex internal lives, he reveals what love, sex, friendship, wealth, laughter and success actually do to our brains – and the often surprising truth behind what makes us tick.



1.45–2.45pm S088

Unmasking Art's Secrets

The Cube
£8*

From unmasking fakes to uncovering layers hidden for generations, cutting-edge science is helping to expose some of the art world's most exciting secrets. Join the Courtauld Institute's Head of Conservation and Technology, **Aviva Burnstock** and art historian **Martin Kemp**, as they explore science's crucial role in revealing the remarkable stories behind some of the world's most iconic paintings.



2–3pm S089

Checkmate: How AI Conquered Games And Why It Matters

The Arena
£9*

AlphaGo changed the game of Go with its creative strategies. Then an AI taught itself to play chess in just four hours, before beating the best chess-playing computer program with a completely new style of play. What do these feats tell us about how artificial intelligence could one day help humanity solve our most challenging and complex problems? **Demis Hassabis**, CEO of world-leading AI lab DeepMind, joins a panel to explore the role of games in developing creative AI.



2–3pm S090

The History In Our Genes

The Crucible
£9*

Every single one of us carries the history of our species in our genes – a tale of births and deaths, war and famine. Anatomist **Alice Roberts** and geneticist **Adam Rutherford** discuss how these hidden tales and the accompanying chapters in the genomes of the dogs, horses, crops and other species which have shaped us, are rewriting and uncovering our history.

2–3.30pm S091
4–5.30pm S092

Workshop Puzzling Pizza Party

Bottle of Sauce
£20*

Includes full-sized pizza from a set menu.

Fancy some puzzles and problem-solving with your pizza? Give your brain a workout with puzzle-mad mathematicians **Katie Steckles** and **Ben Sparks**. Their selection of pizza-themed puzzles will put your mind to the test: figure out the best way to slice your pizza, and make sure you get the last piece. Suitable for beginners as well as puzzle-aficionados.

3.30–4.30pm S093
4.45–5.45pm S094

Workshop Becoming a Chess Grandmaster

Cyber Zone

Free no ticket required
Places limited, unreserved seating

Whether you're a complete beginner or a champion player, join this session to discover how artificial intelligence is transforming the game of chess. Learn about the brand new chess strategies created by AlphaZero with just four hours of play. And then put its most creative moves to the test, guided by chess Grandmaster **Matthew Sadler** and Women's International Master **Natasha Regan**.

 DeepMind

4–5pm S095

The Dark Side Of Genetics

The Arena
£9*

Genetics has a dark history firmly entangled with eugenics colonialism, race and identity politics. Now cheap genetic tests, that can seem quite trivial, are fueling both neo-Nazis and the exploitation of Native Americans. **Adam Rutherford** offers a new and brighter side to genetics – as the only science that has triumphantly demonstrated that the concept of race has no scientific validity.



4.15–5.15pm S096

The Element In The Room

The Pillar Room
£8* *Suitable for ages 14+*

Do you like having your brain tickled with science? Want to know why it's impossible to rotate your right foot clockwise while you draw the number six with your right hand? If you just tried to do exactly that, join nerdy comedians **Helen Arney** and **Steve Mould** for an entertaining and science-y look at the stuff that's right in front of you.

 spirax sarco
Charitable Trust



4.15–5.15pm S097

Human Remains: The Science Of Specimen Conservation

The Cube
£8*

Join pathology technician, anatomy museum curator and Queen of the specimen jar **Carla Valentine** as she uncovers the fascinating process of preserving human remains. From the wax models used in anatomy lessons' past to the chemical conservation of modern-day specimens, she explores the science and cultural significance behind the preservation of organs.

4.15–5.15pm S098

Building A Virtual Human

Cheltenham Ladies' College, Parabola Arts Centre
£9*

One day your doctor could have a digital version of you in a computer. It could be dissected, probed and explored in unprecedented detail to work out what is wrong and to help choose the best treatments for you as an individual. **Roger Highfield** talks to **Peter Coveney**, **Ana Mincholé** and **Andrea Townsend-Nicholson** who are bridging the fields of human biology, chemistry and computational science to pioneer this technology.



4.15–5.15pm S099

Connected:Divided
What Is Attraction?

The Crucible
£9*

What attracts us to someone else? What is the difference between the spark you feel on a first date and long-term relationship potential? Mathematician **Hannah Fry**, research scientist **Jonathan Beber** and psychologist **Viren Swami** discuss whether science can help all those lonely hearts to find a perfect match.



5.30–6.30pm S100

Connected:Divided
Our Place In The Animal Kingdom

Helix Theatre
£8*

As humans, we hold the power to drive animal populations to collapse. But we can also protect and conserve them, and possibly one day even bring them back from extinction. Anthropologist **Alice Roberts**, science journalist **Gaia Vince**, zoologist **John Ewen** and author **Helen Pitcher** explore the complicated relationship we have with the animal kingdom.



6–7pm S101

Demis Hassabis: The Future Of AI And Science

The Arena
£10*

Artificial intelligence has the potential to change the world of science – by making new discoveries, solving complex problems and pushing the boundaries of existing knowledge. From drug discovery and disease pandemics to climate change, astronomy and material design, **Jim Al-Khalili** talks to co-founder and CEO of the world leading AI research company DeepMind, **Demis Hassabis**, about AI's huge potential for scientific breakthrough.



6.30–7.30pm S102

Gravitational Waves

The Crucible
£9*

The recent detection of gravitational waves and the confirmation of Einstein's century-old prediction, has marked the beginning of an exciting new era in Astronomy. From the black holes and neutron stars that produce them to the incredible experiments designed to detect them, **Sheila Rowan**, Director of the Institute of Gravitational Research, explores the nature of these waves and how they are being used to explore the universe like never before.



6.45–7.45pm S103

Frankenstein

Cheltenham Ladies' College, Parabola Arts Centre
£9*

A blood-curdling warning about the dangers of uninhibited scientific progress, Mary Shelley's *Frankenstein* remains the most celebrated horror story ever written. 200 years on from its publication, 'Prof of Goth' and Professor of English Literature **Nick Groom**, science writer **Jon Turney** and pathology technician and curator **Carla Valentine** explore the spine-tingling tale that continues to shock and inspire to this day.



6.45–7.45pm S104

Autism And The Senses

The Cube
£8*

Our senses put us in touch with the world around us, and through internal bodily sensations, such as those that guide hunger or fear, we are aware of ourselves. In autism, the outer senses like vision and touch can show enhanced sensitivity, but is this at a cost to inner awareness? Neuroscientist **Sarah Garfinkel** considers the new research that could change the way we think about the senses and autism.

7.30–9pm S105

The Science Of Gin

The Pillar Room
£18* Age 18+

Sip on a range of delicious gins as you delight your senses with the sights, sounds, smells and tastes of the gin-making process. From infusion to distillation, chemist **Andrea Sella** and materials scientist **Mark Miodownik** guide you through the fascinating art and science of gin, as they attempt to uncover the secret behind the perfect G&T.



8–9pm S106

Can Science Explain Art?

Helix Theatre
£9*

Whilst some argue that mathematics reveals why we're drawn to certain images, others protest that our reaction to art is driven by emotion and personal taste. So can science really solve the mystery of the perfect picture? Art historian and Da Vinci expert **Martin Kemp** and psychologist **Chris McManus** ponder this million dollar question with anatomist and keen artist **Alice Roberts**.



8.30–10pm S107

Jury Live: DNA In The Dock

The Crucible
£10*

A defendant stands accused in the courtroom. Are they guilty or not guilty? Presented with the evidence collected from the crime scenes of two murders, you, the Festival Jury, decide their fate. Back by popular demand and with brand new cases, judge for the evening **Quentin Cooper** is joined by DNA evidence expert **Georgina Meakin** and criminologist and forensics expert **Lisa Smith** to guide you through the forensic reports and offer their expert analysis.

8.45–10.30pm S108

Entertainment Science Festival Variety Night

The Arena
£15* Age 18+

Funny, entertaining and enlightening – climb aboard our Science Variety Night for late night laughs, songs and silliness, with some fascinating facts thrown in for good measure. Expect the unexpected with a fabulous lineup of guests to be announced. Hosted by the man who puts the angle in newangled, stand-up mathematician **Matt Parker**.



Family EVENTS



10–11am SF01

The Science Of Sweets

The Arena
£6* Ideal for ages 7+

Get ready for an explosive and bizarre journey into the science of sweets. BBC Gastronomist **Stefan Gates** and chemist **Andrea Sella** tear apart sweet chemistry, spin sugar and make amazing colours as they conjure up lollies, jellies and various chewy things for you to taste.



10–11am SF02

Maddie's Mission To Mars

The Crucible
£6* Ideal for ages 4+

Calling all budding space explorers! TV presenter **Maddie Moate** is looking for new recruits for her Astronaut Academy. Take a journey through our solar system, equipped with Maddie's special cameras and spacey science demos. Find out how rockets work, how space suits are made and what space smells like!



10–11am SF03
FrankenAnatomy

Helix Theatre

£6 * Ideal for ages 8+

In celebration of *Frankenstein's* 200th birthday, join mad anatomists from the **University of Bristol** and help them build a body from scratch. Embark on a hair-raising adventure and discover how our vital organs, bones, muscles and more work together to form a functioning human being. Expect brains, guts and more!

10am–12pm SF04

Capture-The-Flag: Hacking Challenge

Cyber Zone

£6 * Ideal for ages 11+

Do you love unraveling puzzles and solving problems? Then get ready for our hands-on Capture-the-Flag challenge. Have fun with computers and learn from experts in the cyber world as they guide you through challenges in small groups. Put your new skills in cyber security to the test as you work together to crack fun computer-based challenges using problem-solving and logic.



10–10.45am SF05
11.15am–12pm SF06
12.30–1.15pm SF07

Workshop
Colourful Chemistry

Cheltenham Ladies' College, Parabola Arts Centre, Dance Studio
 £6 * Ideal for ages 4+

Every child is an artist and a scientist. Join chemistry teacher **Rosie Coates** for a colourful, playful and hands-on art workshop. Explore how different pigments dissolve in different liquids, and how you can use these properties to create works of art.

10–11am SF08
11.30am–12.30pm SF09
1.30–2.30pm SF10

Workshop
Coder Academy

University of Gloucestershire Computer Studio, Park Campus

£8 * Ideal for ages 7+

Enrol in Coder Academy and get to grips with the wonderful world of programming! Prepare for a challenge as you learn snippets of the Scratch programming language and experiment with digital art with writer and coder **Sean McManus**. No previous experience of coding is required.

If you'd like to save your work, please sign up for a free account before the session at scratch.mit.edu

10–11am SF11
11.30am–12.30pm SF12
1–2pm SF13
2.30–3.30pm SF14

Workshop
Build Your Own Universe

ExperTent

£8 * Ideal for ages 8+

Get ready to build your own Universe with physicist **Ben Still**. Find out how our Universe evolved from a split second after the Big Bang to the formation of stars and the elements of the periodic table. Put your newfound knowledge of nature's building blocks and construction rules to the test as you create your own Lego® Universe.

11.15am–12.15pm SF15
Probability Games

The Pillar Room

£6 * Ideal for ages 11+

Roll up, roll up for some probability games! Join mathematicians **Katie Steckles** and **Zoe Griffiths** to learn how you can use maths to understand your chances of winning and maybe even increase them. There'll be prizes to be won as we flip coins, roll dice and even play the lottery. You have to be in it to win it!



12–1pm SF16

How Does Your Body Work?

The Crucible

£6 * Ideal for ages 4+

Discover how your body works with children's TV favourites **Maddie Moate** and **Dr Ranj**. Get ready for a brand new live show packed with music, laughter and some rather messy science demos. Armed with special cameras and stethoscopes, they'll take you on tour of the body exploring questions such as why our blood is red, what happens to our food and how our skeletons move.

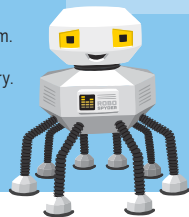
3–4pm SF17

Insects vs. Humans

Helix Theatre

£6 * Ideal for ages 8+

The insect world has had enough! The six-legged rulers of planet Earth have laid down the ultimate challenge to humankind – can we jump further than a grasshopper, beat a beetle in a tug-of-war or outwit a colony of ants? Join BBC Gastronom **Stefan Gates** and bug-bothering broadcaster **Adam Hart** to find out how we measure up.



10–11am S109
The 100,000 Genomes Project

Cheltenham Ladies' College, Parabola Arts Centre
£8*

The Human Genome Project and the even more ambitious 100,000 Genomes Project are revolutionising medical research, leading to new diagnoses of rare diseases and in time better and more effective treatments for cancer and many other diseases. **Tim Hubbard** and **Richard Scott** talk to **Vivienne Parry** about the learnings from these projects and the ways they are already transforming NHS practice.



11.15am–12.15pm S110

Entertainment
The Science Of Star Wars

The Crucible
£8*

Can you build a lightsaber? What is the Force? How powerful was the Death Star and is the Millennium Falcon the coolest spaceship ever? Star Wars fans are invited to join Jedi Master (or is that Sith Lord?) **Karl Byrne** as he answers these and more questions about the science from a long time ago, in a galaxy far, far away.

*Plus booking fee: charged at £2 per order.

SUNDAY 10 JUNE PLANNER

	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm
The Arena	SF20 VOICE SPEECH & LAUGHTER			S116 THE ART AND SCIENCE OF CONVERSATION			S117 BEYOND FUTURE OF ASTRONOMY		S124 HOW TO HACK A BANK LIVE			S130 WHAT DOES KNOW ABOUT YOU?		
The Crucible	SF21 A CATERER AND OTHER TINY THINGS	S110 THE SCIENCE OF STAR WARS		SF30 NATURE'S SECRET PRINCE	SF31 CYBER SECURITY SUPERHEROES			S122 THE ETHICS OF ARTIFICIAL INTELLIGENCE	S125 A RECIPE FOR A SIBERIAN	S128 OVER AMBITIOUS DEMO CHALLENGE				
Helix Theatre														
The Cube		SF29 PE & POO: A STINKY HISTORY			S114 ETHICS COMMITTEE LIVE			S126 THE SCIENCE OF FAIR BERGS						
The Pillar Room		S111 COMPUTER GENERATED MUSIC			S115 HOW TO HACK A HUMAN			S121 WHAT MAKES A MASTERPIECE?		S122 BEAM THERAPY				
ExpertTent		SF22 BUSY BEES		SF23 BUSY BEES	SF24 BUSY BEES			S123 HOW TO HAVE BETTER CONVERSATIONS						
Cyber Zone	SF18 HACKING AND CRYPTOGRAPHY	SF19 HACKING AND CRYPTOGRAPHY			S113 CYBER TALKS			S120 CYBER SURGERY: ASK THE EXPERTS						
CLC, Parabola Arts Centre	S100 THE 100,000 GENOMES PROJECT		S112 SPONES READ TO TAKE OFF?						S127 HOW FILM MAKES US FEEL			S121 HORN INCES CHAOS OF DELIGHT		
CLC, Parabola Dance Studio	SF25 BOMKERS ABOUT BETLES	SF26 BOMKERS ABOUT BETLES			SF27 BOMKERS ABOUT BETLES	SF28 BOMKERS ABOUT BETLES								
Family Events	10am	11am	12noon	1pm	2pm	3pm	4pm	5pm	6pm	7pm	8pm	9pm	10pm	11pm

11.15am–12.15pm S111

Computer Generated Music

The Pillar Room
£8*

From the computers using artificial intelligence to write folk music to the algorithms that are transforming live performance of electronic music, musical composition is truly changing in the technological era. Philosopher **Barry Smith** joins musicians **Oded Ben-Tal** and **Palle Dahlstedt** as they explore this unique and exciting field of computer generated music.



12.30–1.30pm S112

Drones: Ready To Take Off?

Cheltenham Ladies' College,
Parabola Arts Centre
£8*

Cheaper, faster and more mobile than piloted planes, drones have so many potential uses. They can deliver life-saving equipment, survey crops and habitats, provide internet to remote areas, allow repairs for buildings and bridges and even act as taxis. Engineer and drone pilot **Stephen Prior** talks to **Mark Miodownik** about new and creative ways of using and designing drones, and the huge potential for these unmanned aerial vehicles.

12.30–1.30pm S116

Connected: Divided The Art And Science Of Conversation

The Arena
£9*

Umm... ahh... ever been lost for words? Conversation analyst **Elizabeth Stokoe** knows precisely what makes conversations flow freely, and what leads to conflict and misunderstanding. From the verbs and grammar we use to the sound of our voice, she shows you how to steer a conversation in the right direction, how different ways of talking change the outcome of an encounter, and ultimately how to communicate more effectively.



4–5pm S123

Workshop How To Have Better Conversations

ExperiTent
£20* Price includes ticket to
Elizabeth Stokoe's talk S116.

For a more in-depth look at effective communication, join **Elizabeth Stokoe** for this workshop. Use real-life conversations and scenarios to identify the moments that can change the course of an interaction, test out her top tips and get chatting!

1.30–2.30pm S113

Cyber Talks

Cyber Zone

Free no ticket required
Places limited, unreserved seating

Grab a seat and hear from our leading experts about some of the hottest topics in the world of cyber.



1.45–2.45pm S114

Ethics Committee: Live

The Cube
£8*

Recent high profile legal cases involving parents and doctors who don't agree have highlighted the complexity of the heartbreaking decisions that have to be made in paediatric medicine. **Vivienne Parry** joins Medical Mediation Foundation Founder **Sarah Barclay** and **Katharine Wright** from the Nuffield Council on Bioethics, as they go through a case and ask – when should we stop treating sick children?

1.45–2.45pm S115

How To Hack A Human

The Pillar Room
£8*

Do you have a habit of using the same password online? Despite increasingly sophisticated defensive technology, hackers are targeting our human nature to gain access to sensitive data. Join **Jessica Barker** as she shares her best advice for staying secure online and considers why we are so often described as the weakest link when it comes to cyber security.

3-4pm

S117

Beyond Light: The Future Of Astronomy

The Arena

£9*

Traditional telescopes have been shedding light on the secrets of the Universe for centuries, but in the next decade they'll be joined by gravitational wave observatories, neutrino detectors and kilometre-sized radio receivers – with unprecedented capabilities.

Experts **Sheila Rowan**, **Linda Cremonesi** and **Emma Chapman** talk to **Andrew Pontzen** about why these approaches open extraordinary new windows on the cosmos – revealing answers, but posing even bigger questions for the coming decades.



3-4pm

S119

Pain In The Machine

Helix Theatre

£8*

What is pain, and could robots ever be able to truly 'feel' it? Could they ever experience other kinds of suffering, either physical or emotional, and might this prevent machines from hurting themselves and others? Showing her AHRC Best Research Film of the Year, *Pain in the Machine*, **Beth Singler** is joined by philosopher **Barry Smith** and cognitive roboticist **Murray Shanahan** to explore whether robots ever could, and should, feel distress and pain.



Arts & Humanities
Research Council



4-5pm

S121

What Makes A Masterpiece?

The Pillar Room

£8*

It's said that beauty is in the eye of the beholder. So why is it that Da Vinci's work sells for millions when an equally beautiful painting is only worth a fraction? Comedian **Robin Ince** ponders the psychological and cultural factors at play in the art world with psychologist **Chris McManus**, journalist and author **Georgina Adam** and former art forger **Shaun Greenhalgh**, whose fakes famously fooled the establishment before his imprisonment in 2007.

COTSWOLD LIFE

3-4pm

S118

Connected:Divided How Do We Stop Social Media Trolls?

Cheltenham Ladies' College,
Parabola Arts Centre

£8*

The internet can be a nasty place. What drives abusive behaviour online and should social media platforms be doing more to prevent it? MP **Jess Phillips**, who has received thousands of abusive threats, social media analyst **Jeremy Reffin** and psychologist **Catriona Morrison** discuss the impact this behaviour can have and how best to deal with social media trolls.



The British
Psychological Society
Promoting excellence in psychology

3.15-4.15pm

S120

Cyber Surgery: Ask The Experts

Cyber Zone

Free no ticket required

Places limited, unreserved seating

Ever wondered how you'd know if your emails had been hacked, how to keep your kids safe online, or your online banking details secure? Join our Guest Curators and leading cyber security experts **Jessica Barker** and **FC** as they offer practical advice and answer your questions in our Science Festival Cyber Surgery.

4.15–5.15pm S122

The Ethics Of Artificial Intelligence

The Crucible
£9*

New technologies have the potential to radically transform the world for the better, but may have uneven impacts that are hard to predict. How can we ensure that artificial intelligence is developed and deployed in ways that benefit all parts of society and serve the public interest? What are the potential risks and rewards of applying AI in the real world? A leading speaker discusses the challenges and opportunities that AI presents for people and society as a whole.



4.15–5.15pm S126

The Science Of Fatbergs

The Cube
£8*

Fascinating, shocking and downright disgusting, fatbergs are huge lumps of fat, oil, grease and rubbish that are clogging up the sewage system beneath our feet. Chemist **Andrea Sella** and pathology technician and curator **Carla Valentine** get up close and personal with a chunk of this monstrous mass, as they dissect a piece of fatberg live on stage and explore what this gruesome phenomenon can tell us about how we live today.



5.30–6.30pm S125

A Recipe For A Skyscraper

Helix Theatre
£8*

How have our buildings evolved from the mud huts of our ancestors to towers of steel reaching into our skies? Structural engineer **Roma Agrawal** takes you on a journey through the history of construction. Discover historic building projects, find out how our buildings are designed to stand strong in the face of nature's forces and meet some colourful characters along the way.

5.30–6.30pm S124

How To Hack A Bank: LIVE

The Arena
£9*

As an ethical hacker, cybersecurity expert **FC** regularly 'breaks into' hundreds of banks, offices and government facilities in the UK and Europe. Join him for a rollercoaster ride of lock-picking, kidnap, police chases and multi-million pound bank heists, as he demonstrates how his work is helping organisations to improve their security and protect against threats.



5.30–6.30pm S127

How Film Makes Us Feel

Cheltenham Ladies' College,
Parabola Arts Centre
£9*

Why do we become so immersed when watching a film? What is going on inside our brains and bodies to create this empathetic connection with the screen? How does the film industry use this to their advantage? Philosopher **Barry Smith** talks to neuroscientists **Vittorio Gallese** and **Sarah Garfinkel**, and film editor **Joe Walker**, whose credits include *Blade Runner 2049* and *12 Years a Slave*.



Arts & Humanities
Research Council

6.45–7.45pm S128

Proton Beam Therapy

The Pillar Room
£8*

Could particle accelerators like the Large Hadron Collider really help to cure cancer? An advanced form of radiotherapy, proton beam therapy enables specialists to target tumours with incredible precision, causing significantly less damage to surrounding healthy tissue. With two NHS proton beam centres set to open this year, physicist **Simon Jolly** sheds light on how this cutting-edge technique is helping to revolutionise treatment.

6.45–8pm S129

Entertainment
**Over Ambitious
Demo Challenge**

The Crucible
£9*

Steve Mould and Andrea Sella host our infamous annual contest to find the most spectacular, show-stopping science demos. Expect mind-bending tricks from **Ginny Smith**, mathematical mayhem from **Kyle D Evans** and colourful chaos from **Nate Adams** as they compete to become the 2018 champion – who gets your vote?



8.15–9.15pm S130

**What Does The
Internet Know
About You?**

The Arena
£9*

How much does Google really know about you? From reward cards to social media posts, data is used to profile our every habit and behaviour, sometimes without our knowledge. **Quentin Cooper** challenges ethical hacker **FC** and cybersecurity expert **Jessica Barker** to find out what information he has unwittingly shared on the web, as they explore the positives and negatives of our data-driven world with data ethicist **Brent Mittelstadt**.



8.15–9.15pm S131

Entertainment
**Robin Ince:
Chaos Of Delight**

**Cheltenham Ladies' College,
Parabola Arts Centre**
£10*

Robin Ince, Festival favourite and co-host of the Rose d'Or and Sony Gold-winning *The Infinite Monkey Cage*, returns with a brand new show about art and science: *Chaos of Delight*. Expect a frenetic hour of ideas and some stupid voices.

'Displays the art of brilliant babble'
★★★★ *The Scotsman*

**Family
EVENTS**

10–11am SF18
11.30am–12.30pm SF19

Workshop
**Hacking And
Cryptography**

Cyber Zone

Free ticket required. Ideal for ages 11+

Get ready to untangle riddles and crack codes with the **University of Gloucestershire**. Watch as 'white hat' hackers take control of a computer before your eyes, learn how messages are hidden from spies using cryptography and put your new skills to the test as you create your own secret messages and have a go at hacking yourself.



UNIVERSITY OF
GLOUCESTERSHIRE
at Cheltenham and Gloucester

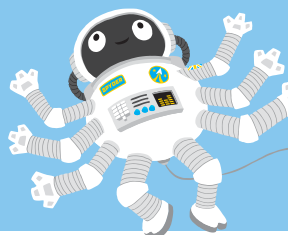
10–11am SF20

**Voice, Speech
And Laughter**

The Arena

£6* Ideal for ages 11+

Humans have a relentless need to communicate with each other. How do we use our words, voices, body language and even laughter to tell each other what we're thinking and feeling? Neuroscientist, comedian and 2017 Royal Institution Christmas Lecturer **Sophie Scott** explores the importance and variety of human communication, and how it has evolved.



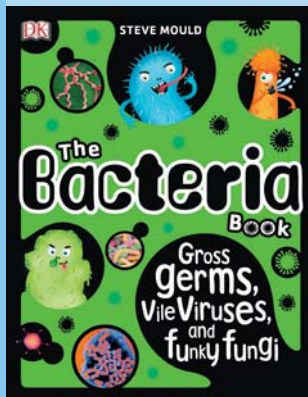
10–11am SF21

Bacteria And Other Teeny Tiny Things

Helix Theatre

£6* *Ideal for ages 6+*

What do squids that glow, fungi that grow and tiny creatures in the soil under your toes all have in common? They're all part of the awesomely weird world of microscopic life. **Steve Mould** introduces you to the bacteria, viruses, microbes and other teeny things that are all around us – but are too small for us to see. With live demos and experiments, find out how they keep us and our world running.



11–11.45am SF22
12.30–1.15pm SF23
2–2.45pm SF24

Workshop Busy Bees

ExperiTent

£6* *Ideal for ages 4+*

Back by popular demand, CBeebies presenter **Maddie Moate**'s stories about these buzzing little insects are the bees' knees! Find out how bees make their honey and learn how important foraging and pollinators are to honey production. Try some honey tasters, play silly games and be prepared for an epic waggle dance finale!



10–11am SF25
11.30am–12.30pm SF26
1.30–2.30pm SF27
3–4pm SF28

Workshop Bonkers About Beetles

Cheltenham Ladies' College,
Parabola Arts Centre, Dance Studio

£8* *Ideal for ages 6+*

Did you know creepy crawlies make up 25% of all animals on our planet? Or that there are 400,000 different species of beetles? Join author, illustrator and bug-lover **Owen Davey** for an introduction to the wonderful world of beetles. Grab a pencil and find out how to use simple shapes to draw a mighty Goliath Beetle and other bugs.



11.15am–12.15pm SF29

Pee & Poo: A Stinky History

The Cube

£6* *Ideal for ages 7+*

Pinch your noses shut and get ready to explore the stinky history of our sewers (and the smelly stuff inside them) with **Roma Agrawal**. Find out how the Romans built giant toilets, why Japan had a 'Turd Trade', what London's year of the 'Great Stink' was all about and how massive new engineering projects are keeping our water safe and clean.



12.30–1.30pm SF30

Nature's Secret Patterns

Helix Theatre

£6* *Ideal for ages 10+*

Nature's palette of patterns can be intricate, beautiful and mysterious, from spiralling sunflower seeds to planetary harmonies. Our **2007 FameLabbers** return with their infamous live experiments and demonstrations to explore the origins of these patterns, why they share common themes and the artistry of nature.

1.45–2.45pm SF31

Cyber Security Superheroes

The Crucible

£6* *Ideal for ages 12+*

The internet can be a battleground between the cyber criminals trying to exploit our information, and the people trying to keep us safe. Hear from one of these cyber security heroes, **James Lyne**, as he demonstrates the latest technology the bad guys are using through a live hack on stage. Do you have what it takes to join the fight?



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* Walk-up only, valid on the day of the event and subject to availability.

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Phones are open Tuesday – Friday, 10am–5pm



Before the Festival: Pop-up Box Office at The Wilson (Clarence Street, GL50 3JT);
Wednesday 11 – Friday 13 April & Tuesday 17 – Thursday 19 April, 10am–2pm.

Please note that on Wednesday 11 April 10am–1pm Patrons only booking; 1pm–2pm Members booking. Members and Public on sale dates and times below. Box Office opening times are subject to change, for details please visit cheltenhamfestivals.com/booking

During the Festival: Festival Site Box Office, Imperial Square, Cheltenham, GL50 1QA

For queries email boxoffice@cheltenhamfestivals.com

For full details about Box Office opening hours, in person and telephone ticket sales, booking fees, terms & conditions and Membership, visit cheltenhamfestivals.com/booking

Special Access Requirements

Please book using our online form which will be available from 11 April at cheltenhamfestivals.com/access-requirements

Booking Dates

Members' Priority Booking From 1pm, Wednesday 11 April 2018

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Cheltenham Festivals Gift Vouchers may be purchased at our Box Office or online at cheltenhamfestivals.com/gift-vouchers and may be redeemed against ticket or Membership purchases online, in person or by phone.

Getting to Cheltenham Science Festival

Cheltenham is easily accessible from all over the UK, by road and rail.

Most events take place on the main Festival site, located in central Cheltenham on Imperial Square (GL50 1QA). For more information on public transport and car parks go to cheltenhamfestivals.com/your-visit

Festival Venues

Imperial Square (including Festival Box Office, The Arena, The Crucible, Helix Theatre, The Cube, ExperiTent, MakerShack and Cyber Zone) **GL50 1QA**

Cheltenham Town Hall (including the Discover Zone and Pillar Room) **GL50 1QA**

Cheltenham Ladies' College, Parabola Arts Centre **GL50 3AA**

University of Gloucestershire, Computer Studio, Park Campus (Room WW001) **GL50 2RH**

The Bottle Of Sauce, Ambrose St, Cheltenham **GL50 3LH**

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