



26th April 2017

science4
Transformation
showcasing exciting careers in science



#science4u2017

The 14th Annual Schools Science Conference
Presented by science4u.info
in collaboration with University of Westminster

Science for Transformation

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Welcome!



Introduction

We are delighted to see you at our 14th Annual Schools Science Conference **Science for Transformation**

On behalf of the organising group we hope that you find this conference an exciting and informative day. Scientists and Healthcare Professionals from all over London have put together an exciting programme of interactive displays, talks and workshops about what they do. Each one of them is keen to share with you what they find fascinating about science and their profession. Make sure you ask them lots of questions. We want you to leave the conference with a better understanding about some of the many varied and interesting science based careers so that you can begin to plan for your own future and, hopefully, you might want to join us!

We are delighted this year that the **University of Westminster** has again graciously offered to host the **science4u** schools day. They have lent us use of their facilities, many of their staff are participating in the programme and the secondary school students will experience what a university environment is like. We are also grateful to **The Royal College of Pathologists** (RCPATH) for again supporting this event and are delighted they are running the workshop **Transforming Pathology**. We would also like to thank all our sponsors and supporters who enable us to provide this event.

The theme, **Science for Transformation**, was chosen as there is a real emergence of new therapies that are making national headlines (eg genetically modified immune cells to treat cancers) that are transforming our approach to patient treatment.

Throughout the day, please refer to the programme paying particular reference to start times for each of the events. Sticking to the programme times will help the day run smoothly. There will be lots of things for you to collect as you go round the exhibits and a number of prizes given out throughout the day. Be aware that the equipment is there to let you try to use it and that not everything is for you to take away. Please ask before taking anything.

To win a prize:

Remember to hand in your completed evaluation form (Green form) before the Keynote speech to enable you to enter the Prize Draw.

After the event, see the conference website **science4u.info**:

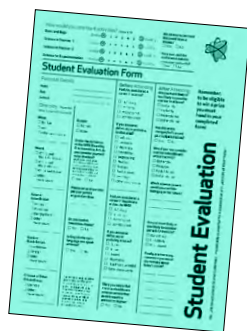
- Tour the **Virtual Laboratory** and learn more about science
- Access the **Conference Quiz** to test yourself on how much you learnt at the event!
- Enter the **Reporter Competition**
- See pictures taken at the conference

Wishing you an enjoyable and worthwhile day!

Best wishes

Kimberly Gilmour & Stuart Adams

Kimberly Gilmour & Stuart Adams
Chairmen of the Organising Committee





Annie Bligh

We are very excited about the theme of this year's conference: **Science for Transformation**.

The world has transformed radically since 1838, when the **University of Westminster** first started showcasing the technologies and educating the scientists, for careers that can improve the world we live in.

Science has been the agent of this transformation allowing people from quite different cultures and traditions to work together to solve the problems that increasingly we all share. At this University, as a research chemist I, for example, collaborate with colleagues in Shanghai to apply the rigour of modern science to the analysis of traditional Chinese herbal medicines in order to secure safe and effective therapies.

A world in transformation is a challenging one, holding so many exciting opportunities for you.

Coming from a non-academic background in Hong Kong - my parents left school before they were ten - I know that developing a passion is all.

We hope today helps you develop yours – please enjoy the day and keep in touch.

Annie Bligh

Professor Annie Bligh BSc PhD CSci CChem FRSC
Dean
Faculty of Science and Technology
The University of Westminster

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Clare Elwell

Professor of Medical Physics
Keynote speaker

Head of Near Infrared Spectroscopy Group,
Biomedical Optics Research Laboratory,
Department of Medical Physics
and Bioengineering, UCL

Clare Elwell studied Maths, Physics and Chemistry at A' Level and initially had her sights on a career in medicine but lingering concerns about her dislike for biology, chemistry and writing essays did make her question whether she would actually enjoy medical school. Whilst on a summer school for sixth form science students she attended a lecture on Medical Physics and learnt for the first time about how integral physics and engineering are to so many areas of medicine. This was her 'light-bulb' moment and she returned from the summer school with a new career aspiration. Although her school careers advisor had never heard of Medical Physics she found an undergraduate course in Physics with Medical Physics at Exeter University. After finishing her degree in 1988 she started work as a Clinical Physicist at the local hospital where she also completed an MPhil on sleep related breathing disorders. She joined University College London as a research assistant in 1991 and completed her PhD in the Department of Medical Physics and Bioengineering in 1995. Her research involves the development and application of novel optical methods for investigating the human brain. She gained an MRC Fellowship in the same year that she became pregnant with her first child and returned to work part time (0.6FTE). Whilst on extended maternity leave with her second child she was awarded a lectureship, taking up the post on continued part time status in 1999. She was promoted to Senior Lecturer in 2005 and increased her hours to 0.8FTE. She continued to build a successful multidisciplinary research team using near infrared spectroscopy techniques to investigate acute brain injury in adults, neurodevelopment in young infants and neurological consequences of cardiothoracic procedures. She was promoted to Professor in 2008 and continues to work part time (0.8 FTE).



Organising Group 2017

Don Henderson (Founder)

Kimberly Gilmour (Chair)

Great Ormond Street
Hospital For Children
NHS Foundation Trust

Sue Alexander (Secretary)

The Royal Marsden
NHS Foundation Trust

Manfred Almeida (Treasurer)

Imperial College Healthcare
NHS Trust

Stuart Adams

Great Ormond Street
Hospital For Children
NHS Foundation Trust

Sarah Armstrong

The Royal Marsden
NHS Foundation Trust

Mike Carter

Public Health England

Paul Hampson

University of Westminster

Patrick Lees

University of Westminster

Ayuen Lual

Public Health England

Amaka Nwagbara

The Royal College
of Pathologists

Maria Rossini

British Science Association

Sharon Gage

(Event Organiser)

SRG Project Management



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Programme

science 4 Interaction

Interactive workshop
Presented by the Royal College of Pathologists

Transforming Pathology



Did you know that pathology is involved in over 70% of diagnoses in healthcare? In this practical workshop you will learn about the current innovations transforming pathology and how pathologists are involved in the prevention, diagnosis and treatment of disease.



The Royal College of Pathologists
Pathology: the science behind the cure

Interactive exhibits
Exploring how the body works

Science in Practice



2 hands-on interactive sessions where you meet scientists, try out some scientific equipment, undertake scientific assessments, answer questions for prizes and learn how science is applied to healthcare. AND don't forget to ask scientists what they do and why they love their jobs.

See the **Big Quiz** on subsequent pages and ask these questions as you meet appropriate experts.

Programme



11:20 **Group 1** 14:00 **Group 2**

Workshop Youth Grand Challenges
Presented by Jane Dowden, British Science Association

Teachers' Workshop

Drawing on the BSA's 30 years' experience in running CREST awards we will share best practice for running inspiring and challenging science projects. Try out hands-on stimulus activities from our brand new Youth Grand Challenges and reflect on ideas for open ended investigations they could lead to.



Science for Transformation

Scientists have been using **Gene Therapy** to correct faulty genes in rare human diseases for over 2 decades now. The process is complex

and most of the difficulties have involved the method of getting the correct version of the gene into the cells that need it. Now a new

tool has come to the aid of scientists working in the cutting edge field of **Gene Therapy**. This tool is called **CRISPR**; a naturally-occurring,

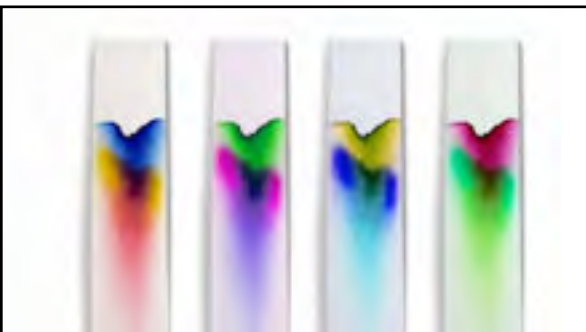
ancient defence mechanism found in a wide range of bacteria.



Interactive event

Presented by University of Westminster

The Science of You



Whether you know if or not, you are a living, breathing work of science. **The Science of You** will demonstrate, through a number of interactive stands, how each of us is a product of the science that is constantly occurring within and around us. Increasing our understanding of nutrition, health, materials, biology and medicine will help us know more about ourselves.

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science4 Experimentation

Workshop

Young Scientists present their own work



Prior to today's event we asked you to undertake a research project that you will present to the other schools in your group. All presentations will be competing for **The Association for Clinical Biochemistry & Laboratory Medicine Trophy for the Don Henderson Award**. The award will be presented at the end of the day.



The Association for Clinical Biochemistry & Laboratory Medicine

Keynote Speech

Shedding Light on the Human Brain

In this talk our keynote speaker, Clare Elwell, Professor of Medical Physics, will show how cutting edge innovations in physics and engineering are transforming how, when and where we can image the human brain.



Science for Transformation





Can your school succeed in The Big Quiz?

The Big Quiz

1 How many chromosomes does a human have?

- A 23
- B 44
- C 46

2 What is the age of consent to be a bone marrow donor?

- A 16
- B 18
- C 21

3 Why are cell therapy and gene therapy procedures carried out in a closed system?

- A To protect the scientists doing the work
- B To ensure the cells are sterile
- C To stop mutant cells escaping!

4 Radiotherapy uses X-rays to treat cancer?

- A TRUE
- B FALSE
- C I don't know

5 Radiotherapy is effective in cancer treatment?

- A TRUE
- B FALSE
- C I don't know

6 Therapy Radiographers and Diagnostic Radiographers do the same job?

- A True
- B False
- C I don't know

7 Which Austrian biologist and physician identified the ABO blood group system in 1901?

- A Charles Darwin
- B Gregor Mendel
- C Karl Landsteiner

8 How many blood group systems have so far been classified by The International Society for Blood Transfusion (ISBT)?

- A 36
- B 3
- C 20

9 Which blood group is considered to be the "universal donor" for transfusion to patients in an emergency?

- A O D positive
- B AB D Negative
- C O D negative

10 Approximately how many people are on the UK national transplant kidney waiting list?

- A >54
- B >540
- C >5,400

11 Do a kidney transplant patient and donor need to be blood group compatible?

- A Yes
- B No
- C Sometimes

12 Why is a crossmatch needed before a kidney transplant can take place

- A To prevent the kidney being rejected
- B To ensure the patient and donor are compatible
- C A and B

13 What is microbiology the study of?

- A Bacteria and Viruses
- B Yeasts and Moulds
- C All of the above

14 Are all bacteria, yeasts, moulds and viruses bad for you?

- A Yes
- B No
- C Some are good, some are bad, some may have no affect

15 What are bacteria grown on in the laboratory?

- A In water
- B Agar plates
- C Glass slides

16 What does CPAP stand for?

- A Constant Pressure Applied to the Patient
- B Critical Pulmonary Arterial Pressure
- C Continuous Positive Airway Pressure

17 What is obstructive sleep apnoea?

- A Pauses in breathing during sleep caused by obstruction of the upper airway
- B When the nerves to your lungs are blocked
- C When you are unable to fall asleep due to environmental distractions (eg tv)

18 What does spirometry measure?

- A How much you weigh
- B The amount and/or speed of air that can be inhaled and exhaled
- C Your heart rate

19 Why do we randomise patients to their treatment allocation in a clinical trial?

- A To reduce bias
- B Fairest way of deciding who gets which drug
- C So that patients don't know which drug they're taking

20 The commonest element in the Earth's crust is

- A Iron
- B Silicon
- C Oxygen





Science for Transformation

As far as back the 1980s, scientists observed a strange pattern in some bacterial genomes. One DNA sequence would

be repeated over and over again, with unique sequences in between the repeats. They called this odd configuration **Clustered Regularly**

What advances are transforming our approach to patient treatment?

Interspaced Short Palindromic Repeats, or CRISPR. This was all puzzling until scientists realised the unique sequences in between

the repeats matched the **DNA** of viruses — specifically viruses that prey on bacteria.



As you travel around the exhibits, find an appropriate expert to speak with to find the answers

21 Why are moths and other nocturnal insects attracted to bright lights at night such as porch lights or headlamps?

- A Because they navigate using artificial lights
- B Because they are confused by the lights as they fly by and think it might be the Moon
- C They are attracted by the heat given off by the lights

22 Most of the iron in my body is in

- A Muscles
- B Liver
- C Red blood cells

23 What is the main purpose of a phase 3 clinical trial?

- A To test the safety of the drug in healthy volunteers
- B To test the safety and efficacy of the drug in a small number of patients
- C To assess the efficacy of the drug in a wide patient population

24 Who should usually analyse the data from a clinical trial?

- A The data manager
- B The statistician
- C The clinical investigator

25 What is Engineering?

- A Using science & technology to build something new
- B Using science & technology to solve problems and support society
- C Using science & technology to fix a vehicle

26 What is the name of the ligament that runs diagonally in the middle of the knee?

- A Anterior cruciate ligament
- B Coracoclavicular ligament
- C Deltoid ligament

27 What is a stent?

- A Flexible feeding tube that is placed through the abdominal wall and into the stomach
- B Thin tube made from medical grade materials serving a broad range of functions
- C Small mesh tube that's used to treat narrow or weak arteries

28 What is the length of human DNA in a single cell?

- A 10 meters
- B 6 meters
- C 2 meters

29 What is the largest chromosome?

- A Chromosome 1
- B Chromosome 10
- C Chromosome X

30 When a gene is 'expressed' it is

- A Transported around the body to make proteins
- B Used as a blueprint to assemble the protein it codes for
- C Passed on from parents to children

31 How many chambers are there in the heart?

- A 2
- B 4
- C 5

32 Which valve is located between the left atrium and left ventricle?

- A Mitral (bicuspid valve)
- B Tricuspid valve
- C Aortic valve

33 Which chamber is responsible for pumping blood to the lungs?

- A Right atrium
- B Left ventricle
- C Right ventricle

34 Which types of disease/ conditions might parasites be used to treat?

- A Malnutrition
- B Allergies
- C Anaemia (low blood haemoglobin)

35 Which of these is considered to be a simple sugar?

- A Glucose
- B Starch
- C Lactose

36 Which of these drinks has the lowest amount of sugar?

- A Fruit Juice
- B Lemonade
- C Milk

37 How many teaspoons of sugar does the average UK person eat every week?

- A 10
- B 85
- C 140

38 What is the correct ratio for ventilations to compressions in an adult

- A 5 compressions 20 ventilations
- B 30 compressions 2 ventilations
- C 20 compressions 2 ventilations

39 What does the B stand for in DR ABC

- A Bleeding
- B Baby
- C Breathing

40 Which exposure will give the highest radiation dose?

- A A two week holiday in Cornwall
- B A banana
- C A chest X-ray

The Big Quiz

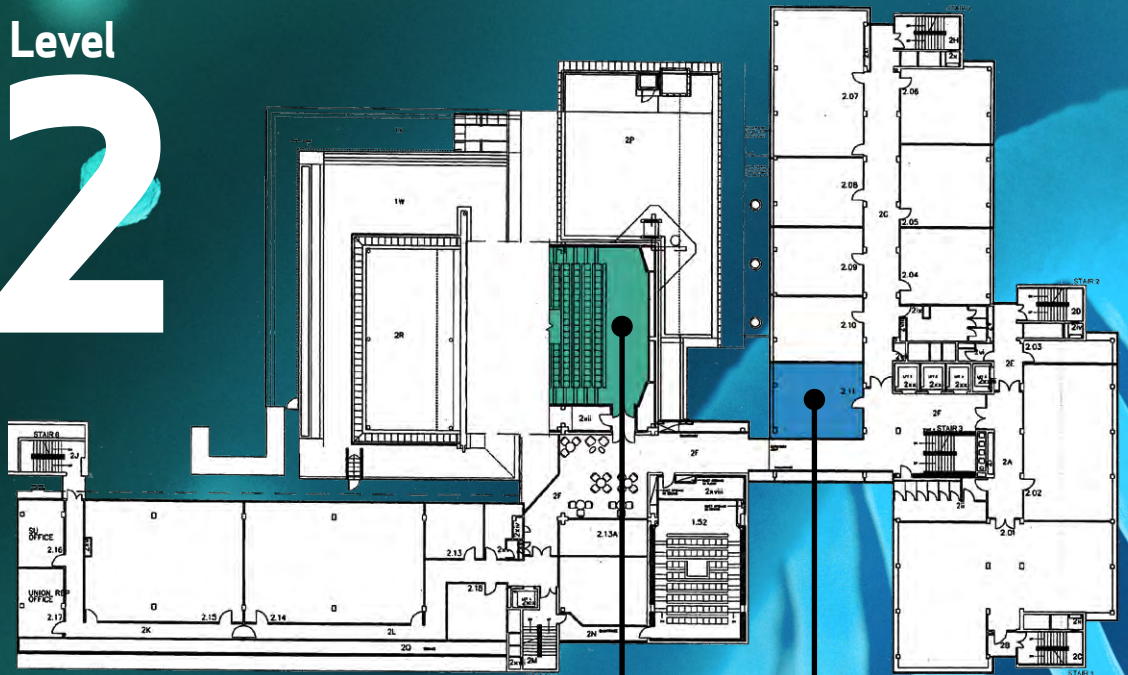
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Floorplan

Level

2



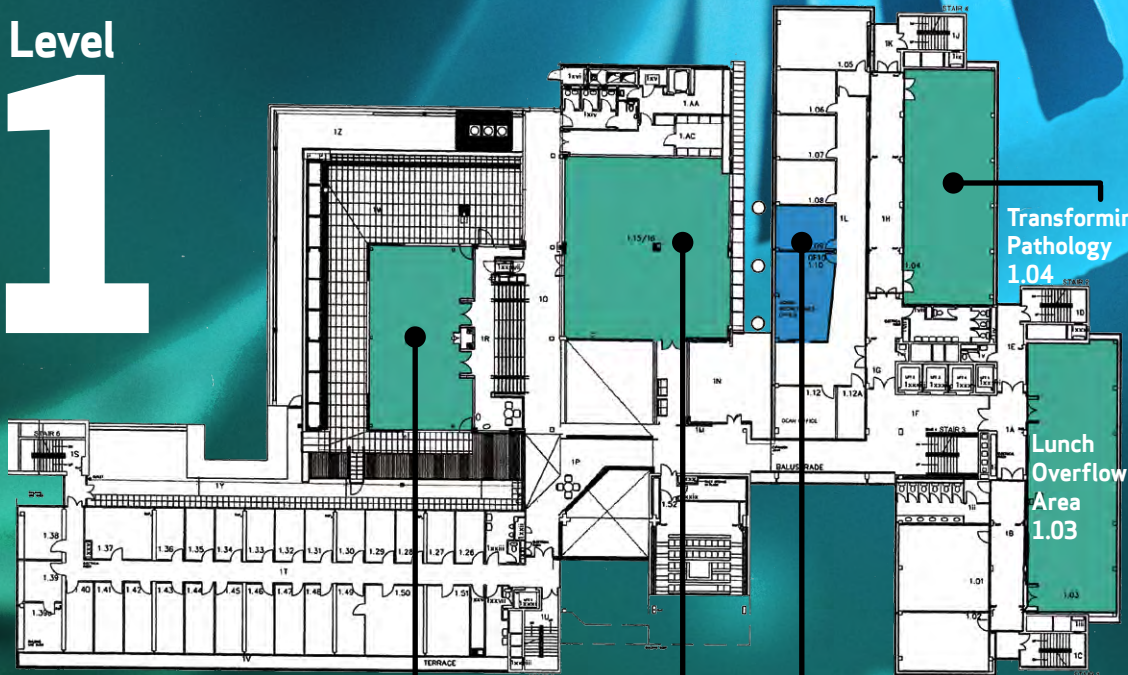
Introduction, Science for Experimentation, Keynote speech
 Large Lecture Theatre

Teachers' Workshop
 C2.11

Level

1

Floorplan



Science of You
 The Pavilion

Science in Practice - 1
 1.15/1.16

Teachers'/Volunteers'
 Tea & Coffee 1.04

Transforming Pathology
 1.04

Lunch Overflow
 Area 1.03





Science for Transformation

It turns out **CRISPR** is one part of the bacteria's immune system, which keeps bits of dangerous viruses around so it can

recognise and defend against those viruses next time they attack. The second part of the defence mechanism is a set of enzymes called

What advances are transforming our approach to patient treatment?

Cas (CRISPR-associated proteins), which can precisely snip DNA and slice up invading viruses. Conveniently, the genes that encode

for **Cas** are always sitting somewhere near the **CRISPR** sequences.



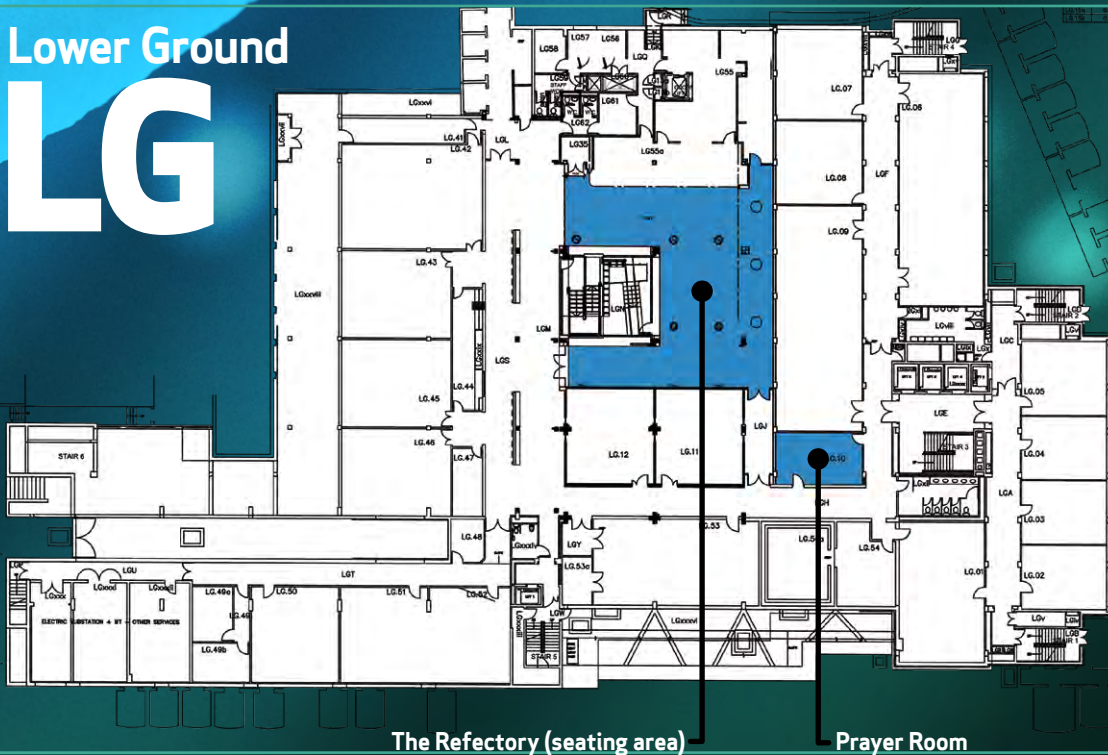
Ground

G



Lower Ground

LG



Floorplan

After the conference...

science4u.info

If you've enjoyed the conference, then visit the science4u.info website

View photographs of the event, see how much you learned today by trying the 2017 Quiz, tour the Virtual Laboratory, take part in *Battle of the Devices* and submit your Conference Report.

Reporter Competition

Simply write a report (500 to 1000 words) describing today's event.

Entries will be published on the website and the best report will win a prize! The report should include what you found exciting and interesting and what might inspire you to continue to study science or to take up a healthcare profession.

Closing date 5th May!

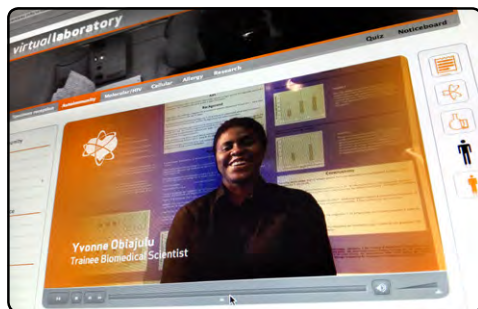
Battle of the Devices

Each year, millions of patients find their lives are changed or saved by medical technology. Our experts go head-to-head to try to convince you that their chosen medical device is the most innovative technology in healthcare today. Who deserves to win the **Battle of the Devices**? You decide.

Virtual Laboratory

If meeting and speaking with scientists has got you interested in a career in science then tour the Virtual Laboratory.

- Try your hand at diagnosis
- See a wide range of immunology tests
- Discover what it is like to be a scientist in a number of video interviews!



westminster.ac.uk

UNIVERSITY OF WESTMINSTER

University of Westminster Faculty of Science and Technology

It may be early days for you to decide about a career but not for developing your interests.

Opportunities change fast, particularly in London where business drives and is driven by technology - only a small number of professionals have job titles as recognisable as doctor or lawyer but there are many more which you may not be aware of. We can help you keep yourself informed about the many opportunities and possible career paths that there are, in the rapidly changing sciences.

Our central London site is dedicated to the teaching and research of Science and Technology where we offer a full range of professionally certified courses in:

**Biomedical Sciences Biosciences
Business Information Systems
Complementary Medicine Computer and Network Engineering
Computer Science and Software Engineering Computer Systems and Robotics Electronic Engineering
Multimedia and Games Computing
Nutrition Pharmacology Psychology**

We aim to find the best ways for you to become effective in your chosen area: being able to think, communicate, innovate and influence positively with opportunities to work creatively with your colleagues in our technologically advanced spaces or, if you chose, in a relevant external organisation.

Check out our website: www.westminster.ac.uk, take the online virtual tour, come to an open day, and ask your teacher if you would like us to customise a visit for students in your school.





Science for Transformation

CRISPR allows scientists to edit genomes with unprecedented precision, efficiency, and flexibility. The past few years have seen

a flurry of firsts with CRISPR, from creating monkeys with targeted mutations to preventing HIV infection in human cells. Chinese scientists

What advances are transforming our approach to patient treatment?

announced they applied the technique to nonviable human embryos, hinting at CRISPR's potential to cure any genetic disease.

And yes, it might even lead to designer babies...



Acknowledgements & thanks

Thanks to the following organisations and their staff for this year's event

- Barts Health NHS Trust
- British Science Association
- GlaxoSmithKline
- Great Ormond Street Hospital for Children NHS Foundation Trust
- Guy's and St Thomas' NHS Foundation Trust
- Institute of Biomedical Science
- Institute of Cancer Research Clinical Trials and Statistics Unit
- King's College Hospital NHS Foundation Trust
- London Ambulance Service NHS Trust
- London Metropolitan University
- London School of Hygiene & Tropical Medicine, Faculty of Infectious and Tropical Diseases
- NHS Blood and Transplant
- Plymouth Hospitals NHS Trust
- Public Health England
- Royal College of Anaesthetists
- Royal Marsden NHS Foundation Trust
- Royal Microscopical Society
- School of Engineering and Materials Science, Queen Mary University of London
- St George's University Hospitals NHS Foundation Trust
- The Association for Clinical Biochemistry and Laboratory Medicine
- The Royal College of Pathologists
- University College London
- University of Westminster

Science for Transformation has been made possible thanks to the very generous support of our key sponsors

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Gold



The Westminster Almshouses
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Silver

Thanks also to the following organisations for their generous support



PHILIPS



Supporters



Printed on 100% recycled paper using vegetable oil based ink

Acknowledgements



Programme Timetable

Smooth running



Please refer to the programme times to help the day run smoothly

A steward will accompany your group around the venue and help direct you to the appropriate areas

Timetable

Group 1

10:00 **Welcome & Introduction**
Large Lecture Theatre Level 2

10:10 **science4interaction**
In your colour-coded groups work through the 4 rooms containing these 4 interactive sessions
Be sure to ask questions to complete your quiz
Follow your steward and change rooms when asked; you have 35 mins in each room

Science in Practice 1

Science in Practice 2

Science of You

Transforming Pathology

12:30 **Lunch**
Lunch break - **The Refectory** Lower Ground

13:15 **Science for Experimentation**
Large Lecture Theatre Level 2

14:30 **Break**
Large Lecture Theatre Level 2

14:40 **Keynote and prize-giving**
Large Lecture Theatre Level 2

15:00 **Finish**

Group 2

10:40 **Welcome & Introduction**
Large Lecture Theatre Level 2

10:50 **Science for Experimentation**
Large Lecture Theatre Level 2

12:05 **Lunch**
Lunch break - **The Refectory** Lower Ground

12:50 **science4interaction**
In your colour-coded groups work through the 4 rooms containing these 4 interactive sessions
Be sure to ask questions to complete your quiz
Follow your steward and change rooms when asked; you have 35 mins in each room

Science in Practice 1

Science in Practice 2

Science of You

Transforming Pathology

15:10 **Break**
Large Lecture Theatre Level 2

15:20 **Keynote and prize-giving**
Large Lecture Theatre Level 2

15:40 **Finish**

