

Imperial College
London

Faculty of Natural Sciences Schools Science Competition

Impact Report November 2019



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Introduction

"The Schools Science Competition was an absolutely fantastic event from start to finish. It really challenged the students to come up with a new idea to benefit society which developed their interest and research skills in the wider scientific area. The challenging topic really pushed the students to work together and fostered a strong team spirit where they wanted to improve their idea for the good of the team."

Nathan Francis, Teacher and Mentor to the winning team 2016, from Haydon School

The FoNS Schools Science Competition first launched in 2014. In this first year, the aim of the competition was for teams of secondary school students to put together a case for "The most significant scientific discovery of the last century". The competition was open to all secondary schools in Greater London.

From 2015, following feedback from teachers, pupils and the judging panel, the focus of the competition was changed. The aim of the competition became for teams of school pupils to identify an everyday problem that directly impacts society. They were then asked to come up with a new and innovative scientific solution to tackle this problem.

The competition aim has remained the same since 2015, although in 2019 and for the upcoming 2020 competition, the UN's Global Goals for Sustainable Development are used to frame the competition. Teams are now asked to focus on one or more of the 17 goals, to identify a problem associated with this/these, and to come up with a new and innovative scientific solution in response to this.



Aims and Benefits of the Competition

- To motivate school pupils to engage with science
- To develop an understanding of the global challenges facing the world
- To encourage innovation
- To encourage pupils to work together as part of a team
- To engage pupils in an activity motivated by their curiosity and drive
- To inspire pupils to consider the study of science at degree level
- To create an awareness across various schools of the Faculty of Natural Sciences at Imperial College
- To increase outreach activity and in particular, to make our reach wider -to include schools from which we do not typically recruit undergraduate degree students



Competition Structure

Registration and submission- October-January

The competition is open to teams of pupils from secondary schools and home-schooled groups from across the UK and overseas. Each team must comprise of between two and four students and must be mentored by a Science, Mathematics or Design and Technology teacher from their school, or a home educator.

To enter, teams must create a 5 minute film that: outlines the goal they have selected and the specific challenge they hope to solve; describes their innovative solution; explains the science behind the idea; and illustrates how their idea would address the goal.

A panel of staff from across FoNS review the entries and select those teams that will take place in the final.

The Final- March

For 2020, the final will consist of two events and will form part of the College's Enterprise Week.

Science Exhibition

In the afternoon, ca. 12 long-listed teams chosen by the panel will exhibit their ideas at an exhibition-style event that is open to all. A prize will be given for the best exhibition stand.

Grand Final

At the grand final event, to be held in the evening in front of an audience, ca. 6 of the teams, who have previously been shortlisted by the panel will show their film and pitch their idea to a VIP group of judges.



Participation

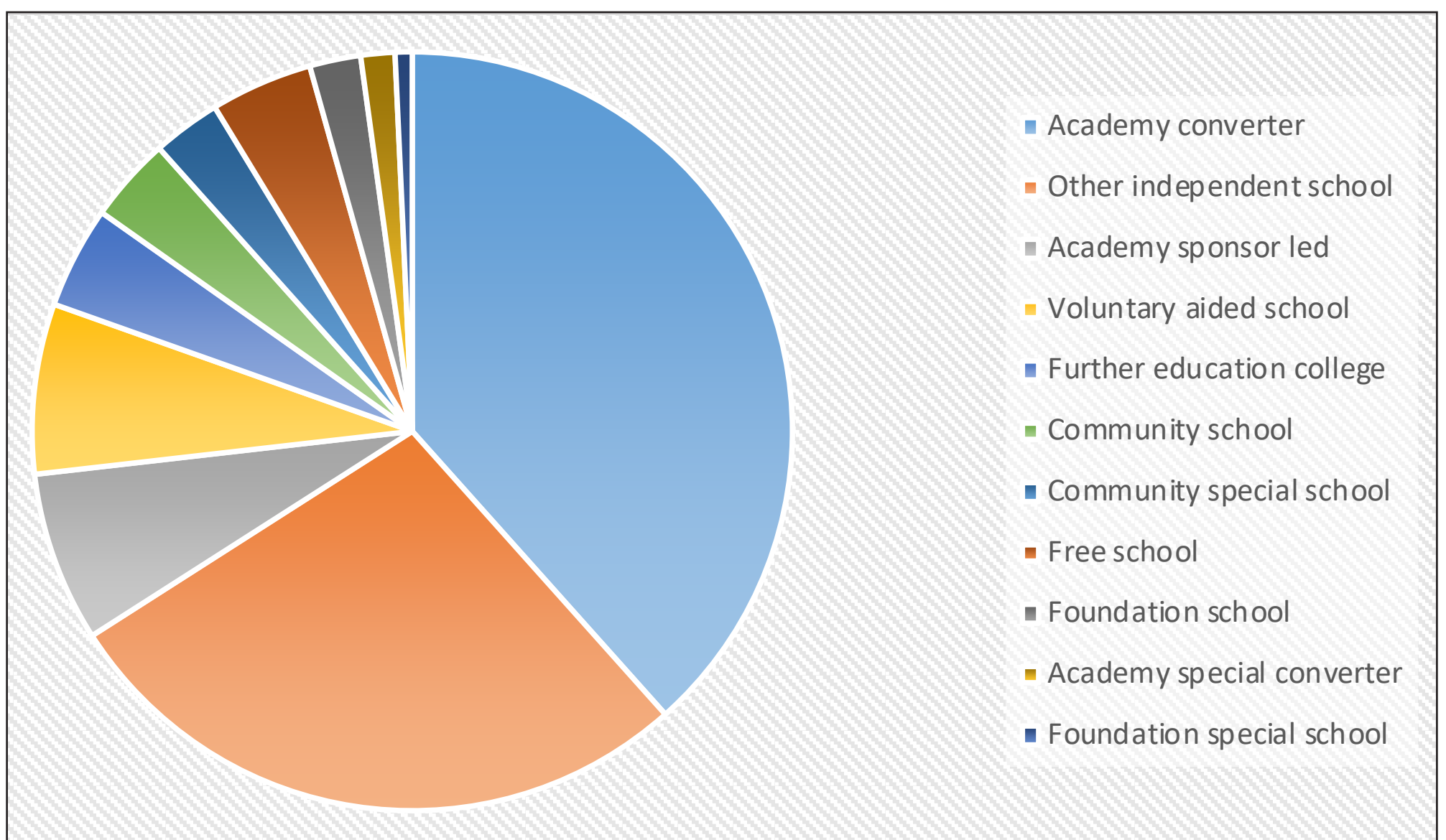
Since 2015, over 360 individual teams have taken part in the competition and a total of 35 teams have competed at the final event.

Over 140 UK-based schools have taken part since the competition launched and from 2019, when the competition was formally opened up to schools outside of the Greater London area, we have seen schools from the following UK regions apply:

East of England
 North East
 North West
 South East
 South West
 West Midlands
 Yorkshire and the Humber

In the last year, teams from schools in Vietnam, Thailand, Macau, India and China have also taken part.

Of the UK-based schools who have been involved to date, the majority have been Academies and Independent schools, as illustrated below:



Winning Teams and Projects

“The teams all had great ideas for helping to meet the sustainable development goals. They had done some excellent science and research to explore the viability of their ideas and thought about some of the potential problems as well as the benefits. It was a privilege to be asked to judge the entries and it was very encouraging to see such a strong interest in science and its practical application to improve the world.”

Vicky Pope, Head of Science and Technology Futures at the Met Office and Judging Panel member 2018

2015



The winners of the first year of the competition were Team Neutron from Gumley House Convent School FCJ, in West London, pictured above.

Teams were required to make a case for what they thought was the most significant scientific achievement of the last century. Team Neutron, formed of Year Ten pupils Louisa Albertini, Evie Bedford, Emily Binns and Millie Tupper from, took home the top prize for their presentation about the discovery of the link between smoking and cancer.

June Marks, a Biology Teacher at Gumley House Convent School FCJ, and the team’s mentor said:

“The Challenge was a fantastic opportunity for our students to research a subject of their choice outside of the science curriculum and gain some experience working as a team. Each of our teams entered with enthusiasm and were very supportive of each other. The team who went on to win had a lot of fun making their presentation and all improved their confidence in expressing their views on a science topic.”

As part of their prize, the winning team visited the Diamond Light Source national synchrotron science facility, located at the Harwell Science and Innovation Campus in Oxfordshire. They were accompanied by two science teachers from their school, and by Faculty of Natural sciences Education Manager, Becky Middleton, organiser of the competition.



Following the competition, a group of finalists from Prendergast Vale School in Lewisham also went on to complete work experience placements at the College in the summer of 2015, in the Departments of Life Sciences; Physics; Chemistry; Medicine; and at the NHLI.



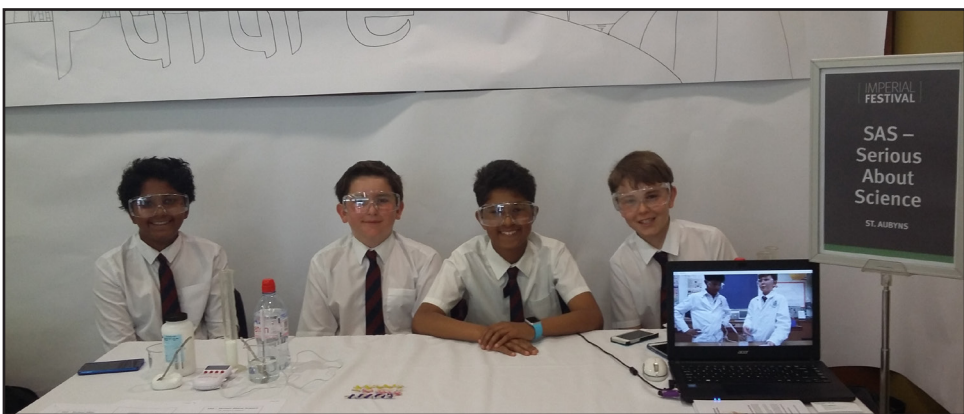
2016

In 2016, the focus of the competition was changed. The challenge called on teams of students from secondary schools across Greater London to identify an everyday problem that directly impacts society and to come up with a new and innovative scientific solution to tackle it.

The winners were Newton's 4th Law, formed of Shivam Chauhan, Daniel Jenkins, Emilia Lawer and Lauren Wallis from Haydon School in Pinner (pictured below). They took home the top prize for their film and presentation on their idea for a new water purifier and electricity generator which utilises silver nanoparticles.



The team were subsequently invited to take part in the Imperial Festival 2016, alongside Schools Competition Runners-Up, Team SAS (Serious About Science), formed of Bilaal Auleer, James French, Ethan Swords and Ziggy Wamae all 12 years old and from St Aubyn's School (pictured below).



Following the competition, the winning team also went on to complete work experience placements at the College in the summer of 2016, in the Departments of Life Sciences; Physics; Chemistry; Medicine; and Earth Science & Engineering.

2017

The winners of the 2017 competition were team HBSVexplosions, from Henrietta Barnett School (pictured below). The team were all part of their school's Robotics club and their idea was for a new, light-weight type of exoskeleton.



Following the competition, the team went on to win the top prize at the VEX IQ national robotics competition in Birmingham in 2017. They were subsequently invited to the VEX Robotics World Championships in Kentucky, US, and received an award from the FoNS Dean's Fund to help them to attend:

<https://www.imperial.ac.uk/news/179183/imperial-backed-school-team-wins-awards/>



2018

This year's theme focused on seven of the UN's Global Goals for Sustainable Development – Zero Hunger, Good Health and Wellbeing, Clean Water and Sanitation, Affordable and Clean Energy, Climate Action, Life below Water, and Life on Land.

Teams were asked to choose one of the Goals and come up with a solution that would help achieve it, before creating a five minute film to explain their idea and the science behind it. The final event formed part of the College's Enterprise Week.

The winning team, 'Aqua Power' from Ashmole Academy in Southgate, focused on Affordable and Clean Energy. Their project promoted renewable and clean energy – specifically hydroelectric power – to help combat climate change.



The team proposed to develop compact hydroelectric generators that fit into the water outlets in homes or commercial buildings. A small amount of electricity would be generated every time a tap is used, which could help power the home or building.

Judge, Simon Foster, said of the winning team:

“Not only was the solution they proposed innovative and ingenious, it was also explained excellently and with real creativity. The winners are now investigating the possibility of developing this into a business and we were all excited to hear about what the future holds for these fantastic young scientists.”

2019

In 2019 the competition was opened up to teams across the world.

The winners were team Zinc-air Power, from Pui Ching Middle School, who travelled all the way from Macau to take part in the final event.

The team's idea was to scale-up the use of zinc-air batteries. While these batteries are low-cost, rechargeable and safe, platinum- and palladium-based materials are needed to create the reaction and these materials are costly and rare. The team therefore identified a need to find replacement materials that work just as well and are also low-cost and environmentally friendly, in order to popularise and scale-up the production of zinc-air batteries.



The final also featured a team from Severndale Specialist Academy, a school for children with special educational needs based in Shropshire. The team, named Robotic Inclusion, were highly commended for their idea for a robot called MAAC.



Impact

Assessing the impact of the competition is a challenge, given the large number of teams and schools involved and the fact that participants are external to the College, under 18 at the point of participating, and many have not yet left secondary education.

However, below are some highlights, linked to some of the original competition Aims:

- **To motivate school pupils to engage with science**
- **To encourage innovation**
- **To encourage pupils to work together as part of a team**
- **To engage pupils in an activity motivated by their curiosity and drive**

The competition has inspired and encouraged students to continue with their project ideas. For example, the 2017 winners, who, as detailed previously, took part in the VEX IQ national robotics competition and the VEX Robotics World Championships in Kentucky, US, after their success at Imperial.

The winners of 2019, team Zinc-air Power from Macau, have also entered their project into other, international competitions since taking part in the final.

Plus, as previously mentioned, team members have taken part in Imperial Festival.

- **To inspire pupils to consider the study of science at degree level**

A number of team members have gone on to study STEM subjects at University since taking part in the competition. Two of the members of the 2015 winning team are studying STEM subjects at the Universities of Cambridge and Durham. Another two members of the 2016 winning team are also studying STEM subjects at Southampton and UCL.

In addition, 8 team members have undertaken work experience at the College since taking part in the competition.

- **To create an awareness across various schools of the Faculty of Natural Sciences at Imperial College**
- **To increase outreach activity and in particular, to make our reach wider -to include schools from which we do not typically recruit undergraduate degree students**

We have engaged with over 140 schools across the UK, including those outside of our normal catchment area, including schools based in towns in the northern half of the UK, such as Liverpool, Sunderland, Preston, Burnley and Manchester.

More recently, at an international level, we have engaged with schools in Brazil, India, Mexico, South Africa, Macau, Vietnam, Thailand and China.

Schools Competition 2020

The Schools Science Competition 2020 opened for registrations in September 2019.

For the coming year, the competition again focuses on the UN's Global Goals for Sustainable Development- as shown below. Teams are asked to select one or more goals, identify a problem associated with these, and to come up with a new and innovative scientific solution in response.

The best teams will be invited to present their idea at a showcase event at Imperial College in front of a live audience and a panel of VIP judges.

The deadline for team registrations is 02 December, but as of the date of this report, we have had teams register from the schools across the UK, including schools in Surrey, Oxfordshire, Gloucestershire, Newcastle-Upon-Tyne, and Liverpool, plus schools in Brazil, Mexico, India and South Africa.

In 2020, the competition will again form part of the College's Enterprise Week.

THE GLOBAL GOALS For Sustainable Development



The Judging Panel

Since 2015 the Judging Panel has included the following members:

Helen Arney, Imperial College Physics Alumna, science presenter, and one third of 'Festival of the Spoken Nerd'.

Dr Simon Foster, Outreach Officer for the department of Physics at Imperial College and a former school teacher.

Vicky Pope, Head of Science and Technology Futures at the Met Office.

Dr Helen Sharman, Britain's first astronaut and UK Outreach Ambassador, Imperial College.

Dr Philip Ramsden, Director of Cross-Curricular Mathematics Education, Imperial College

Professor Ramon Vilar, Professor of Medicinal Inorganic Chemistry and Director of Research in the Department of Chemistry.

Dr Jess Wade, early career researcher in the Department of Physics, Imperial College.

Renee Watson, founder of The Curiosity Box, the first STEM subscription box in the UK, which is a monthly supply of specially curated STEM activities that's designed to bring science to life for families.

Professor Tom Welton, Dean of the Faculty of Natural Sciences at Imperial College.

Professor Lord Robert Winston, Professor of Science and Society and Emeritus Professor of Fertility Studies, Imperial College.

In 2020, existing panel members Simon Foster, Jess Wade and Renee Watson will be joined by Dr Annalisa Alexander. Annalisa is Head of Outreach at Imperial College and has led the College's Outreach team since 2013.



Financial Summary

Currently, the competition is funded entirely by the Faculty of Natural Sciences.

The table below details the planned budget for the upcoming 2020 competition. The total budget remains the same as it has been for the past 2 years.

Item	Details	Budget
Final Judging Event	Catering, AV, Room Booking etc.	£3090
Winners Prizes	Trophies for Winners and Runners-Up	£210
Printing, postage and other miscellaneous		£100
TOTAL:		£3400

APPENDIX A- List of Finalist Teams 2015-2019

2019- Choose one of the Global Goals and come up with a solution that would help to achieve it

Team Name	School	Project
Handy-Capables	Haydon School, Pinner	The use of piezoelectric plates before and after ticket barriers at train and tube stations to power London streetlights
Metal-air Energy	Pui Ching Middle School, Macau	An idea to popularize and scale up the production of Zn-air batteries and eventually establish a sustainable and clean energy system
Mitro-Power	Hayes School, Bromley	Providing multi-source electricity supplies to isolated rural communities.
Sciencesteins	Henrietta Barnett School, London	How nanorobots could be used for water treatment
The Modern Day Einsteins	Parkstone Grammar School, Dorset	Combating global warming (extracting carbon dioxide from the atmosphere), creates energy (using thermal electrics), creates a semiconductor in solar cells and helps make agricultural fertilizers.
Forte	Bablake School, Coventry	Harnessing energy from the movement of water through pipes
Severndale Specialist Academy	Severndale Specialist Academy, Shropshire	MAAC the robot- which could plant seeds to grow vegetables, warm up or cool down its user depending on location, teach new languages or carry medicines

2018- Choose one of the Global Goals and come up with a solution that would help to achieve it

Team Name	School	Project
Uro_stars	Home Education group based in Hackney, London	Improve soil quality using a fertiliser generated from urine and squash seeds, in order to grow more food crops without polluting water systems or depleting resources
Wimbledon Steam Team	Wimbledon High School for Girls, London	Reduce global warming and air pollution by genetically modifying flora to carry out photosynthesis faster, reducing the CO2 in the atmosphere
Hadron	The Heathland School, Hounslow, London	Sea erosion defences that also generate electricity
The Forgotten Chromosomes	The London Oratory School	Reduction of CO2- using CRISPR technology to alter the photosynthesis in phytoplankton, such that some of the glucose they produce is in an indecomposable form.
Aqua Power	Ashmole Academy, London	Development of compact hydroelectric generators that fit into the water outlets in homes or commercial buildings
Algae & Co	Hayes School, Kent	Using algae to produce sustainable electricity

2017- Identify an everyday problem that directly impacts society and to come up with a new and innovative scientific solution to tackle it

Team Name	School	Project
Athena	Saint Martha's School, London	Various ideas for reducing carbon emissions, including campaigns around eating less meat, shopping locally etc.
HBS Vexplosions	Henrietta Barnett School, London	A new, light-weight type of exoskeleton
Team Highams Park	Highams Park School, London	An idea to design ships with propellers (connected to a turbine) that can be used to generate electricity due to the motion of the vessel through the water
GO Kinetic	Bullers Wood School, Chiselmhurst, London	Using piezoelectrics to generate current to recharge a phone from the movement of the wearer
Newton's Force	The Heathland School, Hounslow, London	Adaptation of gym equipment to supply energy through body movement and to promote healthy living whilst helping the environment
Team Streatham Girls	Streatham and Clapham High School, London	Using solar power to pump water to a condenser system, then storing before use in areas with poor access to clean water
Filter	Hatch End High School, Harrow, London	The use of underground tesla coils to create a safe, positive field of electrostatic charge in a given radius, to ionise harmful air particulates to address the problem of air pollution
Amplitude	James Allen's Girls School, London	Using sound from loud public places to generate electricity
Flare	Chelsea Academy, London	Protection against solar flares

2016- Identify an everyday problem that directly impacts society and to come up with a new and innovative scientific solution to tackle it

Team Name	School	Project
Team IV	Saint Martha's School, London	A potential treatment for Perthes Disease, which occurs in children
SAS – Serious about Science	St Aubyn's School, London	A case that uses an endothermic reaction to cool overheated personal devices quickly
Team Highgate	Highgate School, London	An idea to solve the problem of emissions, noise and costs associated with flying
Newton's 4th law	Haydon School, London	A new water purifier and electricity generator which utilises silver nanoparticles
Team Technika	Oaklands School, London	A dual car battery system
Team to Beat	Prendergast School, London	An idea to locate the gene responsible for the production of antibodies against TB and insert these into crops, so that more of the population in developing countries can easily be made immune
Convergence	Dormers Wells High School	The use of oxide of graphite in water purification
The Scientistas	James Allen's Girls' School, London	A tab used to test for dangerous levels of bacteria in food

2015- The most significant scientific achievement of the last century

Team Name	School
Absolute Zero	Chelsea Academy, London
Team Energetics	Saint Martha's, London
Magnus	Canons School, London
Team Neutron	Gumley House Convent School, London
The Semmelweis sisters	Prendergast Vale College, London
Team U-235	Merchant Taylors' School, London

