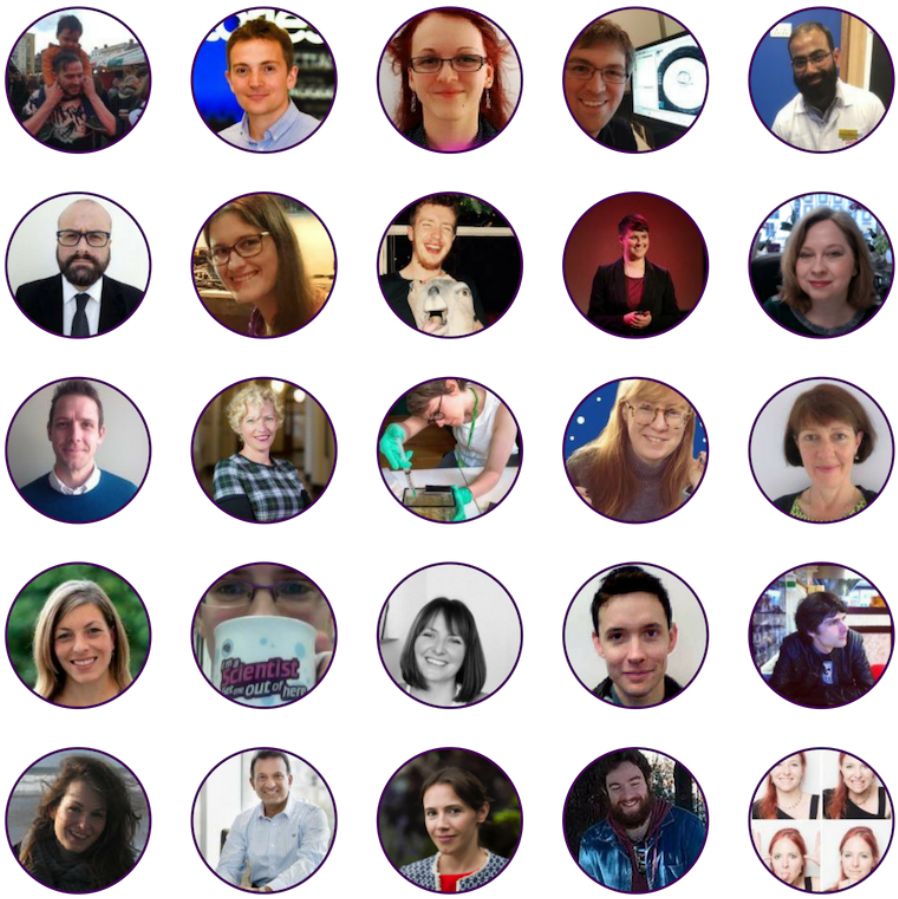


2018 CHRISTMAS LECTURES Zone:

Who am I?

7 January – 1 February 2019

The 2018 *I'm a Scientist* CHRISTMAS LECTURES Zone was commissioned by The Royal Institution with support from Lloyd's Register Foundation.

The online event gave school students, the viewing public, and the LECTURES attendees the opportunity to continue the conversation about the Royal Institution's CHRISTMAS LECTURES series, "*Who am I?*", as well as the surrounding scientific, societal, and ethical themes.

Who took part?

Experts

Scientists who had previously taken part in *I'm a Scientist* events (IAS alumni), and whose work related to the LECTURES themes (evolution, human evolution, and genetics) were invited to take part. Psychologists, ethicists, paleontologists, evolutionary biologists, and biomedical scientists were included so as to provide a wide range of perspectives. Alumni were also asked to recommend colleagues to take part. Experts were asked to commit to 10 live chats over the month.

As hosts, Alice and Aoife were given places and asked to encourage members of their research groups to take part, all Lecture contributors and members of the production team were invited to take part, and information was provided to the Royal Institution to pass on to members of the Genetics Society. A total of 62 people were personally invited or applied after being recommended by colleagues.

25 experts were given log in details for the Zone, and were invited to complete their profile pages. Of these, 20 actively took part in the Zone, through answering questions or taking part in live CHATs.

Compared with recent years it was difficult to sign up the people involved with the LECTURES (6 took part of 24 invited). In future the upfront commitment for 10 live CHATs could be dropped for LECTURES contributors; expecting that they'll enjoy their first and then do lots more. Additionally, more experts could be recruited through IAS alumni recommendations and learned societies to reach people who are available for a month of engagement. Having more experts allows students to interact and CHAT with a greater variety of people, as well as having their questions answered more quickly.

Participating experts

Tomas Fitzgerald Bioinformatic researcher and self-confessed technology geek.	**Kat Sanders** Lecturer in Clinical Anatomy and science communicator who created Anatomy Nights, a series of events where scientists dissect animal organs in pubs.	**Gemma Chandratillake** Works with the NHS to teach staff about genetics and how it can help provide better patient care.
Richard Milne Part of the Society and Ethics Research Group focusing on genomics.	**Judith Sleeman** Biologist and senior lecturer working on degenerative diseases, particularly through microscopy.	**Freya Harrison** Assistant Professor at the University of Warwick who studies why certain bacteria are potentially unkillable.
Reka Nagy Scientist hunting disease-causing genes using human genetic data.	**James Cole** Lecturer at the University of Brighton studying human evolution to examine the complexity of human ancestors.	**Emma Meaburn** Senior Lecturer examining how genes shape individual differences in behaviour and cognition.

Paul McKeegan Postdoctoral researcher examining reproduction and the development of embryos.	**Heather Widdows** Philosophy professor examining the impact of research at the University of Birmingham.	**Edward Morrison** Psychology lecturer who splits time between teaching and investigating how evolution shapes human and animal behaviour and reproductive preferences.
Omar Mahroo Eye doctor and vision scientist.	**Hannah Cornish** Curatorial and Collections Assistant at the Grant Museum of Zoology.	**David Howard** Postdoctoral research fellow attempting to find regions of the human genome that influence whether someone develops depression.
Laura Nolan Australian research scientist currently working in London finding new ways to kill bacteria.	**Hannah Currant** PhD student researching the genes that affect the shape of the human eye and its relation to certain diseases.	**Anthony Redmond** Research fellow comparing genomes to understand evolutionary relationships between species.
Kevin Daly Dublin-based postdoctoral researcher who extracts DNA from 10-millennia-old goat bones to study their domestication.	**Gill Harrison** Radiographer and featured in Lecture 2, where she performed an ultrasound for the students to watch.	

Schools

Teacher applications for the 2018 CHRISTMAS LECTURES Zone were opened to all schools between 5 November and 10 December 2018, and teachers registered on the UK and Ireland *I'm a…* events activities lists were emailed and invited to take part.

75 teachers applied to take part; all were given log in details for the Zone, and instructions on how to book their live chat(s) and create log in details for their students. From experience of previous CHRISTMAS LECTURES Zones it was not expected that all 75 teachers would participate, over-allocating the Zone in this way ensured a good level of activity.

Live chats were booked on a first-come-first-served basis, until bookings were full; with bookings for the first week being opened early as there was a concern that bookings would be slow in the first week back after schools' Christmas breaks, these were booked quickly though. This lack of specific allocation did, however, mean that widening participation and underserved schools could not be prioritised.

Participating schools

School uptake continued to improve on previous years, with students from 41 schools actively taking part in the Zone (see above).

While the lack of specific allocation meant that underserved and widening participation schools could not be prioritised; 12 of the participating schools were underserved / distant from major HEIs (U), and 8 were widening participation schools (WP).[1]

Allerton High School, Leeds	**MidKent College**, Gillingham (U)
Arboretum Primary School, Derby	**Netherfield CofE Primary School**, Battle (U)
Beaulieu Convent School, Jersey (U)	**Parklands High School**, Chorley
Bruntcliffe Academy, Leeds (WP)	**Priory School**, Southsea
Colton Hills Community School, Wolverhampton (WP/U)	**Reepham High School and College**, Norwich (U)
Convent of Jesus and Mary Language College, London	**Royal Masonic School for Girls**, Rickmansworth
Darrick Wood School, Orpington	**Smith's Wood Academy**, Birmingham (WP)
Dunboyne Senior N S, Meath, Ireland (U)	**St Anne's RC High School**, Stockport (WP)
Fetlar Primary School, Shetland Islands (U)	**St John Rigby RC Sixth Form College**, Wigan
Garforth Academy, Leeds	**St Mark's CofE Primary School**, Manchester
Harris Girls' Academy East Dulwich, London (WP)	**St Mary's Catholic Primary School**, Morecambe (WP)
Heath Mount School, Hertford	**St Mary's School for Girls**, Colchester
Howard of Effingham School, Leatherhead	**St. Mary's Menston**, Ilkley (U)
Irchester Community Primary School, Wellingborough	**Strathearn School**, Belfast
Jeavons Wood Primary School, Great Cambourne	**Sullivan Upper School**, Holywood
Levenmouth Academy, Fife (WP/U)	**The British School Yangon**, Myanmar
Lymm High School, Lymm	**The Charter School**, London
Mackie Academy, Aberdeenshire (U)	**The Holy Cross School**, New Malden
Meridian School, Royston	**The Mount School**, York

Map of participating schools in the UK, Ireland, and Jersey *(additionally, a school participated from Myanmar) [Map: Google]*

The Priory School, Shrewsbury (U)	
Trinity CofE High School, Manchester (WP)	
Waddesdon CE School, Aylesbury (U)	

[1] For more information, see about.imascientist.org.uk/under-served-and-wp/

Schools outside the UK

As one of the LECTURES presenters — Aoife — was Irish, schools in Ireland were invited to take part in the Zone. Invitations were sent to teachers who have subscribed to the *I'm a... Ireland* teacher mailing list, and five teachers applied to take part. All were given access to the Zone, however only one school in Ireland actively participated.

The CHRISTMAS LECTURES are broadcast on the BBC over the festive period, and are available to watch on BBC iPlayer afterwards. Feedback from a teacher taking part in Ireland raised the issue that these services are available only to viewers in the UK.

> *"Brierhill won't be on today thanks. We didn't get access to the lectures unfortunately."* **— Teacher**

Content is licenced by the BBC and making it available to schools / viewers internationally would be difficult. In future, the CHRISTMAS LECTURES Zones should be opened only to schools in the UK, where students have the ability to watch the LECTURES broadcast, or online.

LECTURES audience and social media registration

The CHRISTMAS LECTURES studio audience were given access to the Zone through question cards distributed during the filming. Questions submitted on these cards were uploaded to the Zone, and accounts created to allow audience members to receive email notifications when their questions were answered (for those who provided email addresses).

170 people submitted questions, and 87 user accounts were created. In total, 109 questions were approved and sent to experts to answer. This is a significant improvement on the previous year, where 18 audience members used cards to submit questions to the Zone. Increased awareness of the cards this year is likely what led to more questions being submitted; the audience were told about the cards during the warm up, and told about there being a prize for best question. Previously the cards were left on the audience's seats without further explanation.

8 social media users[2] actively engaged in the Zone, this is lower than in previous years (11 users in the 2017 Zone). Access to the Zone was promoted via the *@imascientist* Twitter account during the broadcast of the LECTURES.

[2] Members of the public who used social media registration on the Zone, to log in using their social media accounts.

Zone activity

Key figures from the Zone and comparison with previous years

This was the busiest CHRISTMAS LECTURES Zone run to date; recording the highest numbers of registered users and schools taking part.

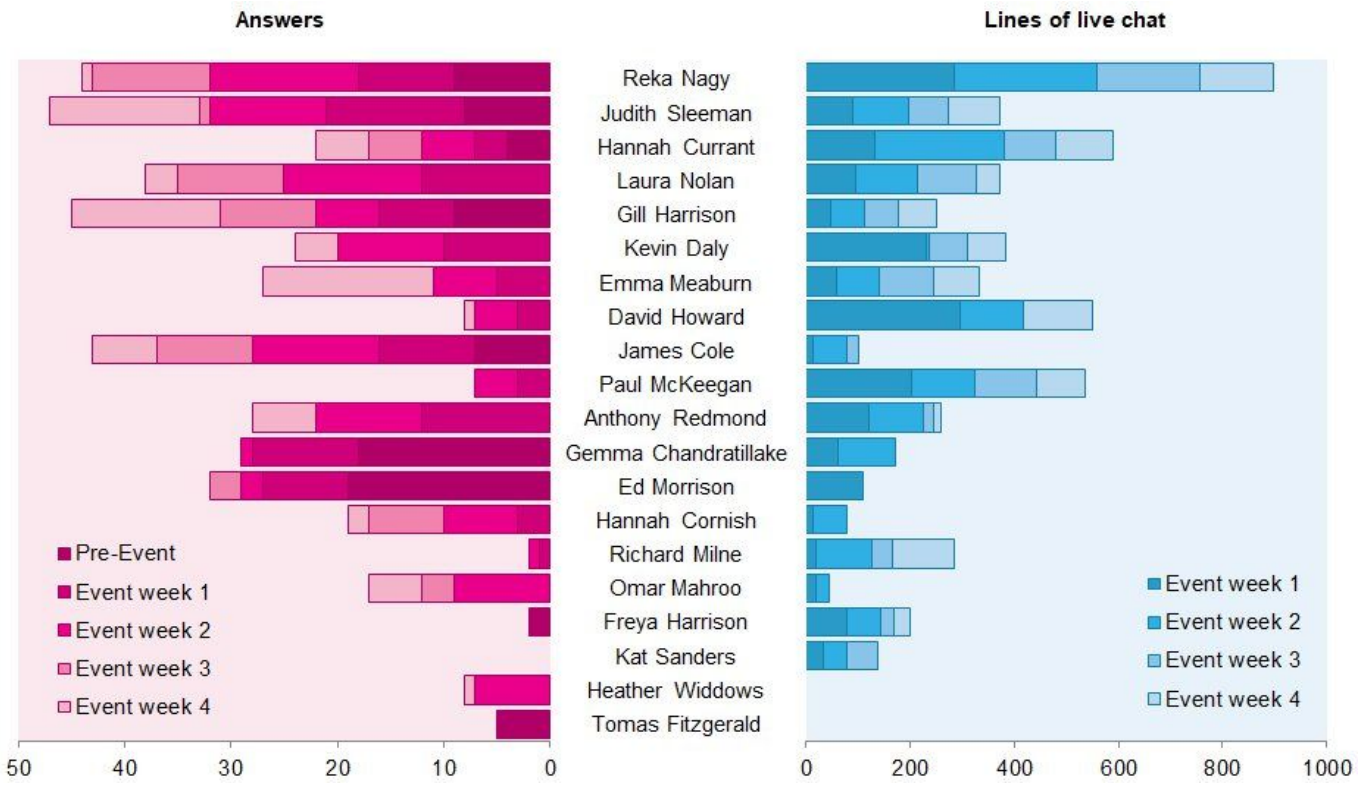
The Zone saw double the average number of live CHATs run, and set a new record for lines of live CHAT in a CHRISTMAS LECTURES Zone, beating the previous record by more than 5,000 lines.

		2018 ZONE	2013–17 RI ZONES AVERAGE
Page views	***Total zone***	30,852	24,308
	ASK page	1,879	1,731
	CHAT page	2,838[3]	3,518
Registered users		953	571
% of registered users active in ASK, CHAT, or comments		97%	82%
Questions asked total		623	467
Questions approved		303	214
Answers from experts		434	285
Comments		17	44
Schools		41	24
School live chats		56	28
Lines of live chat		16,028	7,410
Average lines per live chat		286	268

[3] The number of CHAT page views being lower than the average would appear odd given the large increase in number of live chats run; this could be explained by improvements to the CHAT engine in recent years, leading to fewer students refreshing the page during their sessions.

Expert activity

Expert activity in is shown separated by questions answered in ASK, and lines of live CHAT contributed; activity is further divided by weekly[4] contribution:



CHRISTMAS LECTURES team

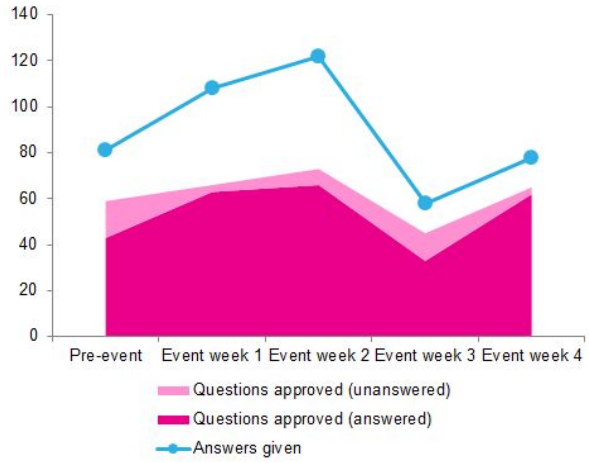
Neither Alice or Aoife answered any questions through ASK, or took part in a live CHAT.

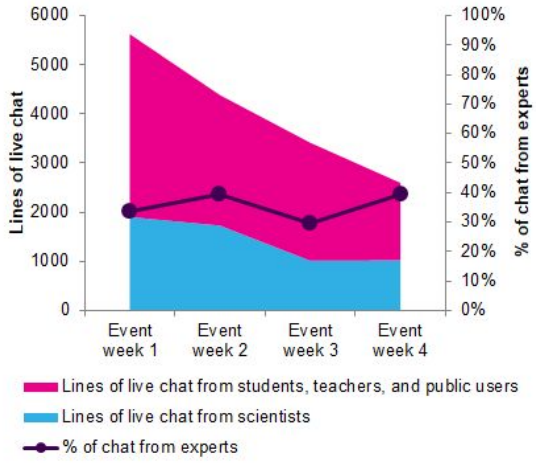
However, it was good to have Gill, Heather and Omar on the team, who each appeared on one of the LECTURES episodes. They were able to answer students' questions about the filming when they did come up, which happened occasionally, mostly in chats and instigated by the experts themselves.

[4] "Pre-event" refers to the time before the start of the event (pre-7 January) where questions were submitted from the CHRISTMAS LECTURES audience.

Zone activity by week

The charts below show varying activity in ASK and CHAT across the four weeks of the event:





[Left] Activity in ASK: *Comparison of questions approved, to answers given.*
[Right] Activity in CHAT: *Comparison of lines of live chat contributed by experts, to those from other participants.*

Looking at the activity in ASK there is a drop in questions asked during week three of the event; the corresponding drop in answers given though seems more severe than might be expected. In CHAT we see that while the overall number of lines of live CHAT reduce toward the end of the event.

Differing to previous CHRISTMAS LECTURES zones, experts were invited to take part for the duration of the event, rather than being allocated specific weeks. This was done to (a) allow experts more flexibility in when they would take part, and (b) reduce the admin required by organisers in allocating weeks, and managing weekly site updates to show “active experts”.

There was however, a concern that this change would lead to uneven participation from experts.

As can be seen *(see also: Expert activity)*, most experts spread their time over the four weeks of the event — though a few contributed more to earlier or later weeks — and the percentage contribution from experts remained relatively steady, between 30% and 39%. Additionally, admin time was reduced. This change then, has been successful.

Popular topics

The questions in ASK and live CHATs covered a wide range of themes and ideas related to genetics and identity.

“What would happen if…” scenario type questions were popular, as were questions about the future of humanity; thinking both about evolution and future changes to the planet. Students asked, “What will humans look like in 1,000 years?” and, “Will the world ever end?”

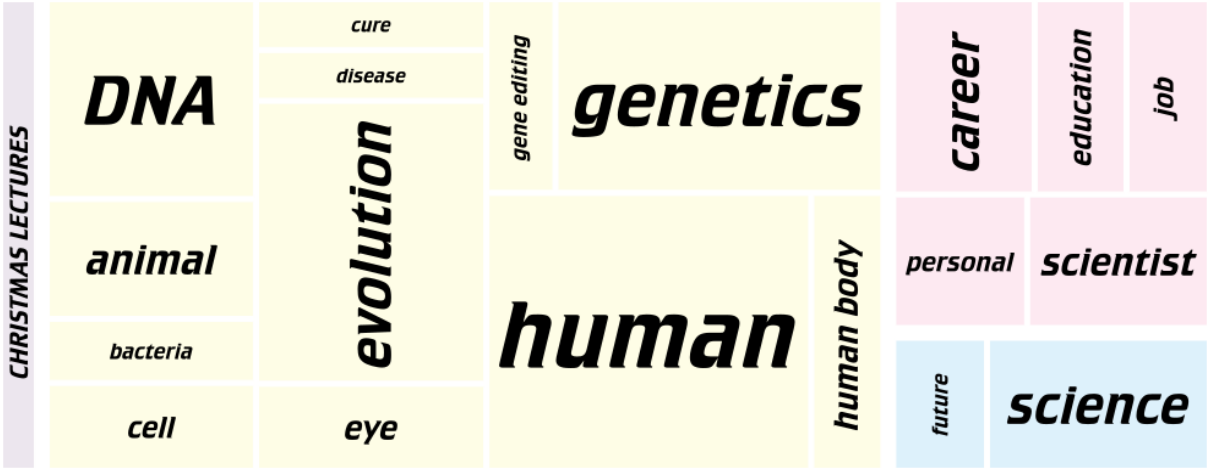
Additionally, students had questions about the experts motivations to get into STEM, as well as their hobbies and lives outside of work. Experts were also asked questions relating to their work and the content on the profile pages; for example, Kevin received lots of questions about his work with goats. Paul’s research was particularly interesting to students, and his one-liner opening to chats of, “You are what your parents ate! I’m interested in how egg cells and embryos grow from one unique little cell into a whole person…” was often met with questions about how eating habits might affect growth.

Popular topics in live CHATs

Popular words used by participants (both students and experts) during live chats; size of each word represents its frequency (colour has no significance):

Top keywords of questions approved in ASK

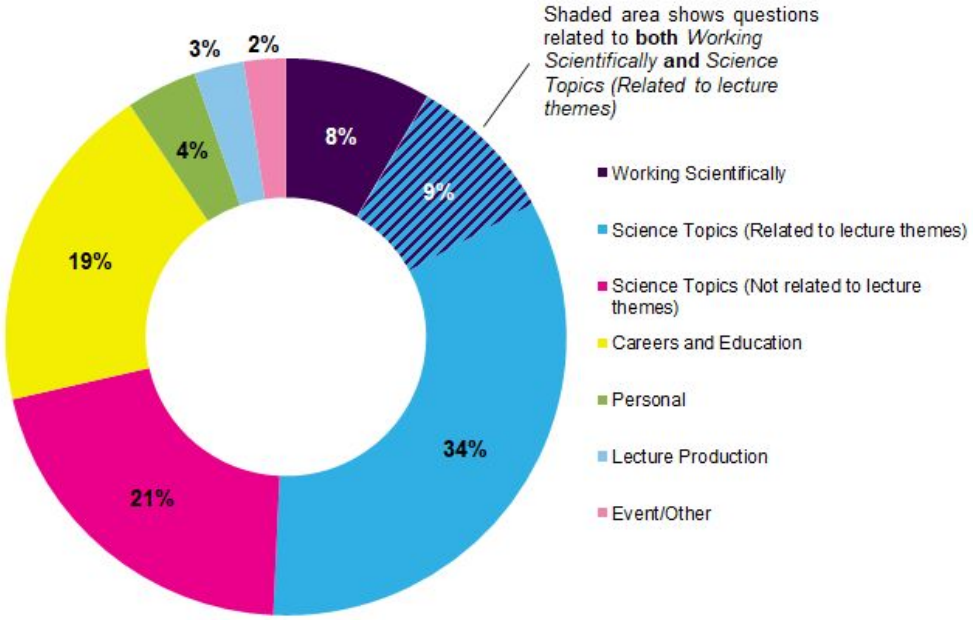
Keywords in questions approved in ASK; arranged by frequency (size) and category (colour):



Category key: *Being a scientist* *Science topics (related to LECTURES themes)* *Science topics (not related to LECTURES themes)* *LECTURES production*

Question themes and example questions in ASK

Questions posted in ASK, categorised by theme. Find out about how we've coded the questions at: about.imascientist.org.uk/what-do-students-ask-about/



Examples of questions asked (colour coded as above):

Working scientifically

How can you connect religious beliefs/Christian texts and ideas with your information?

Working scientifically / Science topics (related to LECTURE themes)

How can geneticists tell what part of the DNA sequence correlates to different attributes?

How soon in the future do you think (if at all) that people may be given the opinion to change their genes concerning things like eye colour? If never, why not?

If we eradicate all disease from everyone and make genetics more similar, wouldn't that make people less unique?

If everyone is genetically unique, how is there a human genome?

Do you think that we have slowed down evolution in humans, as the medicine available means that people with mutations or disabilities survive more, natural selection is not as common?

Science topics (related to LECTURE themes)

How can we tell, without being there, what life was like before humans evolved?

Why does DNA allow recessive genes? What is the use of them?

How large is the role that genetics plays in determining traits more related to personality and habits?

Science topics (not related to LECTURE themes)

Will we ever lose our nucleus so, like bacteria, our cells can swap DNA in our body (and potentially with other people) to become more resistant to disease?

How do fungi and bacteria fit into the tree?

Careers and education

Is it quite scary seeing dead animals?

Personal

Do you know the periodic table off by heart?

Examples of good engagement

The discussions in the Zone covered a wide range of themes and ideas related to genetics, identity, evolution, and science in society.

In one discussion, students were also interested in the possibilities of bringing back dinosaurs and the scientific realities of what we see in movies:

> ***Student:*** *Could you make a clone of a dinosaur like in jurassic world?*
> ***Kevin:*** *A bit too old I'm afraid! DNA doesn't survive that long (say 65 million years). The oldest DNA recovered was from a horse about 700,000 years old - but even then, the DNA is very damaged. Would be hard to clone that horse!*
> ***Student:*** *what sort of information do u find out about the goat from their bones and what do u use the information for*

Kevin: *If their bones have DNA preserved, we can extract their entire genome - so that gives us lots of information! We can figure out how they relate to wild goat, or goat from other regions at the same time.*
Student: *How do you extract DNA from bones*
Kevin: *I cut a chunk of bone out with a saw, break it down to a fine powder, and leave it for 48 hours in a mixture that is mostly an enzyme called proteinase K - it breaks down the bone collagen and releases the DNA!*

Bacterial resistance was also discussed, and the experts talked about how the danger levels of different bacteria changes over time:

Student: *What is the most resistant bacteria*
Freya: *There are some terrifyingly impressive resistant bacteria. There is tuberculosis (TB) that is resistant to so many antibiotics that in the US, you are legally required to be quarantined if you get it (i.e. you can be arrested and kept in hospital)*
Student: *Why are some bacteria impossible to kill*
Freya: *That's a great essay title I often set my students. Some bacteria have proteins in their cell membrane that actively pump out antibiotics before they can do any damage, some make a sticky capsule that keeps drugs out...Have you come across any other examples in your biology studies?*
Student: *super gonnhoroa*
Freya: *Yes! I wasn't sure if I was supposed to mention super gonorrhoeae in a school chat. It's sweeping down across the UK from the north east and almost entirely untreatable.*
Student: *can bacteria mutate from dangerous to harmless*
Freya: *That is an excellent question. Yes, there's no reason why they can't. Some bacteria have become a lot less dangerous over time. Like the bacterium that causes syphilis - it's still an illness, but the symptoms are way less horrible than they were 200 years ago. I'm going to have to look up examples of bacteria going from pathogenic (disease causing) to totally harmless though!*

In one chat, a student was worried that their squeamishness when it comes to dissections would rule out Biology as a possible career path; Reka set the record straight:

Student: *Do you think that if you want to become a biologist you have to be able to dissect things and not be screamish?*
Reka: *Absolutely not!! I am a biologist through and through and I am very squeamish about cutting into things or seeing blood - so my dream of becoming a surgeon went out the window! But, there are many kinds of biology (e.g. cell biology or plant biology!) that doesn't involve cutting into living things. Or you can do what I do, and only use computers to study genetics (which is a type of biology!)*
Student: *OK thank you so much for you answer. I think I would like to be a biologist but recently we have been dissecting things so I was worried I wouldn't be able to be a biologist if I was screamish*

Feedback during the event

We're still collecting feedback from participants, **here are a few of the comments made during the event:**

Tweet, Lab_13 Irchester:
twitter.com/Lab_13Irchester/status/1082253278921003008

Tweet, Beaulieu Biology:
twitter.com/BeaulieuBio/status/1086194122300555265

Tweet, CJMLC:
twitter.com/Cjmlc/status/1088444259777179651

Thank you all ive really enjoyed this chat. Its really helped me to think there are LOADS of different things i can do when I grow up hope we will be talking to you all again!!! **— Student**

The whole class just went OOOOOH! They can't believe that some people can 'taste' words and colours! They think it is really cool! **— Teacher**

Thanks for a great session this morning. They loved it!! They all want to scientist now. I really think these session are brilliant for Year 6 pupils. They are always fascinated by the fact these scientists are normal! Eating burgers and taking the kids to school. I think they have these misconceptions of men wearing lab coats with crazy hair. **— Teacher**

It's been great seeing 'unlikely' students take an interest in science, and its had a positive impact on the girls who have been learning the history of the atom and the periodic table (all discoveries credited to men)
— Teacher

[The best thing about chatting with the students has been] having to think twice about my answers - a lot of the questions have been things I did not think about before and I _thought_ I had a good answer but then I started second-guessing myself so I had to look things up (and learn a lot along the way!)
— Reka, expert

I've really enjoyed all the chats I've been in. One of my favourites was after a lot of very taxing high-level questions about evolution, I realised the students were in primary school! I also appreciated chatting about Star Trek and Firefly earlier today :) **— Paul, expert**