TEACHERS TV: THE CREATIONISM CONTROVERSY IN THE CLASSROOM – ADAM RUTHERFORD ON EVOLUTION AND CREATIONISM

Hello. I'm Adam Rutherford. I'm a scientist and a writer but most importantly I'm a member of the species Homo sapiens – the latest in a long line of ape-like creatures. Now, human beings may have their biological faults, such as back pain or problems during labour. But as a species we are pretty successful. We have developed the ability to walk upright, to talk and to reason. We are the product of millions of years of evolution as Charles Darwin worked out from his observations of the world around him. Darwin transformed our understanding of nature and the teaching of science forever. But in this programme we will be asking whether that understanding is being threatened and whether that teaching is being undermined.

Creationism we are led to believe is making a come-back. Adam and Eve are breaking out from the church, mosque and synagogue and moving into the classroom – the science classroom. Goodbye the descend of man, hello the fall of man. I'll be examining the issues and talking to the leading academic who dared to suggest Creationism should be addressed in the science class. Professor Michael Reiss will be explaining his views which sparked a controversy that cost him the most prestigious job in science education.

Reiss: "Now what you find as well of course is such an increasing proportion of young people come to school either with quite strong Creationists beliefs or from family backgrounds that have got them. So what interests me is whether or not teachers in science lessons should take account of that."

Evidence for a rise in Creationism amongst school pupils is understandably mostly anecdotal. But there is a detectible increase in the number of students who are starting science degrees believing the world and everything upon was made and put there by a supreme deity.

Dr. Jeremy Pritchard (University of Birmingham): "Well in the first year Evolution Course I think about 20% of them perhaps would profess overtly to be Creationist, have Creationist views which I find quite surprising from my background and my training."

As we hear from Darwin's great-great-grandson his theories and his methods must be placed at the heart of science education.

Randall Keynes (Darwin's great-great-grandson): "It's the rigor and imagination with which he approached each problem that he tackled using observation and experience. That's so wonderful I think and it's such an example for us all today."

Darwin lived and worked here – Down House near Bromley in Kent. 2009 brings the bicentenary of his birth and also sees the passing of a hundred and fifty years since the publication of *The Origin of Species* – his great work which shattered religious perceptions. It was along this lane that he thought through his ideas and worried about them.

Rutherford: "So Randall, this is Darwin's thinking path. Do you think he was considering when walking here the wider implications of his theory?"

Randall Keynes: "He must have been very often. It was a great concern of his. And he would walk round this path every day four or five times and would have been thinking through every implication of the theory."

Darwin delayed publishing his conclusions because of those implications: That we are not descended from Adam and Eve. We are just another species that evolved like all the others. He wanted to make sure he could counter every argument and satisfy every objection. For a hundred and fifty years no one has been able to undermine his theory using science rather than religion.

Jeremy Pritchard of Birmingham University is a biologist who specialises in plants but uses bones to engage students when explaining the evolutionary process. With an almost missionary zeal he is reaching out to schools to promote Darwinism and combat Creationism.

Dr. Jeremy Pritchard: "I think some teachers perhaps have Creationist views and don't want to disabuse them. Or they … I think others … the teachers are too busy. Explaining to somebody evolution you need quite a lot of knowledge beforehand. You can say 'How can a 747 evolve by chance in one go?', but if you were to go to the factory and explain this is how it's put together bit by bit that would take a lot longer. And it's the same analogy in science."

Six-formers are invited to use the university's laboratories and resources. In this exercise they are tracing the development of cranial capacity. They can use the fossil record and any passing living specimen.

Rutherford: "This is a very familiar position from my undergraduate days where I mostly was asleep at the time."
Pupil: "You can move your head from your position"
Rutherford: "That looks like I've got quite a prominent brow there which is a characteristic of Neanderthalers. I'm not sure I'm happy about that."

Dr. Jeremy Pritchard: "I think as a scientist it is very important to engage. I mean we are often accused of being in the ivory tower and not coming down and talking to people about our science… so that's it. Obviously it's a recruitment thing as well. It is important that people know the sort of things you can study at university and then how you can further your A-Level studies. And it's also because of some of the evolution questions you have been raising that I personally think we should address some of these; and we should take people on; we shouldn't sit there and hide and not not talk about it. The human evolution story obviously is a great context because everybody is human."

Rutherford: "Shiv, you're a Hindu. How does learning about evolution in this way conflict with your religious beliefs?"
Shiv (pupil): "I wouldn't necessarily say it conflicts. What I would say though is that I personally believe that God created the first initial species and that that species slowly evolved over time."

Where better to see the effect of billions of years of evolution than the Zoo. In this case London Zoo. Birmingham University's Bio Sciences Department has invited nearly two hundred six-formers for a day out. It's its first attempt to reach a wider audience. The day starts in the Zoological Society's lecture hall.

Dr. Jeremy Pritchard: "Right. Evolution – that's really why we are here. To talk about evolution and where all that diversity that we see in the Zoo has come from."

Teacher: "Legs in Gorillas. Four pairs of legs?"

Students: “No”
Teacher: “Gills?”
Students: “No”
Teacher: “Feathers?”
Students: “No”
Teacher: “Hair?”
Students: “Yes”
Teacher: “Okay”

Dr. Jeremy Pritchard: “You can look at these animals and make some decisions about 26-27 characters which I’ve suggested for about 45 to 50 animals. We are going to score that in a binary form. Put a one if you think the character is present and a zero if it’s absent.

Teacher: “Does it have claws?”
Students: “Yes”
Teacher: “Thumbs?”
Students: “No”
Teacher: “What about parental care? What do we think?”
Students: “No” “Yeah”
Rutherford: “I don’t think Komodos bury their eggs. I think they put them in nests and incubate them.”
Teacher: “Okay”
Rutherford: “I just read that off the sign.”

It’s called scientific research. I know it’s not a scientific sample but in the stroll poll conversations I had with students almost all had faith and none had a problem in accepting evolution.

Student: “Personally I’m a Christian myself but I still believe in evolution and I think that’s the way that things should be.”

Student: “I kind of use the bible to influence my decisions. I don’t solely base my life on religious teachings and stuff. They kind of just guide me along the way and I go along with what scientists say about the evolution of animals where we do all come from apes.”

The students' data are fed into a programme which groups all the species according to their characteristics and comes up with this: A phylogenetic tree.

Dr. Jeremy Pritchard: "You've got all your mammals here in that group, and then.."
Rutherford: "So when you look at this output does this help you to connect up all the different species you have been looking at?"
Student: "Yeah because you can see where they derive from each other.."
Rutherford: "And does it help you understand how evolution works?"
Student: "Yes, it does because you can see who is kind of grouped together now and you can see where do they stem from. It's really interesting."

A phylogenetic tree is the only diagram that appears in *[On] The Origin of Species*. Darwin is best remembered for his voyages on HMS Beagel and his observations around the Galapagos Islands. But he also made use of what he saw here at London Zoo and he relied even more on studying nature in his own backyard.

Randall Keynes: "It was his open-air laboratory and just here for example we've got one of the 54 kinds of gooseberries that he cultivated here and this was artificial selection which was comparable to what nature does in natural selection. He shows from that how if you either artificially or naturally select the plants each generation you can get the variations to develop into major differences between varieties which can eventually become separate species."

Rutherford: "So why was this field so important to Darwin?"
Randall Keynes: "It was here that he looked closely at the phenomenon of biodiversity really for the first time to take one area with a uniform habitat and just count the number of different plants that were growing here and he found that there were about a hundred and forty different species of plant growing in this one small area."
Rutherford: "So it really shows that you don't have to go all the way to the Galapagos Islands to get a real understanding of variation in nature?"
Randall Keynes: "Exactly."

So with all the evidence around us to support evolution why is it being rejected by more and more pupils?

Dr. Jeremy Pritchard: “I think that what is happening in America has certainly come over here in a sense that the Intelligent Design debate in the States has spilled over in some of the faith schools here. It has got into people’s psyche and people are thinking about it. I’m surprised there’s a problem because of course in this country we have the safety valve of RE [Religious education] lessons which you don’t have in the States. So I really haven’t got a full answer to it. I think there is some agitation from the Creationist’s side though – for example there is been some big mail shots for a lot of material truthing Creationism and stuff to schools and teachers often find it difficult to deal with that when they are multitasking other things.”

In 2006 an organisation called Truth in Science sent this material to every school in the country advocating the theory of Intelligent Design, the belief that nature is shaped by a higher entity. The organisation claims that it had 59 positive responses from schools who said that it was a useful classroom resource.

Its impact has also been observed by Michael Reiss. Expressing his views on how teachers should respond to Creationism led to him stepping down as Director of Education at the Royal Society. He continues however as the professor of science education at the Institute of Education. He is also an ordained minister of the Church of England. Instead of sitting in his office we invited him to take a pew at a nearby church.

Michael Reiss: “Within the Christian tradition Creationism has definitely become more powerful. Obviously that has been sent in the USA but it has been exported from the USA not just in the United Kingdom but other countries. The Truth in Science DVDs which I’ve looked through have not in my experience been widely used. This is mainly because most biology teachers think they are poor quality and reject them. A small number use them. They are more likely to use them to argue against their content showing how some of the arguments are invalid than anything else.”

The government responded to Truth in Science by reminding schools that Creationism and Intelligent Design are not scientific theories and have no place in the curriculum. But there is another reason for the increasing disbelief in evolution.

Michael Reiss: “The other reason is now we have a great many more children from Muslim families in schools in Britain and a quite of high proportion of the Muslim community has Creationist views. In Islam Creationist beliefs are much more at the centre of main stream religious faith and therefore, as the number of Muslims in the United Kingdom increases, I’d expect to carry on seeing more and more Islamic students with Creationist beliefs.”

Michael Reiss believes teachers should not avoid the issue of Creationism if it’s raised in a science class. He is not saying science teachers should teach Creationism – but that’s how it was interpreted when he spoke about his views at a national science festival in September 2008.

Michael Reiss: “I think avoiding the issue of Creationism and Intelligent Design is a very common response from science teachers because teaching this area just doesn’t fit into their understanding what science is about very often.”

Rutherford: “Some teachers would argue they are pretty hard pushed for time. Why do you think that they should address Creationism?”

Michael Reiss: “I’m not in favour at all of requiring science teachers to teach in this way, in this area but if they feel comfortable doing so I think it can be a better way of enabling pupils to learn about evolutionary biology than by merely either implying or telling them that they are wrong to reject evolutionary thinking.”

Rutherford: “Why not take a black and white approach and a science teacher says if a pupil comes to him and says ‘I want to learn about Creationism’; then he says ‘Thank you for asking. Go and talk to the vicar about that’. What would be the problem with that approach?”

Michael Reiss: “None but there are disadvantages with that. The main problem that young people have with a lot of their school science lessons is that they say they are boring. So what message are we sending when you finally get some pupils asking some genuine hard felt questions about science to be told ‘We are not going to discuss that here’?”

In fact, Rice's view is reflected in official advice to the teachers that they should not teach Creationism or Intelligent Design but can respond to questions. However, he and the Royal Society felt that his position had become untenable because of the controversy.

Now I'm told that there are plenty of science teachers out there who prefer to rely on the Koran or the Bible rather than on *The Origin of Species* and as we have heard their influence is being felt in higher education but it seems that they are not that willing to engage in a debate with us. We have been in touch with a number of organisations that bring together religion and education including the Association of Muslim Schools, Truth in Science and the Association of Christian Teachers. None of them could provide us with a teacher who is willing to talk to me.

I had better luck at the Natural History Museum where I discovered that evolution can be taught with both a scientific and religious perspective. The Museum stages workshops called "The Great Debate" which pit the arguments of Darwin against the beliefs of Sir Richard Owen. Owen was a Victorian Naturalist and fervent Christian. He sponsored the building of the Natural History Museum as a cathedral to God's creation. The Museum has a school programmes developer who explained the purpose of the workshops.

Rutherford: "So when you show these specimens like we can see a manatee there, a rhinoceros there, and the elephant, and of course of all these amazing whales – how do you connect all these things together?"

Sally Collins (Natural History Museum): "We are trying to get the students to really think about the relationship between theory and evidence and how interpretations of evidence can be really, really different."

Rutherford: "What do you do when you actually come across a student who will just not accept it despite in the face of all that evidence?"

Sally Collins: "We have students in the workshop who have strong religious beliefs but we really reinforce it. It's fine for students to make up their own minds, to form their own opinions. What we present is ...the scientific community has brought together all this evidence

and the best explanation we have for that evidence at the moment is the theory of evolution by natural selection. So we say ‘Bring that into your thinking. Make your own minds up’.”

The workshop starts next to Owen’s statue which used to be found on the main staircase but he has been moved to a corner and replaced by Darwin.

Sally Collins: “To be honest I don’t think Richard Owen would be that happy. It’s his museum. He founded the museum. But I think, you know, for this year for Darwin’s birthday it’s fine.”

Rutherford: “Owen and Darwin had a pretty fractious relationship anyway, didn’t they?”

Sally Collins: “To start with they were fine but he is known as one of Darwin’s chief opponents.”

After being introduced to the issues and characters the pupils are split into groups representing the opposing sides of the great debate over evolution that all began in 1859.

Sally Collins: “We set them challenges. We say ‘Imagine those characters were here today in the Natural History Museum with all the modern evidence on display. How would they use that evidence just to support their argument – either for or against evolution?’”

Rutherford: “And then you bring together in the end and they fight it out?

Sally Collins: “Yeah, they fight it out.”

The pupils are asked to focus on the pentadactil or five-fingered limb common to mammals great and small. To Darwin the limb showed that all mammals had descended from a common ancestor. To Owen the limb was an archetype designed and perfected for each mammal by God.

Rutherford: “What did you just noted down there? You put down that these bones are fused together on whale specimen? What does that tell you?”

Pupil: “Because the whales don’t need to move their hands as much as we do. They’re chosing to just swim along. So they fused together over time.”

Rutherford: “And does that say to you that it’s a result of evolution or of design?”

Pupil: “I’d say the evolution ‘cause I think it happened gradually over time.”

Pupil: “… Evolution because evolution is the stronger argument because there is more solid evidence.”

The pupils come together for their own great debate.

Pupil: “Are they completely taking God out of the equation and just saying that it was all randomly selected and it hadn’t been designed by anyone else?”

Pupil: “If God was so smart why did he not give all the animals the advantageous characteristics – then they would all live longer?”

Pupil: “If Darwin was so religious why did he totally go against God and everything there is like in the Bible about God?”

Pupil: “He contradicted his religious beliefs because he believed that the evidence was much stronger for evolution than the argument for God.”

At last I find a science teacher who has religious convictions and has the courage of those convictions to talk to me. He is the Head of Science accompanying these pupils from a grammar school for girls in Wilmington in Kent.

Peter Maddison (Head of Science): “From a personal point of view I am quite religious which is perhaps unfortunate as a science teacher. So I kind of believe in mutual exclusivity. I think it’s perfectly possible just about to believe in both. So to accept the scientific evidence for evolution and to look at the creation model as almost being a simplistic explanation for evolution rather than taking a literalist view of the scripture if you like. That’s how I would prefer it. But from a scientific point of view you present them with the evidence and you have

to conclude that evolution has occurred. And that's why it's brilliant to come here and see the pentadictal limbs and it really makes it live for them which is why this is really, really fantastic day."

The Natural History Museum's approach in examining the religious arguments alongside the evolutionary evidence has also been developed in Jungle Book style by this Head of Science in Lancashire.

Caroline Molyneux: "Okay, this is the line of human history."

Caroline Molyneux from the Balshaw's Church of England High School in Leyland was the Outstanding Teacher of the Year in Northwest England in 2007.

Caroline Molyneux: "One of the apes is the oldest, most ancient ape here. Then we have got the next that came in history. Then we've got the next one and finally the present day human. Can we tell which one that is?"

She won the award because of lessons like this one on evolution which engross and entertain her class.

Caroline Molyneux: "Jane can you put them in order please…. Okay, are you happy with that? Why do you think that?"

Pupil: "Because that one's bigger.."
Caroline Molyneux: "Okay, that one's bigger. Alright."
Pupil: "And that one's more like a human."
Caroline Molyneux: "Yeah, right. That one got some human features.. Thank you very much, Jane."

Once they understand evolution these pupils also stage a great debate. Caroline Molyneux helps the evolution side while a local chaplin joins the Creationist corner.

Ruth Taylor (Youth Chaplain): "You see that evolution doesn't explain really complex organisms, aren't you."

Pupil: “It’s like evolution is saying that when minor things happen ... something like the eyeball is that advanced that it … I don’t believe that it could have been …”

Interestingly Darwin also worried about the origin of eyes until he grasped what he described as the vastness of past ages – the millions years that complex organs took evolve.

Caroline Molyneux: “How do you know that Darwin’s theory is so trustworthy? What is the evidence?”

Pupil: “Cause we’ve got quite a bit of proof about that species changed after a certain amount of time and he also proved about different … the same species … changed differently in different areas.”

Pupil: “But there is many gaps in science ...”

Pupil: “What gaps have you got for God? That’s not a gap. It’s just not there. Fullstop.”

Pupil: “But he was the one actually who created evolution. Maybe he left us here to adapt by ourselves.”

Caroline Molyneux: “In general in science if you can create some passion for it, then they are engaging and they are learning and it’s a real triumph I think. By allowing children to argue not necessarily their opinion you’re facilitating their investigative skills and you’re facilitating their empathy skills.”

Pupil: “Some people find it better to believe in something than nothing.”

Pupil: “Yeah, we do believe in something. That’s evolution.”

Caroline Molyneux: “I know exactly what the theories are and the evidence is for evolution and I know exactly what the pupils need to know for their exams which is at the end of the day what we are trying to teach them but I think that by using this process it will help them to

remember, it will help them to engage and so you're just almost bringing a bit of kind of I want to say devil's advocate."

Ruth Taylor (Youth Chaplain): "It's not just me saying I think this. It's actually saying Christians who believe the bible. So let's look what the bible says. And then the peoples can look at that for themselves. So I'm always really careful to say 'Christians believe' and 'the bible says' as terms so that they can see it is not that I say 'you have to believe this'."

It's lessons like this that teach the facts and encourage debate. They are applauded by Michael Reiss.

Michael Reiss: "There has been quite a move the last ten years to realising the value of good argumentation discussion in science lessons and I'd like to see more of that. When I was at school we had science teachers, one in particular who taught us physics who seemed to be capable of letting us discuss just about anything. But he was also good enough that after five or ten minutes we'd come back to the main thrust of the lesson."

Jeremy Pritchard wants to ensure that evolution can't be avoided and that all children understand it's pivotal importance by reinforcing it's place in the national curriculum.

Jeremy Pritchard: "I think often at schools there might be one or two, maybe three lessons of evolution and it's not plugged into the whole biological story. It's almost a pick'n mix. You can do microbiology, and now we do plants and now we do the circulation system whereas in fact they are all adaptations, they are all consequences of evolution or a way of increasing your fitness. And I would argue that would be a much better way of teaching A-Level Biology but currently that's not the way it's done."

Rutherford: "So do you think that there is a fundamental problem with the way that evolution is taught as part of the national curriculum?"

Jeremy Pritchard: "I think it probably is. And I think that it's a consequence of over-assessment and a consequent lack of engagement of the pupils and the teachers are rushing around trying to tick all the boxes. And you can't take your foot off the gas and then enjoy

and appreciate the subject. And I think evolution, teaching of evolution always engages. It's good place to start and I think maybe the QCA should be started from that point."

With all the shrilled debate about teaching Creationism and evolution in the media it seems that the reality in the classroom that it is far more calm. Evolution underpins all aspects of biology and as such should be at the core of the biology curriculum. Creationism plays no part in that process but teachers should be equipped to deal with Creationism when it arises. We have seen from the activities at the Natural History Museum that this can help pupils understand that Creationism is not science and as such it can inform the scientific process.