Creationism, Darwinism and Intelligent Design: What are Biology Teachers Supposed to Do?

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For reasons that delight some and amaze others, creationism is growing in extent and influence, both in the UK and elsewhere. The impact in education is perhaps the most notable effect. So how should biology teachers deal with the issue?

Definitions of creationism vary but about 40% of adults in the USA and 10% or more in the UK believe that the Earth is only some 10,000 years old, that it came into existence as described in the early parts of the Bible or the Qur'an and that the most that evolution has done is to change species into closely related species (Miller *et al.*, 2007). For a creationist it is possible that the various species of zebra had a common ancestor but this is not the case for zebras, bears and antelopes – still less for monkeys and humans, for birds and reptiles or for fish and amphibians (Figure 1).

For evolutionary biologists, indeed, for the overwhelming majority of biologists and other scientists, the Earth is some 4,600 million years old and all organisms share a common ancestor. Furthermore, if one goes back far enough, life had its ancestry in inorganic molecules. An evolutionary understanding of the world is fundamental to biology and many other aspects of science. For an evolutionist, an evolutionary perspective enables us to understand ourselves, the other organisms and the world about us.

There have always been creationists while evolutionists, some of whom have a religious faith and some of whom do not, have been around in large numbers for well over a hundred years. However, science teachers in the UK have until recently been able to avoid the issue of creationism, largely

because it only rarely came up in class discussions. But that seems to be changing (Jones and Reiss, 2007). Accusations that the evangelical beliefs of some of the founders of the new Academies are influencing the way that science is taught, the growth of Islam and fundamentalist Christianity in the UK, the way in which religious beliefs are increasingly being used as sociological markers of identity and the apparently endless legal battles in the USA about whether creationism or intelligent design can or should be taught in schools (Moore, 2007) have all contributed to an atmosphere in which the average UK science teacher is sometimes left wondering what to do when faced with teaching aspects of astronomy, biology or earth sciences.

Teaching about origins (biological or cosmological) in science is an issue about which many people have strong views, and this is hardly surprising. There may not be a necessary connection between where we came from, who we are and what we should become, but the three questions relate to one another in most people's minds. A lot of evolutionists think creationists, at best, should be tolerated, provided they don't attempt to force their views on others or interfere with the teaching of science. In addition, evolutionists are deeply suspicious of those who advocate intelligent design – the notion that the intricacy of the order we see in the natural world, including at a sub-cellular level, provides strong evidence for the existence of an intelligence behind this (e.g. Behe, 2003).

On the other hand a lot of creationists believe that evolutionists refuse to listen to any arguments against evolution. At best evolutionists are seen as presenting a one-sided view of origins and making cheap jokes at creationists; at worst they denigrate religion and betray their ignorance of matters spiritual. Intelligent designers wish that evolutionists would treat intelligent design as a reputable theory deserving of consideration in school and college science lessons.

Teaching about the nature of knowledge

In many countries, including the UK, school science curricula have come in recent years to include more about the *nature* of science: about the practice of doing science and the knowledge that results. Certain things clearly fall under the domain of science – the workings of electricity, the arrangement of atoms into molecules and human physiology, to give three examples. However, what about the origin of the universe, the behaviour of people in society, decisions about whether we should build nuclear power plants or go for wind power, the appreciation of music and the nature of love, for example? Do these fall under the domain of science? A small proportion of people, including a few prominent scientists, would not only argue 'yes' but maintain that *all* meaningful questions fall within the domain of science.

However, most people hold that science is but one form of knowledge and that other forms of knowledge complement science. This way of thinking means that the origin of the universe is also a philosophical or religious question – or simply unknowable; the behaviour of people in society requires knowledge of the social sciences (including psychology and sociology) rather than only of the natural sciences; whether we should go for nuclear or wind power is partly a scientific issue but also requires an understanding of economics, risk and politics; the appreciation of music and the nature of love, while clearly having something to do with our perceptual apparatuses and our evolutionary history, cannot be reduced to science (Reiss, 2005).

While historians tell us that what scientists study changes over time, there are reasonable consistencies. First, science is concerned with the natural world and with certain elements of the manufactured world – so that, for example, the laws of gravity apply as much to artificial satellites as they do to planets and stars. Secondly, science is concerned with how things are rather than with how they should be. So there is a science of gunpowder and *in vitro* fertilisation without science telling us whether warfare and test-tube births are good or bad.

Should science teachers teach about religion? Some have argued not on the grounds that religion has no place, on epistemological grounds, in science.

Others have emphasised the value of using the evolution/creationism controversy as a way of teaching about science as a process of critical thinking (Skehan & Nelson, 2000). Perhaps the strongest argument for teaching anything about religion in a science class, whether at school, college or university, is if it helps students better to understand science. Teaching about aspects of religion in science classes could potentially help students better understand the strengths and limitations of the ways in which science is undertaken, the nature of truth claims in science and the importance of social contexts for science. However, there are also reasons to be cautious before teaching about aspects of religion in science classes. For example, a science teacher might feel that they simply don't have the expertise to teach effectively about such matters, that these matters are better dealt with elsewhere in the curriculum, or that it is impossible to teach objectively about such matters since one risks indoctrinating one's students either into or away from a religious faith (Reiss, in press).

However, what I have found to be of worth, and feasible, in science classes with undergraduates training to be primary science teachers is, when teaching about the nature of science, to get them to think about the *relationship* between scientific knowledge (i.e. the knowledge that results from science) and religious knowledge (i.e. the knowledge that results from religion/theology). What seems to work well is to ask students, either on their own or in pairs, to illustrate this by means of a drawing and then for all of us in the class to discuss the various drawings that result. See, for example, the hypothetical representation in Figure 2. A person producing the representation in Figure 2 sees both religious and scientific knowledge as existing but envisages the scope of religious knowledge as being smaller than that of scientific knowledge and of there being no overlap between the two.

A number of people who write about science and religion favour a clear-cut distinction between religious and scientific knowledge (e.g. Gould, 1999). There are a number of advantages to such a position. For example, it allows a person with a strong religious belief who might otherwise be troubled by certain aspects of science to avoid possible conflict (and vice versa) and it

provides an epistemological justification for why religious matters should not be examined in science classes, which is useful in countries such as the USA and France where there are tight rules about what aspects of religion may be taught in schools.

But there are many for whom scientific knowledge and religious knowledge are not distinct. At one end are those who draw religious knowledge as being much smaller than scientific knowledge and wholly or partly contained within it; at the other are those whose worldview is predominantly religious. In between are a whole range of portrayals of the ways in which science and religion can relate.

Teaching about controversial issues

A widely accepted definition of a controversial issue is that a matter is controversial if contrary views can be held on it without those views being contrary to reason (Dearden, 1984). Most people would agree that the science/religion issue is controversial.

An issue may be controversial at one time but not at another. For instance, slavery was controversial in the middle of the nineteenth century even if it is not so now and the existence of anthropogenic global climate change has become less controversial in recent years. Furthermore, a matter may be controversial for some people but not others. After all, the science/religion issue is not controversial, merely exasperating, for Richard Dawkins. A more general point is that controversy is often neither entirely absent nor completely present; there are degrees of controversy.

Importantly, a matter can be controversial without it being scientifically controversial. There are very few professional scientists for whom the young Earth hypothesis (i.e. that the Earth is some 10,000 or fewer years old) is scientifically controversial: it is simply judged to be wrong. In the same way, there are very few professional scientists for whom the theory of evolution is a

controversial part of science. However, this last example illustrates the fact that a scientific theory may not be controversial even though aspects of it are. For example, precisely how life evolved from inorganic materials is still highly controversial, and there is at least some degree of controversy about such matters as the relative importance attached to natural selection versus other agents of evolutionary change, how long it typically takes for a new species to arise and many, many details of the history of life.

Would one want explicitly to teach about creationism in science lessons? The response from most scientists and science educators is generally 'no'. Here my interest in not in the legal situation (for the current advice from the Department for Children, Schools and Families (DCSF) see www.teachernet.gov.uk/docbank/index.cfm?id=11890) but in whether it would desirable on educational grounds to teach about creationism in science lessons. Given the preceding paragraph, I would not want any such teaching, were it to occur, to give the impression that creationism and the theory of evolution are equally valid scientifically. They are not (and nor is it appropriate to insist on spending equal amounts of time on evolution and creationism in science lessons).

However, while it is likely that the great majority of those who believe in creationism or intelligent design theory do so because of their religious beliefs it is logically possible to hold that evolution (*sensu* major anatomical, physiological, genetic and biochemical changes in organisms over the generations) has not happened. One can conceive of a world in which the earliest fossils indicate creatures as complicated as ourselves and in which the same geological strata show human and dinosaur footprints. Indeed, I very much favour students examining the evidence for evolution in a critical manner, and have done since I first started teaching biology back in the late 1970s.

Furthermore, just because something is 'non-scientific' is surely not sufficient to disqualify it from being considered in a science lesson. An understanding of (non-scientific) context often helps in learning the content of science, partly by

motivating the learner, partly by indicating why the content is meaningful and partly by rendering the content more intelligible. As far as evolution is concerned, stories about, for example, the voyage of *The Beagle* or the domestication of pigeons can be motivating for students and can help clarify the thinking that Darwin went through, thus enabling students themselves better to understand the science.

An additional point is that much of the debate about the teaching of evolution is still situated, albeit implicitly, in a view of education in which the teacher has complete control over that which enters each student's mind about the issue in question. Such a view has been outmoded for years. If one turns from considering that which is taught to that which is learnt, it immediately becomes clear that students have always (and nowadays possibly more than ever) learnt outside of formal lessons and from people (including family) and other sources in addition to their prescribed textbooks.

This leads onto the more general point about how one should teach about controversial issues in science. The short answer is that one should surely do so in a way that respects evidence and valid reasoning and that helps students to understand which aspects of an issue are controversial and which are not.

As to the precise techniques one can employ when teaching a controversial issue, there are many. I have tried, in addition to other approaches, the approach of procedural neutrality (in which the teacher acts as a facilitator but does not try to steer the debate in any particular direction). Graduate science students doing a Secondary Science PGCE were presented with a wide range of materials detailing how Darwin's *On the Origin of Species By Means of Natural Selection* was received after its publication on 24 November 1859. The students then divided themselves into four groups and desk-top published the front page of a newspaper of that time reacting to Darwin's book. One group produced *The Times* which, though it discussed the book, gave pride of place to Garibaldi's campaign in Italy. Another group produced *Nature* which, though generally positive about the book, stressed the

controversy caused in the scientific establishment. A third group produced *The Church Times* which gave pride of place to Lord Wilberforce's scientific assessment of Darwin's theory. Finally, the fourth group formed a feminist workers' co-operative and produced a tabloid called *The Splurge*. Their lead story was headed "All Men are Apes. It's Official!!!".

Teaching about matters of personal significance

Even if one agrees that there are aspects of the science-religion relationship that can or should validly be taught in science lessons, this is not to minimise the fact that teaching about this relationship is, for many, a matter of considerable personal significance.

Teaching about a matter of personal significance is related to but not identical to teaching about a controversial issue. To teach about matters of personal significance can demand much of teachers. It exposes aspects of ourselves to our students in a way which many teachers will find threatening or invasive, though some may find exciting. There are parallels to discussing our own experiences as sexual beings when teaching sex education – a dangerous state of affairs and one that new entrants to the teaching profession are wise to avoid, at the least for their own sakes.

Equally, teaching about matters of personal significance can make significant demands on students. We need to find ways that are respectful of students, that neither threaten their beliefs not molly coddle them as if getting them to think about their beliefs was necessarily to attack them. In England and Wales, Salters-Nuffield Advanced Biology has been running for 16-19 year-olds in a pilot version since September 2002 and nationally since September 2005 (Salters-Nuffield Advanced Biology, 2007). One of the learning objectives in the topic on evolution and ecology is "Appreciate why, for cultural reasons, the theory of evolution has been so controversial for some people". The reason for including this learning objective was because the team devising the course felt it worthwhile for 16-19 year-olds to understand

something about this issue Of course, the aim is neither to persuade students to embrace certain religious beliefs nor to cause them to abandon them: it is to help them learn and to clarify their thinking.

Conclusion

The strongest argument as to why science teachers might deal with the relationship between science and religion when teaching about origins, whether in biology, earth sciences or astronomy, is that it can be good science teaching so to do. It is unlikely that teaching in this area can help students for whom there is a conflict between science and their religious beliefs to resolve the conflict (Jackson *et al.*, 1995), but good teaching may help them to manage the conflict – and it can certainly enable students, whatever their personal beliefs, to understand science better. We can help students to find their science lessons interesting and intellectually challenging without their being threatening. Effective teaching in this area can not only help students learn about the theory of evolution but better to appreciate the way science is done, the procedures by which scientific knowledge accumulates, the limitations of science and the ways in which scientific knowledge differs from other forms of knowledge.

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