10/11/07

Jim Knight,
Minister of State for Schools and Learners,
Department for Children, Schools and Families

A science teacher's response to the government's 'GUIDANCE ON THE PLACE OF CREATIONISM AND INTELLIGENT DESIGN IN SCIENCE LESSONS'

Dear Sir,

I am concerned at the number of statements in this document which are unsupported, misleading or false. It does nothing to inform science staff of the arguments raised by proponents of intelligent design (ID). Instead ID is simply dismissed as being 'wholly outside of science'. The document seems to have been created for no other purpose than to appease pressure groups like Science Just Science, Ekklesia and the British Humanist Association who have been lobbying government for just such a pronouncement.

The guidance notes (up to but not including the glossary of terms) are reproduced in full here.

The parts to which I address my comments are highlighted in yellow.

(I make a number of references to the American 'National Association of Science' (NAS) since they have been the one influential group most resolutely and vociferously opposed to ID in the US in recent years.)

GUIDANCE ON THE PLACE OF CREATIONISM AND INTELLIGENT DESIGN IN SCIENCE LESSONS

The National Curriculum

The National Curriculum secures for all pupils, irrespective of background and ability, an entitlement to a range of areas of learning. Its aim is to develop knowledge, understanding, skills and attitudes necessary for each pupil's self-fulfilment and development as an active and responsible citizen. It makes expectations for learning and attainment explicit to pupils, parents, teachers, governors, employers and the public, and establishes national standards for the performance of all pupils.

The National Curriculum provides the framework of what should be taught in a particular subject. It does not state how subjects should be taught and schools are free to add additional material to it when developing their school curriculum (for example some schools choose to teach Astronomy at GCSE in addition to other science GCSEs).

Science in the curriculum

Science is a core subject of the National Curriculum throughout every key stage.

The science programmes of study set out the legal requirements of the science National Curriculum. They focus on the nature of science as a subject discipline, including what constitutes scientific evidence and how this is established. Students learn about scientific theories as established bodies of scientific knowledge with extensive supporting evidence. Hypotheses are developed on the basis of the body of knowledge and are tested experimentally to generate further evidence that may be supportive or contradictory. Experimental work can then be used to generate further evidence in order to test new hypotheses based on these bodies of scientific knowledge. The role of the scientific community in evaluating and validating new work is also included as is the nature of, and evidence for, evolution.

Religious Education in the curriculum

Religious Education (RE) is a component of the basic curriculum, to be taught alongside the National Curriculum in all maintained schools.

There is scope for young people to discuss beliefs about the origins of the Earth and living things in RE. The DfES and QCA have published a non-statutory national framework for RE and supporting teaching units which include the unit 'How can we answer questions about creation and origins?' The unit focuses on creation and the origins of the universe and human life, as well as the relationships between religion and science. Students have opportunities within RE lessons to discuss, explore, question and evaluate these relationships. The unit can be downloaded from http://www.qca.org.uk.

Scientific theories

The use of the word 'theory' can mislead those not familiar with science as a subject discipline because it is different from the everyday meaning of being little more than a 'hunch'. In science the meaning is much less tentative and indicates that there is a substantial amount of supporting evidence, underpinned by principles and explanations accepted by the international scientific community. However, it also signals that all scientific knowledge is considered to be provisional as it can be overturned by new evidence if this is validated and accepted by the scientific community.

Creationism and intelligent design are sometimes claimed to be scientific theories. This is not the case as they have no underpinning scientific principles, or explanations,

Depends on one's definition of a scientific theory. Under questioning from the American NAS recently Dr. Michael J. Behe (author of 'Darwin's Black Box') defended his position on the Intelligent Design (ID) argument; "Under my definition, scientific theory is a proposed explanation which points to physical data and logical inferences."

It could be argued that the 'Big Bang' theory of the origin of the Universe has no 'underpinning scientific principles or explanations' but this has not prevented it from being widely accepted by the 'scientific community'. One could say that other 'theories' such as Superstring theory should also not be so called. The fact is that the debate over what constitutes a theory could continue for a long time. But this misses the point that the Science National Curriculum – like Science itself - is not about theories per se, it is about Science. The real question should therefore be; 'Is the Intelligent Design argument Science?'. But I see that you tackle this question later.

and are not accepted by the science community as a whole.

Their acceptance or otherwise is surely irrelevant to the argument. History is filled with examples of new theories which were at first ignored/rejected by the 'scientific community' of the day. Dr.W.A.Dembski (Executive Director of the International Society for Complexity, Information and Design) wrote; 'Science is not decided by majority vote. Can the majority of scientists be wrong about scientific matters? Yes they can. Historian and philosopher of science Thomas Kuhn (1970), in his *Structure of Scientific Revolutions*, documented numerous reversals in science where views once confidently held by the scientific community ended up being discarded and replaced. For instance, until the theory of plate tectonics was proposed, geologists used to believe that the continents were immovable.' Even Richard Dawkins writing with Jerry Coyne to the Guardian (01/07/05) made clear that while ID is rejected by the majority of biologists, 'science does not proceed by majority vote among scientists.'

Creationism and intelligent design therefore do not form part of the science National Curriculum programmes of study.

What is appropriate to teach in science lessons?

The nature of, and evidence for, evolution must be taught at key stage 4 as these are part of the programme of study for science. Key stages 1, 2 and 3 include topics such as variation, classification and inheritance which lay the foundations for developing an understanding of evolution at key stage 4 and post-16.

The nature of science as a subject discipline must also be taught, as described in Sc1 Scientific enquiry at key stages 1 and 2 and how science works at key stages 3 and 4.

Creationism and intelligent design are not part of the science National Curriculum programmes of study and should not be taught as science. However, there is a real difference between teaching 'x' and teaching *about* 'x'. Any questions about creationism and intelligent design which arise in science lessons, for example as a result of media coverage, could provide the opportunity to explain or explore why they are not considered to be scientific theories and, in the right context, why evolution is considered to be a scientific theory.

Yes - why *is* evolution considered to be a scientific theory when senior biologists have described it variously as 'not part of science', 'outside of empirical science' and 'not satisfactorily supported by present-day evidence'? (see pages 6 & 7).

Addressing students' questions about creationism or intelligent design

Science teachers can respond positively and educationally to questions and comments about creationism or intelligent design by questioning, using prompts such as 'What makes a theory scientific?', and by promoting knowledge and understanding of the scientific consensus around the theories of evolution and the Big Bang.

Choosing appropriate resources

The DCSF does not specify teaching resources. There is a wide variety of resources available for use in schools and teachers are free to use their professional judgement to select appropriate materials for their science lessons.

Any resource should be checked carefully before it is used in the classroom. If resources which mention creationism or intelligent design are used, it must be made clear that neither constitutes a scientific theory.

FREQUENTLY ASKED QUESTIONS

Is creationism a valid scientific theory?

'Creationism', a term commonly used as a shorthand for 'young-Earth creationism', is the belief that the Earth and its many species did not gradually come into being over billions of years but were created suddenly and within the last 10,000 years. This proposed timescale can be investigated scientifically with the scientific evidence indicating a much older Earth (between 4,000 and 5,000 million years). The existence of a 'creator' is not scientifically testable.

Is a belief in creation the same thing as 'creationism'?

Belief that God created everything that exists is shared by Christians, Jews, Muslims and many others all over the world. Many of the founders of modern science, as well as contemporary scientists, have held and do hold this belief, one 'that science cannot address' since it is religious/metaphysical. In view of this, in the interest of good science education, it is important that science teachers do not assert or imply that science contradicts traditional beliefs in creation and design.

But Darwinian Evolution *does* contradict the design argument! If we teach students that Evolution is the only scientific explanation for life then we *are* implying that science contradicts a belief in design. So what are we to say to students?

To the belief in creation, creationists have added the belief that the Earth is geologically young, although this is not supported by mainstream science.

Is intelligent design a valid scientific theory?

The intelligent design movement claims there are aspects of the natural world that are so intricate and fit for purpose that they cannot have evolved but must have been created by an 'intelligent designer'. Furthermore they assert that this claim is scientifically testable and should therefore be taught in science lessons.

Indeed it *is* scientifically testable because it makes clear predictions ('Is intelligent design a credible scientific theory?' by C.Luskin). One of the predictions has been that the genetic code will NOT contain much discarded genetic baggage code or functionless 'junk DNA'.

Intelligent design lies wholly outside of science.

Unsupported statement! *Why* do you contend that ID 'lies wholly outside science'?

According to the NAS; 'Anything that can be observed or measured is amenable to scientific investigation.' Yet one of the cornerstones of ID theory; 'Irreducible Complexity' *is* observed and the other; 'Specified Complexity' *can* be measured. The NAS continues; 'Explanations that cannot be based upon empirical evidence are not a part of science. The statements of science are those that emerge from the application of human intelligence to data obtained from observation and experiment.' *(NAS, Teaching About Evolution and the Nature of Science, pg. 42)* So if the ID explanation was not based on evidence/observational data it would rightly remain outside of science – but this is not the case.

For many years I was required to teach about the search for extraterrestrial intelligence (SETI) in GCSE Science. Yet this 'search' is based only on a *belief* that there is intelligence out there. There is no evidence for such a belief. No signal containing 'specified complexity' – the indicator of an intelligent agent - has ever been found. This has led some scientists to question whether indeed it is science at all. Writer and medical doctor Michael Crichton, in his Caltech Michelin Lecture (2003), criticized SETI as follows: 'SETI is not science.…The belief that there are other life forms in the universe is a matter of faith. There is not a single shred of evidence for any other life forms, and in forty years of searching, none has been discovered. There is absolutely no evidentiary reason to maintain this belief. SETI is a religion.' Crichton's criticism may be considered extreme; indeed NASA has funded SETI research in the past. For many the search for an intelligently designed signal (i.e. one with high 'specified complexity') would seem to be sufficient for it to be considered a legitimate scientific enterprise.

But the same 'specified complexity' that would indicate the existence of an intelligence behind a signal received from outer space is exactly what ID proponents claim to have discovered within the encyclopaedic information in living things. Why then is SETI considered science and worthy to be taught in schools while ID is not? Most ID proponents are practising scientists. They do real science. They present papers at conferences and despite substantial prejudice have had some of their work published in peer reviewed scientific journals.

So what is it about ID that you believe puts it outside science? You have not referred to it in this document but I believe it is that the explanation may invoke the existence of something beyond our current understanding of 'nature'. And this 'supernatural' something is not allowed according to certain definitions of science**.** Richard Dickinson, prominent Biochemist and member of NAS says;

> 'Science, fundamentally, is a game. It is a game with one overriding and defining rule: Let us see how far and to what extent we can explain the behaviour of the physical and material universe in terms of purely physical and material causes, without invoking the supernatural.'

Let's be clear though that 'There is currently no definition of science agreed upon by all philosophers of science.' (Lauden, 1988). Karl Popper described science simply; '…as a system of hypotheses, or as a system of guesses or anticipations that in principle cannot be justified, but with which we work as long as they stand up to tests, and of which we are never justified in saying that we know they are "true" . .'

We could even question whether Darwinian Evolution is a valid scientific theory. Indeed many biologists have questioned whether it lies within science at all;

> 'One must conclude that, contrary to the established and current wisdom a scenario describing the genesis of life on earth by chance and natural causes which can be accepted on the basis of fact and not **faith** has not yet been written' *(H.P.Yockey Journal of Theoretical Biology, vol67,1977 p396.)*
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> '…**is [biology] then a science or a faith?** Belief in the theory of evolution is thus exactly parallel to belief in special creation – both are concepts which believers know to be true but neither, up to the present, has been capable of proof.' *(L.H.Matthews,FRS Introduction to Darwins Origin of Species, J.M.Dent & Sons Ltd 1971)*
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> 'Our theory of evolution has become, as Popper described, one which cannot be refuted by any possible observations. Every conceivable observation can be fitted into it. It is thus "**outside of empirical science**" but not necessarily false. No one can think of ways in which to test it.' *(P.Ehrlich Prof. of Biology, Stanford Uni. And L.Birch Prof.of Biology Uni.of Sydney, Nature vol214 1967 p352)*
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> 'It is easy enough to make up stories of how one form gave rise to another, and to find reasons why the stages should be favoured by natural selection. But such stories are **not part of science**, for there is no way of putting them to the test.' *(Dr.C.Patterson Senior Palaeontologist British Mus of Nat History quoted in Darwin's Enigma by L.Sunderland Master Books USA 1984, p89)*

And what of the 'extensive supporting evidence' that you say is fundamental to a scientific theory?

> "The attempt to explain all living forms in terms of an evolution from a unique source, though a brave and valid attempt, is one that is premature and one that is **not satisfactorily supported by present-day evidence**." *(Dr.G.A.Kerkut, Professor of Physiology and Biochemistry, University of Southampton)*
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> We [palaeontologists] fancy ourselves as the only true students of life's history, yet to preserve our favoured account of evolution by natural selection **we view our data as so bad that we never see the very process we profess to study**." *(Stephen Jay Gould Prof. of Geology & Paleontology, Harvard University)*
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> "…the transition from insectivore to primate is **not documented by fossils**." (*A.J. Kelso Prof. of Physical Anthropology, University of Colorado)*
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> "There is **no fossil evidence** of the stages through which the remarkable change from reptile to bird was achieved." (*W.E.Swinton Natural History Museum, London)*
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> "Modern Apes…seem to have sprung out of nowhere. They have no yesterday, **no fossil record**." (*Dr. Lyall Watson (anthropologist) Science Digest, vol.90,p.44)*

> "The geological record has so far provided **no evidence** as to the origin of fishes." (*J.R..Norman Natural History museum, London)*
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> "But I still think that to be unprejudiced, **the fossil record of plants is in favour of special creation**." (*Professor E.J.H.Corner of the Cambridge University botany school)*
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> "The irony of this whole situation is that the very concept of organic evolution is completely absurd and impossible. **It is absolutely astonishing that an idea which is so devoid of any legitimate scientific evidence could have attained a position of such prestige in the name of science**." *(Scott M.Huse B.S.,M.S., M.R.E.,Th.D.,Ph.D)*

With so many questions over the legitimacy of Darwinian Evolution - from within Biology itself - one ought to ask why it is so widely accepted. Could it be, as Prof. D.M.Watson has said, that:

> 'Evolution [is] a theory universally accepted not because it can be proven by logically coherent evidence to be true, but because the only alternative, special creation, is clearly incredible.'

If this is so - is it a good enough reason to be teaching Evolution in our schools?

Many critics of ID now choose to define science in such a way that evolutionary theory falls within science and intelligent design falls without. The 'methodological materialism' argument is that a valid scientific explanation can only involve 'natural' causes. As a result;

> 'Even if all the data point to an intelligent designer, such a hypothesis is excluded from science because it is not naturalistic.' *(S.Todd, Kansas State Uni.)*

It was primarily this argument which resulted in the Court finding that ID is not science in the 2005 Kitzmiller vs Dover Area School District case. The Court decided that ID 'invokes and permits supernatural causation'. Yet Behe – lead witness for the defence - vehemently denies this; 'The Court's opinion ignores….the distinction between an implication of a theory and the theory itself. As I testified, when it was first proposed the Big Bang theory struck many scientists as pointing to a supernatural cause. Yet it clearly is a scientific theory, because it is based entirely on physical data and logical inferences. The same is true of intelligent design.'

Eugenie Scott (1998), director of the National Center for Science Education (a group advocating an exclusively Darwinist curriculum), explains how methodological materialism interprets nature: 'Most scientists today require that science be carried out according to the rule of *methodological materialism*: to explain the natural world scientifically, scientists must restrict themselves only to material causes (to matter, energy, and their interaction).'

But how do we know that 'nature' works this way? What right do we have to impose restrictions on what nature can and cannot do? Dembski argues that methodological materialism restricts the nature of nature;

> 'Nature, as conceived by Scott and most critics of intelligent design, consists of material entities ruled by fixed laws of interaction, often referred to as "natural laws." How do we know that nature is in fact a set of material entities ruled by fixed laws of interaction? Equivalently, how do we know that everything that happens in nature can be accounted for in terms of antecedent material conditions and the material causes that act on them? Once the question is posed this way, it becomes an open question whether nature comprises a set of material entities ruled by fixed laws of interaction. In fact, it becomes a live possibility that nature,

so conceived, is radically incomplete.'

'Nature is what nature is and not what we define it to be….defining nature as a closed system of material entities operating by fixed laws of interaction doesn't make it so.'

'Science is supposed to pursue the full range of possible explanations. Evolutionary biology, by limiting itself to material mechanisms, has settled in advance which biological explanations are true apart from any consideration of empirical evidence.'

I believe we should allow nature to speak for itself, not impose restrictions on what it is allowed to be. We should not be telling the Universe how we think it should behave. There was a time when we tried to tell it that the Earth was at the centre. In the 19th century we tried to fill it with 'luminiferous aether'. Then Einstein tried to tell it that it wasn't expanding – famously adding his fudge-factor, the Cosmological Constant – 'the biggest blunder of my life'. Have we learnt nothing from the past? Nobel-prize-winning physicist Richard Feynman stated; 'Science alone of all the subjects contains within itself the lesson of the danger of belief in the infallibility of the greatest teachers in the preceding generation… As a matter of fact, I can also define science another way: Science is the belief in the ignorance of experts.' We would all be living on a flat Earth at the centre of a static aether-filled universe if scientists continually closed ranks whenever a new idea was born!

In any case many science philosophers now argue that 'philosophically neutral criteria do not exist that can define science narrowly enough to disqualify theories of creation or design without also disqualifying Darwinism and other materialistic evolutionary theories on identical grounds. Either science will be defined so narrowly as to disqualify both types of theory, or science must be defined more broadly and the initial reasons for excluding opposing theories evaporate'. (Intelligent Design in Public School Science Curricula: A Legal Guidebook *David K. DeWolf, Stephen C. Meyer, Mark E).*

Accordingly Eugenie Scott no longer rejects design theory as inherently "unscientific," as she did as recently as 1994; she now argues that it constitutes a minority viewpoint within science. (*Testimony to U.S. Commission on Civil Rights: Schools and Religion Project, Seattle Briefing*, August 21, 1998)

So call ID 'a minority viewpoint within science' if you like but please don't pretend that it 'lies wholly outside science'!

Sometimes examples are quoted that are said to require an 'intelligent designer'. However, many of these have subsequently been shown to have a scientific explanation, for example, the immune system and blood clotting mechanisms.

They have not been shown to have any explanation other than that of design (assuming this is what you mean by 'scientific' explanation). I believe you are referring again to the Dover Court case in 2005 in which the court accepted Dr Miller's argument that a system is not irreducibly complex if one or more parts can be used for another purpose ('co-optation'). However, Behe has protested that Miller was using an 'adulterated definition' of irreducible complexity *('A Response to the Opinion of the Court in Kitzmiller vs Dover Area School District' by Dr. Michael J.Behe).* This 'co-optation' argument does not demonstrate a Darwinian explanation and has been analysed by Dembski who argued that the 'only evidence we have of successful co-optation…comes from engineering and confirms that intelligence is indispensable in explaining complex structures.' *(Does Evolution even have a Mechanism? By Dr.W.A.Dembski)*

Attempts to establish an idea of the 'specified complexity' needed for intelligent design are surrounded by complex mathematics.

I understand it is the *measurement of* the specified complexity which is complex – not the establishment of the idea. In any case I don't see the relevance of this statement to the question of the validity of ID.

Despite this, the idea seems to be essentially a modern version of the old idea of the "God-of-the-gaps". Lack of a satisfactory scientific explanation of some phenomena (a 'gap' in scientific knowledge) is claimed to be evidence of an intelligent designer.

No! The 'gap' is not the evidence. The discovery of numerous irreducibly complex molecular machines / processes in living things and the highly specified information content – such as that in DNA - is the evidence.

Should time be given to creationism and intelligent design in science lessons?

The theory of evolution lies at the heart of biology and should be taught at key stage 4 and in GCE advanced level biology. Creationism and intelligent design are not scientific theories and do not form part of the science National Curriculum or the GCSE and GCE A level subject criteria. There may be situations in which it is appropriate for science teachers to respond to student comments or enquiries about the claims of creationism or intelligent design. This would be to establish why they are not considered as scientific theories as described above in 'What is appropriate to teach in science lessons'. One way to do this would be to consider the mechanisms by which new scientific knowledge becomes established and why creationism and intelligent design do not meet these requirements.

If questions or issues about creationism and intelligent design arise during science lessons they can be used to illustrate a number of aspects of how science works. Such aspects include: 'how interpretation of data, using creative thought, provides evidence to test ideas and develop theories'; 'that there are some questions that science cannot currently answer, and some that science cannot address'; 'how uncertainties in scientific knowledge and scientific ideas change over time and about the role of the scientific community in validating these changes'.

Which subject should deal with creationism and intelligent design?

Teachers of subjects such as RE, history or citizenship may deal with creationism and intelligent design in their lessons. If such issues were to arise there might be value in science colleagues working with these teachers in addressing them.

Should I use resources about creationism and intelligent design that are sent to my school?

Decisions about which resources to use rest with schools and teachers. Organisations promoting creationism and intelligent design quite often provide resources for schools; these may include paper-based activities, leaflets, DVDs, CDs, music, workshops, other activities and web resources. While these resources may be used, it must be remembered that they do not support the science National Curriculum and they present a particular minority viewpoint that is not underpinned by scientific principles and evidence.

What about students who hold creationist beliefs or believe in the arguments of intelligent design?

Some students do hold creationist beliefs or believe in the arguments of the intelligent design movement and/or have parents/carers who accept such views. If either is brought up in a science lesson it should be handled in a way that is respectful of students' views, religious and otherwise, whilst clearly giving the message that the theory of evolution and the notion of an old Earth / universe are supported by a mass of evidence and fully accepted by the scientific community.

1) Belief in ID does not preclude the notion of an old Earth/Universe.
2) Theory of evolution is clearly not 'fully accepted' as an explanation of the origin of specified complexity in living things. You seem to be suggesting that ID proponents lie outside the 'scientific community' which is nonsense.

Final thoughts:

Following the opinion of the Dover Court that ID is not science Behe notes in his response that according to the Court's legal analysis;

> '"science" is what the consensus of the community of practicing scientists declares it to be.'

Whereas Behe's own view is that;

> '"science" is an unrestricted search for the truth about nature based on reasoning from physical evidence.'

Which of these definitions should we be teaching our students?

Science should not be decided by judges or by consensus and if we've learned anything from the past we should not be suggesting to students that the majority view must always be the right view.

We should not waste time getting sidetracked into arguments over whether something does or does not fall under a particular definition of science. Instead it is better to spend time discussing how to check scientifically whether that 'something' is true.

We should be teaching the next generation of scientists to be objective, unbiased investigators. Rejecting one line of investigation because we are afraid of the possible implications is absurd – and is certainly not a scientific approach.

And why is it that such issues only seem to arise in Biology? In Physics the Big Bang theory did ruffle some feathers when it was first suggested since it required a beginning – a moment of creation - which *implied* the existence of a creator. There is a direct parallel with Intelligent Design here where the theory *implies* a designer. However, ID has been rejected as science on the basis of the implication of a 'supernatural' cause, while the Big Bang theory has been widely accepted despite a similar implication. Why the difference? And how is it that physicists are allowed to talk freely of the apparent evidence of design in the laws of physics – e.g. Paul Davies; 'It seems as though somebody has fine-tuned nature's numbers to make the Universe....The impression of design is overwhelming'. Comments like this are widespread amongst prominent physicists and cosmologists today. But why should inferring design from the evidence of cosmology be scientifically respectable, while inferring design from the evidence of biology be scientifically disreputable?

Intelligent design may not be correct. But the only way we could discover that is by admitting design as a real possibility, not ruling it out at the start. Darwin himself would have agreed. In the *Origin of Species* he wrote: 'A fair result can be obtained only by fully stating and balancing the facts and arguments on both sides of each question.' Double Nobel laureate Linus Pauling said that 'Science is the search for the truth'. So let's teach the next generation of scientists to search for the truth. And if that search leads to an inconvenient conclusion – a conclusion of design – so be it. What are we afraid of?

Dean Taylor
Science teacher