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## **The wrecking of British science**

If the world's future lies in scientists' hands, the answers are unlikely to come from the UK unless we reverse decades of political neglect, argues Nobel laureate Harry Kroto

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Without first-class science graduates, how will we understand and deal with the crises caused by global warming, asks Kroto. Photograph: [www.kroto.info](http://www.kroto.info)

There is food for thought in the fact that, after a decade of Labour government and at the same moment that the prime minister was making a speech about how important he considered science, the University of Reading announced the closure of its physics department.

Thirty per cent of physics departments have either been closed or merged in the past five years. What is one to make of the deafening silence of ministers when, last year, the small Sussex chemistry department - a fantastic department to work in, where I stayed for some 37 years and which has housed some 12 fellows of the Royal Society, three Nobel laureates and a Wolf prize winner since it was created in 1962 - was under threat of closure? It was only through the concerted efforts of staff and students that a U-turn occurred.

Does no one in the government care, or is there a hidden agenda? Some government measures, such as those aimed at improving technology transfer and the encouragement of start-ups, have been successful. However, nothing effective has been done by this government, or for that matter the previous one, to improve the situation on the science education front. Indeed, several new measures have exacerbated the problem. The laissez-faire attitude to

science education has resulted in a disaster exemplified by the fact that more young people are opting for media studies than physics.

As a new five-storey chemistry building nears completion here at Florida State University (where I was wanted!), the jaws of American colleagues drop with incredulity at news of each successive UK science department closure.

All of this matters because the need for a general population with a satisfactory understanding of science and technology has never been greater. We live in a world economically, socially and culturally dependent on science not only functioning well, but being wisely applied.

### **Dwindling numbers**

Unfortunately, the numbers of young people opting for scientific training has dwindled frighteningly all over the developed world, not just in the UK. It is worth noting that, over decades, the US has been spectacularly successful in making up its homegrown science and technology shortfall by draining first western European scientists, and now eastern European and Asian scientists.

As well as trained engineers and scientists, we desperately need a scientifically literate general population, capable of thinking rationally - and that includes lawyers, businesspeople, farmers, politicians, journalists and athletes. This is vital if we are to secure a sustainable world for our grandchildren.

The facts that a) we use in one year an amount of fossil fuel that took a million years to accumulate, b) we may be on the verge of a climate change catastrophe of global proportions and c) powerful technologies may soon fall into the hands of disturbed individuals with minds riven with those twin cancers of nationalism and religious fanaticism, seem to concern the scientific community a lot more than they do politicians or the media. As my Sussex colleague, the Nobel laureate Sir John Cornforth, has written: "If you are a scientist, you realise before long that if the world is in anyone's hands, it is in yours."

The failure of our general science educational policy is manifest in the fact that so few are aware of the true level of our dependence on science and technology, or the truly humanitarian contributions that science and technology have made to society: from raising the health of the population (half of all 18th-century children died by the age of eight) to the advanced technologies that pervade our everyday lives (the internet and mobile phones being archetypal examples).

The personal reasons for choosing a science education are also overwhelming. A Royal Society of Chemistry/Institute of Physics study found that graduates with chemistry and physics degrees earn, for the most productive 15-20 years of their working lives, some £15,000 more annually than most other graduates. They earn thousands more than those studying psychology, that seductively popular subject diverting a large proportion of our best young people into dead-end, uncreative careers. It is actually a triple whammy, as the government gets greater investment return in tax from this better-paid workforce, and there are science and technology industries for graduates to enter. The chemical industry posts a £50bn annual turnover with a £5bn profit. Which is more than can be said for law.

At a time when China and India are producing the hordes of scientists and engineers upon which they know their futures depend, all we hear from our government is that it is not its job to interfere with a secondary or tertiary education system that is graduating 10 times as many psychologists, linguists, historians and media people than there are jobs for. Too bad if young people are not going to be qualified for the careers available and commensurate with their abilities, forcing many to settle for poorly paid, uncreative jobs.

Many think of the sciences as merely a fund of knowledge. Journalists never ask scientists anything other than what the applications are of scientific breakthroughs. Interestingly, I doubt they ever ask a musician, writer or actor the same question. I wonder why.

### **Inquiring mindset**

The scientific method is based on what I prefer to call the inquiring mindset. It includes all areas of human thoughtful activity that categorically eschew "belief", the enemy of rationality. This mindset is a nebulous mixture of doubt, questioning, observation, experiment and, above all, curiosity, which small children possess in spades. I would argue that it is the most important, intrinsically human quality we possess, and it is responsible for the creation of the modern, enlightened portion of the world that some of us are fortunate to inhabit.

Curiously, for the majority of our youth, the educational system magically causes this capacity to disappear by adolescence. Without it, we have no instinctive ability to assess the importance of the technical issues that impinge on our everyday lives. We are unable to gauge accurately the validity of fears over such issues as climate change and the looming energy crisis, or grasp the socio-economic and humanitarian importance of new genetic technologies.

Scientific education is by far the best training for all walks of life, because it teaches us how to assess situations critically and react accordingly. It gives us an understanding based on reverence for life-enhancing technologies as well as for life itself. If we do not know how things work, how can we fix things? And how are we going to use these powerful technologies wisely?

The situation in universities is exacerbated by present policy, which actively encourages vice-chancellors who know the cost of everything and the value of nothing to eliminate science departments in favour of trendy, cheap courses. These VCs bleat about how important their freedom is to do whatever they wish with taxpayers' money, and steer funds earmarked for the sciences into softer areas that students prefer.

Just as cheap fast food has resulted in unprecedented levels of obesity, so this McDonald's approach to cheap, trendy, seductively soft courses designed for mass consumption in tertiary education has resulted in a plethora of students trained for non-existent jobs.

Another major factor, encouraging VCs to close science departments - even if, as at Exeter University, they have plenty of students - is the inadequate provision made by the government to cover the real cost of science education. The unit of resource ratio for an arts graduate versus a science graduate is 1:2, when a more realistic ratio is at least 1:4. It is no wonder that VCs who fail in their primary role - to bring in outside funds - are encouraged by such manifest governmental disdain for science education to eliminate science departments.

## **Divisive dogma**

Do I think there is any hope for UK? I am really not sure. It is beyond belief that in the 21st century, our prime minister and the Department for Education and Skills are diverting taxpayers' money to faith-based groups intent on propagating culturally divisive dogma that is antagonistic to the secular, enlightened philosophy that created the modern world.

It is a scandal that the present system is enabling a car salesman to divert significant government funds to propagate dogma such as "intelligent design" in our schools. State funds are also being used to support some schools that abuse impressionable young people by brainwashing them into believing that non-believers will burn for all eternity in the fires of hell. This policy is a perfect recipe for the creation of the next generation of homegrown and state-educated suicide bombers.

I think there is every likelihood that the lack of scientifically educated and aware young people in the UK will result in ever poorer performance on a global scale, and a takeover by the next generation of young Chinese and Indians, ravenous for the scientific knowledge that will free them from the shackles of present poverty levels. They are being actively encouraged by their governments, who understand that the future lies in a scientific education based on doubt and questioning, rather than on belief.

It is truly disturbing that a well-funded cohort of religious groups - aided, abetted and condoned by the Labour government - is undermining our science education. If they achieve any more success in their subversion of the intrinsic secular safeguards embodied in our democratic institutions and our educational system, there can be no doubt there is major trouble ahead. So my final message is: "Do Panic!"