

## **6 Tying science to business**

By the end of the 19<sup>th</sup> century, science in the service of production was an essential feature of capitalism, especially in the chemical and electrical industries. But the outright commercialisation of scientific knowledge and research, where such activity becomes a commodity, came to prominence in the last quarter of the 20<sup>th</sup> century. The integration of state-sponsored and funded research more directly into the needs of production is a major feature of the development of the market state in Britain and the United States.

In Britain, the state invests over £7 billion a year in research and development. Much of this is now tied to “outcomes” which demonstrate how they lead to further wealth creation by the private sector. Turning knowledge – scientific understanding – into products for the market place is seen as the key to economic success. The open commercialisation of this sector began as an objective of the Thatcher governments of the 1980s; the Blair governments have deepened and regulated this process. This is done to create the basis for new firms to develop in Britain but also to attract existing investment by transnational corporations (TNCs). A developed “science base”, with potential new research staff available for employers, is seen as an essential requirement by the New Labour government. The net result is an intense commercialisation of science in all areas – from research to the publication of findings.

Under the Tories, more than 80 public sector research

establishments like the Medical Research Council and the Southampton Oceanography Centre were given commercial freedom while some were privatised outright. The first decade of Thatcher's government from 1979-89, saw a decline in the government's share of funding for research in universities from 81% to 72% of the total, with a corresponding increase in income from charities, industry and overseas sources. This trend has accelerated. Business and charitable foundations now provide universities with over 40% of their funding for research.

### **The state steps in**

In 1993, the Tory government published a White Paper called *Realising our potential: a strategy for science, engineering and technology*. It was based on the premise that the primary function of science is to generate technological innovation in industry. This model has become explicit under the Blair government and other countries have copied it. In a strategy document published in July 2002, bearing an almost identical name, published by three government departments, New Labour declared: "Startling advances in communications, information, health and basic technologies are now converging to magnify the pace of scientific and technological change and the productivity of scientific research. Now more than ever before, investment in science accompanied by matching investments in technology and innovation offers the prospect of sustained social and economic dividends." The strategy added:

The potential of scientific and technological discoveries will only be realised, though, if they can be effectively translated into innovation – new products, processes, services and systems. A vibrant innovation system is the key to reaping the gains from research, *connecting science and technology with developments in market demand and social needs*. The individual entrepreneurs, businesses, and investors are the essential catalysts who convert science and technology into new ways of meeting economic and social needs. They translate ideas into commercial reality... It is only through innovation that science and technology can benefit our economy and society. [emphasis added]

The Office of Science and Technology (OST) is based within the Department for Trade and Industry (DTI). It is responsible for all public sector investment in science. On its website, the OST talks of the need for “knowledge transfer” – the transfer of ideas, research results and skills between universities, other research organisations and business ”to enable innovative new products and services to be developed”. The OST says its aim “is to promote the transfer of knowledge generated and held in Higher Education Institutions (HEIs) and Public Sector Research Establishments (PSREs) to the wider economy to enhance economic growth”.

A number of schemes exist that are aimed at “supporting entrepreneurship”, training, commercialisation and development of links between the universities, the PSREs and business. These include the Higher Education Innovation Fund, University Challenge, Science Enterprise Challenge (SEC) and the Public Sector Research Exploitation Fund. The aim of the SEC is to establish a network of centres in UK universities, “specialising in the teaching and practice of commercialisation and entrepreneurialism in the field of science and technology”. Twelve centres were established as a result of 1999-2000 awards. Another 39 are in the pipeline. The OST says: “Early measures of activity are encouraging with 5,900 science and technology graduates exposed to new enterprise teaching in the first two years, and over 850 at postgraduate and professional level. The centres have also helped to generate 400 new business ideas, over 80 of which have led to early stage businesses.” The purpose of University Challenge is to enable universities to access seed funds in order to assist the successful transformation of “*good research into good business*”. [emphasis added] It is reported that in the first two years of operations 105 new “spinouts” were created.

Direct collaboration between public research institutions and business is fostered through the LINK scheme. The scheme “offers an opportunity to engage with some of the best and most creative minds in the country, to tackle new scientific and technological challenges so that industry can go on to develop innovative and commercially successful products, processes and services”. LINK encourages innovative research “with good

potential for eventual commercial exploitation, and offers opportunities for researchers from industry and academia to acquire knowledge and develop new technologies together which will help shape the 21<sup>st</sup> century". Companies of any size and research organisations throughout the UK can participate in LINK projects. Global corporations with a manufacturing and research organisation in the UK are also eligible. In 2004, it was reported that a number of major companies, including GlaxoSmithKline, AstraZeneca, Shell, Vodafone, Amersham and Rolls Royce, were in discussions with the government on how their commercial investment in research and development can "partner public investment in the UK science base".

The bulk of government money for research is distributed through seven research councils. It goes to the universities and to the research institutes that are nominally state-owned but increasingly run along commercial lines. Big business has a highly influential role in the most important one, the Biotechnology and Biological Sciences Research Council (BBSRC). Nearly one quarter of the BBSRC's committees are industry scientists. GlaxoSmithKline, one of the world's top pharmaceutical corporations, has no fewer than six representatives, including one on the governing council itself. There are also representatives from AstraZeneca, Unilever and United Biscuits. There are no consumer or trade union representatives.

The BBSRC's purpose is "to sustain a broad base of interdisciplinary research and training to help industry, commerce and Government create wealth". As a further sign of the merging of the public and private sectors, the BBSRC's chairman until January 2002 was Peter Doyle, a director of biotech giant Syngenta and the former executive director of GM company Zeneca (now part of Syngenta). Doyle originally took up his BBSRC post while still Zeneca's executive director. Doyle's replacement as chief executive is Professor Julia Goodfellow, the wife of geneticist Dr Peter Goodfellow, head of discovery research at GlaxoSmithKline.

There has also been a 300% increase in the grant given by the BBSRC to the Sainsbury Laboratory of the John Innes Centre

(JIC) in Norwich. The JIC is a plant biotechnology centre with major research alliances with Dupont. The BBSRC has been accused of instituting what has been called “a gagging order” that prevents all publicly funded researchers from speaking out on concerns about GM foods.

In a 2002 report called *Delivering the commercialisation of public sector science*, the National Audit Office examined the steps taken by the state-owned research establishments to attract commercial contracts and support. They cited with approval the example of Celltech, a biotechnology company created in 1980 which employed a total staff of 1,803 in the year to 31 December 2000, including some 1,150 research and marketing staff in the United Kingdom and abroad. This was built on science originating in Medical Research Council laboratories.

The MRC has since created a separate company – Medical Research Council Technology Ltd – “to lead the commercialisation of research outputs” for the organisation’s work. The MRC was also instrumental in the creation of MVM Limited, a venture capital company managed by individuals from the private sector. This has two funds which invest in early stage life science companies. The first, UK Medical Ventures Fund, raised £40m in 1998 and the second fund raised a similar amount in October 2001.

### **Medical Research Council**

The “mission” of the Medical Research Council is “to choose the most suitable commercial arrangement and the partner(s) judged most likely to develop Medical Research Council technology into products and services useful to society; to maximise the contribution to national wealth creation and UK industrial competitiveness; and to maximise income to the Medical Research Council in the medium to long-term.”

The Treasury agreed in 1999 that research councils and research establishments could retain the financial benefits of their commercial activity and share this between them in whatever proportion they agree. The Medical Research Council income has grown from £150,000 in 1986-87 to some £7 million in 1999-2000 and £17.9 million in 2000-01.

Other research establishments have also obtained funds to develop commercial activity. The Babraham Institute, for example, obtained a £250,000 grant to refurbish laboratory and support facilities appropriate for use by “early stage companies”. This attracted 19 companies to rent about 3,000 square metres

### **Scientists ‘asked to fix results for backer’**

*Daily Telegraph*, 14 February 2000

One in three scientists working for government quangos or newly privatised laboratories says he has been asked to adjust his conclusions to suit his sponsor.

Contracting out and the commercialisation of scientific research are threatening standards of impartiality, scientists claim. The survey was conducted by the union representing research scientists, which is campaigning against further privatisation of public laboratories.

The Institute of Professionals, Managers and Specialists says that public safety could be harmed by the Government’s plans to bring private funding into the National Air Traffic Services and the Defence Evaluation and Research Agency. Privatisations over the last few years have included the Radio Chemical Centre, now Nycomed Amersham Laboratories, and the Atomic Energy Authority, which trades as AEA Technology.

Charles Harvey, the institute’s spokesman, said an increasing number of scientists had privately raised concerns with the union so it had decided to include a question about the influence of sponsors in a survey about pay and conditions. Thirty per cent of the 500 respondents said they had been asked to tailor their research conclusions or resulting advice.

The figure included 17 per cent who had been asked to change their conclusions to suit the customer’s preferred outcome, 10 per cent who said they had been asked to do so to obtain further contracts and three per cent who claimed they had been asked to make changes to discourage publication.

“Some were working for quangos and some for fully privatised laboratories,” said Mr Harvey. “The piper is calling the tune and it raises worrying issues. We have seen the BSE crisis, food scares and the GMO debacle and the public is losing confidence in Government as an independent, fair-minded arbiter.”

of space at their bio-incubator site and generated £680,000 from rents and services in 2000-01. But the NAO found that not all research sites were as enthusiastic and noted: “To meet the increasing emphasis on commercialisation, a culture that is also supportive of commercial activity, which helps staff to overcome barriers, such as the lack of recognition for commercialisation work, is needed. This will require change in many Research Establishments.”

### **Catching the corporate bug**

The Royal Society, which was set up in 1660 as a counter-weight to the anti-science, church-dominated universities of the time, boasts that its independent status allows it to play a “crucial role as the champion of top quality science and technology”. It too, however, has caught the corporate bug. The Royal Society, has reported that recent donors included BP, Esso UK, AstraZeneca, and Rolls-Royce. Now the Society has introduced more formal processes to “encourage the commercialisation of the products of scientific research”. It has a series of awards and in 2004 launched its Science, City, Industry Dialogue programme. The Society says it hopes that the scheme will allow scientists to discuss ways in which their work might be commercialised and industrialists to identify possible new academic research partners, products and funding routes. It also aims at helping “financiers to identify potential areas for new investment”. So much for its vaunted independence.

### **Capturing the universities**

The drive by successive governments to tie funding contracts to defined commercial outcomes has created stronger incentives for researchers to pursue projects leading to patentable results. Many universities have changed their rules and are encouraged to take shares in spin-off enterprises based on faculty research. For example, Oxford University now claims ownership of “works generated by computer hardware or software owned or operated by the university” and “patentable and non-patentable inventions”.

Corporate influence on science is also exerted through direct

funding of university research centres, which then have a significant say in policy and research nationally. One of the most notorious examples of this is Nottingham University's International Centre for Corporate Social Responsibility (!), which was set up with a £3.8m grant from British American Tobacco. Around 30 of the 200 professors at Nottingham hold sponsored chairs.

In *The Captive State: The Corporate Takeover of Britain*, George Monbiot says that there is scarcely a university that has not been compromised by its funding arrangements. He explains:

Business now inhabits the cloisters of even the biggest and richest institutions. Cambridge University, for example, possesses a Shell chair in chemical engineering, BP professorships in organic chemistry and petroleum science, an ICI chair in applied thermodynamics, a Glaxo chair of molecular parasitology, a Unilever chair of molecular science, a Price Waterhouse chair of financial accounting and a Marks & Spencer chair of farm animal health and food science. Rolls-Royce, AT&T, Microsoft and the biotechnology company Zeneca have all set up laboratories in the university.

In June 1999, BP gave the university £25m to fund work across five departments. In November 1999, Cambridge set up an £84m joint venture, funded largely by the British government, partly by industry, with the Massachusetts Institute of Technology. Its purpose is to "change the face of business and wealth creation in the UK" by stimulating "research spin-offs" and "training the business leaders of the future". Cambridge's vice chancellor explained: "We may once have been thought of as an ivory tower – today we are a tower of high technology and business prowess".

More recently, the pharmaceutical giant GlaxoSmithkline announced a £44m investment in Imperial College, London, to build and equip a clinical imaging centre. The vice-chancellor of Imperial College, Sir Richard Sykes who has led the campaign for university top-up fees, is a former chairman of GSK.

Britain is home to the headquarters of BP and Shell, two of the world's three largest fossil fuel companies. These companies, says

*Degrees of capture*, a report by Corporate Watch and the New Economics Foundation, have succeeded in capturing the allegiance of some of Britain's leading universities, through sponsoring new buildings, equipment, professorships and research posts. In return for corporate sponsorship and contracts, universities are encouraging oil companies to steer the research agenda, tailoring courses to meet corporate personnel demands and awarding high profile positions to oil executives. The director of the BP Institute at Cambridge University is one of the company's senior managers. The publicly-funded Engineering and Physical Sciences Research Council determines academic grants through a peer review council containing 12 oil or gas executives and just two renewable energy members.

According to the report, few universities have handed themselves over so completely to the oil and gas industry as Aberdeen, located in Europe's oil capital. Principal Professor Duncan Rice admits: "We are genuinely committed to trying to do all we can to help [the oil and gas industry] through contract work and through consultancy and, where possible, training programmes for people who are already in the labour force of the industry or moving towards it." In 2002 Heriot-Watt University was restructured into six schools and two institutes – one of these latter being the Institute of Petroleum Engineering. The Institute boasts that "we tailor our teaching and research to the needs of the petroleum industry and place considerable importance on the maintenance of close links with the industry". Principal and vice-chancellor of the university, Professor John Archer, himself a distinguished petroleum engineer, says: "At Heriot-Watt we have always made a virtue of the fact that over 50% of our income comes from our competitive endeavours in the market place – be it in research, in university businesses or in overseas markets."

The International Petroleum Research Directory (IPRD) lists about 1,000 research and development projects carried out in UK universities. Researchers Greg Muttitt and Chris Grimshaw say: "While the value of such research is protected by confidentiality agreements, we can estimate that it is worth about £67m per year. Almost half of this research is geological – finding

where new fields are and how to exploit them. Most of the other research focuses on the development of new technology and drilling techniques, which enable the industry to extract petroleum from ever more marginal, difficult and expensive areas – such as the deep ocean – or to get more oil and gas out of existing fields. Thus most R&D serves to expand fossil fuel reserves.”

### **Distorting the results**

The commercialisation of science has other results too, including the concealment of poor performance. GSK is facing major legal actions in the United States over alleged covering up of negative trial results involving its anti-depressant paroxetine (marketed there as Paxil and in Britain as Seroxat). One action by New York state’s attorney general, Eliot Spitzer, charged the drug company with “repeated and persistent fraud” in suppressing evidence that suggested that paroxetine was ineffective in treating depression in adolescents. Spitzer has an internal memo from 1998 which stated that it would be “commercially unacceptable” to admit that paroxetine did not work in children. It went on to say that the company would have to “effectively manage the dissemination of these data in order to minimise any potential negative impact”. In August 2004, GSK settled with Mr Spitzer for \$2.5m, without admitting liability, but there are still several class actions outstanding against GSK regarding the withdrawal side-effects from Seroxat.

Earlier in the same year, UK government scientists accused the drug companies of refusing to release evidence that anti-depressants can be harmful to children. Researchers preparing new National Health Service guidelines for childhood depression said they were astonished by the lack of co-operation from the manufacturers of SSRIs (selective serotonin re-uptake inhibitors). This family of drugs includes Lustral, Seroxat and Prozac. With five out of six SSRIs, the risks to children outweighed the benefits, the unpublished data showed. Previously published data suggested that the drugs were safe and effective in children. At that time, about 20,000 children were being prescribed the five drugs. SSRIs have never been approved for use with children in

Britain but have been used “off licence” by GPs. The National Institute for Clinical Excellence (NICE) had asked the National Collaborating Centre for Mental Health to investigate treatments for childhood depression.

Dr Tim Kendall, the co-director of the centre, which is supported by the Royal College of Psychiatrists, looked first at the published data on SSRIs and found they supported their use in children. When he and colleagues tried to obtain unpublished trial results, however, drug companies refused or ignored his requests. “We asked them for it and they would not give it to us,” he told *The Daily Telegraph* (24 April 2004). Instead, the centre’s researchers used unpublished data obtained by the government’s Committee for the Safety of Medicines, which has access to confidential findings. Their analysis of all published and unpublished data showed that the side effects of all but one SSRI outweighed any advantages. Seroxat, for instance, increased the risk of suicidal thoughts, the team found. The only drug to have benefits in children was Prozac. Dr Kendall said the companies may have been unwilling to provide information because it had already been submitted to a peer-reviewed journal. Some data may have been commercially sensitive. He said: “But I think there is growing evidence to suggest that drug companies are withholding trials that are unfavourable. This is worrying because we do lots of work for NICE and we rely almost solely on published data. If we had seen only the published data, we might have concluded that SSRIs were worth prescribing to children.”

Another way that industry influences the direction of science is by funding organisations which can lobby in their favour on science-related issues. For example, pharmaceutical companies fund some patients’ groups to lobby for new drugs, while the Scientific Alliance was set up by money from the quarrying industry. Sense About Science seems a harmless enough name. But GM Watch, which analyses the underhand ways used by genetic engineering corporations to get their message across, has revealed the truth about this organisation. Sense About Science staff include Tracey Brown and Ellen Raphael. Both are also part of the extreme libertarian network behind the highly dubious

*LM* organisation, the *Spiked* website, and the “Institute of Ideas”, to all of which Brown and Raphael have contributed. *LM* is the reincarnation of *Living Marxism*, a magazine that claimed atrocities in the Yugoslav civil war were invented by journalists.

According to GM Watch, most of the members of Sense About Science’s advisory council and board of trustees are well known GM proponents. Funders include the Association of the British Pharmaceutical Industry (ABPI), Amersham Biosciences plc, BBSRC, BP plc, GlaxoSmithKline and the biopharmaceutical companies AstraZeneca plc, Pfizer plc and Oxford GlycoSciences. Sense about Science was created just in time for the UK’s official GM Public Debate. After the debate had shown an overwhelming level of public opposition to GM crop commercialisation, Sense About Science launched a media campaign.

A Sense About Science article appeared in *The Times* under the headline “GM vandals force science firms to reduce research”. Director Tracey Brown, was quoted as saying that: “The burden of trying to organise the research community to pre-empt and protect from vandalism is potentially disastrous”. Articles in the *Times Higher Education Supplement (THES)* and elsewhere went still further, suggesting the debate had been hijacked by “activists” and that GM plant researchers were being subjected to physical and mental abuse, leading some to take jobs abroad. One *THES* article, headlined “Scientists quit UK amid GM attacks”, included claims of intimidation by Chris Leaver (a Sense About Science trustee) and Mike Wilson (a Sense About Science advisory panellist). Fiona Fox and Tony Gilland, who both sit on a Sense About Science Working Party, are also both *LM* contributors. Indeed, Fox penned the notorious *LM* article denying the Rwandan genocide.

### **Scientists fight back**

Scientists who obstruct the commercialisation agenda come in for systematic hounding by more pro-business scientists, who use learned journals to attack colleagues who do not conform to corporate agendas. A recent example is the case of Dr Andrew Stirling of Sussex University. He was not convinced about the

case for commercialisation of GM crops. He is an expert on risk assessment at the Science Policy Research Unit and was a member of the government's GM Science Panel. He was privately warned by a senior pro-GM scientist that his research position would be under threat if he did not shift his position. The best known case in Britain was the attack on Dr Arpad Pusztai, who spoke out on the TV programme *World in Action* about the health effects of GM based on his research. Because he broke ranks with the way the scientific establishment publishes its findings, Pusztai was suspended, gagged for months and his research team was disbanded. At the time, he said of the scientific establishment: "Their remit was to screw me and they screwed me."

In May 2002, George Monbiot, in an article published by the *Transnational Corporations Observatory* website, exposed how the Bivings Group, a PR firm contracted to the biotech company Monsanto helped shape scientific discourse – and almost destroy the careers of independent scientists. In 2001, two researchers at the University of California, Berkeley published a paper in *Nature* magazine, which claimed that native maize in Mexico had been contaminated, across vast distances, by GM pollen. Before the publication, one of the scientists, Ignacio Chapela, was approached by the director of a Mexican corporation, who first offered him a glittering research post if he withheld his paper, then told him that he knew where to find his children.

On the day the paper was published, messages started to appear on an Internet discussion list used by more than 3,000 scientists. The trickle turned into a flood and the pressure on *Nature* was so severe that its editor did something unparalleled in its 133-year history: he published, alongside two papers challenging the findings, a retraction in which he wrote that their research should never have been published. Monbiot later tracked "Mary Murphy" and "Andura Smetacek", who launched the first attacks on the findings, to the same Bivings Group that worked for biotech corporations.

Monbiot noted: "'Sometimes,' Bivings boasts, 'we win awards. Sometimes only the client knows the precise role we played.' Sometimes, in other words, real people have no idea that they are

being managed by fake ones.” Chapela was eventually denied tenure by the University of California which had a controversial academic-industrial partnership with the Swiss agribiotech firm Syngenta, which ended last year. He appealed. The resulting report, issued on 28 June 2004, claims that Jasper Rine, a geneticist at the university who sat on a key committee reviewing Chapela’s tenure, had conflicts of interest. It says that Rine had financial dealings with biotech firms, oversaw the Syngenta agreement and had cited Chapela’s *Nature* paper as an example of poor science in one of his classes. Both the dean of Chapela’s college and his department chair requested that Rine be taken off the committee four times; but Rine did not excuse himself nor did the committee chair ask him to leave.

In the United States, concerned professionals have formed the Integrity in Science project. In their founding statement, they say: “Although many have cheered partnerships between industry and the research community, it is also acknowledged that they entail conflicts of interest that may compromise the judgement of trusted professionals, the credibility of research institutions and scientific journals, the safety and transparency of human subjects research, the norms of free inquiry, and the legitimacy of science-based policy.” The scientists say, for example, that:

- ▶ there is strong evidence that researchers’ financial ties to chemical, pharmaceutical, or tobacco manufacturers directly influence their published positions in supporting the benefit or downplaying the harm of the manufacturer’s product
- ▶ a growing body of evidence indicates that pharmaceutical industry gifts and inducements bias clinician judgement and influence doctors’ prescribing practices
- ▶ there are well-known cases of industry seeking to discredit or prevent the publication of research results that are critical of its products
- ▶ studies of life-science faculties indicate that researchers with industry funding are more likely to withhold research results in order to secure commercial advantage
- ▶ increasingly, the same academic institutions that are responsible for oversight of scientific integrity and human

subjects protection are entering financial relationships with the industries whose product-evaluations they oversee.

In July 2003, scientists and industry watchdogs gathered in Washington to explore cases of industry-led manipulation and distortion of scientific research, as part of the Integrity in Science project. According to the speakers, several industries have made so-called “junk science” – the publication of their own self-serving research results – common practice. Also common are suppressing or criticising research that does not support their position and disseminating data or their own risk interpretations directly to the lay press and policy makers. Many industries have detailed plans in place to challenge scientific findings as soon as regulations appear that could threaten their bottom line, said David Michaels, a research professor of occupational and health services at George Washington University.

Using the tobacco industry’s own documents, Lisa Bero, a professor of clinical pharmacy at the University of California, San Francisco, described the ways in which tobacco companies have intentionally manufactured doubt and controversy via their own research findings in the hope of downplaying scientific

### **Research and profit**

But increasingly over the years, and especially during the last 30 years since the Rothschild report, agricultural research has become directed more towards commercial benefit (profit rather than discovery), and in doing so it has become increasingly reactive, having to respond to the perceived needs of industry and, indeed, politics. As research has moved towards providing solutions for industry, so industry has gained more control over the funding as a customer paying for a service, with attendant controls over what is done and how. Furthermore, as funding from government sources has become more concerned with wealth creation and value for money, it too has become increasingly responsive to pressures from industry and, more or less directly, political influence.

*Science, Agriculture and Research – a compromised participation?*  
William Buhler

evidence that illustrates the health risks associated with cigarette smoking and second-hand smoke.

Jeffrey Short, chief chemist for the National Marine Fisheries Service investigation of the Exxon Valdez Oil Spill, described a series of attacks on government science by Exxon. According to Short, Exxon manipulated data about the extent of the spill to support its claim that much of the seafloor near Alaska was already contaminated by natural oil seeps. Short also cited glaring abuses of scientific peer review, the manipulation of scientific meeting agendas, and abuses of the Freedom of Information Act. Exxon used these to make very broad requests – including requests for data associated with research still in progress – that slowed studies and interfered with their publication. “It has, in effect, reduced us to being field technicians for Exxon,” said Short, who took leave from his job in order to speak out on the subject.

What are the results of this intense commercialisation of science? Dr Stuart Parkinson, director of Scientists for Global Responsibility – an independent British-based organisation supported by people like Stephen Hawking – believes that it leads to a bias towards research that produces commercial returns. In a speech in March 2004, he said:

For example, the BBSRC [the research council mentioned earlier] is currently funding 26 projects concerned with growing GM crops, but just one involving organic production. One important reason for this is that cutting-edge science can lead to an avalanche of commercially valuable patents – much faster than that generated by more established science. For example, nanotechnology-related patents in the United States rose by 500% in the ten years to 2002. A knock-on effect from large amounts of funding going into hi-tech R&D is that we can get what is known as “technology lock-in”. This is where society becomes so reliant on particular technologies that it becomes very difficult and expensive to change direction if they are found to be problematic. One classic example is nuclear power. Political decisions over the last half-century have meant that the lion’s share of R&D funding for energy in industrialised countries has been directed towards this technology, while

alternatives like renewables have seen much lower levels of investment. Figures from the International Energy Agency show that R&D on renewables has rarely reached 25% of that spent on nuclear fission during the last 25 years. The consequence now is that attempts to phase out the technology due to concerns about, for example, links to nuclear weapons, vulnerability to terrorism or the dangers of nuclear waste are countered by the argument that we cannot afford to do without it because alternatives (eg renewable energy) are not sufficiently developed.

The second effect of industrial involvement is that more research is steered towards areas which can yield a commercial return, so that work developing a new product or process tends to be prioritised over, for example, work examining environmental or human health impacts of an existing product or process.

### **Capitalism and science**

As socialists, we do not criticise the commoditisation of science in order to appeal for a return to times before science became a commodity... The commoditisation of science, its full incorporation into the process of capitalism, is the dominant fact of life for scientific activity and a pervasive influence on the thinking of scientists. To deny its relevance is to remain subject to its power, while the first step towards freedom is to acknowledge the dimensions of our unfreedom. As working scientists, we see the commoditisation of science as the prime cause of the alienation of most scientists from the products of their labour. It stands between the powerful insights of science and corresponding advances in human welfare, often producing results that contradict the stated purposes.

*The Dialectical Biologist*, Richard Levins and Richard Lewontin