science *vs* superstition

the case for a new scientific enlightenment

Edited by

James Panton
and Oliver Marc Hartwich

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Foreword: the case for a new scientific enlightenment

James Panton

In contemporary Western society we live longer and healthier lives than in any previous historical period. Science in the 21st century promises even greater longevity and health. We are closer than ever to discovering cures and treatments for some of the most debilitating diseases. Developments in stem cell research (discussed by Deichmann and Spahl in Chapter 6) and in genetic technology promise the possibility of abolishing genetic diseases and hereditary conditions, as well as the possibility of taking even greater conscious control of our human biology by manipulating our genetic make-up.

Increased standards of living throughout the world are also on the cards. Although the scientific and technological revolutions of the past have brought us close to the eradication of hunger, technologies such as genetically modified crops (discussed by Ridley in *Chapter* 7) have already seen the development of pest-resistant crops, and species of plant able to survive in some of the harshest environments on the planet. An agricultural future which is less land and labour intensive gives the possibility of freeing individuals in the developing world from the land, in much the same way that the vast majority of people in the developed world have been freed from the dictates of producing food and servicing necessity, allowing them to pursue more meaningful and self-determining modes of existence.

Of course, as science develops we uncover as many new problems as we find solutions for the problems of old. However, as it has done since the rise of modernity, it is science itself which gives the greatest possibility of resolving those problems. The apparently looming energy crisis, for example, might be solved quite readily by a greater investment in

nuclear power, which, as Kaplinsky explains, for its proponents is "a source of safe, clean energy with good prospects to meet our expanding needs" (*Chapter 5*). And this is not to mention the newer developments, such as the prospects for nuclear fusion, and other, even more experimental methods of energy production which are already beginning to move from the realm of science fiction to the sphere of social reality. Even the apparently gravest threat facing humanity at the moment, climate change, is something for which solutions must be sought through science. Even accepting the important arguments made by Hartwich in *Chapter 8* – that there is no consensus amongst scientists on its cause(s) or its implications, let alone upon any single set of solutions – the challenge of understanding climate change and developing technologies to prevent its potentially debilitating impact upon human beings, is one of the greatest, and for that reason one of the most exciting, challenges for science in the 21st century.

It may seem paradoxical, then, in a period when science promises so many great and exciting contributions to humanity's future, that we are at the same time beset by a fear, uncertainty, and at times an outright antipathy, towards science; that we are distrustful of the promises science makes, and fearful of the risks it throws up and of the consequences of scientific intervention in the world around us.

One explanation for our contemporary insecurity and risk aversion that has gained popularity over the past couple of decades is that if we are more risk averse; it is because the risks which science itself creates are greater than the risks humanity once faced.[1] If we are more insecure about the changes science proposes it is because those changes are experienced to be of a greater magnitude, and occurring at a far greater rate, than ever before in human history, so it is claimed.[2] In reality the risks of the present are not greater than those of the past, nor is the pace of change faster. What is novel about the present, however, is that they are often experienced as such, and for this reason, our experience is unsettling.

A second novelty is that our capacity to intervene in the world is far greater today that it has ever been. What this suggests, ultimately, is that

it is our own increased capacity to intervene in the world and to manipulate it in the service of our interests which is experienced as unsettling. At the same time that science gives us a far greater capacity to control consciously the natural, social and biological world, we are unsettled and alienated from this very possibility. It is inside this paradoxical state of affairs that we can uncover the cause of contemporary society's sense of uncertainty about science and the promises it makes.

Of course, scientific discoveries have always raised controversy, and the social changes such discoveries have engendered have always been as likely to throw-up opponents as supporters. But those who oppose science today are very different from the kinds of groups and individuals who objected to scientific developments in the past. As Maxeiner and Miersch suggest in *Chapter 1,* ecologists have become the new priests who call for humanity to strive less and learn to accept our lot with greater humility. Campaigning organisations of the (once-progressive) left are leading the campaign against industrial society in the name of a romanticised rural idyll; liberals who once believed in a free market (in economics and in ideas!) and in human perfectibility are now calling for greater regulation of scientific intervention, experimentation, and of the pharmaceutical companies who seek to make profits from scientific development.

Just as today's opponents of science come from very different perspectives than former opponents, so too is the form and substance of their arguments historically novel. The arguments which do most to undermine our belief in science today often present themselves not as opponents, but as proponents of science. As both Hartwich and Kaplinsky suggest, for example, the proponents of ecologism as a solution to global warming, and the opponents of nuclear power, respectively, both present their arguments in superficially scientific terms; but both are equally selective in their use of science, and their interpretation of the scientific data is equally determined by pre-conceived political agendas.

Further, the form of their arguments is not a critique of science as such, but simply a call for greater precaution (as Hanekamp and Verstegen point out in their discussion of the Precautionary Principle in

Chapter 2) and greater external, extra-scientific regulation in the name of "ethics" (as Derbyshire discusses in *Chapter 3* on the rise and institutionalisation of ethics committees). Both approaches, however, ultimately serve to breed a mistrust of science. In the case of the Precautionary Principle, the very foundation of the argument is premised upon the idea that we should hold back from scientific endeavours the outcome of which we cannot predict in advance with certainty, which ultimately means a call to hold back from scientific interventions, as the uncertainty of outcomes is at the very heart of the scientific enterprise. In the case of ethics regulation, the implication is more insidious but equally corrosive. As Derbyshire argues (*Chapter 2*), the institutionalisation of ethics regulation leads to a increasing levels of bureaucratic legislation which delays and potentially prevents scientists from undertaking their research, while the introduction of lay "experts" on ethics committees serves to undermine the authority of scientific knowledge and expertise.

The example of ethics regulation is particularly interesting. Just as in my discussion (*Chapter 4*) of the tendency amongst vivisectionists and research institutions to water down their arguments for animal research in the desire for greater public acceptance of their research, so too has the rise of ethics regulation occurred in an attempt to reassure the public and increase their trust in science. In both cases, however, the actual result is the opposite. Scientific expertise is undermined, the promises of science come to be viewed as dubious, and the motivation of scientists themselves is increasingly called into question.

The chapters in this book are written by a range of individuals from diverse backgrounds – a practicing scientist, a psychologist, scientific commentators and science popularisers, a social policy expert, and myself, an academic working in the social sciences turned pro-vivisection campaigner. They have contributed their expertise and arguments on a range of topics, from the general tendencies in contemporary science and society, to specific case studies on areas in which science is making huge leaps and bounds while at the same time being increasingly criticised and challenged. The authors are united in their attempt to get to grips with contemporary society's mistrust of science; and their

contributions are cohered by a serious attempt to understand and explain that pessimistic tendency, and to develop the arguments we need to begin to counter it.

In making the case for a new scientific enlightenment, we are not presenting some golden-ageist fantasy for a bygone age in which science was trusted, and in which the public were deferential. Nor are we celebrating a naive technological determinism which dreamed of a science that on its own would solve all the problems of the world. Quite the contrary. Founded in London in 1640, the motto of the Royal Society, *Nullius in verba* ("on the words of no one") sums up precisely the spirit of the Enlightenment: that ideas and their proponents must be held up to account, that received wisdom must be interrogated, and that pregiven assumptions must be interrogated and, as they normally were, rejected, to be replaced by a more rational and open-ended thirst for knowledge and understanding. It is this essential search for truth, coupled with a growing belief in the capacities of human beings to understand the world and to determine their own future, upon which the development of modern science was grounded; and it is in this spirit that the authors of this book have sought to interrogate the state of contemporary science itself.

By invoking the spirit of the Enlightenment, this book recognises the important truth that science exists and is conditioned by the social and political context in which in exists. It can contribute to those conditions, but it does not exist in isolation from them. The attitude that society takes towards science is one of the most important determinants of the possibility that science can have of pushing forward the boundaries of knowledge for the benefit of humanity. The significance of the Enlightenment is precisely that it describes a period of human development which was optimistic about the capacity of human beings to intervene in the world, to develop knowledge and understanding of nature, and in so doing, to change it. The intellectual developments of the Enlightenment went hand in hand with a dynamic period of social transformation, and they inspired a period in which individual and social freedoms were won against the old structures of authority and superstition.

Contemporary society could not be more different. Of course, scientific developments occur, but they lack any real social and cultural validation. The problems which confront science at the start of the 21st century are not *scientific*, at least not in any straightforward way. Rather, they are social and cultural; they are the problems of a culture which is pessimistic about science, and of a society which is insecure about the increasing capacity of human beings to engage in nature and to shape both the world around us, and our own lives. In our post-ideological age, in which politics has moved from debating different conceptions of social organisation towards the more limited horizon of simply managing society as it exists, there has arisen a new fundamental division. The new division is not between left and right, between the free-market or the socialist command economy – these labels have lost all meaning. It is rather a division between those, on the one hand, who are pessimistic about the possibility of, and cynical about the motivation for, human engagement in the world; and on the other, those who see the capacity for such engagement, of which science is one of the highest expressions, as something we should celebrate and pursue. It is a division between a misanthropic sentiment in which human beings are encouraged to feel ill at ease with their own creativity and a humanistic endorsement of the great possibilities for human progress.

Ultimately, the problems discussed in this book are not limited to science. Mistrust of science is an expression of a more fundamental mistrust of ourselves as human beings. To call for a new scientific enlightenment is not to make a call for a greater faith in science. On the contrary, it is a call that what currently stands as scientific fact must be held up to account, just as much as the current state of science generally must be investigated, challenged, and criticised. The chapters in this book are an attempt to begin that process. Calling for a new scientific enlightenment means, ultimately, calling for a greater faith in the human spirit and in the capacities of human beings to investigate, to know, and, - where we decide it appropriate - driven by our expanding knowledge and guided by reason and the search for truth, to change the world in which we live for the better.

1: The century of science and the culture of pessimism

*Dirk Maxeiner and Michael Miersch**

Fifty years ago in a laboratory in Mexico City a young chemist was looking for a new method of producing cortisone, a drug considered at the time to be a miracle treatment for arthritis. Carl Djerassi's experiments with steroids, which were thought to play an important role in the development of cortisone, would turn out to be hugely important for a reason entirely different to the treatment of arthritis. Although he did not realise it at the time, Djerassi was on the way towards a groundbreaking medical discovery that would play a decisive role in the revolutionary social changes occurring in the post-war period: the contraceptive pill. As with so many other technical and scientific breakthroughs, chance played a decisive role. The development of the pill was made possible only because of the knowledge Djerassi was generating about the characteristics of certain kinds of steroids. Timing was also on Djerassi's side.

It was the right moment for a number of reasons. The 1960s were the years of Rock'n'Roll, drug culture, and hippies; the gradual freeing up of social relations and the rise of youth culture meant that promiscuity was on the rise. Despite the nervousness of the pharmaceutical company, Schering, who originally trialled the drug in Australia for fear of the moral approbation they expected were the drug to be released in Europe, there was no great public outcry when the pill was released onto the market. Djerassi himself was surprised: "No-one, no pharmaceutical company and really none of the researchers, expected that the pill would be accepted so rapidly by so many women."[1]

Though the pill did not trigger the sexual revolution, its acceptance and spread were the result of the social and cultural transformations already underway in the late 1950s and early 1960s.

Djerassi and the other scientists involved in developing the pill were not motivated by any desire to contribute to the promiscuity of the swinging Sixties, but to bring an end to the life-threatening infections that all too frequently resulted from illegal abortions. Djerassi is convinced that without the pill "there would have been a lot of unwanted pregnancies" resulting in many more dangerous terminations. The pill, in his opinion, prevented "a lot more misery".[2]

Of course, like any drug, the contraceptive pill can lead to undesired side effects in some users. This is why the law is so strict in ensuring clinical trials and other testing procedures before any new medicine can be approved. Even with this diligence, however, risks can never be entirely ruled out. It is worth remembering that even penicillin can be lethal in some circumstances. Since the discovery of the pill in the 1950s our attitudes towards new technologies, science and medicine, have drastically changed. Most important in this change is the fact that we are no longer willing to accept the important insight that, whatever precautions we take, nothing we do will ever be one hundred percent certain. It is for this reason that Djerassi is convinced the timing of his discovery was a crucial determinant in the eventual development of the contraceptive pill.[3]

In the 1960s, the consumer protection movement took off, and it has since developed into a mass industry. In the US, and to a slightly lesser degree in the UK, litigation against corporations for damages for actual or even suspected side effects of medicines and other pharmaceutical products has become a vast industry with a multi-billion dollar turnover. In today's context it seems highly likely that the contraceptive pill, which not only saved many lives through reducing the need for back-street abortions, but also allowed women to take control of their own fertility, would not have been developed and released onto the market at all.

At the root of contemporary society's attitude towards science is the so-called 'precautionary principle', which states that a procedure or experiment should not be undertaken unless we can determine with absolute certainty the outcomes of the process. In relation to the development and licensing of drugs, this implies that a drug ought not to be released onto

the market unless we can guarantee that it will have absolutely no problematic side effects, both in the long and the short term. This, of course, is scientifically impossible. As Djerassi points out: "Final certainty about the long term side effects of the contraceptive pill could be achieved only after women had been taking the drug for many years."[4] In today's precautionary climate many companies think twice about introducing a new drug, whatever its expected benefits may be. The male contraceptive pill, which has been put on hold precisely because of such uncertainties, is but one example. The combination of the precautionary principle (discussed in more detail in *Chapter 2*) and the culture of litigation, keeps many new pharmaceuticals off the market.

Contemporary society is dominated by a widespread pessimism about science; a pessimism which can only be understood within the context of developments that began in back in the 1980s. Though the churches may have been increasingly emptied, society has not developed an enlightened scepticism or a free-thinking culture; not even agnosticism. The ever present need for salvation has simply found new modes of expression. Among the educated classes a variety of new religious creeds is spreading: anthroposophy and esotericism of numerous kinds. But the strongest and most popular belief refuses to be called a religion. Its name: ecologism. Under a worldly camouflage we have come to be dominated by a new natural religion.

Ecologistic dogmas have increasingly come to dominate public discourse on science, environment, technology, and even politics. Their mantras are delivered by a mass media which for three decades now has announced the imminent end of the world. In the early 1970s it was predicted that the turn of the millennium would see the end of the world: by the year 2000 natural resources would have been exhausted, the trees would have died and many other plant and animal species would have become extinct. The Americans Paul Ehrlich and Dennis Meadows, the German Herbert Gruhl, the Austrian Robert Jungk and other prophets of environmental doom were complimented by an endless stream of catastrophist headlines in the newspapers. While none of the prophecies ever came true, the headlines nonetheless became shriller and yet more catastrophic.

Just as abstinence and penitence are central to the Christian moral credo, so too they are central to the ecologist's dogma: it is through abstinence and penitence that we should prepare for the coming end. The literature on climate change is full of such motifs. Many leading newspapers are adopting the picture uncritically: nature is good, man is evil. And if man does not obey the rules, he risks the "revenge of nature". The furious goddess of nature demands rituals of placation such as recycling paper and installing energy-saving light bulbs. The natural is pure, unspoilt and holy. By contrast, everything man-made is sinful, dirty, and corrupt.

And, as in all religions, there are food taboos which allow the spiritual elite to mark out their differentiation from the "impure pagans". "Organic" is not so different from "halal" or "kosher": a symbolic statement of purity that strengthens one's resolve against material temptations; and although many attempts have been made to prove the greater health and nutritional benefits of organic and GM-free, the scientific evidence is still wanting. Deliverance is promised through joining an "ecological circle" which transcends individual transience into an eternal circle of nature.

"Ecologism is one of today's most influential religions in the Western World," argues Michael Crichton, a writer whose thrillers perceptively capture the contemporary zeitgeist. "It seems to have become the preferred religion for urban atheists."[5] As traditional Christianity is eroded, ecologism is conquering the hearts and minds of the people. But there is a difference: ecologism is a religious creed which deems itself entirely rational, indeed, considers itself to be based on scientific facts.

The ecologists do not think of their belief as a belief, but as a reflection of undeniable, scientific facts. However, discoveries within the science of ecology often stand in direct contradiction to the dogmas of ecologism. For example, no scientific ecologist would still claim that there is anything like an equilibrium in nature. But the motif of "natural equilibrium" and "balance" belongs to every fancy political speech.

The ecologistic preference for everything rural and rustic, in contrast to the industrial complex of the modern world, cannot be reconciled

with ecological facts. From a rational point of view, the primary sector (e.g. agriculture, mining, forestry) today still exerts a greater influence on landscapes, plants and animals than any nuclear power station or car factory. Archaic practices like fire clearing, hunting, fishing and land-use changes from forests to fields, change the nature of our planet much stronger than modern technologies which ecologists fear.[6]

Undertaking scientific research means embarking on an open-ended inquiry, based on measurable facts. Thus ecological scientists (i.e. those academics dealing with ecology) often find themselves in opposition to ecologism. One of the most respected ecological scientists in Germany, the Munich professor of biology Josef H. Reichholf, published a pamphlet (*Die falschen Propheten* – "The false prophets") in which he defended his academic field against the hostile takeover by the ecologist movement. He writes that it is becoming increasingly difficult to do good science in a climate of alarmism. He claims about ecologism that it had developed into a religion-like lifestyle which more and more tells us what to do and what to leave.[7] But for many of these commandments there is no reasonable cause. The borders between justified concerns and esoteric humbug have long disappeared. Buzzwords like "GM-free", "free of chemicals", "nuclear-free" no longer require a factual foundation but have become more dogmas which are contrasted to the problems of technological and scientific progress.

In Europe, where sufficient food and sustenance is produced for the populations, what might once have been crises in production, creating famines and threats to our very survival, have now become crises of meaning. Food is often no longer seen as something that we need for our nutrition, but, as in the religions of old, is endowed with psychic power. For a devout Muslim it may be enough to observe the month of Ramadan and to avoid alcohol and pork; for the average middle-class European the obsession with food has become a full-time occupation. The list of taboos, prohibitions, warnings, recommendations and diets might even ask too much of the most devout followers of the Koran. The ecumenical essence of all ecologist food rules can be summed up in the following way: natural is better than artificial, vegetable products are bet-

ter than animal products, and the less processing involved the better. Yet none of these commandments stands up to scientific scrutiny.

The Greenpeace campaign against so-called Golden Rice is an especially frightening example of the scientifically unfounded fetish for 'natural' food. Golden Rice is a new rice variety which is enriched with Vitamin A. This could help millions of people around the world who suffer from Vitamin A deficiency, a deficiency which often leads to blindness and even death. Two German GM scientists, who developed this rice, have donated their discovery to small farmers in developing countries. But eco-activists have opposed both the product and the donation for fear that it could lead to a greater popular acceptance of GM food in general.

The world view of these groups was called "Green Thinking" by the Dutch environmental historian Wybren Verstegen. It rests on subjectivist pillars, built into the prevailing zeitgeist: man is always seen as the consumer and perpetrator, never as the problem-solver and creator. On the contrary, mankind is thought to be a "cancer" and a burden to nature.[8]viii Technological innovation is rarely regarded as the solution to problems, but is rather seen as their cause. Ever faster technological and economic development is a problem which must be slowed, if not halted. The market and its agents are viewed as destructive and predatory actors who can only wreak havoc on the welfare of the public. In their place the ecologist mindset seeks a more natural "balance" – even though nature is in reality dominated by permanent evolutionary change.

The cynical attitudes towards science and technological progress are most readily apparent in the current debates about embryonic stem cells and pre-implantation genetic diagnosis (PGD). Never in the history of science have scientists been so quickly transformed into pariahs as in the public debates around embryonic research in the first years of the new millennium.

So what is it all about? After the insemination of the egg by the male sperm a handful of tiny cells develop: the early stage of an embryo. The minute cell cluster measures less than 0.1 millimetres. In other words: hundreds of these early embryos would find space within a single drop

of water. Scientists would like to use some of these so-called embryonic stem cells to develop new cures for a number of diseases. They hope that one day they will be able to replace destroyed brain or bone cells which would make it possible to effectively fight diseases like multiple sclerosis and perhaps even produce organs for transplantations. Surveys in the US have calculated how many people could benefit from this stem cell research: 58 million heart cases, 30 million auto-immune cases, 16 million cases of diabetes, 10 million cases of Osteoporosis, 8 million cases of cancer, 1.5 million cases of Parkinson's disease. (See *Chapter 6: The Problem of Stem Cell Research Regulation – limiting the individual right to self-determination*).

PGD has a different goal. This is about diagnosing potential conditions in egg cells that have been artificially fertilized in a test tube prior to implantation into the mother. In this way the embryo can be tested for the existence of hereditary diseases. In cases in which a severe disease or deformity can be expected, the parents can then be given the choice to decide for or against a pregnancy. This invokes difficult questions about the ethical status and the dignity of early human life. Does human dignity begin the same moment that an egg cell unites with a sperm? Or does it begin when the fertilized egg cell has found its place in the uterus? Or does it begin when the embryo begins to develop its own nervous system?

The terminology and the fury of the opponents to stem cell research are frightening. On the one hand, they play down the most severe diseases: "The imperfect man. The right to be not perfect" was the title of a German exhibition in the museum of hygiene in Dresden in 2001[9]. On the other, the chance of healing diseases is reduced to the status of a "vague promise". Of course, it is not clear whether scientific research will deliver the results that are hoped for – but that is a truism in every kind of experimental research. But history shows that even when direct progress on the problem under investigation fails to be forthcoming, other possibilities are often thrown up along the way. It was precisely such a spin-off which helped Carl Djerassi to develop the contraceptive pill. The argument from uncertainty is less an argument against genetic

research itself than a mindset which dominates contemporary culture's attitude towards scientific research and innovation in general.

However, those who oppose stem cell research all of a sudden discover a sense of certainty when they come to construct the scenarios in which the potential for unintended consequences are explored. The fantasies of some scientific show-offs, often driven by personal and business interests, are always taken at face value, no matter how far away they are from reality. The scientific avant-garde is accused of following perverted pipe dreams – consider the dystopian fantasies of super-humans in the discussion of cloning. At the same time actual and severe physical and mental disabilities are portrayed as something human, natural and normal. "Man does not have a right to be born healthy. Behind this is the wish for a better Hitler," said 96 year-old Erwin Chargaff shortly before his death in 2002. Chargaff, the biochemist, philosopher and author remains one of the favourite opiners of today's opponents of scientific and technological development. "They bungle human beings, they manipulate the genes – there is the danger of a molecular Auschwitz. … The natural scientists are the Taliban of modern times," argued Chargaff.[10]

The scientific use of stem cells is raised to the level of embryonic mass murder in many debates;[11] in other horror scenarios we frequently hear about "designer babies" and a new "genetic underclass". All this is very far-fetched. The modest progress we have made with the new possibilities for diagnosing illnesses are light-years away from the actual possibility of producing human beings of desired characteristics. Given the actual state of technological development, the debate about designer babies is about as relevant as the question of whether traffic on the moon ought to drive on the left or on the right, said the Nobel Prize laureate for Medicine Christiane Nüsslein-Vollhard.[12] Yet the voice of such reasoned discussants are normally drowned out in the current debates in the public sphere.

Stem cell research and PGD have led to a curious coming together of the most diverse groups (feminists, liberals and right-wingers). Feminists who once devoted their political energies to the fight for abortion rights

have transformed themselves into equally vehement pro-lifers; liberal clerics, who once took a progressive stance on social debates, have almost begun to take the position that life starts before the act of procreation; right-wing extremists who speak in a language of blood and purity find themselves united with the anti-capitalist mentality of the anti-globalisation movement. And all of them are united in their desire for more laws, moral rules and selective bans for research and technology.

Considering the daily practice in bedrooms and hospitals the argument seems strangely detached from the realities of life. Artificial fertilization, contraception and abortion happen on a daily basis – thousands of times. Selection is another of life's constants: every day, every hour, within human beings, through human beings, in nature, in all spheres of life. The contraceptive coil, for example, involves a process that is generally accepted and often used: a couple has sexual intercourse and produces an embryo which is prevented from being implanted in the uterus and, therefore, dies. Looking at abortion, which many opponents of PGD have accepted (and some even fought for), then the fight against PGD and embryonic stem cell research must seem even more absurd and contradictory.

The arguments against stem cell research and against PGD show a profound mistrust of the individuals and their capacity to take control of their lives. It paints a picture of a society ravaged by untrammelled individualism and reckless in its hedonistic pursuit of ego satisfaction. In this mindset the risk of leaving complex decisions about their own lives to individuals themselves is seen as far too risky. Individuals are thought to be incapable of making morally responsible choices about the application of controversial technologies.

The trajectory of humankind from the primitive to the modern world has been a continual attempt to emancipate herself from the forces of nature. There is nothing natural in the fact that humankind has succeeded in doubling average life expectancy in the course of the last century. The motivation has not been avarice, just as the result has not been a movement ever closer to the apocalypse. Rather, we have taken increasing control of our capacity for reproduction, and in so doing, we have increased our freedom from the realm of necessity.

The most important question to ask is: who owns ethics? We often hear the argument that ethics must not be sacrificed to the arrogance of a few scientists in their pursuit of glory. Ethical objections have to be taken seriously, everyone believes. The unspoken premise which underlies the discussion is that only the opponents of stem cell research, only those seeking greater restriction and ever more caution from technological developments, can claim to have ethics on their side. On the other side those who support more research and greater freedom to pursue scientific and technological developments are accused of being driven by profit or career ambition, or even worse, the most terrible sin of all, the pursuit of scientific curiosity for its own sake.

There is, we can agree, a legitimate ethical debate to be had about the moral status of cell clusters from which, under certain conditions, a human being can develop. But there is equally an important ethical possibility that emerges when we manipulate nature and in so doing increase our possibilities for treating illness and curing disease. The pro-technology, pro-science attitude is rarely presented in its ethical dimension. Indeed, many debates around science and technology are presented in a similarly one-sided way. For example, it is uncritically assumed that animal testing is ethically dubious; but what about the ethical value of animal testing (see *Chapter 4*). And what about the moral case for genetic engineering? What about the moral case for nuclear technology (see *Chapter 5*)?

Attempting to get to grips with contemporary society's cynicism around science is not something that can be done simply by posing scientific facts against prejudice and insecurity. It is beholden upon scientists and commentators to present the positive arguments for scientific experimentation and technological progress: arguments which must be developed at the level of morality and ethics, politics, and scientific possibilities.

A serious discussion means accepting that both proponent and opponent are sincere in their beliefs. But in current debates about science the possibility of "healing the sick" is immediately undermined by the fact that it is a pharmaceutical company developing a therapy. There is a false

dichotomy in the current discussion that the pursuit of profit cannot go hand-in-hand with the pursuit of life-improving technologies and life-saving therapies. But without profits, of course, much of the research that goes on could not be funded. In the absence of any real social debate about the rights and wrongs of the market, opponents of scientific developments need only cite commercial interests in order to close off the possibility of a balanced debate.

The scientific developments that have brought humankind from primitive to modern society have contributed greatly not only to our increased longevity, but to our improved wealth and standard of living, to our freedom to control our lives and to our knowledge about the world. Progress in all these areas has occurred at a breathtaking pace in the past few decades.

We often hear that these rapid developments have failed to make us happy; indeed, the opposite. Opinion polls regularly show that a majority of people thinks that things are deteriorating and that civilisation is on the brink of decline.[13] The American environmental journalist Gregg Easterbrook argues that a sense of wellbeing is much like prices on the stock market: it cannot be measured against how things have been in the past but only on what you expect for the future.[14] Contemporary society's insecurity with science is an expression of a far greater insecurity about how we understand the present, and about how we might come to face the future. Science cannot solve this problem. On the contrary, a more positive attitude towards humanity's scientific and technological possibilities will much depend upon whether or not we come to take a more optimistic attitude towards the future. Whether or not we are able to develop a more rational attitude towards science remains an open question at the moment. If we do not, it may be that we allow the paralysing pessimism about science and technology to be transformed into a self-fulfilling prophecy.

We believe a different future remains open. Beginning to develop a more confident debate about science is an important start to opening up a more optimistic vision of the future.

2: The problem of the precautionary principle: the paternalism of the precautionary coalition

Jaap C. Hanekamp and S. Wybren Verstegen

In recent years, the traditional wisdom that 'one can never be too careful' has been formalized as a dominant legal doctrine, enshrined in international law as the Precautionary Principle. The first international endorsement of the precautionary principle was the acceptance in 1982 by the United Nations General Assembly of The World Charter for Nature, and it first appeared in an international treaty in the 1987 Montreal Protocol. It can now be found in a host of diverse national and international legislative treaties.[1] In terms of international policy-making, the most influential enshrinement of the precautionary principle was its insertion into the 1992 Rio Declaration on Environment and Development.

Although the principle has been defined in a host of different ways, leading to a variety of interpretations[2], its essence is expressed quite clearly in the Rio Declaration, which states that in relation to a given action or state of affairs:

> *"Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."*[3]

In other words, the precautionary principle suggests that if the result of a given action may be to cause irreversible damage of some sort, in the absence of scientific consensus that such harm will not ensue, we must proceed as if there is evidence that such harm will indeed ensue. The result is that the burden of proof falls not on the regulator, but on those who advocate taking the action.

The precautionary principle has arguably had an enormous impact in the areas of scientific and, particularly, environmental law and regulation. It has been the subject of innumerable publications and appraisals, fluctuating between sycophantic and derogatory. For its most vociferous proponents, the precautionary principle is seen as the foundation upon which a new universally applicable (environmental) legal system can be built that can protect present and future generations against the environmental and health risks associated with contemporary society's technological methods of production and high rates of consumption. To its critics, the precautionary principle has served to formalise a climate of fear around scientific development which places unreasonable burdens upon scientists and which, if carried out in full, can only seek to prevent a wide range of scientific developments and breakthroughs.

The extent to which the precautionary principle has become enshrined within the European Union is expressed by the fact that in 2001, the European Environment Agency, the EU body which claims to be "dedicated to providing sound, independent information on the environment", published the now well known and much cited report, *Late Lessons from Early Warnings*.[4] According to the European Environment Agency this report,

> *"is about gathering information on the hazards raised by human economic activities and its use in taking action to protect better the environment and the health of the species and ecosystems that are dependent on it. The study aims to contribute to better and more accessible science-based information and more effective stakeholder participation in the governance of economic activity so as to help minimise environmental and health costs and maximise innovation."*[5]

In reality, however, the report *assumes* the perspective of the precautionary principle as its starting point. The report is organised around 14 case studies involving "a range of well known hazards to the public, to workers and to the environment, where sufficient is now known about their

impacts to enable conclusions to be drawn about how well they were dealt with by governments and by civil society".[6] Beginning with the precautionary principle as its unquestioned premise, it proceeds to argue that a host of previous environmental problems and scientific accidents could have been prevented if only the precautionary principle had been understood and actionable prior to those problems and events. *Late Lessons* is worth considering in some detail precisely because it seeks to extrapolate back from the contemporary social and scientific climate, in which the precautionary principle is often simply *assumed*, and in so doing to demonstrate that *precautionary* measures have always been at the heart of sensible scientific practice. However, the report reveals far more about our contemporary mindset and obsessions than it teaches us about the history of particular scientific events.

An example from the introduction can serve to illustrate this point. In recounting events surrounding the cholera epidemic in London in the 19th century, *Late Lessons* takes the actions of John Snow who, having noticed a correlation between individuals infected with cholera and their use of a water pump on Broad Street, proposed removing the handle of the pump to prevent people using it. According to the authors of *Late Lessons* this demonstrates a "classic case of precautionary prevention".[7] However, a more accurate interpretation of Snow's actions would be to point out that he was relying upon the basic scientific method of induction: having noticed a correlation, he set out to test whether or not there was a causal connection between the water pump and the infection of individuals with cholera. Rather than *precaution* as the guiding principle underlying his actions ("we don't know the consequences of our actions, so we'd better not do anything"), it seems to us that this example illustrates perfectly the attempt to develop scientific knowledge through a process of trial and error in which the results of a particular action are not known in advance.

This is precisely the kind of attitude that we believe is at the heart of the scientific endeavour, and it is an attitude which we believe the precautionary principle stands opposed to. Because this principle has become such an unquestioned premise of contemporary regulation, we

believe it is important to subject it to some serious questioning. Because *Late Lessons* stands as such a well known and influential report which seeks to demonstrate the importance of the precautionary principle, published by the EU's own Environmental Agency tasked with providing "sound, independent advice on the Environment", we believe that interrogating the arguments of *Late Lessons* is a particularly important task for anyone who wishes to understand the limits of the precautionary principle.

Late Lessons from Early Warnings

In *Late Lessons,* fourteen historical case studies are presented and twelve lessons formulated on environmental and health issues. The examples considered range from halocarbons and the ozone layer, acid rain and forest dieback, to hormones in beef. It is argued that these problems have all created (or will create) great harm that could have been (or will be) prevented through the application of the precautionary principle.

One thing that is clearly revealed is the extent to which the precautionary principle is as much a political tool as it is a method of sensible scientific practice. The first case study, on fish stock depletion, makes this fact very clear indeed.

As far back as the Middle Ages, human beings have been aware that fish stocks could be overexploited. The abundance of many fish species fluctuates markedly as a result of a range of natural and environmental processes; but clearly the rate at which fish are caught by humans can have a marked effect upon such 'natural' cycles. In recent years, marine biologists have attempted to establish what level of fishing is possible at sustainable levels without causing the degradation of fish stocks; what are called 'maximal sustainable yields'. The setting of such limits, however, is not a purely 'scientific' question. One problem is that the predictions of marine biologists as to the capacity of fish stocks to replenish themselves are not definitive. A second is that the imposition of limits has to take into account not only the actual number of fish that will be caught, and the predictions of the implications of the number of fish caught for the overall capacity of the stock to regenerate. It also involves the livelihoods

of fishermen and the provision of fish that consumers wish to eat. There are important questions of economics, of local economies, and human livelihoods at stake. In reality, prolonged political debate between scientists, fishermen, lobbyists and politicians, has not tended to result in any consensus on acceptable fishing levels for all parties concerned.

Examples of the depletion of a host of fish stocks over a number of centuries suggest a real uncertainty in our capacity to determine a maximal sustainable yield. So the historical lesson drawn from this is that the precautionary principle must be fully employed. This would mean a 'temporary halting' of fishing activities through the establishment of 'no-take zones'. Such an approach employs what the report authors euphemistically term the "error-resilient concept"; or in other words, given that there is uncertainty about the optimum levels of fishing that will maintain fish stocks, the only safe, error-free course of action is to call a halt to fishing in these areas altogether for a certain period of time.[8]

However, there are a number of obvious problems with this approach. First, there is the question of its implications for both consumers and fishermen. The precautionary principle would seem to suggest that their interests simply have to be over-ridden. Second, there is the definitional problem of what is to count as a 'temporary' halt to fishing activities. Precisely because the call for this measure is the result of uncertainty as to the impact that a particular level of fishing will have upon a particular fish stock, the question of how 'temporary' the closure should be, much as the question of what constitutes a 'maximal sustainable yield', is a question of political debate, not scientific fact. According to the EU's communication on the precautionary principle, the provisional nature of precautionary measures "is not bound up with a time limit but with the development of scientific knowledge".[9] Here we enter a problematic circle: it is the fact of scientific uncertainty which has led to the call for the precautionary principle to be enacted leading to a 'temporary' halt to fishing activities, yet the temporary nature of such a halt is to be determined by the development of scientific certainty on a particular issue. But the possibility of scientific certainty is precisely the thing that is here under dispute: what level of 'certainty' is required to satisfy the propo-

nents of the precautionary principle? A precautionary ban will most likely have an "enduring temporality".

A second example of a case-study employed in *Late Lessons* gives further illustration of the political underpinnings of the precautionary principle. 'Knocking' is the name given to the process where petrol ignites too early in a four stroke combustion engine; it causes a knocking sound, reduces the engine's performance, and increases wear and tear. In the 1970s, MTBE (methyl tert-butyl ether) was introduced as an anti-knocking agent to replace lead, which had previously been used, because rising concentrations of airborne lead had been deemed undesirable. However, *Late Lessons* draws attention to the fact that MTBE has, or may have, its own set of environmental costs; and indeed that all anti-knocking agents which could be used as an alternative to lead have, or at least may have, environmentally undesirable consequences. The solution proposed is therefore that the best option would be "questioning the basic need for a mass transit system".

In the logic of the argument, we move from the recognition that rising concentrations of air-borne lead are undesirable, through the claim that alternatives to lead have, or may have, undesirable implications, to the solution that we ought, therefore, to adopt "a policy to discourage citizens from driving personal vehicles".[10] We move, in other words, from a demonstrable scientific problem (the use of lead as an anti-knocking agent in combustion engines), to the raising of uncertainty about alternative practices (the uncertainty about the impact of alternative anti-knocking agents), to a call for cutting back citizens' use of personal vehicles.

These two examples illustrate the underlying thrust of *Late Lessons*: the use of the logic of the precautionary principle as an attempt to trump each side of the political debate, and in so doing, to locate the problem as that of consumers and producers who are unable and unwilling to 'restrict' their self-interest.

On smoking guns

There is good reason to believe that there is no necessary conflict between self-interest and environmentally better practices. An example

is the discovery of the 'hole' in the ozone layer above Antarctica in 1985, and the development of scientific data indicating that the use of CFCs may be the problem. The result was the rapid development of a consensus amongst the international community that the use of halocarbons must be quickly phased out.[11] What is most interesting in this example, however, is that the movement from discovering the cause of an environmental problem and acting upon it was in no way the result of a precautionary approach. The discovery of ozone depletion caused by halocarbon emissions was a 'smoking gun', direct proof of the effect of halocarbons on the atmosphere: there was no uncertainty.

The environmental movement has been quick to grasp that it is such 'smoking guns', not the vagaries of the precautionary principle, that in fact lead to swift action. The discovery of 'natural disasters', such as floods and hurricanes, which are often interpreted, rather crudely, as evidence of man's impact upon global temperatures, are employed as a (quasi-) 'proof beyond reasonable doubt' that will satisfy public opinion and politicians who, though often in an oversimplified manner, keep thinking in terms of the authority of 'scientific proof'. Society does not accept precautionary action, but relies on what it conceives as 'scientific proof'.

This is precisely the structure of events that lead to the introduction of policies around SO2 (sulphur dioxide) emissions, which *Late Lessons* takes as a further case study.

In the early 1980s, as a result of lobbying, public opinion in Europe became convinced that acid rain (especially caused by SO2) threatened to cause forest dieback. This fear of 'forest death' – *Waldsterben* – was a major factor in the development of anti-air pollution measures. In November 1981, the German news magazine *Der Spiegel* triggered a wave of public interest with three successive articles on acid rain. On the 14th of February 1983, *Der Spiegel* dubbed *Waldsterben* 'an ecological Hiroshima'. From the start, however, scientists had been critical of the association of *Waldsterben* with acid rain.[12] In 1990, a ten-year, $500 million National Acid Precipitation Assessment Program (NAPAP) concluded that there was no widespread forest damage caused by acid rain in the United States.[13] A later report on European forests concluded that

the effects of air pollutants were small compared with other stresses affecting tree conditions (such as abnormal weather conditions and insect damage). Indeed, it pointed out that overall forest productivity had increased in Europe since the 19th century.[14] Kandler, in 1993, exposed the discussion of *Waldsterben* as a hoax,[15] and in 1995 one of the key scientists who had proposed the relationship between sulphur dioxide emissions and forest dieback himself explained that the hypothesis of "large-scale forest dieback in the near future is not backed by data and can be discarded."[16]

In spite of this scientific evidence, the introduction of policies limiting SO2 emissions is understood to have been a great victory for the environmental lobby. The introduction of such policies was the result of public opinion and resultant political pressures premised upon the false belief that there was a serious threat of forest dieback, and that SO2 emissions were to blame. The perception of forest dieback, in other words, supplied the 'smoking gun' which lead to the introduction of anti-SO2 emissions policies. What is most interesting is that here we again have an example of the 'success' of environmental legislation being the result not of the precautionary principle, but of (in this instance) the fabrication of a smoking gun which circumvents the need for precautionary measures by making what are taken to be demonstrable scientific facts. The existence of scientific certainty, real or imagined, makes the far more ambiguous claims to uncertainty upon which the precautionary principle is founded, effectively impotent.

The 'Conclusion' of *Late Lessons* makes a call for the inclusion of "lay and local knowledge" in any scientific appraisal.[17] Yet the example above, on the construction of the false problem of forest dieback, gives good reason to be wary of this. In situations of scientific uncertainty, the inclusion of lay knowledge in the decision making process is actually a call for the greater propensity to manipulate the public with idiosyncratic reference to scientific data. This conclusion should also be reached if we consider the case of growth promoter hormones, another case study considered in *Late Lessons*. The authors admit that the infamous Delaney Clause in the United States, which prohibits the use of carcinogenic substances in food for human con-

sumption, cannot be applied in practice. Food literally consists of hundreds of thousands of chemicals, including carcinogenic compounds. These cannot be eliminated. Nevertheless, *public opinion* has ensured that "the clause remained on the statute books".[18] The problematic nature of 'public scrutiny' is well illustrated here. *Late Lessons* makes clear that the risks of exposure to food additives hormones, such as growth promoters, despite thorough research, are non-existent.[19] The introduction of an EU ban on such additives was in reality, a "*political* risk assessment".[20] The assessment of the Lamming Committee that hormonal growth promoters were safe "was clearly unpopular with the EU officials."[21] It was *fear* among bureaucrats redefined as 'public concern', rather than any scientific evidence or knowledge, which paved the way for a ban. Risk aversion, distrust of scientific research, and ultimately the precautionary culture *itself* caused the problem.

A False Utopia

As with many studies about environmental issues, *Late Lessons* laments the optimism and scientific 'hubris' which dominated Western society from the 18th century onwards. Precautionary thinking is urgently looking for an alternative framework from Enlightenment scientism, and it seeks it in a call for the replacement of 'knowledge' by 'wisdom'. Aristotle, for example, is introduced as an authority and Socrates is presented as a precautionary thinker *avant la lettre* "when he acknowledged ignorance as a source of wisdom. Our report shows that this is a lesson from history that many people have forgotten".[22]

As a biblical triptych, paradise – fall – salvation, *Late Lessons* extols the wisdom of the past, bemoans the abhorrent technocratic present, and looks forward to a technological eco-efficient 'third' industrial revolution. This triptych is a typical example of the false utopianism of precautionary thinking: a future which can be made viable only when contemporary society is sketched in dark colours of crisis, against the background of a paradisian past that serves as a guide to a bright future.[23] Subsequently, this bright future can only be inaugurated by the precautious wise, who have risen above the limitations of scientific knowledge and in so doing, have developed a 'truer' grasp of what society needs.

Claiming that the world lacks (ancient) wisdom and, therefore, is in crisis, underlines the romanticism we are confronted with in precautionary thinking. Romanticism is the ideological motive behind the precautionary urge for bans on an increasingly broad range of technologies, especially chemical technologies (which are discussed in two of *Late Lessons*' chapters). It is the romantic idea that modern technology spoils or pollutes an otherwise 'clean earth'. This comes down to the wish that mankind must leave as little trace of its existence as possible. Ideologically, it is a way of denying factual history and the influence history has on the present and the future.[24] Banning certain technologies is a way of banning history by trying to create a world in which coming generations will be set free of what we are doing now, to give them 'clean earth to till' as Gandalf states in *The Lord of the Rings*.

The distrust in science caused by precautionary thinking is already backfiring on society. In the case study on BSE, *Late Lessons* insists that the whole issue was a *political*, not a scientific, mess, although this seems an overstatement.[25] The most interesting aspect of this case is that the precautionary culture *itself* caused the trouble. The government was faced with a conundrum, as it feared that *any* regulatory response would be a disclosure that there was something wrong, undermining worldwide consumer confidence. So, it is the risk aversion of modern society, fuelled by lay knowledge and technophobia, which has fallen victim to 'doubt beyond reasonable proof', that lies at the heart of the *political* row over BSE, not scientific hubris. As Forbes remarks: "Pessimism about structures – and a generally negative view of political actors as a group – can be entirely consistent with high expectations about what governments can and will do."[26] To state that 'public scrutiny' would have been a way of checking the BSE row, as the authors of *Late Lessons* do, is to turn the whole issue upside down.[27]

The precautionary coalition

Since the precautionary principle presents itself as counterbalancing the hubris of scientism and 'greed' of business interests, we might ask exact-

ly who are the promulgators of this principle, and why their motives are promoted as more trustworthy?

We first note that mistrust has become an important source for scientific investigations themselves. Scientists nowadays build a career on technophobia within society. They are the first group who form the scientific core of the precautionary coalition. The authors of *Late Lessons* are an example. A second group who have been central to pushing the precautionary principle are environmental and consumer organisations. Precautionary-inspired environmental legislation has given NGOs a weapon to subdue corporations[28]; while consumer organisations are, by their very nature, obliged to find potential harm caused by technology. A third party are supranational political bodies. Through the politicisation of the European consumer, with the introduction of accountability as the market was deregulated in the 1980s, which resulted in the concomitant loss of political power of the nation state, EU governments were able to (re)-establish their legitimacy.[29] Through the institutionalisation of mistrust, the regulation of a principally deregulated market was established. The insistence on *ex-ante* proof that products are safe, rather than reassuring the public as to the safety of their commodities and consumables, serves in reality to further promote consumer suspicion. Fourth, the mass media is a key coalition partner as it is well-equipped to find stories of harm, guilt and blame. As Forbes states in relation to BSE: "Fears about the safety of beef bloomed like so much algae under the heat of *The Sun* and other media exposure."[30]

When confronted with the power of the precautionary coalition, politicians have begun to move in a precautious way. Public authorities might be blamed for any suffering caused by technological failures. Authorities will not quickly be held responsible for traffic accidents or lung cancer, but they will be when a problem is uncovered with food additives. How can they avoid this, and what are the most common strategies the authorities will use to avoid responsibility?

A first strategy is the call for 'safer' technology. The result is that nonsensical levels of safety regulation are derived from scientific results that

are generated by cooperative scientists who themselves distrust the blessings of the modern world, or because our fearsome and rich society is ready to spoil enormous sums on increasing amounts of research on ever-decreasing risks.[31] This is the obvious consequence of "promoting more robust, diverse and adaptable technologies to minimize the costs of surprises and maximise the benefits of innovation".[32] One wonders what the *hubris* is behind precautionary thinking!

A second strategy is to involve the public in decision-making because then the public can no longer claim that 'technology' is a realm outside its responsibility. The public seems to be offered a chance to speak out, although on issues on which it has no great expertise and often little understanding. Nonetheless, when problems arise politicians appear less blameworthy if they have simply been enacting the will of the public. Of course, this means an intrusion into the realm of science by the laity. The justification is that science and scientists can no longer be trusted considering the environmental havoc wrought over the last century. A report like *Late Lessons* makes great play of this point. Yet exactly why laymen and politicians are *better* equipped than scientists to foresee the future is never made clear. Could the laity have seen the risks of BSE or ponder on the potential threats of MTBE or other anti-knocking alternatives? We doubt it.

To understand this we need to remember that the precautionary principle is in reality not about science, but about politics and the (transfer) of political responsibilities. Once lay knowledge is introduced into the arena of political decision-making about science, everybody becomes responsible for any future disaster that was overlooked. It is not surprising that, from a position of relative ignorance, faced with the question of what risks are acceptable, the decision of the public should be conservative. The coupling of the precautionary principle with the introduction of lay-knowledge results in a call for *safety in stasis*.[33] The precautionary principle is turned into an ultimately reactionary political tool. As *Late Lessons* points out about the introduction of any new technology "their very novelty might be taken as a warning sign".[34]

A paternalistic future?

This remark, as a final observation, suggests that the precautionary coalition has a paternalistic, even anti-humanist, perspective on society, its citizens and its economies. The perspective is one that assumes that once we have begun to engage in a direction that *might* lead to undesirable outcomes, we will be unable to stop, or to make choices between good and bad outcomes.[35] It is the possibility of human action in the world for human betterment that the precautionary principle throws into doubt. It is scientific activity itself about which the principle calls upon us to be precautionary.

The supporters of the precautionary principle are moving on a slippery slope by trying to impose the ancient 'wisdom' – better to be safe than sorry – over scientific knowledge, as the guide to our actions. This is really a call to move away from conscious knowledge, information, education, ethics of responsibility and the capability for judging freely, towards the unconscious and the ultimately uncontrollable. Its prohibitions, moreover, suppress freedom of choice, since this suppression of freedom is thought to be the only way to prevent future wrong uses of freedom.

The precautionary coalition believes itself to have the capacity to protect us against any concatenation of events. When precautionary policies are devised, all for the benefit of European citizens, then a 'true value' of human and environmental wellbeing is assumed. This 'true value' carries utopian overtones. Resisting precautionary regulation is branded as irresponsible. This means certain parts of society define and impose on others their conception of human health and environmental quality and the maintenance thereof. Precaution thereby tends to empower supranational bureaucratic organisations. It resembles enlightened absolutism. It uses 'lay knowledge' as a political tool to circumvent science, but is nevertheless only weakly attached to democratic scrutiny. The only way out of this conundrum is to reiterate the values of knowledge, information, education, ethics of responsibility and the individual capability of judging freely. That is why we oppose the precautionary principle.

3: The rise of the ethics committee: regulation by another name?

Stuart W. G. Derbyshire

The past fifteen years has seen a phenomenal expansion in the role and remit of ethics committees in the UK.

In 1991 the Department of Health issued guidelines indicating that no NHS body should support research without the approval of a local ethics committee.[1] In 1994, the Department of Health, British Medical Association and Association of British Pharmaceutical Industries established a framework of standards by which all research ethics committees (RECs) could ensure consistency of performance. In 2000 the Central Office for Research Ethics Committees (COREC) was established to "maintain an overview of the operation of the research ethics system in England."[2]

But it is not only in the sphere of health care and medical research that there has been a spread of ethic regulation. The Economic and Social Research Council (ESRC), as its name suggests, does not fund medical research, yet at the beginning of 2006 the ESRC announced a new Research Ethics Framework for social science research with the aim of protecting the dignity, rights and welfare of research participants.[3] As of 2006, all projects funded by the ESRC must have REC approval before funds will be released.

The changes in governance of medical research in the UK have led to an increasingly vocal backlash against what are perceived as overbearing regulations that stifle innovation and investigation.[4] Aside from the numerous examples of over-zealous criteria – such as the example of COREC reviewers who requested evidence that the ink used on medicine bottle labels, which is exactly the same as that used by computer printers in every hospital pharmacy, has no toxic effect that could endanger research partic-

ipants, or the example of a research application that was rejected because patient information stored on laptops would be compromised if the laptops were stolen – is the fact that COREC applications take several weeks if not months to complete, often run to dozens if not hundreds of pages and take weeks, often months, to be reviewed.

However, much more important than the inconvenience of COREC is the distrust in medical practitioners that its existence represents. The demand for increasing detail as to the potential risks and benefits of research imply that researchers would otherwise engage in dangerous research with trivial benefits. The demands for openness and transparency imply that without regulation researchers would otherwise mislead research subjects and engage in covert, maleficent investigation. Similarly, the demand for ever greater levels of consent for all manner of investigation and clinical intervention suggests that the moral and intellectual standing of medical practitioners is insufficient to ensure that subjects and patients will be treated appropriately. The desire to reduce the distance between doctor and patient, which the consent process aims to achieve, has also resulted in the introduction of lay opinion to RECs and to increasing concerns about the interests of the "community" being represented.

There is obviously a case for the overview of biomedical research, which can involve the possibility of subjects being physically harmed during the course of an experiment or drug trial, as the tragedy with the novel immune drug TGN1412 demonstrated.liv[5] In contrast, subjects partaking in economic and social research may be emotionally hurt, embarrassed or even humiliated, but are unlikely to be physically harmed. While there is good reason for researchers to protect their subjects from emotional harm there is also good reason to be cautious as to the mischief that can be invited when RECs are asked to regulate how social science researchers might make their subjects feel. Research subjects are not as fragile as RECs seem to think they are and, as with medical researchers, social scientists are not maleficent in their aims.

The corrosion of trust in medical practitioners and the undermining of medical expertise, along with an increasingly suspicious and mis-

trustful attitude towards social science researchers, are rarely commented upon, but they are amongst the most disturbing consequences of the expansion of ethics regulation. At present, ethical procedures are running far ahead of what subjects require and researchers expect. This over-regulatory climate cannot but contribute to an increasingly negative view of science and to the corrosion of relations between science and society.

Early regulation battles

The modern research ethics era begins with the Nuremberg code written in response to the "experimentation" performed on the victims of the Holocaust. The code contains ten directives, including voluntary consent as an essential component of research and the protection of subjects from injury, disability, death and other physical or mental suffering.[6]

However, for many years after the war the code was rather marginalised, viewed as overly restrictive, and as a corrective to the madness of war rather than the necessities of medical research[7]; it was only in the 1960s that concerns about medical and research practice came to be more broadly addressed. It was at this time that Henry Beecher in the US and Maurice Pappworth in the UK both published influential exposes of clinical experimentation practices. Beecher documented 22 "unethical or questionably ethical practices" including the withholding of effective treatment during a drug trial, that likely played a role in the deaths of 23 patients, and the injection of 22 subjects with live cancer cells without mentioning the cancerous nature of the cells to the subjects.[8] Pappworth exposed similar practices in British institutions, including cardiac catheterization and liver biopsy experiments performed at the prestigious Postgraduate Medical School at Hammersmith Hospital.[9] In these experiments, diabetics had their insulin withheld for two days so that they became ill. Samples of the blood leaving their livers were collected and small samples of liver tissue were also taken. These procedures were of no possible benefit to the patients involved and exposed them to definite danger of complications.

Beecher's 1966 article played a significant role in the implementation of federal rules governing the conduct of human experimentation in the US, including a clear call for fully informed consent from research subjects.[10] Pappworth's efforts to influence UK medical practice, however, were much less effective.lix This failure might in part be due to Pappworth's more aggressive approach – whereas Beecher protected the anonymity of the investigators, Pappworth did not – causing the medical establishment to close ranks against him. But it also highlights that UK medical investigators were not ready to accept that their behaviour needed policing despite the negative publicity that Pappworth had brought to their door.

Writing in the *British Medical Journal*, Bradford Hill argued that there were situations in which consent "need not – and even should not – be sought". Hill raised the problem of patient understanding, suggesting it was "quite impossible to tell ill-educated and sick persons the pros and cons of a new and unknown treatment versus the orthodox and the known".[11]

Hill's comment generated one of the first battles between the medical profession and the public. Helen Hodgson, founder of the newly formed Patients Association, responded with astonishment at "a commentary on medical ethics which appears to advocate a doctor/patient relationship based upon deceit". She went on to argue that the public "would not be willing for much longer to submit blindly their health and their lives to any arbitrary code of ethics in which they have no say, and whose application is not guaranteed".[12]

External pressure on medical and scientific practice increased as further scandals were reported. In the US the Willowbrook experiments, originally exposed by Beecher, were causing increasing consternation. During the 1950s, intellectually disabled children were deliberately infected with hepatitis upon enrolment in the Willowbrook School in New York. Details of the Tuskegee Syphilis study, conducted by the US Public Health Service from 1932-1972, came to public prominence shortly after Willowbrook in 1972. The study had monitored the natural course of syphilis in 400 black males from Tuskegee County,

Alabama. The subjects were never informed that they had syphilis and were not provided with penicillin as treatment when it became available in 1951.

The revelations about Willowbrook and Tuskegee had a significant impact on ethical discussions in the UK, but Britain also had a home grown problem following the death of an army volunteer at a Ministry of Defence installation, Porton Down. The volunteer had died during the testing of nerve gas agents in an experiment shrouded in military secrecy. Embarrassing press coverage from the events at Porton Down, the revelations of Pappworth and the increasingly influential rise of the Patient's Association led the Chief Medical Officer, George Godber, to call for an enquiry into allegations of unethical practice and to pursue the establishment of ethics committees to oversee clinical research. In 1973, the Royal College of Physicians responded with a document stating that the supervision of research ethics should be the sole function of an ethics committee, which must include laymen, to which all projects should be referred.[13] These recommendations led to the establishment of local research ethics committees. In the US, Senator Edward Kennedy held extensive hearings in 1973 regarding the conditions of human experimentation and, in 1974, the National Research Act was passed creating the National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research. In 1979, the Commission drafted the Belmont Report, which required an investigator to submit research protocols for review and led to the establishment of institutional review boards (IRBs).

Social science is also scrutinised

The social sciences also faced criticism following several prominent studies that raised ethical concerns on both sides of the Atlantic. During the summer of 1961, Stanley Milgram, a psychologist at Yale University, began a series of experiments to investigate how far people would go when subjected to instructions from an authority figure.[14] Milgram discovered, to his surprise, that people will go along with instructions from an authority figure even when those instructions included delivering

very high voltage electric shocks to a person they had just met. Ordinary individuals, recruited randomly through adverts, would obey instructions leading to the possible death of another person seemingly recruited for the same experiment but simply playing a different role. Although nobody was actually harmed as the events were staged, Milgram came in for considerable criticism because of the stress his subjects experienced when following his orders.[15] Moreover, the subjects in Milgram's studies were never aware of the true nature of the study; their involvement was based upon deception. Subjects that are deceived, by definition, cannot provide informed consent.

Deception also caused controversy in the studies of Laud Humphreys, a student at Washington University in 1965. Humphreys began an investigation of men who commit impersonal sexual acts with one another in public restrooms for his Ph.D. (1965-1968).[16] "Tearoom sex," as fellatio in public restrooms is called in the US, accounted for the majority of homosexual arrests at that time. Humphreys decided to find out more about the men visiting tearooms and so he watched what happened[17], gained the confidence of some of the men he observed to find out about the rest of their lives, and even secretly followed them to obtain their names and addresses. About a year later and carefully disguised, Humphreys appeared at their homes claiming to be a health-service interviewer and interviewed them about their marital status, race, job, and so on. Objections were raised that Humphreys' research had invaded the privacy and threatened the social standing of the subjects. The turmoil in his department resulted in a fist fight among faculty members and the exodus of about half of the department to positions at other universities. There was also considerable public outrage after details were leaked to a journalist who ran the story.

In 1971, Phillip Zimbardo, a psychologist at the University of Stanford and a former student of Milgram, organised an audacious role-playing experiment to investigate prisoner and guard behaviour.[18] The basement of the psychology department was converted for use as a mock-prison and students were recruited to play the role of prisoner or guard. There

was no deception and the subjects were screened before the experiment began for anti-social tendencies. The subjects were divided randomly into "prisoners" and "guards".

The results were surprising. The guards initiated several rituals, including night-time counts and push-ups. They controlled toilet access and sometimes required the prisoners to use a bucket, which could not be emptied at will. When a prisoner's rebellion broke out, they were sprayed with fire-extinguishers, stripped naked, deprived of their beds and toiletries and the ring-leaders placed into solitary confinement. Some of the prisoners tried to obtain legal assistance through their families and one prisoner went on hunger strike to protest the conditions. The study was finally terminated when the experimenters reviewed the overnight tapes and saw that the guards were escalating their abuse of the prisoners in the middle of the night and when a new investigator objected to the conditions. This was day 6 of a planned 14 day experiment.

Zimbardo was aiming to investigate what would happen to good people put into a bad place and although he expected to find some deviation from decent behaviour he was, like Milgram, stunned at the level of deviancy. The study has become a social psychology classic, just like the Milgram study, but also like Milgram, Zimbardo's study generated a storm of ethical debate centring on the various decisions of the experimenters to allow the study to continue in the face of surprising and escalating brutality towards the prisoners.

Coming to terms with past incidents

The treatment of patients at Willowbrook, during Tuskegee and in the various studies described by Beecher and Pappworth certainly provide damning evidence in favour of regulating medical research. The use of deception, the invasions of privacy and the casual allowance of maltreatment in the studies of Milgram, Humphreys and Zimbardo also provide grist for the mill of research regulation. There are, however, several reasons to remain sceptical as to the value of increasing regulation over scientific research.

The overbearing paternalism of the past was bad but the intentions were good

It is difficult to conceive of anything less defensible than the deliberate infection of children with a disease, yet the investigators at Willowbrook did, in fact, manage a defense. The investigators defended the deliberate infection of students on the basis that almost everyone at the school became infected and that it was better to provide a deliberate, controlled and monitored course of infection than leave the child to the inevitability of a chance encounter with infection. The investigators only enrolled children between the ages of three and ten years in whom hepatitis was known to be especially mild and infection was provided using strains that were known to be mild. The investigators made no effort to hide their methods and published their findings in the highly respected and well read *New England Journal of Medicine*.[19]

This is not to condone the investigators behaviour. It certainly would be better to have attempted control of infection at the school and to have investigated those children who, nevertheless, became infected. But it is to suggest that the desire to investigate, to understand and to provide for better treatment in the future is one that should not be forgotten in the rush to condemn.[20]

The same zeal for understanding and for better treatments tomorrow also characterise other ethically dubious practices uncovered by Beecher and Pappworth. The investigators were in thrall to a scientism that characterised the post-war period and was widely expected to yield miracle cures and understanding of the human body. This belief was not without foundation as the breakthroughs of that period, including the discoveries of penicillin, cortisone and chlorpromazine and the developments of open-heart-surgery and transplantation, testify.[21] The problem was that the science of experimental medicine was getting in the way of the greater personal contact which had previously characterised the relationship between doctor and patient. Scientific advances in the early to mid 20th century created a tension between the treatment of persons and the ability to look through the person to examine the disease. While a personal connection with patients is important, so too is the ability to

ignore the patient and recognise the mechanisms of disease that will yield to the brute force of investigation.[22]

Social science is not medicine

Because social science does not offer any promise of breakthroughs that will cure disease it is in a much weaker position, at least rhetorically, to defend itself when accused of unethical behaviour. At the same time, the lack of directly invasive procedures means that social scientists are unlikely to kill or seriously harm their research subjects. The danger of social science lies not in its threat to physical well-being but to the mental health of the subjects. The excitement, and political threat, of the social sciences lies in the ability to overturn preconceived notions of why human beings do the things they do.

Understanding what people will do when confronted with authority (Milgram), power (Zimbardo) or temptation (Humphreys) are all legitimate scholarly subjects that are tackled both by social scientists and journalists.[23] There can often be tension between the interests of the subjects immediately involved in a piece of research or an experiment and the pursuit of understanding human action and motivation. Balancing that tension is difficult but it is a necessary part of any social science investigation. Openness to critique by fellow professionals is a reasonable mechanism to address the tension and, arguably, Milgram, Humphreys and Zimbardo got the balance wrong. Nevertheless, Milgram reported that 84 per cent of the subjects in his studies were glad to have taken part and none reported any serious psychological distress in the years after the study. Humphrey's "tearoom" studies resulted in the end of the police practice of arresting those who frequented "tearooms". Zimbardo's subjects also reported that the experience was generally a good one without long-term negative consequences and the study was considered innocuous enough to be repeated for a documentary program by the BBC.[24]

The ESRC and MRC do not cite past incidents in support of increased ethics regulation

In their documents establishing an expansion of research ethics regulation, neither the medical research council (MRC) nor the ESRC make

reference to past research scandals that originally gave rise to the modern research ethics debate. As justification for their Research Ethics Framework, the ESRC list the changes in public perception of research, the growing range and sophistication of social science research and a series of new legislation being proposed or recently introduced to regulate research. In their "statement on research regulation and ethics"[25] the MRC justify further regulation as providing researchers with protection from regulatory acts that the uninformed researcher might breach, inadvertently or otherwise.[26]

The lack of emphasis on past problems of research might be because it is no longer considered necessary to labour the point; the need for research ethics is widely accepted and the only question is what type of regulation we will have. Nevertheless, a key aspect of the justification for increasing ethical regulation of the medical and social research appears to be, somewhat circularly, the context of increasing regulation of medical and social research. It is the fact that research regulation is expected that justifies the expansion of regulation.

In reality, since 1974 it is difficult to find a breach of medical ethics that compares to that of Willowbrook or Tuskegee or an example of a problematic social science project such as those of Milgram, Humphreys and Zimbardo. Some scientific investigations have certainly gone wrong and have, most tragically, resulted in the deaths of Ellen Roche, who received an experimental asthma therapy, and Jesse Geslinger, who received an experimental gene therapy. These incidents, however, are notable for being the exception and for being totally unexpected, similar to the terrifying reaction of healthy volunteers to the immunosuppressant drug TGN142. Lessons can certainly be learned from these incidents so that better care might be taken in the future, but it takes a fairly jaded view of science to believe that investigators were acting negligently, and it takes a fairly childish view of science to believe that experiments should never be allowed to go wrong.

There is, however, an increasingly strong view of science as a malign force in the world and a belief that no risk, however small, should be accepted in the pursuit of further knowledge. Public and professional

discussion of science is increasingly dominated by cynicism, distrust and a profound expectation of the worst.[27] This culture of distrust explains the suspicion that science is a dishonest, biased and dangerous enterprise that involves publication bias, suppression of data and conflicts of interest born from industrial sponsorship. Accordingly, there are calls for greater transparency and regulation that RECs are being increasingly mobilised to address. A culture that sees subjects as fragile and science as a dubious enterprise is much more likely to look upon previously standard scientific procedures as unethical.[28]

What is happening today and what will happen in the future?

The RECs of today are, in part, a product of past discussion about research that was actually or potentially detrimental to the subjects involved. However, they are also a product of an increasing suspicion regarding the nefarious aims of scientists. There is, consequently, a call for the regulation of science to be performed by those who are outside the scientific discipline under review and even outside of science altogether. The inclusion of lay members on RECs is intended to ensure that future scientific practice will be guided by the interests of the broader community and by socially desirable goals.

A desire for medical ethics to regulate beyond the mere practice of medicine, to have wider social influence and improve social awareness, is reflected by recent changes to the Declaration of Helsinki.[29] Two new paragraphs in the Declaration require research trials of new drugs to include the best currently available therapeutic alternative as a control, rather than placebos, and that every patient studied be given the best available therapy at the end of a trial.

These changes may appear admirable, but in reality they represent an unfortunate confusion of politics and science. The economic disparities that blight poorer nations and communities are lamentable but the reorganisation of medical research will not alter those disparities. Efforts at reorganisation, however, may very well distort medical research. Consider, for example, the possibility of providing a therapy that is less effective than the best available but vastly cheaper. This therapy might be

useful to poorer nations, but the revised Declaration would prevent testing. Furthermore, charities, institutions and drug companies might all be reluctant to fund trials of expensive drugs if they are subsequently to become responsible for the provision of those drugs.

Similarly, the ESRC is concerned that studies are performed with appropriate subject protections in place. However, such protections go beyond that of the immediate subjects towards the broader interests of 'the community and wider society': RECs should 'give due regard to the consequences of the proposed research for others directly affected by it and to the interests of those who do not take part in the research but who might benefit or suffer from its outcomes in the future".[30] Similarly, the ESRC invites investigators to look beyond their immediate research subjects. In the current climate of suspicion regarding science, demands for community interests to be addressed will have a chilling effect on social science. A pressure to make research 'legitimate in the eyes of the community'[31] will result in local sensibilities regarding the proprietary of the inquiry, or what it might reveal, having veto power over inquiry. Academic freedom is bound to include periods of struggle against the constraints of community attitudes regarding the propriety of the subject investigated. The additional suggestion by the ESRC that, "a broad view should be taken of possible ethical problems arising from research"[32], provides an REC with discretion to disapprove proposed research under the most arbitrary balancing of potential benefit against risk of harm in light of the community's perceived attitudes. Such directives to consider community feelings can only mean that some less popular research proposals will be sidelined. Unfortunately, like unpopular speech needing the strongest freedom defence, unpopular research will require the most robust defence of freedom of inquiry.

It is widely assumed that the promotion of lay persons and concern for the interests of the wider community will result in increased concern for the welfare of research subjects. But the assumption of threat to research subjects is poorly documented and there is little consideration of the consequences to research integrity when lay opinion and consid-

erations beyond research excellence are entertained. The theoretical foundations of a discipline is a matter for the members of that discipline and, by definition, they cannot be wholly independent of its methods and aims. They are involved. They have something to lose if the discipline is compromised by poor research. Thus, they are the best people to judge the merits of a research proposal. In contrast, lay members have no stake in moving forward the intellectual integrity of the discipline and they are not capable of judging more substantive research matters, such as methodology and potential outcomes. Their inclusion on ethics committees can only mean that research will be compromised by an agenda other than the integrity of the research itself.

An examination of the US Institutional Review Board (IRB) system, which involves far greater scrutiny and regulation of research practice than is currently the case in the UK, does not support an argument for greater REC control over research practice. Gunsalus and colleagues have documented what they call "mission creep" in the IRB system, which has led to IRB committees focusing on procedures and documentation, central government requirements and exaggerated precautions to protect against lawsuits.[33] IRBs have, for example, imposed constraints on historians conducting oral history interviews of stressful events, such as the Holocaust and civil disobedience during social protest. They have made procedural requirements for conducting surveys that make them impractical – for example, requiring signed consent forms in advance of surveys being sent to subjects.

US government guidance invites IRBs to consider the "stress and feelings of guilt or embarrassment" that "may arise simply from… talking about one's… behavior or attitudes" to the researcher. IRBs are invited, in effect, to reject a research proposal entailing just such a conversation, one that could be carried out in the ordinary course of human interaction absent investigative intent, when they believe the good of what might be learned does not justify the risk of that "harm". Yet such a conversation is normally not at all beyond the risks of everyday life. As a further example, one IRB told a "Caucasian Ph.D. student seeking to study career expectations in relation to ethnicity that Africa American Ph.D.

students could not be interviewed because it might be traumatic for them to be interviewed by the student."[34]

An overly protective stance towards research subjects is more likely to occur in an atmosphere of distrust towards scientists and medical professionals. Such distrust is actually heightened because ethics review mechanisms increasingly work on the assumption that researchers are unethical and must prove their innocence. Consider these comments from the ESRC Research Ethics Framework:

> *Regular monitoring of RECs as part of research governance procedures is fundamental to demonstrating the independence and quality of the decision they take.*

and

> *…where the research subjects are considered not competent to give their assent to the research, the issue of honesty and consent may need to be managed via proxies.*[35]

There is an assumption of guilt and dishonesty on the part of researchers; an accusatory question lurking in the background: "How many subjects have you abused this week? How many do you plan on abusing next week?" There is an assumption that without constant vigilance the true abusive nature of research will assert itself. Such assumptions can only encourage greater perception of damage to subjects and increase the calls for regulation.

Conclusion: The capitulation of scientific authority

Beginning with the Nuremberg Code, the past 60 years have seen a shift in the regulation of medical and scientific practice away from the professionals directly involved and towards research ethics committees. RECs have increasingly demonstrated commitment to a negative view of researchers that has increased suspicion and distrust between scientists and government, scientists and journalists and scientists and the public.

Some of that distrust follows practices that scientific professionals ought to be concerned about – Willowbrook, Tuskegee, Zimbardo and other procedures described by Beecher and Pappworth – but there are dangers that in the condemnations flowing from hindsight we fail to consider the wider aims and achievements of scientific professionals. Ironically, these dangers include not only the diminishment of science but the diminishment of those who volunteer for scientific investigation. There is little reason to believe that subjects being interviewed about stressful episodes or being placed into difficult circumstances will be unable to cope or will want such investigations to be prevented.

The zeal to regulate scientific investigation has generated considerable technical barriers that prevent or delay the onset of research. Long application forms with myriad questions and rules to negotiate, long waits for applications to be processed and long consent forms for subjects or patients to read and sign are the most obvious barriers. Although the aim is to prevent harm to subjects and patients there is no evidence that the application forms, review procedures and consent materials actually do this. There is concern, however, that investigators will step around ethical procedures by not doing research, by doing research without approval or by being instrumental in their approach to ethics – equating good practice with the bureaucratic exercise of responding to REC directives. There is also concern that consent is becoming less of a vehicle to inform research subjects and patients and more of a means by which the risk of experimental and therapeutic practice can be offset from the investigator and the institution and onto the subject or patient. Such consent procedures are not in the interests of patients or research subjects and are part of what Tallis has described as a shift from the dictum of "first do no harm" towards "first cover your ass and damn the harm".[36] Moreover, long consent forms that spell out every possible risk of a procedure, however statistically unlikely, can only serve to scare subjects and patients and further erode trust in the process.

Finally, there is the diminishment of expertise by the introduction of lay members and the need to consider the community during review of research procedures. Specialised expertise is marginalised against the

need to be sensitive to the feelings of non-specialists. Consequently, research questions will be restricted to conventional, safe and popular areas, inquiry will be characterised by deference rather than challenging established wisdom and censorship will replace academic freedom.

4: Anti-vivisection and the culture of misanthropy

James Panton

On the last Saturday in January 2006, 16 year-old Laurie Pycroft staged a spontaneous demonstration in support of the part-built Oxford University biomedical research laboratory. The facility – which once completed will be one of the UK's leading centres for animal-based medical research – had become the national focus for anti-vivisection campaigners over the past two years. Finding himself in central Oxford on the day of an anti-vivisection demonstration against the laboratory, Pycroft and two friends bought a marker pen and a large square of card at WH Smith and wandered round the city waving their quickly made placard stating: "Support Progress – Build the Oxford Lab!"

Within a few days the internet was buzzing with talk of Pycroft's impromptu action. By the end of the week he had been interviewed on local radio, mentioned in the national press and contacted by a number of individuals associated with the university – undergraduates, post-graduates and faculty from a range of disciplines – myself included. Before long, Pro-Test was founded with a mission to raise public support for the Oxford Lab, and to promote vivisection research generally.

Over the next few months the campaign which Pycroft had initiated became the focus of national media and political debate. In the days surrounding the first Pro-Test demonstration at the end of February, on which nearly 800 people marched through the streets of Oxford, Pycroft was lauded in the press as a "bedroom blogger" taking on animal rights protestors[1]; a "campaigning hero"[2] and voice of the "silent majority" who "is prepared to put his head above the parapet"[3] in opposition to what the *Daily Telegraph* dubbed "the al-Qaeda of the animal rights lobby".[4] Pycroft, and Pro-Test, seemed to have catalysed a mass of popular sup-

port, and galvanised the scientific community to take to the streets and speak out in public in defence of vivisection.

It was not for another three months, in the days leading up to the second Pro-Test demonstration in June, that anyone raised the obvious point. In an article titled "The shame of our silence", scientist and fertility expert Professor Robert Winston expressed a sentiment that many people had surely been feeling: "How disgraceful," he argued, "that a 16-year-old boy has put the medical and scientific establishment, drug companies and universities to shame".[5] This was the important question which lay behind the Pycroft Pro-Test hype: why had it taken the amateurish action of a 16 year-old boy to begin to galvanise popular support, and to stimulate the scientific establishment to speak out en masse in defence of vivisection? Why had government, scientists, pharmaceutical companies, universities and academics remained silent on the issue for so long?

The answer to this question is, I believe, disconcerting. Whatever the public, institutional and political support that the Pro-Test campaign was able to generate in its few months of fame, the reality is that the proponents of vivisection have singularly failed to make the hard argument: to assert and defend the moral superiority of human beings over animals. The refusal to make this argument is an expression of a broader insecurity in contemporary society about the status of human beings, and about the role that science plays in manipulating the world around us towards the satisfaction of our needs and the furtherance of our desires.

The "shame of our silence" and the problem of "animal rights extremism"

Because of the relative silence of politicians, scientists, universities and research institutions in the past few years, the debate over vivisection has been dominated by the arguments of anti-vivisectionists. The putative reason for such silence is the alleged threat posed by animal rights extremists.

At the beginning of 2004, Cambridge University announced that it was terminating plans to build a new neuroscience laboratory in which research on primates would be undertaken. Although the university cited

funding problems, it was widely believed that they had capitulated to protests and demands of the anti-vivisectionist lobby[6]; not least because the spiralling costs of the project were in part blamed upon the need for increased security in the wake of threats by anti-vivisectionists. A few months later, Walter Lilly, the construction company contracted to build the research facility in Oxford, announced that it was pulling out of the project amid apparent threats of violence and intimidation from animal rights activists. The Department of Trade and Industry announced that it would do "whatever is necessary to combat animal rights extremists", including the proposal to call in the army to protect the building site and secure deliveries.[7]

The alleged threat posed by animal rights activists has dominated all discussion of the Oxford facility over the past two years. Writing in *The Independent*, Oxford University Registrar David Holmes justified the university's return to the High Court to seek an injunction against anti-vivisection demonstrators with the claim that "we are besieged by hatred and vitriol".[8] In 2006 the university sought, and was granted, three such injunctions: preventing activists from demonstrating nearby during university examinations; extending the category of "protected persons" – those who anti-vivisectionist campaigners are legally prohibited from contacting or communicating with – from staff, students, alumni, and contractors working on the laboratory building site to "all contractors who supply any goods or services to the collegiate University"; and further extending the "exclusion zone" around the building site and university properties which protestors are prohibited from entering except for short periods of officially sanctioned demonstrations. In the spirit of Holmes' article, each of the injunctions was justified in the name of protecting individuals from "intimidation, harassment, and potential violence from animal rights activists."[9]

In May 2006, three animal rights activists were sentenced to twelve years in prison for conspiracy to blackmail the owners of Darley Oaks farm, which bred guinea pigs for vivisection research. Their campaign against the farm had culminated in the theft of the body of Gladys Hammond from her grave in October 2004. The following week, Prime

Minister Tony Blair announced his decision to sign The People's Petition – an online petition set-up by the Coalition for Medical Progress to give voice to the "silent majority" who support vivisection.[10] Blair explained that the rare act of a serving government minister signing a petition was "a sign of just how important I believe it is that as many people as possible stand up against the tiny minority of extremists threatening medical research and advances in this country."[11] So great is the perceived threat of animal rights terrorism that in 2005 anti-terror legislation introduced to combat Islamic extremism was extended to include the activities of animal rights activists.[12]

The current debate around vivisection is almost entirely oriented around the activities and putative threat posed by animal rights extremism. The oddity in this orientation, however, is that the incidence of animal rights extremism and violence has dropped markedly over the past few years. Since the high point of animal rights extremism in the UK, roughly between 1985 and 1995, activists have moved away from terrorist-style tactics, such as sending letter bombs to leading scientists and politicians, towards much smaller scale demonstrations outside individuals' homes and research facilities, as well as more occasional acts of vandalism and arson.[13] Such tactics are far from pleasant, and they are very often unacceptable; but they are also very rare. In much of the current discussion, however, the activities of a handful of cranks are treated as if they were part of the supposed global terror network currently holding Western society to ransom; and the activities of grave-robbers are discussed as if they were on a par with the atrocities of 9/11 and 7/7.[14] The orientation of the current discussion grossly exaggerates the incidence of extremist anti-vivisection actions, and the threat posed by what is, in reality, a handful of anti-vivisectionist cranks. Such talk is also highly irresponsible, because it contributes to a climate of fear and insecurity in which individuals believe that to speak out in defence of vivisection is to take one's life in one's hands.[15]

By continually defining themselves against animal rights extremism, rather than for animal research, government, scientists and the universities in which they work, have reneged upon their responsibility to make

the more difficult – but far more important – moral and political argument. It is very easy to state that we are all against vandalism and death threats; more difficult to make the positive case for animal-based experimentation.

The focus upon extremism has also led to the draconian use of law to limit the right of anti-vivisectionists to demonstrate. This is, in reality, what has happened in Oxford through the introduction of "exclusion zones". Further, the call to protect individuals from "intimidation, harassment, and potential violence", the terms in which the Oxford University injunctions have been justified, casts an unacceptably wide net, defining legal limits not only to actual and threatened assault, but the chanting of slogans and the attempt to heckle and argue with scientists, student and members of the public in the vicinity of the research facility. The demonstrations and noise of anti-vivisectionist demonstrators in Oxford have been a nuisance, not only to builders working on the new research facility, but also to academics and students working in nearby departments, and to Oxford residents passing through the city centre. Democracy, however, is a noisy and at times disruptive process.[16] Animal rights protestors have a democratic right to protest, to argue, to shout, to make a noise, and to do everything in their power to make their presence felt and their voices heard. Those of us who support vivisection have a moral responsibility to challenge their arguments and, where necessary, as it has become recently, to take to the streets and demonstrate ourselves.

The harsh sentences handed down to the grave-robbers in the Darley Oaks farm case stands as further example of the attempt to use law to side-step the moral and political argument that ought to be had out not in the law courts, but in the court of public appeal. On the day the sentences were announced, Detective Chief Inspector Nick Baker, who led the police investigation, argued that "the lengthy sentences send a strong message to people who might be considering doing anything similar. While lawful protestors have nothing to fear, single issue extremists will be caught and strongly punished for their offences."[17]

It is difficult not to suspect that these individuals have been sentenced not for their actions – which certainly express the contempt in

which they hold human beings – but for their beliefs that the lives of guinea pigs are of greater value than the emotional suffering imposed upon a family by excavating and holding ransom the body of their grandmother.[18]

The use of legal injunction and severe sentencing to crack down on anti-vivisectionists can only give the impression that their arguments are far stronger than they really are. And it gives the impression that those of us who support vivisection are both unwilling and potentially unable to win the argument in the court of public appeal.

The idea that the animal rights lobby are a major force holding back medical and scientific advances has become commonplace. But it is far from true. As the journalist Brendan O'Neil has argued, it gives too much credit to the anti-vivisection lobby to suggest that they were responsible for the termination of work on the primate lab at Cambridge. Their activities were undoubtedly an annoyance and a times a factor of concern to those directly involved – from daily demonstrations, occasional vandalism, threats and, in one case, actual physical assault. But we should note that the government failed to give any real public backing to the project until too late – wading in at the last minute with a decree from on high to force through a planning decision, having previously failed to win the more important political (and public) argument that the facility was "in the public interest". At the same time, officialdom is beset by a broad insecurity about primate research. Great Ape research was as good as banned in the UK in 1986 under the Animals (Scientific Procedures) Act; and the Animal Procedure Committee has stated that a major aim must be eventual elimination of all primate research.[19] It is only within the context of this lack of official support for primate research that we can understand the university's about-turn on the primate lab.

The context within which anti-vivisection campaigners have come to dominate the discussion around animal research is the culture of defensiveness and uncertainty about vivisection research amongst government officials and within the scientific community itself. By focussing upon extremism, the public's uncertainty about vivisection

has not been assuaged. The anti-vivisectionists have made their mark only because pro-vivisectionists have refused to properly counter their arguments by standing up and being counted in an unapologetic defence of vivisection.

The problem of pragmatism

To claim that scientists themselves have refused to make the difficult argument for vivisection, as I have done, may seem unfair, not only to those scientists engaging in important animal-based research, but particularly to those individual scientists who have been attempting to explain and defend the work they do in public. Such individuals are particularly noteworthy precisely because in the social and political context I have outlined above, in which the threat of animal rights extremism has been both exaggerated and allowed to dominate the debate over vivisection, these individuals have been lone voices standing up for animal research, normally without any public support from their colleagues, faculties, or institutions.[20]

What I want to suggest, however, is that in the attempt to present a positive case for vivisection, its proponents, both individuals and institutions, have frequently relied upon overly instrumental and pragmatic arguments which cede too much to the anti-vivisection lobby, and end up ultimately undermining the case for vivisection.

i. Animal Welfare

The first example of this is the tendency to play up the importance of "animal welfare". For example, Animal Research at Oxford, a briefing document on the new biomedical research facility, has three sections: the first on the construction of the research laboratory, the second on the importance of the medical research carried out at Oxford, and the third on animal welfare. The section on welfare begins: "The welfare of animals is an absolute priority, which is why Oxford is replacing existing facilities with even better ones." It continues: "The UK has some of the strictest regulations in the world when it comes to animal research – Oxford's research meets these official standards and its own [self-imposed] policy on animal use."[21]

The scientist and fertility expert Professor Lord Robert Winston recalls his experience of working with animals thus: "The work we do is performed with compassion, care, humanity and humility. I have never seen an animal suffer pain. All my rabbits, when I worked with them years ago, were stroked and petted every day. All had names. I still remember Marigold and Wilhemina, who used to lollop around the lab with me and whose contribution changed the understanding of ectopic pregnancy - the most common cause of maternal death in many countries. My rodents bred happily, and their offspring are indistinguishable from those of other rats and mice. The rigour with which animal licence applications are granted by the Home Office prevents work that is cruel."[22]

On the face of things, it is reassuring to know that scientists engaging in vivisection are not cruel animal-haters, and that they go out of their way to ensure that their animals are well looked after.

The problem, however, is that for all the attempts to "humanise" the scientists undertaking research on animals, and to reassure the public of the care taken to ensure that the animals do not suffer, the pursuit of scientific advance through animal research stands in direct contradiction to the priorities of animal welfare. The pursuit of scientific research through animal testing involves using animals instrumentally, as means towards our own ends; this is incompatible with the pursuit of animal welfare for the sake of the animals themselves.

It is the case that the reliability of the scientific procedures often depend upon the fact that laboratory animals are well looked after, because stressed and badly treated animals will be less likely to behave or respond normally during procedures and thus run the risk of invalidating or skewing results. There is a reason then for ensuring that the animals are well looked after. Nonetheless, many of the procedures carried out on animals involve conducting experiments on them that cannot be claimed to be in their interests – giving them untested drugs to find out how the drugs affect the animal, for example, or cutting them open to test out surgical procedures. The host of procedures carried out on animals may well be undertaken in such a way as to minimize the animals

discomfort or suffering, but it is disingenuous to suggest that these procedures can be carried out while maintaining that animal welfare is a key priority.

However well-intentioned the claims of scientists and institutions about the importance the place on animal welfare, and however sincere they are in ensuring that their animals do not suffer unduly, the simple fact is that using animals in scientific research is not in the interests of those animals. Vivisection is ultimately incompatible with the claims of animal welfare.

Further, under the guise of welfare, institutions are at pains to point out that the vast majority of animals used in vivisection are those from low down the phylogenetic tree. Animal Research at Oxford explains that of the 2.8 million scientific procedures carried out on animals in the UK, "by far the largest number of procedures are carried out on rodents". Further: "The vast majority of mice, which are by far the largest number of animals used for scientific research in this country, are simply used for breeding."[23] These claims are true; but the emphasis placed upon them by research institutions, and the context in which they are so frequently asserted, runs the very serious risk of implying that while research on rodents and lower animal species is acceptable, vivisection research on higher animal species is morally problematic. This is the clear implication of the constant attempt to emphasize that most research conducted on low level animals.

In contrast to this we should be far clearer that the reason scientists are able to undertake their research with a clear conscience, and the reason that those of us who support vivisection are able to do so from a moral point of view, is because animals are less valuable, morally speaking, than human beings. This is the crux of the matter; and this is the argument upon which any claim for the morality of vivisection must be grounded.

ii. The Three Rs

A second example of the problematically pragmatic arguments for vivisection is the fetish that has been made in recent years of the "3Rs". The Rs stand for:

- Reducing the number of animals needed in a given study.
- Replacing animals with existing models wherever possible.
- Refining procedures to ensure the most humane treatment possible using the fewest number of animals to yield valid results.[24]

They have become the cornerstone of every claim to ethical conduct and good scientific practice in the world of vivisection. As Animal Research at Oxford explains: "in order to obtain the requisite licence from the Home Office those proposing research must demonstrate that they have done everything possible to reduce the number of animals used, the refine the processes involved to minimize any suffering caused and, wherever possible, to replace the use of animals with alternative research methods."[25]

In principle, the 3Rs seem to be an expression of good scientific practice. I have already pointed out that minimising the suffering caused to animals is fundamentally important in gaining reliable results; and it is the case that the refinement of technique and scientific procedure is good practice. There is good reasons for replacing animals with other research objects, where such alternative objects are more cost efficient, and where they have been demonstrated to produce better and more reliable results. And there are both practical and economic reasons for reducing the number of animals used in a procedure, for reasons of cost and efficiency.

In the current discussion the 3Rs have been transformed from an argument for good scientific practice into a kind of moral apologetic for the use of animals in research altogether. First, as Stuart Derbyshire has pointed out, the 3Rs "draw attention away from the value of experimentation toward the importance of animal welfare." Hence "adoption of the 3Rs comes across as a confession of guilt. The impression is that research animals are a necessary evil, when in fact they are just necessary."[26]

Second, the 3Rs are often coupled with the notion that our overriding aim should be the reduction in the number of animals used in scientific research towards an eventual halt to animal-based experimenta-

tion. The US Foundation for Biomedical Research, a pro-vivisection lobby, is explicit in its literature that "prospects are favourable for reducing the use of animals in the area of product development and testing. And conceivably, the day may come when animal research is no longer necessary."[27]

However, as a legislative requirement for research licensing in the UK (and as a voluntarily enforced condition of research licensing by the Institutional Animal Care and Use Committees in the US) the 3Rs neither require nor imply anything about the overall number of animals used in scientific procedures. Rather, they call for the reduction, refinement and replacement of animals in a given study; they are case-specific. It is quite compatible, therefore, to work to the letter of the 3Rs on each and every individual scientific study, while at the same time increasing the number of animals used overall in the research undertaken in a given laboratory or institution. Developments in genetics, to give just one example of current research which is pushing back the boundaries of human understanding, are likely to require precisely such an expansion of the total number of animals used in medical research, as the total number of research procedures carried out increases.

Scientists and research institutions have increasingly come to promote the 3Rs as a means of demonstrating their ethical status: that they recognise the moral problems of animal research and are doing their best to reduce and, eventually, bring an end to it. Yet this is dishonest and wrong-headed. It is dishonest because it means presenting a false picture of what the 3Rs actually represent (the pretence that they refer to science as a whole rather than individual studies). It is also dishonest for the reason that that the ethical status of scientists does not depend upon their real or pretended moral unease with animal research but, on the contrary, with their engagement in the very moral struggle to advance knowledge, and in so-doing, to improve the human condition. Not only should we correct these misrepresentations; we should call for the abolition of the 3Rs altogether. Rather than bowing down to the bureaucracy of ethics committees, we should leave scientists themselves to decide the appropriate number of animals used in their experiments, and the appropriate

techniques employed. We should also be prepared to accept and promote the view that more scientific and medical research will inevitably mean more animals used in that research. This is not something to be apologetic about.

iii. Necessary vs. unnecessary research

The third example of the pragmatic arguments for vivisection is the tendency to couch justifications of vivisection research in terms of necessity. It is important that this point is not misunderstood. Animal research is necessary for the development of scientific and medical procedures, treatments and therapies. Vivisection has been central to the development of almost every medical procedure and therapy which has improved the human condition over the past century. The development of new treatments and procedures will not be possible now or in the future if vivisection research were to be halted. However loudly the anti-vivisection lobby argues to the contrary, no scientist whose principle objective is the furtherance of scientific and medical understanding would deny this.[28]

In the struggle to win the argument for vivisection it is important that this point is made again and again: that the numerous examples of the benefits wrought by animal research in the past, and the numerous examples of current attempts to find treatments and cures using animal research in the present, are explained and repeated. The examples are numerous, and they are explained more eloquently by scientists themselves than I could hope to do in the final few paragraphs of this chapter.[29]

The problem, then, is not in this claim to necessity, but rather, in the to attempt to justify vivisection on the grounds that it is necessary for the discovery of treatments or cures for particular conditions. Such arguments imply that if certain research is necessary because of the likelihood that it will lead to treatments and cures for specific diseases and conditions, then other research, which has nether the intention or possibility of developing treatments, can by implication be considered unnecessary. If, for example, we attempt to justify vivisection on the grounds that it

is involved in a particular piece of research that seeks to find a cure for cancer, then the justification of vivisection depends entirely upon the success of the research in producing a cure for cancer.

It is easy to fall into this trap, because the hunt to find cures for human diseases are the most obvious and immediately striking examples of the moral importance of vivisection research. However, much important medical and scientific research has neither the immediate goal, nor the expected result, of finding cures or treatments for disease. Much research is speculative. It depends upon testing hypotheses, pursuing ideas, attempting to uncover the biological or neurological mechanisms at work in a particular biological processes. Such "blue skies" or open-ended research is an essential part of the scientific pursuit of knowledge. It is on the basis of such research that cures, therapies and treatments may, in the future, be forthcoming. Such research may lead to medical application in the medium or long term; but it may not. The development of scientific knowledge occurs as much through accidental and unexpected discoveries as through investigations which yield predictable outcomes (a case in point is the discovery of the mechanisms upon which the contraceptive pill was developed, as discussed in Chapter 1).

It is important that, in making the argument for vivisection, we also make the argument for the role that vivisection plays in such open-ended research for the simple reason that such research is an integral part of the attempt to push forward the boundaries of human understanding. The development of the human species through the pursuit of knowledge is one of the highest expressions of our creativity and freedom. Where such research involves the use of animals, it is no less important or moral for that fact; and it is no less necessary. On the contrary, the thirst for knowledge that motivates us, and the creative impulses we pursue through such scientific endeavour, are at the heart of what makes humans and animals distinct.

Conclusion: anti-vivisection and the culture of misanthropy

In contemporary society we seem uncomfortable with our human uniqueness. That discomfort is expressed in the current insecurity about

defending the fundamentally moral pursuit of medical and scientific research using animals.

It is precisely this distinction between human and animals on which the moral arguments for the use of animals in scientific research rests. Yet it is precisely this fact of human uniqueness that is missing from the arguments of the proponents of vivisection, from scientists and scientific institutions, to Government and regulatory bodies. In a report published last year, the Nuffield Council of Bioethics rejected the idea of "categorical human superiority" over animals.[30] The Government, while legislating against animal rights extremists – a tactic which only serves to distract from the real hold that anti-vivisectionists have upon the contemporary debate – has at the same time introduced the world's strictest regulations on animal research. The Animal Welfare Bill would further raise the official recognition of animal rights, forcing pet owners to respect their animals' right to privacy, to ensure that their pets are provided with adequate "stimulation", and banning acts of "mutilation" such as tail-docking and fish-dyeing. The university administrators who speak publicly on behalf of their research institutions make great play of their commitment to animal welfare, and seek to assure us that the great majority of animals they will research on will be not more valuable than fish or rodents.

Rather than standing up to the arguments of animal rights activists by presenting the moral case for vivisection, grounded in the assertion of human uniqueness, the arguments presented in defence of vivisection often betray a fundamental insecurity about the ethics of vivisection.

The morally significant distinction between humans and other animals is the fact that humans, unlike all other living beings, are conscious. This consciousness is not simple awareness, but it is the capacity to engage with one another, and with the world around us, towards the satisfaction of our needs and in the pursuit of our desires. It is the very capacity to act as subjects in the world, to step outside the world and to take it as an object of investigation; indeed, to step outside the immediacy of our own being and to reflect upon it. This conscious subjectivity is the cornerstone upon which human civilization has advanced; and it is the practi-

cal condition from which human knowledge and science has developed.

Contemporary society is dominated by a deeply misanthropic sensibility, of which the arguments and activities of anti-vivisectionists are but one relatively minor expression. The culturally-sanctioned claims to animal rights, and the assertion of a moral equivalence between humans and animals, is an expression of a humanity which has lost its moral compass. If we are to win the argument for vivisection against this confused and misanthropic sentiment we must be prepared to stand up and explain, without apology, that the pursuit of human knowledge through animal-based research, directed towards the betterment of the human condition, is a fundamentally moral activity, that morality being grounded in the very uniqueness of human beings. Our very capacity to engage in the world around us through scientific research is one of the highest expressions of this uniqueness, and it stands on a par with the great human achievements of arts and culture, of social development and organisation, and all other aspects we might group under the name human civilisation.

Attempting to win the moral argument for vivisection must be part of a much broader initiative to put humanity back at the centre of our moral world-view. It must begin with a preparedness to assert, and to celebrate, the uniqueness and creativity of human beings. This is no easy argument in the current climate. However, framing the problem correctly is the first essential step towards winning that argument.

5: "A disaster waiting to happen" – why are we so anti-nuclear?

*Joe Kaplinsky**

In May 2006 Tony Blair announced that nuclear power is back on the agenda "with a vengeance".[1] But given that nuclear power is a source of safe, clean energy with good prospects to meet our expanding needs, why did it fall off the agenda in the first place? And why should its return come with "vengeance"?

Critics of nuclear power have for a long time disputed the facts and figures around claims that it is a clean and safe source of energy. Yet the current debate around nuclear power is not as simple as the disputation of objective facts on the safety, costs, or cleanliness of nuclear power. The nature of the current debate around nuclear power can only be properly understood if we recognise the defensive way in which nuclear power is now promoted. While the critics of Tony Blair's support for nuclear power have been obsessed by his apparent determination to drive through a pro-nuclear policy, they have failed to notice that the case he makes is really only lukewarm.

Nuclear power's return to the centre of debates around energy policy has not been driven by any new technological breakthrough or a burst of enthusiasm about the opening up of new possibilities. Rather, it has been fuelled by a sense of desperation. Energy policy has come to be dominated by a sense of crisis. Fears about the scarcity of fossil fuels have been joined by newer fears about the catastrophic climate change those fossil fuels might be causing, while geo-political unrest has lead to increased fears about the security of energy fuel supplies.

The framework within which nuclear power is now promoted is the need to deal with a risky and potentially catastrophic future. As a result it is promoted reluctantly, as a least bad option. The strongest points in

its favour are claimed to be its lack of greenhouse emissions and low reliance on imported fuels. Indeed, the weakness of commitment to nuclear is such that it is doubtful it would be back on the agenda at all if the need to replace existing nuclear power had not made the question unavoidable.

New initiatives today are promoted on the grounds that they contribute to human survival, while the prospect of nuclear power contributing to a better life is seldom discussed. Until a case is made that nuclear power will help us flourish and improve our lives, the anti-nuclear option will inevitably seem less risky, and the prospect of real development of nuclear power as an energy source will remain distinctly unlikely.

Nuclear power as survivalism is a programme that even a thinker as sceptical of science and progress as John Gray can sign up to. While endorsing nuclear power on the grounds that it reduces greenhouse emissions, he remains profoundly sceptical. Wallowing in gloom, he writes that it "cannot even deflect the current wave of climate change", only "help us cope with the abrupt alteration in the planetary environment that human activity has triggered" and "avoid accelerating it."[2] We need nuclear power, according to Gray "not in order to further our domination of nature, which has always been an illusion, but as ways of retreating from our hugely overextended position in the planetary system." He promotes technology only on the basis of rejecting "Promethean philosophies that seek to subject the natural environment to human will".

The negative promotion of nuclear power leaves unchallenged the wider prejudices that surround it. More than any other technology, nuclear power has taken on powerful metaphorical significance. Attitudes toward nuclear power are closely bound up with wider attitudes toward science, nature, risk, and the meaning of progress. Making the case for nuclear power therefore means understanding how nuclear power has become freighted with meaning. Clarifying the scientific facts about risk can help here, but it also requires promoting an alternative, more positive attitude toward the future.

Born of the Bomb

Misgivings about nuclear power go back to its origins in the second world-war effort to build an atomic bomb. The first man-made nuclear reactor went "critical", meaning that the controlled chain reaction releasing energy became self-sustaining, on 2nd December 1942. It was constructed under the leadership of two European physicists who had fled Fascism to the US, Enrico Fermi from Italy and Leo Szilárd from Hungary. Their "atomic pile", as they called the reactor, produced a feeble half a Watt of power on that first day, barely enough to illuminate a single fairy light. Yet it proved what was possible – and it worked on the same principle as every nuclear power station constructed since. At the time, however, there were more urgent matters at stake than the powering of fairy lights. The reactor was a contribution to the Manhattan Project to build a nuclear bomb.

It is hard to overstate the impact made by the use of atomic weapons against Japan. The experience of total war, and above all the revelation of the full horror of the Holocaust, threw into question the very morality of scientific and technological progress. For many, the awesome power that destroyed Hiroshima became symbolic of the destructive power that could be unleashed by science.

During the post-war economic boom, as both the US and the Soviet Union ran programmes promoting the civilian use of nuclear technology. President Eisenhower's 'Atoms for Peace' proposal posed a contrast between the military and peaceful uses of nuclear technology.[3] The Soviet Union promoted the application of nuclear explosions to mining and construction, and carried out a series of tests. Nuclear electricity generation got underway with the opening of the world's first commercial power reactor at Calder Hall in the UK in 1956. Calder Hall produced plutonium for the UK's bomb programme alongside electricity. This did little to tarnish its image as progressive.

An explicit link between nuclear power with war and social destruction was made only by a small minority of political activists. For the rest of society, technological and scientific advance was viewed in positive terms. This was of course the era in which British Prime Minister Harold

Wilson had promised that a New Britain would be forged in the white heat of the technological revolution.[4]

But as the 1960s gave way to the 1970s, and economic boom gave way to economic slow down, the future of nuclear power was thrown into question. At first, the immediate effect of the 1973 oil crisis was to accelerate the move away from oil burning as a means of energy production. Nuclear power played an important part here, especially in France and Japan, countries lacking a domestic oil reserve. In France, for example, the proportion of electricity derived from nuclear power rose from 4% in 1970 to 24% in 1980 and to 71% in 1990 as stations ordered in the 1970s came on line.[5] However, the longer-term result was a drawing back from visions of a nuclear powered future as the crisis of 1973 developed into the economic stagnation that dominated the decade.

The world economy failed to achieve the growth rates that had been predicted during the experience of the post-war economic boom. In 1975 Walter (later Lord) Marshall of the UK Atomic Energy Authority predicted that world energy demand would roughly quadruple between 1970 and 2005, and that 5000 GW of nuclear electricity would be needed[6]. In fact energy demand only doubled[7], and nuclear capacity in 2004 stood at 368.5 GW[8].

As a result the more ambitious plans for nuclear expansion proved uneconomic. Without the benefits of standardisation and economies of scale nuclear expansion began to look an increasingly bad option. For example, fast breeder reactors and reprocessing had been envisioned as technologies that could make the most of uranium resources by extracting unused fuel and plutonium by-products for reuse. But as the optimistically predicted demand for electricity failed to materialise, the scarcity of uranium upon which such processes had been envisaged also failed to occur and the development of complex reprocessing technologies appeared an expensive waste of money. By 1981 one informed commentator had already concluded that assessing the disappointing results of West Germany's fast breeder efforts "casts serious doubts on the economic justification for direct government subsidies to civilian technology."[9]

Tony Benn provides an example of the change from positive to negative vision of the role that nuclear energy could play in society's future. In the 1960s, he recalled, "many people, including me, saw this as a classic example of 'beating swords into ploughshares' and strongly supported civil nuclear power in Britain, a view I still held when, in 1966 I was appointed Minister of Technology with responsibility for the development of that programme."[10] As Secretary of State for Energy under James Callaghan in the 1970s Benn became more frustrated. He began to draw back from support for nuclear power because of the close connection between civil and military nuclear power (in spite of the fact that the link had been equally strong during his support for nuclear power in the 1960s). Benn increasingly felt that in nuclear matters civil servants were making decisions behind his back and failing to keep him informed.[11] By 1980, reflecting on his experiences, he began to ask the question: "[t]o what extent is it possible to control [high technology] at all or does it have an impetus of its own?".[12] Instead of interpreting his misgivings in terms of politics or power structures in society he had come to see the problem as inherent in the technology itself.

This shift in outlook between the 1960s and 1970s, in which nuclear energy had come to be seen as an out of control force, expressed the view that the attempt to master nuclear energy was too dangerous an enterprise for mere humans to undertake. This reflected a view that was becoming increasingly common and went deeper than the questioning the specifics of nuclear technology. If humans cannot control technology then a high technology world will not be viable.

From Three Mile Island to Chernobyl

The event that most clearly marks the abandonment of nuclear power is the accident at the Three Mile Island power station in Pennsylvania in the early morning of March 28, 1979. The accident itself was caused by a mechanical failure in the cooling system, which ultimately resulted in the venting of radioactive gases to the atmosphere. Subsequently further gases had to be vented, and liquid waste was released into the Susquehanna River.

Three Mile Island was the worst nuclear accident in the West. But in retrospect we can see that it was less serious than many accidents that are inevitably associated with all industrial activity. No workers were injured. A 1998 follow up of more than 30,000 people living close by during the accident found "no consistent evidence that radioactivity released during the nuclear accident has had a significant impact on the overall mortality experience of these residents".[13]

What was decisive about Three Mile Island was less the accident itself, than the reaction to it. At the time, Governor Richard Thornburgh issued advice to evacuate pregnant women and children within a five-mile radius, leading to over one-hundred thousand people jamming the roads, or 50% of the population of Three Mile Island.[14] In the aftermath of the accident the regulatory oversight of the entire nuclear industry was restructured and expanded. And since the accident, no new nuclear power station has been ordered in the US, and many of the existing plans for new power stations were abandoned.

What accounts for this reaction? At the time of the accident the popular mood was already ambiguous about nuclear power. This mood is summed up in the movie *The China Syndrome*, directed by James Bridges, which, by coincidence, was released less than two weeks after the incident at Three Mile Island. The plot of The China Syndrome centres on a nuclear accident. It introduces some key themes that illustrate the mood of the times. The film stars Jane Fonda as an investigative journalist who makes contact with a whistle blowing engineer at a nuclear power station. The film goes on to show safety taking a back seat as short cuts are taken to maximise profit, with the corrupt collusion of government regulators. The picture is completed with pressure put on the media from corporate backers to stop the story coming out.

Here was a cultural script through which the accident could be interpreted. The new mood of cynicism was not about science *per se*, and still less driven by public understanding of the physics and biology of radiation. Instead it was symptomatic of breakdown in consensus in American society. Bitter divisions over Vietnam (of which Fonda had already become an icon through her support for the Vietnamese) and fall out

from the Watergate scandal were the context in which any claims associated with "the establishment" were subject to automatic suspicion.

But while the reaction to Three Mile Island summed up the cynicism of the times, the reaction to the explosion at Chernobyl in the Ukraine seven years later was decisive in moving popular attitudes even further towards an anti-nuclear stance. After Chernobyl it was not just particular groups of people, like business or politicians, that were in the firing line. The very idea of scientific knowledge and technological advance came in for criticism. As the philosopher John Gray put it, Chernobyl was "a warning against human hubris".[15]

Chernobyl had serious health consequences for those living nearby, not least the "liquidators" who worked to clean up the accident. However, despite much comment on Chernobyl as a harbinger of the globalisation of risk, its health consequences for those outside the Ukraine were negligible.[16]

One example of the extent to which the reaction to Chernobyl and the reality of its threat are discordant is that of the restrictions introduced on the consumption of livestock farmed in Cumbria, as a result of radioactivity levels in the area reaching the action levels put in place by the UK government.[17] In reality, if the average family had consumed their lamb exclusively from affected animals they would have received a lower does of radiation from that lamb than from the natural environment, which contains radioactivity in the form of gasses in the air, minerals and cosmic rays. For comparison, if the Cumbrian population were uprooted to certain areas in southwest France, the natural environmental radioactivity resulting from the area's granite rocks would increase their daily radiation dose tenfold.[18] The damage to the livelihood of Cumbrian sheep farmers was missed entirely from policy-makers overreaction grounded in bad science.

Even more striking in the debate that has surrounded Chernobyl since 1986 is the vast differences between the scientific assessments of its impact, and the arguments put out by anti-nuclear activists. When the Chernobyl Forum (made up of UN agencies and regional governments) assessed the situation it found that around 50 workers died as a result of

radiation exposure or other accidents in the immediate period after the accident. They estimate that there will eventually be an additional 4,000 fatal cancers in the population of 600,000 that received significant exposure. In addition there are effects that do not show up in figures for deaths – such as an increase in cataracts amongst liquidators and around 4,000 thyroid cancers amongst children, which are treatable, but with severe long-term side effects.[19]

In contrast to the findings of the Chernobyl Forum, Greenpeace claim that between 1990 and 2004 alone, the Chernobyl accident resulted in 200,000 deaths.[20] The marked difference between these two sets of figures can largely be explained by the differential treatment of scientific uncertainty. As the Chernobyl Forum noted, "small differences in the assumptions concerning radiation risks can lead to large differences in the predicted health consequences, which are therefore highly uncertain."[21]

The Chernobyl Forum handled uncertainty by attempting to account for all the evidence. They started with what is known about radiation and exposure of the population, but also accounted for the rise in diagnosis of cancer uncovered by intense post-accident surveillance, and the effects of the disastrous health effects that followed the 1989 collapse of the Soviet Union. In reality it is difficult to determine the correct allocation of the massive statistical increases in depression, suicide, unemployment and alcoholism, between the disruption caused by the Chernobyl accident and the wider effects of social collapse following the fall of the Soviet Union.

Greenpeace, by contrast, after noting the uncertainty inherent in estimating health impacts, used "uncertainty" as an excuse to blame every "unexplained" problem on Chernobyl. This included not just cancer but also respiratory, digestive, blood, musculo-skeletal and skin diseases. Even infectious diseases were pinned on Chernobyl, on the grounds that radiation could impair the immune system.

A scientific approach demands high standards of evidence. Until all the observations and theories fit together it necessarily refuses to provide certain answers. While that can seem frustrating it ensures that scientific

conclusions are solid. It also means that the scientific approach is always open to new explanations, often ones that no one had anticipated. Instead of proceeding on the basis of science the Greenpeace methodology takes as its starting point the idea that Chernobyl lies at the root of all problems. Because so many illnesses are, at least to some extent, unexplained, this creates tremendous scope to inflate the consequences. But this is just a confirmation of already existing prejudices, not a scientific investigation.

Chernobyl was a serious accident. But put in perspective its consequences were typical of a disaster in a poor, developing country. By way of comparison the 1984 disaster at Bhopal, in which a pesticide plant released a toxic cloud over the surrounding slums, killed 3,000 overnight, a further 15,000 in later years, and injured tens of thousands more.[22] Chinese coal mining provides another example. In 2004 over 6,000 people died in accidents.[23] The 2004 death rate in the Chinese mining industry was around 100 times that in the US, where in 2003 each miner produced more than 45 times as much coal as a Chinese miner. The Chinese government has been engaged in closing thousands of small scale, inefficient, unsafe mines and, as a consequence, the death rate is declining rapidly.[24]

While Chernobyl was less deadly than Bhopal or Chinese coal mining it is nonetheless analogous in terms of the fact that the consequences of all three accidents would have been far less, and indeed, the accidents themselves would very likely not have occurred, had there been a better economic system, and consequently a greater degree of investment in the industries. These accidents were each the result of under-funding, the consequence of industries being forced to function in cash-strapped contexts, rather than the result of any inherent problems or dangers in the industries themselves.

While no accident has since approached the seriousness of Chernobyl's meltdown, if such a thing were to happen in the developed world, the consequences would be drastically limited by the "containment", a formidable concrete and steel wall surrounding the reactor, which is the characteristic spherical structure seen at nuclear power sta-

tions. It has always been standard in the West. According to University of Pittsburgh physics professor Bernard L. Cohen, "post accident analyses [of Chernobyl] indicate that if there had been a US-style containment, none of the radioactivity would have escaped, and there would have been no injuries or deaths."[25]

The real lesson of Chernobyl is the need for more technology and economic development, not less.

Nuclear energy beyond survivalism

Survivalism is shaky ground on which to challenge the anti-nuclear argument.

The example of terrorism shows how closely the anti-nuclear case fits in with our contemporary tendency to inflate risk. When it comes to terror, Greenpeace have not hesitated to embrace the politics of fear. Typical of their approach is a video available on their website under the heading "Friday the 13th" in lurid green with a subhead "watch your worst nightmare unfold".[26] The film shows a family enjoying a day at the beach nearby a nuclear power station when suddenly a Jumbo Jet falls out of the sky headed for the reactor containment. Further information is provided under a link labelled "frightening facts". "To be truly terrified", they promise, "download our full briefing on Nuclear Power and Terrorism".

Undoubtedly, Greenpeace exaggerate the risks of nuclear power. As a review published in the journal *Science* pointed out: "No airplane, regardless of size, can fly through [a reactor containment]. This has been calculated in detail and tested in 1988 by flying an unmanned plane at 215 m/s (about 480 mph) into a test wall 3.6 m thick." As the authors go on to note "To tell people that they and the Earth are in mortal danger from events that cannot cause significant public harm is to play into the hands of terrorists by making a minor event a cause for life-endangering panic."[27]

But an assertion of the facts will make little impact in a culture that prioritises the quest for worst-case scenarios. What is needed instead is the development of a more positive vision of the way in which nuclear

energy can help to meet our energy needs, and in this way contribute to broader social development.

First, and most importantly, we need to note that the world will continue to need much more energy to meet its needs. Ever since James Watt and Mathew Boulton entered into a partnership to manufacture and sell their steam engine the world has been consuming more energy. "I sell here, Sir, what all the world desires to have – power," proclaimed Boulton.[28] And so it has proved.

A recent newspaper report was headed "plasma screens threaten eco-crisis" on the grounds that "a scientist has warned that if half of British homes buy a plasma-screen TV, two nuclear power stations would have to be built to meet the extra energy demand."[29] The aspiration for better goods is described as an "obsession" and "insatiable appetite", hinting that an attempt to meet demand would be futile, pandering to an addiction rather than raising standard of living. The government response was to adopt a similarly pessimistic strategy, calling a summit with high street retailers at number 11 Downing Street to discuss cutting greenhouse emissions from their products, and the suggestion from the Energy Saving Trust that "people can change how they use [TVs], for example, turning them off standby when not in use."[30]

The idea that the two extra nuclear power stations might actually be built is simply never entertained. It is used only as a bogeyman to be avoided.

The expansion of energy that will be needed in the developing world is even more dramatic. If the rest of the developing world is just to catch up with existing Western standards of living the world as a whole will have to quadruple its energy output. Western lifestyles, with their unprecedented opportunities, should need no defence. Unfortunately, today they do. Such statistics are rarely taken as indicating the need for nuclear – alongside every other sort – of energy. More often used is a kind of *reductio ad absurdum* of the idea that Western lifestyles are "unsustainable".

There is considerable enthusiasm for nuclear power in the developing world, not just in China and India but also in countries whose relationship with the West is more problematic such as Nigeria, Venezuela and

Iran. Instead of automatically seeing aspirations for nuclear energy through the negative lens of nuclear proliferation, we should recognise the desire to develop a richer, more broadly based, high technology economy. Such co-operation will likely make the difficulties of proliferation easier rather than harder to negotiate.

A second point in favour of nuclear power is its controllability and large-scale character. The controllability of nuclear power is in contrast to renewables such as wind, which is dependent on the vagaries of natural fluctuation, and solar or tidal power, which are dependent on natural cycles. We can build nuclear stations where we want them, not just where the wind happens to blow.

The large scale of nuclear power is also a point in its favour. As we have seen above, the idea that nuclear power is inherently authoritarian is deeply ingrained in the anti-nuclear case. More recently the idea of local energy independence has become fashionable among environmentalists and businessmen alike.

For environmentalists networks and large-scale trade are wasteful and destroy community by breaking down the bonds formed in local economies. For businesses the appeal of micro-power is informed by the rise of planning for business continuity and risk management, which has been especially emphasised post-9/11. This is expressed not just in a heightened awareness of terrorism but also in a decreased confidence in the continuity of supply from the grid.

In contrast to these approaches the positive case for nuclear power's large-scale centralisation rests on the elementary insight that the social co-operation embodied in a division of labour is proven as a liberating force that allows us greater freedom to pursue our ends. The unwillingness to trust in others may, in a certain sense, fairly be described as "anti-social".

Science has shown us both how to direct natural forces, and nuclear power is one of its most significant products. The suspicion of science in today's culture is in large part a refusal to believe that such power is really within our grasp. Even worse. It is a fear that human beings are not the sorts of creature capable of using power to bring forth for good.

Any case for nuclear power must begin with what it will allow us to achieve. Nuclear power is not a means to reduce our impact on nature or to minimize our footprint. Like any source of energy it will raise our capacity to reshape the world around us. So long as concepts like "impact" are unthinkingly assumed to be negative rather than opening the possibility of creative positive impact, nuclear power will be stigmatised.

6: The problem of stem cell research regulation – limiting the individual right to self-determination

*Thilo Spahl and Thomas Deichmann**

Stem cell research promises the possibility of treatments and cures for a host of different serious medical conditions. It is also research which is pushing back the boundaries of scientific knowledge. Yet it remains hugely controversial for the reason that stem cells are extracted from human embryos. In this chapter we seek to explain a little of the technology which is at stake, and also to investigate the implications that current opposition to stem cell research will have if it goes unchecked.

The science of stem cells: a beginner's guide

Stem cells play a special role in our bodies. When fertilized egg cells first divide, the zygote, which is sometimes already called an embryo, forms a cluster of cells (morula) and afterwards a hollow space (blastocyte) with an inner cell mass – embryonic stem cells, from which the actual embryo and later human being with all her different kinds of cells will develop.

Since, at least theoretically, all human tissues and organs can be produced from these embryonic stem cells, they have a great scientific and medical value.

The development of stem cell technologies could make possible the development of therapies which would enable us to replace cells that can no longer fulfill their assigned functions. Our body can by itself regenerate cells with so-called "adult stem cells", yet this is only possible on a restricted scale. As is well known, this works very well with fractures of the bones; and the liver can also regenerate itself, but many other organs have only a very restricted regenerative capacity. Stem cell technology

creates the possibility that we may be able to cultivate the required cells in the laboratory and then inject them into the body, thus allowing for the regeneration of damaged or malfunctioning cells. There are many potential applications of such a technology. One example is the possibility of a cure for Parkinson's disease, which results from brain cells that can no longer produce sufficient quantities of neurotransmitters. A second example is that of diabetes, which results from the inability of certain pancreatic cells to produce blood sugar regulating insulin. In each case, and in many others, stem cell technology raises the very definite possibility of generating new cells which can carry out the functions of these redundant or malfunctioning cells, leading to cures for these conditions.

Both postnatal and embryonic stem cells can form the basic material for such procedures, and both are potentially available in large numbers. Through the process of artificial insemination many more fertilized ova are produced than those actually required for a successful pregnancy.

These supernumerary embryos are usually deep-frozen and later destroyed. At the moment, scientists are permitted to extract cells from these embryos for research purposes in a number of countries, including the UK, Sweden, Israel, the USA and Japan. Although such extracted cells do not yet have a therapeutic application, they are essential for the research which could produce such applications.

Research involving human embryonic stem cells (human Embryonic Stem Cells, hESC) is still very much at the basic research level and cannot, as yet, promise any cures. However, the potential already being expressed in such research is hugely exciting.

Yet there is also a great deal of opposition to stem cell research because it makes use of human embryos.

The problem of stem cell research

Although extensive research is being carried out around the world on both adult and embryonic stem cells, it is only embryonic stem cell research that has been the subject of controversy. The reason is quite clear. In order to extract embryonic stem cells the donor embryo must

be destroyed. Even though these embryos are only a few days old when they are destroyed – an undifferentiated heap of cells which is no bigger than the dot at the end of this sentence – and were in any case produced artificially for the purpose of artificial insemination, they are considered by some to be entities endowed with moral worthiness and deserving our protection. The lobby groups that defend the interest, presumably, of these embryos themselves, have emerged as a powerful force in many countries. This has forced embryonic research on to the defensive. We will look in particular at the situation in Germany, the country with the most restrictive legislation of all nations in which significant scientific research is currently being undertaken.

The German Embryo Protection law of 1990 put in place strict and far reaching legal limits upon research involving embryos. It is a law which defines human life as beginning with the fusion of the cores of egg and sperm cell. From this arises the ban on a use of human embryos and the cloning of human life both for the medical research and for reproductive technologies. The Stem Cell Law of 2002 clarified the situation: researchers were only allowed to use imported embryonic stem cells which had been produced prior to January 1 2002.

The debate in Germany is therefore particularly interesting precisely because of the strength of the embryo protection lobby, and because of the strictures of law which are far more severe than those currently in place in the US. Further, it is an interesting example of the current moral debates around science because the foundation of this law is not religious but a fundamentally secular ethics. Interestingly, this secular moralism is more problematic than its religious counterpart in the US. It captures perfectly the current zeitgeist – an ethical problematisation of science which has resulted in a scientific paralysis.

The status of the stem cell

There is an interesting distinction between the arguments against stem cell research and the protection of embryos in the US and in Germany. The Christian Democrat MP Hermann Kues explained the German moral context within which embryonic research should be banned, thus:

> *There is an ethical obligation to heal, in particular to prevent nearly unbearable pain and to fight illnesses that have hitherto been thought to be incurable. The freedom of research is another high value. However, there is also a respect for the* dignity of every human being. *There has to be a trade-off here, and not every value has the same rank. The hierarchy of values must be right. Human dignity ranks first in the ranking of the goods to be weighed up. Let me state it quite clearly: these are not the special morals of a scattered group with ideological preconceptions. No, we have reached an agreement at the adoption of the constitution on this.*[1]

George W. Bush spoke in similarly absolute terms when he justified his veto against the state financing of embryonic stem cells research in July 2006:

> *This bill would support the taking of innocent human life in the hope of finding medical benefits for others. It crosses a moral boundary that our decent society needs to respect.*[2]

In the German example, the discussion is about the defence of human dignity. In the US it is a discussion about the protection of human life. Bush addresses the conservative target group of anti-abortionists. On the other hand, Germany is the ideological arena of "humanitarianism" which is primarily concerned with the cultivation of the moral claim of granting protections for human dignity and preserving it.

In Germany, therefore, opposition to embryonic research is not only the preserve of the Christian Democrats, the CDU, but can be found in all parties. Interestingly, the majority of politicians who support research with human embryonic stem cells are to be found in the ranks of the liberal FDP, while the fewest supporters are to be found in the ranks of the Greens. There are also supporters of hESC research within the conservative CDU (although not at a ministerial level), the most distinguished of which is the Bundestag MP Katherina Reiche, who comes to a very different conclusion on the moral trade-off involved than her colleague Herman Kues:

> *The decisive question is: what is more important, the protection of ova which were fertilized outside of the body and are not needed any more or the life and the health of people like you and me? In the context of an ethical and legal tradeoff the protection of human life should enjoy a priority over fertilized egg cells in the frozen containers of reproduction medicine. More than 60,000 fertilized egg cells (pre-nuclear stages) are stored in Germany alone in eternal ice without ever having the chance of reaching the womb. I am in favour of giving the parents the right to donate these discarded egg cells to medicine.*[3]

Both the supporters and the opponents of stem cell research in Germany make their arguments in terms of the trade-off between two competing moral values: protection of the embryo on the one hand, help for sick on the other. This structure of argument can also be found in the US debate, where those who defend stem cell research couch their arguments in terms of the possibility of cures for debilitating conditions. These arguments have received strong support from celebrities or their relatives who advocate scientific research because of its potential ability to cure diseases such as Alzheimer (Nancy Reagan), Parkinson's disease (Michael J. Fox) or paraplegia (Christopher Reeve).

These arguments are important, and they may well be a useful strategy in the attempt to forge a ground swell of public opinion in support of stem cell research. But they are arguments which are limited in two ways. First, they fail to stress the highly important principle of freedom of research. Second, they introduce a potentially destructive dimension to the debate, that stem cell research can be justified in relation to its capacity to generate concrete therapeutic results which remain, at present, a long way off.

There is, however, a far stronger, if more difficult, argument that must be developed. This is the argument that we should not accept the idea of a moral trade-off between protecting the embryo and curing disease, precisely because we should refuse to grant any moral equivalence between the embryo and the post-natal human being. The German the-

ologian Richard Schröder points to the dubious consequences of granting such equivalence:

> *If one granted the status of human beings to the fertilized egg cells - and there are people who prefer to speak about 'embryonic people' rather than 'human embryos' in this period - one comes to the strange conclusion that 70 per cent of all people are never born.*[4]

While the scientist Hubert Markl points out that,

> *Those who believe a caterpillar to be a butterfly, a seed to be a tree, an egg to be a chicken, a floor plan to be a house, a baby to be a geriatric, a virgin to be a mother, and a zygote to be a human being just because all of these can eventually become the others, must give good logical reasons for this belief.*[5]

Neither membership of a biological species nor developmental potential are decisive factors in the debate about the status of the embryo. Supporters of stem cell research have repeatedly argued that the developmental ability of the embryo, and the moral worthiness of the embryo, is given only once the embryo has established itself in the uterus. It is true that the capacity to develop, known as totipotence, is given only once the embryo has become established in this way. Although such a position grants research the necessary room for test tube research with embryonic cells, this position also erroneously assumes that genuine totipotence is constitutive for human dignity. It is not. And indeed, in other contexts, such as the contraceptive use of the coil, the morning after pill, and abortion, are morally justifiable only if we accept that totipotence is not sufficient for the granting of moral worthiness or dignity; if it were, each of these contraceptive procedures would have to be viewed as morally wrong and, for consistency with other laws, made illegal.

When we begin looking for the moral arguments as to why we should ascribe moral worthiness, or dignity, to a fertilized ovum, we come across two 'slippery slope' arguments.

First slippery slope: experiments on the mentally handicapped

Hubert Hüppe of the CDU, one of the most prominent opponents of embryonic research in Germany, warns us that once we accept that the end of therapeutic technologies justifies the means of destroying human embryos, then we will end up in a situation in which "other groups of people who, it could be argued, lack human dignity, such as the severely mentally handicapped, might also be included in such research."[6] In other words, if we once allow embryonic research we are at a top of a slippery slope which leads logically towards morally abhorrent kinds of experimentation being carried out on human beings.

It is difficult to understand why, when a couple already has a child but has kept a few fertilized egg cells preserved in the deep freeze, could not donate those preserved egg cells without being tempted to send their senile grandfather to the laboratory for dissection. The couple would rather, we would argue, be able to distinguish between an undifferentiated bunch of cells, the research embryo, and a member of the human community, their grandfather, with consciousness, the capacity to feel pain, the moral value which we rightly accord to all members of human society. The slippery slope argument rejects the possibility that as a society we might be able to develop a morally responsible definition of human dignity. In reality, rather than presenting a moral case, they are seeking to define human dignity in terms of our biological capacity for totipotence and in so doing avoid the need for making a properly moral discrimination.

The argument is peculiarly dubious precisely because the ability to develop moral arguments and to draw moral distinctions is one of the fundamental capacities within which our common humanity is to be found. It is a paradoxical venture to deny our capacity for moral judgments only in order to simultaneously grant the moral value of human dignity to single cells.

Second slippery slope: cloning

Using embryonic stem cells does not mean that a good cause justifies a morally reprehensible means. The means would only be morally ques-

tionable and reprehensible if one accepted the arguments against research which this is supposed to support.

The legal philosopher Reinhard Merkel illustrates this problem with a historical example. About a hundred years ago one of the arguments against giving women the right to vote was "If we do this, then where will it end?" Some people feared that voting women would soon demand the right to be elected and to become ministers or even heads of state. Merkel thinks that the putative dangers which are feared by opponents of stem cell research today represent thoroughly positive developments, in much the same way that the emancipation of women was a thoroughly positive benefit that developed from the top of the slope on which women were first given the vote. Allowing embryonic research may well be the first step – which we should better view as a step forward rather than a tumble down a slope – towards the development of therapeutic cloning.

In opposition to therapeutic cloning we find the argument that it involves the production of embryos (understood in the argument as people) for research purposes and that this is very clearly reprehensible. The moral force of this argument is again derived from the equation of embryos with people and the attribution of equal moral status to each.

But there is a further step which the opponents wish to take use down this slippery slope: the claim that therapeutic cloning paves the way for reproductive cloning.

While therapeutic cloning and reproductive cloning share the same first step – inserting genetic material from the cell of one patient into a donated egg cell which is then activated and begins to divide – they have completely different motivations. As in the case of in-vitro-fertilization the result of the first step is a blastocyte from which stem cells can be gained. These stem cells have the great advantage that they have the same genome as their intended host, because they have been generated from her donated cell.

It is easy to determine a legal distinction between such cloning for therapeutic purposes and cloning for reproductive purposes. The structure of law depends precisely upon our capacity to define, to prohibit,

and to pursue criminality. We do not attempt to make all criminal acts impossible to carry out – we do not ban medicines on the basis that they might be administered maliciously to give someone an overdose, and we do not confiscate all sharp objects which might be used to stab someone to death. Rather, we make a distinction between the legal an the illegal use of a particular medication or implement, and we are capable of drawing exactly such a distinction between the legal and the illegal use of cloning technology.

Moral authority, paternalism and legal incapacitation

We should at this stage ask the question: why is the attempt to protect embryos and stem cells such an obsession in Germany at the moment? Why has Germany introduced more restrictive legislation than that which exists in our neighboring, predominantly Roman Catholic, countries?

The attitude in Germany, our secular moralism, is a peculiarity of the current political and cultural climate in which political judgments are disguised behind moralistic proclamations. At the heart of this climate is a diminished view of the citizenry as unable to act as moral individuals, to take responsibility for their actions, and to make moral choices in the world. The result is a peculiarly coercive attitude which hides behind the claim to care for the citizenry, and to seek to protect the innocent and defenseless: the citizen from her own moral incapacities; the embryo from the scientist who would seek to undermine its moral value or dignity. The ban on the donation of egg cells is a perfect example: is it justified as an attempt to protect women from the exploitation of their bodies. Yet in reality, as Reinhard Merkel has argued, the presumption that women need such protection is a "practically oppressive, illiberal, and anti-women presumption."[7] Rather than giving women the right to choose whether to, and how to, dispose of their embryos, it is assumed that they must be protected against the possibility of having to make such a choice.

An alternative, and in our view more properly moral attitude, would be to welcome the donation of embryos as an altruistic gesture which

will contribute to scientific research of great importance, which has the potential to develop therapeutic applications that can slow and prevent a great many debilitating health conditions.

Are things better in the UK?

The UK is, from our perspective in Germany, in a much better state. The production of embryonic stem cells for research purposes and therapeutic cloning are permitted. The UK government promotes stem cell research, offering financial support. Tony Blair recently traveled to California to invite US companies engaged in embryonic research to the UK. John Burn, head of the Institute of Human Genetics at of The University of Newcastle whose team were the first to clone a human embryo, has been quoted in the press claiming that the British public are more morally perturbed by vivisection research involving mice than by human therapeutic cloning (see Chapter 4).[8]

Indeed militant anti-vivisectionists are a greater threat to medical research in the UK than the militant "pro-lifers" who oppose stem cell research in the US. The UK offers the best conditions for embryonic research of all Western countries. The suspicion seems reasonable, however, that economic considerations are the decisive factor. One wants to be ahead of international competition. This is good for research, and it is an understandable position for politicians to take. However, it is not a powerful enough argument, nor a moral enough argument, to win the case for embryonic research against its opponents. And UK law does not support embryonic research in terms of giving the freedom of citizens to donate their embryos, and does not put scientists in the position of responsibility over the cells on which they research, but rather defines and proscribes certain permitted, and many more prohibited, research objectives.

Embryos as scientific material

So what is the way forward for embryonic research? We believe it is time to call for a far reaching process of deregulation of embryonic research. The embryo, until the age of fourteen days, should be considered the

possession of a woman who ought to be in a legal position to donate it as she sees fit. One would therefore permit, among other things:

- Embryo consuming research
- Production of embryos for research purposes
- Use of embryonic stem cells for the production of tissue and organs
- Therapeutic cloning
- Pre-implantation diagnostics
- Germline intervention, provided this does not risk the future health of the human being (Germline intervention is the same as germline (gene) therapy. Two categories of cells make up the body, germline and somatic cells. In genetic engineering, changes only to the germline can pass to the next generation. Therefore germline therapy is more of a moral issue than somatic gene therapy.)
- Reproductive cloning, provided that the procedure is medically safe

Freedom of research

Above all else, the debate about stem cell research is a debate about, on the one hand, the autonomy and self-determination of individuals, in this case, women, to donate their embryos, and on the other hand, the attitude that society takes towards science in general, and scientific research in particular.

Freedom of scientific research, which is the condition upon which scientific discoveries and breakthroughs are made, must be defended, even when such research involves the questioning of contemporary taboos.

Developments in modern society are increasingly based upon scientific research which has social, economic and of course also personal consequences. Freeing up scientists to engage in the research they see fit makes possible the development of the knowledge society which most of us believe to be so important. Such a society must be prepared to question everything, and it must be able to bear personal, institutional, and moral uncertainty. And we must be willing to take steps forward in science, in order that society can progress. Developing a morality which

is grounded in the attempt to better the human condition is an important task for those of us who wish to live in a society in which we can take full benefit of the advantages which current science offers us.

7: Genetically modified crops and the perils of rejecting innovation

Matt Ridley

Genetically modified crops are an unnecessary, dangerous and untested innovation, bad for the environment and cynically foisted upon farmers and consumers for profit by multinational firms, or so goes the conventional European wisdom. Here I demonstrate that every one of these assertions is untrue, and that in fact opposition to GM crops is a misguided campaign, bad for the environment, the consumer and the poorest farmers, and cynically foisted on the public by publicity-maximising environmental groups at the expense of the truth.

It will pay to start with some history. In 1798, Thomas Robert Malthus famously warned the world that it was going to starve, because population must inevitably soon outstrip its food supply. A century later, in 1898, Sir William Crookes, president of the British Association, repeated the warning in a famous speech entitled 'the wheat problem'. The Malthusian fate had been averted so far by the opening up of the prairies, the pampas and the steppes, and by the fortuitous discovery of rich deposits of nitrogenous guano on islands off South America and South Africa. But both guano and new land would soon be exhausted. Starvation was inevitable and imminent, said Crookes.

At the time of Crookes' warning, world population stood at roughly 1.7 billion and famine was commonplace. Today it stands at 6.5 billion and famine is virtually unknown – except in regions wrecked by war and corrupt government. Per capita food production has reached record highs, and the wheat price record lows. We are finding it easier and easier to "feed the world". Four innovations brought about that change in the twentieth century:

Mechanisation: Tractors freed up perhaps 25 per cent of extra land to grow human food instead of fodder for draught horses and oxen;

Fertiliser: Fritz Haber's 1913 invention of a method of synthesising ammonia transformed agricultural productivity, so that today nearly half the nitrogen atoms in your body were 'fixed' from the air in an ammonia factory, not in a soil bacterium;

Pesticides: Chemicals derived from hydrocarbons enabled farmers to grow high-density crops year after year without severe loss to pests and weeds;

Genetics: In the 1950s Norman Borlaug crossed a variety of dwarf wheat, originally from Japan, with a different Mexican strain to make dwarf wheats that responded to heavy fertilisation by producing more seeds, not longer stalks. These varieties, imported into India and Pakistan, rapidly replaced the subcontinent's hunger with surplus in the 'Green Revolution'.

The effect of these four innovations was to allow more and more food to be produced from less and less land. This goes under the name of intensification and it is generally assumed to be a bad thing. Nostalgic urban dwellers would prefer farmers to leave fields fallow, to grow oats for horses, to tolerate cornflowers in wheat and bees in clover, and not to pollute streams with nitrate run-off. That would indeed be nice (although maybe not for the farm worker, hand-weeding the crop; or for the consumer, forced to devote a much higher proportion of the household budget to food of uneven quality). But the environmental price the planet would have paid for this idyll would have been high. If the average yields of 1961 had still prevailed in 1998, Indur Goklany has calculated, then to feed six billion people would have required the ploughing of 7.9 billion acres, instead of the 3.7 billion acres actually ploughed in 1998: an extra area roughly the size of South America. And that's optimistically assuming that yields would have remained at the same level in the newly cultivated land, taken from the rain forests, the swamps and the semi-deserts. To put it another way, today we farm (i.e. plough, crop or graze) just 38 per cent of the land area of the earth, whereas with 1961

yields we would have to farm 82 per cent. Intensification has saved 44 per cent of this planet for wilderness.[1]

This simple fact – the conservation benefit of high-yield farming – needs to be borne in mind when discussing any agricultural innovation. Invention can cause environmental harm; but so can lack of invention.

The many ways of modifying genes

Almost by definition, all crop plants are 'genetically modified'. They are monstrous mutants capable of yielding large, free-threshing seeds or heavy, sweet fruit and dependent on human intervention to survive. Wheat, for example, has three whole diploid (double) genomes in each of its cells, derived from three different wild grasses. It also has various genetic mutations encouraged by the first farmers. It cannot survive as a wild plant – you never encounter wheat weeds. Borlaug's green revolution wheats of the 1950s brought in new mutant genes for dwarfing, this time quite consciously. By the 1960s, plant breeders had begun to cause deliberate mutations from which to choose. They did this by exposing seeds to gamma rays in nuclear power stations, or to powerful carcinogenic chemicals. This is how some of the crops we plant today – including some organic ones – were produced. For example, Golden Promise, a variety of barley especially popular with organic brewers, was first created in the Harlow atomic reactor. Crops produced this way do not have to be tested for health or environmental risks.

Transgenic – or GM – plants were first invented in the mid 1980s as a kinder, gentler, more precise and better controlled alternative to such 'mutation breeding'. The idea was, instead of random scrambling of the genes of a target plant with unknown result, to take a known gene, with a known function, and inject it into the genome of a plant, where it would do its known job. That gene would often come from a different species, so achieving the horizontal transfer of traits between species that only rarely happens in nature. Of course, it would be possible to do something dangerous with such a technology. You could for example take the toxin gene from deadly nightshade and transfer it to wheat. But then you could achieve the same dangerous result by accident through

mutation breeding: you could accidentally re-activate the dormant toxin gene in deadly nightshade's close relative, the potato. What you cannot rationally argue is that the technology of genetic modification itself is dangerous. Cooking is not inherently dangerous, but it is possible to make a poison in a kitchen. The first and biggest mistake of the media has been to confuse process and product.

The idea of transferring genes between species was first mooted in the early 1970s. The first genetic modification was of bacteria, with the intention of turning them into miniature factories for scarce human proteins such as insulin (for diabetics), coagulants (for haemophiliacs) and growth-hormone (for children with growth deficiencies). A vigorous public debate attended these inventions, resulting in a temporary, voluntary moratorium, several legal bans and plenty of angst. The precautionary principle would suggest that the safest place to start transferring genes between species was not with human genes into bacteria whose natural home was the human gut and which were capable of causing disease. But the results speak for themselves. Transgenic bacteria have been the cause of no health or environmental problems, and have saved many lives. Indeed without transgenic human growth hormones, many people would still have been being treated with growth hormones from cadavers – a major cause, it later emerged, of CJD.

The first genetically engineered animals were produced in 1980, and the first plants in 1983. The first genetically modified food to be sold was the 'flavr-savr' tomato in 1992, followed by insect-resistant cotton and herbicide-tolerant soyabeans in 1996. In 1998, widespread public suspicion of the technology emerged as an issue, sharpened in the UK by a later discredited claim from Arpad Pusztai that GM food of any kind caused health problems in rats. Sensing an opportunity, several environmental groups rushed GM crops to the top of their publicity agendas and the whole movement – white boiler suits, 'Frankenfoods' placards and all – was born.

The campaign was especially effective in the UK, a country still reeling from BSE, but which had pioneered some of the techniques of genetic modification and, in 1998, had a potentially world-leading posi-

tion in GM technology. GM became as polarised an issue in the UK as stem cells in the US.[2] By 2006 not only had the commercial growing of GM crops still not begun in the UK, but even the science had been driven out of the country as scientists found their experiments vandalised and their livelihoods threatened. Restaurant menus throughout the land piously boasted of using GM-free ingredients. It is one of the most dramatic examples in history of a scientific advance being stopped in its tracks by pressure groups and the media.

Elsewhere in the world, though, GM crops were taken up. By 2005, 60 per cent of the world's soyabean crop was genetically modified and 222 million acres of GM crops were grown. Indeed in the period 1996-2005 the total acreage planted with GM crops exceeded a billion acres in 21 countries, or 20 times the entire land area of the UK.[3] To describe this technology as untested is therefore absurd. Not one single human health problem has been encountered, despite legions of activists eagerly pouncing on every putative case. It is possible now to answer all the reasonable questions and fears raised ten years ago by and for the public. Here are seven such questions.

GM crops might cause allergies?

In 1996, when Pioneer Hybrid International planned to introduce an albumin gene from a brazil nut to a soybean to improve its nutritional quality as animal food, the firm soon realised that this risked causing a rare allergy to human consumers of the modified soybeans. So it stopped the project. Far from being a cautionary tale of the dangers of GM, this exemplifies just how careful the scientists and businessmen who create GM crops are prepared to be – the last thing they need is a lawsuit.[4]

Crossing the species barrier?

The notion that there is something specially taboo about genes moving between species has long been abandoned by scientists, though it remains in the folklore of modern environmentalism. First, many crops arose by hybridisation. Wheat, the biggest crop of all, is an unnatural 'polyploid' merger of three wild plants. Second, gene sequencing has

revealed that species have far more genes in common than was once thought. Virtually all the genes in a human being are also recognisably found in a mouse, though most are subtly different in small ways (the difference between a human being and a mouse lies not in the genes so much as in how, where and when the genes are switched on). Indeed, in the case of Hox genes, the normal development of a fruit fly can be accomplished by the replacement of one Hox gene with its mouse or human counterpart. And the commonest gene in the human genome derives from a retrovirus: reverse transcriptase. In the bacterial world, genes move between species all the time. E coli 157 probably became pathogenic by naturally acquiring some genes from Shigella. Of course, the particular gene transfers that led to GM crops have not happened, or else it would not be necessary to do them. But it is arbitrary and irrational to say that only the gene transfers that Mother Nature happens to do are safe and others are not.

Control of the food chain by multinational companies?

Opponents make much of the so-called 'terminator' technology that comes with some GM crops. This is a special genetic switch that (rather ineffectually) tries to render the plant incapable of reproducing itself, so that a farmer has to acquire his seed afresh each year. Two snags with this argument should have been obvious from the start. First, it was not new. High-yielding hybrid maize had been sold this way for decades. In any case, where they can, farmers generally prefer to buy seed than save it, to avoid growing weeds. Second, the chief reason 'terminator' was developed was to assuage an environmental concern—that the crop would spread naturally in the wild or cross-breed with wild relatives. The opponents of GM really cannot have it both ways.

Of course, it is true that most GM crops were produced and sold by profit-seeking companies. So are mobile phones and tractors. The notion that GM crops are going to drag peasants into the cash economy that they had managed to resist so far is absurd. If a peasant could resist buying tractors, fertilisers and hybrid seed for the past few decades, then he could resist GM crops. More likely, the reason he had 'resisted' was

poverty, not high-mindedness. Subsistence farming is admired by nostalgic westerners, not by subsistence farmers. Many environmentalists speak as if companies have the power to force consumers to buy their products.

Contamination of conventional and organic crops nearby?

By the early 2000s, many critics of GM crops had fallen back on a new argument, that pollen from GM crops somehow 'contaminated' their own organic crops. This was entirely self-inflicted. Organic farmers had suddenly made their own new rule, that their crops must have less than a certain trace of genes from GM plants to still qualify as organic. Lo and behold, this rule gave them a reason to object to neighbours using GM crops. Ingenious, and circular, reasoning!

The creation of superweeds?

This is one of the most topsy-turvy arguments of all. Environmentalists argued that herbicide-resistant rape might cross-breed with a wild plant and result in a weed that is impossible to kill. There are two problems with this argument. First, herbicide resistance in weeds is already a well known, if rare, problem wherever herbicides are used. It comes about through 'natural' selection. Nothing about GM crops makes it a worse problem. But second, a 'superweed' of this kind is not especially vigorous or invulnerable; it is merely resistant to one particular herbicide. That renders the herbicide in question useless. So 'superweeds' are a problem for the herbicide industry, which should gladden the hearts of organic supporters everywhere – they might hasten the day when herbicides are no longer effective. A farmer who does not use a herbicide finds a 'superweed' just as easy to deal with as an ordinary weed. Can the opponents really not have seen this point?

The increased use of pesticides?

Farmers use three main kinds of pesticide: insecticide, fungicide and herbicide. In the case of insecticides, the only point of GM crops is to reduce, not increase, the use, by making plants insect resistant. A gene,

taken from a bacterium called Bacillus thuringiensis (bt), that is lethal to insects and harmless to other animals, has been inserted into the chromosomes of various plants. As a result any insect chewing such a bt plant dies and bt crops therefore need very little spraying. The irony is that their insect resistance derives from an 'organic' compound, in two senses of the word. First, it is a natural compound, invented by a bacillus aeons ago; and second it is a substance that organic farmers have been happy to spray on their crops for at least two decades. It is displacing synthetic, chemical insecticides. So the campaign against GM, supported by the organic movement, might as well have had the slogan 'save the sprays'. Several companies, burnt by their first experience of GM, decided to go back to inventing new chemical sprays. There was less trouble for them that way. Nobody abseiled down their buildings or marched with placards outside their offices.

The same is true for fungicides. In August 2006, BASF announced that it wanted to do British field-scale trials of blight-resistant potatoes, which would need no fungicide spray. The blight resistance comes from a gene discovered in a natural, wild strain of the potato. Yet even with an existing plant gene, moving within a species, and expected to eliminate the need for sprays, the company anticipated virulent and perhaps violent protest. BASF will continue to sell fungicides as an alternative: no protests there.[5]

In the case of herbicides, it is true that the first and biggest GM crops were herbicide resistant rather than weed resistant, specifically allowing farmers to spray weeds in the growing crop without killing the crop. But this did not have the effect of increasing the amount of weedkiller applied. It simply meant spraying at a different time and with a cheaper (and safer) chemical such as glyphosate – a broad-spectrum herbicide that kills all plants. Besides, given that farmers have been controlling weeds since 10,000 BC, it is not necessarily true that chemical herbicides are worse for the environment than alternative methods of weed control. Organic farmers control weeds in, say, a California lettuce farm by three methods: they till the soil repeatedly, irrigating it between tillings to encourage weed germination; they employ migrant workers to pick

weeds by hand; and they use propane blow torches to scorch weeds. Compared with a single application of near-harmless (to animals) glyphosate, these three methods do far greater harm. The tilling interrupts and damages the work of soil bacteria, worms and beetle larvae; the hand-picking drives away wildlife and is gruelling and poorly paid hard labour; and the blow torch (as I can testify from having used it to clear paths of weeds) fries every living creature that gets in its way.

The killing of butterflies?

In 1999 a report in Nature related that Monarch butterflies fed on bt-maize pollen die. Well, of course they do. Bt is an insect toxin. But consider the following facts: first, butterflies don't usually eat maize pollen; second, the same toxin is used enthusiastically by *organic* farmers, who spray the bacterium itself on to their crops, killing any insect unlucky enough to be hit, whether it is a pest or not; and third, by contrast, in the GM maize, the toxin is found not on the surface of the plant, but inside its cells, so it will only kill insects that actually eat the plant – i.e. pests. The case of cotton is even more dramatic. Farmers have long tried to kill the bollworm larvae that live inside the cotton boll, but they are hard to get at so heavy doses of insecticide must be used and collateral damage from spraying is great. Along comes bt-cotton, with the toxin gene inside the cotton plant's cells and only the greedy bollworm gets it. If you don't believe it, look at the statistics. In *bt* cotton crops in China the use of insecticides is down by 80 per cent[6] and the bees, butterflies and birds are back in abundance. Oh, and by the way, two years after the Monarch butterfly report, five different studies unanimously concluded that the experiment had been flawed anyway and the risk to butterflies from bt maize was negligible.[7]

Organic's misjudgment

The standard of reporting by the British media during this debate was often outrageously mendacious. For example, in 2003 Michael Meacher MP visited Canada as a guest of the National Farmers Union of Canada and the Saskatchewan Organic Directorate, accompanied by Rebecca

Fowler, a journalist from the Daily Mail. Meacher and Fowler reported that Canadian farmers opposed GM foods and regretted adopting them. 'Frankenfoods: the damning truth' was Fowler's headline. They omitted to mention that, despite its name, the National Farmers Union is a fringe group representing less than 1 per cent of Canadian farmers. They also failed to mention that in a representative survey of 650 Canadian farmers growing rape (called Canola in Canada) – half GM and half not – the GM growers reported higher returns, 10 per cent higher yields, 31.2m fewer litres of fuel used, and 6,000 tonnes less herbicide applied. The Daily Mail simply refused to print letters from Canada pointing out these facts.[8]

The truth is that the organic movement made the wrong call on GM. It was a golden opportunity for them: to embrace truly competitive crops that did not need so many sprays because they were – organically – self-sufficient. As it is, merely to board a passing bandwagon of protest publicity, the leaders of the organic movement locked themselves into an increasingly shrill game of claiming environmental virtue for practices that are rapidly being overtaken and left behind. They still occasionally use harsh, broad-spectrum insecticides such as copper sulphate or nicotine sulphate (yes, organic farmers do use such sprays – though they prefer not to mention it in public), but not highly specific, non-persistent chemicals such as synthetic pyrethroids. They use bt as a spray that hits non-target species, but will not allow it as an ingredient of the plant itself where it can only hit pests. They repeatedly till the soil, when chemicals can do less harm to the soil fauna. They import mined Chilean nitrate and fish products as fertiliser, to the detriment of Andean landscapes and ocean ecosystems. And still they preach.

Organic farmers aspire to rely less on fossil fuels, but in practice, a pound of organic lettuce, grown without synthetic fertilisers or pesticides in California, and containing 80 calories, requires 4,600 fossil-fuel calories to get it to a customer's plate in a city restaurant: planting, weeding, harvesting, refrigerating, washing, processing and transporting all use fossil fuel (hardly less than a conventional lettuce which requires about 4,800 calories).[9] Unless organic food is to be expensive, scarce, dirty and

decaying, then it has to be intensively produced, and that means using fossil fuels. GM crops, by reducing the need for sprays and (one day, we may hope) fertilisers, are a small step to reducing that dependence.

Quantity or quality

There is one respect in which the environmental critique of conventional agriculture has force. In the pursuit of quantity, we may have sacrificed nutritional quality of food. Indeed, the 20th century drive to provide a growing population with an even faster-growing supply of calories has succeeded so magnificently that the diseases caused by too much bland food are rampant: obesity, heart disease, diabetes, and perhaps depression. For example, modern plant oils and plentiful red meat give us a diet low in omega-3 fatty acids, which may contribute to heart disease; modern wheat flour is rich in amylopectin starch, which may contribute to insulin resistance and hence diabetes; and maize is especially low in the amino acid tryptophan, a precursor of serotonin, the 'feel-good' neurotransmitter.[10] Consumers will rightly be looking to the next generation of plant varieties to redress these deficiencies. They could do so by eating more fish, fruit and vegetables. But not only would this be a land-hungry option, it would suit the wealthy more than the poor, so it would exacerbate health inequalities.

Instead, genetic modification provides an obvious solution: to insert healthy nutritional traits into high-yielding varieties. This was exactly the reasoning used by the Swiss scientist Ingo Potrykus and his colleague Peter Beyer when they set out in 1999 to design a GM crop that would solve a real problem of malnutrition among poor people in the third world (see Chapter 1). They chose vitamin A deficiency, a chronic disease that each year blinds up to 500,000 children dependent on a diet of rice and little else. Potrykus and Beyer took two genes from a daffodil – a plant that is rich in vitamin A – and inserted them into the genome of a rice plant. In doing so they trespassed on roughly 300 patents belonging to multinational firms such as Monsanto. Potrykus simply asked the firms to waive their rights to royalties so long as his rice was not sold for profit. They readily agreed (so much for the Greens' argument that cor-

porate patents were preventing poorer countries getting any benefits from agricultural innovation)[11].

Nonetheless, environmentalists virulently opposed Golden Rice, arguing that it was a plot by the biotech industry, and that it would not provide a sufficient daily dose of vitamin A. Greenpeace even argued that "Golden Rice could breed with wild and weedy relatives to contaminate wild rice forever"[12], as if a vitamin were a virus. Since Potrykus was funded by charities and intended to give seed away free, allowing peasants to save their own seed for replanting, and since no firms were involved at all, the argument about an industry plot was straight nonsense. The dose argument had some validity until Potrykus improved the vitamin-A content 23-fold in his second strain. Now as little as 200 grams of rice contains a sufficient daily dose of the vitamin. Yet still Greenpeace objected. The Indian activist Vandana Shiva, echoing Marie Antoinette, recommended that Indians should eat more meat, spinach and mangoes rather than relying on golden rice.[13] (One is tempted to reply: go ahead. Nobody has been stopping you growing fresh spinach for the children of Nepal, Sumatra and Laos. Where exactly are you going to grow it, how are you going to distribute it, and who is going to pay?)

Potrykus wrote recently: "Better food means better lives and better productivity, a chance to break the cycle of poverty that traps traditional farmers all over the world: blanket opposition to all GM foods is a luxury that only pampered westerners can afford."[14] Disgracefully, the European Union still bans the import of genetically modified food. Disgracefully, many British restaurants still boast of not using it. There is no rational reason, either to protect human health or to protect the environment, for such an attitude. Ten years after they were first tested, GM crops have proved on a grand scale that they can improve biodiversity, save land for wilderness and not only cause no human health problems whatsoever, but contribute real solutions to malnutrition and ill health.

8. Climate change – scepticism and science as drivers of progress

Oliver Marc Hartwich

The meaning of the Enlightenment is highly contested. Nonetheless, any serious attempt to describe or define it would have to involve reference to the following: scepticism towards received doctrines and wisdom; a belief in science and empirical methods of investigating the world; the employment of human reason and the ever-present possibility – perhaps necessity – of doubt.

These principles, which blossomed during the Age of Enlightenment, are the foundation of most of the innovations and developments that we in the modern world take for granted. Much of our technical, social and economic development could only happen thanks to those scientists and inventors who challenged those commonly held beliefs – what the late John Kenneth Galbraith called "conventional wisdom".[1] Michael Faraday's idea of generating electricity by moving a magnet in a wire coil was initially the subject of much derision; and the then president of the Royal Society, Lord Kelvin, warned the Wright Brothers that an object which was heavier than air could not fly. Hindsight is a great cure for ignorance, but there could be no such hindsight without those few brave individuals who are prepared to challenge the received wisdom of the day. It is this kind of fearless enquiry which broadens our understanding of the world and which drives our progress in it. We must be careful not to accept our own "conventional wisdom" which may yet turn out to be little more than unsubstantiated beliefs and prejudices. It is the task of scientist to challenge such thinking.

Science is not a discipline in which we should expect to find final truths. On the contrary, the principles upon which science is built are doubt and constant inquiry. In the 20th century, this view of science was

most clearly expressed by the philosopher Sir Karl Popper, who once put the issue thus: "Whenever a theory appears to you as the only possible one, take this as a sign that you have neither understood the theory nor the problem which it was intended to solve".[2] To Popper science was an ever evolving process of discovery and refinement.

We can only wonder what Popper would make of the current debate about climate change.

In April of this year TIME magazine devoted almost an entire issue to the topic of "climate change", with a front cover declaring: "Be worried. Be very worried. Climate change isn't some vague future problem – it's already damaging the planet at an alarming pace."[3] The Economist recently told its readers that "[t]he heat is on" and that any remaining uncertainties argued for action, not inaction.[4] Tony Blair's chief scientific adviser, Sir David King, keeps warning the public that climate change is the most severe threat we face today, more serious than terrorism.[5] French president Jacques Chirac agrees that climate change is "the greatest threat hanging over the future of humankind".[6] One can only wonder what happened to HIV/AIDS, malaria, malnutrition or the proliferation of WMDs. And the governor of California, Arnold Schwarzenegger, attempted to terminate the discussion with the assertion that "[t]he debate is over. We know the science. We see the threat posed by changes in our climate. And we know the time for action is now."[7]

Time and again one hears the claim that there is a broad consensus on climate change: what it means, what is causing it and what has to be done about it. But is this true? And can there ever be such a scientific consensus?

To begin with, "consensus" is a term which is alien to science. It is a concept from sociology which describes only that a general agreement has been reached, a process of collective decision-making, if you will. In science, however, such a process could never be understood as a means of establishing "truth", for it would not only require the individual scientist to submit himself to a majority view, but it would make that consensually achieved view virtually unassailable. Thus, establishing a scien-

tific consensus is incompatible with the way that science has evolved, from the Age of Reason to Karl Popper's theory of critical rationalism.

One would be well advised then to treat the talk about a "climate change consensus" as what it is: not as a *scientific* consensus about climate change but at most as a *political* agreement to act and speak as if the major questions surrounding climate change had already been answered. In reality, however, there are very few things on which the majority climate scientists would readily agree.[8]

Dealing with those issues on which there is agreement is very simple, for they are few. First, the average global temperature has risen by approximately 0.7 degrees centigrade since 1860. Second, an ever increasing world population has an influence on the climate through increased energy and land use. Everything else in the climate change debate is highly controversial. Has the climate of the past millennium always been colder than today or not? How much of an effect on the climate does atmospheric carbon dioxide have? Do rising carbon dioxide concentrations lead us to a point of no return? Or are there self-regulating mechanisms which will slow, halt, or even reverse the process? For each question one finds much disagreement among climatologists. Such disagreement should be welcomed, for it is what science is all about. Far from any clear-cut consensus then, there is a debate amongst experts about the various aspects of climate change. Puzzling, then, that most of what we hear in the public domain gives the impression that the case is quite the opposite.

One reason why the public perception and the reality of scientific debate and disagreement are so discordant is the way in which the climate change debate is conducted. In 1988, an Intergovernmental Panel on Climate Change (IPCC) was established by the World Meteorological Association and the UN Environment Programme. It has since produced three substantial assessment reports on the scientific basis of climate change, which have been compiled by hundreds of scientists. A fourth report will be published next year.

The IPCC assessment reports have been remarkable achievements, bringing together scientific expertise, and this is something on which the

IPCC has to be commended. Yet we must also not overlook some serious limitations with the IPCC process. The first problem is that the scientific content of the reports is far too complex to be understood by non-scientists. Recognising this, and assuming, probably correctly, that it is very unlikely that anyone but the most expert student of the debate will wade through several hundred pages of scientific evidence, the IPCC provides a "Summary for Policymakers". However, this summary is as much *by* policymakers as it is for policymakers: its wording is determined not by scientists, but by governments; the contents are thus less a reflection of the breadth of the scientific discussion, than an exercise in political "consensus-building".

Apart from this obvious politicisation of the IPCC process, the second problem is that the IPCC has failed to deal adequately with the numerous criticisms raised. Two examples can exemplify this problem. The first concerns the treatment of the economics of climate change. In order to estimate future carbon emissions, one must project global economic development over a long period of time. This in itself is a difficult task for there are many unknowns such as population growth and technological development. The IPCC based its predictions on the assumption that the least developed countries will over time catch up with today's rich nations in terms of their per-capita incomes. While this may be plausible, the way in which it was modelled was not. Instead of estimating the future growth of developing countries' economies based on purchasing power parities – a standard method in economics – the IPCC used exchange rates. In several papers, David Henderson, former OECD chief economist, and Ian Castles, former head of the Australian Bureau of Statistics, demonstrated that this led the IPCC to seriously overestimate future global economic growth. In one of the scenarios used by the IPCC even North Korea achieved a higher per capita income than the US in 2100. The IPCC first ignored and then rejected this criticism. However, when the House of Lords Select Committee on Economic Affairs produced a report on the economics of climate change last year, it acknowledged that Henderson and Castles were not only right to raise the issue, but concluded that the IPCC's use of economic scenarios con-

tained "questionable assumptions and outcomes". The Lords also found that the IPCC process was "apparently influenced by political considerations".[9]

The second example comes from the other side of the Atlantic, where Canadian economist, Ross McKitrick, and mineral consultant Steven McIntyre, have criticised the so-called "hockey stick curve", which features prominently in the IPCC's third assessment report and summary for policymakers. This model suggests that global temperatures had basically been cold and unchanged for the first eight centuries of the second millennium and then started to rise steeply, and this has been taken to demonstrate the effect of carbon dioxide emissions over the past two centuries. However, McIntyre and McKitrick claimed that the methods used to calculate the hockey stick curve were flawed. This triggered an investigation by the US House Committee on Energy and Commerce. Three renowned professors of statistics were commissioned to evaluate whether McIntyre and McKitrick's accusations were justified. The result of their report did not leave the slightest doubt. It found a misuse of statistical methods, a lack of effective peer review and inadequate scrutiny in the preparation of the IPCC's assessment report. The judgement on the IPCC could hardly have been harsher.[10]

What all this means is that the desire to establish and defend a "consensus" has seriously damaged the very basis of our understanding of climate change. This is regrettable as it has done a disservice to science, which should be an open inquiry process in which scepticism is regarded as a virtue, not a vice. Even worse, the doctrine of a "climate change consensus" has also narrowed down the political debate. When climate change is discussed in political debates and the media, the focus is now almost exclusively on the question of carbon emissions rationing. Interesting as this issue may be, it is only one aspect of the climate change challenge; and it may not even be the most important one. In this way, the so-called climate change consensus prevents necessary political debates that must go beyond the question of carbon emissions reduction. To understand why such debates are needed, it is worth considering the current programme of emissions reduction established in the Kyoto Protocol.

Under the Kyoto Protocol industrialised countries have committed themselves to a reduction in emissions of 5.2 per cent on 1990 levels by 2012. The actual achievements, however, have thusfar been disappointing. According to figures from the United Nations statistics division the UK has only achieved a reduction of 1.9 per cent. Most other industrialised countries are even further away from their reductions targets. For example, France increased its emissions by 3.2 per cent, Denmark by 9.2 per cent, Japan by 15 per cent, Ireland by 35.1 per cent, Spain by 46 per cent and New Zealand by a staggering 47.3 per cent.[11]

Failure to meet the Kyoto commitments will have financial consequences. In the case of Spain, for example, the gap between its Kyoto target and its actual emissions over the period from 2008 to 2012 will be up to 289 million tons of carbon dioxide. In order to close this gap the Spanish government and Spanish businesses will have to purchase emission certificates. According to the Spanish environment minister Cristina Narbona, at current prices this would cost about three billion Euros (£2 billion).[12] Other countries face similar problems: New Zealand's Kyoto bill will probably be around one billion NZ$ (£350m),[13] and Ireland is expecting a fine of up to a billion Euros (£670m).[14]

It should be noted that these are by no means the only costs associated with the Kyoto Protocol, although other costs are more difficult to predict precisely. Economist William D. Nordhaus of Yale University has calculated that a full implementation of the Kyoto Protocol, including full adherence by the US, would cost about 2.5 trillion US$ (£1.33 trillion) until the year 2100.[15] More ambitious goals than those under Kyoto would be even more expensive. The IPCC estimates that limiting the rise of carbon dioxide concentrations to a level of 550 ppm from their current level of around 380 ppm could cost up to 17 trillion US$ (£9.08 trillion) in present value terms.[16]

As the costs of cutting carbon emissions become more and more apparent, it is likely that political support for more severe targets will dwindle. It does not need much imagination to predict the reactions of the Spanish, Irish or New Zealand public to suggestions of emissions targets far below their existing Kyoto commitments. It would be even hard-

er to explain to these economically successful countries why they should be penalised by being forced to buy emissions certificates from countries with emissions certificates to sell as a result of their more sluggish economies. Yet, this is precisely the kind of policy that supporters of the so-called climate change consensus have in mind. What they are often calling for are targets of cutting carbon emissions by 60 to 80 per cent over the next decades. Given the experience with the much less ambitious targets under the Kyoto Protocol and the consequences, both practical and financial, it is extremely unlikely that more stringent targets could achieve any kind of international political agreement. Even if such a treaty were to be negotiated this would by no means be a guarantee that its targets would actually be achieved. Thus the Kyoto Protocol should serve as a warning, not as a model.

The problems with the implementation of the Kyoto Protocol do not, however, suggest that nothing should be done about carbon emissions. Neither do they mean that increasing energy efficiency is unnecessary. In fact, increasing energy efficiency may be a desirable goal for a number of reasons, of which fighting climate change is only one. Another may be the wish to reduce the dependency of the world economy both on energy prices and on oil and gas exporting countries. But if emissions rationing regimes do not successfully contribute to achieving these aims, then it is only reasonable to consider alternatives.

One such alternative is promoted by the six countries of the Asia-Pacific Partnership on Clean Development and Climate Change (APPCDCC). It was formed by Australia, India, Japan, China, South Korea and the US in 2005 – six countries which currently account for about half the world's population, greenhouse gas emissions and GDP. What differentiates the APPCDCC from the Kyoto Protocol is the very fact that it is not an agreement by which the member states would submit themselves to fixed emissions reductions targets. Although emissions reductions are the goal of APPCDCC they are meant to be achieved through developing new technologies and cooperation between the member states in this process. This way, their economies shall become less emissions intensive.

It would be all too easy to dismiss the APPCDCC approach out of hand as an American and Australian led PR exercise – after all, these two countries are the only industrialised nations that have not yet ratified the Kyoto Protocol But actually the US has already demonstrated the value of technology-based climate change policies at home. At the time the Kyoto Protocol was signed in 1992 the US was emitting 0.69 metric tons of carbon dioxide for every 1,000 US$ of GDP (£534). By 2004 this figure had fallen to 0.55 metric tons – a 25% increase in energy efficiency.[17] Put differently, US carbon emissions in 2004 were approximately 1.5 billion metric tons lower than they would have been in the absence of efficiency improvements, a reduction the magnitude of which is greater than the entire emissions of India this year.

The US government has introduced a wide variety of measures to improve energy efficiency as well as programmes to capture greenhouse gases. It has set itself a target of a further 18 per cent increase in efficiency between 2002 and 2012. So far the Bush administration has spent 20 billion dollars on climate change; the climate change budget for 2006 is more than 5 billion dollars, rising to 6.5 billion dollars in 2007.[18] This money is spent on initiatives ranging from the development of clean coal technology to tax incentives for renewable energies.[19] The ENERGY STAR programme alone, an initiative to raise efficiency awareness, helped to save greenhouse gas emissions of 35 million metric tons in 2005 – the equivalent of 23 million vehicles.[20] That all these programmes are producing positive results can also be seen in the US per capita carbon emissions which have begun to fall in recent years. So even though the US have never ratified the Kyoto Protocol, their science and technology based climate change policies have proven remarkably effective. Through the APPCDCC they will now be made available to energy-hungry India and China where they will help to prevent future emissions on a large scale.

Considering the success of this pragmatic, technology based US climate change policy, it seems bizarre that the US has become the pariahs at international climate change conferences where mere signatories of the Kyoto Protocol with no positive records of achievement are cele-

brated for paying lip-service to a failing policy. It could be argued that most supporters of the idea of a climate change consensus follow a version of what Max Weber called *Gesinnungsethik*: the 'ethics of good intentions'.[21] It is thought sufficient to commit oneself to a policy hoping to bring about certain results, regardless of whether this kind of policy is suitable, let alone whether it is actually likely to accomplish anything.

While the climate change consensus, with its focus on carbon emissions reductions, currently serves to block discussion about non-rationing alternatives to the Kyoto Protocol, it hampers discussions about non-carbon related responses to climate change even more. Yet there are such alternatives, and they consist of a variety of adaptive strategies. The reasoning behind adaptation is this: it is politically unlikely that far-reaching emissions reductions will take place in the near future, and if they were to take place they would come at enormous economic costs. At the same time, it is not even clear by how much carbon emissions would have to be cut, and when such cuts would have an actual effect on the climate. Even Al Gore's climate change adviser, Tom Wigley, estimated that the full implementation of the Kyoto Protocol would result in a 0.07 reduction in global mean temperatures by 2050.[22] Put differently, one would be well advised to expect future climate change and proceed from there. Climate change is happening, it is improbable that it can be stopped in the short or medium term and the most pressing question then becomes: How are we dealing with its effects?

That such questions make sense has recently been demonstrated in the heatwave of the European summers of 2003 and 2006. In 2003 there were reports that hundreds or thousands of people had died in the French heatwave. Some even went so far as to claim that the heat had killed more than 14,000 people.[23] But such claims begin from a false premise. It was not heat that killed people, but, at least in the example of the many elderly who died, dehydration. Dehydration occurs when people fail to drink enough, and it was much aided by the fact that many elderly people were stuck in hot flats with no air conditioning. So, although the heat played a role in these fatalities, they were by no means

unavoidable. This was demonstrated in 2006 when another heatwave hit the country. This time, the elderly received phone calls from social services to give them free health advice, and radio and TV programmes reminded people to drink enough water. All this prevented the heatwave from becoming another death trap. There were hardly any reports of heat related casualties.

Adaptation, therefore, is a very pragmatic approach to climate change and it can happen in numerous ways. It can, for example, mean having evacuation plans for areas that are prone to flooding; it can also mean not settling in these areas in the first place. It can mean installing air conditioning as well as changing building standards to include better insulation. Adaptation can also consist of installing agricultural irrigation systems as well as building dams and dykes in coastal areas. In one sense, adaptation is a more complex response to climate change than simply cutting carbon emissions. There is not one single adaptive measure which would be the answer to all problems. On the contrary, the potential of adaptation depends on the circumstances of the situation. But this is also the greatest advantage of adaptation as it enables a much more targeted response to the effects of climate change. Further, it is an approach that works regardless of the reasons that the climate is changing: whether the climate is warming due to increased atmospheric carbon concentrations, or due to other influences which we may not yet fully understand, does not matter. What matters is our ability to cope with the effects. Finally, adaptation may also be a very cost effective way of tackling climate change. As German climate change expert Professor Hans von Storch once put it: you can either invest 100,000 Euros (£67,000) to build a dyke in Bangladesh which will save 3,000 people from storm floods which they already have to fight today, or you can invest the same amount of money in carbon reduction projects which has the potential of lowering sea levels in 2050 by a fraction of a millimetre.[24] Given this choice, it is probably more reasonable to build dykes.

Once again it has to be stressed that adaptation is something to which science and scientists can make valuable contributions. These can range from coastal research, as in the case of Bangladesh, to medical research and

advice as in the case of the European heat waves. It could also mean the development of drought and flood resistant crops which can better cope with extreme weather situations. Needless to say all such measures work better under the conditions of economic prosperity. Countries at a higher level of economic development are obviously better able to deal with climatic changes. Thus, the Netherlands, although mainly located below sea-level, suffers very little flooding, while Bangladesh suffers regularly and severely; thus agriculture in Sub-Saharan Africa is much more weather dependent than Australia's agricultural sector which uses irrigation, better crop varieties, machinery and pesticides. This means that the best policy to strengthen a country's adaptive capacity is economic development. It is economic development which can build weatherproof economies. Australia's economy, for example, had been extremely dependent on its agricultural sector (wheat, meat and wool) throughout the 19th century, but through sound and stable institutions the Australian economy was able to develop and grow into an economy that does not have to be afraid of climate change. Of course, calling for such economic development also means challenging a dominant assumption that underpins the environmentalist lobby, that increased economic and productive development, with its associated increase in consumption, is a problem. This may be one of the many contemporary "common sense" prejudices that a serious political debate around climate change must begin to challenge.

It should be apparent that climate change is an issue that requires a serious scientific, political and economic discussion to which unfortunately there are no convenient shortcuts. Because of this, it is not helpful that the public discussion is too often dominated by scare stories, simplified and often distorted facts and the pretence of a consensus which encompasses everything from the reasons of climate change to the necessary answers to it. It is unfortunate that the notion of such a consensus has made more difficult a reasonable political discussion about effective and efficient strategies to deal with climate change. It is time to engage in a new enlightened debate on the subject.

Endnotes

Foreword

1 The sociologist Anthony Giddens is one proponent of this view. Giddens draws a distinction between "external risks", which are "risk experienced as coming from the outside, from the fixities of tradition or nature", and "manufactured risks", which are "risk[s] created by the very impact of our developing knowledge upon the world." For Giddens, contemporary society can be characterised by the predominance of "manufactured risks" which are the result of human action upon the world, and about which "we simply don't know what the level of risk is, and in many cases we won't know for sure until it is too late." Anthony Giddens, Lecture 2 of the 1999 Reith Lectures 1999, *Runaway World*, available at: http://news.bbc.co.uk/hi/english/static/events/reith_99/default.htm.

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Chapter 8

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