

In our Time Programme 14
Genetic Engineering

Melvyn Bragg : Hello, today I'm joined by the geneticist Professor Graham Bullfield and the writer Brian Appleyard to discuss the impact of the new genetics. One of the most important advances in scientific knowledge in the modern age. Are such advances as the cloning of Dolly the sheep more for the benefit of scientists than for humanity? Is scientific knowledge intrinsically morally corrupt or pure?

Graham Bullfield is a geneticist, honorary professor at Edinburgh University and the director of the Roslin Institute in that same city, where Dolly the sheep was created using adult cells, he says quote, " My job as a scientist is to put as much information out into the public domain so that the public and government can judge it. What we tried to do with Dolly was to get a debate going", unquote.

Brian Appleyard is a feature writer for the Sunday Times and an author known for his occasional withering attacks on science, for example his 1992 book "Understanding the Present: Science and the Soul of Modern Man". He has in the past decried the 20th century as being dominated by quote "A supine technological determinism which is being employed as a bracing antidote to culture and civilisation", unquote. His latest book "Brave New World: Genetics and the Human Experience", published next Monday is no less uncompromising.

Brian Appleyard, genetic science has been heralded as one of the great advances of the 20th century, you yourself consider the discovery of DNA to be one of the greatest scientific events in history, and yet you say that genetics must be quote "contained and humbled in brave new worlds". Why?

Brian Appleyard : Well, I think precisely because genetics is such a radical science, because it is so fundamental. It asks very fundamental questions about us. Human cloning, which is very much in the news, would be obviously a pretty radical transformation in what we understand and the nature of human reproduction. Genetics also raises questions about the identity of an individual, what an individual is, it tends to...it gives a quite radical redefinition of an individual, for example, as a chance emanation from the gene pool, and it's questionable... it raises the question of whether *that* understanding of what an individual is different... fundamentally different from our previous understanding of what an individual was, and I think these are matters that are so basic that unless...the discussion has to be much wider than it has been so far, and it cannot simply be left to a series of, sort of, "Well now we've got the technology we can do it", this seems to me to be wholly unacceptable.

Melvyn Bragg : Well, just before I come to Graham Bullfield, I'm still coming back to your own words, "contained and humbled", how contained and why humbled? I'm still worried about the use of these words, which...you're a man who uses words very carefully, so... ?

Brian Appleyard : Well, humbled... . humbled is a very precise word, because I think the problem at the moment is we have an enormous wave of highly scientific publishing , saying that we are on the verge of explaining everything. Now science has always said this, it's always said it in one form or another for the last two and a half thousand years. We are on a verge of the theory of everything. The saying of it now is particularly effective, because the science is particularly intimate, the science of biology and particularly dangerous I think. Contained I think is... . people always ask "well what would you do", I don't think it's a question of doing something, I think it's a question of changing people's imaginations. Persuading them that they have to make decisions of very fundamental moral importance here , they're not simply questions... . they're not simply issues to be left to whatever technology comes along next.

Melvyn Bragg : Graham Bullfield what's your reaction to this?

Graham Bullfield : Well I mean I see modern genetics as just beginning to be the start of our understanding of biology. Once we have the gene, as geneticist we are always impressed by how far we are from the end of the story, the gene is just simply the beginning, it has to interact with other genes, it has to interact with the environment, it changes its action in different places, and at different times, so I think in many ways biology is in the same position that chemistry was at the end of the 19th century, when they were putting together the periodic table of some 100 or so elements. We're putting together a periodic table in biology of some 70, 000 elements.

Melvyn Bragg : So you think it's humble enough already, you mean?

Graham Bullfield : Well I see we've got so far to go, I see that we're just at the very beginning and we're just

scratching the surface. I do think though however, it is increasing our knowledge of biology in a somewhat different way, it's bringing a more predictive type of biology along. We're beginning to understand how things operate a bit more. We're beginning to see opportunities being offered, its in many ways, it's just a from of information in the same way that the internet is producing information. I think that what is critically important and what has changed over the last ten years is the willingness and the necessity for scientists to put that information out into the public domain so that there can be a widespread discussion. I mean I'm very pleased about the way that's happening now, compared to say what was happening in the 40's over nuclear energy, where there was very little discussion.

Melvyn Bragg : I'd like to very much concentrate on Brian Appleyard's polemic, but before we... some of which he's expressed in his opening remarks, but before we get to that, could you just give us some notion of what you see as the most important and encouraging advances in modern genetics now.

Graham Bullfield : Well, I think the way that if we begin to understand how different biological processes are controlled, and as I said, I need to repeat, we're only just scratching the surface, we begin to work out rational therapies to treating a number of rather devastating diseases, I'll give you a classic example, a very early one, is the screening in the UK for a devastating genetic disease called PKU. Now all children are now screened for this disease, it's one in ten-thousand live births, and understanding of the biochemistry enables us to treat it. If untreated the children have very severe mental impairment, if treated they live a relatively normal life, they're almost completely cured. Now that's an example of an understanding , particularly of the biochemistry of that disease, that has enabled us to have a rational therapy.

Melvyn Bragg : So you see new genetics again and again, working for the good of humanity?

Graham Bullfield : It doesn't necessarily work for the good, no. I believe genetics like much of science is amoral, it has a lack.....

Melvyn Bragg : Non-moral?

Graham Bullfield : Amoral, it lacks scientific content. The problem is how it is used. Every scientific advance can be used for good or evil, and that's why it is critical that we put the information out into the public domain so that its uses positively or negatively can be assessed. I mean almost every advance has both a positive and a negative use, and it's important for us to sift those out and understand them, and unless we understand the science, we can't understand how it can be used or misused.

Melvyn Bragg : Before we come to our main... . the main burden of your argument Brian Appleyard, do you agree that the new genetics can do good, can help improve, alleviate?

Brian Appleyard : Of course, of course it would be futile to disagree. I mean.....

Melvyn Bragg : So how are you able to judge what can do good and what cannot do good ?

Brian Appleyard : Erm, it's extremely difficult , erm, but it is... that is the nature of moral choice .

Melvyn Bragg : Well, it might be the nature of scientific choice mightn't it?

Brian Appleyard : I might indeed, yes, but I mean you can't... . I'm delighted to hear Graham Bullfield say that... .. make the point that genetics is in very early days, because I think to a large extent the publicity suggests otherwise, and I think it is important to put this in a wider context which is the nature of society as it now is. In a society which is atomised and lacking consensual belief systems or value systems , it is likely that a force as powerful as science *will* be elevated to a moral condition, a moral status, and to a determining force in human affairs, and that is indeed what is happening.

Melvyn Bragg : Let's take a few of these points Graham Bullfield. Do you think first of all science is making these claims? Do you think it's trying to make these claims? And then let's talk about the morality.

Graham Bullfield : Well, I don't actually see science as making those claims. I see science as offering

opportunities. I have to say it does pose moral dilemmas, what I see much science in my own work as that of others is an approximation. There is a natural humility in science because everything we do, someone is going to find out was only an approximation and is often wrong. I mean our own work is in our lifetime in science is often overturned, which probably doesn't happen as fast to philosophers or writers. I mean we do it ourselves. I mean our first aim is to overturn or qualify or extend something we've discovered ourselves.

So there is something inherently humbling or self-critical about science anyway, or a good scientist will have to be that way or they will get caught out. But I do think it poses moral dilemmas, because often the use of it can be simplified, and often a scientific advance in human genetics for example, is put into practice with enthusiasm without the whole social consequences of it being seen. I mean there is an example that Brian Appleyard gives in his book, which I completely agree with him, which was the discovery of the extra Y chromosome syndrome in man, in a small number of individuals who are mentally abnormal and seem to show violent tendencies.

It actually turns out that 97% of all people with this syndrome are perfectly normal. So that to label the syndrome from a very small sample as being a syndrome that causes problems, causes some sort of aggression or some sort of pathological behaviour, turned out to be wrong. So we have to be very careful to make sure, particularly in genetic counselling, pre-natal diagnosis, that all these things are incorporated into a social structure, and we work out the implications of what we're doing. I mean a very simple one is, that in many ways it is no good pre-natal or predictively diagnosing a disease before the syndrome has developed unless you can do something about it, I mean that's one of the common problems we have. It's no good diagnosing somebody before the symptoms have developed, that they're going to develop later on in life something, if we can't do something, we can't treat them in some way. Sometimes it is, because sometimes people do want to know what their future's going to be, but often that's a major problem. So we do have to make very sure that these scientific advances are put in the correct social context, and we have to think them through, and that often is not a job for the scientists, because they're narrowly thinking just of the excitement of the science, and it can cause problems.

Melvyn Bragg : And isn't Brian Appleyard right in that sense that newspapers are full, very full nowadays of people saying we can change human personality, we can identify this gene, pluck it out, modify it and so on and so forth... .

Graham Bullfield : But all the cautions don't sell a story, you know yourself, I mean there is no point in saying "Well this is an interesting so and so advance but, but, but... .", I mean we've experienced this ourselves, all the "buts" we put in on the Dolly story don't get published, it's the scientific advance, I mean you end up buried on page 14 if you put all the "buts" in, you don't get it to page 1. So it's the natural nature of the way scientific journalists have to get their articles on to page 1 as much as any other journalist does, and there's a problem there that the black and whiteness of it gets taken, but that's partly our job. We have to stick with the story longer, we have to make sure we don't just announce it and let other people take it off into these flights of fancy. We have some sort of obligation to say "Hey, just a minute you can't do this with it", or "There are problems about the use of the technology in that way", and that's I think, more and more, what scientists are doing.

Melvyn Bragg : Should scientists themselves draw the line at a certain point? Should they enter into the moral debate, rather more than they do? You yourself, or your institute, Dolly the sheep, has said that you can't see much interest in taking this one to clone human beings. You've drawn the line there haven't you?

Graham Bullfield : Yes.

Melvyn Bragg : So why did you draw the line and do you think drawing the line is important? And A. Do you think if you draw the line, does it matter a damn because somebody else in the States, or the University of Bristol will just go over the line?

Graham Bullfield : Well, you've asked me 3 really quite complicated questions there. I try very hard not to give my personal view when I'm having these discussions, because I don't think that's my job, my knowledge is as a scientist and not as an ethicist. The second point is about the institute. What we've tried to do as an institute is point many of the technical difficulties that would be involved. We also have said... . gone to a point where we said we cannot see any clinical reasons why you would want to clone humans from adult humans, that's humans reproductive cloning. And then finally you're also correct, that the genie was let out of the bottle by Pasteur in the 1850's, and if we hadn't

have carried on with Dolly, once we realised we could do it, within a year somebody else would have done it. I mean science is going on in a broad way all over the world gradually. One scientist deciding to opt out doesn't actually help the issue. I think in many ways it's important to stay in there so that you can inform about what's going on.

Melvyn Bragg : I'd like to turn to Brian Appleyard's ... one of his major concerns, which he... . you say Brian that genetics encourages the notion of sameness and normality, and briefly, and you'll correct me if I am wrong, obviously, when women are diagnosed, things might be wrong with the children they are about to have, the overwhelming tendency is to prevent this happening and bring them back to the norm, because we all want normal children, and this could have an impoverishing effect.

Brian Appleyard : Yes, I mean it's not simply... there are two points. One is the practical effect that people actually do it, and the other is the sort of imaginative effect it has on people. I think the problem... . I mean this is... . I'm not original in this... . many people have addressed this issue, the problem with offering more and more reproductive choice to people in terms of what they can do with their children, is that the tendency will be to normalise the population according to prevailing norms at the time, to produce people to prevailing norms at the time. I mean the obvious case is if you found a gene for homosexuality, which in spite of the publicity has not actually been found.

Melvyn Bragg : Genes are only predisposed, we must keep saying it, it's a predisposition, they don't automatically result in this do they?

Brian Appleyard : No they don't automatically result in this, but if you remove the predisposition, you certainly remove the thing.

Melvyn Bragg : Sure, sure. I'm just trying to correct that.

Brian Appleyard : If you offer people... if you say to people, "Well, your child has a 75% chance of being homosexual", or in other terms if it's a 75% chance of having a heart attack by the age of 40, this raises new questions, is that child, in advance of having a heart attack, ill? Or is it, in advance of being a homosexual, gay? And what choice would you make? I mean to me it would not be a choice because I would not regard it as being ill to be gay. But on the whole I think people would. I think people want grandchildren, for example, and they worry about the difficulties of growing up homosexual, and there are many many behavioural aspects of genetics which are coming out at the moment, almost weekly there is a story about finding the gene for alcoholism, risk taking whatever. Some of which claims are later withdrawn, and these ask questions about what we think about people and what they are for. Now it seems to me, obvious they ask those questions, you can't avoid asking those questions if that knowledge is in the world, and it is very important to address the idea of what we think, what we value in human beings as part of that process.

Melvyn Bragg : Yes, it raises all sorts of questions as you say. I mean if it had been discovered that there had been a gene for gayness, and the mother of Michaelangelo had found that out, and a gene for madness and the mother of Nietzsche had found it out, you can go through a great number of people, or indeed the mother of Newton, in his depressions. But I'd like to talk about two things here. One is... . the first is your own... . it seems to me that one of the motors of your book is your relationship with your niece, your late niece alas, Fiona, who lived to the age of 30 despite the fact that she had muscular dystrophy, which is very rare for a woman to have, and you describe her as "the most extraordinary person I've known", and it would seem to me that the book is driven by... . one of the things which drives the book is look this person had she been aborted, they would obviously have not have lived a life and the most extraordinary person I've known would not have existed. Can you just develop that?. I'm fully aware that if you were told that your child was about to have muscular dystrophy, the temptation to have an abortion would be overpowering, probably.

Melvyn Bragg : Was your brother told, was your brother's wife told about it?

Brian Appleyard : No, it was pre the possibility of such diagnosis, well there was no risk factor involved so it wouldn't have arisen. The... it raised... . Fiona raised fundamental questions for me about what we value in human beings and of what human life consists. These are ancient questions they were addressed by Pascal among others, about what the worth of human life is. Now it seems to me that unless you are prepared to address those questions,

unless we are prepared to think about those questions, then the genetics debate will simply pass by, by default. I want to know what it is about human beings that we value? I want to know where that value comes from, I want to know at what point we can say human beings are individual or valuable.

Now I think it is all too easy to take an utterly mechanistic view, based almost certainly on ignorance, because genetics is in its infancy, a mechanistic view of what an individual is, I don't accept that, and I find it doesn't accord with my own experience, and that is why she's at the centre of the book yeah.

Melvyn Bragg : Graham Bullfield do you think that there is a danger, do you agree with Brian Appleyard, there is a danger that such genetic knowledge means that we will cease to celebrate difference or allow there to be the sort of variations that he's been discussing?

Graham Bullfield : No, I don't think so. I think we have to decide as a society where to draw lines. Let me give you a contrary example. Cancer is caused by a large number of genes and environmental factors all interacting and therefore if you had a predictive system for cancer it would be quite a complicated one and would try to indicate a number of lifestyle changes that could reduce your risk of getting it. Now generally speaking people don't change their lifestyles in response to that sort of prediction. However among cancer there are some sub categories which behave as single genes running in families, which it is possible to do early diagnosis and to identify the members of those families that are at risk, and to catch the cancer before it's had time to develop. Now that's an example of the sort of complexities that occur and in some circumstances where predictive screening can be useful, because it gives you a potential therapy and catches the disease before it's had time to take root. Now in the case of muscular dystrophy is an interesting one because a third of the cases are new mutations therefore you can't predict they're going to occur. But where people have had one child with muscular dystrophy and they've been offered pre-natal screening and therefore potential termination for other children, they generally refuse that pre-natal diagnosis or 90% of them, they just change their lifestyle, they don't have any more children.

So you know, you are offering them the opportunity and in a way you have to then balance between the individuals requirements and what society believes is right or wrong, and there's always a balance. I mean another example of that is in xenotransplantation, giving kidneys from pigs to humans, where there's a risk of maybe passing over pig viruses to humans. Now in the case of somebody who is dying and requires a kidney transplant, of which there is a very large number in the UK, it's not a choice for them, they'll take the pigs kidney and take a risk, but it's a choice for the rest of us, because it is a possibility of introducing a virus into the population.

So always there is balances between whether you can find a cure through doing early prediction, the balance between what the individual or the family requires, and also the balance between that and what society requires, so it's all a matter of drawing lines and taking things on a case by case basis, so there's no simple answers.

Melvyn Bragg : What...? From the way Graham Bullfield has been talking, and the way he described the way he approaches these things, Brian it does seem slightly to be against your alarm, your worry that the new genetics can be compared with two other quasi-scientific systems of this century, Nazism and Communism in its totalitarian enforcement of a particular point of view.

Brian Appleyard : No I didn't say that, I said that....

Melvyn Bragg : You do compare it with Nazism.

Brian Appleyard : No I don't. I suggest that we may indulge in a form of totalitarianism brought about by consumerism, that genetics on its own can't do that, of course, it's the way we use it. My concern is that you'll get a form of free market eugenics arising from genetics which I compare with a great danger. I mean I do think that at the end of the 20th century, in years to come, the scientific literature which is so prevalent now, in years to come will be seen as the most horrifically misguided stuff, to be writing this stuff at the end of the 20th century, in which two major and very scientifically influenced belief systems have caused such catastrophe would be extraordinary.

Melvyn Bragg : But can you compare the sort of complete pseudo-science which was spread on top of communism and Fascism, with the careful science of genetics and the other sciences which has been described and outlined though in brief, but still described in detail by Graham Bullfield, I don't see any comparison at all.

Brian Appleyard : It's very difficult to know when pseudo-science becomes other than science. I mean a lot of the biology in "Mein Kampf" was actually rather okay, at the time. It was "okay at the time". It was subsequently

found to be wrong, elements of it. Some of it still stands up actually. But if it is the arrogance of the contemporary is to assume that your knowledge is enough to do something. We must always be careful about that, because people have always assumed that in the past. Communism was based on what was thought to be a scientific analysis of Economic History. It wasn't seen to be wrong scientifically at the time.

Melvyn Bragg : How do you react to these comparisons?

Graham Bullfield : Well I've said already that one's own science is overturned in one's lifetime, and secondly I've also said that the knowledge itself has to be seen in a social context, and that of course is where "Mein Kampf" went wrong from our point of view, and I've already stressed that, so far, that that's essential that we do see everything in a social context, and we work out the ramifications of applying a particular genetic knowledge.

But could I come back to a more upbeat point? And say we are in the middle of a scientific revolution, when we do know the sequence of all the genes in humans, modern biology will begin to start. I think it is a dramatic change for biology to have the sequence and the knowledge of all the genes, and it will produce the rational therapies to a large number of diseases, where we have no therapies for at the moment, some of which are devastating.

So the advantages of being able to apply this knowledge are so dramatic that we do have to be very careful that we don't throw the baby out with the bath water, so we have to put the right regulations in place, and I think in the UK we do have the right regulations in place, to deal with some of these down sides.... the downside of this technology.

Melvyn Bragg : We haven't much time now Brian Appleyard, I'd like to briefly, very briefly come to the last, because underlying... you talk about science being wrong, which Graham Bullfield has admitted, in the sense that theories have changed, we've talked about Hitler and so on and so forth, but underneath your book, it seems to me, inside your book is a feeling, a sense that there's a spirituality, there's something to do with Roman Catholicism, something to do with a spirit of (indistinct) life which is a constant. Now morality changes too, artificial insemination was thought to be terribly wrong, at the time it came in, now it happens all over the place. Cloning human beings, which people have grave doubts about, some people have grave doubts about, might in ten years time be the way life goes, I don't know, but morality can shift as swiftly as science can't it?

Brian Appleyard : Morality tends to shift as swiftly as science, I don't think the underlying nature of morality shifts that much. I don't have a functional view of morality as many people do, I have a sort of transcendent view of morality, I think there are fundamental moral impulses to which we must, you know, to which we must subject ourselves. Now understanding those... ..

Melvyn Bragg : Does that mean that mean that for example there must be absolutely no abortion under any circumstances? Is that a fundamental thing?

Brian Appleyard : No that would be a I mean it refers to fundamental issues .

Melvyn Bragg : I don't see it as fundamental.

Brian Appleyard : No, you would have to say, "well what are the considerations involved in abortion?", and I think there are considerations that which the Roman Catholic church are absolutely right about. But on the other hand I understand that it's very difficult to take that simple an issue. But what I'm most concerned about... I mean it's very easy to get bogged down with particular issues many of which I admit, I haven't made up my mind about, and I can't answer simply.

But what I'm concerned about is pointing people to a form of language that would make these things coherent to themselves. I mean I think it's very difficult when you're deluged with news stories and particular ethical debates to make sense of these things, because people find it very difficult to refer to any sort of basis of morality or an ethical sense of the human being. I'm trying to point out that there are such ethical centres, that indeed our society is built on such ethical centres, one is the Christian view, and another is the Enlightenment view of the absolute nature of the individual as end not a means, and these are absolutely basic, and people need to address that.

Melvyn Bragg : Last word Graham Bullfield?

Graham Bullfield : Yeah, I'm impressed by, as time goes on, about how much more the public is beginning to understand of scientific issues. The questions I'm getting asked now are very much more sophisticated than I was

asked even only 2-3 years ago, and therefore I think that that proves that we've got to get out there and communicate to people.

Melvyn Bragg : Well thank you very much to Brian Appleyard and Graham Bullfield, and thank you very much for listening.