

Giving Your Genes to Biobank UK: Questions to Ask

A Report for GeneWatch UK by Kristina Staley

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INTRODUCTION

**You could soon
be asked to give a
sample of your
blood or cells to a
biobank**

Sometime soon you could be asked to give a sample of your blood or cells to a 'biobank' - a collection of genetic material linked to personal medical information. The number of biobanks is increasing in the UK and there are plans for a national collection involving half a million people. This might be expanded to include almost the whole UK population. This booklet aims to help you decide whether you want to take part. It describes what giving a sample entails, how biobanks operate and how well existing guidelines and legislation would protect you. It's impossible to predict exactly how biobanks will develop or what type of research they will be used for but the information here provides a guide to the general questions you might want to ask before signing up to any biobank project.

You may decide after reading this booklet that you wouldn't want to donate a sample unless the laws and safeguards were changed. For this reason, there is also information about what you could do to make a difference – how your involvement could help create the right conditions for your participation in the future.

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WHAT IS A BIOBANK?

1. What is a biobank? What are they used for?

Biobanks are simply repositories of large amounts of genetic and medical information. They contain biological samples from large numbers of people linked to information about their medical history and lifestyle. Each person's sample can be processed to obtain information about their genes. Comparing this genetic data with information about people's health is expected to show how genes and environment interact to cause common illnesses like heart disease and cancer. The aim is to identify the genes that make people more susceptible to these illnesses and to use this knowledge to create better medicines and vaccines.

Many different biobanks have been created for a variety of purposes (see Box A) but it's the new proposal for a national collection (Biobank UK) that's causing the biggest stir¹ (see Box B). This collection will be vast - much bigger than those in most other countries.

The aim is to identify the genes that make people more susceptible to certain diseases and to use this knowledge to create better medicines and vaccines

BOX A – Where are the existing biobanks in the UK?

There are lots of small collections used by academics studying families with a high incidence of disease – there may be as many as 300 in the field of cancer research alone. The Medical Research Council (MRC) is investing a further £12 million on new collections specific to heart disease, diabetes and mental health problems².

Some larger collections are also being developed including:

ALSPAC – the Avon Longitudinal Study of Parents and Children. 14,000 families from the Avon area have been monitored since 1991 with the aim of finding out how environmental and genetic factors influence the susceptibility of children and adults to disease. The parents have filled out questionnaires about their health and, from the age of seven, the children have been invited to take part in a number of different tests².

NCCGP – the North Cumbria Community Genetics Project. By December 2000, afterbirth samples from 5,200 babies and blood samples from 2,000 mothers had been collected – ultimately, 10,000 mothers and babies will be involved. This collection will be made available to researchers in many different areas of research³.

In the commercial world, pharmaceutical companies now routinely collect samples during clinical trials to study the genes of those people who respond well to a drug and those who experience adverse reactions. But there are also biotech companies (e.g. Oxagen in Oxford²) that are collecting samples from families with specific diseases. Oxagen is interested in osteoporosis, coronary artery disease, and autoimmune diseases like arthritis.

Further information on existing UK biobanks can be found on the GeneWatch UK website at www.genewatch.org

There may already be as many as 300 biobanks in the field of cancer research alone

Biobank UK is being developed jointly by the MRC, the Wellcome Trust and the Department of Health at an estimated cost of £60 million

BOX B – Biobank UK

Biobank UK is being developed jointly by the MRC, the Wellcome Trust and the Department of Health at an estimated cost of £60 million^{1,2}.

The plan is to collect 500,000 samples from men and women aged 45-60, the age when illnesses like heart disease and cancer are most common. The health of these people will be monitored over the next 10-20 years. Although the precise details of how it will operate are still being worked out, the biobank plans to be up and running by the end of 2002. The biggest challenges lie in generating high quality medical records and developing the technical expertise to link large databases of information. The Government's plans to create electronic records for every NHS patient are crucial here. (For further information, see <http://www.nhsia.nhs.uk>.)

2. What are the pros and cons of the biobank approach?

There are great expectations of biobanks. The research is promised to lead to new cures, new ways to prevent disease, and new drugs that could be specifically tailored to you or your condition. But it's not certain that the overall approach will work. More importantly, if information from the biobank got into the wrong hands, it could be used inappropriately to justify genetic discrimination (see Sections 4 and 5). If we want this type of research, we need to make sure it delivers real benefits and at no cost to the volunteers who take part.

Biobank UK will be vast - much bigger than existing biobanks in the UK or those in many other countries. But some scientists are voicing concerns that the data will be of poor quality and so of limited use. The main criticisms are that:

- **the information in the biobank won't be accurate or complete.**

Information about people's health and lifestyle will come directly from their medical records but doctors don't yet collect this information in a standard way⁴. People don't always tell the truth about their habits and it's unlikely that all the environmental factors like exposure to toxins and pollutants will be included. Some scientists are arguing that to get useful information, participants would need to undergo many more clinical tests, but this would greatly increase the costs⁵.

- **Biobank UK won't offer any real advantage over other types of genetic research.**

A large number of samples are required to ensure the results are statistically significant. Researchers have to prove that genetic differences between people are meaningful and not just part of normal variation, like having different coloured hair or eyes. The number of false statistical links between genes and ill-health may be enormous and will all have to be checked out^{6,7}. Will this really speed up the progress of genetic research?

With your support, important and necessary safeguards can be put in place before the UK national biobank goes ahead.

Useful addresses:

Dr Mike Dexter
Director
The Wellcome Trust
The Wellcome Building
183 Euston Road
London NW1 2BE
Email: m.dexter@wellcome.ac.uk

Professor Sir George Radda
Chief Executive
Medical Research Council
20 Park Crescent
London W1B 1AL

Email: george.radda@headoffice.mrc.ac.uk

The Rt. Hon. Alan Milburn, MP
Secretary of State
The Department of Health
Richmond House
Whitehall
London
SW1A 2NL

Email: dhmail@doh.gsi.gov.uk

"Your MP"
House of Commons
Westminster
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NB: You can also fax your MP direct from www.faxyourmp.com

Some scientists are voicing concerns that the data will be of poor quality and so of limited use

Raise your concerns about Biobank UK with your MP, the Wellcome Trust and the MRC

In your letters, explain the problems that could arise with the research planned for Biobank UK. These could include:

- creating a 'genetic underclass' of people who are excluded from jobs or from insurance;
- allowing companies to use patents on your genes to limit medical research by others;
- not being able to give informed consent when the future direction of research is unknown;
- failing to keep your genetic information strictly confidential;
- wasting NHS resources on poorly designed research, which could show spurious links between genes and diseases or behaviour.

Ask your MP and the Wellcome Trust/MRC to support the following safeguards before Biobank UK can go ahead:

- new laws to prevent insurers or employers using your genetic information to discriminate against you. The current five-year moratorium is not enough – genetic tests done now could be used against you or others in the future;
- new laws to regulate the commercial use of biobanks and stop the patenting of genes;
- new democratic mechanisms so that you can have a say in future biobank research;
- a commitment to an independent scientific review of the Biobank UK research proposals.

You could also ask your MP and the Wellcome Trust/MRC to urge the Government to sign the European Convention on Human Rights and Biomedicine.

You can keep yourself informed of developments by visiting the GeneWatch UK website at www.genewatch.org. This will be regularly updated to provide details of existing UK biobanks and how they are being used. You will also find information on:

- Government legislation and guidance;
- professional guidelines;
- GeneWatch reports and press releases;
- other relevant organisations and genetics news websites.

You can also take action directly from the website by:

- faxing your MP;
- emailing the Wellcome Trust and Medical Research Council (MRC);
- downloading a leaflet about biobanks to distribute to libraries, hospitals and doctors' surgeries;
- signing a petition against genetic discrimination;
- supporting GeneWatch UK.

• **the results won't be useful to the people who take part.**

Even if the research does show a genetic influence on risk of disease, the effect is likely to be small. In this case, the genes discovered as a result of the biobank research won't mean much to you as an individual, or to others. Most genetic tests discovered as a result of the research are unlikely to help doctors make a detailed prognosis or decide on treatment (see Box C).

Given these concerns, it is questionable whether such an expensive project is a good use of public money. Creating and running the biobank will also place huge demands on GPs and nurses. While the NHS faces a crisis because of a shortage of staff, we have to ask whether taking part in this research is a justifiable use of their time.

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BOX C – Interpreting (and misinterpreting) genetic risk

Much of the research carried out using biobanks will study common diseases where the impact of genes is known to be small. So the results are unlikely to be of much use to individuals, as illustrated by the following example.

If you compared a large group of people with Alzheimer's disease with a similar group of people who didn't have Alzheimer's, many more people in the Alzheimer's group would have a particular form of the ApoE gene, known as ApoE4⁸. The conclusion is that having an ApoE4 gene increases your risk of getting Alzheimer's.

But a closer look at the data would show that nearly half of the people with Alzheimer's don't have the ApoE4 form of the gene. More importantly, over 70% of people with an ApoE4 gene don't get Alzheimer's.

Q: What could you conclude about your risk of getting Alzheimer's disease if you found out you had the ApoE4 form of the gene?

A: Not much. Your risk might be slightly greater, but not that much greater than other people's. No-one could be certain whether you would get Alzheimer's in later life.

Researchers hope that the genetic information that comes out of biobank research will have more predictive value than this. But given the complexity of the common diseases and the huge influence of environmental factors, it's more likely that most information will fall into the ApoE4 category, or worse.

3. What research will be carried out using biobanks?

A major concern is that biobanks could be used for research that is morally questionable⁹. For example, they could be used to find apparent genetic links to:

- human behaviour (e.g. criminal behaviour, alcoholism or homosexuality);
- non-medical conditions (e.g. obesity, intelligence or beauty);

or even to design biological weapons.

A major concern is that biobanks could be used for research that is morally questionable

There is a danger that the wider social and environmental causes of ill-health will be ignored

Such research raises the spectre of eugenics and fuels the prospect of 'designer babies'¹⁰. Even if the research were limited to the strictly medical, the whole approach still reinforces the overly-simplistic view that our genes make us who we are. There's a danger that the wider social and environmental causes of ill-health will be ignored.

The results of any beneficial medical research also have the potential to be misused, particularly if they lead to genetic tests for people's susceptibility to illnesses like cancer. Even though the data will be unreliable, employers or insurers could use the results of such tests to exclude people with the 'wrong genes' from jobs or insurance policies¹¹ (see Section 5).

Companies might use the biobanks to go fishing for genes to patent. Patents could stifle further research by giving exclusive rights to the use of these genes to a single commercial organisation¹² (see Sections 16 and 17).

These issues raise important questions for us all as UK citizens.

HOW COULD CONDITIONS FOR TAKING PART IN GENETIC RESEARCH BE IMPROVED?

22. What needs to change?

Human genetics research has the potential to lead to medical benefits but the results of this research could also be abused to promote genetic discrimination or compromise basic human rights. It is therefore essential that any biobank - particularly one that involves such large numbers of people as the UK national biobank - must have the right safeguards in place at the very beginning. The biobank must be designed and used in a way that maximises the potential benefits and prevents any possible abuses.

At GeneWatch, we conclude that the following changes should be made to enable the UK national biobank (Biobank UK) to become a viable option:

- New legislation should be introduced to prevent all forms of genetic discrimination and prohibit insurers and employers from using genetic test data. More people are likely to participate in research if they can be certain the information cannot be used to discriminate against them.
- The UK Government should ratify and sign the European Convention on Human Rights and Biomedicine.
- Legal clarification is required as to when genetic information can be disclosed without consent, particularly in relation to family members, the courts and the police.
- New legislation is required to regulate the commercial use of biobank collections.
- The patenting of genes should be ended and the functioning of the Patent Office brought under closer scrutiny.
- Scientific concerns about the accuracy, completeness and medical usefulness of biobanks must be addressed and the costs publicly justified.
- New democratic mechanisms should be established to ensure effective public involvement in deciding how biobanks are used and operate.
- New monitoring and enforcement mechanisms should be established to ensure that genetics research does meet the required ethical standards in practice.

The proposed UK collection (Biobank UK) should be shelved until these issues have been resolved and the necessary legislation put in place.

23. What can I do to make a difference?

There are many things you can do to help make a difference. You might want to start by writing to the Wellcome Trust and the Medical Research Council (MRC), who plan to fund Biobank UK, and to your MP. In addition, you may wish to raise your concerns with the Department of Health. (See p35 for addresses.)

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The patenting of genes should be ended and the functioning of the Patent Office brought under closer scrutiny

The proposals for overseeing Biobank UK state that there will be two rounds of independent review:

- a. All proposals will be reviewed by relevant experts to obtain independent advice on the quality of the research. Projects that unnecessarily duplicate other work and research of poor quality will be considered an unethical waste of resources and will not be allowed to go ahead.
- b. An independent regulatory body will be established with 'key representatives on its board including lay members and a study participant'^{2,4}. Members will be recruited through public advertisement.

This body will oversee:

- custodianship of the DNA samples;
- management of the collection;
- application of ethical codes;
- principles guiding priority setting for research;
- quality of information available to participants;
- handling of complaints.

How well are my interests protected?

As an individual participant, you have a right to withdraw from a research study at any time. It should result in the destruction of your sample and related data. As one of the most likely reasons for withdrawing is concern about the direction of the research, you must be kept informed of the future research agenda. You could claim that not knowing about the direction of research would render your original consent invalid.

You might also be asked to consent to an independent body taking responsibility for deciding what biobanks are used for. Most of the professional guidance and independent reviews are supportive of such proposals:

- The House of Lords' investigation of biobanks proposed that a Medical Data Panel with professional and lay members should oversee the use of all biobanks in the UK⁴. All local research ethics committees would have to operate within its policies.
- In the Health and Social Care Act that became law in May 2001, the Department of Health proposed that a new statutory body, the Patient Information Advisory Group, be created to oversee access and use of all NHS patient records³⁵. This body will also have lay and professional members.
- The Research Governance Framework states that "*participants or their representatives should wherever possible be involved in the design, conduct, analysis and reporting of research*"³⁶.
- The Commons Public Administration Select Committee noted in their report '*Innovations in Citizen Participation in Government*' that the parliamentary vote on stem cell research could have been usefully informed by a citizen's panel or jury exercise⁵⁷. They concluded that such "*deliberative techniques should be routinely employed to explore the views of citizens on issues involving scientific uncertainty*".

So there is a move towards creating more democratic decision-making processes in relation to the use and operation of the biobanks. However, it remains to be seen how these panels and groups will work in practice, whether they will agree a common set of standards, and how much power will be given to lay members and/or research participants. You should be certain that any decision-making process is one that you can trust. You might also want to apply to become a member of the panel yourself.

WHAT IS SO SPECIAL ABOUT GENETIC INFORMATION?

4. What is unique about genetic information?

Genetic information is unlike any other information about you because:

- it is unique to you (unless you have an identical twin) so it can be used to identify you in the same way as a fingerprint;
- it may indicate a *risk* (but not a certainty) of developing an illness in the future;
- it shows who's related to you and whether they are at risk of future illness.

But importantly, in the vast majority of cases, knowing that you have a gene variation that is linked to cancer, for example, doesn't mean that you will definitely get the disease. Even in the rare case of Huntington's disease, where everyone who has a particular gene variation gets Huntington's, knowing that you have that gene doesn't tell you *when* you will get ill or *how severe* your illness will be¹¹.

Some professionals claim that genetic information is just like any other information contained in your medical records. But medical records are only created when you visit the doctor – because you already feel unwell or want to have a routine check-up. Information about genetic risk might be obtained when you've not even been examined - for example, if your parents or siblings are found to be at risk. It can also be obtained long before you have any physical symptoms - even before you're born.

Your family history can also sometimes tell you or others something about your future health but genetic information is more detailed and easier to obtain without your knowledge.

Genetic information about you could also be misused – for example, insurers or employers could use genetic tests to decide who gets access to insurance and jobs (see Section 5).

5. Is there a danger of genetic discrimination?

The real worry is that other people might unwittingly or even deliberately misinterpret information about your genes. They might think (wrongly) that a genetic risk is an absolute certainty. Insurers and employers could use such information to deny you life insurance or a job. Such forms of genetic discrimination have already been seen in the USA (see Box D).

Only one UK employer, the Ministry of Defence, currently tests employees for a genetic disorder - sickle cell disease - that may cause problems for pilots at high altitudes. But there's a strong likelihood that genetic tests will be more widely used by employers in the future. There haven't been any examples of genetic discrimination yet in the UK but there's no law to prevent discrimination either¹¹.

Knowing that you have a gene variation that is linked to cancer doesn't mean that you will definitely get the disease

Insurers and employers could use genetic information to deny you life insurance or a job

Without legal safeguards, people who take genetic tests might be discriminated against

In a UK survey, a third of people with a genetic illness had experienced difficulties obtaining insurance

It is important to remember that the results of genetic research are not the same as the results of clinical genetic tests. They have even less predictive value and are more unreliable. Insurers and employers would be seriously misguided if they used results from genetic research as the basis for any employment or insurance policy decision. However, research from biobanks is likely to lead to new *clinical* tests being developed. Without legal safeguards in place, it is possible that people who take these tests in the future might be discriminated against.

How well are my interests protected?

(a) Genetic discrimination and insurance

UK insurers, bound only by a voluntary agreement between the Association of British Insurers (ABI) and the Government, are not allowed to ask you to take a genetic test. They *are* allowed to ask you for results of previous genetic tests, but only if your family has a history of Huntington's disease and you are seeking life insurance for over £500,000 or over £300,000 of critical illness, income protection or long term care insurance. Insurers have said they will not ask for the results of genetic tests taken for research purposes.

But there is no law to stop insurance companies discriminating against you. The ABI's agreement with the Government is for a five-year period only. During this time, other genetic tests will be approved for use by insurers and added to a Government-approved list. Currently, tests for some kinds of breast cancer and Alzheimer's disease that run in families are being considered for this list. The ABI's professional code is only voluntary and some companies have a history of ignoring it¹⁵.

In a UK survey, a third of people with a genetic illness had experienced difficulties obtaining insurance¹⁶. If you felt an insurance company had treated you unfairly, you would need to try to resolve the issue with the company. If it remained unresolved, you would be able to have your case reviewed by an independent tribunal.

(b) Genetic discrimination and employment

The Disability Discrimination Act of 1995¹⁷ would protect your employment rights if you were already sick or disabled. But it does not offer any protection if you are physically well but denied a job because of your genetic risk of future illness. In contrast, the European Convention on Human Rights and Biomedicine (1997)¹⁸ prohibits "*any form of discrimination against a person on the grounds of his or her genetic heritage*". If the UK were to sign up to the Convention, it would have to become an integral part of UK law but the UK is amongst 13 out of 43 countries that have not yet signed¹⁸.

WILL I HAVE A SAY IN THE RESEARCH?

20. Who decides whether biobank research is acceptable?

Biobanks could be used for research that you think is morally unacceptable. The question then is who decides what research gets done? As an individual, you are free to withdraw your own sample if you don't like the direction in which the research is heading but you can't yet influence whether the research gets done at all. This is an extremely passive form of decision-making. As a potential participant - or just as a UK citizen - there should be more opportunities for you to have your say.

Independent local research ethics committees (LRECs) currently decide whether any given research proposal is ethical². Their duty is to protect "*the dignity, rights, safety and well-being of participants*". However, the system has been generally criticised because LRECs:

- do not have to publicly justify their decisions - all their meetings are held in private⁵⁵;
- do not operate according to universal standards and so vary in their decisions across the UK;
- have no responsibility for pro-active monitoring of research to enforce good practice.

Specifically in relation to biobanks, there are also questions as to whether LRECs have sufficient training or expertise to oversee human genetics research. In particular, they may find it difficult to assess the risks of psychological or social harm as opposed to physical harm, and discrimination against communities as opposed to risks to individuals²⁴.

These weaknesses have been recognised. The Department of Health ordered a review of LREC function in parallel with the development of the research governance framework. The new arrangements, published in July 2001, aim to strengthen the LREC role, to make their operations more transparent and to establish a common set of standards throughout the NHS⁵⁶. But it is not enough to issue central guidance without establishing a framework for subsequently monitoring its application in practice. The decision-making processes of the LRECs need to be audited and the quality of their judgements regularly reviewed.

21. Who will oversee the research and make sure it's in the public interest?

Given the sensitivities around genetic research, it is accepted that biobanks may need independent bodies to oversee individual collections in addition to the involvement of LRECs. For example, the North Cumbria Community Genetics Project (see Box A) has established an independent expert committee that has drawn up a public statement on acceptable uses of the database and will advise on the acceptability of new proposals³. However, a voluntary agreement to follow ethics committee guidelines is no substitute for legislation. Legal enforcement may be necessary to prevent genetic discrimination.

You are free to withdraw your own sample if you don't like the direction in which the research is heading but you can't yet influence whether the research gets done at all

The decision-making processes of local research ethics committees need to be audited and the quality of their judgements regularly reviewed

Companies could be required to return a share of the profits back into the NHS or to price products fairly

There are arguments against you as an individual profiting from research. For example, if you were paid for your sample, vulnerable people could be exploited through the sale of body parts (see Section 15). In any case, it would be impossible to quantify the contribution made by your particular sample and so determine what your share of the profits should be. However, the case can be made for publicly supported research being matched by a suitable social return. Dr David King of Human Genetics Alert suggested to the House of Lords Committee that companies could be required to return a share of the profits back into the NHS or to price products fairly, perhaps at a reduced rate to the population on which the research was based². The Human Genome Organisation (HUGO) ethics committee recommends this should be 1-3% of the net profit⁵³ but other commentators have suggested it should be as high as 10%^{2,45}. In the case of the Icelandic population biobank, contractual agreements ensure that any drug that comes out of the research will be made freely available to the Icelandic people⁵⁴.

BOX D – Genetic discrimination at work

Case 1 – In February 2001, the US Equal Employment Opportunity Commission filed its first court action challenging genetic testing by the Burlington Northern Santa Fe Railway Company¹³. The company had asked union members who claimed work-related carpal-tunnel syndrome to provide blood samples for a DNA test for an inherited risk of this condition. The only conceivable explanation is that the company wanted to use the results of genetic tests to argue that the workers would have got carpal tunnel syndrome anyway and so shouldn't get compensation. The Commission has asked the court to order the company to put a halt to this policy. As it stands, it is a violation of the Americans with Disabilities Act 1990.

Case 2 - In April 1999, Terri Seargent went to her doctor with slight breathing difficulties. A genetic test confirmed that she had alpha-1 deficiency, which had caused the death of her brother. The test probably saved her life because the condition is treatable if detected early. But when her employer found out, she was fired. She is now self-employed¹⁴.

A US company sacked an employee when a genetic test showed she had a treatable genetic illness

WHAT HAPPENS WHEN I GIVE A SAMPLE TO A BIOBANK?

6. What is involved in giving a sample? What personal information will I be asked to give about my health and lifestyle?

You might be asked to give a blood or tissue sample to a biobank:

- if you undergo medical tests or treatment, to contribute to research into a particular disease;
- if you participate in a clinical trial, for research into the effects of a drug;
- during your next routine visit to your GP or by letter of invitation from your GP's surgery. This doesn't mean you are ill. Many collections depend on healthy volunteers.

The 'sample' is likely to be a 35-50 millilitre sample of your blood⁵. The white blood cells provide a source of DNA. But since DNA (the genetic material) is found in every cell in your body, any tissue would do - cells scraped from the inside of your cheek, or tissue collected during a biopsy or following surgery. Obviously, each sample is finite. Only so much DNA can be extracted from it. So there's a chance you may be asked to give a repeat sample in the future.

As well as a blood or cell sample, you will be asked for details about your medical history and lifestyle

At the same time as giving a sample, you will be asked to give some details about your medical history and lifestyle, and/or give the researchers permission to access your medical records. You may also be asked to persuade other family members to become involved. In the North Cumbria Community Genetics Project³ - a study of mothers and babies - the mothers are asked questions about:

- their ethnic background;
- their education record – exams passed at school or university;
- their employment over the last 5 years and whether any job involved working with chemicals or food;
- whether they smoke or have ever smoked;
- history of illness in their family.

The same questions are asked of the baby's father. The mothers are also asked for permission to access their medical records and whether they would be willing to fill out more questionnaires in the future.

7. What's involved in giving my 'consent'?

Before giving any information about yourself or donating a sample, you will be asked to sign a consent form. This confirms that you have freely and willingly given your informed consent to take part in the study. You should have been given all the information you need to fully understand the project and a complete explanation of what will happen to you, your sample and your data. Your involvement must be entirely voluntary. You can also withdraw at any time without having to give a reason. If they can be traced (see Section 10), your sample and your records will be destroyed.

Your involvement must be entirely voluntary and you can withdraw at any time without having to give a reason

BOX M - The Case of R. v Dept of Health ex parte Source Informatics Ltd

The company Source Informatics Ltd requested access to anonymised data from patients' prescription forms. This information would be of great commercial value to pharmaceutical companies wishing to market their products more effectively because they could find out more about how their products were being used. Source Informatics wanted to create a database for this purpose, paying a small fee to the GPs and pharmacists for their trouble. The Department of Health (DH) refused them access on the basis that it would be a 'breach of patients' confidentiality'. Source Informatics went to court but the judge ruled in favour of the DH. On appeal, this decision was reversed. The Court of Appeal concluded that personal information can be used for public health research purposes providing that appropriate steps are taken to conceal the participants' identities⁵¹.

19. Who owns and profits from the information that comes out of the research?

Research findings from biobanks will be patented in the normal way (see Sections 16 and 17). The companies that own the patents will own the information. At this late stage in the process there is likely to be a certain amount of invention in converting research findings into therapeutic products. The pharmaceutical companies claim that it costs £200-300 million to bring each product to market. It is this financial investment and the level of invention that is said to justify the use of patents.

The development of commercial products from biobank research will only be possible if people donate their samples and if large sums of public money are invested in creating and maintaining the databases. Is it right that only the companies make a profit? Some patient groups in the US have taken control of sample collections themselves to ensure that profits are reinvested back into further research (see Box N).

BOX N – Who profits from biobank research?

Sharon Terry had two children with a rare genetic condition, pseudoxanthoma elasticum. It causes mineralisation of elastic tissue, the most serious consequence being blindness. Sharon wanted to help promote further research to find a cure so she established a foundation, PX International, found 2,000 people with the disease, set up a repository of tissue samples and raised money for research. It took over four years. Now the foundation takes precautionary steps when signing contracts with researchers to ensure that the organisation will have rights to a share in the profits from any patent that might arise. The foundation will then ensure that this profit goes back into further research and that any genetic tests become freely available⁵².

The development of commercial products from biobank research will only be possible if people donate their samples and if large sums of public money are invested in creating and maintaining the databases

An American family are suing a researcher and a children's hospital on the grounds that they have severely impeded further study of a fatal genetic disease

BOX L - Who owns your genes?

The Greenbergs had two children who became extremely ill and sadly died at a very young age. They were diagnosed as having Canavan disease, a rare and fatal genetic condition that is almost exclusively found in Ashkenazi Jews. The family wanted to support further research into the condition and started a campaign to raise funds. They also helped co-ordinate the collection of samples from a large number of affected families. A researcher from the Miami Children's Hospital, Dr Matalon, made use of these samples to identify the underlying gene mutation. He also obtained a substantial amount of funding for the study from the hospital. In return, he was obliged to sign over any rights to his intellectual property. Dr Matalon subsequently moved on but the hospital kept control of the commercial uses of his discovery.

When the genetic test for Canavan disease was developed, the hospital decided to charge a \$12.50 royalty fee for its use. This may not seem expensive but genetic testing laboratories usually offer hundreds of tests, so the combined royalty fees can quickly become onerous. The hospital also restricted the number of laboratories that could do the test and the number performed each year. They claimed this would help attract one large company to carry out all the testing with an exclusive licence.

The families were outraged. They thought the test should be made available to all clinical laboratories free of charge. They argued that if they had known that the gene was going to be patented they would not have agreed to work with Dr Matalon. They would have found another researcher to carry out what is widely agreed to be an obvious task. The Greenbergs are now suing the researcher and the children's hospital with the claim that the strictly enforced licensing has severely impeded further study of the Canavan disease⁴⁸.

18. Who owns my medical records?

Your records are generally thought to be owned by the NHS but the NHS is really more of a custodian. You can freely access your records while no-one outside of the medical profession can view them without your permission.

The information in your records is protected by common law principles of confidentiality, professional codes of conduct, the Data Protection Act 1998, and your right to privacy as described by the Human Rights Act 1998. However, if the information is anonymised, your records can be used without your consent for the purposes of medical research (see Box M). As discussed in Section 9, the NHS and other professional guidelines state that you should be made aware of this possibility and given the choice to opt out. Whilst your data can still be linked to you, you can refuse to consent to your information being anonymised.

There are professional guidelines as to how your informed consent should be obtained¹⁹⁻²¹. Information about the research and its implications must be provided in writing. You must be given time to read and consider it - over days rather than hours - and time to ask any further questions if necessary. However, there is still much debate as to exactly how much information should be given to you to be certain that your consent has been truly 'informed' (see Section 8). You also might not be informed if the aims of the research change later on (see Sections 20 and 21).

How well are my interests protected?

The principle of informed consent is one of the fundamental principles of ethical research and is enshrined in medical law. Since the Nuremberg Trials at the end of the Second World War, when Nazi scientists were accused of conducting torturous experiments in the concentration camps, the medical and scientific professions across the world have been united in their support for protecting the rights of people who take part in research. The Trials resulted in the Nuremberg Code (1947) that is central to all legislation and guidelines governing research at an international and national level²².

However, the principle of consent was established to ensure that patients fully understand the *physical* risks and benefits of any medical tests or treatments they receive. There's still some uncertainty as to the application of the principle in the context of genetic research. With genetic research, there is very little risk of physical harm but the results can be psychologically or socially damaging and/or a serious threat to individual privacy. There is some concern that the current guidelines and legislation around participation in medical research (see Box E) may not meet all the complex challenges posed by human genetics²³.

The principle of informed consent is one of the fundamental principles of ethical research and is enshrined in medical law

Current guidelines and legislation around participation in medical research may not meet all the complex challenges posed by human genetics

There is no legislation to regulate medical research on people even though there is a law to regulate research on animals

There is growing public concern over the effectiveness of professional self-regulation following the recent medical scandals in the UK involving the unauthorised use of body parts

BOX E – Regulation of medical research in the UK

There is no legislation to regulate medical research on people even though there is a law to regulate research on animals – the Animals (Scientific Procedures) Act 1986²⁴.

Research is generally self-regulated via a system of professional guidelines issued by the Department of Health (DH), the Medical Research Council (MRC), the General Medical Council (GMC) and the Royal Colleges. These guidelines draw on principles that have been set at an international level by such bodies as the World Medical Association (WMA), the World Health Organisation (WHO) and the Human Genetics Organisation (HUGO). Further details of relevant guidelines and laws can be found on the GeneWatch UK website (www.genewatch.org).

The guidelines do have semi-legal status as they are considered to set the standards for 'lawful medical research practice'. Any medical professional who failed to act within the GMC guidelines would be struck off the register. Any researcher funded by, for example, the MRC (and every other researcher collaborating with them) would have to follow the guidelines as a condition of getting funding. However, there are serious limitations to this regulatory approach:

- guidelines tend to rely on vague terms such as 'minimal risk' that may mean different things to different people. This means they are likely to be applied in different ways across the country;
- there is growing public concern over the effectiveness of professional self-regulation following the recent medical scandals in the UK involving the unauthorised use of body parts²⁴. In a recent MORI poll, 75% of those polled thought that "rules and regulations are not keeping pace with new scientific developments"²⁵;
- there is currently no system to ensure these guidelines are enforced. It is not enough to know what standards should apply - it is also vital to ensure these standards are applied in practice.

8. What information should I be given before I agree to take part?

Not all of the professions are in agreement as to what information ought to be provided to you. In the best-case scenario, you should be given information on all of the following^{19,20,26-28}:

- the nature and purpose of the research;
- potential benefits to others and to science;
- why you are being asked to participate;
- the exact nature of any procedures (e.g. giving a blood sample);
- how your sample will be stored and for how long;
- the nature of possible risks and discomforts for either you or your family;
- whether you and/or your family will be told of the results of the research;

BOX K – Reaping the benefits without the cost

The company Human Genome Sciences (HGS) patented a gene called CCR5 without knowing anything about its function. Another group of researchers later discovered that CCR5 encodes the receptor that allows the AIDS virus to enter cells. CCR5 thus appears to be a potentially lucrative drug target. HGS have since licensed the use of the gene for developing AIDS therapies, even though they had no input whatsoever into the discovery. They will reap all the rewards without doing any of the original research. Even worse, the introduction of licensing fees will make any final treatment more expensive⁴⁷.

The biggest concern over the patenting of genes is that companies will end up with too much control over the future of medicine¹². They will be able to decide whether development of a genetic technology is in their interest and could block others from carrying out the work. No-one would want to invest in research and development on an already patented gene because developing an actual product would not be possible unless the patent holders agreed to a licence. Thus, patents may actually hinder the progress of medical research. A family in the US have sued a patent holder on exactly this basis (see Box L).

17. Will any of my genes be patented? If so, will I know who has the patent and how they are using it?

The European Directive on the legal protection of biotechnological inventions⁴⁹ has now been incorporated into UK law. This means that legally your genes could be patented, but only if:

- an industrial application is included in the patent;
- the granting of the patent does not lead to a 'restriction of access to life-saving treatment'.

In most cases, it's up to the Patent Office to decide if these conditions are met and there are serious questions as to whether they are effectively carrying out this task⁵⁰. In the case of the UK national biobank (Biobank UK), the sponsors have declared that they will not allow basic genetic information to be patented². However, it is not clear at which point in the research process patenting will be allowed. It may still be too early.

As the donor, you would not be entitled under patent law to own the patent but you should be asked for your consent if your genes are going to be patented. The recitals (the introduction) to the European Directive say that "if an invention is based on biological material from a person, then they must have had an opportunity to express free and informed consent before a patent is granted". However, recitals can be ignored. It's up to the member states whether this condition becomes part of the legislation and the UK has chosen not to implement any such consent requirement.

The biggest concern over the patenting of genes is that companies will end up with too much control over the future of medicine

BOX J – The case of John Moore

John Moore, a US citizen, had a rare form of leukaemia that required the removal of his spleen. Without him knowing, his doctors kept some of his spleen cells and patented a cell line derived from them. Mr Moore took the researchers to court arguing that the cells were his property. However, in 1990, the Supreme Court concluded that his tissue had effectively been abandoned and that he had no property rights to cells taken from his body. There was a question as to whether the doctors had failed in their duty to obtain Moore's informed consent. However, the case was subsequently settled out of court, so this question was never resolved⁴³.

16. Who owns the genetic information in the biobank?

Once your sample has been processed to extract DNA and your DNA analysed for genetic information, it becomes something entirely different in the eyes of the law. It is now information protected by the specifications of the Data Protection Act and its commercial exploitation is governed by patent law. Patents protect the ideas behind inventions²³ and give the patent owner rights to:

- sue if someone develops their invention for profit without their permission;
- license their invention (i.e. charge for its use);
- exploit the full commercial potential of their patent for 20 years.

Patenting genes is highly controversial. It has been challenged on the basis that:

- genes exist in nature so can only be discovered, not invented;
- it is immoral to seek financial reward from the exploitation of any part of a human being;
- our genes are a shared human resource and should be made publicly available;
- research will be hindered by restricting access to basic genetic information;
- with the right technology, anyone can process samples for genetic information so it's an obvious (not original) thing to do.

But with the promise of huge financial rewards from any new drug or treatment, numerous companies have rushed to patent as many genes as possible⁴⁵. They have been able to gain far broader patents than normal because they have patented their findings much earlier in the research process. It has not even been necessary to know what a gene *does*. This means that companies may profit from genetic information without having done any of the hard work themselves (see Box K). This 'genetic gold rush' has come under severe criticism as a waste of resources - money that could have been better spent on basic research rather than "amassing stockpiles of poorly characterised intellectual property"⁴⁶.

With the promise of huge financial rewards from any new drug or treatment, numerous companies have rushed to patent as many genes as possible

- whether you will be provided with genetic counselling if the results are reported back to you;
- how your records will be kept confidential;
- who is responsible for the custodianship of the database to ensure confidentiality is protected;
- who will be given access to the biobank and who will be denied access – other researchers, health professionals, your relatives, your employer, your insurance company, the police?
- whether commercial companies will have access to the biobank;
- whether the results of the research will be patented;
- whether or how any commercial benefits of the research will be shared with the community that takes part;
- how you will find out about new research directions before studies begin;
- confirmation of your right to withdraw at any time and how to withdraw;
- confirmation of your right to unrestricted healthcare even if you withdraw from the study;
- a point of contact for further information.

The biggest bone of contention is the first point – the nature and purpose of the research - simply because no-one knows what research will be carried out using biobanks in the future. It's impossible to predict how the science will develop over the next 10-30 years. Without this information, how could the consent you give now be considered valid at a later date?

It is impossible to predict how the science will develop over the next 10-30 years

A number of ways have been suggested to get round this problem:

- **You could be asked to give a 'blanket consent' for 'any type of genetic research in the future'.**

BUT this makes a nonsense of the principle of *informed* consent. It severely restricts your freedom to choose whether or not to participate in any given piece of research. There may be some types of genetic research that you definitely wouldn't want to take part in (see Section 3).

- **You could be asked to give consent to specific types of genetic research** - for example, heart disease or cancer research, or only medically related research. This approach is favoured by the MRC.

BUT it is not so easy to categorise research in this way. A result in one area can have unexpected outcomes in another and it's hard to define what is strictly medical - does research into obesity or dyslexia count as medical research? Even strictly medical research can still lead to genetic discrimination - for example, if people at risk of a heart attack were denied jobs or insurance (see Section 5).

- **You could be asked to give your consent before the start of every single study that wants to use your sample.**

BUT this could mean endless letters or telephone calls from researchers. Would this be too much of a burden for participants? It would certainly increase the costs of the research. This approach was favoured in a MORI

poll²⁵ - 82% of those polled thought fresh consent should be sought for new research.

A universal set of standards urgently needs to be agreed by potential participants and the professionals

This issue has yet to be resolved. Clearly, a universal set of standards urgently needs to be agreed by potential participants and the professionals. These also need to take into account the issues raised by research which involves children or people with mental health problems. But it is important that obtaining consent is not simply viewed as 'ticking a box'. It should really take the form of ongoing dialogue between researchers and participants to ensure openness and transparency and to create a climate of trust. The same can be said of the important question of who decides what research gets done. This issue is discussed in more detail in Sections 20 and 21.

9. Will my sample ever be used for research without my consent?

Until the beginning of 2001, your doctor could have used your sample for some research purposes without having to ask for your consent – but only under the following conditions:

- if the research was considered to be in the public interest as judged by a research ethics committee (see Section 20);
- if your sample was anonymised - i.e. it could not be traced back to you (see Section 10).

But all this changed in the light of the implementation of the Data Protection Act²⁹. The General Medical Council (GMC) altered their guidelines to suggest that doctors should seek informed consent for every use of a patient's sample, irrespective of whether it was anonymised³⁰. They recognised the need to protect people's autonomy in making decisions about where their personal information goes and what it gets used for. The recent scandal at Alder Hey³¹ has added to the pressure for transparency.

The idea that consent is needed for every use of medical information has met with strong opposition from doctors. It would prove very costly and time-consuming. For example, a GP might want to pass on general information about the number of his/her patients that have cancer or how they have responded to treatment. This information is essential for assessing the effectiveness of NHS services. Is it necessary for GPs to seek consent from thousands of people to pass on such non-specific details?

The GMC seems to have settled on the following solution: you should be told if your sample is going to be used anonymously for this kind of public health related research and should be given a genuine choice to 'opt out' if you so wish. This means that your sample cannot be used without your permission if there's any way the sample can be linked back to you. However, it remains to be seen how this system will be put into operation.

The recent scandal at Alder Hey has added to the pressure for transparency

WHO WILL OWN AND PROFIT FROM BIOBANK UK?

15. Who owns the samples in the biobank?

In law it is not possible to own a dead body. However, it is still unclear whether you can own parts of your body once they have been removed⁴³. Tissue samples have been given the status of property but only in circumstances when:

- samples have been stolen in cases relating to samples of hair, urine and blood;
- body parts have acquired different attributes via the application of a skill, such as dissection or preservation;
- relatives have wished to bury/cremate a body.

This case law could be interpreted to mean that once a DNA sample had been isolated from your tissue, it would become the property of the researcher. The researcher could then use it in any way he/she saw fit without having to ask for your permission. New legislation is required to resolve this issue.

While the legal position remains uncertain, what happens to your tissue is governed by your informed consent (see Sections 7, 8 and 9). This becomes particularly important in relation to any tissue removed for purposes other than research - for example, tissue removed during an operation. Unless made explicit, this 'waste' tissue can be thought of as abandoned, leaving you with no control over its future use (see Box J).

The professional guidelines have tended to avoid the issue of ownership and focus on the ethical concerns over what is done with your tissue^{19,44}. They recommend that instead of being 'owned', publicly funded sample collections should be managed by a 'custodian'. The custodian would have a responsibility for:

- safe storage of tissue samples;
- safeguarding participants' interests;
- control of use or disposal of samples.

They would therefore have to ensure that any restriction you placed on the use of your sample was strictly observed.

Similarly, a commercial company may not seek to own your sample but, as part of the consent process, you would be asked to hand over all intellectual property rights to the information that comes out of the research (see Sections 16 and 17).

Professional guidelines have tended to avoid the issue of ownership and focus on the ethical concerns over what is done with your tissue

Will I be paid for my sample?

The MRC guidelines do not allow you to be paid for your sample and nor do they allow your sample to be sold¹⁹. They prefer that you view your sample as a donation or a gift. It is hoped that this arrangement will encourage your participation for 'the good of others' and it removes the danger that vulnerable people may be exploited through the sale of their body parts.

When your sample is perceived as a gift, it also means that once you give it away, you relinquish your rights to any share of future profits from its use. All the guidelines state that you must be told if your tissue is going to be used for commercial research. The fact that you will not receive any profits from the research should also be made explicit before you give your consent.

How well are my interests protected?

At a general level, the research governance framework states that organisations should make details of their current and previous research readily accessible to the public³⁶. However, there are no guidelines or standards for feedback to individuals. The only recommendation is that the issue must be decided before the research starts and that any plans for feedback should be approved by a local research ethics committee (LREC).

As part of the consent process, you might be asked to identify what type of health information you would want to know about but this is almost impossible to answer in advance. Since most results are likely to be of limited use, the best policy might be to ask for no feedback at all. However, one area of concern remains. What if (although highly unlikely) there was a genetic mutation that made you drop down dead unless you took some simple precautions? Should you be told if you had it even if you haven't asked for feedback? The European Convention on Human Rights and Biomedicine concludes that you should¹⁸. Even though your 'right not to know' is recognised, the Convention makes exceptions when it's in your interest. In particular, it recommends that *"if it can prevent harm, a person should be informed of unexpected findings of genetic analysis, if the information is of importance to treatment or prevention and even if the person has not asked for this information"*.

This recommendation is not universally accepted. In the interests of protecting your autonomy, some would protect your 'right not to know' about a life-threatening disease even if you could do something about it. The Human Rights Act 1998, in recognising your right to privacy, would come into play here as it provides the only means by which the 'right not to know' might come to be recognised by the UK courts³³.

Since most results are likely to be of limited use, the best policy might be to ask for no feedback at all

How well are my interests protected?

There are three main areas of concern here:

a) Your consent to give a sample

If a doctor took a sample *without* your consent, then he or she could be liable to criminal prosecution. It would amount to battery. However, criminal prosecution is rare and it is more likely that it would be up to you to decide whether you wanted to sue the doctor and prove your case in court. The law is less clear if the doctor took a sample *with* your consent, say for a blood test, and then went on to use it for something else, say genetic research. Your consent would probably be considered invalid and the doctor might be prosecuted for negligence. But 'negligence' usually refers to instances where poor or inappropriate medical treatment causes injury. Failure to provide the information necessary for informed consent may not be covered²³. There is no legislation that specifically applies to consent to the storage and use of samples or DNA.

The European Convention on Human Rights and Biomedicine does provide clear guidance on this issue. Article 22 of the Convention implies that if a sample is used for a purpose other than that for which it was removed, then the person should be asked for new consent. But the Convention as yet has no legal force in the UK.

b) Your consent to have your sample processed for genetic information

You may feel that your genetic information is something you want to keep private and that no-one should access the information without your permission. For example, would you want a researcher to investigate your genetic risk of cancer without you knowing about it?

The House of Lords concluded in their investigation of biobanks⁴ that the Data Protection Act (DPA) would effectively protect your genetic privacy. The DPA has a requirement that, given your consent, your *"personal data should be obtained for only one or more specific purposes and not processed in any other way"*. But there are a number of exceptions with health-related research being one of them. Evidence from the Office of the Data Protection Commissioner stated that the Commissioner did not have the expertise to judge whether any particular processing of genetic information is acceptable². So even the Commissioner concluded that the DPA does not offer sufficient protection. The Human Genetics Commission (HGC) agree³² and are considering whether 'fair' processing of genetic data can only be assured through the introduction of specific legislation³³.

The Human Rights Act 1998³⁴ may also be relevant here since it protects the privacy of medical information as part of respect for private and family life. However, it is not yet clear how the British courts will apply the human rights principles. Also, the new Health and Social Care Act 2001³⁵ allows the Government to make decisions about what information can be extracted and passed on to others, both in the interests of individual patients and of the general public. It remains to be seen what regulations will be made under this new Act and who might get access to your genetic information in the future as a result.

c) The process by which your consent is obtained

Before any research can start, the informed consent procedure has to be checked by a Research Ethics Committee (REC). The Department of Health requires a local REC to be attached to every health authority, which has to approve all research involving patients and NHS staff in their area². They ensure that the information given to potential participants is clear and meets ethical standards but they have no further powers (see Section 20). The responsibility for ensuring good practice now lies with the other parties involved - the researchers, doctors, their institutions and the bodies funding the research. A new Research Governance Framework developed by the Department of Health clarifies exactly who is responsible for each and every part of the research process³⁶. But as yet there is no way to assess whether people are adequately performing their roles - a new system of monitoring and enforcement is promised.

If you felt that the process for obtaining your consent was inadequate - if, for example, you weren't given enough information or were unhappy with the conditions - you could simply choose not to take part. However, you could also register a complaint with the institution where the research is being carried out. Under the new framework, they are obliged to address your concerns.

WHO WILL GET ACCESS TO MY PERSONAL INFORMATION?

10. Will my personal information be kept confidential?

If your genetic information got into the wrong hands, it could be used by mistake or even deliberately to discriminate against you

If your genetic information got into the wrong hands, it could be used by mistake or even deliberately to discriminate against you. So one of the most important safeguards for the operation of biobanks should be that all the records are kept confidential.

There would be two types of information about you in a biobank – your genetic make-up and your medical history. Both would be stored electronically. The question is how to ensure this data can't be stolen or accessed without your permission. Beyond restricting entry to rooms and log-on to computers, there are technical ways of prohibiting access to the information. Your data could be:

- **unlinked and anonymised** – all personal information is permanently removed so that the genetic and medical data can never be linked back to you;
- **linked and anonymised** – personal information is removed and a code added (e.g. each record given a number) so that the researchers who use your data cannot link it to you but others are able to re-establish the connection;
- **coded or encrypted** – all information is turned into a meaningless string of numbers using a code. Only those who have the code are able to access the information.

In a biobank, your records cannot be completely unlinked and anonymised because new facts about your health and lifestyle need to be added over time. But this has the advantage that if you wanted to withdraw from the study, it would still be possible to trace your sample/data and destroy it.

In most biobanks, a combination of linked-and-anonymised and coded data is used. Encoding can take place at several points wherever information is exchanged (see Box F). However, as yet there are no standards set for security and coding mechanisms. There are also concerns that hackers might be able to infiltrate the computer systems (see Box G).

BOX F – Protecting medical records and genetic information

The system set up by the Oxagen Company illustrates how the different encoding techniques can be used to protect anonymity².

The collaborating doctors collect samples and health information from their patients. Each person's record and sample is given a unique identifying number and anonymised (i.e. names and addresses removed). The records and samples are then passed to Oxagen's researchers without any information that could be used to identify individuals. The researchers carry out the genetic analysis and store this data on secure computers with access limited to certain company employees. If they require further information or more DNA, they send a request to the doctor, referring to the relevant identifier. The researchers never have direct access to the research participants. Similarly, the doctors never have access to the results of the genetic research.

However, twenty years won't be long enough to collect all the health information, let alone analyse it, so the biobank records are likely to be maintained for much longer. The Data Protection Act (DPA) allows data to be kept "for as long as necessary for the purposes for which they are processed" so your records may survive long after you do.

The DPA does not apply if you are deceased and neither does the law on confidentiality. But there is clearly an ethical obligation to respect your confidentiality even after death. Researchers would still have to make sure that any disclosures were fully justified. In the event of an unwelcome disclosure, your relatives might be able to take action under human rights legislation.

It is not clear who would decide on the future uses of your sample. There is an argument that your relatives should be given the right to veto its use in research whenever your consent had not been made explicit²⁸. Unlike other kinds of medical information, your genetic information may say something about health risks to your relatives as well as you (see Sections 4 and 11). But even though your family could be affected by research using your sample, there are no legal requirements for their protection.

14. Will I be told of the results of the research? If so, will I get genetic counselling?

Feeding back the results of genetic research is a potentially dangerous policy. As a general rule, existing UK biobanks do not provide participants with feedback about their health or their genes². In any case, you may not even want to know the results of the research because:

- Any conclusions are likely to be ambiguous and of little predictive value to you as an individual (see Box C). The information from genetic research is unlikely to meet the standards of the clinical tests doctors use to make a diagnosis.
- It might be more harmful to take action on the basis of preliminary findings than to remain unaware of a potential risk. For example, it would be dangerously short-sighted for women to have a double mastectomy if research results suggested a possible risk of breast cancer.
- Information about risk of disease is likely to emerge long before any treatment is developed and you may not want to know about a future you can do nothing about.

If you were offered feedback, then effectively you'd be receiving a genetic test so you should be offered genetic counselling before and after being given any results. Such arrangements should be discussed with the researcher at the outset. Your 'right not to know' should also be respected²⁰.

Although you might not want your own results, you might still want to know about the research results in general. There is likely to be a newsletter or website that provides regular updates and should advise you if and when reliable clinical tests become available. It's also important that publicly accessible information is provided about research that's being planned for the future (see section 21).

Even though your family could be affected by research using your sample, there are no legal requirements for their protection

Information about risk of disease is likely to emerge long before any treatment is developed and you may not want to know about a future you can do nothing about

As yet there are no standards set for security and coding mechanisms to ensure confidentiality

12. Will my sample be used for commercial research?

Recognising the potential pitfalls, the sponsors of the UK national biobank (Biobank UK) have agreed that no single company will be granted *exclusive* access to the data². However, there is no doubt that commercial companies will be allowed to use the biobank. Indeed, if the research is to lead to new medical treatments, they will have to be involved. All drug manufacture in the UK is dependent on the private sector. Although new DTI policy is promoting public investment in this area, this is only in support of private initiatives, not as an alternative source of funding⁴².

The precise details of the contracts between the biobank and the companies have not yet been established. However, they are likely to be based on the following principles:

- industry will not provide funds for the creation of the collection;
- companies will meet the costs of any survey work or analysis needed for their projects;
- the same system will be used to prioritise research whether projects are undertaken by companies or academic researchers;
- companies will be expected to add their results to the central database.

The commercial use of biobanks raises issues that have not been adequately addressed by reviews of research ethics and policy (see Section 16). It is questionable whether guidelines that have been developed to regulate professional practice are sufficient to control the new market relationships³⁹. New legislation is necessary for these relationships to be properly controlled.

How well are my interests protected?

You may object to your freely donated sample being used by companies to make a profit. The MRC guidelines are clear that you should be told if your sample is going to be used in commercial research *before* you agree to participate. This is founded on the belief that you might want to stipulate that only academic institutions are given access to your data. But making a distinction between academia and industry may be too simplistic as the boundaries are becoming increasingly blurred. Many individual researchers seek to profit from patents on their findings and much commercial research has important medical benefits. So, as part of the consent procedure, it is essential that you are given enough information to make your own judgement about the potential benefits and/or commercial exploitation. You should also seek to reassure yourself that any system prioritising research projects is one that you can trust (see Section 21).

13. How long will my records be stored for? Will my relatives get control over the use of my sample and records after I die?

This is uncertain. In general, the MRC suggests that research records are kept for a minimum of twenty years to allow validation and any further study²⁰.

BOX G – Can the security of computer systems be guaranteed?

In 1999, a hacker penetrated the computer network of a major university hospital in Seattle and accessed files containing information on 5,000 patients. The hacker described himself as an 'ethical whistle blower'. He simply wanted to expose the weaknesses in the hospital's network. In a statement, the hospital said the copied information wasn't directly related to the delivery of care to its patients. It was information stored in administrative databases for *following up on research studies*. The hospital has since reinforced its firewalls to improve its network security³⁷.

11. Who will have access to my records and who will be denied access?

There are a number of parties who might want to access the information in a biobank for a wide variety of reasons. These will be considered in turn along with the relevant legislation. All the international guidelines and laws state that your written consent is required before any information about you can be disclosed to a third party²⁶. However, there are some grey areas in the UK.

• Academic researchers

An important principle underpinning the development of publicly funded biobanks is that the data should be freely available to *all* researchers to ensure the rapid progress of all medical research (see Box H). By becoming a centralised, public resource the biobanks can also remove some of the barriers to collaboration. Often, the most labour intensive phase of genetic research is identifying the potential participants, collecting their samples and interviewing them. Academic researchers who spend many years painstakingly diagnosing patterns of illness and collecting samples are then wary of handing over the data to others. They might even delay publishing their early results until they are certain all of their studies have been completed. This will not be allowed to happen with the UK national biobank (Biobank UK). Researchers will be obliged to feed back their findings to a central database after a certain period of time². It is hoped that this will speed up the progress of research and make the database increasingly useful.

However, not all academic researchers are independent from industry. Many now work as consultants to industry or set up their own companies to commercialise research (see Section 12).

BOX H - Protecting the principle of public access to research findings

For over fifty years, Boston University and the National Heart, Lung and Blood Institute established a collection of detailed health information about thousands of people in the USA - the Framingham Heart Study. It began in 1948 and has since become famous for the number of useful findings it has produced over the years. In 1999, a new company called Framingham Genomic Medicine (FGM) asked to examine the data for information that would be useful to drug companies. They asked for exclusive access for a limited period of time and promised Boston University 20% of the company's future stock. But because the study had been established with the principle of making its data publicly available to researchers, it was finally decided not to provide the data exclusively to FGM. The company has since been disbanded³⁸.

The commercial use of biobanks raises issues that have not been adequately addressed by reviews of research ethics and policy

An important principle underpinning the development of publicly funded biobanks is that the data should be freely available to all researchers to ensure the rapid progress of all medical research

Commercial companies may influence the research agenda to promote profits over public interest

- **Commercial research companies**

Access by commercial research companies raises major concerns including fears that companies will:

- (a) influence the research agenda to promote profits over public interest. For example, they might promote research into products that exploit people's insecurities, such as beauty products or diet pills. They are also less likely to research medical conditions where only a few people are affected and the market is small. The research that is most beneficial for health is not always the research that makes most money;
- (b) develop and market tests for genes that might be used for genetic discrimination in the future. Some of these tests will help early diagnosis and treatment of some diseases but others will not. Many genetic tests only give highly uncertain information about your risk of developing an illness (see Box C). If genetic tests become widely marketed (e.g. over the Internet), widespread misuse of genetic test results by insurers or employers could become more likely (see Section 5);
- (c) patent genes for their exclusive use and charge exorbitant fees for related genetic tests. This would hinder further research and may severely limit any subsequent medical benefits (see Section 16).

The question of whether your sample could be used by commercial companies is considered in more detail in Section 12.

Allowing companies to patent genes would hinder further research and may severely limit any subsequent medical benefits

- **Employers, insurers, government, schools and government agencies**

There are concerns that these organisations could use the data in a biobank to discriminate against you (see Section 5). All the public documents relating to the UK national biobank (Biobank UK) state that these parties will not be given access to your medical or genetic information². However, if government agencies, namely the MRC and Department of Health, become custodians of the biobank, then the Government will effectively already have access to your information. It might be preferable for an independent body to manage the collection and make decisions about access to the data. This could be a statutory organisation run along similar lines to the Human Fertilisation and Embryology Authority^{24,39}.

Often, the guidelines don't make a distinction between medical data and genetic data. This is important because if you gave authorisation for release of your *medical* records - for example, to a prospective employer - it's not clear whether these records might also include information about your genes. The Department of Health recognises that clarifying legislation is required, especially as all patients' records are soon to be computerised and more easily accessible².

- **The police**

There is some debate as to whether the police should have access to biobanks in order to investigate serious crimes (see Box I). Some commentators conclude that the police should not be given access to

biobanks nor allowed to make links to their forensic databases²⁸. The Biobank UK proposals also state that law enforcement officers will not have access⁴⁰. However, the legislation relating to confidentiality and data protection does allow information to be disclosed if it's in the public interest or could prevent serious harm. There are no guidelines to help researchers or their organisations determine when such disclosure is appropriate. Further legal clarification is required.

BOX I - The case of Stephen Kelly: an unacceptable breach of confidentiality?

Stephen Kelly was a prisoner in Scotland when he agreed to give a blood sample to a study of an HIV outbreak among drug addicts in his prison. All participants were assured that the findings would be kept confidential. However, Kelly's sample later provided crucial evidence in a criminal trial. He was found guilty of knowingly infecting his girlfriend with HIV. Kelly's girlfriend, Anne Craig, had also taken part in a research project. This project studied the genetic diversity of HIV in Scotland. Anne's virus was later shown to be very similar to the prison virus and distinct from others in the country. This match was vital to the prosecution's case. It resulted in Kelly being sent to prison for another five years.

This case has been heavily criticised because the police were able to override guarantees of confidentiality in two separate research studies. The MRC justified their disclosure on the basis of the public interest in seeing justice prevail. However, the concern is now that many people will refuse to take part in research because they do not believe their confidentiality will be respected⁴¹.

People may refuse to take part in research if they do not believe their confidentiality will be respected

- **Your relatives**

Your family may want access to your sample or data to establish their own genetic status. There are two issues here - whether the results would be of any benefit to them (see Section 14) and whether you will allow them that access. If there were potential benefits to your family but you were unwilling to share the information, the health professional or researcher would be left in a very uncertain position³³. They would be bound by a duty of confidence to you but could also justify disclosure to your relatives on the basis of 'preventing serious harm'. The Human Genome Organisation (HUGO) guidelines suggest that immediate family should be allowed to access samples²⁶. However, without any legal precedent in the UK, further clarification on this issue is necessary.

- **You**

You may want to find out about your health or your genes or simply find out about the research results in general. The issues raised are discussed in Section 14.