Course of the conference

The consensus conference was held on Friday 22 September, Saturday 23 September and Monday 25 September. On Friday and Saturday, the days open to the public, a layman panel heard speeches from a range of experts and asked probing questions.

From Saturday afternoon until Monday morning, the laymen wrote their replies to the key questions of the conference - i.e. the final document of the conference. On the last conference day, the final document was presented to the participants. First the experts were given an opportunity to correct factual errors, and then the laymens evaluations were discussed by the two panels and the audience. The final document contained in this report was later forwarded to the conference participants, the member of the Danish parliament and other interested parties.

The interview panel consisted of 11 Danes with differing backgrounds and without any explicit, previous knowledge of gene therapy. In March, advertisements in nation-wide newspapers invited interested people to come forward. From the received applications, a wide panel was composed on the basis of sex, age, address, occupation and education or training.

On 3 May the interview panel attended the debate meeting on gene therapy organised by the Danish Council of Ethics. They also met for a weekend in May and in August to prepare for the conference. This process introduced them to the basic problems facing the field of gene therapy. Based on the ongoing discussions of these problems, the laymen worded the key questions and sub-questions of the conference.

The overall planning of the conference was in the able hands of a planning group with the following members:
- Lars Bolund, professor, M.D., University of Aarhus
- Mogens Hørder, dean, consultant, M.D., University of Odense
- Linda Nielsen, associate professor, D.LL, University of Copenhagen
- Bent Danneskiold-Samsøe, MA (economics), Dansk Sygehus Institut
- Niels Holtug, MA, Institute of Philosophy, University of Copenhagen
- The secretariat to the Board of Technology was responsible for the practical organisation of the conference. Further, professor Karsten Schnack chaired the interview panel and the conference.

Composition of the interview panel

- Jan Arent, 29, civil engineer, Odense
- Johnny Jensen, 41, manual worker, Ølsted
- Mogens Jensen, 34, farmer, Holbæk

- Pia Vejlgård Jørgensen, 26, nursing student, Odense
- Laust Peter Lausten, 65, economist, Bagsværd
- Lise-Lotte Lemvig, 35, self-employed, Augustenborg
- Aase Kirstine Nielsen, 53, technical assistant, Randers
- John Ravn, 38, financial advisor, Vejle
- Karen Schwartzbach, 62, voluntarily retired, Aabyhøj
- Jørn Suurballe, 52, electrical engineer, sales and marketing manager, Haderslev
- Charlotte Willemoes, 18, student, Birkerød

Composition of the expert panel

- Professor Finn Skou Pedersen, Institute of Molecular Biology, University of Aarhus
- Consultant, M.D. Finn Cilius Nielsen, University of Copenhagen Hospital
- Reseach Manager, M.D. John-Erik Stig Hansen, Hvidovre University Hospital, Laboratory of Infectious Diseases
- Professor, M.D. Lars Bolund, Institute of Human Genetics, University of Aarhus
- Hanne W. Tybkjær, Head of Secretariat, National Association of Cystic Fibrosis
- Consultant Kirsten Rasmussen, Section for Clinical Genetics, University of Odense
- Christine-Lise Julou, Director of Regulatory Affairs, RPR GenCell, France
- Marlene Gyldmark, MA, Danish Hospital Institute
- County Health Director Sten Christensen, Frederiksborg County Health Authority
- Associate Research Professor Lene Koch, Institute of Social Medicine, University of Copenhagen
- Niels Holtug, MA, Institute of Philosophy, University of Copenhagen
- Professor, D. of Theology Svend Andersen, Institute of Religious Philosophy, University of Aarhus,
- Assistant Professor Lone Nørgaard, MA.
- Peter Saugmann-Jensen, M.Sc. (medicine), Danish National Board of Health
- Associate Professor Linda Nielsen, Institute of Legal Science, University of Copenhagen

Key questions

1.What is gene therapy?

a)Which advantages and disadvantages are gene therapy expected to have over existing treatment methods?

b)Can gene therapy be used for all diseases everywhere in the body, including in the brain?

c)Can diseases caused by defects in several genes be treated?

d)Why are many scientists today pro body cell therapy and con germ cell therapy?

2.How far have we progressed?

a)How far have we progressed in the mapping of the genetic causes of different diseases?

b)What is the time span visualised for treatment of popular diseases (cancer, cardiovascular diseases, etc.) and more rare diseases (ADA, cystic fibrosis) in Denmark?

c)What is the research status and time horizon for the solution of the technical difficulties of gene therapy, e.g.:
- control of the injected gene?
- control of gene vectors?
- control of the function of injected genes?
- vectors suited for injection?
- immune-related rejection?

d)Do scientists expect that gene therapy will completely replace existing treatment methods or merely supplement them?

e)What are the expectations for preventive treatment based on gene therapy (gene vaccine)?

3.What are the risks connected to gene therapy?

Risk for the patient in relation to gene therapy

a)Is it justifiable to implement gene therapy before DNA has been mapped?

b)Can we be certain that gene therapy will not activate inactive DNA (DNA junk)?

c)Is there a risk that more than one gene may be injected into the same cell - and which consequences would this have?

d)Is there a risk that germ cells may be influenced when body cells are treated - and how resistant is our hereditary material to such influence?

e)Are there risks of side effects of gene therapy - e.g. that the patient may start to grow again or that viruses (gene vectors) become active?

Risk to the environment and society

f)Can gene vectors spread from laboratories to organisms in the surroundings and impact on them ("Turtle Effect")?

g)Can gene vectors spread from the patient to other persons?

h)Will gene therapy on body cells give an increased incidence of hereditary diseases where generation after generation will see more and more persons becoming dependent on gene therapy?

i)Is there a risk of abuse of gene therapy for e.g. genetic warfare and terror actions?

4.How will gene therapy affect the financial resource prioritising in the health sector?

a)We often hear that gene therapy will be very expensive. How expensive is that actually? What aspect of it is expensive? And what is the price compared to traditional treatment?

b)Will gene therapy bring about changed priorities in the treatment of diseases? Could the same resources be used better in traditional treatment methods?

c)Can we expect cuts in the health sector caused by lower costs for nursing, anticipatory pensions, home help etc. in relation to the introduction of gene therapy?

d)Who will set the priorities?

5.Which ethical/moral reasons can be listed pro/con gene therapy on germ and body cells?

a)Should gene therapy on body cells only be used for disease combating/prevention or also for developing/improving normal characteristics?

b)Could the implementation of gene therapy on body cells give results which would mean that it would be unethical to refuse gene therapy on germ cells? Could, for instance, gene therapy used only on body cells mean that certain hereditary diseases will become more widespread?

c)Is it our duty as "Good Samaritans" to help our fellow human beings with all available means, including gene therapy?

6.How will the application of gene therapy affect our perception of humans?

a)How will the application of gene therapy affect our perception of diseases?

b)Will the application of gene therapy affect the human concept of normality (normal/abnormal)?

c)Would we renounce responsibility of our own bodies and behavioural patterns (under the pretence: "blame it on the genes")?

7.How can patient rights be secured in relation to gene therapy?

a)Will specific needs arise to secure patient rights in relation to gene therapy, or is the existing legislation on informed consent sufficient? Would the establishment of a special patient counsellor position for gene therapy matters be an option? What is the position of children/fetuses in the existing legislation?

b)Should the patient be granted free choice between gene therapy treatment and other treatment methods?

c)Do we need special rules on the application of the information inherent in patient DNA profiles compared to other health data?

8.Legislation and control

Legislation:

a)Will gene therapy require special legislation?

b)Which international agreements may we expect in this field, including EU directives and UN agreements?

c)Would it be possible to acquire ownership to or patents on discoveries linked to gene therapy?

d)Do other countries have legislation we can "copy"?

e)Is it possible to establish legislative/legal limits for gene therapy treatment/research when it is already going on?

Control:

f)Should we set up a gene therapy council?

-who would sit on the council?
-which competence should be vested in the council?
-how should the relations to the existing central scientific ethical commission be defined?

g)How can we control private clinics (distinguishing between treatment and experiments)?

h)How do we ensure public insight into research of gene therapy? Is there a limit to public insight?

Final document of the interview panel

Key question 1 - What is gene therapy?

Gene therapy is defined as the implantation of genetic material into selected cells in the body. This can be effected either inside or outside the human body, with or without transport vectors. The process serves to supply a new gene. The supplied gene contributes a function lacked by the cells or it counteracts defects in the cell function.

Gene therapy is expected to be a viable means of combating disease everywhere in the body, including the brain. At present, no research is being conducted on gene therapy /tests of mental disorders. Researchers expect to be able to use gene therapy against diseases which are not only caused by defects in one gene, but in several genes. Such diseases might be hereditary diseases, infectious disease, AIDS and cancer; diseases often caused by several defective genes and where some of the defects are not hereditary, but acquired.

Today, research is only being conducted on gene therapy on somatic cells (body cells). Most researchers agree that germ cell therapy is unethical and furthermore requires the use of technology not available today, nor in the immediate future. Neither is it necessary to apply gene therapy on germ cells, as methods have already been developed for selection of zygotes that do not carry the defective genes.

Compared to existing treatment, gene therapy is a more precise method, in which a healthy gene is supplied to enter the body and take over the function of the defective gene. This makes for a causative treatment as opposed to todays symptom treatment. In addition, researchers expect in the future to be able to treat diseases which today are incurable.

A long-time effect of gene therapy treatment has not yet been achieved, and repeated

treatments are therefore needed. This may activate the immune system which will render the patient immune to the treatment.

A disadvantage of gene therapy is that the therapy gene cannot be guided to a specific location in the genome, but may interfere with the function of a neighbouring gene. This may cause the cell to develop into a cancer cell.

We cannot rule out the theoretical risk that the treatment of body cells may have an unintentional impact on germ cells. Animal tests have proven this risk to be minor. It is therefore important that gene therapy applies technology that supplies new genes without bringing about unintentional impacts on germ cells. In addition, thorough control of tests and treatment should be implement at several levels.

The above disadvantages seem minor compared to the disadvantages of many traditional treatment methods, such as chemotherapy and irradiation, whose many side-effects we accept today.

It has not yet been possible to observe significant side-effects of gene therapy. Tests have only been conducted on a limited number of persons. Consequently, it is difficult right now to compare gene therapy with traditional treatment in relation to long-term side-effects.

Key question 2 - How far have we progressed?

In 5-10 years researchers expect the human hereditary material - the genome - to have been mapped. Some diseases can be associated with a single of the 60,000-80,000 genes making up the human genome. Today we already know the genetic reason for many diseases, such as haemophilia, ADA deficiency, various cancer types and cystic fibrosis.

The actual treatment with gene therapy against cancer, cardio-vascular diseases, cystic fibrosis etc. still has far to go. Forecasts from different experts vary from 5-10 years up to 20-30 years. But already now researchers are set to start gene therapy tests. Both Odense University Hospital and Hvidovre University Hospital are preparing applications for approval by the Danish National Board of Health and the Central Scientific-Ethical Committee of Denmark. In Odense, researchers want to start gene vaccine tests on cancer of the colon, and at Hvidovre tests will be made on blood cells in 4-5 patients.

Control of the transplanted gene depends on whether the treatment is done in the body (in vivo) or outside the body (ex vivo) - cells extracted from the body to be treated and then reinserted into the body.

In-vivo gene therapy still presents major difficulties as researchers have not yet discovered a gene vector which can be controlled effectively and precisely.

Where fats (lipids) or ligating molecules (ligands) are used as gene vectors, the process cannot be controlled completely.

As to use of virus as a gene vector, researchers have not yet found one that can be controlled effectively and precisely.

When genes are transplanted, it is possible to implant a control gene with the therapy gene. The control gene is especially susceptible to, for instance, a given toxic substance. In this way, it is possible to kill the cells where the gene was implanted if anything in the tests goes wrong (if, for instance, cancer cells develop).

In addition, the vectors used can be traced in the body. This makes it possible to control the position of the transplanted therapy gene and to trace whether it has spread to other cells, including germ cells.

Vectors for injection are those used for in-vivo treatment. In this regard, a description of the characteristics of the ideal vector would be pertinent:
- It must be possible to guide it precisely and effectively to a certain cell
- It must be possible to target it for a specific location in the hereditary material
- If a virus is used as vector, the virus must be weak so that it cannot become active

As mentioned above, the ideal vector does not yet exist, but today a variety of types are known, each with its advantages and disadvantages. The table below shows some of their overall characteristics:

Type Advantages Disadvantages
Retrovirus Couples gene with cell DNA.

Impacts on cells under division. Random implant location, may be infectious AA virus Primarily inserts the gene on chromosome 19. Only small genes may be inserted, may be infectious Herpes virus May insert large genes Not possible to be sure that all cell-deteriorating genes in the virus have been eliminated, may be infectious Adenovirus Impacts on cells that do not divide Only short-term effect, as the gene is often lost in cell division, may be infectious Lipids Inexpensive and uncomplicated, may transfer large genes, impacts on cells that do not divide, non-infectious Usually only temporary expression (effect) and only few cells achieve stable integration into genome, risk of amplification (enhanced effect), risk of rearrangement of the genes to be implanted Ligands As lipids, may be guided relatively

precisely to one certain cell type As lipids

Today, Denmark does not use gene therapy as a treatment method. Researchers only wish to start testing. As long as the testing process goes on, we cannot know whether existing treatment methods can be replaced.

Thus, gene therapy will not from the outset replace existing treatment methods, but may do so in the long run, depending on the results of the gene therapy tests and the price of gene therapy compared to traditional treatment.

Today, we have come so far as to launch tests this year on treatment by gene inoculation of AIDS patients in the USA, and in 1996 Denmark will commence animal tests in this area. 1996 is also expected to see the launching of tests of gene inoculation against cancer of the colon in Denmark.

Gene vaccinations will offer great advantages:
- No risk of infection (which "normal" vaccine may entail)
- Improved immunisation
- Easy to produce in large volumes
- Inexpensive
- Easy to store (which today poses problems in developing countries)

Key question 3 - What are the risks connected to gene therapy?

Previously, in combating diseases researchers have researched and applied medicine and methods whose effects and side effects had not been determined in detail before use, and still satisfying results have been achieved. The history of medicine shows that treatment has always been associated with uncertainties. Researchers believe that gene therapy makes it possible to cure a disease whose defective gene is known. It is not necessary to know the entire genome. So far, tests have not disproved this hypothesis.

b)To date no problems have been registered in relation to activation of that part of the DNA molecule called DNA junk by a gene implanted through gene therapy. Whether DNA junk can be influenced is not known. Consequently, the risk exists, but experts rate it as small.

c) There is a theoretic risk that more than one gene may be inserted into the same cell, as the gene vector cannot be controlled completely. At worst this could create a mutation which may generate cancer. In the US tests on humans, work is being done on technologies which can trace the implanted gene. A control gene is implanted which allows doctors to intervene and kill the cell (see question 2c).

d)In general, the treatment of body cells will not affect the germ cells. The risk is limited, but cannot be completely ruled out. If the treatment is effected outside the body, there will be no risk of influencing the germ cells. A similar risk is found in chemotherapy and irradiation. Human genes are very resistant to changes. In a middle-aged person, gene changes may be found in every cell without the person being ill.

e)There might be a risk of side-effects in gene therapy, but so far they have not been observed in tests on humans. One side-effect of transplantation of several vectors in a cell could be that it metamorphoses into a cancer cell. As the treatment would primarily be used on seriously ill people, it is probably an acceptable risk. However, hypotheses of side-effects which, for instance, would cause patients to start growing again, are highly unlikely. As a weak virus is used as gene vector, the risk that it may become active is minor.

f)As weak viruses are used, the risk that gene vectors will spread from laboratories and impact on the surroundings is virtually non-existent. They would simply not be able to survive in the natural competition.

g)Neither can gene vectors spread from one person to another.

h)In hereditary diseases, where the disease only erupts when the person has had children, gene therapy will not increase the incidence of these hereditary diseases. In hereditary diseases erupting before a person has had children, gene therapy will increase the incidence of these hereditary diseases. This is of course true of all disease treatment.

i)As weakened vectors are used, there is no risk of gene therapy abuse for e.g. genetic warfare or terror.

In conclusion, it cannot be ruled out that gene therapy may present risks in the long run, as there are very few test results to prove otherwise. Consequently, it will be necessary continuously to evaluate risks to be able to discover any negative side-effects.

Key question 4 - How will gene therapy affect financial resource prioritising in the health sector?

It is our understanding that the bulk of gene therapy research is carried out in the USA, whereas research is only carried out on a modest scale in Denmark and the rest of Europe. If Denmark is to reach the level of other countries in implementing gene therapy as a treatment method, increased appropriations are needed for research and education, and we must expect gene therapy to be very expensive at first.

As to treatment with gene therapy, two possible applications can be envisioned: a supplementing treatment or a miracle cure.

Both expensive and inexpensive gene therapy methods are likely to become available. Where treatment is inexpensive, economies will only appear when development costs have been paid.

On this background, it is difficult today to predict whether gene therapy in the long run will become cheaper than existing treatments.

If gene therapy only comes to supplement traditional treatments, this could either entail higher costs or renewed prioritising. Gene therapy will probably become a supplementary treatment replacing other less effective treatment methods.

After having heard statements from several experts, we believe that nobody at present can make forecasts with precision on the price of gene therapy, as an established treatment is non-existent. Several experts state that basic research is generally expensive, and that the price of a given treatment must cover the costs generated by its development. Treatment costs per person of widespread diseases might be low due to the volume of patients. Therefore, we can expect that research will first of all focus on development of treatment for widespread diseases such as cancer.

If, however, gene therapy develops into a "miracle cure", which inexpensively can replace expensive existing treatment, large resources can be redistributed to other areas of the health sector.

The largest possible saving per patient would probably arise, if a gene therapy method was discovered which could replace the costly life-long treatments of, for instance, haemophilia or cystic fibrosis.

The costs of disease prevention would increase - and those of disease combating decrease.

No expert expects additional resources to be transferred to the health sector in the years to come. This calls for a debate on the priorities of resource distribution, on whether additional resources must be added and on the guidelines to be used in the prioritising. We recommend the solidarity principle to be used, though other conditions such as life quality must be considered.

We agree that prioritising of resources for gene therapy in relation to the other costs in the health sector should be a task for politicians.

Gene therapy will further reinforce the fact learned from other treatment methods that an increased supply automatically leads to increased demand.

At the start, we recommend that the application of gene therapy focuses on serious diseases for which we have no effective treatments today.

Key question 5 - Which ethical/moral reasons can be listed pro/con gene therapy on germ and body cells?

The following arguments have been voiced for/against gene therapy:

For gene therapy on body cells:

Gene therapy is a new treatment method which opens up opportunities for treatment of diseases for which no treatment has thus far existed. The method can treat the causes of a given disease and has considerably fewer side-effects than known treatment methods.

When such a method becomes available, it is our duty to use it. Danish society is founded on solidarity with the weak.

Against gene therapy on body cells:

One of the main arguments used is that once gene therapy technology exists, there will be no way of preventing a sliding effect so that gene therapy will eventually also be used on germ cells.

Thus, it has been maintained that gene therapy is the key to creation of the perfect human with the "right" qualities. Some researchers conduct research for the sake of researching, and medico-technological development is not always in the interest of the community.

The many negative consequences of various treatment tests attract less attention than successes. Gene therapists play God - interfere with creation. Gene therapy will not be limited to treatment of diseases.

For germ cell therapy:

In the long run, there is hope that the application will diminish the number of hereditary diseases.

This will reduce the number of diseased people, thus doing away with the suffering experienced by the affected people waiting for a treatment. The therapy will also allow costs

in the health sector to be redistributed.

Against germ cell therapy:

It is unethical to manipulate with future generations. The procedure will deprive our descendants of their right to self-determination. Germ cell therapy will pave the way for eugenics.

We should not manipulate the hereditary material of our descendants in a way that deprives them of their right to decide what is disease and what is not.

It is essential to preserve genetic diversification, in terms of biology as well as to the extent nature can be ascribed an independent value of enjoyment.

a)We support gene therapy on body cells for disease combating. We also support the application of gene therapy in relation to inoculations and the prevention of more serious diseases.

In addition, the panel believes that in principle there is no difference to improving normal characteristics (we interpret normal characteristics as those that are not considered to be diseases. In time the limits of this may change) by means of gene therapy than other methods. But besides the ethical ones, there may be other objections for changing normal characteristics.

To the extent that gene therapy opens up new vistas for changing normal characteristics compared to todays possibilities, the ethical evaluation must be reviewed.

b)The panel supports gene therapy on body cells, but not germ cells. Even though gene therapy on body cells might entail an increased incidence of hereditary diseases, this does not precondition implementation of gene therapy on germ cells.

As it is already today possible to select healthy cells by the normal test tube method, the panel does not believe that it would be unethical to refuse gene therapy on germ cells. (Ethical problems also arise in relation to test tube fertilising and selection of healthy ova/fetuses.)

c)As to diseases, it is always our duty to help our fellow human beings with every available means, even gene therapy.

Key question 6 - How will the application of gene therapy affect our perception of humans?

We have heard various statements from expert witnesses. Some believe that gene therapy will impact on our perception of diseases, others foresee no changes.

a)"The individual person will become less tolerant of his/her own frailties and those of others (...). He/she will be painfully aware of the slightest irregularity of body or mind and worry that it might be the symptom of a disease".

(Lone Nørgaard)

"It seems likely that gene therapy (...) will influence our perception of diseases. The role of genes will be underlined. As more and more can be treated, we will experience more pressure that it must be treated, i.e. a greater deal of what we today perceive as normal, will in the future be perceived as abnormal (or requiring treatment). We may be applying the pressure ourselves or it might be a result of intense marketing from the pharmaceutical sector of its products". (Nils Holtug).

"The application of gene therapy may - just as genetics in general - change our metaphors of disease. For instance, we may come to view diseases as errors in a computer program. We may come to view our biological set-up as less finalised". (Svend Andersen)

In general, gene technology researchers tend to believe that gene therapy in itself will not influence our perception of diseases.

The panel believes that in the short term gene therapy as such will not change our perception of disease compared to existing treatments.

But in the long run we can imagine that demands will arise for "genetic equality" understood as "if you have the 'right genes, I want them too", i.e. if I lack some genes and it gives me a disease or predisposes me to diseases, it is my right to have this corrected. QED: a change in the perception of disease/health.

Furthermore, we believe that the claims often heard that a gene determining alcoholism or homosexuality has been found, will influence our perception of disease, even though the claims are later retracted under less media attention than at the time they were made.

b)Lars Bolund points out that we have to develop our concept of normality in step with our increasing knowledge. Diversification is our strength.

In contrast, Lone Nørgaard believes that our concept of normality will contract and that we will become even less tolerant of deviations.

"As we come to recognise that we all carry genes for different diseases (for instance we carry five recessive genes for terminal diseases on average), we will realise that it is normal to carry disease genes. In other words (...), it is normal to be abnormal (or abnormal to be normal)". (Nils Holtug)

The panel believes if that gene therapy shows that a large number of our characteristics are determined by genes, more characteristics will by definition be perceived as natural. We will no longer label humans "abnormal", if they are born with differing characteristics, just because we do not like these characteristics.

On the other hand we fear that the possibility of changing certain characteristics will lead to a higher degree of regimentation.

c)We believe that this should not be allowed to happen. To all intents and purposes, external factors and the free selection of the individual should control humans, irrespective of gene composition. External influence might include social environment, pollution, accidents, etc. For instance, we could be born with many "musical" genes, but this will not do us much good, if we are never given a piano.

The panel believes that humans are not just the product of their genes. In Nils Holtugs words, our identity is to a wide degree based on our remembrance of the past and our interests and plans for our lives.

We are not just the product of our genes.

Key question 7 - How can patient rights be secured in relation to gene therapy?

Today, patients are covered by the rule of informed consent, of the Practice of Medicine Act, of the Drug Act, and patients under test treatment are protected by the legislation on the scientific-ethical committees.

We believe that the present patient protection is sufficient - also to cover gene therapy. However, we wish to emphasise the necessity of providing thorough information to patients in close co-operation between doctor and patient. At the same time, patients should be given opportunity to seek independent advice on gene therapy.

But individual persons must decide for themselves whether they want to know their own gene maps. We wish to emphasise the necessity of providing thorough information to the patient.

In relation to embryo diagnostics, parents must always be offered access to information on whether the child will be born with serious diseases.

A persons DNA profile is his personal property. Nobody else can or must be allowed to deal with this property. (We are aware that special conditions may apply to criminal cases).

Every citizen should by law be protected against discrimination based on his/her DNA profile. We must also ensure that citizens not wanting others to know their DNA profile will not be discriminated against.

This means that citizens DNA profiles must not be used when, for instance, a person wishes to contract an insurance, apply for a job or an education.

Key question 8 - Legislation and control

a)Today gene therapy is covered by: the Practice of Medicine Act, the Drug Act, legislation on the environment and gene technology, legislation on the scientific-ethical committee system, processing of bio-medical research projects and by the Danish Council of Ethics, etc.

To ensure that gene therapy is carried out in the fields where we want it, i.e. gene therapy on body cells, legislation to this end should be implemented.

A special act should be adopted on gene therapy due to the special character of the area.

b)EU regulations exist for the registration and marketing of drugs.

The Council of Europe is preparing a bio-ethical convention, article 16 of which is concerned with human hereditary material. The article proposes that interference in hereditary material should only be allowed in relation to purposes of prevention, treatment or investigation, is so far as the objective is not a deliberate change of germ cells - however, a small risk of influencing germ cells is acceptable.

We believe that Denmark should ratify the principles of intervention in human hereditary material set forth in the convention.

c)Experts have informed us that it is not possible to acquire ownership of and patents on treatment methods. Neither can a gene as such be patented. In relation to industrial utilisation, e.g. in relation to the manufacture of drugs on the basis of gene technology, patents may be taken out. Only inventions can be patented, not discoveries.

A 1988 EU draft directive on patents etc. was rejected by the European Parliament on 1 March 1995.

d)When Denmark is to set up a gene therapy act, we can study the legislation of other countries. Basic attitudes to gene therapy are largely uniform: a positive attitude to gene therapy on body cells and bans on gene therapy on germ cells.

e)We believe that it should be possible to delimit gene therapy treatment as it develops. However, this is inexpedient and might entail large costs. Consequently, we recommend that tight legislation be adopted now containing bans on gene therapy on germ cells, as we might otherwise risk a sliding effect.

f)We agree that there is no need for a special gene therapy council, but that a sub-committee should be set up under the existing scientific-ethical committee system, in which both experts and laymen should be represented. The sub-committee should work under a duty to inform the public of its work.

g)The panel agrees that no special legislation on authorisation should be adopted for private clinics, as the operation and staff of the clinics are covered by prevailing legislation.

Instead a quality assurance scheme should be set up to ensure a uniform and clear distinction between treatment and tests.

h) Reference is made to the answer to sub-question f. However, we believe that the bounds of publication should be determined by the risk of revealing production secrets.