

The Future of Cloning Young People Decide

The
Royal Society
of Edinburgh

Image courtesy of Roslin Institute

On the 18th of June, 2002 a group of young people from Schools in Central Scotland gathered at The University of Stirling for what turned out to be a lively debate on the ethics of cloning, chaired by The Rt Hon Lord Ross PC FRSE.

The students heard from Scottish experts and then, after working in small groups, presented their ideas on how we should use cloning technology.

FACTS AND ISSUES

Cloning Technology Explained: the benefits and drawbacks Mr Tim King, Roslin Institute



Cloning technology provides us with many possibilities and also practical problems. The dictionary definition of cloning is "to produce an individual or group of organisms from a single ancestor to which they are genetically identical". Cloning occurs commonly in nature in many plant species and in a few animal species. Man first used cloning technology with the use of plant cuttings and today we have succeeded in cloning a host of animals including sheep, rabbits and a kitten. There are two distinct uses of cloning, i.e. reproductive cloning and therapeutic cloning, both of which have many possibilities as well as limitations.



Reproductive Cloning is the process by which an individual organism is produced from another organism and therefore they are genetically identical. This process requires the removal of genetic material from an unfertilised egg, followed by its replacement with the genetic material of another individual. The newly formed egg is stimulated to divide and, if successful, will develop into an embryo which can be implanted into an adult uterus. This form of cloning gives us the ability to replicate numerous, genetically identical offspring. The benefits of this process include the production of many identical animals known to be resistant to a particular disease. The genetic trait (e.g. disease resistance) can then be spread throughout the gene pool much more quickly than could be achieved by traditional animal husbandry methods, where the trait is spread 'naturally' by mating with the single ancestor. Additionally, genetic modification of the embryo to further specify the genetic trait, prior to implantation, is possible. In this way many useful traits can be produced in the cloned animals. For example, sheep that have been modified in such a way that they produce human therapeutic proteins in their milk have been cloned. Though still at the trial stage, this is a

great breakthrough as these proteins were previously only obtainable from human blood. If successful, the use of this technique would reduce the dependence on limited supplies of human blood and avoid the risks of the proteins being infected by diseases carried in the donor blood supply. Other examples include the modification of the cells of pigs so that when pig organs are implanted into humans they are not rejected. The success of this technology could open the door to organs from an animal being transplanted into humans (xenotransplantation), so patients needing an organ transplant would not have to rely on the limited number of human organs available for donation. Modification could also be made such that animals could be used as more precise models of human diseases and thus hasten the development of therapies and cures. However, Reproductive Cloning has its share of practical drawbacks. Only a small percentage of eggs used will successfully produce a cloned animal. From 100 eggs produced only 80 may be successfully collected and of these only 60 may be successfully injected with new genetic material. Of those on average only 30 would begin to develop and after a period of about 7 days in culture, just 3 eggs would still be alive. It is generally accepted that

at least 8 are required to produce a single lamb. So the process is still of very low yield. If a cloned embryo is implanted there are often abnormalities with the pregnancy. In cloned sheep pregnancies 80% deliver late and many with oversized lambs. Some cloned offspring, although born alive, have been shown to have abnormalities. For example cloned mice have been shown to have considerably lower survival rates than mice produced by natural mating or by *in vitro* fertilisation (IVF). It is worth noting that in the United Kingdom, any experiments conducted to clone animals are controlled under the Animal (Scientific Procedures) Act 1986. This legislation is amongst the strictest in the world.

Therapeutic Cloning is the most controversial but exciting new area made possible by the cloning technology. In this form of cloning human embryos would be produced by taking genetic material from a patient and fusing that with an unfertilised egg. Following culture of these embryos for 6 or 7 days they would be destroyed and totipotent cells extracted from them.



Totipotent cells are unique because they are the precursors to all the other cells in the body. During normal development in the womb, these cells differentiate and form the various different types of cells and tissues that make up the body. Totipotent cells extracted from embryos can also be stimulated to produce different cells *in vitro* (in the test tube). Thus from a single totipotent cell, many differentiated cells can be produced e.g. neurones (nerve cells) to treat patients with Parkinson's disease or Alzheimer's disease and cardiomyocytes (heart cells) for the treatment of degener-

ative heart conditions. Therapeutic Cloning will pose a host of technical problems, and the ability to culture the various types of cell from the totipotent ancestors is still in its infancy. Cloning of human embryos in the United Kingdom is only allowed under licence from the Human Fertilisation and Embryology Authority (HFEA). To date no licence for this has been issued.

It is vital that the public, including young people, has as much information as possible so that they can influence how cloning should be regulated.

Modern Biotechnology: evolution in the fast lane

Dr Kenneth Boyd, University of Edinburgh

There are many moral arguments for and against the use of cloning technology.

Is cloning 'playing god' or being responsibly human? There was a great deal of difference between traditional technology and biotechnology, since e.g. hardware engineering has predictable results because we understand the properties of the products that we use. However, in biological engineering we deal with complex self-functioning systems, which therefore have many unpredictable properties. It was accepted that cloning could be considered unnatural, but that interfering with nature is an integral aspect of 'human nature' and humans have always tampered with nature.

We all judge issues in two ways, i.e. 'deontological', where we deem an issue to be inherently right or wrong, regardless of its consequences and 'utilitarian' where we make a judgement based on bringing the greatest

good to the largest number of people/animals. One of the most contentious issues in the field of cloning is the use of embryos in research,



which at present must, by law, be under 14 days old. Deontological arguments against, are that it is inherently wrong to kill an innocent. However, the same form of argument in favour states that the embryo's moral status grows as it develops and so pre-implantation embryos do not have an absolute right of 'sanctity of life'.

The utilitarian argument against says that using embryos diminishes respect for life and that we may therefore be on a 'slippery slope' when we decide what age the embryos can reach before we should stop using them. The converse utilitarian argument says that the benefits of stem cell research outweigh the lesser claim of the embryo's absolute protection.

Another issue arising from this is whether embryos should be specially created for stem cell research or whether this should be limited to 'spare' embryos only. Since 1990 only 118 embryos have been specially

created for medical research. However 53,000 embryos have been donated for research by couples having infertility treatment and 250,000 'spare' embryos produced during infertility treatments have had to be destroyed by law. Embryos from which embryonic stem cells are derived can only be used with the full consent of the donor parents.

A further argument against therapeutic cloning was the fear that it was a 'slippery slope' towards reproductive cloning of humans. Whilst

Britain has strict laws against this form of cloning, other parts of the world do not. Yet there are arguments for reproductive cloning, e.g. a second child to produce compatible organs for a dying child or infertility cloning which might be seen as a better option than donation of eggs/sperm or than adoption. Arguments against this form of cloning are that there may be difficulties in terms of identity and autonomy for a cloned child, that cloning could lead to the 'designer baby'

phenomenon and the questionable issue of whether a child should be produced only to go through a dangerous procedure like organ donation.

While regulatory bodies that control cloning include lay people and organisations such as the Human Genetic Commission (HGC) and the Human Fertilisation and Embryology Authority (HFEA) often put out consultation documents to the public, it is important that young people like you decide how you would like to regulate the use of this technology.

STUDENTS' VIEWS

The students were divided into small groups to discuss and have their own say on this controversial issue. During the workshops it was immediately clear that quite strongly-formed opinions were held on both sides of the debate. The views of each group were presented to the rest of the forum during the plenary session at the end of the day.

Is cloning 'unnatural'?

The consensus was that whilst cloning could indeed be thought of as 'unnatural', most other areas of science could be considered in the same way and so 'unnatural' did not necessarily equate to 'bad'.

If cloning was shown to be completely safe, should it be used to clone humans?

The group was strongly against human cloning, feeling that only cloning of organs and therapeutic cloning was justified. They thought that the creation of 'designer babies' was immoral, being a commercial process and thus putting a price on life. They were concerned that people would all end up the same, that this cloning could result in segregation with

clones being thought of as either better or worse than other humans. They also felt that replacing a dead child with a clone would devalue the former child by reducing the mourning over its loss. The students were concerned that being able to pick the baby you wanted would make adoption a less attractive option, leaving children in need of adoption without potential homes. Finally they were concerned that our natural capacity to evolve and become resistant to disease would be put at risk by narrowing the gene pool.

Do the arguments for human reproductive cloning outweigh the arguments against?

Those in favour of cloning humans reiterated the benefits in terms of organ transplants for sick siblings and



of infertility treatments in very specific cases. However, in opposition they were concerned as to where it would stop if it were allowed to begin at all. They were certainly against the possibility of 'designer babies'. In general they felt that human reproductive cloning should only be allowed if there was no alternative, if it was for the greater good and if there were strict international laws saying where it had to stop.

Would a cloned human have a soul?

Whilst there was some debate as to what exactly was meant by a soul, the consensus was that whether the soul was a spiritual thing or simply the aspect of ourselves which made us human, a cloned individual would indeed possess one and that they would in fact be no different from anyone else.

Would/should a cloned human have the same rights as a non-cloned human?

The students appeared to agree





unanimously that the same rights should be extended to cloned humans as to others. Indeed some groups felt that the cloned individual might deserve extra rights to privacy and protection so that they would not be plagued by intrusive press coverage or used unscrupulously by science.

Would a cloned human have unusual expectations thrust upon them?

For example, would there be pressure on the cloned individual to be like the sibling or a parent of which they were a clone?

The students thought this a difficult

issue but agreed that there might be certain expectations and a clone might lose its individuality as a result.

Would it be better to be a clone of one parent than to be adopted and not genetically related to either parent?

Some felt it was better to be adopted than be a clone as you would still be a random mix of two different people and thus more individual.

Are there any drawbacks to using cloning to reproduce large numbers of high-quality animals in agriculture?

short-term suffering of the few and as animals are used as food it is reasonable to also use them for developing cloning technology. A minority felt that the potential suffering of the experimental animals was never justified.

'Spare' human embryos from IVF programmes should be used in research rather than embryos being specially created for research

The whole group agreed that the use of embryos should be restricted to 'spare' embryos, but for exceptional circumstances. They were unable to fully define their reasons for this as the majority of the group had previously determined that the embryos were not yet 'human'.

The group felt that the cost to animal health and life should be more carefully weighed in the case of agricultural cloning. The use of animals was more easily justified for use in experiments to improve human or animal health rather than in intensive farming practices.

Should animals be used for the production of replacement organs in people?

The group was in favour of using animals for the production of human organs, feeling that since animals are already used for meat, this was just as valid. Organs produced in this way would be more standardised than those from donors. The group concluded that there could be a potentially endless supply and hospital waiting lists would therefore be reduced.

What risks are there in allowing transplantation of animal organs into humans?

The students also pointed out that hospitals could find their workload increasing dramatically as they would have to cope with many more transplant operations and aftercare. They were also concerned about the risk of commercial companies taking advantage and artificially inflating prices for the organs. There could potentially be psychological issues for the recipients, though most said they would feel comfortable to receive an animal organ. They were concerned about the potential of animal viruses crossing to humans from animal to human organ transplants.

RECOMMENDATIONS

If reproductive cloning of humans was allowed, it could be justified only under special circumstances

The only circumstances in which the group felt cloning of humans would ever be acceptable (and then with reservations) was for some cases of organ replacement and that it should never be carried out merely for research.

The potential health benefits of therapeutic cloning outweigh the harms to experimental animals. Although the group was divided on this issue, the majority was in favour of therapeutic cloning. Those in favour felt that human beings had priority over animals, that the long-term benefit to other animals outweighed the

However, their gut feelings were that it would be wrong to waste those 'spare' embryos produced for IVF in favour of specifically produced ones.

The use of cloning technology needs to be regulated in the UK and World-wide

The students felt that irresponsible use of this technology could be prevented if there were strict enough laws governing the situation.

The group felt an international panel should be created which comprised people from different walks of life, including the general public and scientists, and that opinions both for and against should be represented (as already happens with the UK's Human Genetic Commission).

Speakers

Tim King is currently the Named Veterinary Surgeon at The Roslin Institute (Edinburgh) and amongst other achievements his work has resulted in the first gene targeted lamb and the first pig to be cloned in Europe.

Professor Kenneth Boyd is Professor of Medical Ethics at the University of Edinburgh Medical School. He is also the Chairman of the Boyd Group on the use of animals in science.

Chair

The Rt Hon Lord Ross PC FRSE, Vice President of the Royal Society of Edinburgh (1999-2002) and formerly Lord Justice-Clerk of Scotland.

Workshop Facilitators

Lindsay Easton

Joanne Lello (also rapporteur)

Gillian McDonald

Senga Morran

Steve Paterson

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Participants

Bannockburn High School

Heather Courtney

Amanda Cowie

Sarah Cully

Peter Davidson

Frances Elrich

Calum Fulton

Danielle Gibson

Yvonne Johnstone

Lindsay Kaney

Claire Logan

John McCloy

Iain MacKay

Donna Martin

Drew Millar

Lisa Scott

Anne Marie White

Blairgowrie High School

David Cole

Megan Crichton

Rebecca Crump

Christopher Elcombe

Stuart Gordon

Callum Hain

James Larsen

Rachel McLagan

William Ramsay

St Columba's High School

Mark De'Mar

Maire Laurie

Karen McPhee

Juleigh Malcolm

Siobhan O'Malley

Emily Paterson

Steve Terry

Leanne Wilson

Beath High School

Sharon Adamson

Robert Aidie

Qamar Azher

Claire Bett

Nicola Brown

Ashley Connor

Naidean Garvie

Sarah Haines

Fiona Jackson

Adele Jamieson

Laura Johnstone

Joe McColl

Nicol Marshal

Laura Martin

Kirstyn Mitchell

Gwen Mullen

Laura Nelson

Chadni Ramzan

Sharon Thomson

Scott Webster

Penny Winsborough

Dollar Academy

Tom Coles

Philip Dunsmore

David Garrard

Denny High School

Deborah Allan

Alison Craig

Allan Drummond

John Keith

Colin McNaughton

RSE Young People's Events

Schools' Lecture Programme

These lively talks for secondary schools throughout Scotland are funded through corporate and charitable donations. They aim to enthuse and excite students about science, engineering and technology and demonstrate the relationship between subjects studied at school and their practical applications.

Christmas Lectures

Held at a different location each year, there is a talk for local schools and a talk for the wider community. Supported by the Heggie Fund, they aim to encourage an interest in science and technology.

RSE Roadshow

The RSE Roadshow, funded through corporate and charitable donations, is aimed at older primary and younger secondary school children throughout a given area. It includes talks and workshops to bring science to life and is held at different locations throughout Scotland.

Startup Science Masterclasses

These masterclasses are held at five different locations in Scotland. They aim to widen students' experience of science, engineering and technology. The masterclasses are for students in S1 and S2 and emphasise the role of science in society through talks and practical activities.

Physics Masterclasses

Building on the success of the Startup Science Masterclasses, these new classes allow S5 and S6 students the chance to find out about the everyday applications of physics, through imaginative, hands on activities. In conjunction with the University of Glasgow.

Science Summer Camp

A non-residential summer camp for S1 and S2 students where young people learn about science and technology through fun, interactive activities. It is planned to hold camps at different locations around Scotland.

Maths Masterclasses

These established masterclasses are aimed at primary school children to show that maths is fun and creative whilst also developing children's intuition, problem-solving and analytical skills.

Discussion Forum for Young People



The RSE Young People's Discussion Forum aims to offer students in S5 and S6 a chance to get to grips with topics such as Mobile Phone Safety and Cloning.

Based on the Consensus Conference model, participants hear evidence from experts and interested parties before discussing the issues in greater detail in smaller workshop groups. The students then put forward their own ideas and proposals which are compiled into a report that is sent to decision-making bodies. This allows young people the opportunity to have a say in issues that affect society.

The Royal Society of Edinburgh (RSE) is Scotland's National Academy.

An independent, non party-political body, the RSE is a knowledge resource for the people of Scotland.

Its multi-disciplinary fellowship of men and women makes the RSE unique amongst learned societies in Great Britain, encompassing excellence in the Sciences, Arts, Humanities, the Professions, Industry and Commerce.

Its wide-ranging activities include the organisation of:

- conferences for specialists and the public
- educational activities for young people
- events to promote links between academia and industry

The RSE also awards research fellowships, prizes and scholarships and publishes internationally recognised journals.

The RSE is Scottish Charity No. SC000470

For more copies of this report or for further information contact:

Dr Harinee Selvadurai
Education Officer
The Royal Society of Edinburgh
22-26 George Street
EDINBURGH, EH2 2PQ

Tel : 0131 240 5000
Fax : 0131 240 5024

education@royalsoced.org.uk
www.royalsoced.org.uk