

Transgenic Animals

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<https://www.slideshare.net/slideshow/ethical-issues-related-to-transgenic-animals/246253061>

Transgenic Animals

- These are animals that have had their DNA manipulated to express an additional (foreign) gene.
- Gordon *et al.* (1980) were the first to accomplish this in mice by direct microinjection of a DNA construct into the pronuclei of fertilized eggs.
- Transgenic technology is typically used to
 - (1) overexpress a normal gene,
 - (2) rescue an ablated gene,
 - (3) ectopically express a gene, or
 - (4) express a mutant gene.
- Although more than 95% of transgenic animals are mice; there also exist transgenic rats, sheep, rabbits, pigs, cow, and fish.

...Transgenic Animals

- Several terms are used to describe genetically engineered animals: genetically modified, genetically altered, genetically manipulated, transgenic, and biotechnology-derived, amongst others.
- In the early stages of genetic engineering, the primary technology used was transgenesis, literally meaning the transfer of genetic material from one organism to another.
- However, with advances in the field, new technology emerged that did not necessarily require transgenesis: recent applications allow for the creation of genetically engineered animals via the deletion of genes, or the manipulation of genes already present.
- To reflect this progress and to include those animals that are not strictly transgenic, the umbrella term “genetically engineered” has been adopted into the guidelines developed by the Canadian Council on Animal Care (CCAC).
- For clarity, in the new *CCAC guidelines on: genetically-engineered animals used in science* (currently in preparation) the CCAC offers the following definition of a genetically engineered animal: “an animal that has had a change in its nuclear or mitochondrial DNA (addition, deletion, or substitution of some part of the animal’s genetic material or insertion of foreign DNA) achieved through a deliberate human technological intervention.”
- Those animals that have undergone induced mutations (for example, by chemicals or radiation — as distinct from spontaneous mutations that naturally occur in populations) and cloned animals are also considered to be genetically engineered due to the direct intervention and planning involved in creation of these animals.

- Genetic engineering technology has numerous applications involving companion, wild, and farm animals, and animal models used in scientific research.
- The majority of genetically engineered animals are still in the research phase, rather than actually in use for their intended applications, or commercially available.
- **Companion animals**
- By inserting genes from sea anemone and jellyfish, zebrafish have been genetically engineered to express fluorescent proteins — hence the commonly termed “GloFish.”
- GloFish began to be marketed in the United States in 2003 as ornamental pet fish; however, their sale sparked controversial ethical debates in California — the only US state to prohibit the sale of GloFish as pets.
- **Wild animals**
- The primary application of genetic engineering to wild species involves cloning.
- This technology could be applied to either extinct or endangered species; for example, there have been plans to clone the extinct thylacine and the woolly mammoth.
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Farm animals

- Productivity of farm animal species can be increased using genetic engineering.
- Examples include transgenic pigs and sheep that have been genetically altered to express higher levels of growth hormone.
- Genetically engineered farm animals can be created to enhance food quality.
- For example, pigs have been genetically engineered to express the $\Delta 12$ fatty acid desaturase gene (from spinach) for higher levels of omega-3, and goats have been genetically engineered to express human lysozyme in their milk.
- Effort has also been made to generate genetically engineered farm species such as cows, goats, and sheep that express medically important proteins in their milk.
- In 2006, ATryn[®] became the first therapeutic protein produced by genetically engineered animals to be approved by the Food and Drug Administration (FDA) of the United States.
- This product is used as a prophylactic treatment for patients that have hereditary antithrombin deficiency and are undergoing surgical procedures.

Research animals

- biomedical applications of genetically engineered animals are numerous, and include understanding of gene function, modeling of human disease to either understand disease mechanisms or to aid drug development, and xenotransplantation.
- The use of genetically engineered animals has also become routine within the pharmaceutical industry, for drug discovery, drug development, and risk assessment.
- “Transgenic and knock out mouse models are extremely useful in drug discovery, especially when defining potential therapeutic targets for modifying immune and inflammatory responses.

Concerns

- During the development of the *CCAC guidelines on: genetically-engineered animals used in science*, some key ethical issues, including animal welfare concerns, were identified:
 - 1) invasiveness of procedures;
 - 2) large numbers of animals required;
 - 3) unanticipated welfare concerns; and
 - 4) how to establish ethical limits to genetic engineering

BIOETHICAL CONCERNS RELATED TO TRANSGENIC ANIMALS:-

- Fear of transferring **allergens** from genetically modified food to sensitive humans and animals.
- Risk- whether they pose **harmful effect** on biodiversity and overall impact on environment.
- GM animals may bring about **changes in natural evolutionary pattern** .
- Use of animals in biotechnology is **cruelty towards animals** which causes great suffering to them.
- Transfer of human genes into animals is great **ethic threat** for humanness.
- No respect for living things-It's goal is to exploit them for commercial use in benefitting the human society.

GEAC:

- Indian Government has setup organisations such as **GEAC**(Genetic Engineering Approval Committee)which will make decisions regarding the validity of research and the safety of introducing GM organisms for public services.
- It has the power to permit large scale use of GMO's at commercial level and also monitors field trails of transgenic animals and agricultural crops,industrial products,health care products etc.

RELIGIOUS CONCERNS:-

- ❖ Transgenic animals can create particular problems for some religious groups.
- ❖ **For Muslims, Sikhs and Hindus** it would be forbidden to eat foods containing **genetic material from animals** whose flesh is forbidden. Such religious requirements raise fundamental questions about the identity of animals and its genetic basis.
- ❖ The essence of this concern is that modern biotechnology is trying to “**displace the first Creator**” or to “**play God**”.

ANIMAL WELFARE :-

- “Animals are not ours to eat, wear, experiment on, use for entertainment, or abuse in any way.”
- It' the most controversy and debate regarding animal biotechnology surrounds the animals themselves.

CONCERNS :-

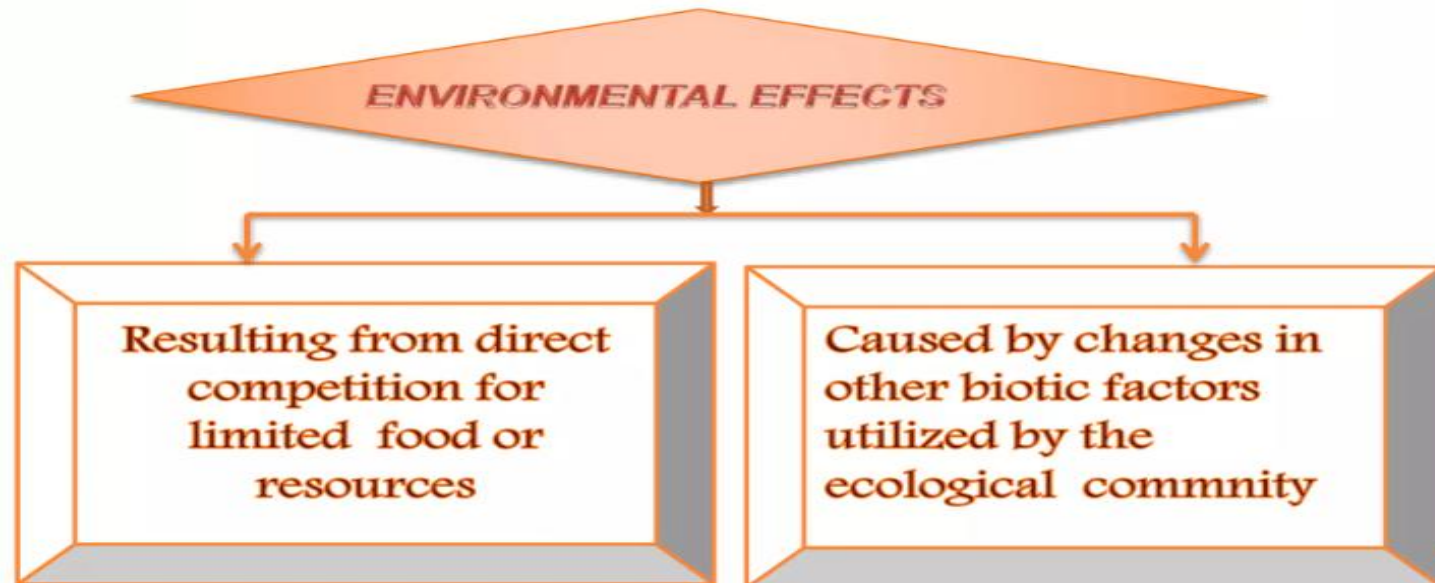


- ✓ Proteins designed to produce a pharmaceutical product in the animal's milk might find their way to other parts of the animal's body, possibly causing adverse effects.
- ✓ Over **90%** of the genetically engineered animals used in research and testing.
- ✓ Interfering with the genome by inserting or removing fragments of DNA may result in alteration of the animal's normal genetic **homeostasis**. For example:–**Early transgenic livestock**.
- ✓ Studies have revealed that cloned mammals may suffer from developmental abnormalities, including extended gestation, large birth weight and effects in organs and tissues.
- ✓ **Genetic engineering** also brings with it concerns over intellectual property, and patenting of created animals and/or the techniques used to create them.
- ✓ **Embryo collection** and transfer present a range of animal welfare issues.
- ✓ Like in cattle genes can be given under epidural anesthesia, in non-surgical way.
- ✓ It has been estimated that less than one percent of microinjected livestock embryos result in transgenic offspring.
- ✓ Even if an individual does express the transgene, it might not be transmitted to subsequent generations.
- ✓ Approximately 30 % of transgenic mice are mosaics, which means that they carry the transgene in only some of their cells.

- ✓ Mutations by inserted genes can occur.
- ✓ It has been estimated that **5 to 10 %** of established transgenic mice lines produced by microinjection have such mutations.
- ✓ Example of welfare problems arising from inappropriate transgene expression is that of the so-called **Beltsville pigs**, salmonids transgenic for fish growth hormone,
- ✓ Gene insertion and removal also can have effects on behavior. For example - Growth hormone constructs in fish have been found to affect swimming ability.
- ✓ Some types of knockout mice also have been found to exhibit behavioral problems, such as increased aggressiveness.

ENVIRONMENTAL EFFECTS

The negative impacts might either be



BIOPATENT:

- The modification or usage of living organisms for public service (as food and medicinal source ,for example)has also created problems with patents granted for the same.
- Dictionary meaning of patent is “**an official right to be the only person to make,use or sell a product or an invention**”.Thus a patent is the right granted by a government to prevent others from commercial use of this invention.
- A patent is granted for
 - An invention including a product.
 - An improvement in an earlier invention.
 - The process of generating a product,and as a concept or design
 - Initially,patents were granted for **industrial inventions** by a particular company,such as patent medicines etc.,But now a days patents are also granted for **biological entities** and for products derived from them,such patents are called **biopatents**.Eg:Neem and it's products, turmeric(haldi)and it's products.

BIOMPIRACY:

- Biopiracy is a term used for the use of bioresources by a multinational companies and other organisation **without proper compensatory payment**.

CONCLUSION:



- ❖ The Indian Parliament has recently cleared the **second amendment of the Indian Patents Bill**, that take such issues into consideration ,including patent terms,emergency provisions and research and development initiative.Transgenesis and Genetic engineering present difficult challenges for 21st century scientists and ethicists.The issue is **where you draw a line between Human benefit and Animal discomfort.**