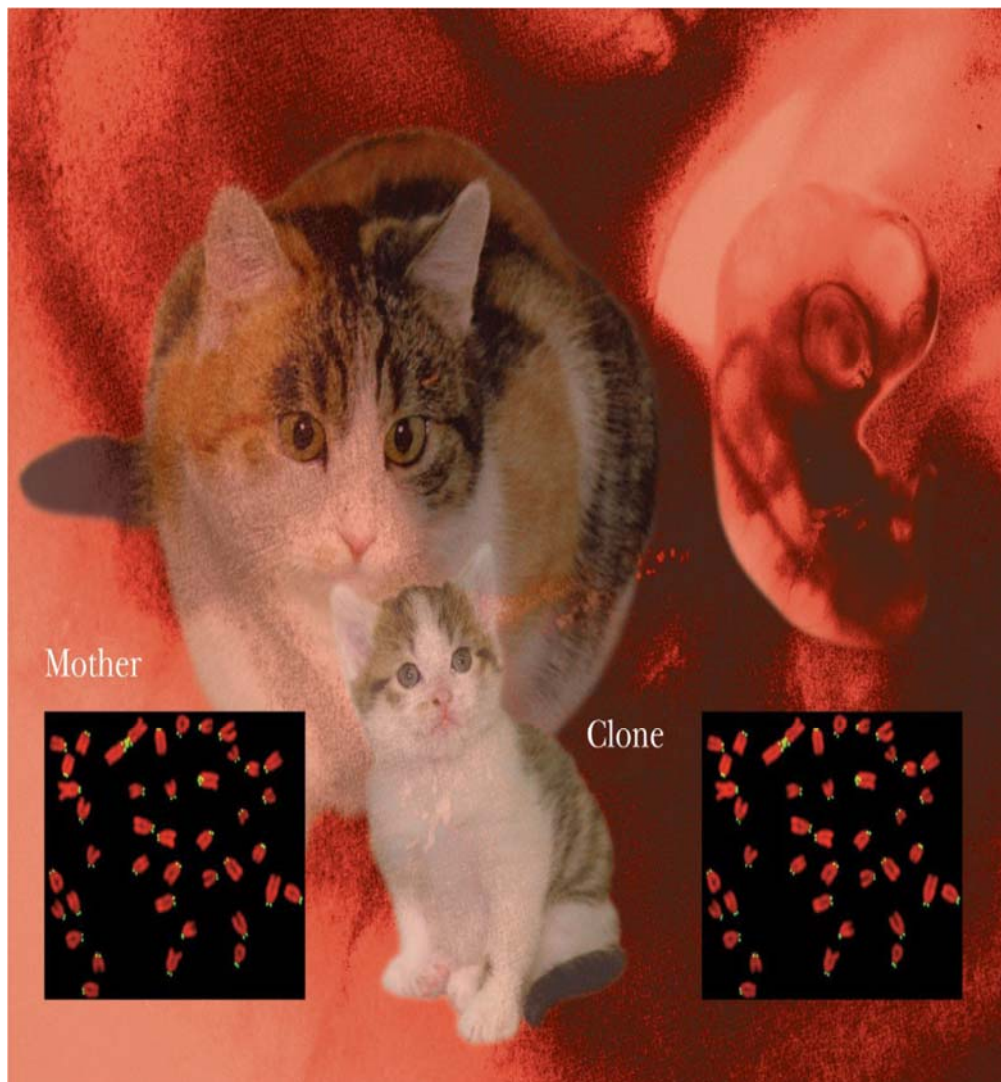


Lecture 11: Animal biotechnology application

A Clone Is Not a Copy

This digital collage shows CopyCat and his mother Rainbow. It is a true clone generated by nuclear transplantation. Rainbow, a calico female is the nuclear donor. Both cats therefore have identical chromosomes. Although CC is a genuine clone, she does not look identical to the nuclear donor because the pattern of a cat's coat is partly due to randomized cell divisions and, in females, X-linked inactivation.



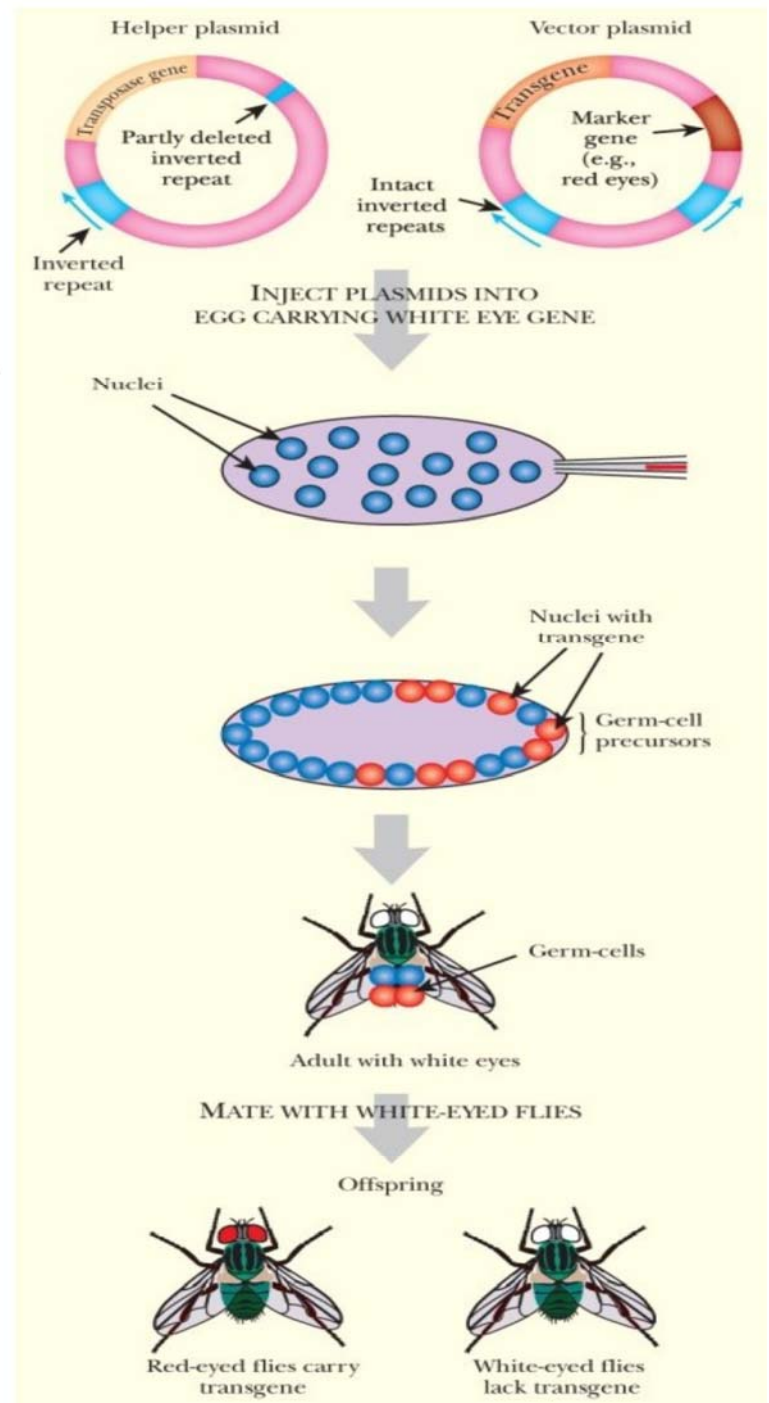
Transgenic Insects

P element transposons are used in *Drosophila* and other insects to introduce transgenic DNA into insects

Cause hybrid dysgenesis (high mutation rate that lowers the proportion of viable offspring), Can be used to introduce any sequence of DNA into a strain of susceptible insects carried on a bacterial plasmid constructed in a bacterial host

DNA may be microinjected into embryos of P⁻negative strains of *Drosophila*

Nuclei migrate to outer membrane where cleavage furrow forms
Center remains undivided and provides nutrients to developing larva



Genetically Modified Mosquitoes

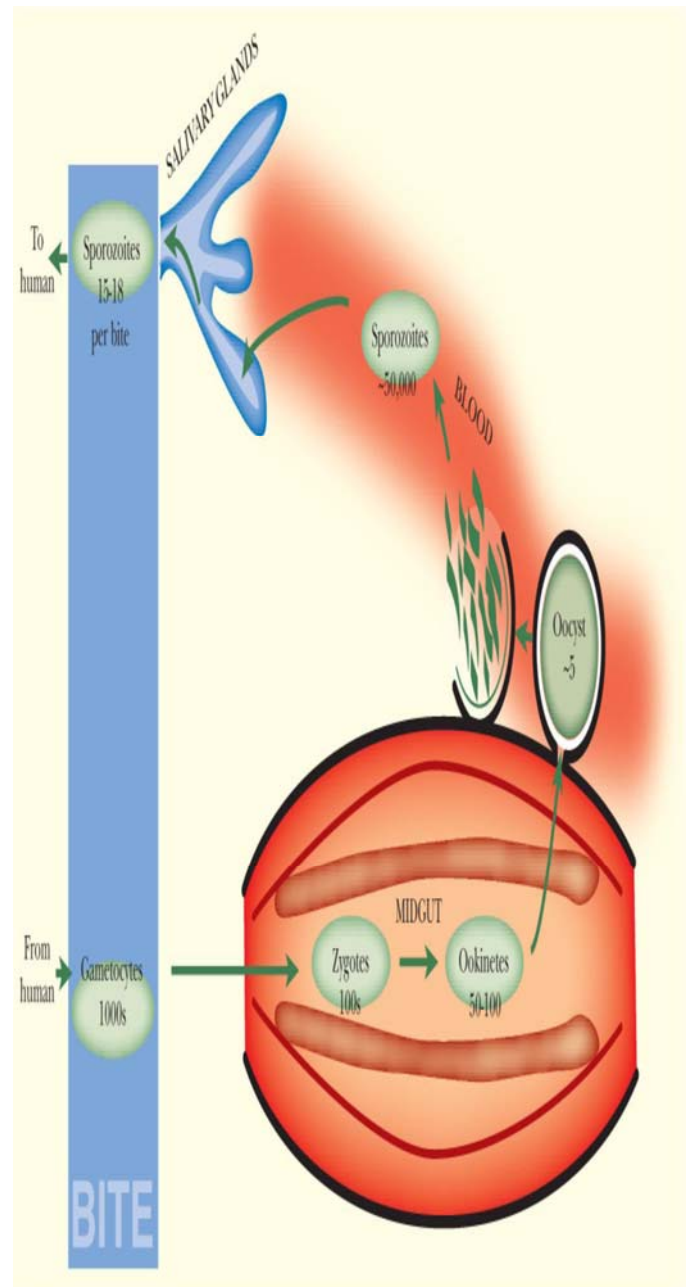
DNA inserted into germline cells
piggyBac transposon from the
 cabbage looper, *Minos* transposon
 from *Drosophila hydei*

Genetically engineering mosquitoes
 that are resistant to disease agent
 colonization, Noncarrier mosquitos
 released into the wild to displace
 disease-transmitting population

Increase expression of defensin A
 protein forms other species
 expressed in mosquito mid gut to
 block transmission

Genetically engineered human
 antibodies

Artificial genes for single -chain
 antibodies to circumsporozoite
 protein of malaria



Transgenic People, Primates, and Pets

- Mammalian cloning has high failure rate
- Human cloning for tissue transplantation
- Therapeutic cloning of reprogrammed cells grown in culture
- Human issues relating to nuclear transplantation
- Cloning of a human individual is not ethical
- Fairly risky, financial costs, and production efforts
- Chance of successful implantation into a surrogate human mother is 3-10x lower than sheep

Genetically Modified Food Animals

Advancements in genetic engineering and biotechnology has created new ways to edit animal genomes

Accelerated growth

Large product yields

Pathogenically resistant livestock

Genetic modification is a viable way to reduce antibiotic use in animal agriculture to make products safer and more sustainable

More immune cattle

Less infections

Less need for antibiotics

Reduces health costs for the farmer

Prevents production losses

Improves public safety toward breeding cattle with greater immunity

Effects of GM foods in animals

- Effects on Growth

-Effects on Gastrointestinal Tract:

1. **Stomach** erosion were reported in rats fed with flavr-savr GM tomatoes.
2. GM soybean which caused inflammation in the **intestine** of salmon
3. **Pancreatic Effects:** mice fed GM soya beans produces low amounts of α -amylase enzyme.

Animal Bio-invasions:

Fish and marine life are threatened by **accidental release of GM fish** currently under development in several countries - trout, carp, and salmon several times the normal size and growing up to 6x times as fast. Such accident has occurred in the Philippines - threatening local fish supplies.

Killing Beneficial Insects

Studies have shown that GM products can kill beneficial insects – most notably the monarch butterfly larvae and honey bees. A study reported honeybees harmed by feeding on proteins found in GM canola flowers.

Insects Super pests:

The transgenic cotton was meant to kill - cotton bollworms, pink bollworms, and budworms - were once "secondary pests. "Toxic chemicals killed off their predators, unbalanced nature, and thus made them "major pests."

Disadvantages of GM Animal

Unintended harm or breeding problems – Animals may be too big for their legs, have shorter life spans, and there are low survival rates for transgenic animals.

Mutagenesis and function disorders – Genetic mutations can occur which may result in diseases and disorders.

Expensive and extensive – The cost of equipment and animals is high. Also, it takes a while to find the right way to genetically modify the animal for whatever purpose. It doesn't happen overnight.

Unintended adverse effects – Genes have more than one function. A gene in one animal may do certain jobs or not that the other one doesn't. This may cause problems in the genes that cannot fully carry out their function.

Nature is complex – Nature is an extremely complex inter-related chain consisting of many species linked in a food chain. Genetically modifying animals may have irreversible effects with unknown consequences.

Other disadvantages

- Ethical issues.

- They have the potential to harm certain native species of animals or plants. It can also potentially affect the environment, thus altering the living conditions of many species.

Introduction of transgenic may also affect the direction of evolution and eventually decrease the gene pool.

The production of transgenic animal may lead to food-safety problems like allergies or toxicities.