

Genetic Engineering & Cloning

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What is Genetic Engineering?

"Genetic engineering is the technology for modifying the genetic information in a plant, animal or human in order to produce some desired trait or characteristic"



A Brief History of Genetic Engineering

- ★ The name is new, the practice is not.
- ★ Plants and animals have been bred for thousands of years.
- ★ Human breeding has also been done now and then.
- ★ All of this has worked by trying to enhance desired characteristics, without knowing how they are transmitted.



Genetic Engineering in the 20th Century

- ★ There have been great advances in our knowledge of genetics:
 - How genetic information is stored
 - How it is transmitted
 - How it is used
- ★ The entire DNA sequence of several organisms is now known, with human DNA just about done.
- ★ We are just beginning to decipher what each unit means and how it works.



Prospects for Genetic Engineering

- ★ Designing plants & animals "from scratch"
 - This is not going to happen anytime soon
- ★ Transgenic Engineering
 - Putting genetic information from one type of plant or animal into another
- ★ Cloning
 - Making genetic copies of an existing plant or animal
- ★ Let's look at the latter two of these.

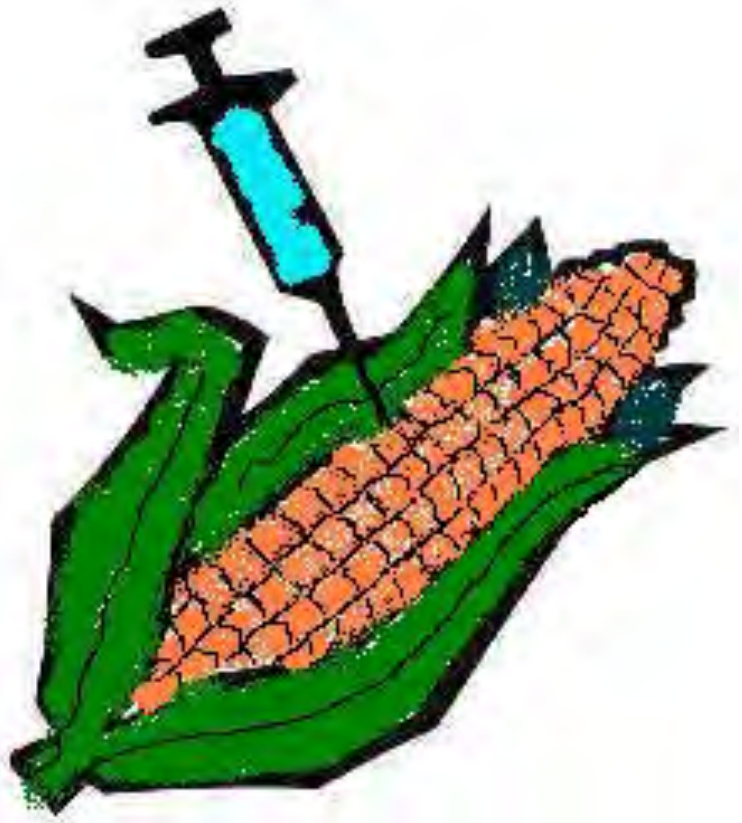


Transgenic Organisms

- ★ An organism is called "transgenic" if it has genetic information added to it from a different type of organism.
- ★ Viruses do something of this sort when they infect plants, animals or humans.
- ★ Humans have begun to do this with plants and animals.
- ★ We are not yet making flying pigs!



Transgenic Plants

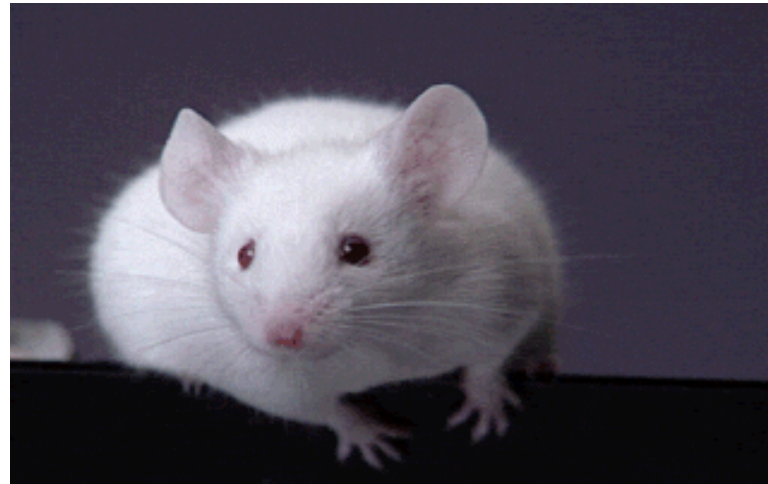


- * This is the work that is furthest along:
 - Corn with its own insecticide
 - Soybeans & cotton resistant to herbicides
 - Papayas resistant to viruses
- * Transgenic crops are being grown in the Americas, South Africa, Europe, Australia and China

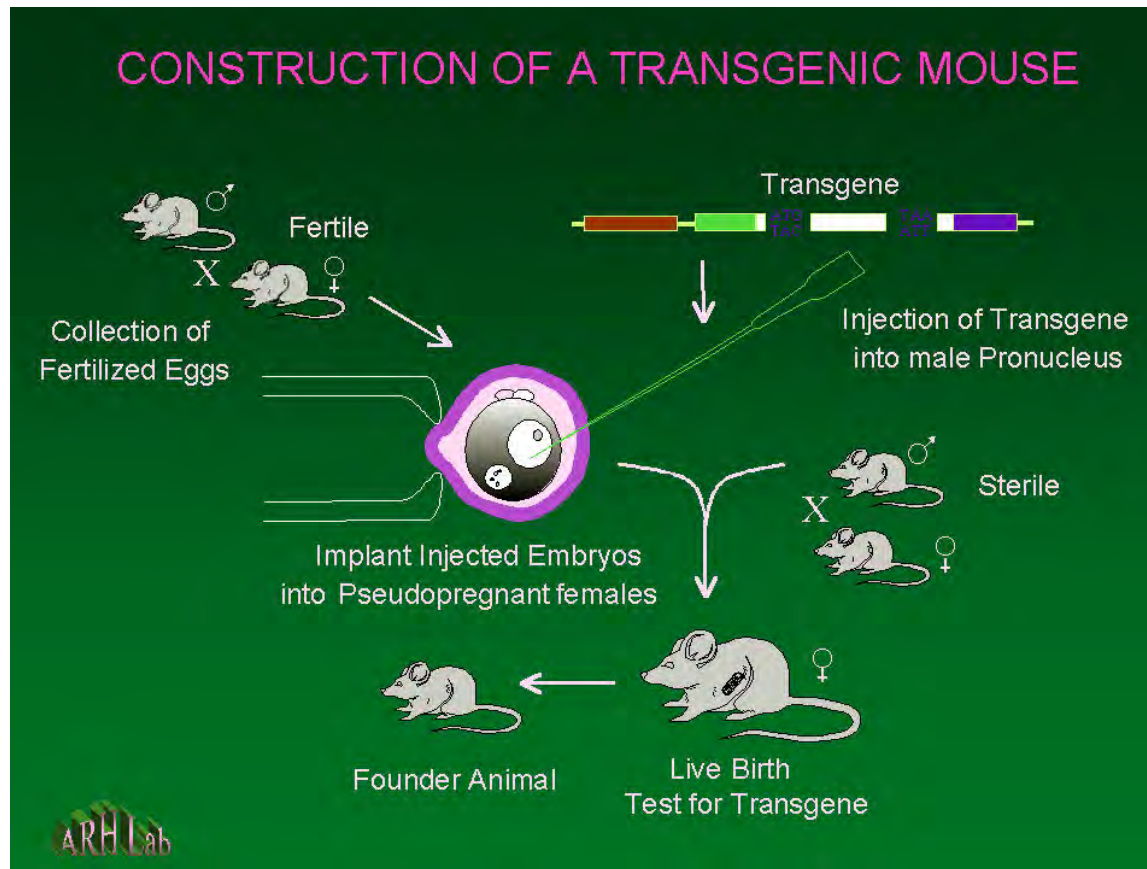


Transgenic Animals

- ★ The work is less advanced here.
- ★ Human genes have been inserted into:
 - Bacteria
 - Mice
- ★ To produce various human proteins for treating diseases.



Making Transgenic Mice



Advantages of Transgenic Engineering

★ Plants:

- More disease-resistant
- Larger yields
- More transportable
- More nutritious

★ Animals:

- Make proteins for medicinal purposes
- Make organs for transplant to humans



Concerns about Transgenic Engineering

★ Plants:

- Are they safe to eat?
- Will they harm wildlife?
- Will some become super-pest weeds?
- Replace or contaminate natural plants?

★ Animals:

- Will they be harmful?
- Replace or contaminate natural animals?



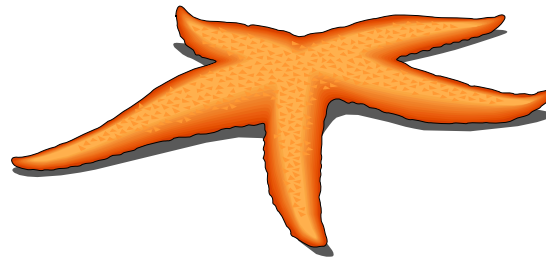
Cloning

- ★ A "clone" is a copy of something.
- ★ Computers that mimic IBMs are called "clones."
- ★ In genetics, a clone is a genetic copy of another organism.
- ★ Clones occur naturally:
 - Asexual breeding in plants & lower animals
 - Identical twins (triplets) in higher animals



A Brief History of Cloning

- ★ For centuries it has been known that simple animals – worms & starfish – can be cloned by cutting them in half.
- ★ This doesn't work for higher animals!
- ★ Part of the problem is cell specialization:
 - Nerve
 - Bone
 - Muscle, etc.



Cloning in the 20th Century

- ★ We now realize that each specialized cell has all the genetic information, but much of it is turned off.
- ★ Problem – how to reset the "program" so this information is usable?
- ★ Cloning of frogs successful in 1950s
- ★ Cloning of livestock from fetal cells in 1970s



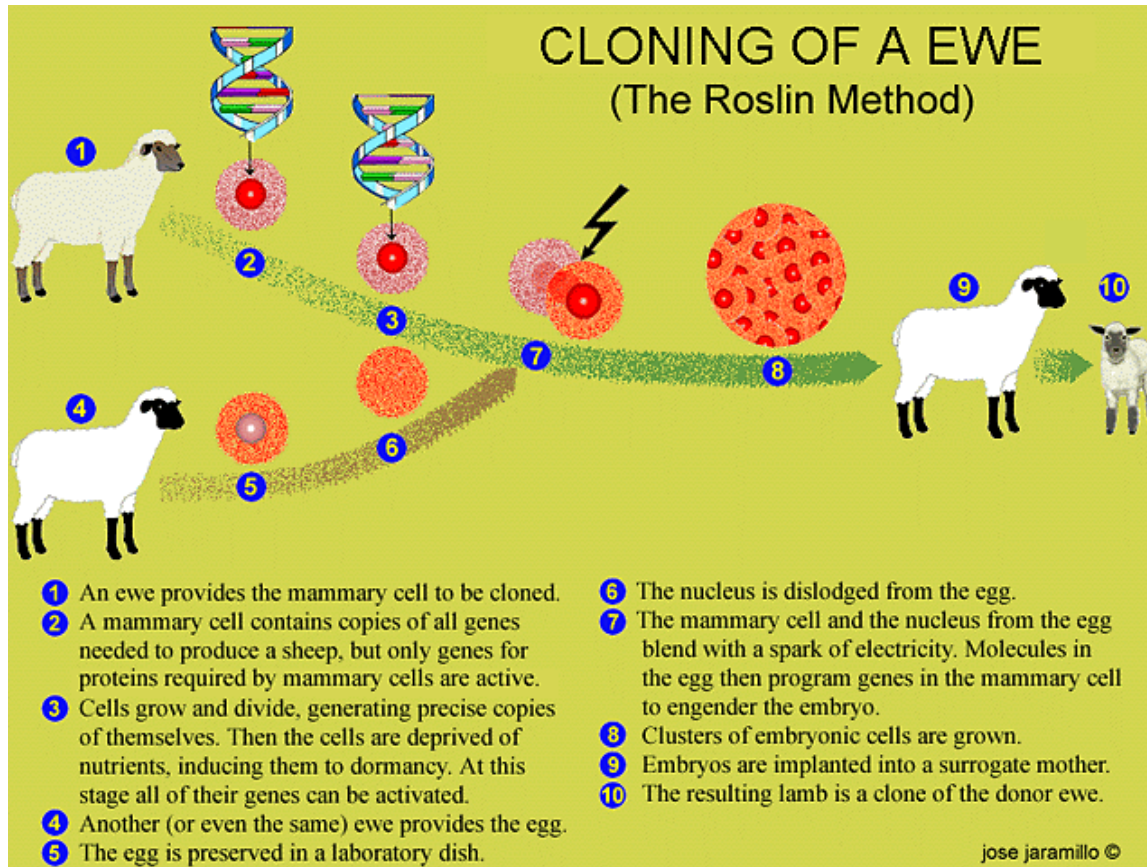
Dolly - 1996



- * Clone from an adult sheep cell by Scots researchers under Ian Wilmut
- * Had only one success in 300 tries.
- * Dolly grew to maturity, and successfully had a lamb by natural means in 1998.
- * But Dolly seems to be prematurely old.



Cloning Dolly



Cloning since Dolly

- ★ Cloning of this sort has now been done on cattle, pigs and mice also.
- ★ The success rate has improved considerably.
- ★ Cloning humans begins to show up in science fiction in 1970s.
- ★ This is now a realistic possibility.



Advantages of Cloning

- ★ With an adult plant or animal, the breeder knows what its traits are; this is not the case with fetal cell cloning.
- ★ Cloning allows making a genetically identical copy of the desired plant or animal.



Concerns re/ Cloning

- ★ The success rate from adult animal cells is still rather low.
- ★ This would be unacceptable for cloning humans in most societies.
- ★ The evidence suggests that the clones which survive are still not right.
- ★ The genetic program has probably not been completely reset.
- ★ We still don't understand what we are doing in cloning from adult cells.



How Should Christians React?

- ★ How should we respond to:
 - Food containing transgenic ingredients?
 - Making mice which produce insulin?
 - Making pigs to harvest for human organ replacements?
- ★ What does the Bible have to say about such things?
 - Nothing directly, but important principles



God's Commandments in Eden

- ★ God's Purposes (Genesis 1:26):
 - Mankind to be in God's image
 - Humans to rule over animals, etc.
- ★ God's Commands (Gen 1:28):
 - Be fruitful, multiply, fill the earth.
 - Subdue the earth.
 - Rule over animals, fish, birds.



God's Commandments at Ararat

- ★ Be fruitful, increase, fill the earth.
- ★ Animals will fear you.
- ★ Animals are given into your hands.
- ★ They will be your food, but you must not eat their lifeblood.
- ★ Neither you nor they may shed human blood. (Gen 9:1-7)



Treatment of Animals

"A righteous man cares for the needs of his animal, but the kindest acts of the wicked are cruel." (Proverbs 12:10)



God's Commands at Sinai

- ★ Have no other gods but God.
- ★ Make & worship no images.
- ★ Don't misuse God's name.
- ★ Remember to keep his Sabbath rest.
- ★ Honor your parents.
- ★ Don't murder, commit adultery, steal.
- ★ Don't give false testimony.
- ★ Don't desire what is not yours. (Ex 20:3-17)



What Should We Expect?

- ★ Technology is good, because creation is.
- ★ Mankind is fallen, "a ruin" (Buswell).
 - Not just a pile of shapeless stones, an artifact.
 - Not what it was designed to be.
- ★ Man has always used the latest technology, for good or evil.
- ★ This is bound to happen with genetic engineering, too.



What Should We Expect?

- ★ By God's mercy, there has been less nuclear, chemical, biological warfare than we had any right to expect.
- ★ Given the world situation, we can expect genetic engineering will be used for both good and evil.
- ★ This will surely include human cloning unless it backfires terribly.



What Should We Do?

- ★ We should act as Christians are supposed to, whatever the situation:
 - Salt – taste, preservative, thirst, stings
 - Light – visible, illuminating
- ★ We should obey God's commands ourselves & encourage others to righteousness as best we can.
- ★ We should pray that God will be glorified and Jesus lifted up in whatever situation God puts us in.



What This Means

- ★ Seek first God's rule and God's righteousness, and all these things (food, clothing, etc.) will be yours as well.
- ★ We may have to take unpopular stands.
- ★ Don't let short-term benefits outweigh doing what is right & compassionate.



Genetic Engineering & Cloning

Not The End!

