

# CHAPTER 13: GENETIC TECHNOLOGY

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## 13.1 Genetic Engineering

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- is a gene manipulation technique to modify an organism's genetic material to produce new combination of genes.
- involves the transfer of a DNA segment from one organism to another by DNA recombinant technology.





# Genetic Engineering

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- By using the techniques and procedures in the recombinant technology, biologists can recombine the DNA or genome (a complete set of DNA) of an organism.
- An organism such as animal, plant or microorganism that is produced by recombinant DNA technology is known as a genetically modified organism (GMO).



# Genetically Modified Organism (GMO)

- are organisms that contain recombinant DNA.
- Recombinant DNA technology enables production of new gene combinations.
- An organism that contains recombinant DNA is known as a transgenic organism



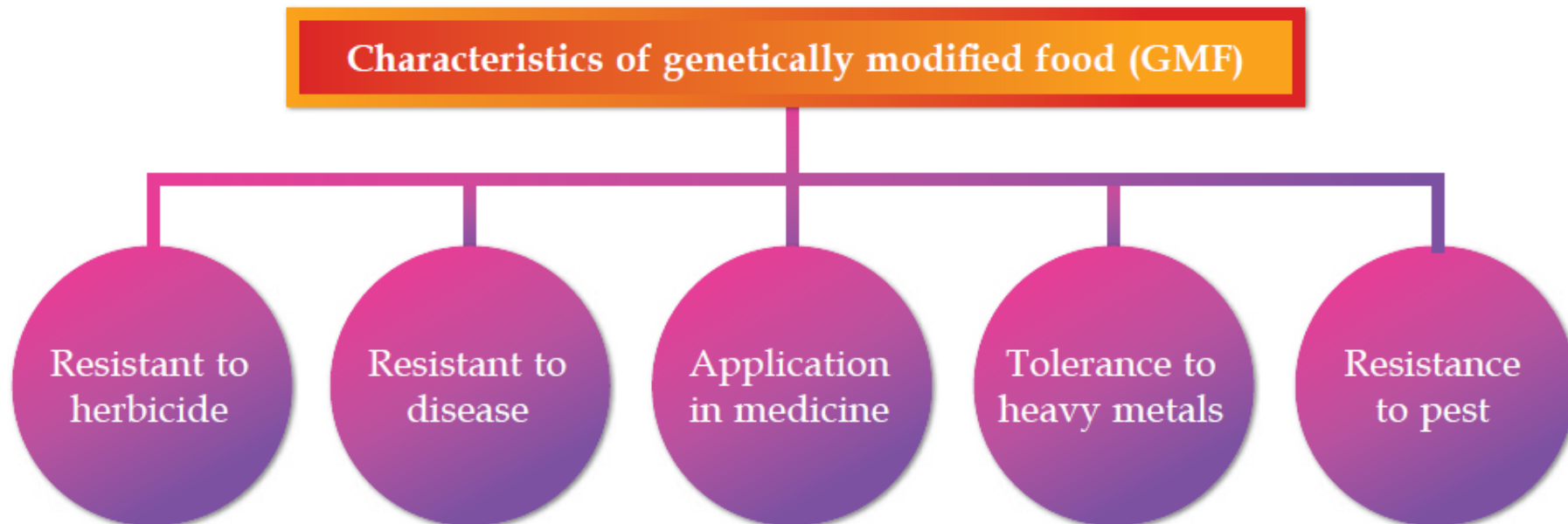
This genetically modified cow produces milk which does not contain  $\beta$ -lactoglobulin, a type of protein that causes allergy among some children.

This genetically modified goat possesses the human gene which codes for a blood clotting factor. This blood coagulation factor is found in the goat's milk and can be purified and used to treat haemophilic patients.



# Genetically Modified Food (GMF)

- Recombinant DNA technology has successfully produced many beneficial varieties of crops (paddy, oil palm, pineapple, corn and soya bean) and livestock (salmon, cattle and goat)



# Genetically Modified Food (GMF)

- possesses DNA from other species of plant or animal.
- Consumption of GMF by humans may cause health implications which are still unknown





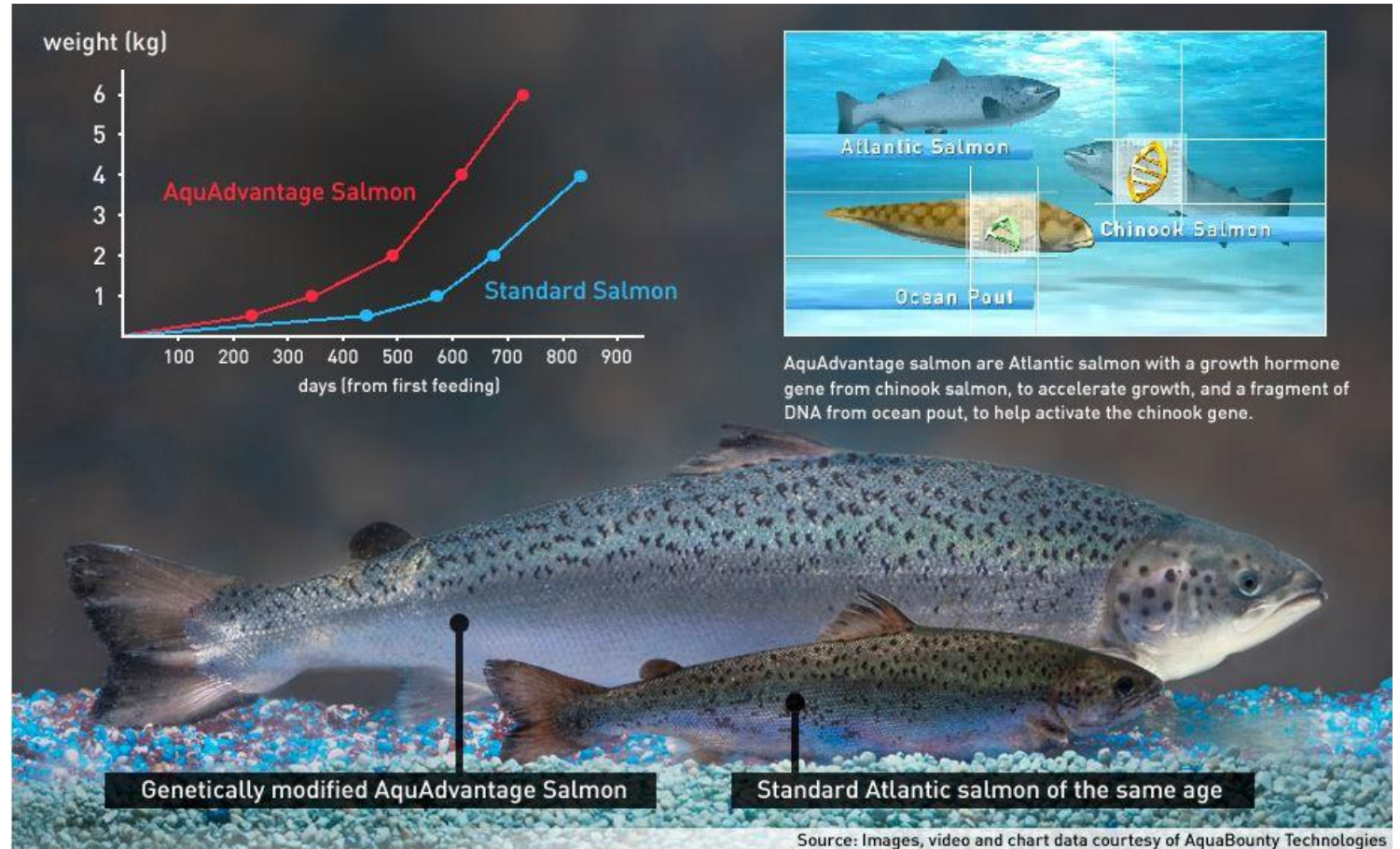
Advantages of GMF	Disadvantages of GMF
<ul style="list-style-type: none"><li>• Overcome worldwide food shortage by producing high quality transgenic crops and livestock</li><li>• Reduce cost of food production</li><li>• Increase nutritional value of crops</li><li>• Reduce problems of crops related to pests</li><li>• Reduce usage of pesticides</li><li>• Increase in production reduces price of food, thus increase food availability</li></ul>	<ul style="list-style-type: none"><li>• Endangered natural species</li><li>• There is a slight possibility that the foreign gene in GMF may be transferred to humans, for example, antibiotic-resistance gene</li><li>• May have adverse effects on human health and genetic material</li></ul>



- A *Bacillus thuringiensis* gene is inserted into corn to increase its resistance against insect pest

# 'Super salmon'

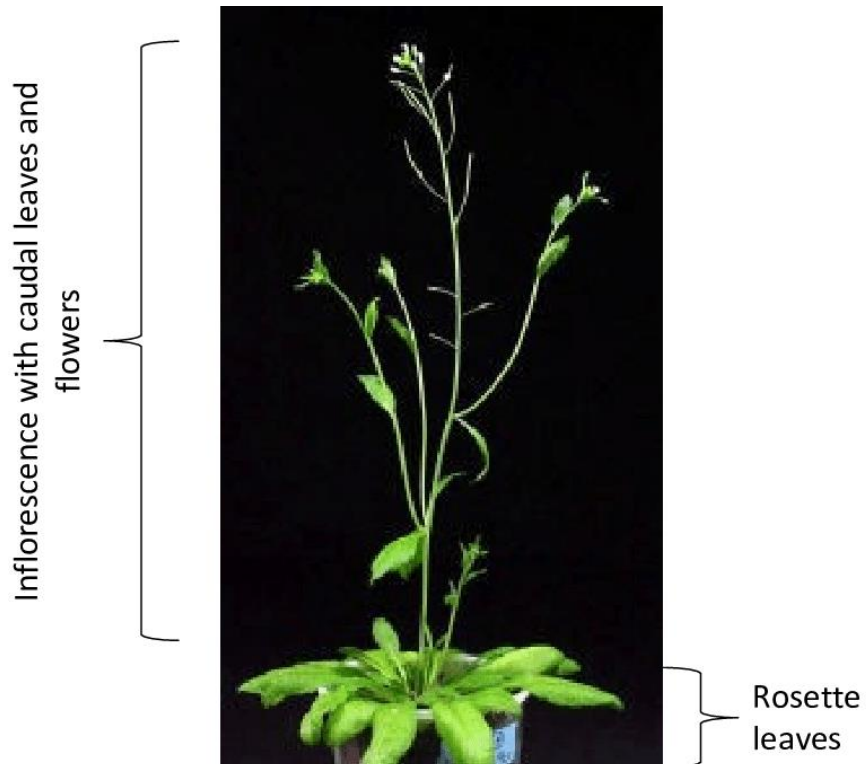
- is a genetically modified fish
- approved by the Food and Drug Administration (FDA) as a safe food for consumption in United States of America and Canada.
- It is modified by inserting a growth hormone gene from a Chinook salmon into the genome of an Atlantic salmon.
- Hence, a Super Salmon is created which grows at a faster rate and can be produced throughout the year





# Potato

- an important crop to people who live in cold climates.
- very sensitive to low temperature and frost.
- A gene from *Arabidopsis sp.* plant, which enables the plant to tolerate freezing condition is inserted into the potato genome to create a genetically modified potato that can grow well in cold climates.



# Insulin

- is an important hormone which controls blood glucose level.
- In the older days, insulin was extracted from the pancreases of cattle or pigs to treat diabetes mellitus patients.
- Nowadays, insulin can be commercially produced by genetic engineering for patients with diabetes mellitus.
- Besides insulin, other successes of genetic engineering include hepatitis B vaccine, blood clotting factor and growth hormone.





