Genetic Engineering

Chapter 13

Selective Breeding

> Breed only animals with desired characteristics
 > Horses, dogs, cattle, etc.
 > Crops: beans, corn, wheat,



Risks of selective breeding

- Parents are too similar
- Chance of passing two recessive alleles to offspring that cause a defect
- Monoculture: the entire crop is genetically identical
 - None are disease resistant
 - Irish potato famine

Hybridization



Crossing two different organisms

- Results in offspring with best of both parents
- Drought tolerant + greater yield
- > Color + fragrance





Increasing variation

Inducing mutations increases variation

- Radiation and chemicals increase mutation rate
- Still totally random
 Easier to do in bacteria



 certain strain can turn oil into biodegradable plastic

> Also helps us understand the function of certain genes

Polyploid

Plants can have extra copies of chromosomes

Diploid vs polyploid

Harmful for animals
Leads to bigger fruit in plants
Most polyploids are sterile = seedless











Genetic Engineering

Scientists can study and alter genes on a chromosome
 Human Genome project
 Learn more about disease and resistance



Chromosome 4

p	1	16 15 13	Huntington disease Wolf-Hirschhorn syndrome PKU due to dihydropteridine reductase deficiency	MPS 1 (Hurler and Scheie syndromes) Mucopolysaccharidosis I Periodontitis, juvenile [Dysalbuminemic hyperzincemia] [Dysalbuminemic hyperthyroxinemia] Analbuminemia
	1	13 21 24	Dentinogenesis imperfecta-1 ?Acute lymphocytic leukemia*	[Hereditary persistence of alpha-fetoprotein] [AFP deficiency, congenital] Piebaldism Polycystic kidney disease, adult, type II Mucolipidosis II Mucolipidosis III
q	2	26 28	C3b inactivator deficiency Aspartylglucosaminuria Williams-Beuren syndrome, type II	Rieger syndrome Dysfibrinogenemia, gamma types Hypofibrinogenemia, gamma types
	3	31 32 35	Sclerotylosis Anterior segment mesenchymal dysgenesis Pseudohypoaldosteronism Hepatocellular carcinoma* Glutaricacidemia type IIC Factor XI deficiency Fletcher factor deficiency	Dysfibrinogenemia, alpha types Amyloidosis, hereditary renal, 105200 Dysfibrinogenemia, beta types Facioscapulohumeral muscular dystrophy

YGA 98-1455

Cutting DNA

- Restriction enzymes cut DNA at specific points
- Only cuts where the DNA nucleotide sequence matches perfectly



Separating DNA

- > Gel Electrophoresis
- DNA is cut into fragments
- Filtered through a gel
- Fragments separate out by size
- > Used to compare DNA of different individuals



Figure 13-7 DNA Sequencing

Section 13-2





Go to Section:

Recombinant DNA

When you know the sequence of DNA, you can cut out specific genes

Using restriction enzymes you can cut and paste genes from one organism into another



Transforming Bacteria

Plasmid – small circular "extra" DNA found in some bacteria

Bacterial chromosome
asmid



Desired gene is cut using restriction enzymes
 Plasmid is cut open using same restriction enzymes
 Gene is pasted into plasmid, plasmid is mixed with bacteria



How do you know if bacteria were transformed?

- Plasmid also has markers to id transformed bacteria
- > Fluorescent markers
- > Antibiotic resistance marker





Transgenic Crops Strawberries that are resistant to fungus Rice that produces vitamin A Corn and Cotton that produce natural insecticide > "Roundup Ready" Crops Roundup Roundup







Transforming animal cells

- DNA can be injected into egg cells
- Enzymes will incorporate that gene into the chromosome
- Sometimes genes can be replaced
- Gene therapy possible treatment for genetic diseases
- Stem cell research can we make replacement organs?
- Cloning can produce animals for research or medical use



