AgriLIFE EXTENSION
Texas A&M System

TEXAS A&M UNIVERSITY
VETERINARY MEDICINE & BIOMEDICAL SCIENCES

FAZD CENTER
National Center for Foreign Animal and Zoonotic Disease Defense

Genetics and Disease

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Objectives

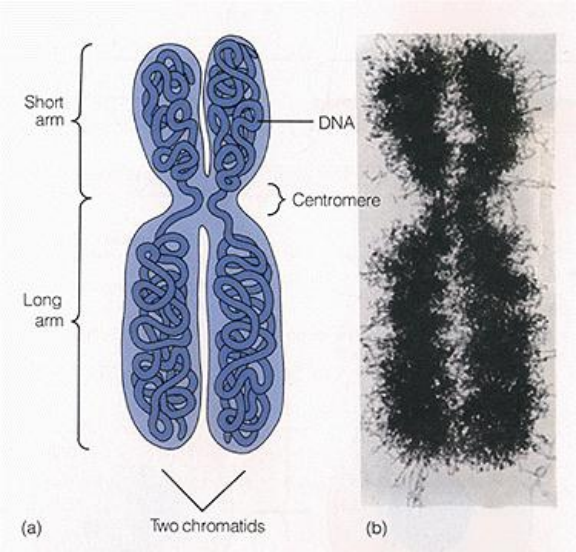
- Define genetics
- Discuss genetic predisposition to disease
- Discuss genetic resistance to disease
- Discuss the future of genetics and disease control

A Science

- Genetics
  - Study of inheritance (heredity)
    - Inherited genetics
    - How characteristics are passed from generation to generation
  - Study of genetic codes of body cells
    - Molecular genetics
- Heredity
  - Transmission of characteristics from parent to offspring
  - By means of genes on chromosomes in nucleus of body cells
  - Controlled by genes (DNA)

Chromosomes

- Occur in pairs
  - One from paternal parent
  - One from maternal parent
- Transfer of gametes (haploids) from both parents to form embryo (diploid)



Genes (Traits)

- Occur in pairs on chromosome pairs
  - One from each parent
- Stores information on chromosomes
  - Tells cell how to build protein (good or bad)
- Proteins made are coded by specific genes

Alleles

- Alternative copy of same gene
  - Dominant or recessive
- Different forms
  - Co-dominant
  - Co-recessive
  - One dominant and one recessive
- Recessive genes expressed if no dominant genes
  - May be good or bad

- Phenotype
  - A particular trait that is observed
- Genotype
  - Genetic makeup of a single trait
  - Not visible

Expression of Genes (Phenotype)

- Homozygous (Genotype)
  - Genes are alike
    - Dominant alleles
      - **PP**
    - Recessive alleles
      - **pp**
- Heterozygous (Genotype)
  - Genes are different
    - One dominant and one recessive alleles
      - **Pp**
  - Carriers

A Genetic Disease

- Expression of two recessive alleles inherited
  - One from each parent
  - Homozygous recessive (double recessive)
    - Abnormal

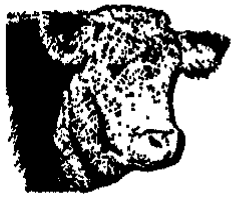
Homozygous dominant (double dominant)

- Normal

Heterozygous recessive

- Normal
- Carrier

PARENTS (NORMAL AND DWARF)



PHENOTYPE:	NORMAL	x	DWARF
GENOTYPE:	DD	x	dd

OFFSPRING

PHENOTYPE:	NORMAL
GENOTYPE:	Dd

PARENTS (DWARF CARRIERS)

PHENOTYPE: NORMAL x NORMAL

GENOTYPE: Dd x Dd

OFFSPRING

	D	d
D	1/4 NORMAL DD	1/4 CARRIER Dd
d	1/4 CARRIER Dd	1/4 DWARF dd

3/4 NORMAL (1/4 HOMOZYGOUS, 1/2 HETEROZYGOUS CARRIERS)
1/4 DWARF (HOMOZYGOUS)

Congenital Defects-Inheritable Defects

- Abnormalities
  - Structural changes
  - Altered metabolism
  - Death
  - Deafness
  - Blindness
  - Hairlessness

Combined Immunodeficiency (CID)

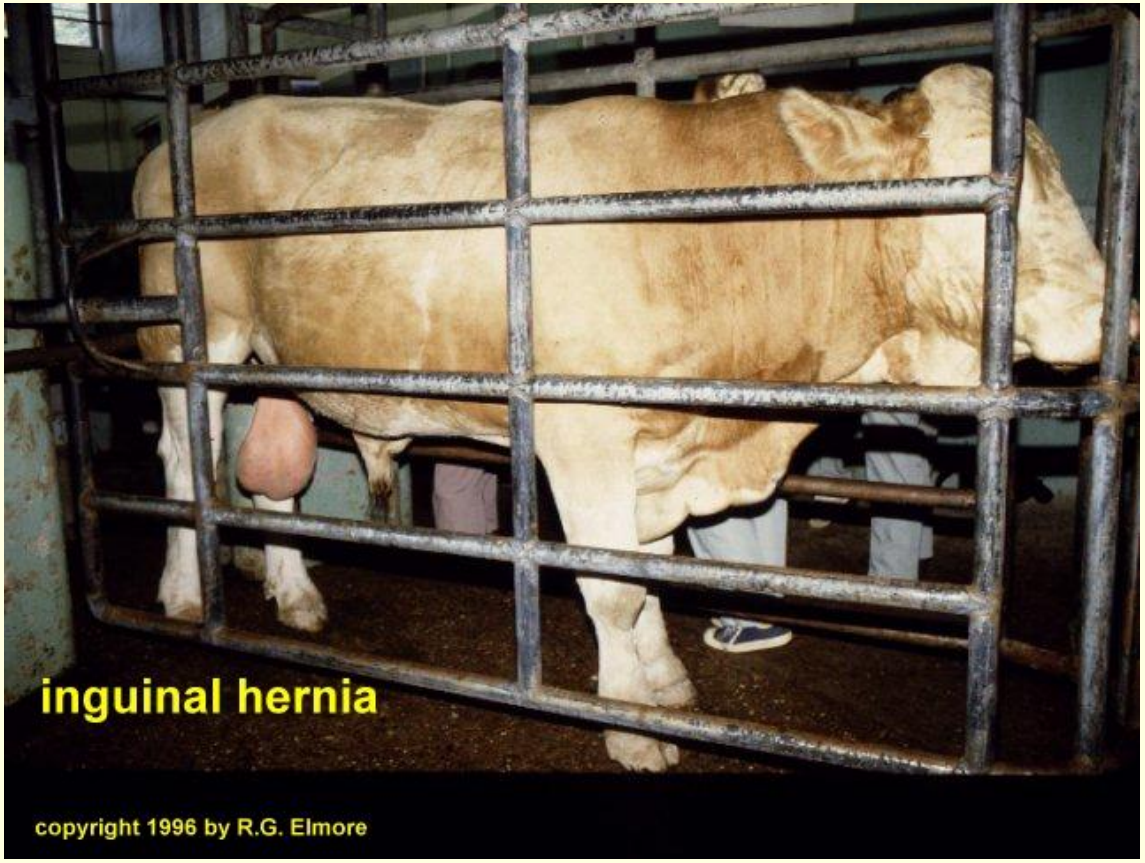
- Absence of immune response

Anal Atresia

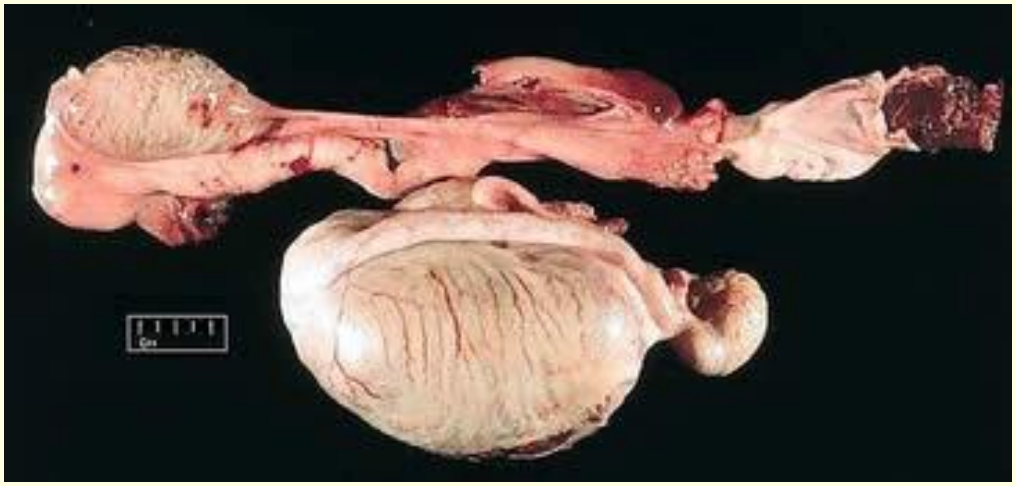
- Lack of opening from the rectum

Scrotal Hernia

Rupture into the scrotum



Cryptorchidism



Albinism

Lack of pigment

Hip Dysplasia

Deformed hip joint

Cleft Palate

Opening in the roof of the mouth

Overshot Jaw

Upper jaw protruding over lower jaw

Mulefoot

Fusion of functional toes in calves

Dwarfism

Large abdomen, short legs, abnormal head

Genetic Disease Control

- Molecular Genetics
  - Study genetic structure of genes
- Remove genetic defects from herd
  - Eliminate defected individual
  - Eliminate or neuter carrier parents

Genetic Resistance

- Natural/innate immunity
  - Inherited genetic resistance
- Genetic predisposition
  - Genes control susceptibility or resistance to diseases
- Genes provide total protection
  - Foot and Mouth Disease
  - Hog Cholera
  - Swine Vesicular Disease
- Genes provide some protection
  - Animals become infected but not diseased
    - Brucellosis
    - Transgenic animals
      - Beneficial and resistance genes transferred