

Introduction to Animal Genetics

Introduction to Animal Genetics – Study Notes

1. What Is Animal Genetics?

- **Definition:** The branch of biology that studies the inheritance of traits in animals, the structure and function of genes, and how genetic variation arises and is maintained.
 - **Key Goals**
 - Understand how traits are passed from parents to offspring.
 - Identify genes responsible for specific phenotypes (e.g., coat colour, disease resistance).
 - Apply genetic knowledge to breeding, conservation, and biomedical research.
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2. Basic Genetic Concepts

Concept	Description	Example in Animals
Gene	Unit of DNA that encodes a functional product (protein or RNA).	<i>MC1R</i> gene influences melanin production ? coat colour in horses.
Allele	Alternative forms of a gene at the same locus.	Black?coat allele (B) vs. brown?coat allele (b) in cattle.
Genotype	The complete set of alleles an individual carries.	BB, Bb, or bb for the coat?colour locus.
Phenotype	Observable traits resulting from genotype + environment.	A black?coated bull (phenotype) may be BB or Bb.
Dominance	Interaction where one allele masks the effect of another.	In many mammals, the dominant allele for black coat masks the recessive brown allele.
Homozygous	Two identical alleles at a locus (AA or aa).	A homozygous recessive mouse (hh) shows the recessive coat colour.
Heterozygous	Two different alleles at a locus (Aa).	A heterozygous dog (Aa) may display the dominant trait.

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Concept	Description	Example in Animals
Locus (plural: loci)	Specific position of a gene on a chromosome.	The <i>FGF5</i> locus controls hair length in cats.
Mutation	Permanent change in DNA sequence.	A point mutation in the <i>myostatin</i> gene leads to “double?muscle” cattle.
Polymorphism	Presence of two or more alleles at a locus in a population.	Multiple alleles of the <i>MHC</i> genes affect disease resistance.

3. Patterns of Inheritance

Pattern	Key Features	Typical Animal Example
Mendelian (simple) inheritance	Single gene, clear dominant/recessive alleles, 3:1 ratio in F ₂ .	Coat colour in Labrador retrievers (black vs. brown).
Incomplete dominance	Heterozygote shows intermediate phenotype.	Roan coat pattern in cattle.
Codominance	Both alleles expressed equally.	Blood type in cattle (AB).
Sex?linked inheritance	Genes located on sex chromosomes (X or Y).	Color blindness in dogs (X?linked).
Polygenic inheritance	Multiple genes contribute to one trait; often quantitative.	Body size in pigs, milk yield in dairy cows.
Maternal (cytoplasmic) inheritance	Genes in mitochondrial DNA passed from mother.	Certain metabolic disorders in horses.

4. Sources of Genetic Variation

1. Mutations

- Point mutations, insertions, deletions, duplications.

2. Recombination (Cross?over)

- Shuffles alleles during meiosis, creating new allele combinations.

3. Gene Flow

- Migration of individuals introduces new alleles into a population.

4. **Genetic Drift