Genetics for breeders

The genetics of polygenes:
selection and inbreeding

Selection

- Based on assessment of individual merit (appearance)

- Many traits to control at the same time

- Some may be difficult to access (health) or may require a long time (males: interest and ability in mating, females: fertility, number of kittens, easy parturitions, ability to rear up kittens unaided)

Methods of individual selection

- **Independent culling levels**
  - Choose and fix important traits
  - Assign a culling level to each trait
  - For each trait evaluate the cat by a score from 1 to 10
  - Discard from line each animal who does not exceed the pre-established culling level for each trait

- **Total score**
  - Choose and fix important traits
  - Assign a weight to each trait, according to importance
  - For each trait evaluate the cat by a score from 1 to 10
  - Discard from line each animal whose total weighted score does not exceed a pre-established level

Flexibility of the total score method

- It is less drastic than the independent culling level method: less risks of discarding an animal as a consequence of a wrong evaluation or a momentary period of sickness.

- It allows for changing weights from time to time (after several generations), according of changes in the choice of most important traits to improve

Family selection

- Selection applied to series of litters from the same parents
- The individual of the next generation are chosen as the best kittens of those parents who have produced the best average results over many litters
- The same parents are mated together repeatedly, different couples are not intermarried
- Pros: more efficient, takes into account the capability for reproducing certain traits (often due to well matched genes and homozygosis)
- Cons: expensive, it requires keeping many litters, years before choosing the individuals of the next generation

Progeny testing

- Mate two or more stud males to the same queens to breed a round of litters from each

- Choose the best kittens from the stud who had the best average results

- It should be done with males, because they sire more kittens

Chromosomes, genes and alleles

- Genetic information: contained in chains of DNA called chromosomes.

- 19 pairs in cats.

- Genes are short segments in these chains. Their localization on the chromosomes is called *locus*. Genes at corresponding loci in the two chromosomes of a pair affect the same genetic trait.

Mendelian genes and modifier genes

- A gene, ideally, has a yes/no action: either full effect or nothing. If the two genes at the same locus are not identical, they may yield different effects. Usually, one is dominant over the other.

- When a trait is determined by a large group of genes at different loci, they are called modifiiers, or polygenes. Their combined effects pile up gradually.

Mitosis and gametes

- Every cell has 19 pairs of chromosomes, except sperm cells and egg cells, who only have 19 chromosomes.

- They are produced by mitosis: a process in which the homologous chromosomes separate, and the cell splits in two. Each carries half of the genetic contents: chosen randomly.

Selection for Intermediate versus Extreme Expression

- Intermediate expression: we want to select for genotypes intermediate between those of the parents --> early homozygosis to fix most traits and breed true --> close inbreeding

- Extreme expression: we want unusual combination of genes, more extreme than in each parent --> slow increase in homozygosis, to avoid the risk of fixing intermediate traits, which are far more likely --> fine tuning of inbreeding with appropriate breeding programs