Lecture title: <u>Age estimation</u>

Lecturer Affiliation: Dept. Veterinary Public Health

Summary:

What is the important of Age estimation?
Age estimation of domestic animals is very important for:
1. farmers during purchasing a new animal since the information provided by the seller may not always be reliable.
2. It is very helpful for field practitioners/clinician for diagnosis and treatment purpose.
3. Age estimation enables the farm manager to take up appropriate managemental practices suitable for different age groups.
4. A researcher/scientist work on different animals should also know exact age of their target groups.
5. Age estimation is also important for collecting statistical data of livestock population age wise.

<u>Methods of Age estimation of domestic animals</u>
There are different methods of Age estimation of domestic animals:

1. Dental Examination (Teeth Eruption and Wear)
2. Bone Ossification & Radiography
3. Eye Lens Weight or Density
4. Body Size and Morphometrics
5. DNA Methylation (Epigenetic Clocks)
6. Horn Rings
7. Farm record

<u>1. Dental Examination (Teeth Eruption and Wear)</u>

<u>2. Bone Ossification & Radiography</u>

Animals are born with cartilage growth plates at the ends of their long bones (like femur, humerus, radius). As they age, these plates ossify (turn into bone) and eventually fuse with the bone shaft (diaphysis). This process occurs in a predictable sequence and timeframe depending on the species and breed.

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Radiography (X-ray) allows veterinarians to visualize these growth plates and determine the animal's skeletal maturity, which correlates with its age.

📅 Examples of Epiphyseal Plate Closure Times:

🐕 Dogs (Medium Breed):

Bone	Approximate Closure Age
Distal radius/ulna	6–9 months
Proximal humerus	10–12 months
Femur (distal)	8–10 months
Tibia (proximal)	10–12 months
Pelvic bones	1–1.5 years

🐄 Cattle:

Bone	Closure Age
Distal metacarpus	~1 year
Radius/ulna	1–1.5 years
Humerus	~2 years
Pelvis & vertebrae	3+ years

Advantages:

1. Non-invasive
2. Accurate for young animals
3. Useful in wildlife biology, forensic cases, and pet age verification

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⚠ **Limitations**:

1. Less accurate in adult animals (once plates are fused)

2. Requires species-specific reference data

3. Affected by nutritional deficiencies or developmental issues

3. Eye Lens Weight or Density

Estimating the **age of animals using eye lens weight or density** is a well-established method, especially in **wildlife biology and post-mortem studies**. It's based on the fact that the **eye lens continues to grow throughout an animal's life**, adding layers (like an onion) without shedding any tissue — making it a reliable indicator of age.

✓ **Advantages**

1. Highly accurate, especially in young to middle-aged animals.

2. Useful in wildlife studies, forensic cases, and population ecology.

3. Not affected by nutrition, disease, or environmental conditions (unlike teeth or bone growth).

⚠ **Limitations**

1. Requires dead animals, so not suitable for live age estimation.

2. Needs species-specific calibration data.

3. Drying and handling require lab equipment and care.

4. Less precise in very old animals, where growth slows down.

4. Body Size and Morphometrics

Morphometrics refers to the measurement of body parts—like length, height, girth, weight, or specific anatomical features (e.g., wing length in birds, carapace length in turtles).

These physical traits often grow in a predictable pattern as the animal matures, so they can be used to approximate age, particularly in young or fast-growing animals.

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✅ Advantages

1. Non-invasive and live-animal friendly

2. Useful in field conditions and wildlife tracking

3. Can be repeated over time for growth monitoring

4. Requires basic tools (measuring tape, scale)

⚠ Limitations

1. Less accurate in adults (growth slows or plateaus)

2. Highly influenced by nutrition, sex, genetics, and environment

3. Requires species-specific reference data for accuracy

4. Can't determine exact age—usually gives an age range or class

5. DNA Methylation (Epigenetic Clocks)

Estimating the age of animals using DNA methylation—also known as epigenetic clocks—is one of the most cutting-edge, accurate, and promising techniques in modern biology. It relies on predictable, age-related changes in an animal's DNA, particularly in how genes are regulated, not just their sequence.

✅ Advantages:

1. Works across a wide range of tissues.

2. Extremely precise compared to physical measurements.

3. Useful even when date of birth is unknown.

4. Can reflect health status and rate of aging.

Limitations:

1. Requires advanced lab equipment and bioinformatics tools.

2. Still expensive and not yet routine in most veterinary practices.

3. Needs species-specific clock models, which are not available for all animals yet.

4. Ethical/sample collection permits may be needed (especially in wild species).

6. Horn Rings

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Estimating the age of animals using horn rings is a traditional and practical method, especially for ruminants like cattle, sheep, goats, and wild ungulates (e.g., deer, antelope). This method relies on the observation that horns develop visible rings or ridges at regular intervals—usually one per year—making them a natural age record.

✅ Advantages:

1. Simple and cost-effective
2. No equipment needed
3. Works well in pasture-based or wild populations

⚠ Limitations:

1. Not very accurate in very old animals (rings wear down or overlap)
2. Can be affected by nutrition, stress, or disease
3. Some animals may have extra rings due to environmental stressors (false rings)
4. Doesn't work on polled animals (naturally hornless)

7. Farm record

Estimating the age of animals using farm records is one of the most accurate and straightforward methods, especially in well-managed livestock operations. Unlike anatomical or biological estimation methods, farm records can provide the exact birth date or at least a very close approximation of an animal's age.

✅ Advantages:

1. Highly accurate if records are complete
2. Non-invasive
3. Useful for livestock management, breeding, and health tracking
4. Ideal for farms using digital record-keeping systems

⚠ Limitations:

1. Not applicable for wild animals or informally managed herds

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2. Accuracy depends on the quality and consistency of record-keeping

3. Some farms may have incomplete or lost records