Subject: Animal Breeding

1st lecture: Horse breeding introduction

Subjects

I. Semester (fall):

VETERINARY GENETICS

II. Semester (spring):

ANIMAL BREEDING

Locations

- **Department**: Building „J“ 3rd floor
- Lectures and practical/lab: „Lecture hall Béla TORMAY“ ground floor

THE STAFF
(Animal Breeding)

1. GÁSPÁRDY András, assoc. Prof., Dr. habil. and head of dept: both theoretical and practical: horse, cattle, sheep and goat, pig, poultry, chairman of exam commission.
2. MARÓTI-AGÓTS Ákos, ass.oc. Prof., Dr. habil. And deputy head of dept.: both theoretical and practical: horse, cattle, dog and cat breeding, examiner.
3. ZENKE Petra, research fellow, PhD: Both theoretical and practical: pig and poultry
4. SZMODITS Zsolt, Dept. Vet., horse, tutor for English course education
5. KŐRÖSI László, Poultry Vet., Hon. assoc. Prof. poultry

English courses
**TANTÁRGYI_TEMATIKA_Animal_breeding_ANGOL_2019-2020-2_spring.pdf**

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:

---

**Recommended literature:**

- text book (ed. L. Zöldág)
- Power.point presentations
- lecture notes
- practical notes

---

**Education**

Summer practical (extramural farm work)

responsible lecturer for English course student: Dr. Zsolt SZMODITS, szmodits.zsolt@univet.hu

Idikó KOVÁCS, kovacs.idiko@univet.hu

---

**Contact persons (class representatives)**

- Name: van Eijk Victoria Elizabeth
- E-mail: vic.vaneijk@gmail.com
- Phone:
Exam:

- Exam within the exam period which consists of two (practical and theoretical) parts. At first, students are controlled by a questionnaire on computer (according to their rapid answers to basic figures, breeds, tools, wool samples and age determination, http://gat.univet.hu/hu/node/2189) as a threshold to enter into the theoretical part. The performance from 80% is successful.

And then, they choose four questions, and after a preparation time they answer these orally. All the four questions should be answered (a single unknown question leads to failure). All questions are published in advance. In case of failed exam, students with at least 80% performance in computer test do not need to repeat the practical part. Time span between the exam failed and its re-take should exceed 5 days.-

Attendance

• The presence on both the lectures and practicals are obligatory.

by reading the names

Training_Agreement_2020.pdf

TRAINING AGREEMENT FOR SUMMER PRACTICE

between

Department of Animal Breeding and Genetics, Institute of Animal Breeding, Nutrition and Laboratory Animal Science, University of Veterinary Medicine, Budapest, Hungary (DEPARTMENT)

and

[PARTNER ORGANISATION]

whereas the PARTNER ORGANIZATION accepts the STUDENT as an intern within the framework of this agreement.

The parties agree to the following:

Horse breeding introduction

(outline of lecture)

• Horse’s evolution
• Horse’s taxonomy
• Horse’s domestication
• Relatives and interspecies hybrids
• Horse’s biological characteristics
• Names after age and gender
• Sorting of horses
Exam question

1. Evolution and domestication of the horse, micro-evolutionary consequences, related species, inter-species hybrids.

Horse's evolution

- Archeologically well documented development, started in the North-American continent.
  - Many transitional species: Eohippus → Mesohippus → Miohippus → Pliohippus → Equus.
  - Cca. 60 million years long process.
  - Major changes: body size, nutrition (omnivorous to herbivorous), tooth, reduction of digits, life mode.
  - Extinction in North-America.
  - Spread: Eurasia, Africa, then America and Australia.

Horse's evolution diagram

Phenacodus (60 million years ago)

The names of the ancestral species

- Eohippus
  - Protohippus
  - Mesohippus
  - Merychippus
  - Hyracotherium
  - Ammihippus
  - Ducheneohippus
  - Phenacodus
  - Sceliohippus
  - Lophioteium
  - Parahippus
  - Archaeohippus
  - Anchitherium
  - Hypohippus
  - Megahippus
  - Hypanterid
  - Neohyracotherium
  - A. Hyracotherium
  - E. Eohippus
  - E. Mesohippus
  - E. Merychippus

Eohippus (55 mya) (Hyracotherium)
(Orohippus, 50 mya)
(Epihippus, 45 mya)
Mesohippus (35 mya)

Miohippus (30 mya)

Anchitherium (extinct)

Hypohippus (extinct)

Parahippus (25 mya)

Hypparion (20 mya)
Merychippus (15 mya)

Pliohyppus (10 mya)

Plesippus (3.5 mya)

Equus (1 mya)
Equus Przewalski (Taki)

Equus (1 mya)
Equus Gmelinii (Tarpan)

Changes on forefoot bones

Lengthening of radius, cannon bone and terminal phalanx
Changes on skull and teeth

Lengthening and broadening of the skull, orientation of post-orbital bar relative to horizontal plane, degree of cranial flexion, development of isthmus on lower molars, development of infundibulum on third lower incisors.

Changes in size and weight

The domestic horse and its ancestor (Tarpan)

Zoological position and taxonomy of the horse (chromosome numbers)

- **Phylum** Chordata
- **Class** Mammalia
- **Order** Perissodactyla (non-ruminant hoofed mammals, horse, tapir, rhinoceros)
- **Family** Equidae
  - **Subgenus** Equus (horses, species: Equus ferus Boddaert)
    - Equus ferus Przewalski (2n = 66), extinct
    - Tarpan (Equus ferus silvaticus, Forest Horse, 2n = 7), extinct
  - **Subgenus** Asinus (African ass,): Species:
    - Equus asinus/africanus (Nubian and Somali wild ass, chrm. No: 62)
    - Domesticated ass (donkey, Equus africanus, chrm. No: 64)
  - **Subgenus** Hemionus (Equus hemionus, Asian semi-ass, onager, culan, kiang etc) (2n=50-56)
  - **Subgenus** Hippotigris (Zebras, 5 species, 2n chrm. No = 62 or 44, or 46)

Zebra (South African Zebra)

Quagga (extinct)
Onager/Kulan/Dziggetai
(Persian/Kirghiz/Mongolian hemionus)

Khur
(Indian hemionus)

Kiang
(Tibetan hemionus)

Wild ass
(Africa, Somali ass)

Domestic donkey

Equine genome
(Number of chromosomes: 2n = 64; n = 32)
Horse Genome Project
(http://www.uky.edu/Ag/Horsemaph)

- First genome sequenced: Twilight English Thoroughbred mare (Cornell University in Ithaca, N.Y.) (Chowdhary BP, Raudsepp T. The horse genome, Genome Dyn., 2006. 2:97-110.)
- Size: 2.7 billion DNA base pairs.
- 1 million base mutations: single nucleotide polymorphisms (point mutation, SNP).
- About 80 genetic diseases are comparable to human genetic disorders.

Interspecies hybridization of equines

Hybridization is possible:
Wild horse (Taki, 2n = 66) × domestic horse (2n = 64 - fusion):
- Domestic horse (2n = 64) × domestic ass (2n = 62);
- Domestic horse (2n = 64) × Zebra (2n = 62);
- Zebra (2n = 62) × domestic ass (2n = 62).

Unfertile offspring!
Used: Mule, hinnies.
Merits: heterosis, power, working, stamina, obedience, heat tolerant, disease resistant.

Haldane’s rule: primarily the heterogametic sex (male!) is affected by sterility in successful crossing of closely related species.

Heterosis: inter-specific hybrids may show higher strength, endurance, tolerance and resistance to heat and diseases (mainly mules).

Domestic horse (2n = 64) × Zebra (2n = 62) (mare, horse, 2007)
zorse

Haldane’s rule:
Heterogametic gender is sterile
Domestication of the horse

- **Domestication 5-6000 years ago**: Central Asia, Persia, Egypt, Europe, to America arrived only after 1492 (by Spanish invaders).
- **Historical use of horse**: hunting, chariot, carriage, coach, people migration, transport, military use, agriculture, races, sport, hobby, leisure, therapy, recreation, status-symbols, etc.
- **Major role in cultural and social development of mankind**!
- **Ancestors, wild horses**:
  - Living to date: *Przewalski* horse or taki, Mongolian steppes.
  - Returned to nature: *feral horses*, Mustang, Bramby - re-domestication possible.
- **Features**: dun, cream-, grey-coloured, black ridge, eel stripe, standing mane, „missing withers“, cross at withers, zebroid stripes on legs, 125-130 cm withers height.

Wild horses:
(1) „Tarpan“ from zoos (Reconstruction as Heck-Horse)
(2) *Przewalski*-horse (Mongolian Taki)

**Wild horse features**: bay dun, rarely mouse dun, eel stripe (dorsal line), standing mane, zebra stripes, height at withers: 125-130 cm

Most important **genetic consequences** of horse domestication

- **2n chromosome number**: fusion of chromosomes?
  - Wild and domestic horse: 66 → 64, presumption only, not proved.
  - Tarpan (?) is unknown (extinct).
  - Ass remained the same: 62.
- **New mutations and artificial selection**:
  - Many new mutations (harmful – genetic diseases, favourable, desired) → high allelic polymorphism on the same locus across breeds.
  - Diversity has increased (in size, type and colour).
  - More than 200 breeds, breed groups and types (Falabella, Shire, Ponies, Brabant etc).
Most important phenotype consequences of horse domestication

- **Diversity seen in:**
  - Varied sizes, body builds (heights 50-180 cm), dwarfism;
  - Weights (50-1200 kg), heavy, light horses and ponies;
  - Many *colour variants*, temperament, long hair disappeared;
  - Less effective *feed conversion*;
  - Accelerated *ageing*;
  - Sensitivity to respiratory diseases, decreased resistance;
  - Not well expressed *sex dimorphism*;
  - Sexual activity changed from mono-estrus to *seasonal poly-estrus*;
  - Ability to return to the nature (feral horses, America – Mustang, Australia – Brumby).

Horses show more, asses less diversity and domestication changes.

Biological characteristics of horse

- Herbivorous, can not ruminate and vomit.
- Odd-toed.
- Loving a group.
- Uniparous.
- Short and long hairs, shedding.
- Vivid, scary, but trainable.
- Escaping lifestyle (frequent ingestion and suckling).
- Large framed.
- Long time periods (slow genetic improvement).
- Dicromatic vision.

Terminology (various sexes, age and life cycle)

- **Foal**: less than one year old of either sex; *nursing foal, suckling, weanling* (at 4-6 months of age).
- **Yearling**: between one and two years.
- **Colt**: male under the age of four; common error: to call any young horse a colt.
- **Filly**: female horse under the age of four.
- **Mare**: female horse four years old and older, *brood-mare*.
- **Stallion**: *stud*, non-castrated male horse four years old and older. A "rig" is a stallion having undescended testicle.
- **Gelding**: castrated male horse of any age.
- **She-ass**: jennet,
- **He-ass**: jack

Horses to distinguish

- **Wild horse**: the only living species: *Equus ferus Przewalski* (taki).
- **Domesticated horses**: horse breeds and types.
- **Feral horses**: free-roaming horses of domesticated ancestry, often are popularly called as "wild" horses. Feral horses live in groups called a *band, herd, harem, or mob*.
- **Semiferal horses**: live in a feral condition but may be occasionally handled or managed by humans.
Most common feral horses

- **Mustang**: Europeans (Conquistadors) reintroduced the horse to the American Continent in the 15th century, some horses escaped and formed feral herds known today as Mustangs.

- **Brumby**: Australia has the **largest population** of feral horses in the world (400,000). The Australian name is the Brumby, feral descendants of horses brought to Australia by English settlers.

- In **Portugal**, there are two populations of free-ranging feral horses, known as **Sorraia** in the southern plains and **Garrano** in the northern mountain chains.

- There are also isolated populations of feral **horses in a number of other places** (Islands of Nova Scotia, of Virginia and Maryland, of Georgia etc).

**Mustang, mestena, the „wild horse” of America (in USA gene preservation, Nevada, Arizona, New Mexico.)

**Brumby in Australia**

**Sorraia in Portugal**

**Namib Desert Horse**

**Spreading and influence of Arab, Barb and Spanish horse breeds**

The English Thoroughbred is unique! World breed, fastest, racing, multinational, improver (James Weatherby, 1783)
**Horse diversity**
Three basic types of domestic horses

- **Work, draft**
- **Sport, racing**
- **Multi-purpose**

The type is not a breed!