The Rabbit

General presentation

by François Lebas

Honorary Research Director INRA
«Cuniculture» association

- Taxonomy
- General biology and peculiarities of lagomorphs

Taxonomy

Order of the **Rodent**
(those who gnaw).

Only one pair of incisors
in the upper jaw

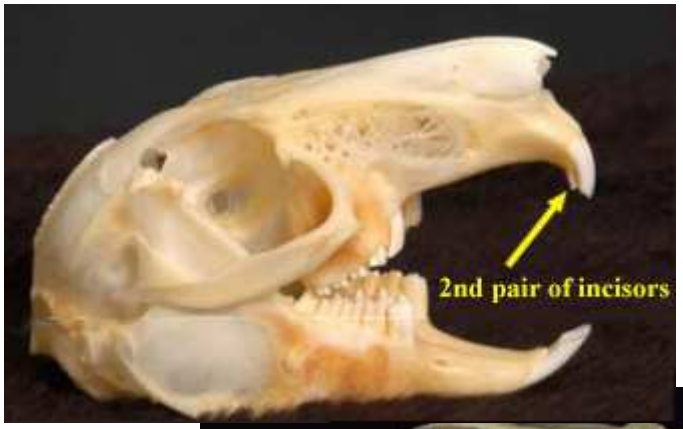
Rat

But also squirrels, beavers, nutria, voles, marmots, ... ~ 30 families

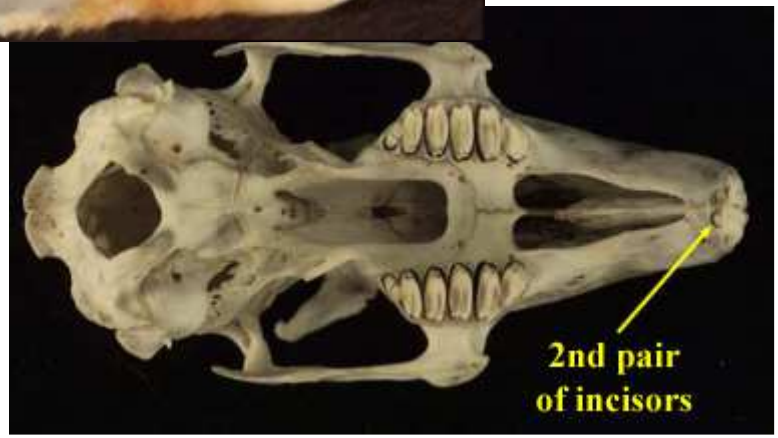
and more than 2000 species

Order of the **Lagomorphs**
(those who look like the hare).

Two pairs of incisors
in the upper jaw



Rabbit
Hares , etc



The lagomorphs: 2 families in all

Ochotonidae family (Picas)

This family includes 1 single genus – *Ochotona* - and 26 different species

Ochotona princeps

Ochotona gloveri

Some examples of Picas

Ochotona collaris

Short ears and no visible tail

The lagomorphs: 2 families in all

Leporidae family

It includes 11 genus (*Lepus, Sylvilagus, Oryctolagus, Romerolagus, Brachylagus,* …etc) and in total about **60 different species**.

This family is sometimes separated into 2 subfamilies: Paleolagineae (3 genera) and Leporineae (other genera)

Lepus europeus
the european hare

Oryctolagus cuniculus,
wild or domestic rabbit

Lepus californicus,
Jack rabbit

Nesolagus timminsi

Hares and rabbits

At **birth** the young hares (leverets) already have
* a full coat
* open eyes

Levrets at their den

The leverets can quickly become free from maternal milk
(5 to 10 days maximum)

At **birth** the little rabbits (kits) already have
* bare skin (no coat)
* closed eyes

Newborn rabbits

Kits depend exclusively on maternal milk during their first 3 weeks of life

RABBITS two genus: Sylvilagus (America) and **Oryctolagus** (Europe)

Sylvilagus cunicularis

Sylvilagus floridanus
cottontail rabbit

Sylvilagus nuttallii

Oryctolagus cuniculus

They look very similar !

But cannot breed

They are genetically too distant species

Sylvilagus audubonii

General biology of the Lagomorphs

Small animals (0.3 to 5 kg) which are all herbivores

Two great originalities

- The practice of **caecotrophy**

- **Ovulation** caused by mating in females which give litters of 3 to 10 young in general (3-5 most often)

Biology of the Rabbit

Main biological characteristics having an impact on husbandry practices

Digestion

Reproduction

Respiration

Sense organs

Rabbit's Digestion

Advantages and disadvantages of cecotrophy

The practice of cecotrophy (process detailed below) results in a **good nutritional valuation of the products of cecal fermentation.**

In terms of their nutrition, rabbits and lagomorphs in general, can thus make **good use of food proteins and synthesize all of the water-soluble vitamins** (group B and vitamin C) that they need.

On the other hand, caecotrophy does not allow a good valorization of the sources of fiber, mainly because of a relatively rapid digestive transit: less than 24 hours in a rabbit against nearly 48 hours in a guinea pig for example (a herbivorous rodent).
The **counterpart** is the requirement in rabbits nutrition of a **high level of fiber** in the ration, to allow the full development of this complex digestive process. A low level of fiber in the diet can lead to digestive problems, which can be fatal

Rabbit's Reproduction

Ovulation is caused by mating in the Rabbit and Lagomorphs in general

Great originality for the Rabbit among the livestock production species

For the rabbit producers, this induced ovulation
has very many consequences for the management of his animals

No estrus: practical consequences

- impossible to know easily when a young rabbit doe is individually pubescent
- no return to heat in unfertilized females after mating or artificial insemination

=> diagnosis of gestation more complex than in cycled females.

Rabbit's Reproduction

Ovulation occurs only after mating: practical consequences

* **the converse is not true:** mating does not cause necessarily ovulation and therefore a gestation start (average rate ovulation after a service of around 80%)

* if adult (pubescent) female rabbits are raised in a group, the dominant doe may overlap some other does and can cause their ovulation without fertilization, and **thus lead to pseudo-gestations** = 3 weeks without possible fertilization. It is therefore necessary to separate the females from each other.

* In case of the **artificial insemination**, **ovulation must be induced without presence of the male** => the solution is the use of an humoral factor causing hormonal discharge which in turn allows ovulation.

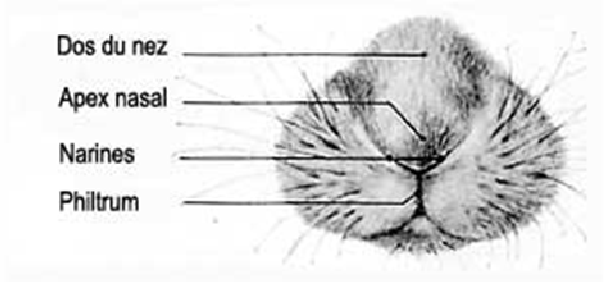
* it is possible to mate or inseminate the rabbit does on a fixed day: **it is therefore the breeder who sets the reproduction rhythm**

Rabbit's Reproduction

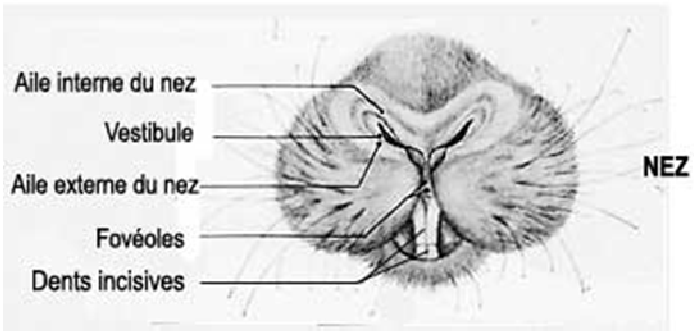
Other important characteristics of rabbits
(but not of all lagomorphs)
for their use as production animal

- The domestic female rabbit gives **litters of 8 to 10 kits (till 11-12 for some selected lines) after a gestation of 30-31 days.**
- Newborns are **naked, blind and with reduced motor skills**: the doe makes a nest to protect them.
- Female rabbit is **fertile from birth** and while she is nursing her litter.
- **Lactation lasts 5 to 7 weeks** if the rabbit is not simultaneously pregnant. It is limited to 28 days in a fertilized doe from birth
- The **lactation peak** (maximum production) is observed at the end of the 3rd week.
- Kits start to quantitatively consume **solid food at 18-20 days**
- **At 28 days** milk represents significantly less than half of the food consumption, young rabbits **can be easily weaned.**

Respiration



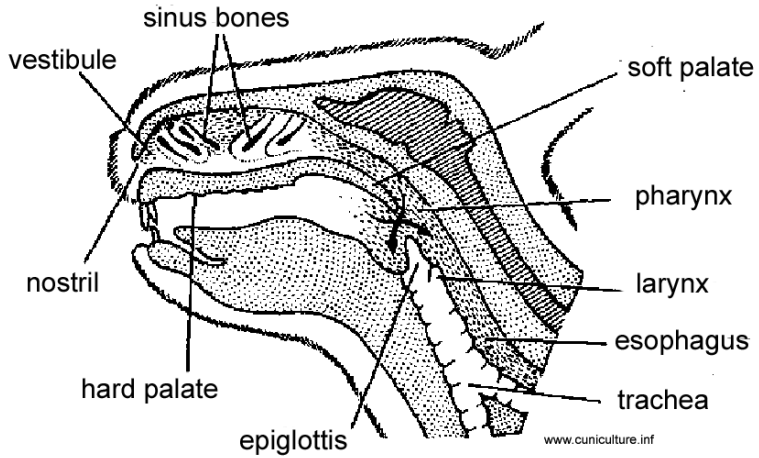
NEZ FERMÉ



NEZ OUVERT

In rabbits, the opening of the nostrils is very close to the mouth

=> the rabbit risks pulling fine particles into the respiratory tract when inhaling, if the food is dusty



Longitudinal saggital section of a rabbit's head

Any dust is stopped in the upper respiratory tract (role of the sinus epithelium and mucus), but beware of "overloads"

Respiration

With each "normal" inspiration, an adult rabbit weighing 4 kg inhales approximately 21 ml of air (19 to 24 ml depending on the individual), and the residual lung volume is approximately 12 to 15 ml.

Considering an average respiratory rate of 90 breaths per minute, the volume inhaled and then exhaled by a rabbit represents approximately 1.8 to 2.0 liters of air per minute or 110 to 120 liters per hour.

This air is used to export about 2 liters of CO2 per hour and to evaporate 3 to 4 grams of water.

Thus, over the course of a 24-hour day, a rabbit exports through the respiratory tract about 26 g of carbon in the form of CO2, corresponding to the "combustion" of 64 g of carbohydrates. It also evaporates about 90 g of water

Finally, it should be remembered that the newborn rabbit is very resistant to anoxia (several tens of minutes) => no need for special ventilation in the nest boxes. *It is an adaptation to life in the bottom of a burrow, that the mother closes when leaving once per day*

Sense organs

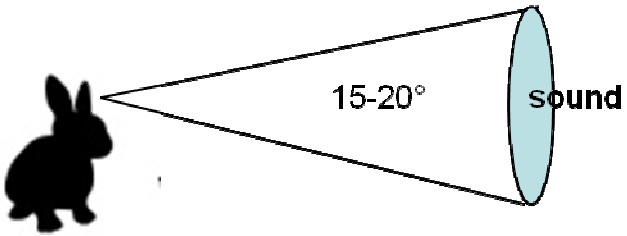
The senses used for relations with the environment

HEARING

A rabbit can hear sounds in the range of 360 to 42 000 Hz (Humans 64 to 23 000 Hz and dogs from 67 to 45 000 Hz)

Low precision for locating the origin of a sound (cone 20° to 15° opening at best)

In rabbits, the localization of the origin of a sound is much worse than in humans:
in a cone of 15 ° to 20 ° opening, against 1 to 2 ° for humans



Sense organs

The senses used for relations with the environment

VISION

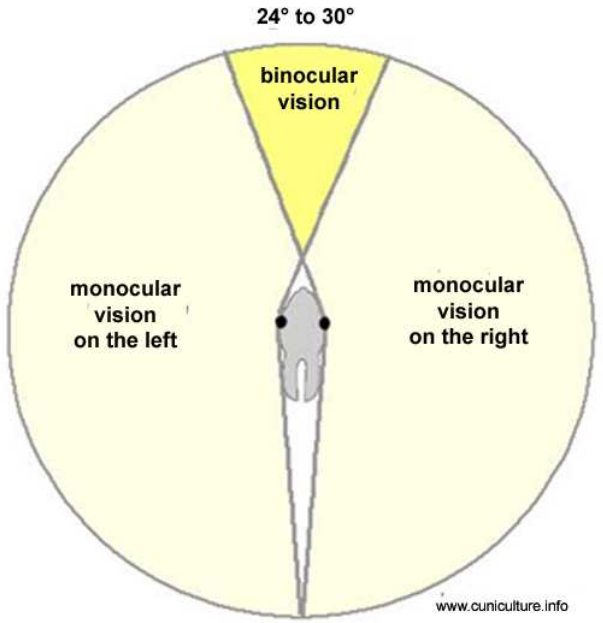


Diagram of the visual field of a rabbit

The field of vision of a rabbit covers quite 360°

Binocular vision is adaptable forward (20° to 30°) but not very precise

Daytime vision is in two-color (dark red and infra-red are ignored)

But night vision is good (It needs 6-8 times less light than man)

What a man or a rabbit respectively see in front of the same landscape

The « New Bridge » in Toulouse (France) as seen by you or me, *i.e* by human eyes

What a man or a rabbit respectively see in front of the same landscape

The « New Bridge » in Toulouse (France) as seen by a **RABBIT** (not very precise).

But if something moves in this image = **Alert** => Is it a **Danger ?**

Sense organs

The 3 senses used for the relations between a rabbit and his environnement

The rabbit's alert system

1. General environment : hearing works in all directions **continuously**.
2. A noise ? => localization of the direction ± 15°-20° (it is roughly there)
3. So the rabbit tries to see if he can identify the origin of the noise
4. He looks in binocular vision in the direction of the noise
5. If nothing moves => OK, it continues his activities
6. If something moves => If he knows => OK, he continues his activities
7. If something moves => If he does not know and especially if "it is getting closer" = **DANGER** => Escape quickly to the burrow, alert other rabbits by hitting the ground.
8. The vibrissae allow the rabbit to move into the burrow (in the burrow the sight is useless)

Sense organs

The 2 senses used for the relations between a rabbit and a potential feed

SMELL

The rabbit has a “delicate" nose
It has 100 million olfactory receptors (12 million for humans, but 1 to 4 billion for dogs)
The sense of smell is of little use in analyzing the distant environment. It is mainly used to analyze food resources close to the rabbit's mouth

TASTE

There are 17,000 sensory receptors on the rabbit's tongue (~ 4000 for humans, ~ 500 for cats and 25,000 for calves!)
The rabbit is sensitive to the 4 basic tastes : salty - sweet - sour - bitter - (? For umami - the 5th taste that of glutamate)
He appreciates sweet and slightly bitter foods

Combined with smell, taste is used to select feeds

To find out more about rabbit biology in general:

Visit the website: http://www.cuniculture.info/Docs/Biologie/Biology-English/Index-Biology.htm
(free access)

ACCUEIL | MAGAZINE | ÉLEVAGE | BIOLOGIE | FOURNISSEURS | RECETTES | PHOTOTHEQUE | LIENS

Biology of the Rabbit

by **François LEBAS**

Directeur de Recherches honoraire de l'INRA

English revised version of "Biologie du lapin" , translated from French by Cathy R. Martin and Joan M. Rosell

Edition 2020

Les dernières modifications

General Index