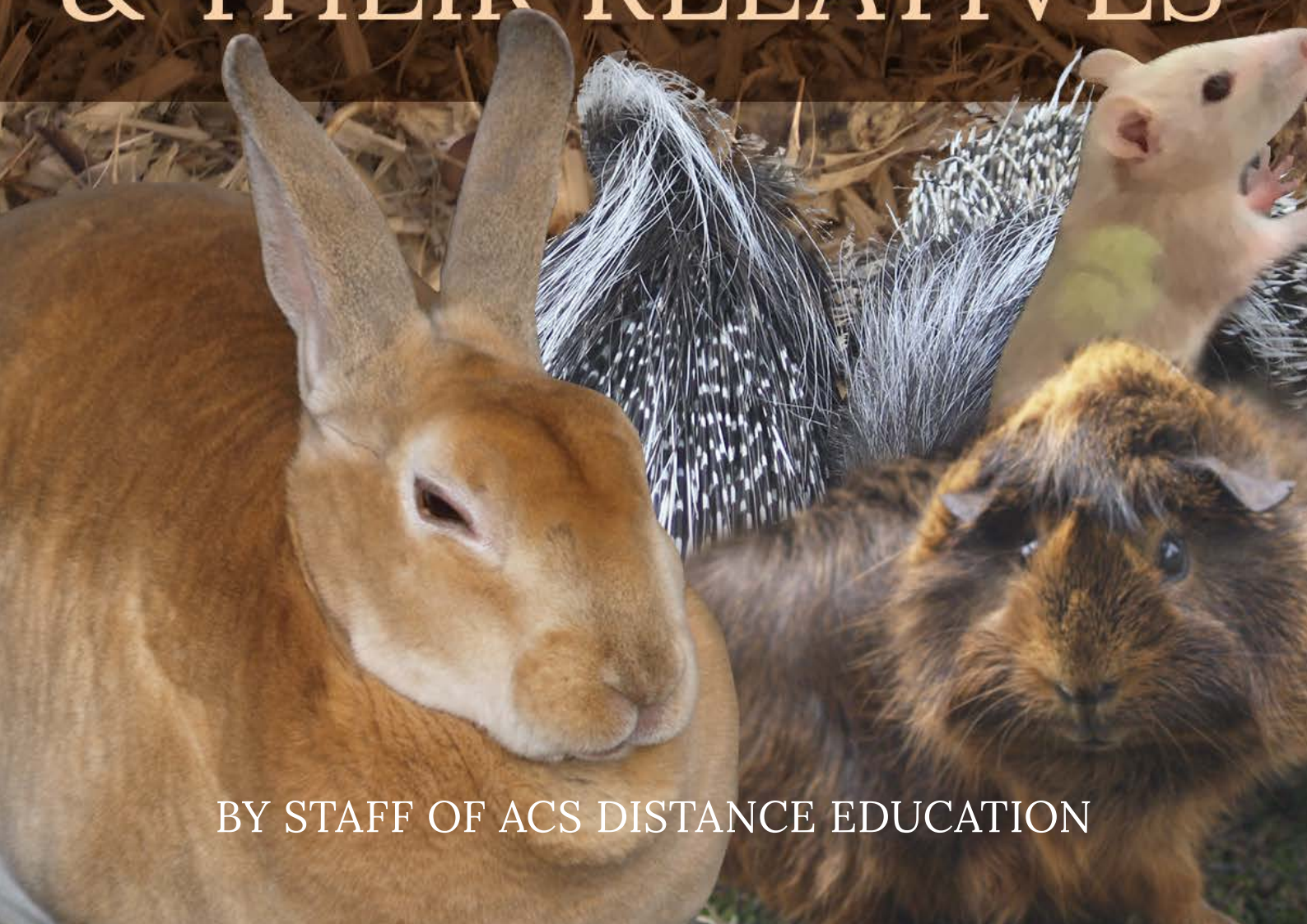




# RODENTS, RABBITS & THEIR RELATIVES



BY STAFF OF ACS DISTANCE EDUCATION

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# CHAPTER 1 INTRODUCTION TO RODENTS AND LAGOMORPHS

*Rodents and Lagomorphs are two closely related groups of mammals belonging to a taxonomic group called the Grandorder “Glires”.*

*Rodents include rats, mice, guinea pigs, squirrels and a very large range of other animals. Lagomorph includes rabbits, hares and pikas.*

## INTRODUCTION

These animals occur widely across the world on all continents except Antarctica. They are economically and environmentally diverse and significant. The only habitat they are not found in is the ocean. Some species are prolific breeders and can be invasive and adaptable to a wide variety of ecosystems. Some have a significantly negative impact upon the health and wellbeing of humans and other animals. Others are kept as pets or farmed, such as guinea pigs and rabbits used for human and animal food. In other example, of non-meat products, Angora rabbits are farmed for fleece.



Common Yellow-Toothed Cavy  
(*Galea musteloides*)

## Rodents

For most of us, the most familiar rodents are rats, mice, and perhaps squirrels. Many people think they're small and insignificant, yet rodents make up close to 40% of the world's mammal population. This makes them the largest and most diverse order of all mammal groups.

Rodents have important ecological values in many environments. Several, such as beavers, are keystone species and make important contributions to ecosystem engineering. How? Beavers change the paths of streams and rivers with their dam building activity, which facilitates the creation, and expansion, of essential wetlands. Prairie dogs are a rodent that contribute to soil aeration and mixing. They trim the vegetation around their burrows, which encourages nitrogen uptake. Together, these practices yield richer soil, which influences the availability of food for other animals in the area, including bison.

While these may seem like extreme examples, the activity of many species of rodents can affect the environment. Underlying their behaviour is intelligence which is often more

developed than people give them credit for. Even the common brown rat (*Rattus norvegicus*) displays advanced cognitive abilities. These rats, which are often used in laboratory work, show evidence of ‘cognitive bias’. That is, they respond to a stimulus based on an emotional response to a recent prior stimulus. Humans also display cognitive bias, though in much greater depth.

## Lagomorphs

Lagomorphs, which are comprised of rabbits, hares, and pikas, were considered to be rodents until the early 20<sup>th</sup> century. Together, these groups have been an important historical source of fur for coats, hats, and other clothing. Beaver fur was highly prized in the Americas, where chinchillas have also been long-valued for their fur. Similarly, rabbits, hares and pikas (sometimes known as conies) have also been hunted for their pelts which are used for warmth in colder areas.

Rodents and lagomorphs are also an important source of food and fur in the developing world. Guinea pigs have been used a source of protein since Roman times. Other rodents, such as chinchillas, gophers, dormice, and squirrels have been hunted for food, as have rabbits, hares, and pikas. In the 21<sup>st</sup> century, rodents and lagomorphs provide a low-cost option for sustainable and self-sufficient farming throughout the developing world. Conversely, rodent populations and in particular rats, can cause significant damage to food production – it has been estimated that rats damage approximately 1% of the world’s cereal production each year.

Humans, rodents, and lagomorphs form part of a very complex web: understanding the anatomy and physiology of rodents and lagomorphs and learning about several species, offers insight into some of the world’s most diverse species.

## HOW THEY ARE CLASSIFIED BY SCIENTISTS

Glires describes the group of species consisting of rodents, rabbits, pikas, and the extinct groups Anagalidea and Mimotonidae. The “Grandorder Glires” consists of two living Orders, Rodentia (Rodents) and Lagomorphs (Rabbits, Hares and Pikas).

At one point in time it was thought that these species were similar and all belonged to the same Order: Rodentia. After many studies, it was proposed in 1912 by palaeontologist, James W. Gidley, that these mammals were different and should belong in two Orders. Therefore, the Order: Lagomorph was created. The main difference between these two Orders is their anatomical and physiological structure and function which leads them to have different diets. Lagomorphs are strictly herbivores and will only eat plant matter. Rodentia species will eat both animal and plant based diets making them omnivores. The dental differences are linked to their incisors. Lagomorphs have four incisors on the upper jaw with enamel on the front and back of each tooth, whereas Rodentia species have two incisors on the upper jaw with enamel present on the front of the tooth only.

# CLASSIFICATION OF GRANDORDER GLIRES

## ORDER RODENTIA

### Suborder Anomaluomorpha

#### Family Anomaluridae

Subfamily Anomalurinae (Scaly-tailed Flying Squirrels)

Genus *Anomalurus* (four species)

Subfamily Zenkerellinae (Pygmy Scaly-tailed Flying Squirrels)

Two Genera, including three species.

#### Family Pedetidae (Springhares)

Genus *Pedetes* (two species)

### Suborder Castorimorpha

#### Family Castoridae (Beavers)

Genus *Castor* (two species)

#### Family Geomyidae (Pocket gophers)

Six Genera, including forty species.

#### Family Heteromyidae

Subfamily Dipodominae (Kangaroo Mice and Kangaroo Rats)

Two genera, including twenty one species.

Subfamily Heteromyinae (Forest Spiny Pocket Mice and Spiny Pocket Mice)

Two Genera, including thirteen species.

Subfamily Perognathinae (Pocket Mice)

Two Genera, including twenty six species.

### Suborder Hystricomorpha

#### Infraorder Ctenodactylomorphi

#### Family Ctenodactylidae (Gundis)

Four Genera, including five species.

#### Infraorder Hystricognathi

#### Family Abrocomidae (Chinchilla Rats)

Two Genera, including ten species.

#### Family Agoutidae (Pacas)

Genus *Agouti* (eleven species)



**Family Bathyergidae (Mole Rats and Blesmoles)**

Subfamily Bathyerginae

Four Genera, including fifteen species.

Subfamily Heterocephali

Genus *Heterocephalus* (one species)

**Family Capromyidae (West Indian Hutias)**

Subfamily Capromyinae

Four Genera, including fourteen species.

Subfamily Hexolobodontinae

Genus *Hexolobodon* (one species)

Subfamily Isolobodontinae

Genus *Isolobodon* (two species)

Subfamily Plagiodontinae

Two genera, including four species.

**Family Caviidae (Cavies)**

Subfamily Caviinae

Three Genera, including twelve species.

Subfamily Dolichotinae

Genus *Dolichotis* (two species)

Subfamily Hydrochoerinae

Two genera, including four species.

**Family Chinchillidae (Chinchillas and Viscachas)**

Three Genera, including seven species.

**Family Ctenomyidae (Tuco-tucos)**

Genus *Ctenomys* (sixty species)

**Family Cuniculidae (Pacas)**

Genus *Cuniculus* (two species)

**Family Dasyproctidae (Acuchis and Agoutis)**

Two Genera, including thirteen species.

**Family Dinomyidae (Pacarana)**

Genus *Dinomys* (one species)

Family Echimyidae (Spiny Rats)

Subfamily Dactylomyinae

Three Genera, including seven species.

Subfamily Echimyinae

Six Genera, including twenty nine species.

Subfamily Eumysopinae

Nine Genera, including forty five species.

Subfamily Heteropsomyinae

Four Genera, including seven species.

Family Erethizontidae (New World Porcupines)

Subfamily Chaetomyinae

Genus *Chaetomys* (one species)

Subfamily Erethizontinae

Four Genera, including fifteen species.

Family Heptaxodontidae (Giant Hutias)

Subfamily Clidomyinae

Genus *Clidomys* (one species)

Subfamily Heptaxodontinae

Three Genera, including three species.

Family Hydrochaeridae (Capybara)

Genus *Hydrochaeris* (one species)

Family Hystricidae (Old World Porcupines)

Three Genera, including eleven species.

Family Myocastoridae (Coypus and Nutria)

Genus *Myocastor* (one species)

Family Octodontidae (Degus, Viscacha Rats and Rock Rats)

Eight Genera, including thirteen species.

Family Petromuridae (Dassie Rat)

Genus *Petromus* (one species)

Family Thryonomyidae (Cane Rats)

Genus *Thryonomys* (two species)

Suborder Myomorpha

Superfamily Dipodoidea

Family Dipodidae (Birch Mice, Jerboas, Jumping Mice)

Subfamily Allactaginae

Three Genera, including fifteen species.

Subfamily Cardicraniinae

Three Genera, including seven species.

Subfamily Dipodinae

Five Genera, including nine species.

Subfamily Euchoreutinae

Genus *Euchoreutes* (one species)

Subfamily Sicistinae

Genus *Sicista* (thirteen species)

Subfamily Zapodinae

Three Genera, including five species.

Superfamily Muroidea

Family Calomyscidae (Mouse-like Hamsters)

Genus *Calomyscus* (eight species)

Family Cricetidae (Voles, New World Mice and Rats, Hamsters)

Subfamily Arvicolinae

Twenty eight Genera, including one hundred and fifty six species.

Subfamily Cricetinae

Seven Genera, including nineteen species.

Subfamily Lophiomyinae

Genus *Lophiomyis* (one species)

Subfamily Neotominae

Sixteen Genera, including two hundred and twenty four species.

Subfamily Sigmodontinae

Seventy four Genera, including three hundred and seventy seven species.

Subfamily Tylomyinae

Four Genera, including ten species.

**Family Muridae (Gerbils, Old World Rats and Mice, Whistling Rats)**

Subfamily Deomyinae

Four Genera, including forty two species.

Subfamily Gerbillinae

Sixteen Genera, including one hundred and three species.

Subfamily Leimacomyinae

Genus *Leimacomys* (one species)

Subfamily Murinae

One hundred and twenty six Genera, including five hundred and sixty one species.

Subfamily Otomyinae

Three Genera, including nineteen species.

**Family Nesomyidae (African endemic Rats and Mice)**

Subfamily Cricetomyinae

Three Genera, including eight species.

Subfamily Delanymyinae

Genus *Delanymys* (one species)

Subfamily Dendromurinae

Six Genera, including twenty four species.

Subfamily Mystromyinae

Genus *Mystromys* (one species)

Subfamily Nesomyinae

Nine Genera, including twenty three species.

Subfamily Petromyscinae

Genus *Petromyscus* (four species)

**Family Platacanthomyidae (Pygmy Dormice and Spiny Dormice)**

Two Genera, including two species.

**Family Spalacidae (Bamboo Rats, Mole Rats, Zokors)**

Subfamily Myospalacinae

Two Genera, including six species.

Subfamily Rhizomyinae

Two Genera, including four species.

Subfamily Spalacinae

Two Genera, including fourteen species.

Subfamily Tachyoryctinae

Genus *Tachyoryctes* (thirteen species)

Suborder Sciuromorpha

Family Aplodontiidae (Mountain Beaver)

Genus *Aplodontia* (one species)

Family Gliridae (Dormice and Hazel Mice)

Subfamily Glirinae

Two Genera, including two species.

Subfamily Graphiurinae

Genus *Graphiurus* (fourteen species)

Subfamily Leithiinae

Six Genera, including thirteen species)

Family Sciuridae (Squirrels)

Subfamily Callosciurinae

Fourteen Genera, including sixty four species.

Subfamily Ratufinae

Genus *Ratufa* (four species)

Subfamily Sciurillinae

Genus *Sciurillus* (one species)

Subfamily Sciurinae

Tribe Pteromyini, including fifteen Genera and forty four species.

Tribe Sciurini, including five Genera and thirty seven species.

Subfamily Xerinae

Tribe Marmotini, including six Genera and ninety two species.

Tribe Protoxerini, including six Genera and thirty species.

Tribe Xerini, including three Genera and six species.

ORDER LAGOMORPHA

Family Leporidae (Hares and Rabbits)

Eleven Genera, including sixty species.

Family Ochotonidae (Pikas)

Genus *Ochotona* (thirty species)

# CHAPTER 2 ANATOMY, PHYSIOLOGY AND BEHAVIOUR

*Whilst rodents and lagomorphs share many similarities in their internal and external anatomy there are also subtle differences which are used to differentiate between these orders.*

## INTRODUCTION

The Glires are a group of mammals that are characterised by having a dentition that is highly specialised for gnawing. They possess “rootless incisors”; that is, their incisors continue to grow throughout their life. Constant gnawing on fibrous food is needed to wear down the teeth so that they do not grow too long. Gnawing also functions to sharpen the teeth. This is common to both orders of the Glires group - Lagomorpha and Rodentia.

Lagomorphs share similar characteristics to other mammals in that they are all tetrapods (four limbed), they are endothermic (warm blooded), they all have hair, and they have mammary

glands. Their brains possess a smooth-surfaced cerebrum which is common to rodents, bats and some other insectivorous mammals.

Although lagomorphs and rodents share a common ancestry, the two orders differ in several biological characteristics. As outlined in the previous chapter, the major difference is that lagomorphs have four incisor teeth in the upper jaw whereas rodents have two. These incisors have a coat of enamel on the front and the back in lagomorphs, but in rodents the enamel is only present on the front of the incisors. Another distinguishing feature is that lagomorphs are strict herbivores. Many rodents are omnivorous scavengers, eating both plant and animal matter.



Capybara (*Hydrochoerus hydrochaeris*)

## Modifications to the Jaw and Teeth

In lagomorphs the second upper incisors is located behind the first incisor. It is small and “peg-like” and, therefore, known as the peg tooth. There is a wide diastema (gap) between the incisors and the cheek teeth. Lagomorph premolars and molars are modified for cutting rather than grinding as they have sharp edges. When the jaw is closed, the bite of the upper teeth is on the outside of the lower teeth.

Rodents similarly possess a wide diastema following their incisors, associated with the absence of second incisors, canines and first premolars. The premolars and molars that are present are consistent in shape.

The nostrils of lagomorphs are bounded by skin which may or may not be covered by fur. Lagomorphs have the ability to close their nostrils.

Rodents have the ability to compartmentalise their mouth into two separate areas by taking folds of skin into the diastema. This functions to store food that is not swallowed in the mouth. In some rodents, for example in hamsters, these skin folds have further developed into cheek pouches. The rodent jaw is characterised by large jaw muscles. These muscles are divided into three sections but the sections are attached to each other. This allows the jaw to move forwards and backwards.



Brown Rat (*Rattus norvegicus*)