Module # 7 – Component 3

Bats

Order: Chiroptera

Origins and Evolution

The earliest fossil specimen dates from approximately 30 million years ago. The origin of bats is not fully understood.

Several theories exist as to the original bat’s ancestor, but no real agreement has been reached.

At one time, it was thought that the bats were closely related to tree shrews and flying lemurs. Later it was shown that bats are in fact divided up into two very distinct groups, not very closely related. These groups are the:

- **Megachiroptera**, or large bats
- **Microchiroptera**, or small bats

In the mid 1980’s one good theory has the megachiropterans evolving from a primitive gliding primate (probably the same ancestor as the flying lemur) and microchiropterans evolving from smaller arboREAL (leaping and gliding) insectivores.

This would mean that powered flight in mammals evolved twice (in parallel) in two completely separate lineages.

It is this last fact that worries many a taxonomist. While parallel evolution certainly exists and examples abound, powered flight is a major evolutionary step. Evolving once is surprising, evolving twice is incredible, but twice in parallel and producing very similar species, is a hard fact for some to accept.

Regardless of the debate, it is likely that bats evolved from a primitive gliding mammal, probably an insectivore.
Flight

Bats comprise nearly one quarter of mammalian species. They are the only mammals capable of sustained flight. While there are other ‘flying’ mammals, they do not exhibit true flight and glide rather than use any mode of real powered flight.

Bat wings are membranes which are made up of skin, elastic tissue and muscle fibre. They extend from the shoulder to the foot, enclosing the tips of the digits and partially or totally enclosing the tail vertebrae. The legs, arms and fingers are attached to the "wings" (membranes) which provide them with support. When at rest, the wings, legs, arms and fingers fold up alongside the body. Holes in the wing heal within a few weeks - even broken finger bones mend quickly.
Anatomy

The **legs** which support part of the membrane are generally **weak**. They project sideways and the **knee bends back rather than forward**, as in other mammals. Bats **hang upside down** when at rest with the hind limb acting as a hook. They possess a mechanism which locks the **digits** of their hind feet in place, to prevent them from falling.

The saying "blind as a bat" is far from true. Some bats have **well developed sight**. Their senses of **hearing and smell are also acute**. All bats have incisors and canines as well as premolars and molars. The difference in **dentition** between the **fruit-eating bats** and the **insectivorous** group is that the **crowns of the molars** are flattened in fruit-eating bats, while the molars of the insect-eating bats have **sharp crests**.

All bats have a **clawed thumb** attached to the wing membrane. This thumb is generally used for moving around the roost, but some species use it to manipulate and hold food as well.

**Tails are extremely variable.** Some lack tails while others possess long and thin tails like mice. The **relationship** of the wing membrane to the **tail vertebrae** is an important factor in **distinguishing families**. The tail is either totally or partially enclosed by the membrane.

**Large ears** and nose **leaves** are present in some species. **Skin area** is **proportional** to the **volume of the body**. Thus, a large quantity of **heat is lost** (wing membrane, ears, nose leaves). This is compensated by **intense feeding**, by **sleeping in clusters** and in some bats by **hibernating** or **torpor**.

(Picture Source: animalia.life/bat)
**Torpor**

This phenomenon is simply hibernation on a smaller scale, which is daily. During torpor bats sleep, slow their metabolic rate and let their internal body temperature fall in much the same way that ectothermic animals do. By not maintaining an internal temperature bats gain a substantial amount of energy saving.
**Echo-location**

Insect-eating bats **locate and capture prey principally by echolocation.** Sounds, either **clicks or bleeps**, are emitted through the **open mouth or nostrils at a rate of about 250 a second.** From the **delay** between the **emission** of the sound and the **return** of its echo, the bat is able accurately to **assess the position and distance of every object in its path.** Some species possess a **nose-leaf,** a flap of skin surrounding the nasal passages which serves to **direct** and **focus the sound.**

Without the aid of this **ultrasound** the insectivorous bat would be **unable to locate and capture** small fast moving prey (insects), while flying in complete darkness.

The **hearing range** of humans is in the **20 to 20 000 Hz** (Hertz) range. Bats can hear sound frequencies up into the **210 000 Hz** range. Most bats echolocate in the 20 000 to 80 000 Hz range, generally outside of our auditory abilities.

To illustrate how effective this method of location finding is, detailed scientific research has revealed the following amazing facts. **Using echolocation** different bat species can:

- distinguish between wood, metal and other substances
- detect a metal wire 0.05 mm [0.002 in] wide
- tell if a target 12 mm [0.05 in] away has moved back 1 mm [0.004 in]

These precision feats extend to their predatory lifestyle; one species being can capture up to **5000 gnats per hour.**
Classification

Bats can be divided into three groups according to their diet:

- **Fruit-eating** - Sub Order Megachiroptera
- **Insectivorous** - Sub Order Microchiroptera
- **Blood-drinking** (These bats do not occur in Africa)

Instead of discussing families which are numerous, we will go through the characteristics of the suborders - **Megachiroptera** (Fruit eaters) and **Microchiroptera** (Insect eaters).
**Suborder: Megachiroptera ~ Fruit-eating bats**

Most members of this suborder do not navigate by echolocation but instead **use their excellent eyesight**. Essentially **arboreal**, they hang in trees during the day, **emerging at night** to forage among trees while searching for food.

Their diet, while always **vegetarian**, ranges between species, with various fruits being preferred. Other food items include:

- Flowers
- Flower buds
- Pollen
- Nectar

All members of this subgroup that are found in the Southern African Sub-region have simple **tapering and dog-like muzzles**, without nose leaves. This muzzle shape has prompted taxonomists to call many of the larger species **flying foxes**. They possess **two claws on the wing structure** - one on the thumb and the other on the first digit. The **tail** is absent. These bats generally tend to be **larger** than members of the microchiroptera.

On a global scale the Megachiroptera include both the **largest and smallest** of bats. The flying fox of New Guinea has a **wingspan of 1.8 m [6 ft]** while another African species has a **wingspan of only 180 mm [0.7 in]**.

Fruit bats are most often found **roosting in large colonies** that may hold thousands of individuals.

**South African species in this suborder are not numerous, and include:**

- Wahlberg’s epauletted bat
- Angolan epauletted bat
- Gambian epauletted bat
- Peter’s epauletted bat
- Dobson’s fruit bat
- Straw-coloured fruit bat
- Egyptian fruit bat
- Bocage’s fruit bat
Suborder: Microchiroptera ~ Insect-eating bats

Insect-eating species are generally smaller in size than their fruit eating counterparts. They all have huge ears and elaborate nose leaves. They need these anatomical features as all rely on echolocation to capture prey. They possess a single claw on the thumb of the forearm, and have a long tail.

Although members of this suborder are mostly insectivorous, some species have strayed from the typical diet and now feed on:

- fish
- fruit
- frogs
- birds
- other bats
- Some even drink blood!

Blood drinking species are native to South America and no African variants are found. These bats do not suck blood, but rather make an incision into the veins of their prey (usually sleeping cattle) and lap up the flowing blood.

Everything told, 65 species have been described for Southern Africa. These are divided up into 6 distinct groups:

- Sheath-tailed bats
- Slit-faced bats
- Horseshoe bats
- Vespertilionidae (Leaf-nosed bats, long eared bats, hairy bats)
- Free-tailed bats
- Molossidae

Microchiroptera species have shown gregariousness on an unparalleled scale as far as any vertebrate species are concerned. A certain cave in Mexico is believed to house an incredible several million bats. It takes them up to an hour just to fly out of the large entrance.
**Conservation**

Bats are one type of creature that have received an **unduly and undeserved amount of bad publicity**. They have been blamed for **rabies** outbreaks and other **disease epidemics**; many still believe that they will fly into and get caught in your hair; and some still associate bats with **vampires** and evil omens.

On the contrary, bats form an **integral part of multiple ecosystems**. Their primary function is in **controlling nocturnal insect** populations. Having bats nearby is one of the best solutions for **mosquito** problems. Several South African game lodges have even gone as far to attempt to **attract bat colonies** for this specific purpose.

As humans increasingly invade natural systems by building infrastructure, bats have found themselves becoming **displaced**. They have adapted to this by **attempting to make themselves at home** in many man-made structures. Humans do not generally enjoy the company of bats, and this is not only due to misinformed opinions. Bats in roofing will make a substantial **mess** and produce a not altogether pleasant **smell**, due to their waste products.

For these reasons (and not health risks) bats are frequently **expelled from human houses**. There is an alternative. A recently adopted method for keeping bats out of houses but keeping them in the vicinity is to offer them **alternative accommodation**. One local company has even begun specialising in building **artificial bat roosts** and placing them in gardens.

Local bat communities do not have to be problematic. If you have an unwanted one, attempt a **bat-friendly solution**.