

Ecological Niches

ECOLOGY – The study of the relationships between living organisms and their physical environment.

A group of organisms that can interbreed and produce fertile offspring.

SPECIES

POPULATION

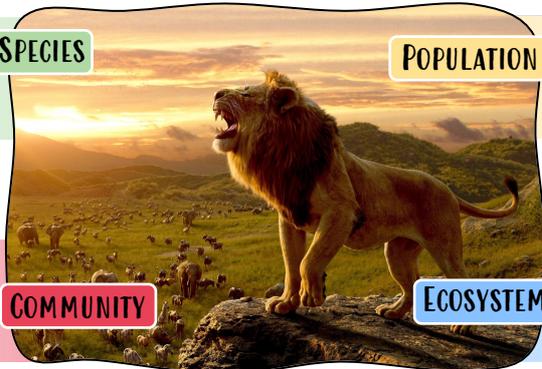
A group of organisms of the same species who live in at the same area at the same time.

A group of populations living and interacting with each other in an area.

COMMUNITY

ECOSYSTEM

A community and its **ABIOTIC** environment.



ABIOTIC FACTORS
(anything non-living)

- Amount of sunlight
- Water availability
- Type of soil
- Temperature
- pH range
- Etc...

NICHE – The unique role (job) that a species plays in a community and where the organism lives (**habitat**)

The environment where an organism lives. Including **BIOTIC** and **ABIOTIC** factors*.

*Seen in B4.1

BIG BRAIN TIP!

Extant – currently existing
Extinct – currently not existing (the whole species)

FUNDAMENTAL NICHE

The **POTENTIAL** niche that it could inhabit, given the adaptations of the species and its tolerance limits.



A dog's fundamental niche could be an entire town, a forest or wherever its adaptations allow it to be...

REALIZED NICHE

The **ACTUAL** niche that it inhabits. Can be different from fundamental niche because of competition with other species.

... but its realized niche is limited to the backyard of a house due to various reasons.

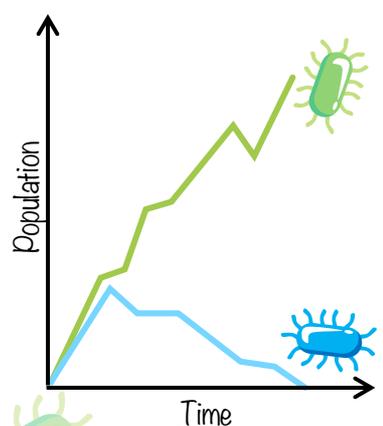
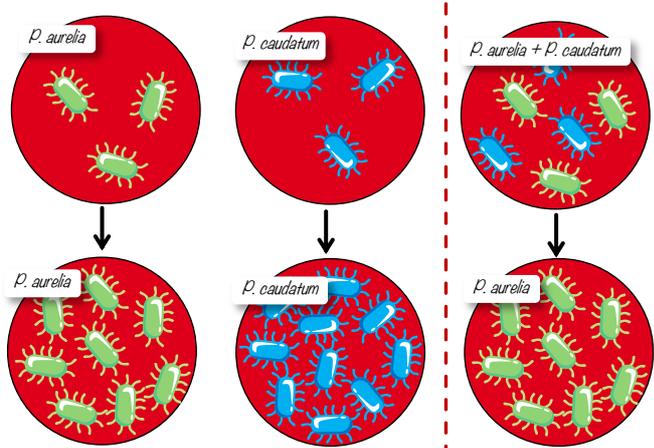


How IS THE REALIZED NICHE AFFECTED BY COMPETITION?

G.F. Cause (1934)

Principle of competitive exclusion

“When two species have a similar need for the same resources in the same space at the same time, one will be **EXCLUDED**.”



INTERSPECIFIC COMPETITION

Between

- ♥ When the two organisms are placed in the same environment but separately, they can both thrive as they have the adaptations to do so.
- ♥ But if they are put in the same environment simultaneously, the one with better adaptation will outcompete the other and **EXCLUDE** it



Ecological Niches

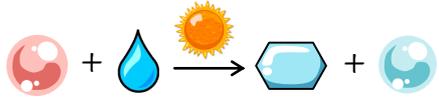
FEEDING AND NUTRITION IN DIFFERENT ORGANISMS



[Also known as producers]
AUTOTROPHS

Self Feeding
Organisms that can synthesize organic matter (food) from inorganic* matter.

✔ **Photosynthesis** – synthesizing organic matter (glucose for energy) from inorganic matter with the help of sunlight (photo)



✔ **Chemosynthesis** (Chemoautotroph) - synthesizing organic matter from inorganic matter **without** the help of sunlight
→ Usually associated with **ARCHAEA & BACTERIA**



[Also known as consumers]
HETEROTROPHS

Other Feeding
Organisms that obtain organic matter (food) by consuming organic* matter.

Categories:

1. **Herbivores** – eat plants
Leaf eater – folivores
Fruit eater – frugivores
2. **Carnivores** – eat meat
3. **Omnivores** – eat both
4. **Detritivores** – decomposer
5. **Saprotrophs** – decomposer

Holozoic Nutrition

[Food is ingested, digested internally, absorbed and assimilated]



MIXOTROPHS

Mixed Feeding
Organisms that can both synthesize their own food and obtain their food from organic matter.

✔ **Obligate mixotroph**
Need **BOTH** to grow and survive

✔ **Facultative mixotroph**
Can survive with one, but use other as supplement

– ORGANIC MATTER –
Contain C-H bonds.
Includes the 4 macromolecules

The 4 macromolecules

CARBOHYDRATES	NUCLEIC ACIDS
LIPIDS	PROTEINS

– INORGANIC MATTER –
Do not contain C-H bonds but may contain carbon, includes rocks, minerals etc.

NA - CL

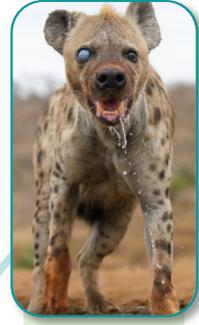
NUTRIENT CYCLE



INORGANIC



ORGANIC



ORGANIC

Decompose (break down) dead organic matter by releasing enzymes onto their food, allowing digestion to happen **OUTSIDE** their bodies. Nutrients are subsequently absorbed.

E.G. FUNGI & BACTERIA



Saprotrophs



Detritivores

ORGANIC

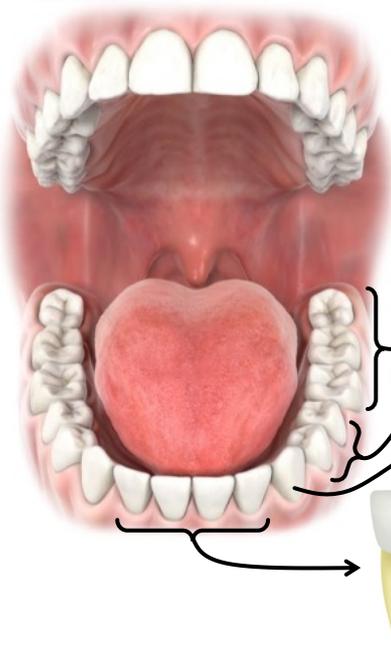
Decompose (break down) dead organic matter by direct consumption. They ingest and digest **INTERNALLY**.

E.G. EARTHWORMS, WOODLICE, OTHER INSECTS



Ecological Niches

TEETH



Molar:
Used for grinding and reducing it to a paste for swallowing.



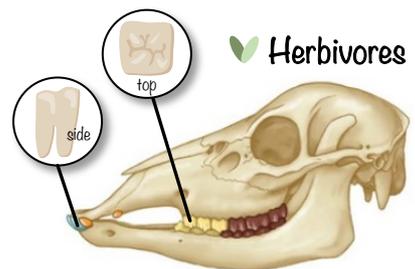
Pre-molar:
Used for crushing or slicing up food.



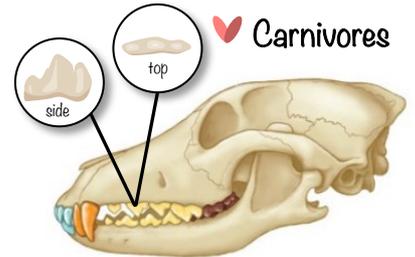
Canines:
Sharper and used for ripping/tearing tougher materials such as meat.



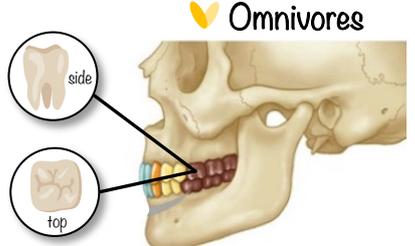
Incisors (front teeth):
Used for cutting of bite sized pieces of food.



♥ **Herbivores**



♥ **Carnivores**



♥ **Omnivores**

How can you guess an organism's mode of nutrition based on their teeth?

• Different tooth shapes depending on diet:

♥ **Herbivores:** Shearing and crushing plant material.
LARGE INCISORS and **WIDE PREMOLARS**.
Molars with **ROUNDED PEAKS** and **VALLEYS**.

♥ **Carnivores:** Killing & breaking tough meat.
Incisors & canines: **SHARP, POINTED**
Premolars & molars: **SERRATED & NARROW**

♥ **Omnivores:** Suitable for meat and plants.
MIX between the two above.

• Other clues:

♥ **Microwear** (small abrasions or removal of a tooth's surface)
Softer food will leave different marks compared to harder foods.
Foods that have grit in them from soil will scratch teeth in a particular way.

These patterns can then be analysed under the microscope!

♥ **Intimidation**

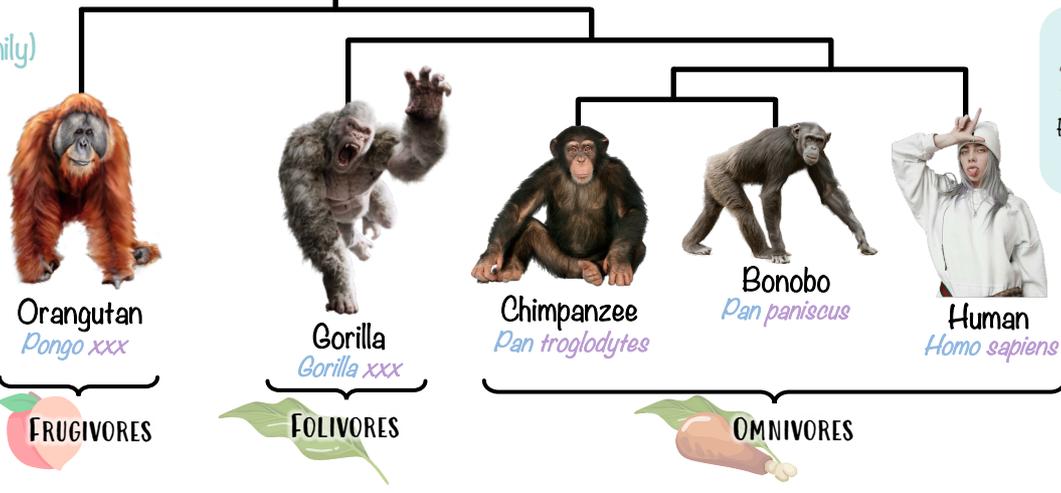
Teeth in gorillas are used for intimidation as they are in fact herbivores



THE GREAT APES

& THEIR DIET
Hominidae (Family)

Ancestor



Scientific Name: **Orangutan**
Pongo xxx

Diet: **FRUGIVORES**

Scientific Name: **Gorilla**
Gorilla xxx

Diet: **FOLIVORES**

Scientific Name: **Chimpanzee**
Pan troglodytes

Bonobo
Pan paniscus

Scientific Name: **Human**
Homo sapiens

Diet: **OMNIVORES**

Remember monkeys are not apes, they have tails



Ecological Niches

AEROBES AND ANAEROBES

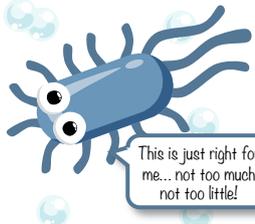
OXYGEN

OBLIGATE AEROBES



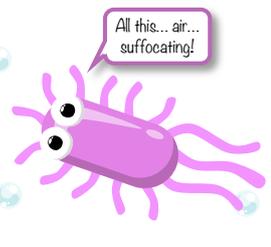
Require oxygen to turn food into energy. With low oxygen (hypoxia) or absent oxygen (anoxia) in the environment, they will die.

FACULTATIVE ANAEROBES



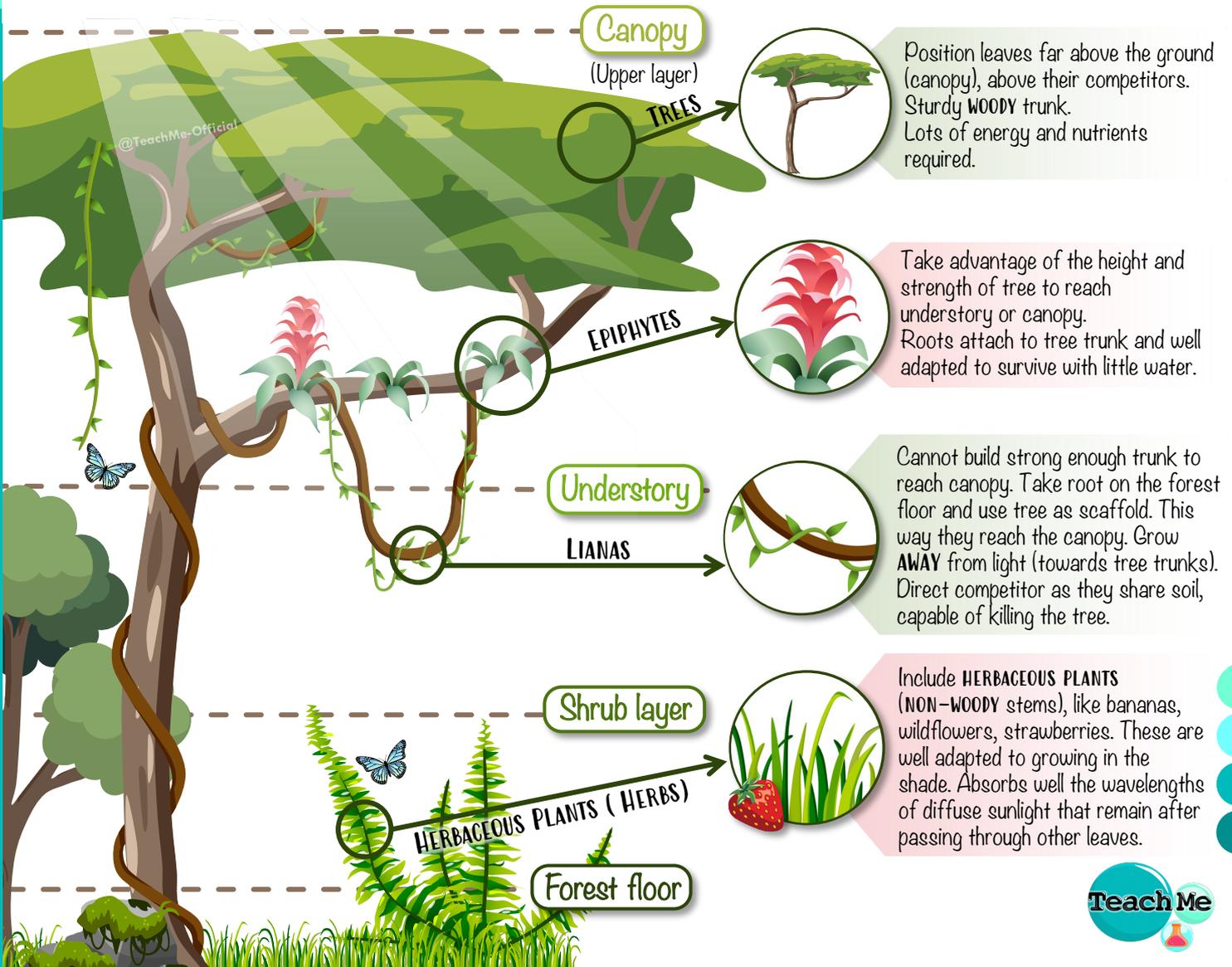
Capable of carrying out both aerobic and anaerobic respiration. They are neither hurt nor killed by the presence of oxygen.

OBLIGATE ANAEROBES



Single celled organisms that have no tolerance to the presence of oxygen and are poisoned by it.

HARVESTING LIGHT FOR PHOTOSYNTHESIS



Ecological Niches

ADAPTATIONS OF Herbivores



Giraffes have **LONG NECKS** to reach high leaves and tough **TONGUES** against thorns



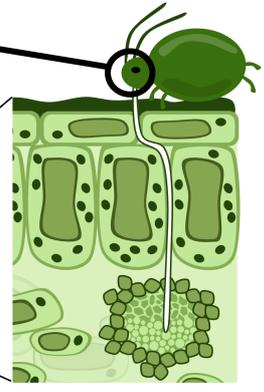
STYLETS (possessed by aphids) used to pierce and drink sap



Grasshoppers use **SHARP PINCHING MANDIBLES** to cut into grass blades and leaves to help digest them



Cows have **SPECIALIZED BACK TEETH** (broad and flat) for grinding plant matter. Ruminants (like cows) swallow before chewing (**REGURGITATE**). Gut contains microbes (such as bacteria & archaea). These can make **ENZYMES FOR CELLULOSE**. They can also help neutralize (detoxify) certain toxins to some extent. **CAUTIOUS SAMPLING**



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ADAPTATIONS OF Plants



THICK BARK is difficult to penetrate by some animals and insects.



The common nettle (*Urtica dioica*) has **CHEMICAL IRRITANTS** filling tiny silica hairs on stem & underside of leaves. When they break (by rubbing), the irritant causes **UNPLEASANT STINGING** and a **BURNING SENSATION** (urticaria) – the animal is likely to remember before considering eating the plant again.



THORNS and **SPIKES** are useful at deterring herbivores (seen on cactus)



Foxgloves (*Digitalis*), produce **PHYTOTOXINS** that cause many mammals to get sick



The castor bean produces nutritious seeds (tempting), but they contain a **HIGHLY TOXIC TOXIN** (called ricin)



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Ecological Niches

Some examples of adaptations found in **PREDATORS** and **PREYS** to ensure their survival;

ADAPTATIONS OF *Predators*

PHYSICAL

SIGHT
Hawk can see far
Owls can see in the dark

KILLING
Claws/teeth/beak
Extract nutrients

MOVEMENT
Flying, running, swimming

SMELL
Vultures can smell their preys to locate them

ELECTROMAGNETISM
Sharks detect other animals

ECHOLOCAION
Used by dolphins to locate other animals

BRAIN
Used to make decisions and planning

BEHAVIORAL

AMBUSH
Predators (like spiders) wait for prey to come. Some use a lure like the anglerfish (illicium)

PACK HUNTING
Strong pack relationship and teamwork as seen in wolf packs and ant colonies

PURSUIT PREDATORS

SPEED: Predators rely on outrunning their prey (speed) such as cheetahs over short distances

PERSISTENCE: Predators rely on their endurance by pursuing until the prey drops from fatigue, like us humans

CHEMICAL

VENOMS
Some organisms like the black mamba inject a venom by biting their prey – patiently wait for them to become paralyzed & die to eat them

PHEROMONES
They are organic molecules that can be transmitted through the air (scent) – some spiders can attract moths by mimicking the moth sex pheromones

I received your date invitation!

I haven't sent you anything...

Hehehe

ADAPTATIONS OF *Preys*

PHYSICAL

CAMOUFLAGE
Take on the appearance of its surroundings, good against visual predators – can be color (moths) or texture

APOSEMATISM
Dramatic and unusual colors to inform predators they are poisonous (like some frogs) – others may have such colors to pretend to be poisonous (though they are not)

NOISE
Warning calls and noises to deter predators and warn others

SHELLS
Shells or exoskeleton for protection like grasshoppers, snails, clams...

SHARP SPINES
For dissuasion like porcupines

BEHAVIORAL

AVOIDANCE
Fleeing, hiding – instinctive behavior encoded in DNA

GROUP FORMATION
“there is safety in numbers” – larger groups suffer fewer losses when attacked, helps protect the young, old and injured

CHEMICAL

BAD TASTE / POISON
Produce chemicals to **taste bad** or **poison** the predator like the poisonous dart frog which produces a chemical on its skin which interferes with muscle function – causing death



