Biological Relationships

- Are a means of transferring both energy and matter through the food webs.
- “+” indicates an organism benefits.
- “-” indicates an organism does not benefit.
- “0” indicates an organism is not significantly affected by the relationship.

Predation

Predation (+,-)

- A relationship where a **predator** organism feeds on another living organism or organisms known as **prey**.
- Predators may or may not kill their prey prior to or during the act of feeding on them.
- The key characteristic of predation, however, is the predator's direct impact on the prey population.

Predator and Prey

- Predator – organism that kills (usually) another for nutrients and food energy.
- Prey - organism that is killed and consumed for nutrients and food energy.
- Is Cannibalism a means of predation?
- Is a herbivore a predator?

What does the success of a predator depend on?

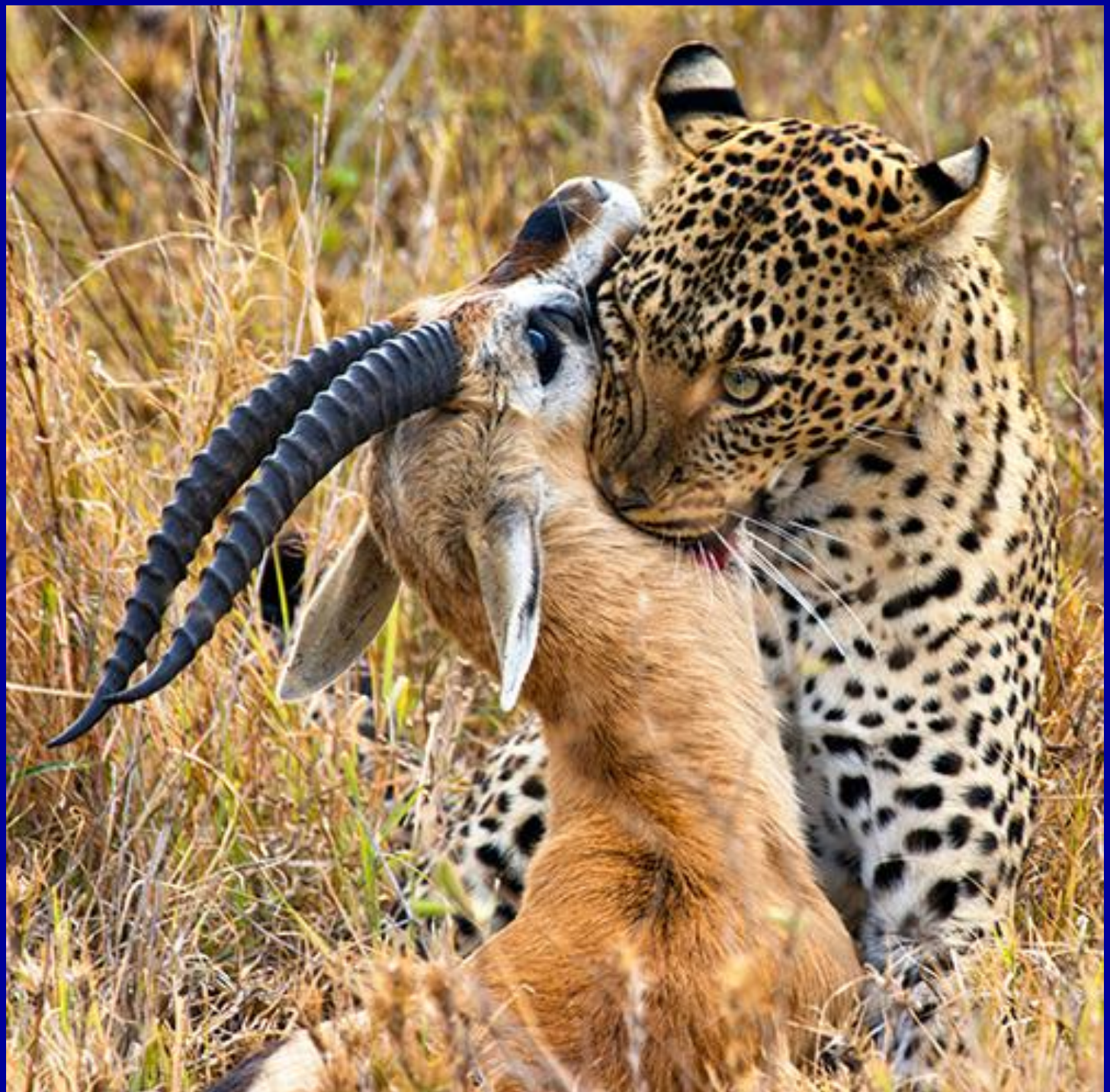
- Find – locate the prey
- Capture – catch the prey
- Kill – make the kill

- Can you think of some evolutionary adaptations exhibited by various predators and prey?
- Specifically how do these adaptations help them survive?

Predator Adaptations

- Good eyesight – find
  - hawk
- Good hearing/sonar – find
  - wild dogs, bat
- Good sense of smell – find
  - rattle snake
- Claws – capture
  - cat
- Coloration - capture
  - Leopard
- Web production - capture
  - Orb weaver
- Speed – capture
  - Cheetah
- Lack of odour – capture
  - Boa constrictor
- Jaws – kill
  - shark
- Venom production – kill
  - Snake

Coyote and Sheep



Dragonfly and Insect

Orb Weaver and Insect

Orcas love penguins!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What happens when the energy used to find, capture, and kill the prey is greater than the energy obtained from the prey?

- Predator dies of starvation…or…
- Predator switches to new prey.

Koalas eat only Eucalyptus

Predator Strategies

- Group hunting – lion pride, wolf pack
- Ambushing – crocodile, snake
- Stealthiness – cheetah
- Grazing – cattle
- Baiting – sharks and killer whales
- Corralling - Humpback whales are famous for “bubble net feeding”, using their exhalation bubbles and then swimming in circles to form a precise circular net of bubbles which concentrates small prey fish such as sardines. Swimming through the circle of bubbles allows them to swallow thousands of fish in one gulp.

Whales Bait Seagulls

- Whales regurgitate fish onto the surface of the water, then sink below the water and wait.
- If a hungry gull lands on the water, the whale surges up to the surface, sometimes catching a free meal of his own.

http://www.youtube.com/watch?v=quwebVjAEJA

Humpback bubble net feeding

Bottlenose Dolphins

A pod of bottlenose dolphins off the coast of Florida have developed a remarkable hunting strategy in order to catch fish. Another awesome thing about this technique is that only one female in the pod can create this ring, and it's always counterclockwise.

https://www.youtube.com/watch?v=bzfqPQm-ThU

Humpback Whales Bubble net Feeding (4 min)

- https://www.youtube.com/watch?v=Q8iDcLTD9wQ

Orcas – Use a teamwork strategy to prey on seals.
http://www.youtube.com/watch?v=p3xmqbNsRSk

Dolphins – Built for the Kill: Packs 12 – 18 min mark
(Use the **VLC media player** so you can fast forward)

Prey Strategies/Adaptations

Strategies

- Social Systems – ants, gophers (“lookout”)
- Flocking, herding, schooling – geese, buffalo, fish – to confuse the predator
- Nocturnal/diurnal – mouse and fox
- Size – puffer fish, frilled lizard
- Hiding – gopher
- Mobbing – black birds mob a crow

Adaptations

- Body Form – leaf bug, makes no attempt to hide
- Mimicry – monarch look alike, robber fly & wasp, drone fly & honey bee
- Camouflage – moth
- Toxins – milkweed, monarch butterfly
- Spines – rose, cactus, porcupine
- Body Armour – turtle, lobster, deer (horns)
- Coloration – skunk, bee

Camouflaged Pepper Moth

Predators use camouflage to hunt and to avoid becoming prey themselves. Can you spot the mantis?


© Art Wolfe

How many Zebras?

Colorful chameleon

Body Form – Dead Leaf Bug

Body Form - Green Leaf Bug

Green Walking Stick

Mimicry - Monarch on the right.

Viceroy Butterfly

Monarch Butterfly

Some butterflies attempt to look like a larger animal to ward off predators.

Aegeria moth, resembles a yellowjacket wasp, but has no stinger.

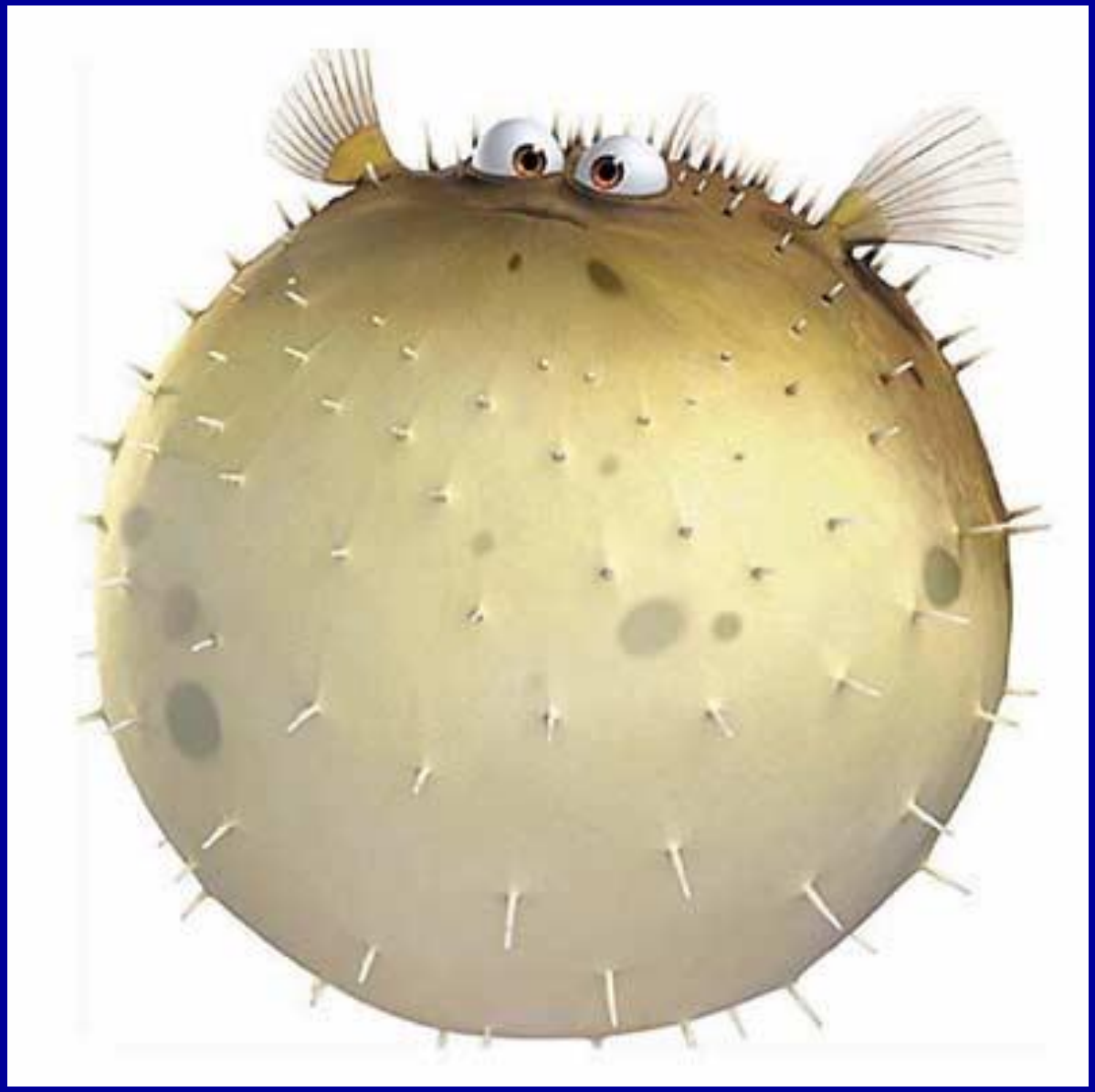
What is this?

A Robber Fly, mimic of a Bumble Bee

This Drone Fly mimics a Honey Bee

Size of Prey – Puffer Fish

“Bloat” a Porcupine Puffer



Size of Prey- Frilled Lizard

What happens when a predator strategy such as group hunting (pack of wolves or pride of lions) faces off against a prey defensive strategy such as herding?

Watch this clip to find out. Also note the interspecific competition. (8 minutes, 24 sec)

http://www.youtube.com/watch?v=LU8DDYz68kM

Bear vs Caribou (4:19)

http://www.youtube.com/watch?v=kdTdp7Ep6AM

Parasitism (+,-)

- A relationship where a **parasite** organism feeds on another living organism or organisms known as the **host**.
- The key characteristics of parasitism are:
  - Parasites do not kill their host directly.
  - The parasite does not have a direct impact on the host population.

Obligatory Parasitism

- *Obligatory* parasites live on or in a host all the time. They cannot live and reproduce free in the environment.
- Example – 19 foot tapeworm shown on the right.

Facultative Parasitism

- *Facultative* parasites can eat, sleep, and lay eggs while off of the host. When they are not on a host we call them 'free-living.' When a host comes around, they will take advantage of a change of scenery and live on the host a while.
- Example – leech

Social Parasitism

- **Social parasites** take advantage of interactions between members of social organisms.
  - Ants “farming” aphids. The ants eat the honeydew that the aphids release. In some cases, ants have been known to bite the wings off the aphids in order to stop them from getting away.
  - Birds with the brooding instinct. For example cuckoos use other bird species as "babysitters", depositing their eggs in the nest of the host species, which raise the cuckoo young as one of their own.

Ants Farming Aphids -

The ants protect the aphids on the plants that they eat and in return, the ants eat the honeydew that the aphids release.

Can you spot the Cuckoo Egg?

Competition (-,-)

- Two different species or two of the same species **compete** for resources such as:
  - Food
  - Shelter
  - Nesting sites
  - Mates
  - Breeding grounds
  - Light

There are two types of Competition

Interspecific

- Between individuals of **different** species.
- Lynx and Bobcat compete for rabbits.

Intraspecific

- Between individuals of the **same** species.
- Two male foxes compete for a female mate.

- Which form of competition is most severe and why?
- Intraspecific!

Interspecific Competition

Lions and Hyenas (4:30)

http://www.youtube.com/watch?v=Pda4zULB3EA

Lions and Hyenas (3:48)
https://www.youtube.com/watch?v=pta_sLKi6nM

Intraspecific Competition

Hippos(1:29)
http://www.youtube.com/watch?v=BUer8Dv2HW8

- Competition between members of a species ("intraspecific") is the driving force behind evolution and natural selection.
- This competition results in the ultimate survival and dominance of the variation of the species best suited for survival.
- Competition between members of different species ("interspecific") causes species less suited to compete for the resources to either adapt or die out.
- According to evolutionary theory, this competition within and between species for resources plays a critical role in natural selection.

Neutralism (0,0)

- The relationship between two species which **do not** interact with or affect each other.
- The population density of one appears to have no effect on the other.
- Examples include:
  - Gopher and antelope.
  - Porcupine and skunk.

Commensalism (0,+)

- A relationship between two living organisms where one benefits and the other is neither harmed nor helped.

There are 3 general categories of benefit.

1) Attaching to another animal for transportation only (mites on insects, millipedes on birds, barnacles on a whale).

2) Using a second organism for housing (orchids which grow on trees, or birds that live in holes in trees).

3) The second organism uses something the first created, after the death or abandonment of the first (hermit crab use snail shells to protect their bodies).

Transportation – Mites on Insect

Sand Gazelle with some tick birds.

Manta Ray with Remoras

Housing – Bluebird uses old Woodpecker holes for nests.

Hermit Crab – using dead snail shell

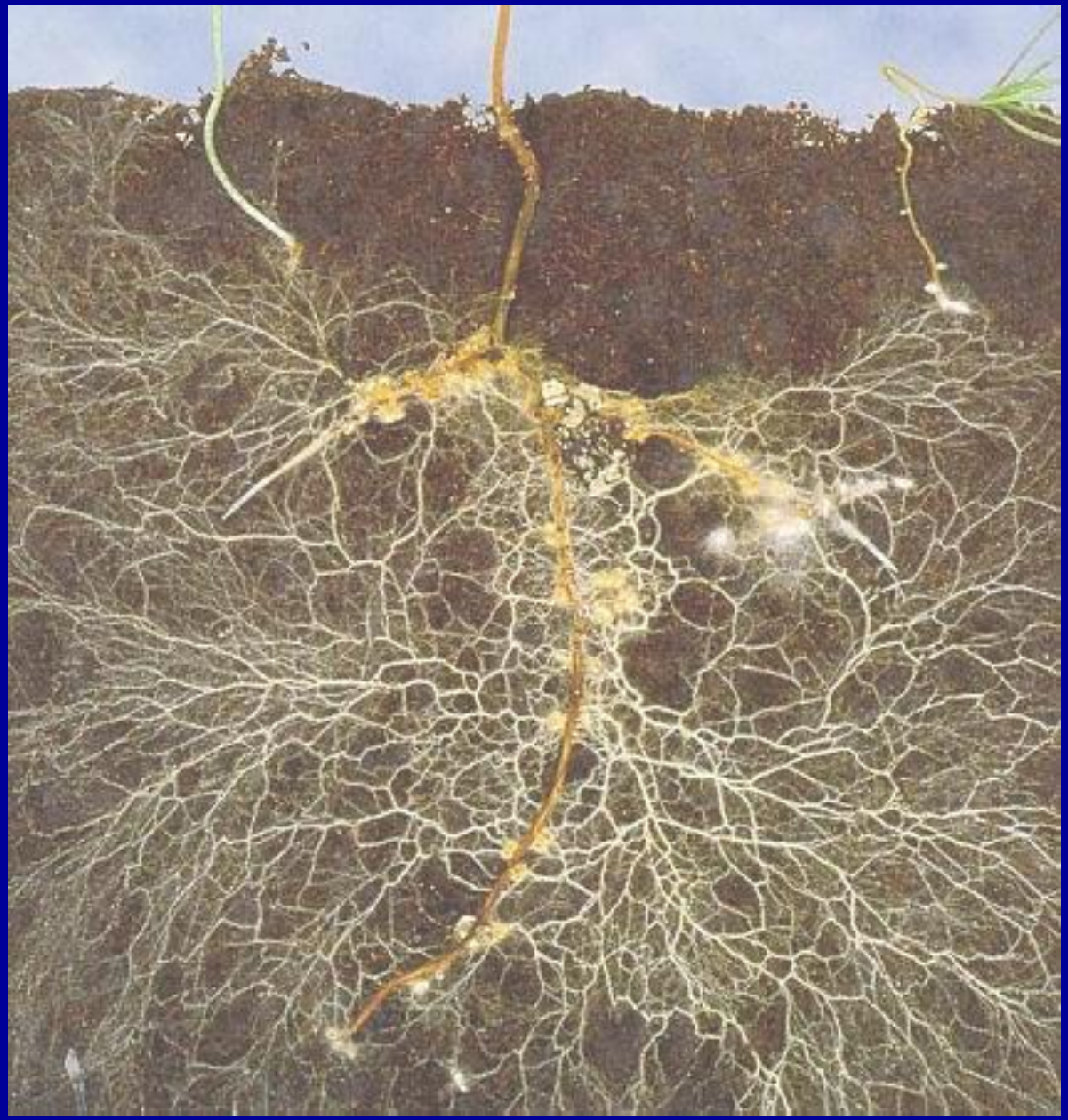
Dung Beetle – uses elephant droppings to feed young

Mutualism (+,+)

- A relationship between two or more species, where both species benefit.

Symbiotic Mutualism

- Lifelong interactions involving close physical and biochemical contact are known as symbiosis.
- Ruminants (cows) and the bacteria in their stomachs – both gain access to nutrients.
- Plants and mycorrhizal fungi - the plant gains a source of nitrogen and better water absorption and the fungi gains sugar.
- Lichens (fungus and green algae)



Mycorrhizal Fungi -

association between a fungus and roots of certain plants

Lichens - a fungus living in symbiosis with a photosynthesizing organism (which may be a green algae or a cyanobacteria, or both).

Non-Symbiotic Mutualism

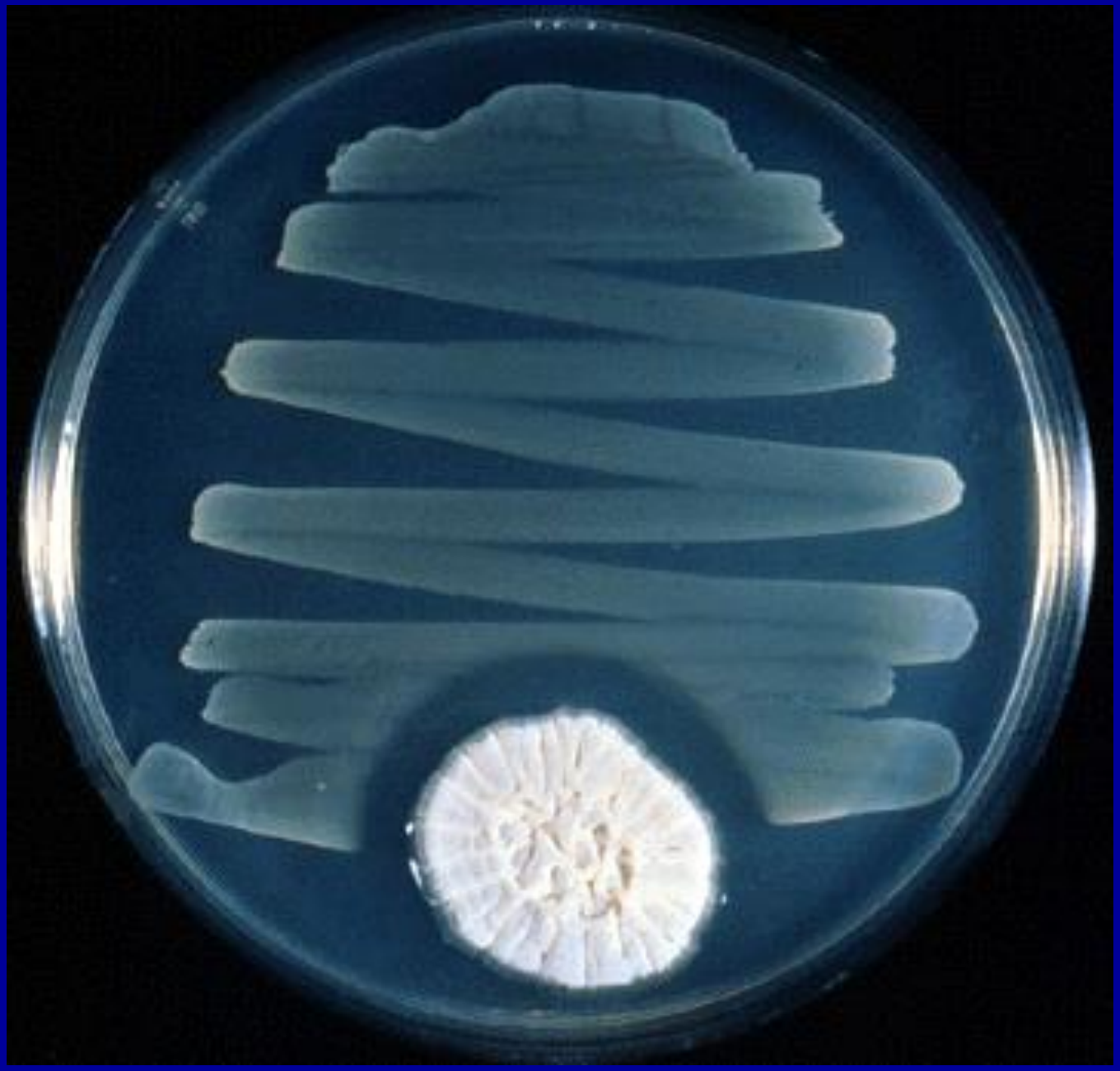
- Briefer, non-symbiotic interactions, such as those between flowering plants and pollinators.

Amensalism (0,-)

- A relationship between two species in which one impedes or restricts the success of the other without being affected positively or negatively by the presence of the other.
- Usually this occurs when one organism exudes a chemical as part of its normal metabolism that is detrimental to another organism.

Examples of Amensalism

- The bread mold Penicillium is a common example of this; Penicillium secrete penicillin, a chemical that kills bacteria.
- The black walnut tree (*Juglans nigra*), which secrete juglone, a chemical that harms or kills some species of neighboring plants, from its roots.
- Barley releases a chemical into the soil that inhibits germination of several weeds.



Penicillin inhibiting bacterial growth

Black Walnut