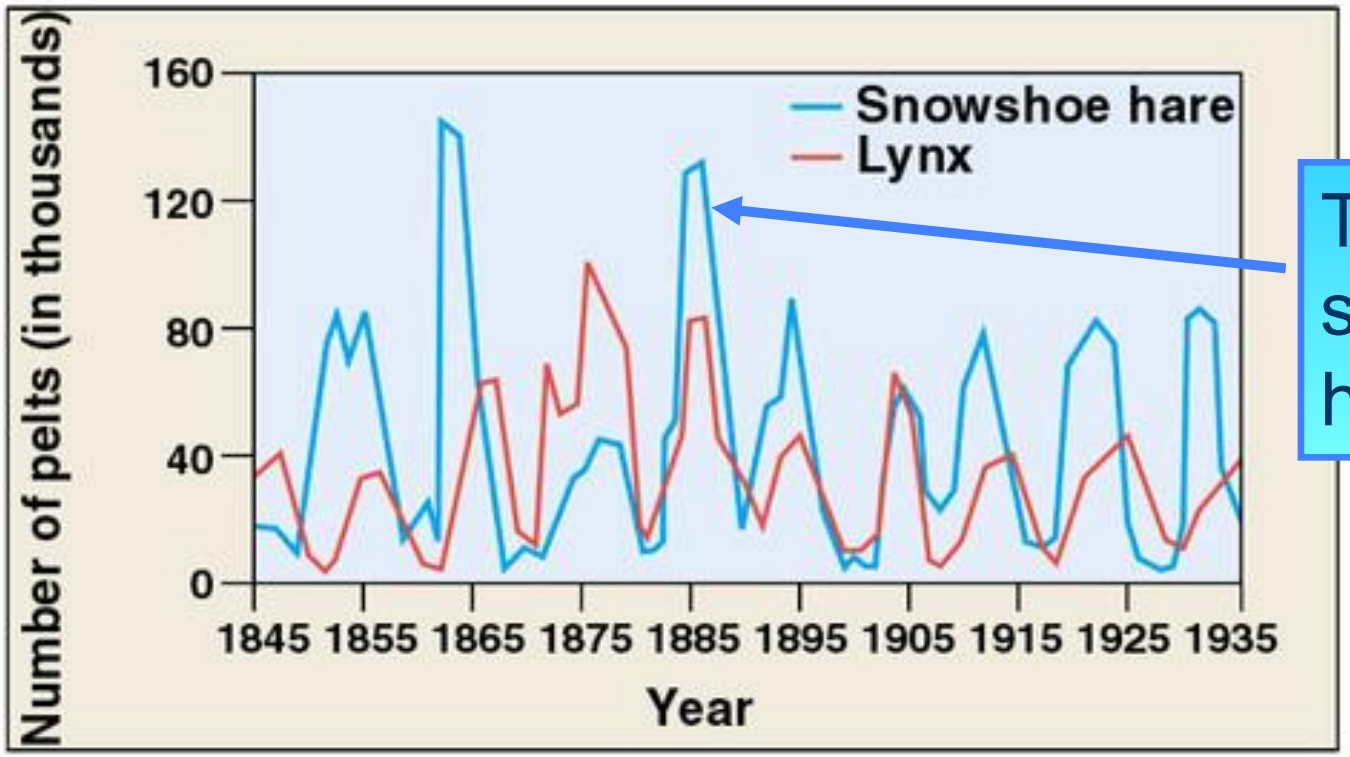
More Population Ecology

Predator-Prey Relationships

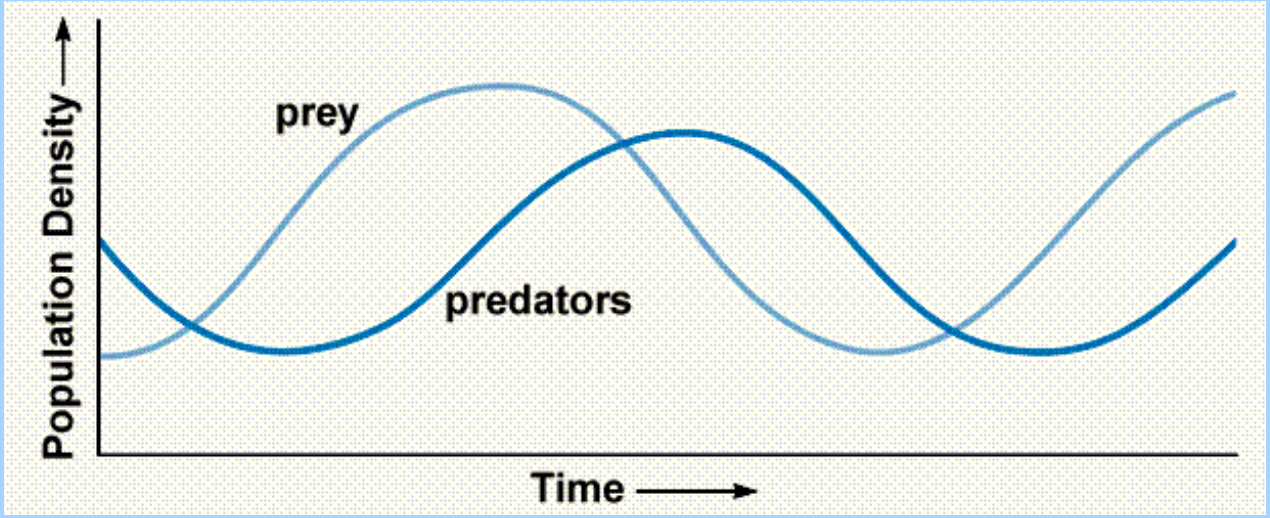
Predator-Prey Cycle



The prey is the species with the higher numbers.

The population of the **PREDATOR** must always be **smaller than the population of the PREY otherwise the cycle will BUST!**

Boom and Bust, Predator and Prey



Prey # increases, then the predator # increases.

Prey # decreases, then the predator # decreases.

Predator Interaction

Predators sometimes cooperate

Avoiding Predators

- Prey have counter strategies to avoid being detected, subdued, and eaten:

1. Mechanical Defenses
2. Visual Deception & Camouflage
3. Group Defense
4. Chemical Defense
5. Warning Colouration
6. Mimicry

Group vigilance and alarms in meerkats

Hiding is a common strategy of fawns

Structural / Mechanical Defenses

Webbed burrfish

Spiny sea urchin

Elk (male)

Armor / Quills

Stag beetle

Pill millipede

Tortoise

Visual Deception

- Markings, such as fake eyes, may deceive predators allowing prey to escape.
- **Camouflage** is used to avoid detection.

Shape shifting/ camouflage octopus:
http://www.youtube.com/watch?v=PmDTtkZlMwM&safety_mode=true&persist_safety_mode=1


Owl butterfly


Leaf insect


Butterfly fish

Group Defense

- Large groups are each less vulnerable to attack… *(more intimidating for predators)*
- Large flocks of birds and schools of fish move together as one mass to confuse predators and make it hard to isolate individuals.
- Large groups also provide greater surveillance.

Zebra Stripes
http://www.animalplanet.com/tv-shows/other/videos/fooled-by-nature-zebras-stripes/

Flamingoes congregate in large flocks

Large schools confuse predators

Chemical Defense

- **Chemical defenses** may include noxious fluids or venoms.

A scorpion's defensive posture warns potential attackers of its venomous sting.

Rattlesnakes have a venomous bite, but rely first on camouflage and a warning rattle.

Pentatomid (stink) bug

North American skunk

Toxin Example: monarch butterfly

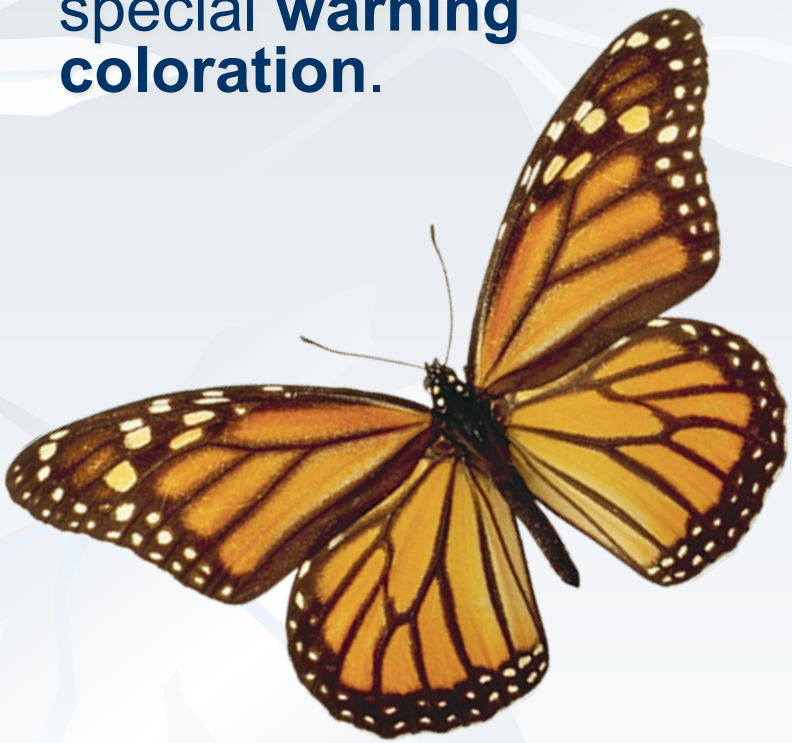
The monarch larvae feeds upon the milkweed plant and stores the toxins in its fatty tissue.

This makes both the larvae and the adult butterfly unpalatable to predators

Blue jays will actually regurgitate a swallowed prey because of it being unpalatable.

Warning Colors

- Many prey species that taste bad, are toxic, or inflict pain on attackers have a special **warning coloration**.



Monarch butterfly

Example: the poison-arrow frog

Mimicry

- In **Batesian mimicry**, a harmless, palatable species resembles a toxic or dangerous species. *(mimics can't outnumber the model)*
- In **Müllerian mimicry**, several unpalatable species may resemble each other.
  - *ex Orange and black, or yellow and black are common warning colors in insects.*

Monarch butterfly

The dangerous common wasp

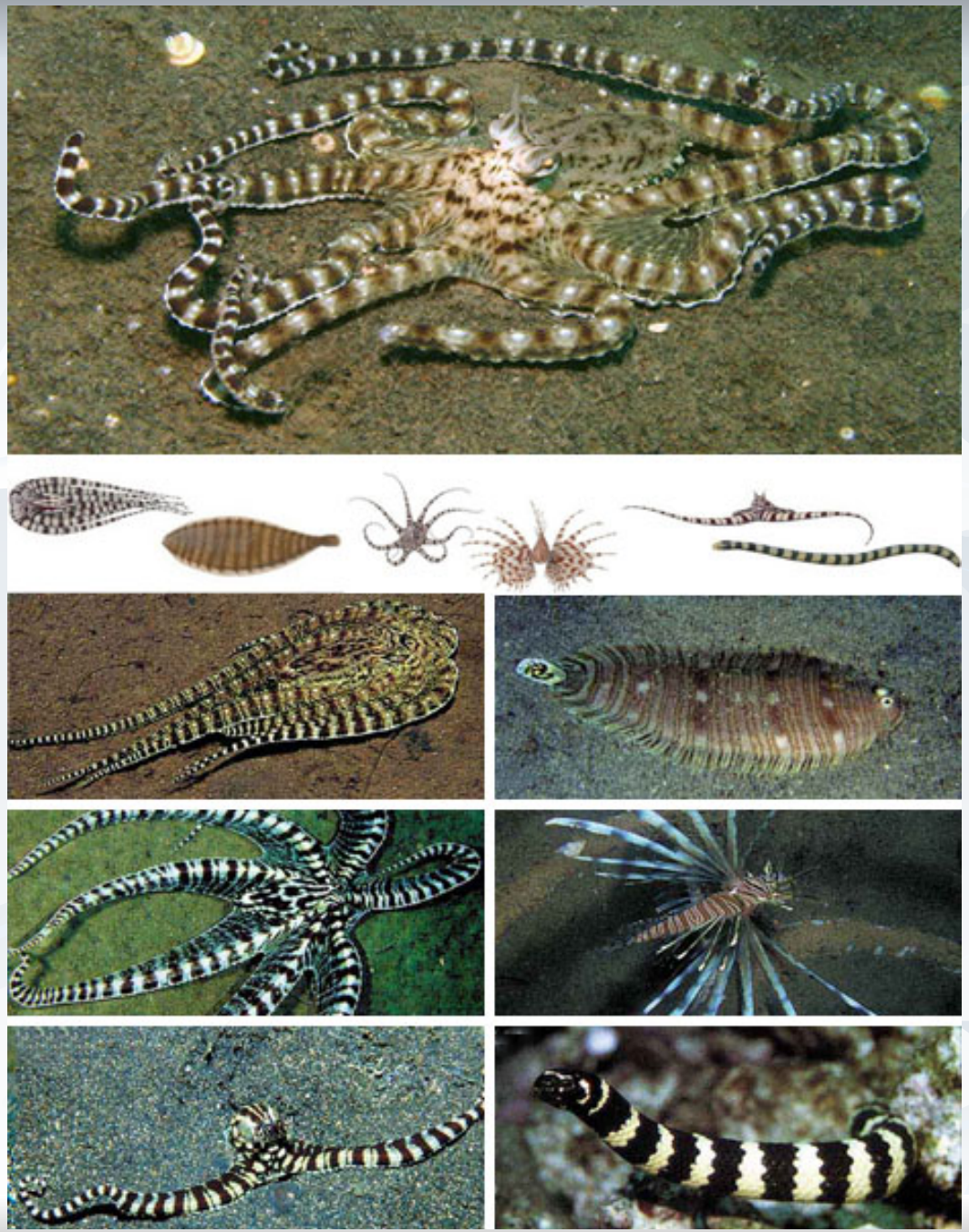
…and its harmless Batesian mimic, the wasp beetle

Watch this baby bird perfectly mimic a toxic caterpillar.

https://www.youtube.com/watch?v=FwSGk1_Y4rY

- Example: viceroy butterfly
- looks similar to the monarch butterfly, but does not contain toxins in its fatty tissues.


Viceroy at Singing Meadows by Joe Constanza

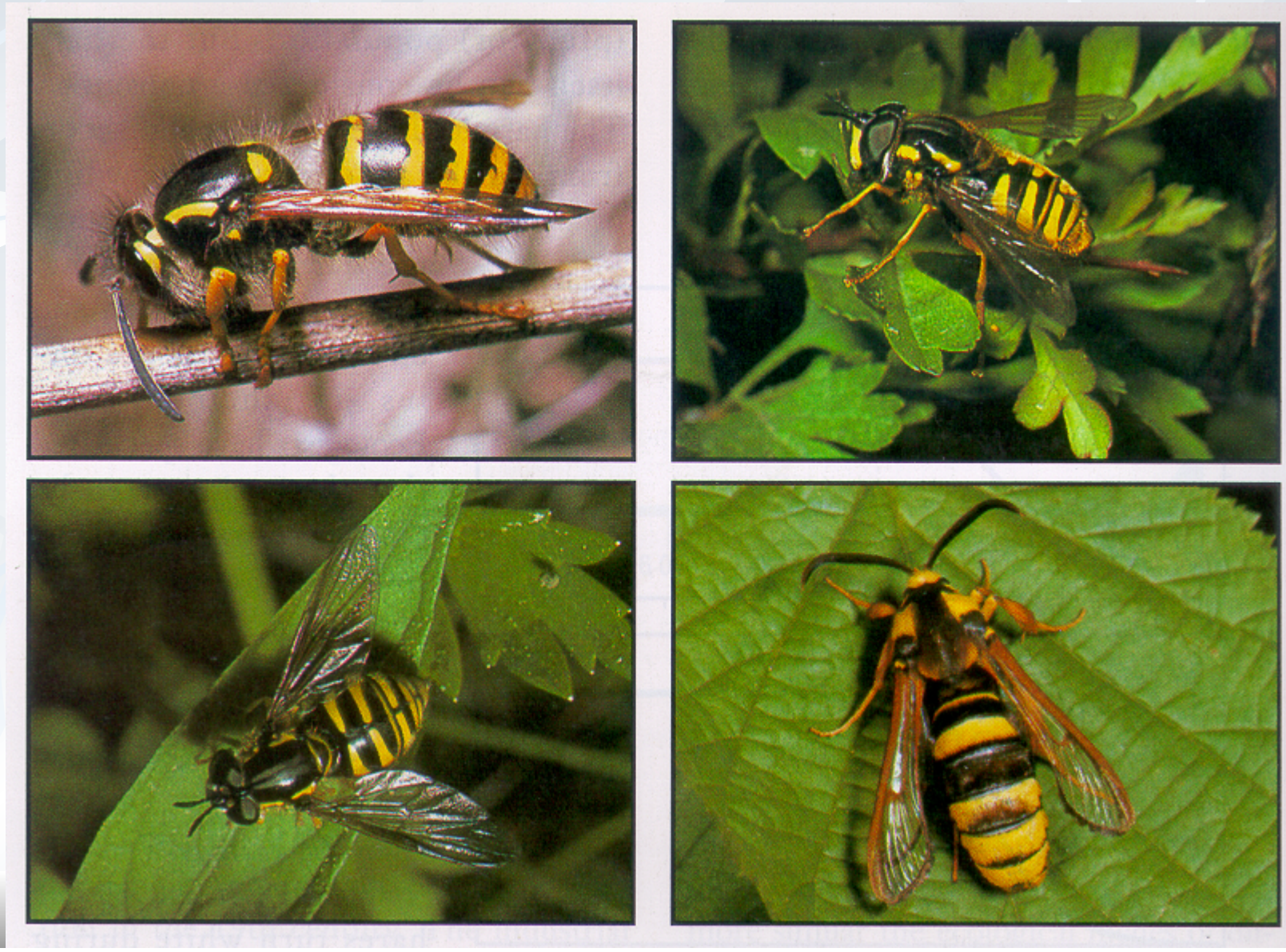


Mimicry

The mimic octopus takes on the shape and behavior of a flounder, a lionfish and a sea snake. By doing this, it is **protected from predators.**

Mimic octopus video:
http://www.youtube.com/watch?v=H8oQBYw6xxc&safety_mode=true&persist_safety_mode=1

Mimicry ..only one dangerous!!



Unpalatable

Palatable

- This hawkmoth larva puffs up its head to mimic the head of a snake

Competition

1. Inter-specific Competition:

- Competition between 2 members of **different** species in same community
- The more similar the niches of a species, the greater the competition
- Niche- the role that an organism takes in an environment

2. Intra-specific competition:

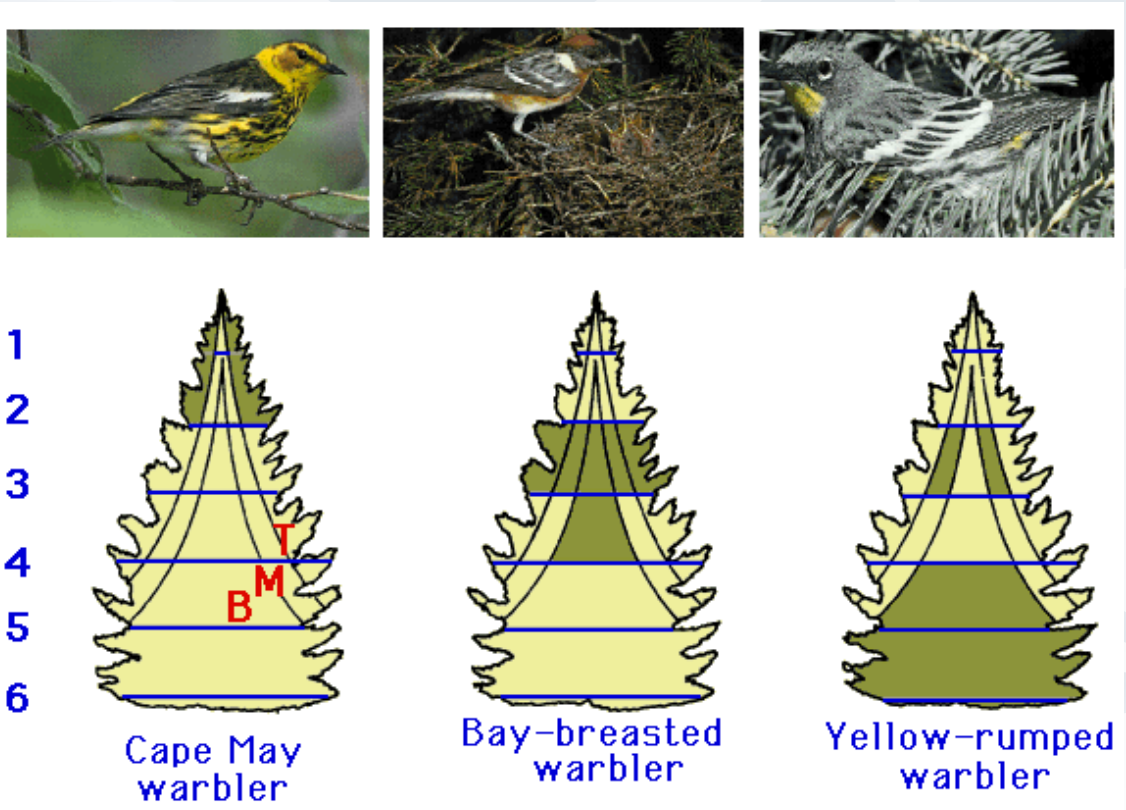
- between 2 members of **same** species

Competition can be for food, space, mates, oxygen, water or sunlight

Inter-specific Competition

Competition is less fierce, when populations have slightly different niches (resource partitioning)

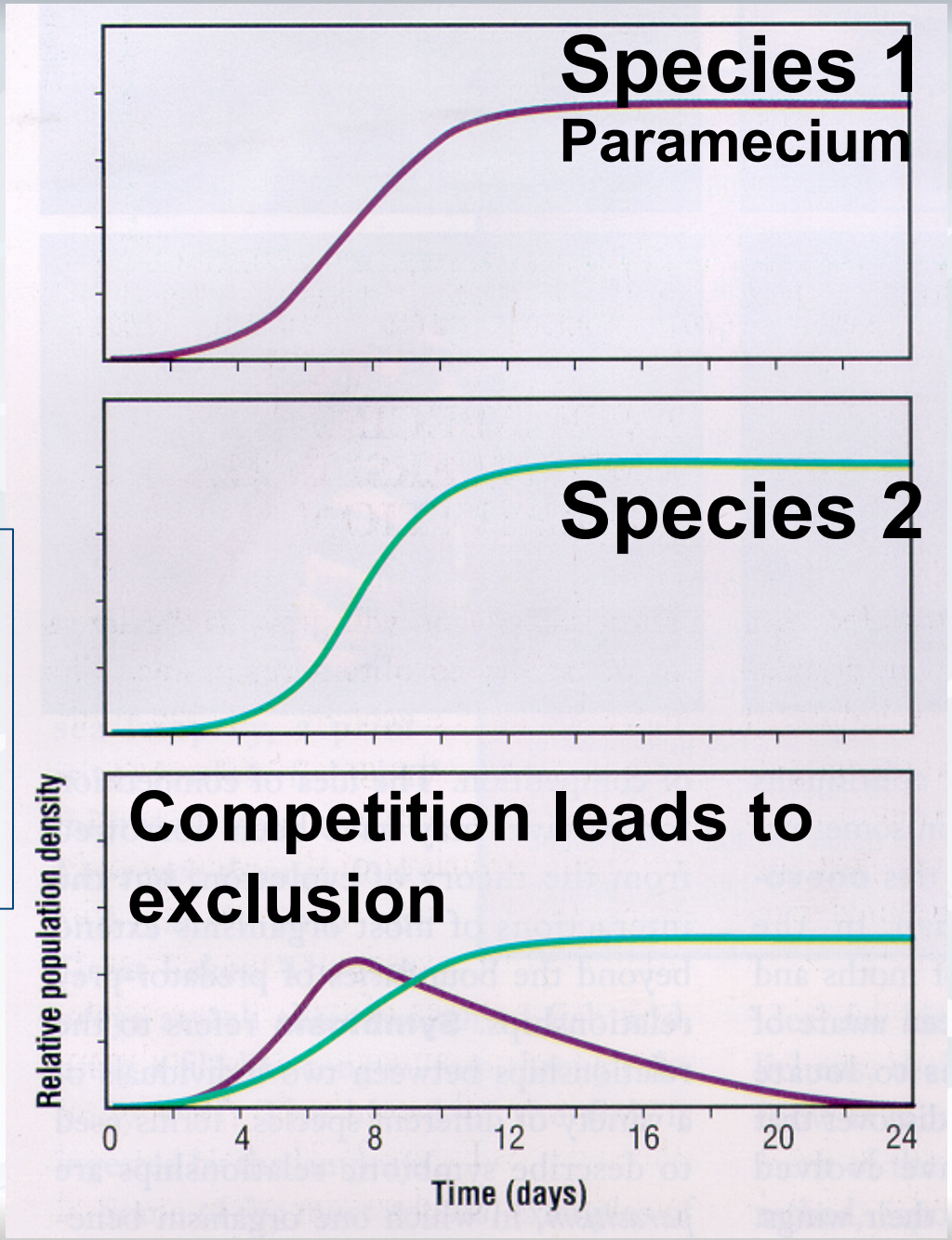
- Example – 5 species of warblers can feed on insects on a spruce tree – eat insects on different areas of tree



Gause's Principle or Competitive Exclusion

No two species can occupy the same ecological niche without one being reduced in number or eliminated

-One species will always have an advantage over the other



Symbiotic Relationships

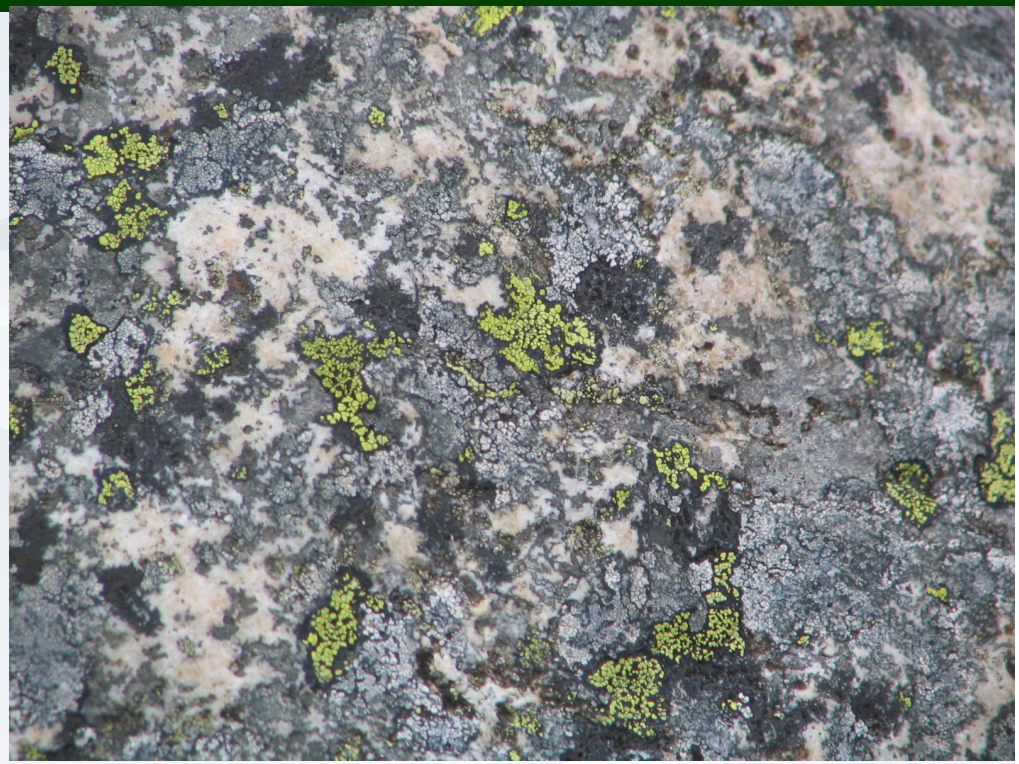
		Organism 1	Organism 2
1. Mutualism	Both benefit **Ex.** cleaner wrasses and whale sharks, e.coli and humans, bees and flowers	+	+
2. Parasitism	One benefits, other harmed Parasites get nutrients from host, and do not usually kill host.		
3. Commensalism	One species obtains food or shelter from another species. Does not harm or help the other species.		

DOCTOR FUN

More unusual examples of animal symbiosis

1. Mutualism

- **Two organisms living together - both benefit**



eg. Lichen (fungus + algae)

-fungus provides rooted structure and algae provides nutrients

Together they eventually break down rock, creating soil

1. Mutualism

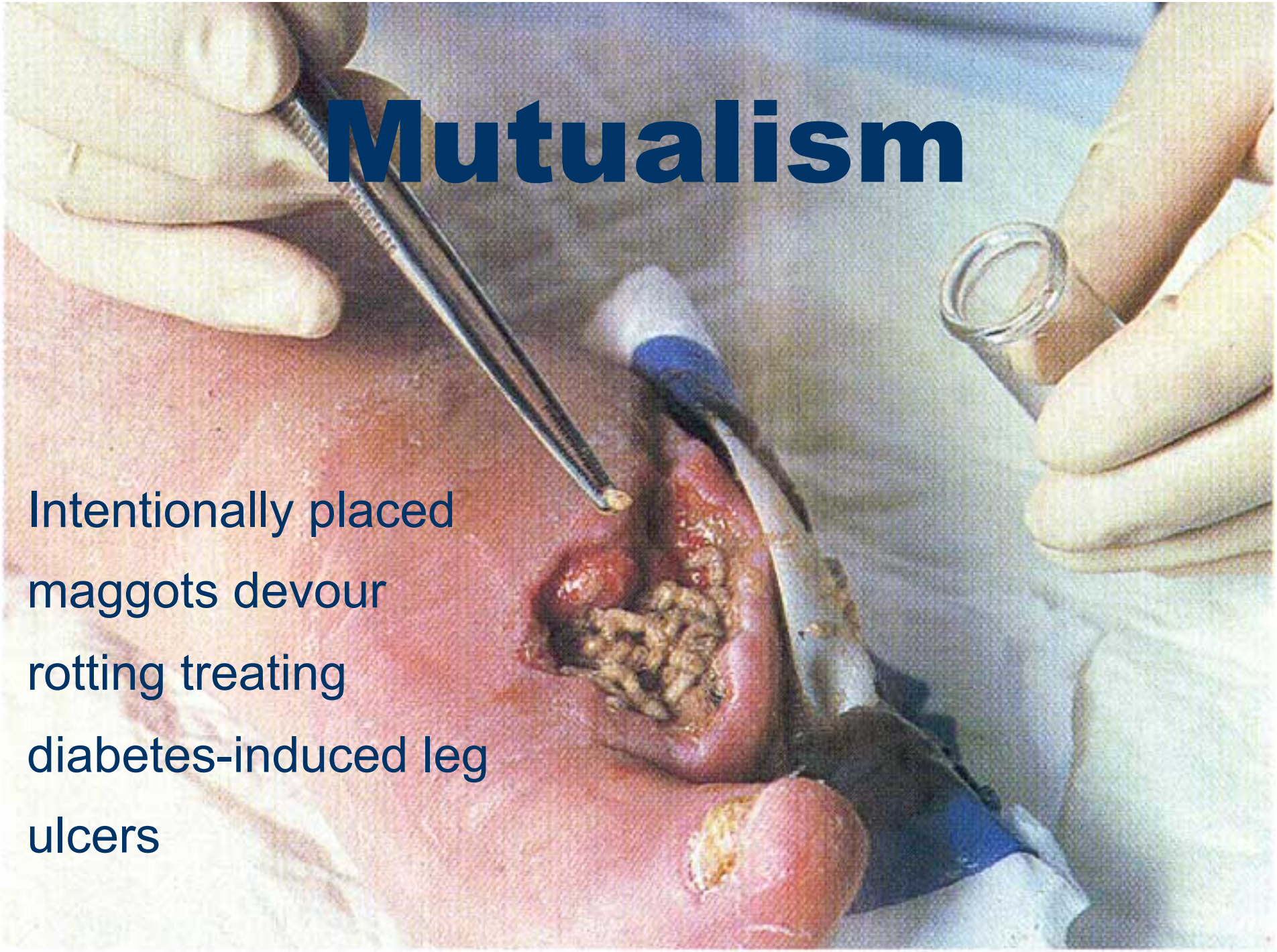
Clownfish and anemones
https://www.youtube.com/watch?v=vNhORnwcQcU

As far as is known, the fish is able to produce a special mucus that causes the anemone not to release its stings. It is also believed that the movements of the fish inform the anemone of its identity. In return for the anemone's protection, the fish brings scraps to it, and lures larger fish into the anemone's tentacles.

Mutualism

Cleaner wrasses and whale shark

Mutualism

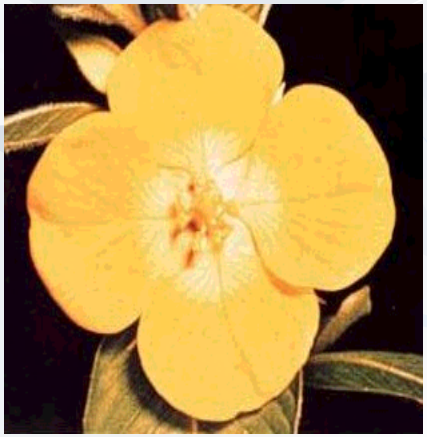


Intentionally placed maggots devour rotting treating diabetes-induced leg ulcers

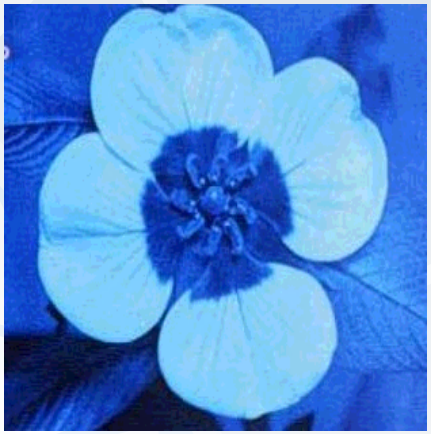
Mutualism

Honeybee & flowering plant

Interesting fact!



How we see the flower



How a bee sees the flower

They can see into the ultraviolet spectrum which helps then locate flowers and specifically the centers of them for nectar.

Symbiotic Relationships

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3. Commensalism	One species obtains food or shelter from another species. Does not harm or help the other species.		

2. Parasitism

- One species benefits, other is harmed
- Parasite receives nourishment from host
- Parasites don't normally kill host

Parasitism

52.5 Most Parasites Are Smaller Than their Hosts This Caribbean soldierfish is host to the parasitic isopod attached to its head between its eyes. The fish has no way to remove the isopod, which feeds on its body tissues.

then there is the…

Tonguefish

https://www.youtube.com/watch?v=XBMK7C_HwI4

Lymphatic Filariasis (Elephantiasis)

- **The disease is caused by parasitic worms, all transmitted by mosquitoes.**

Botfly Larvae Goodness…

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

Parasitism

Tapeworm reaches maturity in intestine of mammals

Heartworm of dogs, whose adults reside in the right side of the heart.

Symbiotic Relationships

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2. Parasitism	One benefits, other harmed Parasites get nutrients from host, and do not usually kill host. **Parasites:** Mosquitoes, lice, mites, round worms, tapeworms. **Hosts:** many animals	+	-
3. Commensalism	One species obtains food or shelter from another species. Does not harm or help the other species. **Ex.** Shark and ramora, buffalo and birds	+	0

3. Commensalism

Shark & Ramora
One benefits.
Other unaffected.

Ramora gets free ride + food

3. Commensalism

Shell fish and barnacles

The barnacles have a substrate...place to live

Buffalo and cowbirds

Birds feed on insects kicked up by buffalo

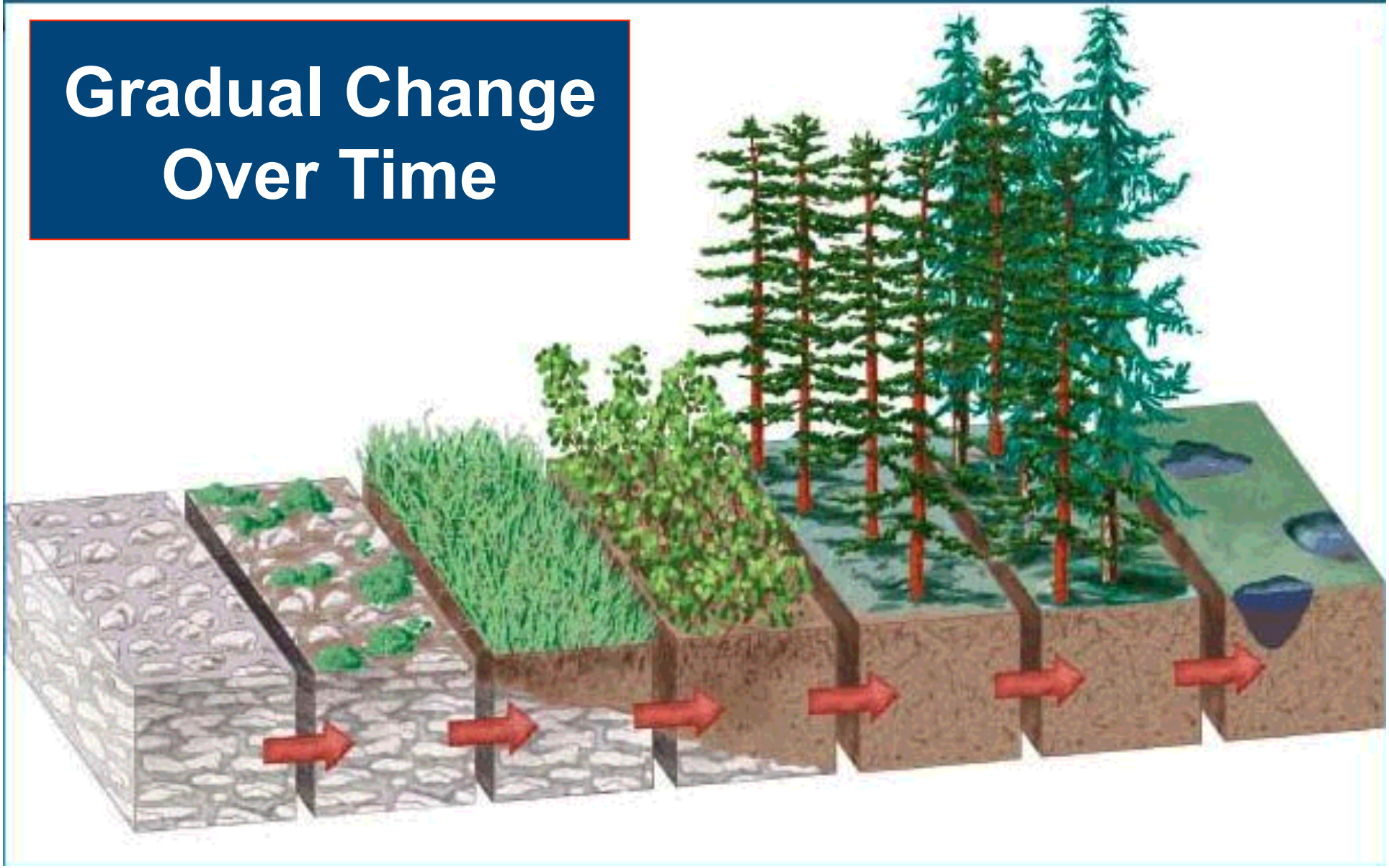
Commensalism

Orchid on tree

Nest in tree

Ecological Succession

Gradual Change Over Time



Succession

- **Gradual process of community replacement**
  - **Succession is the progression through these 3 types of communities**

Ecological Succession

Pioneer Communities

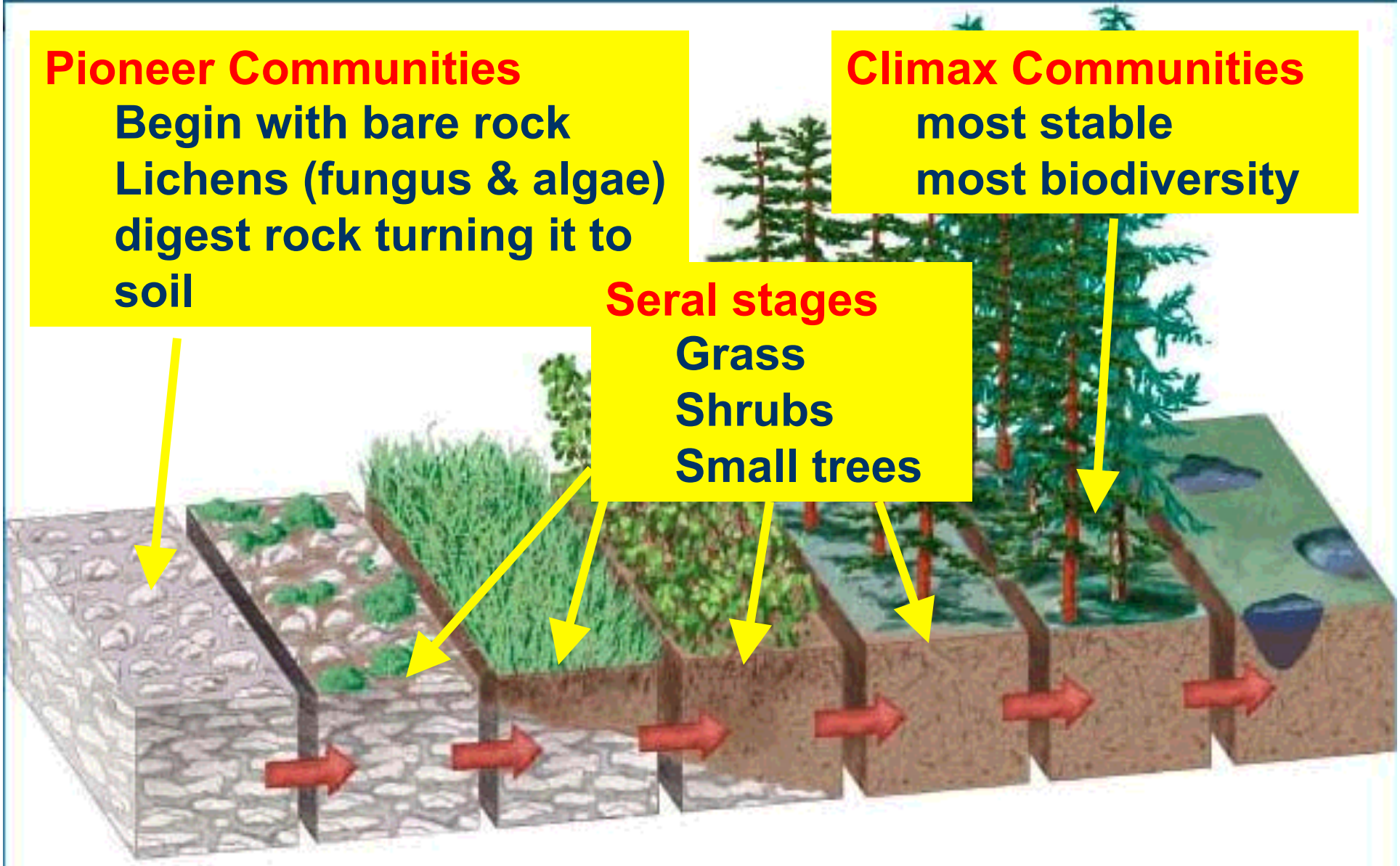
- Begin with bare rock
- Lichens (fungus & algae) digest rock turning it to soil

Seral stages

- Grass
- Shrubs
- Small trees

Climax Communities

- most stable
- most biodiversity



Succession occurs in stages:

- **Pioneer Community**: 1st to colonize a new area: lichens, microorganisms etc
- As soil builds, there is more moisture, more nutrients and grasses replace the lichens
- Grasses change the “micro-climate” allowing shrubs and bushes to grow.
- Shrubs and bushes provide protection for young trees… so trees start to grow and so on and so on until:
- **Climax Community**: Stable or “final” form of the ecosystem

- **Succession: Gradual changes in vegetation as it develops toward its final stable climax community**

Types of Succession

Primary

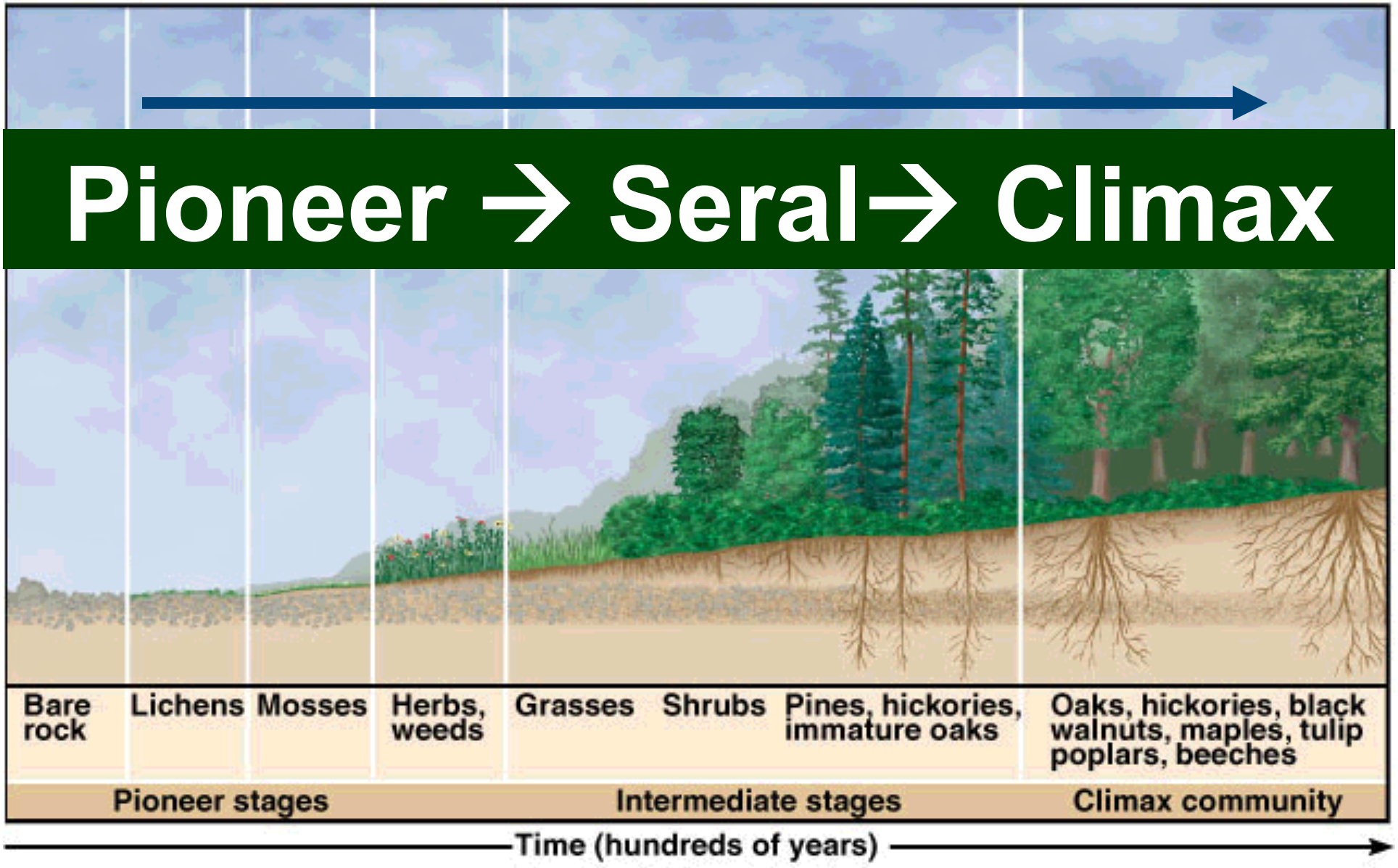
1. Begins with **bare rock**
   after a glacier recedes or volcano erupts
2. Pioneer species invade (Lichens)
3. Grasses, shrubs, trees (seral stages)
4. Climax community is reached

-is much slower than secondary succession because soil must be made from bare rock

Secondary

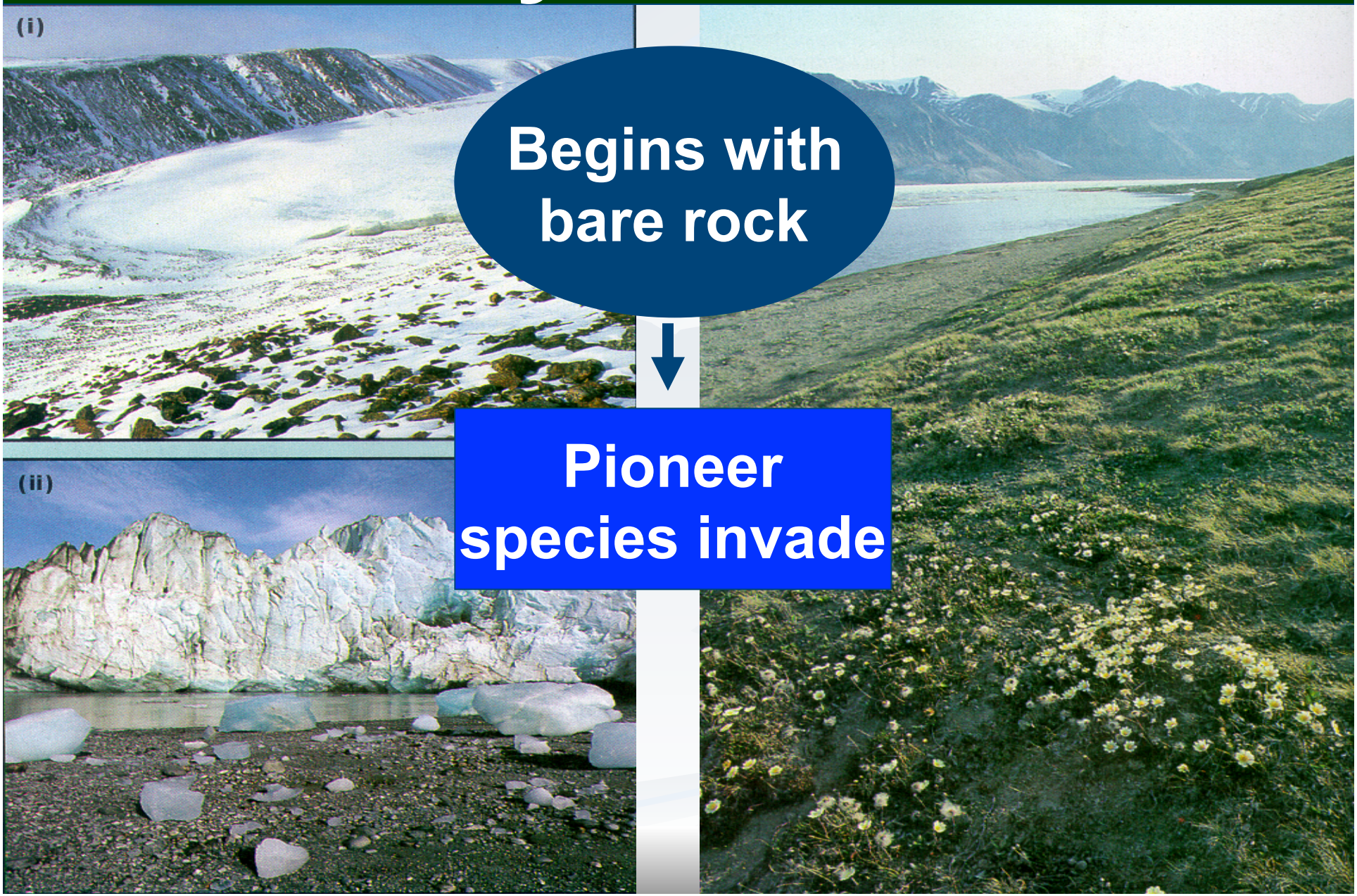
- Occurs after destruction of climax community
  - Ex. Fire, flood
- Does not start with bare rock, **soil is already present**

Primary Succession



Pioneer → Seral→ Climax

Primary Succession



Primary Succession

(a) Retreating Glacier

(b) Barren Moraine

(c) Pioneering Mosses

(d) Invading Alders

Primary Succession

(e) Alder Thickets

(f) Spruce Forest

Primary Succession in Hawaii after a volcano Eruption

Primary Succession in Hawaii after a volcano Eruption

Succession in Communities

- Fires are necessary in forests
  - Debris is cleared away
  - Ash fertilizes soil
  - Heat often necessary for seed release

Secondary succession:
trees are colonizing uncultivated fields and meadows.

Secondary Succession

Occurs after forest fire. Does not start with bare rock. Soil already present.

Secondary Succession

- **What is the difference between primary and secondary succession?**

(c)

(d)

(e)

(f)

Ohhh…And one more thing…