Principles of Ecology

BSc. Course 2024 – 2025

Lecture – 6

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The species and Individuals in the Ecosystem.

Habitat and Ecological Niche
Character Displacement
Biological Clock

- **A Community**

is an assemblage of plant and animal populations that live in a particular area or habitat.

  - Populations of the various species in a community interact and form a system with its own emergent properties.

- **Community Ecology**

Explain the underlying mechanisms that create, maintain, and determine the fate of biological communities.

Biodiversity

The total number of different species in an ecosystem and their relative abundance

Species Richness

- The number of species in a community.
- Clearly, the number of species we can observe is function of the area of the sample.
- It also is a function of method of measuring.
- Thus, species richness is sensitive to sampling procedure.

- # Population

A group of organism of the same species which live in the same habitat at the same time where they can freely interbreed.

- **Diversity** is the number of species in the community, and their relative abundances.
- Species are not equally abundant, some species occur in large percentage of samples, others are poorly represented.
- Some communities, such as tropical rainforests, are much more diverse than others, such as the great basin desert.
- Species Diversity is often expressed using Simpson's diversity index:

$$D=1-S\ (p_i)^2$$

- **Example Problem** : A community contains the following species:

	Number of Individuals
Species A	104
Species B	71
Species C	19
Species D	5
Species E	3

- **What is the Simpson index value for this community?**

- **Answer: Total Individuals= (104+19+71+5+3)=202**
- **P_A= 104 / 202 = 0.51 P_B= 19/ 202 = 0.09**
- **P_C= 71 / 202 = 0.35 P_D= 5 / 202 = 0.03**
  P_E= 3 / 202 = 0.02
- **D= 1 - {$(.51)^2$ + $(.09)^2$ + $(.35)^2$ +$(.03)^2$ + $(.02)^2$}**
- **D= 1 - 0.4 = 0.6**
- **Clicker Question?**

In the example above, what was the species richness?

A. 0.6

B. 202 individuals

C. 5 species

D. 0.4

E. None of the above

Habitat

The characteristics of the type of environment where an organism normally lives.

(e.g. a **Stoney stream**, a **deciduous temperate woodland**, **Desert**, **River Banks**, **Wetlands**)

- The **niche** concept is very important in community ecology.
- A **niche** is an organism's habitat and its role in the ecosystem and its requirements for living.

Habitat + Role + requirement

Keystone species

- Keystone species act to maintain species diversity.
- The extinction of a keystone species eliminates the niches of many other species.
- Frequently, a keystone species modifies the environment in such a way that other organisms are able to live, in other cases, the keystone species is a predator that maintains diversity at a certain trophic level.

- **Keystone species**
- ***Examples of Keystone Species***
- **California Sea Otters:** This species preys upon sea urchins, allowing kelp forests to become established.

Keystone species

Examples of Keystone Species

- **Pisaster Starfish:** Grazing by Pisaster prevents the establishment of dense mussel beds, allowing other species to colonize rocks on the pacific coast

Keystone species

Examples of Keystone Species

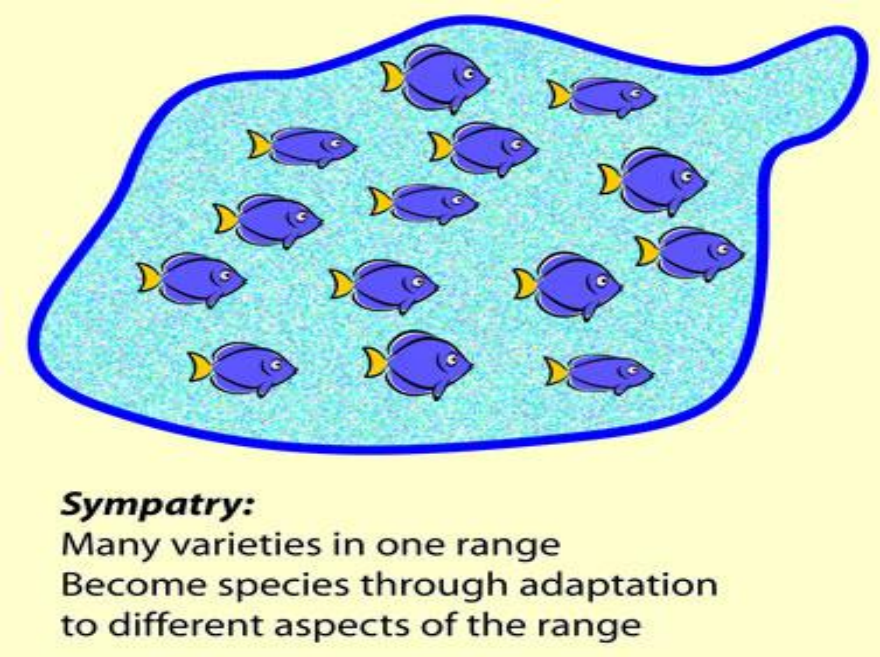
- "**Mangrove" trees**: Their seeds disperse in salt water. They root and form a dense forest in saltwater shallows, allowing other species to thrive.

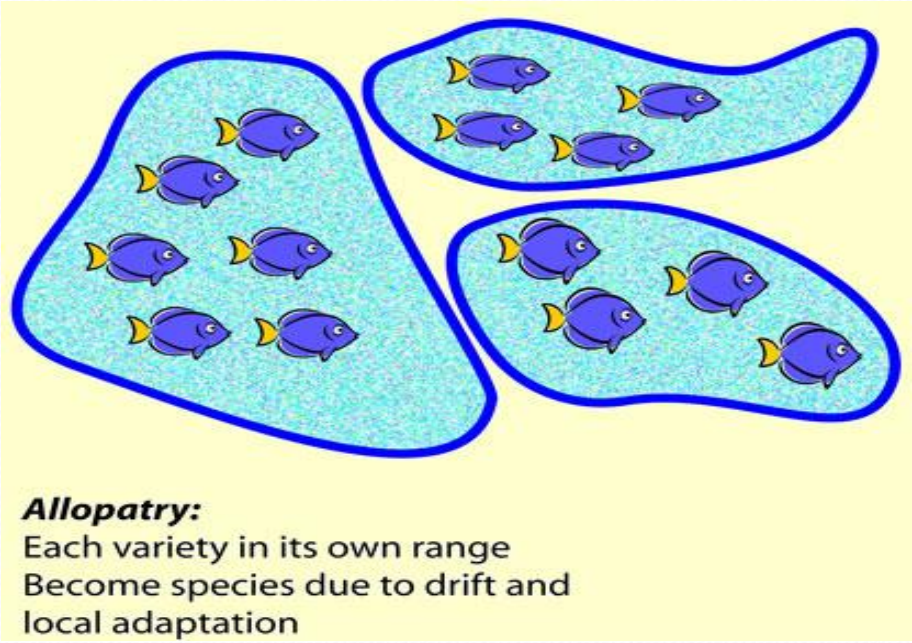
Resource Partitioning

- Species that share the same habitat and have similar needs frequently use resources in somewhat different ways - so that they do not come into direct competition for at least part of the limiting resource.
- This is called **resource partitioning**.
- **Resource partitioning** allow the coexistence of several species using the same limiting resource.
- **Resource partitioning** could be an evolutionary response to interspecific competition.

Character Displacement

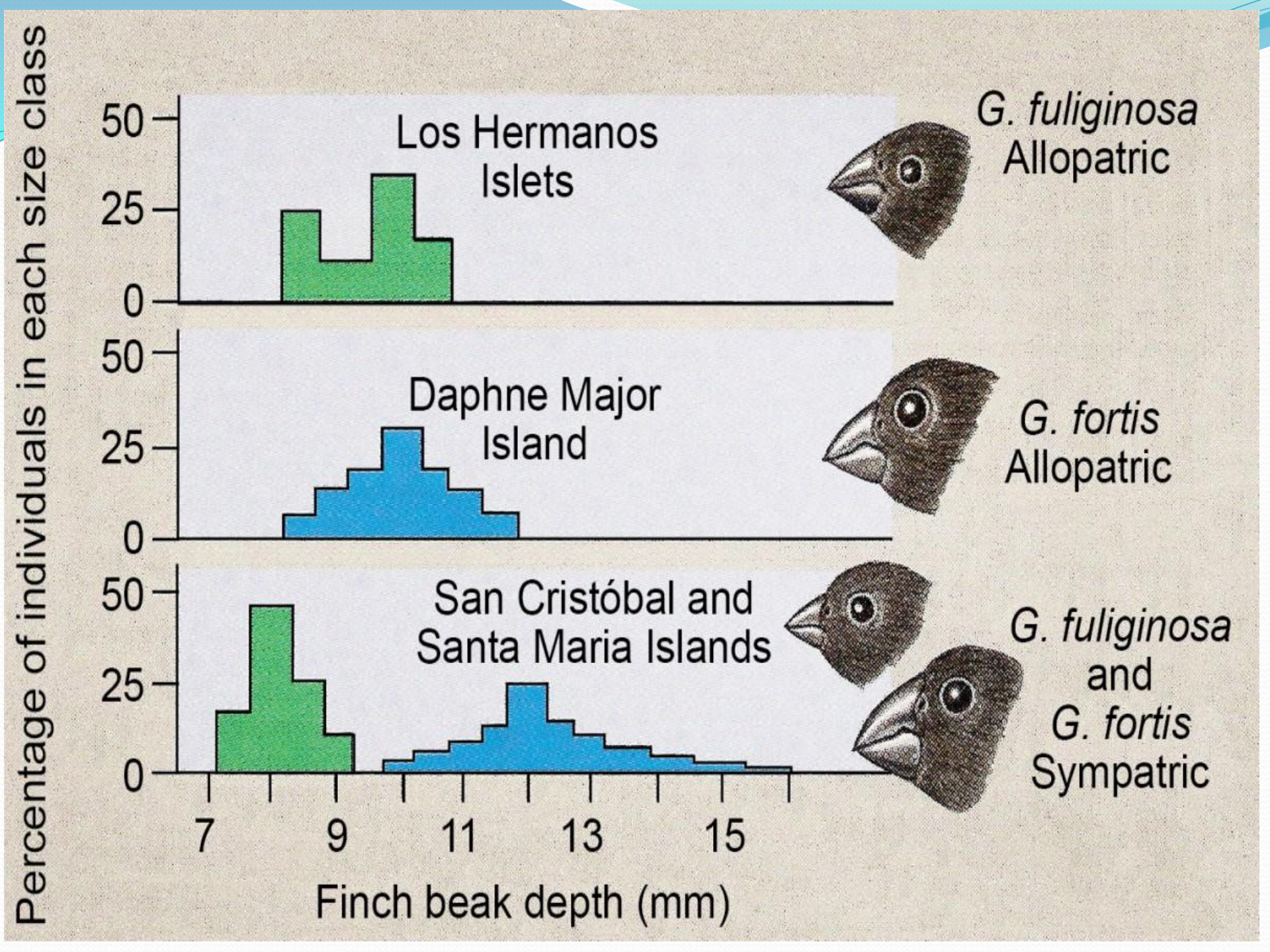
- **Sympatric** populations of similar species frequently have differences in body structure relative to **Allopatric** populations of the same species.
- Character displacement is thought to be an evolutionary response to **interspecific competition**.



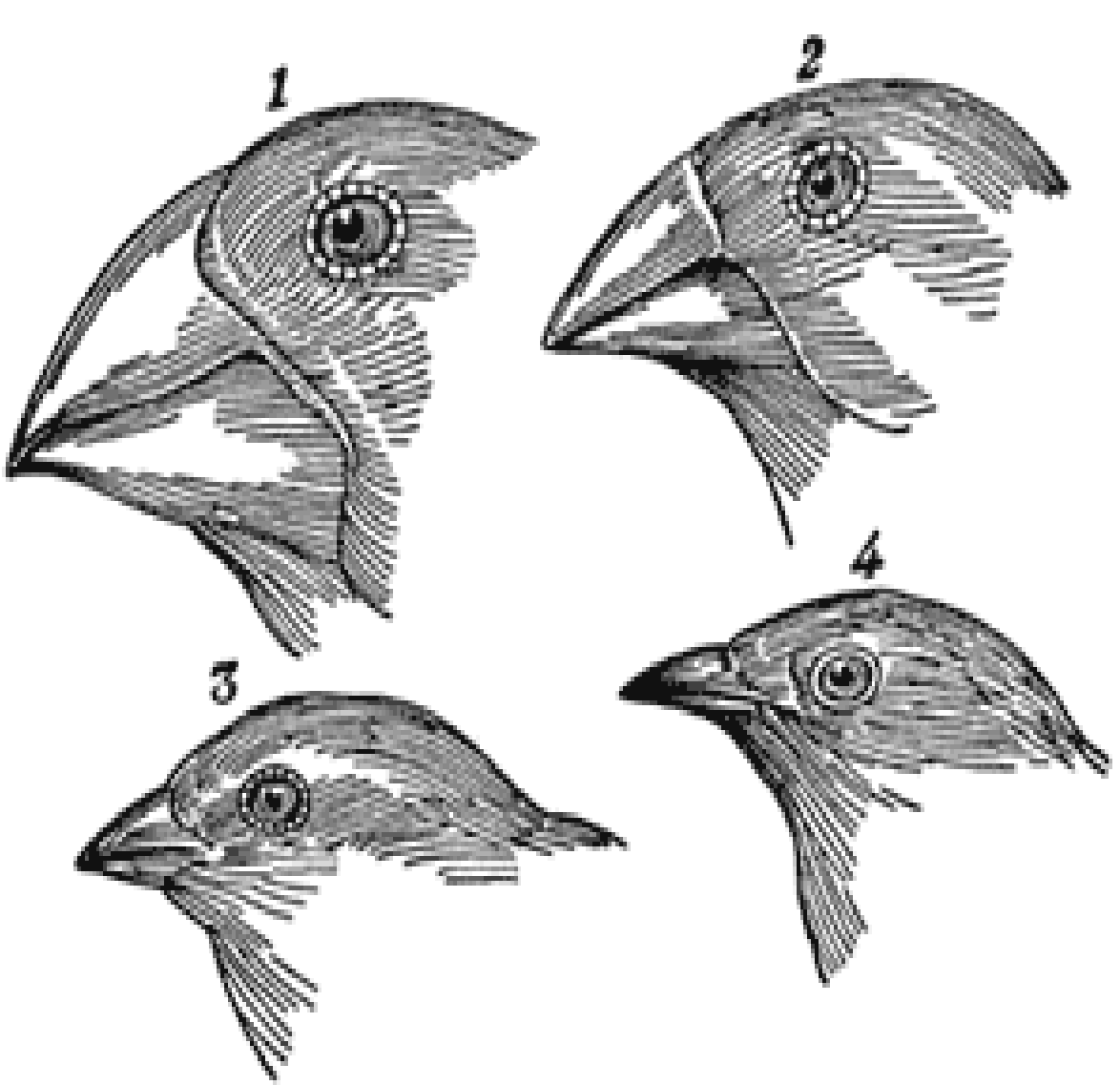


Example of Character Displacement

- The best known case of character displacement occurs between the finches, ***Geospiza fuliginosa*** and ***Geospiza fortis***, on the Galapagos islands.
- When the two species occur together, ***G. fuliginosa*** has a much narrower beak that ***G fortis***.
- Sympatric populations of ***G fuliginosa*** eats smaller seeds than ***G fortis***: they partition the resource.
- When found on separate islands, both species have beaks of intermediate size, and exploit a wider variety of seeds.
- These inter-population differences might have evolved in response to interspecific competition.

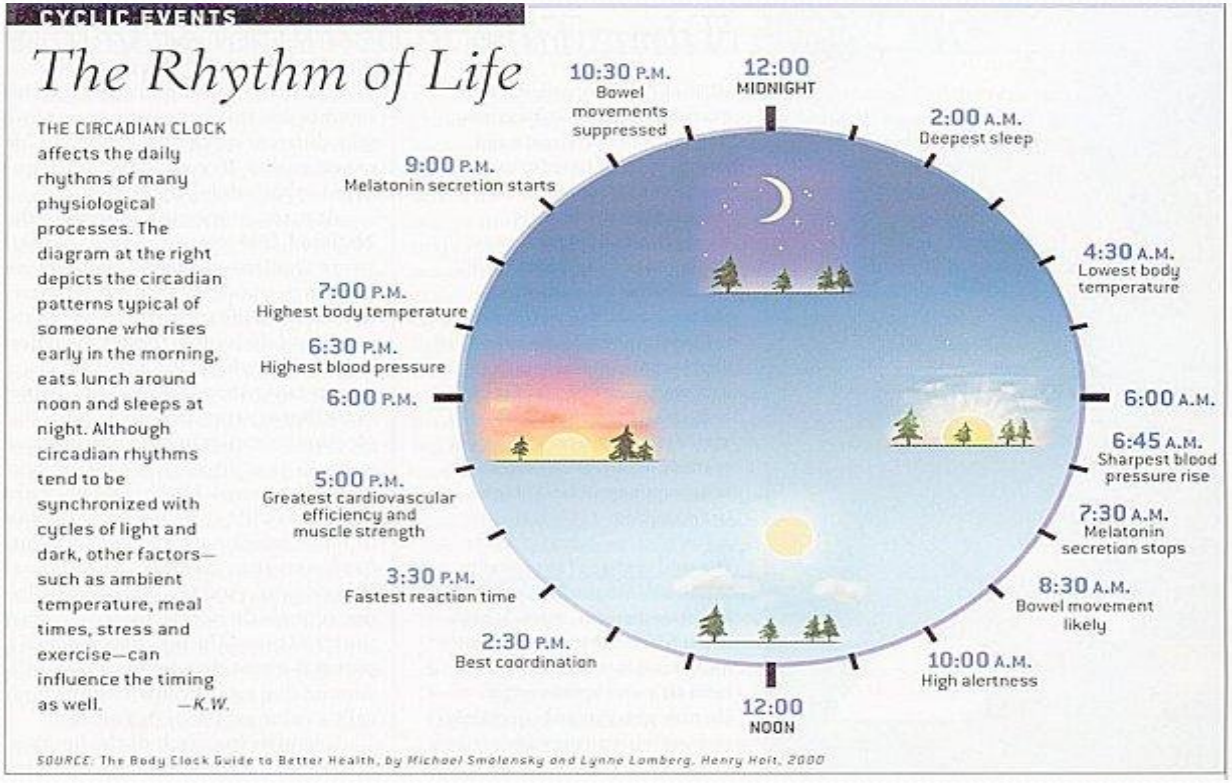

Percentage of individuals in each size class
50
25
0
Los Hermanos Islets
G. fuliginosa Allopatric
Daphne Major Island
G. fortis Allopatric
San Cristóbal and Santa Maria Islands
G. fuliginosa and G. fortis Sympatric
7
9
11
13
15
Finch beak depth (mm)

Example of Character Displacement

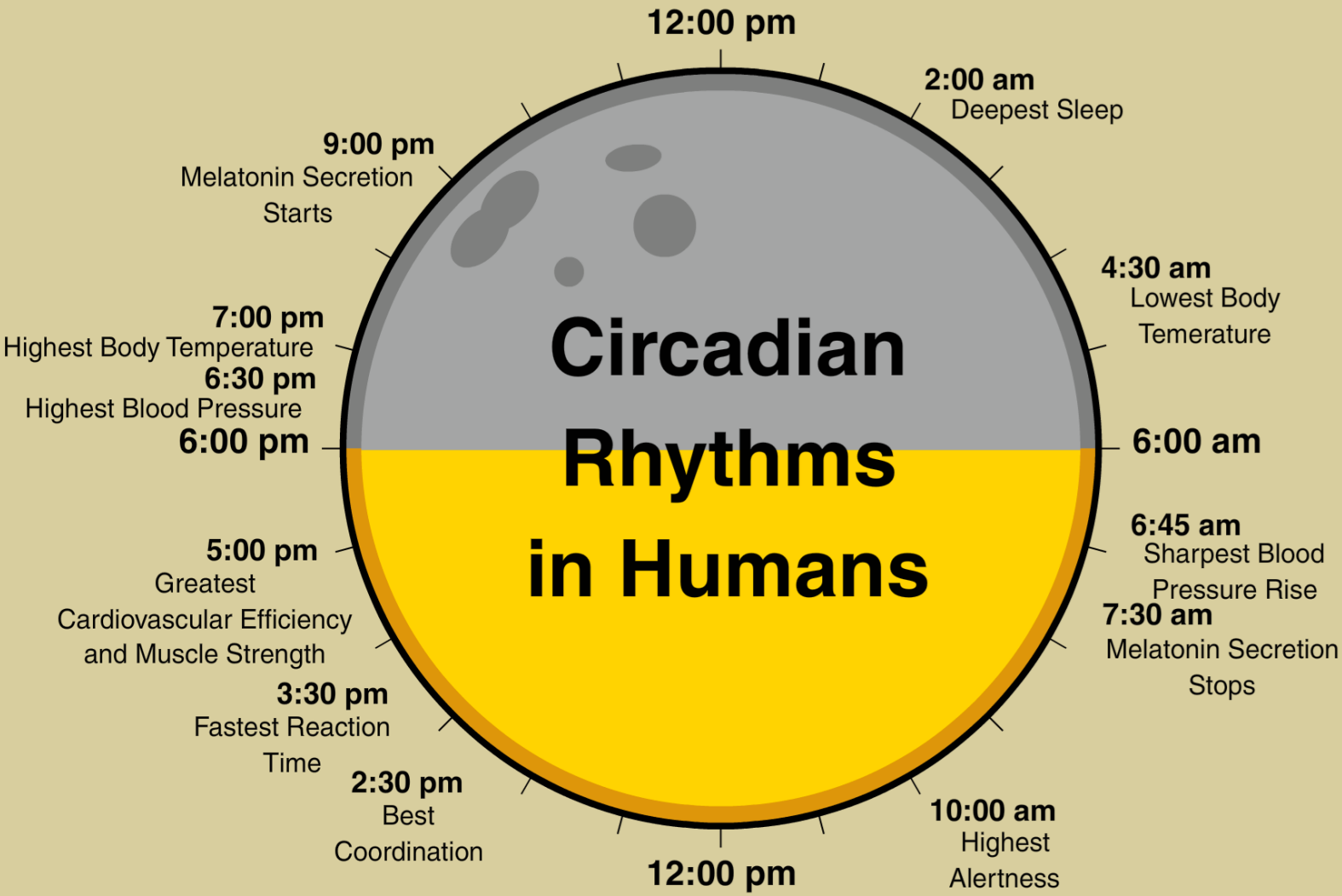


Biological clocks

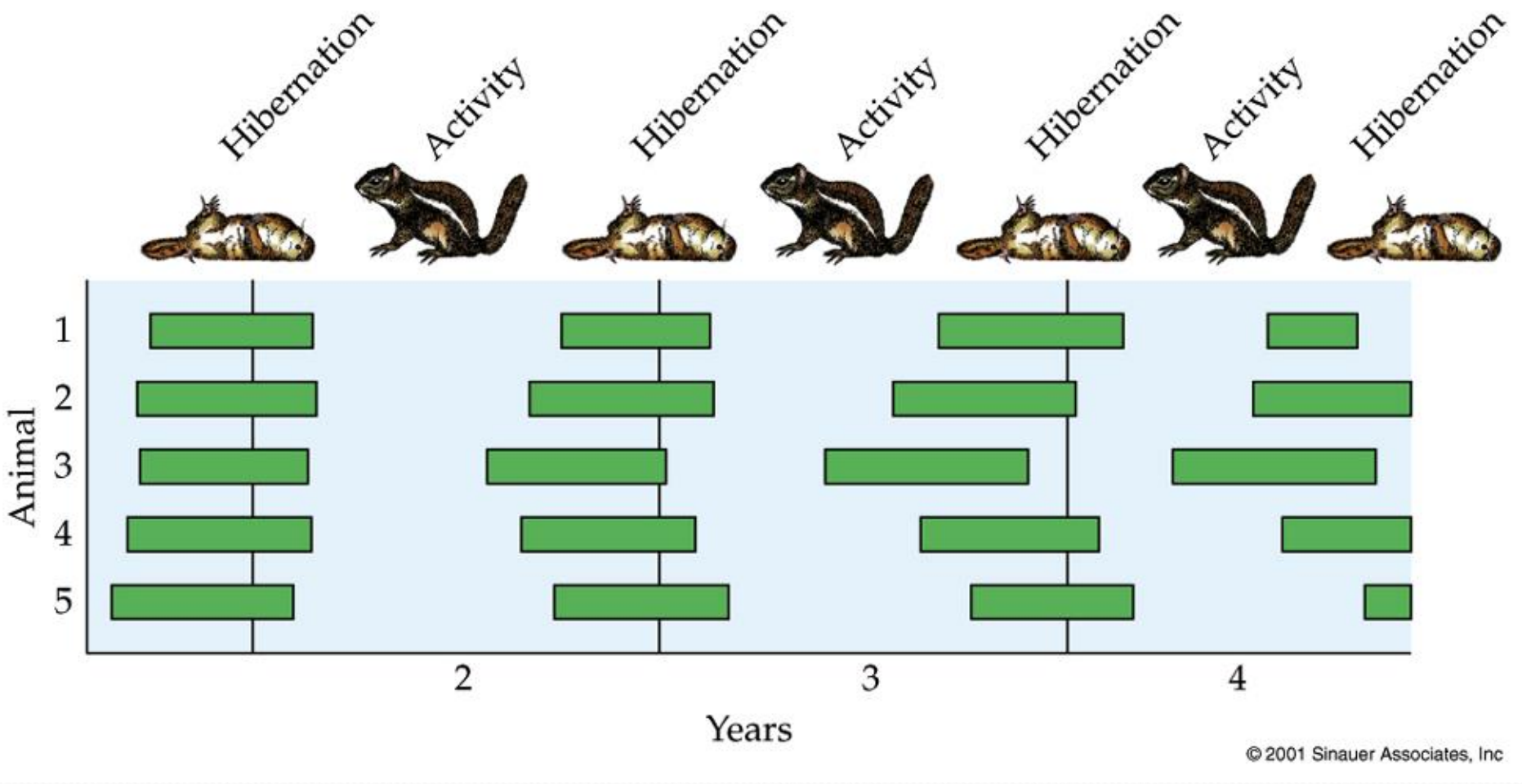
- Clock periods
  - Circannual
  - Circalunidian
  - Circadian
- Clock mechanisms
  - Entrainment
  - Neural location
  - Genetic basis



Biological clocks



Hibernation follows annual rhythm in golden-mantled ground squirrels



Five animals were isolated at birth and kept in darkness at 3°C

Horseshoe crabs mate on full moon, why?