

[Ble] Exam Summary 2023-03-30

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1 Learning Objectives

- Define the term ecology and knowing its scope
- Know the correct meaning of ecological terms and applying them to different examples.
- Understand the terms biotic and abiotic and analyze such factors for any given specie.
- Explain how abiotic factors can affect an organism's distribution.
- Understand what a limiting factor can be.
- Compare endothermic and ectothermic species and naming advantages and disadvantages of the two adaptations.
- Understand what enzymes are and sketching the function principle.
- Explain the effects of temperature (and other factors) on an enzyme's activity (Q10 rule)
- Draw tolerance curves for experimental data.
- Explain the different zones of a tolerance curve.
- Understand the terms stenoecious and euryoecious and give examples.
- Know and apply the Bergmann's and Allen's Rule.
- Explain an experimental setup to show the effect of surrounding temperatures on body temperature.
- Name at least five adaptations and their advantageous effect for the camel.
- Explain what an adaptation is.

2 Glossary

2.1 Abiotic Factors

These are non-living chemical and/or physical factors in the environment impacting an organism.

2.2 Biotic Factors

This word describes all living organisms in the environment and their influence on the organism in question.

2.3 Organism

An organism is an individual plant, animal or single-celled life form.

2.4 Population

Population is a group of organisms of the same species living in a particular geographic area.

2.5 Habitat

This is a characteristic place inhabited by the particular organism and is characterized by abiotic components.

2.6 Environment

Environment describes the external surroundings that act on an organism, population or community. It influences survival and development.

2.7 Community

All the populations of different species living together and interacting with each other form a community. They form the biotic part of an ecosystem.

2.8 Ecosystem

Ecosystem describes all the organisms in a given area as well as the abiotic factors with which they interact. Ecosystems are not closed, because they import and export materials, energy and organisms.

2.9 Biome

A biome is one of the world's major ecosystems. (e.g. tropical rain forest, grassland, desert, ...)

2.10 Biosphere

This term describes the entire portion of Earth inhabited by life. It is the sum of all the planet's ecosystems.

2.11 Enzymes

Enzymes are responsible for all biochemical reactions in our body. They are proteins which make possible biochemical reactions. The rate increases with temperature up to a maximum.

2.12 Adaptation

Adaptations are beneficial evolutionary changes to a species which increase chances of survival.

3 Abiotic Factors

3.1 Temperature

This is an important factor because of its effect on biological processes and the inability of most organisms to regulate body temperature precisely. Cells may rupture if their water freezes and the proteins of most organisms alter their form above 318K (45°C).

3.2 Water

The availability of water varies a lot among habitats. Freshwater and marine organisms live in an aquatic environment, but they face problems of water balance if their intracellular concentration of salts doesn't match that of the surrounding water.

3.3 Sunlight

Sunlight provides the energy which nearly drives all ecosystems, although only photosynthetic organisms use it directly. It's the most important factor limiting plant growth. Light is also important to the development and behavior of organisms that are sensitive to the relative lengths of day- and nighttime.

3.4 Soil

The physical structure, pH and mineral composition of the soil limit the distribution of plants and of the animals that feed upon them.

3.5 Salinity

As already written in *3.2 Water*, most species require stable salinity levels. Plants which can survive in conditions of high salinity are known as halophytes.

4 Limiting Factor

Very often the distribution of species is dependent on one biotic or abiotic factor which is called the limiting factor. It doesn't only mean a factor that limits growth, development, reproduction or activity of a population by its deficiency, but also by its excess.

5 Temperature Regulation

In regards to temperature, two main adaptations have been found: All mammals and birds are endothermic; they regulate their body temperature within given limits at a physiological optimum between 309K (36°C) and 313K (40°C) more or less independent of the temperature of the environment by using internal control mechanisms. Not all of the body is kept at a constant temperature, only the vital organs are. This control requires more energy than ectotherms.

All other animals are ectothermic, they don't maintain their body temperature at constant levels or rely on behavioral control mechanisms. Their body

temperature largely corresponds to the outside temperature. They show physiological adaptations such as heat-resistant proteins or enzymes which maintain their metabolic optimum at low temperatures. Usually, they actively seek areas with more comfortable temperatures. Some can even produce “antifreeze”. Endotherms can remain active over a far wider range of outside temperatures than ectotherms.

5.1 Differences between Endo- and Ectotherms

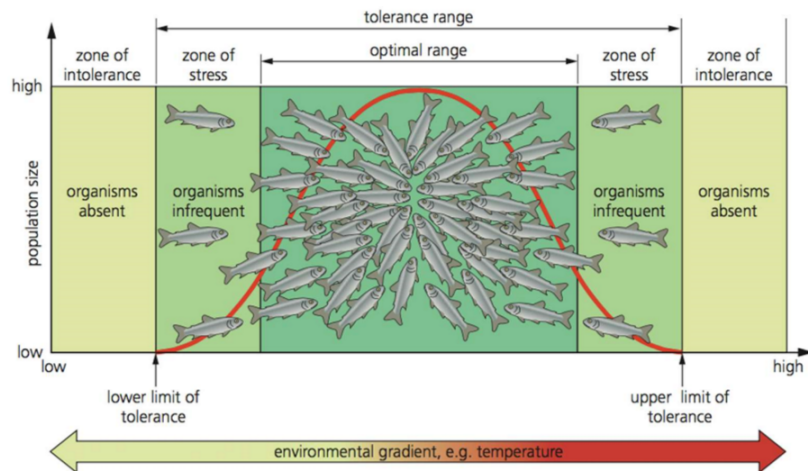
	Ectothermic	Endothermic
Animal species	All other animals	Mammals and birds
Geographical distribution	Mainly in warmer and temperate climates.	All habitats
Thermoregulation	Limited: behavioral strategies and heat resistant proteins/enzymes	Insulation; production of heat as metabolic byproduct; control of blood flow; counterflow; behavioral strategies
Advantages	Low cost of energy	Independent from surrounding temperature
Disadvantages	Activity is dependent on the surrounding temperature	Constant food supply needed at low temperatures

6 The Q10 Rule

If the temperature increases by 10K (10°C), the rate of an enzyme-driven reaction doubles in suboptimal temperatures.

7 Tolerance Curves

A tolerance curve is a diagrammatic illustration of the Law of Tolerance.



8 Bergmann's Rule

The individuals of an endothermal species living in the colder parts of their area of distribution are in general taller than the individuals living in warmer parts.

9 Allen's Rule

Endothermic organisms from colder climates have shorter appendages and limbs than closely related species from warm climates. Body form or shape is linear in warm climates and more rounded in cold climates. Round forms have a smaller surface area to volume ratios and therefore retain more heat.