

## tpo\_29\_passage\_1

When several individuals of the same species or of several different species depend on the same limited resource, a situation may arise that is referred to as competition. The existence of competition has been long known to naturalists; its effects were described by Darwin in considerable detail. Competition among individuals of the same species (intraspecies competition), one of the major mechanisms of natural selection, is the concern of evolutionary biology. Competition among the individuals of different species (interspecies competition) is a major concern of ecology. It is one of the factors controlling the size of competing populations, and in extreme cases it may lead to the extinction of one of the competing species. This was described by Darwin for indigenous New Zealand species of animals and plants, which died out when competing species from Europe were introduced. No serious competition exists when the major needed resource is in superabundant supply, as in most cases of the coexistence of herbivores (plant eaters). Furthermore, most species do not depend entirely on a single resource. If the major resource for a species becomes scarce, the species can usually shift to alternative resources. If more than one species is competing for a scarce resource, the competing species usually switch to different alternative resources. Competition is usually most severe among close relatives with similar demands on the environment. But it may also occur among totally unrelated forms that compete for the same resource, such as seed-eating rodents and ants. The effects of such competition are graphically demonstrated when all the animals or all the plants in an ecosystem come into competition, as happened 2 million years ago at the end of the Pliocene, when North and South America became joined by the Isthmus of Panama. North and South American species migrating across the Isthmus now came into competition with each other. The result was the extermination of a large fraction of the South American mammals, which were apparently unable to withstand the competition from invading North American species—although added predation was also an important factor. To what extent competition determines the composition of a community and the density of particular species has been the source of considerable controversy. The problem is that competition ordinarily cannot be observed directly but must be inferred from the spread or increase of one species and the concurrent reduction or disappearance of another species. The Russian biologist G.F. Gause performed numerous two-species experiments in the laboratory, in which one of the species became extinct when only a single kind of resource was available. On the basis of these experiments and of field observations, the so-called law of competitive exclusion was formulated, according to which no two species can occupy the same niche. Numerous seeming exceptions to this law have since been found, but they can usually be explained as cases in which the two species, even though competing for a major joint resource, did not really occupy exactly the same niche. Competition among species is of considerable evolutionary importance. The physical structure of species competing for resources in the same ecological niche tends to gradually evolve in ways that allow them to occupy different niches. Competing species also tend to change their ranges so that their territories no longer overlap. The evolutionary effect of competition on species has been referred to as "species selection;" however, this description is potentially misleading. Only the individuals of a species are subject to the pressures of natural selection. The effect on the well-being and existence of a species is just the result of the effects of selection on all the individuals of the species. Thus species selection is actually

a result of individual selection. Competition may occur for any needed resource. In the case of animals it is usually food; in the case of forest plants it may be light; in the case of substrate inhabitants it may be space, as in many shallow-water bottom-dwelling marine organisms. Indeed, it may be for any of the factors, physical as well as biotic, that are essential for organisms. Competition is usually the more severe the denser the population. Together with predation, it is the most important density-dependent factor in regulating population growth.

question 1

The phrase "mechanisms of natural selection" in the passage is closest in meaning to

- A types of natural selection
- B dangers of natural selection
- C problems natural selection solves
- D ways natural selection works

question 2

According to paragraph 1, what is one effect of competition among individuals of different species?

- A It results in the eventual elimination of the resource for which they are competing.
- B It leads to competition among individuals of the same species.
- C It encourages new species to immigrate to an area.
- D It controls the number of individuals in the competing populations.

question 3

In paragraph 1, why does the author mention what happened in New Zealand?

- A To indicate that Darwin understood the importance of competition
- B To illustrate that competition can lead to the extinction of species
- C To identify where the idea of competition among species first arose

D To argue against the idea that the process of selection is a natural occurrence

question 4

According to paragraph 2, competition is not usually a significant factor among two coexisting species when

A one of the species has only recently moved into the territory of the other

B the species are closely related to each other

C the population of one species is much larger than that of the other

D both of the species are herbivores

question 5

In paragraph 2, why does the author talk about what happened as a result of North and South America becoming joined at the Isthmus of Panama?

A To make the point that predation can have as much effect on species survival as competition does

B To show how the ability to switch to an alternative resource can give a species a competitive advantage

C To account for the current species composition of North and South America

D To provide an example of the serious effects of competition between unrelated species

question 6

Paragraph 3 supports the idea that Gause's experiments were important because they

A provided a situation in which competition could be removed from the interaction between two species

B showed that previous ideas about the extent to which competition determines the composition of a community were completely mistaken

C helped establish that competition will remove all but one species from any given ecological niche

D offered evidence that competition between species is minimal when there is an overabundance of a single food source

#### question 7

Which of the sentences below best expresses the essential information in the highlighted sentence in the passage? Incorrect choices change the meaning in important ways or leave out essential information.

A Apparent exceptions to this law usually involve cases in which two species compete for the same major resource but occupy slightly different niches.

B Although it may appear that two species always have different niches, many exceptions show that species compete with each other.

C Cases in which two species not only compete for a shared resource but also occupy similar niches are considered exceptions to this law.

D Cases in which the two species do not occupy the same niche yet still compete for the same resource are believed to be exceptions to this law.

#### question 8

According to paragraph 4, "species selection" is a misleading term because it

A overemphasizes the role of selection pressures in species extinction

B suggests that selection pressures directly influence whole species

C does not make a distinction between species extinction and species evolution

D suggests that extinction always results whenever there is competition

#### question 9

Look at the four squares [ ] that indicate where the following sentence could be added to the passage.

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shallow-water bottom-dwelling marine organisms. [] Indeed, it may be for any of the factors, physical as well as biotic, that are essential for organisms. [] Competition is usually the more severe the denser the population. [] Together with predation, it is the most important density-dependent factor in regulating population growth.

### question 10

Directions: An introductory sentence for a brief summary of the passage is provided below. Complete the summary by selecting the THREE answer choices that express the most important ideas in the passage. Some sentences do not belong in the summary because they express ideas that are not presented in the passage or are minor ideas in the passage. This question is worth 2 points.

- A. Competition can eliminate a species, but since most species do not depend on a single resource, competition is often reduced by switching to alternative resources.
- B. Experiments and field observations have established that competition between species is strong enough to prevent two species from occupying the same ecological niche.
- C. Competition between individuals of the same species is usually for food whereas competition between species is usually for habitat.
- D. Competition between a pair of species tends to lessen over time because the species tend to evolve to occupy different ecological niches and ranges.
- E. Investigation of the ecological role of competition is difficult because ordinarily the competition cannot be observed directly and must be inferred from its presumed effects.
- F. Competition is usually strongest when the density of the competing populations is the same.