Competitive Exclusion Principle Encyclopedia Article

Competitive Exclusion Principle

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Competitive Exclusion Principle

In brief, the competitive exclusion principle states that two species with the same requirements cannot coexist in the same place. Though difficult to observe directly in nature, competition continues to be studied by biologists in the field and laboratory. One way in which this field work is done is to look at competition between two species and then remove one or the other; in a number of studies that removal resulted in a dramatic increase in the density of the other species, strong evidence of competition.

Competitive exclusion is also often labeled "Gause's Principle," from its formulation by the Russian microbiologist G.F. Gause. In a 1934 book titled *The Struggle for Existence*, Gause reported experiments on competition for common food in protozoa, experiments in which he tried to "approach the regularities which are characteristic for the biosphere as a whole." He concluded that "owing to its advantages, mainly a greater value of the coefficient of multiplication, one of the species in a mixed population drives out the other entirely." Gause derived his work from what have been called "the Lotka-Volterra equations," attempts to formulate an equation for the interactions between hosts and parasites (by Lotka) and similar attempts to present an equation covering the struggle for existence by Volterra.

But Garrett Hardin (in *Science*, April, 1960) traces the idea back to Joseph Grinnell in 1904: "Two species of approximately the same food habits are not likely to remain long enough evenly balanced in numbers in the same region. One will crowd out the others." Hardin also found similar thinking in Darwin's *Origin of Species*: "we can dimly see why the competition should be most severe between allied forms, which fill nearly the same place in the economy of nature." Hardin decided that the label "the competitive exclusion principle" was correctly descriptive of the concept.

Botanists especially have questioned competitive exclusion, because most green plants use similar resources. But, argument as to its validity is widespread in biology, with the arguments backed up with research. Some studies, e.g., of bacteria, virus populations, and mice have tended to validate the concept. Other studies, e.g., of various insects and of silverside fish have called the principle into question.