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# Commensalism

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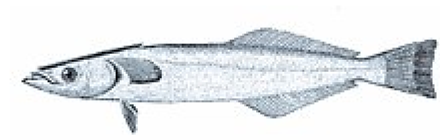

Remora are specially adapted to attach themselves to larger fish that provide locomotion and food.

**Commensalism**, in ecology, is a class of relationships between two organisms where one organism benefits from the other without affecting it. This is in contrast with mutualism, in which both organisms benefit from each other, amensalism, where one is harmed while the other is unaffected, and parasitism, where one benefits while the other is harmed. The word "commensalism" is derived from the word "commensal", meaning "eating at the same table" in human social interaction, which in turn comes through French from the Medieval Latin *commensalis*, meaning "sharing a table", from the prefix *com-*, meaning "together", and *mensa*, meaning "table" or "meal".[1] Originally, the term was used to describe the use of waste food by second animals, like the carcass eaters that follow hunting animals, but wait until they have finished their meal. Commensality, at Oxford and Cambridge Universities, refers to professors eating at the same table as students (as they live in the same "college").

**Commensalism**, in biology, is a relation between individuals of two species in which one species obtains food or other benefits from the other without either harming or benefiting the latter. The commensal (the species that benefits from the association) may obtain nutrients, shelter, support, or locomotion from the host species, which is substantially unaffected. The commensal relation is often between a larger host and a smaller commensal; the host organism is unmodified, whereas the commensal species may show great structural adaptation consonant with its habits, as in the remoras that ride attached to sharks and other fishes. Both remora and pilot fish feed on the leftovers of their hosts' meals. Numerous birds feed on the insects turned up by grazing mammals, while other birds obtain soil organisms stirred up by the plow. Various biting lice, fleas, and louse flies are commensals in that they feed harmlessly on the feathers of birds and on sloughed-off flakes of skin from mammals.

Pierre-Joseph van Beneden introduced the term "commensalism" in 1876.[2]

## Examples of commensal relationships

The commensal pathway was traveled by animals that fed on refuse around human habitats or by animals that preyed on other animals drawn to human camps. Those animals established a commensal relationship with humans in which the animals benefited but the humans received little benefit or harm. Those animals that were most capable of taking advantage of the resources associated with human camps would have been the ‘tamer’ individuals: less aggressive, with shorter fight or flight distances. Later, these animals developed closer social or economic bonds with humans and lead to a domestic relationship.[3][4]

The leap from a synanthropic population to a domestic one could only have taken place after the animals had progressed from anthropophily to habituation, to commensalism and partnership, at which point the establishment of a reciprocal relationship between animal and human would have laid the foundation for domestication, including captivity and human-controlled breeding. From this perspective, animal domestication is a coevolutionary process in which a population responds to selective pressure while adapting to a novel niche that includes another species with evolving behaviors.[4]

Commensal pathway animals include dogs, cats, fowl, and possibly pigs.

## Dogs

The dog was the first domesticated animal, and was domesticated and widely established across Eurasia before the end of the Pleistocene, well before the cultivation of crops or the domestication of other animals.[5] The dog is a classic example of a domestic animal that likely traveled a commensal pathway into domestication. Ancient DNA supports the hypothesis that dog domestication preceded the emergence of agriculture[6][7] and began close to the Last Glacial Maximum when hunter-gatherers preyed on megafauna. The wolves more likely drawn to human camps were the less-aggressive, subdominant pack members with lowered flight response, higher stress thresholds, and less wary around humans, and therefore better candidates for domestication.[3] Proto-dogs might have taken advantage of carcasses left on site by early hunters, assisted in the capture of prey, or provided defense from large competing predators at kills.[7]

The earliest sign of domestication in dogs was the neotonization of skull morphology[8][9][3] and the shortening of snout length that results in tooth crowding, reduction in tooth size, and a reduction in the number of teeth,[10][3] which has been attributed to the strong selection for reduced aggression.[9][3] This process may have begun during the initial commensal stage of dog domestication, even before humans began to be active partners in the process.[3][4]

A mitochondrial, microsatellite, and Y-chromosome assessment of two wolf populations in North America combined with satellite telemetry data revealed significant genetic and morphological differences between one population that migrated with and preyed upon caribou and another territorial ecotype population that remained in a boreal coniferous forest. Though these two populations spend a period of the year in the same place, and though there was evidence of gene flow between them, the difference in prey–habitat specialization has been sufficient to maintain genetic and even coloration divergence.[11][4]

A different study has identified the remains of a population of extinct Pleistocene Beringian wolves with unique mitochondrial signatures. The skull shape, tooth wear, and isotopic signatures suggested these remains were derived from a population of specialist megafauna hunters and scavengers that became extinct while less specialized wolf ecotypes survived.[12][4] Analogous to the modern wolf ecotype that has evolved to track and prey upon caribou, a Pleistocene wolf population could have begun following mobile hunter-gatherers, thus slowly acquiring genetic and phenotypic differences that would have allowed them to more successfully adapt to the human habitat.[13][4]

## *Aspergillus* and *Staphylococcus*

Numerous genera of bacteria and fungi live on and in the human body as part of its natural flora. The fungal genus *Aspergillus* is capable of living under considerable environmental stress, and thus is capable of colonising the upper gastrointestinal tract where relatively few examples of the body's gut flora can survive due to highly acidic or alkaline conditions produced by gastric acid and digestive juices. While *Aspergillus* normally produces no symptoms, in individuals who are immunocompromised or suffering from existing conditions such as Tuberculosis, a condition called Aspergillosis can occur, in which populations of *Aspergillus* grow out of control.

*Staphylococcus aureus*, a common bacterial species, is known best for its numerous pathogenic strains that can cause numerous illnesses and conditions. However, many strains of *S. aureus* are metabiotic commensals, and are present on roughly 20 to 30% of the human population as part of the skin flora.[14] *S. aureus* also benefits from the variable ambient conditions created by the body's mucous membranes, and as such can be found in the oral and nasal cavities, as well as inside the ear canal. Other *Staphylococcus* species including *S. warneri*, *S. lugdunensis* and *S. epidermidis*, will also engage in commensalism for similar purposes.

# Arguments

Whether the relationship between humans and some types of gut flora is commensal or mutualistic is still unanswered.

Some biologists argue that any close interaction between two organisms is unlikely to be completely neutral for either party, and that relationships identified as commensal are likely mutualistic or parasitic in a subtle way that has not been detected. For example, epiphytes are "nutritional pirates" that may intercept substantial amounts of nutrients that would otherwise go to the host plant.[15] Large numbers of epiphytes can also cause tree limbs to break or shade the host plant and reduce its rate of photosynthesis. Similarly, phoretic mites may hinder their host by making flight more difficult, which may affect its aerial hunting ability or cause it to expend extra energy while carrying these passengers.

# Types

Like all ecological interactions, commensalisms vary in strength and duration from intimate, long-lived symbioses to brief, weak interactions through intermediaries.

Phoretic mites on a fly (*Pseudolynchia canariensis*)

## Phoresy

Phoresy is one animal attached to another exclusively for transport, mainly arthropods, examples of which are mites on insects (such as beetles, flies or bees), pseudoscorpions on mammals[16] or beetles, and millipedes on birds.[17] Phoresy can be either obligate or facultative (induced by environmental conditions).

## Inquilinism

Inquilinism is the use of a second organism for permanent housing. Examples are epiphytic plants (such as many orchids) that grow on trees,[18] or birds that live in holes in trees.

Phoresy, a pseudoscorpion on the leg of a crane fly

### Metabiosis

Metabiosis is a more indirect dependency, in which one organism creates or prepares a suitable environment for a second. Examples include maggots, which feast and develop on corpses, and hermit crabs, which use gastropod shells to protect their bodies.

## See also

- Mutualism – where both organisms experience mutual benefit in the relationship
- Parasitism – where one organism benefits at the expense of another organism.
- Parabiosis – where both organisms occupy the same dwelling, but do not interfere with each other
- Symbiosis – long-term interactions between different biological species, which can be mutualistic, commensal or parasitic

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