Reproductive isolation prevents interbreeding (and therefore gene flow) between species. Any factor that impedes two species from producing viable, fertile hybrids contributes to reproductive isolation. Single barriers may not completely stop gene flow, so most species commonly have more than one type of barrier.

Prezygotic Isolating Mechanisms

Temporal Isolation

Individuals from different species do not mate because they are active during different times of the day, or in different seasons. Plants flower at different times of the year or even at different times of the day to avoid hybridization (e.g., members of the orchid genus Dendrobium, which occupy the same location and flower on different days). Closely related animal species may have quite different breeding seasons or periods of emergence. Periodical cicadas (right) of the genus Magicicada are so named because members of each species in a particular region are developmentally synchronized, despite very long life cycles. Once their underground period of development (13 or 17 years depending on the species) is over, the entire population emerges at much the same time to breed.

Gamete Isolation

The gametes from different species are often incompatible, so even if they meet they do not survive. For animals where fertilization is internal, the sperm may not survive in the reproductive tract of another species. If the sperm does survive and reach the ovum, chemical differences in the gametes prevent fertilization. Gamete isolation is particularly important in aquatic environments where the gametes are released into the water and fertilized externally, such as in reproduction in frogs. Chemical recognition is also used by flowering plants to recognize pollen from the same species.

Behavioral (ethological) Isolation

Behavioral isolation operates through differences in species courtship behaviors. Courtship is a necessary prelude to mating in many species and courtship behaviors are species specific. Mates of the same species are attracted with distinctive, usually ritualized, dances, vocalizations, and body language. Because they are not easily misinterpreted, the courtship behaviors of one species will be unrecognized and ignored by individuals of another species. Birds exhibit a remarkable range of courtship displays. The use of song is widespread but ritualized movements, including nest building, are also common. For example, the elaborate courtship bowers of towerners are well known, and Galápagos frigatebirds have an elaborate display in which they inflate a bright red gular pouch (right). Amongst insects, empid flies have some of the most elaborate courtship displays. They are aggressive hunters, so ritualized behavior involving presentation of a prey item facilitates mating. The sexual organs of the flies are also like a lock and key, providing mechanical reproductive isolation as well (see below).

Mechanical (morphological) Isolation

Structural differences (incompatibility) in the anatomy of reproductive organs prevents sperm transfer between individuals of different species. This is an important isolating mechanism preventing breeding between closely related species of arthropods. Many flowering plants have coevolved with their animal pollinators and have flower structures to allow only that insect access. Structural differences in the flowers and pollen of different plant species prevents cross breeding because pollen transfer is restricted to specific pollinators and the pollen itself must be species compatible.