e14 Coevolution of unrelated species < mutual, parasitic >

> The vigorous branching of life's tree, and not the accumulating valor of mythical marches to progress, lies behind the persistence and expansion of organic diversity in our rough and constantly stressful world. And if we do not grasp the fundamental nature of branching as the key to life's passage across the geologic stage, we will never understand evolution right. —Steven Jay Gould.[1]

Natural selection should change species that interact with each other in predictable ways, when it is mutual. This is a test for natural selection that can be made. Darwin's book: *Various Contrivances by which Orchids are Fertilized by Insects*,1862,[2] documented that the intimate relationship between insects and the flowers which they pollinate is matched by their structural compatibility and the insect's behavior. On the strength of his observations, Darwin made bold to predict that the insect which pollinates an orchid (*Angraecum arachnites*, found in Madagascar) with nectaries 11 inches long, is a moth with a proboscis that long! Twenty five years later, the moth (*Panogena lingens*) was found and described by Arthur Gardiner Butler.[3]

Coevolution explains many specialization that exist for plant and herbivores (insect and vertebrate), carnivore and prey, parasitism, and mimicry. Insects camouflaged as natural objects, such as dry leaves or clods of dirt, avoid notice. An alternative to this crypsis (as naturalist Henry Walter Bates noted for insects while exploring the Amazon basin with Alfred Russel Wallace between 1845 and 1859) is Batesian mimicry: a palatable animal (insect, frog, snake) disguises with the bright 'warning' coloration of an unpalatable or poisonous lookalike (Darwin saw to it that Bates got published [4] and was made the secretary to the Royal Geographical Society). Birds see and respond to red. Many day blooming flowers are red and attract bird pollinators. Birds also see ultraviolet light in the 300–400-nanometre range (reflected from feathers, fruits, insects, and vole scent marks) and use that capability to make decisions about mate choice and food selection. Moths (color blind) do see and respond to white and avoid flying in daylight when they would be prey for birds. (Bats? Oh, well.) The bright colors of (day flying) butterflies warn birds that they taste disgusting. Many night-blooming flowers are white and attract (night flying) moth pollinators. Other examples are numerous and of great variety and are reviewed in *The Coevolutionary Process* by John N. Thompson, 1994.[5]

Natural selection should change species that interact with each other in unpredictable ways when one is parasitic. Horrors pile up. Sleeping sickness, leishmaniasis, schistosomiasis, filariases, and intestinal-worm infections cause human misery and morbidity. For creatures great and small, Carl Zimmer in *Parasite Rex*, 2000, essays the bizarre world of nature's most dangerous members, namely parasites, one being *Sacculina*.[6] This, Kevin Padian in his reveiw of the book, writes: "begins life as a free-swimming larva. The female larva settles on a crab, crawls to a joint in its leg, pokes a hole in it, and squeezes her soft parts through it into the crab's insides, leaving behind the husk of her shell. She then makes her way, sluglike, to the abdomen and begins to feed on the nutrients that the crab digests. She forms a bulge in its shell as she grows and sends extensions of her own body, called 'roots,' throughout the crab's body, even to its eye stalks. Soon the crab no longer grows or molts its shell and cannot make eggs or sperm; it's a 'walking corpse,'" living only to serve its relentless parasite. "This grotesquerie" Zimmer continues "would have been enough to disgust Darwin's Victorian audience, but there's more. A pinhole opening in the crab's abdomen, made by the female *Sacculina*, attracts the tiny male, who injects himself into the crab much as the female did. They fertilize each other for the rest of their lives; but to compound the insult, they manipulate the crab's hormonal system so that the crab periodically climbs a high rock, squeezes out the parasite's larvae and waves its claws in the water to speed them on their way—just as it would do for its own offspring."[7]

Not to be ignored are infections, bacterial and viral, that, a growing awareness is, could be causes of such widely disparate ailments as heart diseases and schizophrenia.[8] ❑