Nature's Strange Couples

VOICE: Some couples ***would die*** if they didn't have each other. Others simply ***live*** much ***better*** because they're couples.

PROF.: Nature contains some really unusual couples. For example, a bird that frequently enters a crocodile's mouth!

That's one example of a fascinating biological phenomenon – ***symbiosis***!

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VOICE: Is life in the animal kingdom primarily a ***conflict?*** Or is it a ***cooperation?***

PROF.: Professor William Trager answers, "The ***conflict*** in nature between different kinds of organisms has been popularly expressed in phrases like 'struggle for existence' and 'survival of the fittest.' Yet few people realize that mutual ***cooperation*** between different kinds of organisms – ***symbiosis*** – is just as important, and that the 'fittest' may be the one that ***most helps another to survive***."

VOICE: Isn't part of the word "symbiosis" the same "bio" that we have in the word "biology"?

PROF.: Yes. "Bio" means "life." And the word "symbiosis" begins with the same Greek prefix as "symphony." The root words of "symphony" mean "sounding with."

VOICE: So "symbiosis" literally means "living with"?

PROF.: Yes. Symbiotic organisms live together in a relationship that ***beneficial to both***.

The *Encyclopaedia Britannica* defines symbiosis as "A close, sustained living together of two species or kinds of organisms; ...the relationship between two species in which EACH BENEFITS from the association."

VOICE: We said at the beginning of the broadcast, "Some couples would die without each other." Is that literally true?

PROF.: Yes. One example is the lichen – a fungus living together with an alga.

Some lichens live on bare rocks – where they are exposed to extremely hot and extremely cold temperatures, and to extremes of drought and moisture. Neither the fungus nor the alga could grow individually in these habitats, but in combination they thrive there.

Because the alga is a green plant, it can make vitamins and other nutrients by the process of photosynthesis.

VOICE: So the alga provides nutrients for the fungus. What does the fungus give in return?

PROF.: It provides shade to prevent the alga from drying out and dying of dehydration.

VOICE: What about the other opening statement? Which symbiotic organisms can live without each other, but live ***better*** in each other's presence?

PROF.: One example partners the Nile crocodile and a species of plover sometimes called "the crocodile bird."

Very few animals ever enter a crocodile's mouth voluntarily. Yet the Nile crocodile allows this bird to enter and leave many times — because the bird removes bothersome parasites from inside the river animal's mouth.

VOICE: Do you mean the bird benefits from cooperating with the larger animal, by eating the parasites as food?

PROF.: Yes. A similar situation exists in the sea. Crustaceans and small fish eat debris and parasites from the bodies of larger fish. Professor Trager says, "It is clear that the larger fish actively ***seek*** to be cleaned. In coral reefs there are cleaning stations where host fishes ***congregate*** from large areas."

VOICE: How do host fishes sense which organisms they can safely allow to touch their bodies?

PROF.: The species of fishes that clean other fishes, have specific ***color patterns*** on their bodies. They also seem to swim in distinctive ways.

VOICE: Figuratively speaking, could we say that certain fish species have "passwords"? Their swimming patterns and their body colorations tell the host fish that they should be allowed near it?

PROF.: Yes. And an even more sophisticated situation exists with other symbiotic organisms.

The sea anemone is an invertebrate related to the jellyfish and corals. It protects itself from enemies by stinging them to paralyze them and then kills them. The paralyzing sting appears to occur ***automatically*** when another animal comes into contact with the sea anemone. But the fish ***Amphiprion*** eats parasites from the surface of the sea anemone's body.

VOICE: So how does this one species avoid being stung and eaten?

PROF.: By a combination of chemistry and elaborate motions. This fish approaches the sea anemone gradually, carefully avoiding a disc-shaped sensing organ of the anemone.

Next it passes about a centimeter from the sensitive disc, seemingly exposing the disc to a chemical that partially ***desensitizes*** it. Additional complex movements follow, until the larger organism becomes so tolerant that it allows its symbiotic partner to move freely up and down its body, eating parasites freely.

Only a certain kind of desensitizing chemical and pattern of movements can get this unusual fish past the deadly defenses of the sea anemone.

VOICE: Isn't it interesting that one species of fish has the right chemistry and choreography?

PROF.: Yet the same chemical and the same movements have no effect on other genera of anemones. They ***sting*** and ***eat*** Amphiprion.

VOICE: I've heard that some symbiotic organisms even live ***inside*** their partners. Is that true?

PROF.: Yes. The classic example of this involves a way to digest cellulose $(C_6H_{10}O_5)$.

Termites eat wood, but the cellulose in wood is so hard to digest, that the termites can't digest it ***without help***. That help is in the form of bacteria, protozoa, and other micro-organisms which live in the digestive system of the termite.

One researcher exposed the termites to pressurized oxygen for several hours. That killed the protozoa in their intestines, apparently without harming the insects.

The termites continued to eat their usual diet of wood and paper. Yet they ***died*** within two to three weeks – about the same length of time they would have survived if they were ***starving!***

VOICE: Does that mean that when protozoa were no longer living inside the insects, the insects could not digest what they had eaten?

PROF.: Yes. They were full of food, but they died from not being able to metabolize it.

Experimenters discovered that reinfecting some of the termites with protozoa from other termites, restarted the digestive process and saved the insects' lives.

VOICE: Isn't the relationship between a honeybee and flowers a symbiosis? The bee gets a meal of nectar, for helping the plants to reproduce another generation.

PROF.: Yes. There are ***many*** more examples of symbiosis among various species of plants and animals. But I think we've discussed enough to discover very intricate partnerships within nature – with each partner providing something that the other partner needs.

VOICE: Reviewing briefly, there's the lichen – a team composed of a fungus and an alga, capable of living ***together*** on bare rocks on which each would die individually.

There's the crocodile bird, which eats out of the crocodile's mouth – and the Amphiprion fish, which evades a stinging mechanism to eat parasites from the body of a sea anemone.

PROF.: We also explored the termite, and discovered it would starve to death with its stomach full – if its digestive organs didn't contain just the right microorganisms to enable it to digest cellulose.

In a moment, we will discuss what that kind of complexity might mean.

VOICE: Why do so many animals do the ***best*** thing, as the ***natural*** thing? Why do they instinctively behave in such complex ways, with such desirable results?

PROF.: As far as researchers can tell, animals don't understand what results they are achieving by their actions. They merely follow the instinctual impulse of the moment.

VOICE: Yet their instinctive actions produce desirable results. They obtain food, they escape predators, and they reproduce another generation of their species. Are those merely fortunate accidents?

PROF.: Science writer Nigel Calder observes many very functional operations in biology. He remarks that they appear, quote, ***"AS IF BY DESIGN."***

VOICE: "As if by design"? Does he mean certain animal behaviors ***seem*** to be purposeful, but really aren't?

PROF.: Yes. Many schools have popularized the idea that a scientist can't accept the idea that anything in nature has a purpose or a design. Many think scientists must reject that idea *a priori.*

VOICE: Isn't *a priori* a term philosophers use?

PROF.: Yes. One definition is, "Based on a hypothesis or theory, rather than on experiment or experience. Made before or ***without examination;*** not supported by factual study."

VOICE: So if a scientist ***sees*** what appears to be ***evidence*** of purposeful design in nature, must he tell himself that the appearance is an ***illusion?***

PROF.: One popular philosophy says yes. If his intelligence tells him he sees creative design in nature, he has been told to distrust his intellect and substitute a hypothetical explanation a professor told him.

VOICE: Making an *a priori* guess may be all we can do, ***before*** there is any evidence. But when observational evidence becomes plentiful, why should the original hypothesis override the scientific observation?

PROF.: That's an excellent question. If our study of nature and its complexities, lead logically to the conclusion that some kind of intelligence has made nature – why must we distrust our intelligence?

Think about this possibility. Maybe an intelligent God made the complex symbiotic organisms we've been discussing today.

VOICE: And then maybe God gave us humans the intelligence to ***recognize*** purposive design when we see it.

PROF.: And one final question: Could God also be implying that He wants to have a symbiotic relationship with us? Is it possible that our lives would be more fulfilled by living WITH God in our lives – than by living without Him?

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