

EVOLUTION

They All Get Eaten Anyhow

An Animal's Camouflage, Sting, Bad Odor or Taste Does Not After All Save Him From His Enemies, Scientist Declares

By DR. FRANK THONE

EATING, we are told by an ancient adage, is the proof of the pudding. It would also seem to be the proof of the many devices used by all manner of creatures to avoid being eaten. If an insect or other animal is colored a scary red, or hidden beneath a leaf-colored camouflage, if it is cased in armor or bristles with sharp spines, if it can bite or scratch or sting—and in spite of these devices still gets eaten, then obviously its "protection" has failed to protect. The proof of the protection is in the eating.

The strange and often beautiful colorations and markings of animals have excited the admiration of naturalists from the very earliest times, and philosophers have often speculated as to their possible uses or significance. But until the coming of the Darwinian evolutionary doctrines of struggle for existence and the resulting survival of the fittest, no logical expiration was offered for them, short of passing the problem on to the theologians by attributing them to special design by the Creator.

The Darwinian credo, that the competition between animals is so keen that everything they do either helps them to survive or hurts them toward ultimate extinction, offered an attractive key to the whole puzzle. All animal colorations and markings were eagerly examined for their "survival value," after Alfred Russell Wallace, Darwin's contemporary and co-originator of the evolutionary doctrine in its modern form, first suggested the idea a few years after the publication of the "Origin of Species."

If a poisonous spider or snake, or a sting-armed insect, was conspicuously colored or marked, that was interpreted as a warning to possible enemies, that here was a "hard guy" who wouldn't stand for any foolishness. If an inof-

COVER ILLUSTRATION

Eye-spots, like those on the wings of the *Cecropia* moth on the front cover, are commonly interpreted either as warning markings, to scare off enemies, or as "targets" to draw the enemy's attention to a non-vital spot. But moths get eaten anyway.—(Photo by Cornelia Clarke).

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fensive creature, really good to eat and easy to capture, happened to look like one of these evolutionary "tough babies," that was set down as "mimicry": the pacifist was disguising himself in a warrior's uniform. If on the other hand, the helpless one were brown and lean, like a walking-stick insect, or flat and green, like a katydid, or mottled and lumpy, like a toad, that was considered camouflage, to disguise the wearer as a twig or a leaf or a clod of earth.

There are endless ramifications of this theme, but from Wallace's day until now it has been accepted almost as gospel by a majority of biologists, and is set forth in all school and college textbook.

Comes now a bold heretic, W. L. McAtee of the U. S. Biological Survey, who challenges the whole idea. Animal protection, he says, does not protect. No matter what concealing, or warning, or mimicking devices a creature adopts, no matter what its armament or armor, it meets its Nemesis: some hungry enemy that cannot be either fooled or frightened, and down the red lane it goes. The so-called protective devices, Mr. McAtee insists, do not give even partial protection: all creatures are eaten in approximate ratio to their total abundance, whether they are "protected" or not. If there are few of them, few get eaten; if many, many are devoured, no matter what they look like or how they are armed. Even really dangerous or highly disagreeable ones, like snakes or scorpions or skunks, are no exception.

Experiments Held Not Valid

Twenty years ago Mr. McAtee made a critical examination of experiments supposed to establish the efficacy of protective coloration and other devices. The scientists who performed these experiments usually presented caged birds or animals with insects of various kinds, and noted whether they ate them, rejected them, or merely ignored them. Such tests, Mr. McAtee contended, were unfair. Caged animals and birds are no more to be relied on for natural reac-



POISONOUS, BUT EATEN

The toad, clod-colored and clod-immobile, might surely be classed as protectively colored. Moreover, he is poisonous when eaten. Nevertheless he does get eaten in considerable numbers, and his enemies grow fat on him.

tions than are jailed men. Moreover, the number of tests was usually inadequate.

But in spite of his protest then, the doctrine still attracted. So Mr. McAtee bided his time, and while he waited he appealed to the final jury—the feeding habits of animals living free under natural conditions. Now, in a technical publication of the Smithsonian Institution, he sets forth the verdict.

He was in a uniquely favorable position to obtain the information he sought. In the Biological Survey he is in charge of the division of food habits of birds. When birds are collected for museum purposes, or occasionally when such troublesome species as starlings or crows have to be killed in large numbers, their stomach contents are saved and sent to headquarters in bottles of preservative. There they are spread out, sorted and identified by experts. The insects and other things taken as food by tens of thousands of birds have been counted and listed, and the summary is set forth in Mr. McAtee's book. In addition, he has collected feeding records of other animals from all parts of the world and put these in supplementary summaries.

The bill of fare of the wild creatures thus subjected to scientific scrutiny includes practically everything that flies or crawls or swims, and the list of eaters takes in all living things except the strictest vegetarians. It all goes very

much counter to one of the most widely accepted of evolutionary sub-doctrines, but facts are facts, and Mr. McAtee as a proper scientist is not the man to avoid them.

It would be impossible to discuss all of the hundreds of cases cited by Mr. McAtee, but his point is well established even by a few familiar ones, either from his own list or suggested by his examples.

The common potato beetle is often put forth as an excellent case of warning coloration. It is ill-smelling, to human noses at least, and is credited with being nasty-tasting to birds and other enemies. It is brightly marked in black and yellow, and makes no attempt at concealment. Its pestilential abundance is commonly accredited to immunity to natural enemies. Yet Mr. McAtee has found records of its presence in the stomachs of no less than 27 species of wild birds, and he states further that ducks, chickens and guinea fowl are known to feed on potato beetles. In addition to this score and a half of feathered foes, he lists snakes, frogs, toads, ten species of predacious bugs, fifteen species of beetles, robber flies, wasps, spiders and two spider-like creatures less known to the general public.

Potato Beetle's Markings No Help

"Despite all of its protective adaptations," Mr. McAtee remarks, "the Colorado potato beetle undoubtedly has its full quota of foes; its rapid increase and spread over the United States was due to enormous increase by cultivation of a favored food plant and not to lack of enemies."

Perhaps the most familiar and most widely cited case of mimicry is that of the monarch and viceroy butterflies. Both of these are fairly large, brightly marked insects with a background color of dusty red or orange. The monarch is supposed to be ill-tasting to birds. The viceroy is not, but is supposed to obtain protection by looking so much like the monarch that only a student of insects can tell them apart. Yet both monarch and viceroy pay toll in thousands to birds and other enemies—taste, color and all to the contrary notwithstanding.

Bees, ants and wasps are supposed to be recognizable as bad eating by all possible enemies, and their mimics are supposed to gain protection from their mimicry. Yet stingers and stingless alike are snapped up without discrimination by everything from birds to toads. Mr.

McAtee cites the case of one toad gorging himself on bees, in spite of the fact that they apparently used their stings inside him! And toads themselves, though clod-colored and exuding poison from some of their "warts," are in their turn eaten by snakes, skunks, and many other predators.

Monkeys Eat Spiders

Bright-colored spiders, like the common yellow-and-black orb weaver, are pointed out as good examples of "warning" coloration. Yet the most poisonous spiders, as well as the biggest, are earth-colored species that live on or close to the ground, and might therefore be called "protectively" colored. But in spite of their poison, and regardless of either "warning" or "protective" coloration, spiders get eaten. Birds, toads and wasps lead their manifold list of enemies in our temperate region, while monkeys delight in munching fat tropical spiders whenever they can catch them. And the spiders' kin-creatures, the centipedes and scorpions, fare no better. All are eaten by something or other.

Down in the sea there are brightly-colored fishes—presumably warningly colored, for some of them are poisonous. Nevertheless they get eaten. Sometimes the eater dies of the poison, more often not. And for the most part one experience will not teach him to avoid such fish in future, for the memories of fish are notoriously short: it is a common experience among anglers to have a fish bite again at a hook from which it has just succeeded in shaking itself loose. And even if a poisonous fish, or

any other poisonous creature, should make its eater sick or even kill him, of what avail is that? Its poisonousness has no "survival value" to itself, Mr. McAtee points out, for it quite obviously has not survived.

Among the higher vertebrates, perhaps there is no better example of "protection" than the skunk. It may not be able to punish its attacker with death, but it is abundantly able to make him wish he were dead. And the broad white stripe down its dark back, together with its creamy tail, have been cited over and over again as warning signals. But what happens to the poor woods-puss? The three nocturnal hunters of his own habitat that are big enough to overcome him make a meal off him at their pleasure: owls, mountain lions and bobcats are all known enemies of skunks.

Thus from lowest to highest among animals, all are meat to some other creature, and no development of protective adaptation avails to save them. Over and over again Mr. McAtee emphasizes that the only principle that seems to rule is the relative abundance of individuals. The more there are the more get eaten, but the more survive.

If there is any moral in all this, Mr. McAtee does not point it out. The only one even mistily visible would seem to be one quite unpopular at present: that it is sheer numbers of progeny, rather than cleverness in equipping them for getting along in life, that promises survival and success to a species.

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PHYSIOLOGY

Drinkers More Susceptible To Poisoning by Cleaning Fluid

DON'T use carbon tetrachloride if you have a "hang-over." This chemical, widely used for dry cleaning, cleaning machinery, as a fire extinguisher and in the treatment of hookworm disease, is often poisonous, and particularly so to persons who drink alcoholic beverages or who do not get enough calcium in their food.

Seven employees of a felt manufacturing plant, all wine drinkers, were poisoned by carbon tetrachloride when they used it in large quantities for cleaning

the felt, Dr. L. W. McGuire of Boston has reported to the American Medical Association. When the fluid was used in small amounts to remove individual spots, the men had not been affected by it. When the felt was passed through a large, warm bath of the chemical, all the men become ill and one nearly died.

Calcium lactate or calcium chloride are successful remedies for treating carbon tetrachloride poisoning, Dr. McGuire stated.

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