ANIMAL POISONERS

H. Munro Fox

IN the past the zoologist has not studied poisonous animals very profoundly. He has been content to note that this kind of animal is poisonous, that the other kind is not so. He has satisfied himself that the poison is of use to its possessor as a means of defense and in most cases he has left the matter there. In other words, not much attempt has usually been made to discover how it comes that the well-protected animals possess the poison, how they manage to manufacture it, and why others do not do so. Yet these are profoundly interesting problems, and some of these very questions have been answered by the work of scientists in the last few years.

The use of poison to its possessor is often obvious enough. Scorpions, bees, and snakes have glands which prepare the poisonous liquid, and they have tubes to conduct it to sharp spines or teeth for inflicting a wound. Other animals, which have no offensive weapons, nevertheless derive protection by pouring out a poison on the skin. A toad, for instance, does this. This mode of looking on the question, however, does not go deep enough. We want to know the means by which the poison arises in the chemistry of the animal's body and the nature of the injurious substance.

Emperors and Poison Gas

Poisons are produced by very many different sorts of creatures, whose number includes both higher and lower animals, and it is remarkable that so many of these different poisonous products are used by savage races as arrow poisons. Snakes, lizards, toads, and fishes have provided such venom, and the juices of beetles, bees, wasps, ants, centipedes, and spiders have been used. Yet even to-day little is known of the real chemical nature of the animal poisons.

The poison gas of the skunk, — an animal said to produce the most nauseating odor known, — is a stuff which chemists call mercaptan. It contains sulphur. Now there is a curious example of how an unusual chemical substance may be found in widely dif-

ferent groups of animals. The purple dye used by the ancient Romans for the togas of their nobles was, — as every one knows and as the Science Editor of THE FORUM showed last month, — derived from a shell-fish. A sort of sea-snail furnished the precious color. Now, newly dyed togas always had an unpleasant smell, a smell which disappeared very slowly with the lapse of time. Indeed, it has been suggested that the exaggerated use of perfumes by the Roman patricians was in order to drown the unpleasant smell of their dyed robes, — and really unpleasant it was, as will readily be believed when it is learnt that the smell of the purple was nothing more or less than the skunk's poison gas once more. For the precursor of the purple stuff in the sea-snail's economy contains sulphur. The purple itself contains none, it is true; but as it is secreted in the snail's body, the sulphur is put on one side as a by-product, in the form of the evil-smelling substance, mercaptan. Thus a Roman emperor arrayed in purple came curiously near to resembling a skunk!

WORMS AS FEMINISTS

In some cases we know that poisons play a rôle in the functioning of the body of the animal which manufactures them. This may be in many cases the real and original *raison d' être* of the venoms, quite apart from any protective value. The poisonous spittle of snakes, for example, has work to do in the digestion of the snake's food; and a most extraordinary case of the same sort is presented by a green marine worm, a creature the size of one's thumb, which may be said to be the most extreme and most successful feminist in the sea. The male is microscopic and he lives inside the genital organs of his mate. Now, like all sea worms the young of this feminist creature at first swim about, settling down later, after a certain time, to staid adult life. Now, if these swimming young settle anywhere on the ground, they grow into the fat female worm; but if they happen to fall upon the skin of their mother, quite another fate befalls them, which brings us back to the question of poisons. Part of the worm's skin is covered with a slimy stuff which is poisonous to many animals that would like to eat the succulent worm; but if the minute young settle down on the skin this same stuff, far from killing them, has quite a different effect, for it causes the young to change into the mi-

croscopic and retiring males of the species. In other words, young which would otherwise have grown into fat females are changed by the poison into diminutive males.

One of the most fascinating chapters in animal poisons is the subject of natural immunity, the fact that some animals are immune to the poisons of others and remain unhurt if stung or bitten by the poisonous animal, whereas all other sorts of beasts succumb. A case in point is that of desert animals which are unharmed by a scorpion's sting. The desert fox, the kangaroo rat, and other inhabitants of deserts where scorpions abound are in this happy position. Their cousins, living far away from the desert, would at once be seriously injured by a scorpion's sting, whereas the desert breeds remain unhurt. It is to be supposed that in the far distant past, before the desert animals had this complete immunity to scorpion venom, those which were stung and could not resist died, leaving no offspring. Their luckier brothers, who happened to have a hardier constitution, survived and left behind them a resistant race of descendants.

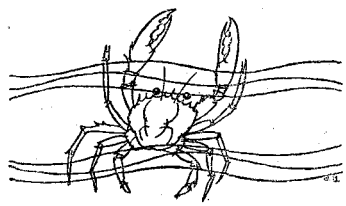
An Immune Crab

Another bizarre instance of this same phenomenon is provided by certain crabs which carry on their backs a kind of sea-anemone. The sea-anemone is a plant-like animal with the power of stinging like a jelly-fish. The sting is due to microscopic capsules containing the poison. These minute capsules, each with a needle for penetrating the skin of the victim, are shot out in uncountable numbers when the sea-anemone is attacked, and as the poison is very harmful, few enemies venture to attack the happy creature. Consequently the crab walks about with a sea-anemone on its back for its own protection. No fish nor octopus will attack a crab with such a redoubtable defender, and the anemone enjoys the advantage of sharing the crab's meals. It picks up crumbs from the crab's table by stretching down its food-catching tentacles to the crab's mouth and stealing bits of food.

We come now to the most curious part of this story. How does it come that the anemone's batteries of poison capsules do not injure the crab? It is true that the crab has a thick armor, but the poison, one would think, should injure the crab by way of its mouth. Researches carried out this year have been revealing.

If the poison is extracted from the anemone and injected into any ordinary crab by means of a hypodermic syringe, the crab very rapidly dies. The effect is most striking when the poison is thus inoculated into a crab's leg. Within two seconds of the inoculation, the crab, following the Biblical injunction, twists off its poisoned member; but if the poison is injected with a syringe into a crab which bears an anemone on its back, no effect follows at all. The creature does not even notice the venom. In other words, the crab with the anemone is immune. Just as the desert fox is uninjured by the sting of a scorpion, so the crab is unhurt by the weapon of its mate, the anemone. Were this not so, of course, the foxes would be decimated by scorpions which swarm in the desert, and the crabs would be killed off by their passengers.

The new researches did not stop here. They revealed one further chapter of the story. It turns out that, unlike the desert fox, the crab is not born into the world immune to the poison which it will meet later on. The young crabs are all of them vulnerable, but when one of them adopts an anemone as a permanent guest, it gradually becomes immune to its visitor's poison. Every time a fish or other creature pushes against the anemone, it shoots out a cloud of poison capsules. It does this no matter whether the intentions of the fish are malevolent or otherwise, and the crab, whether it likes it or not, is thus often forced to swallow a number of these ejected venom capsules and, — as it has to do this day after day, — gradually ceases to be affected. In just the same way the snake charmer makes himself immune to snake or to scorpion poison by giving himself very small but repeated doses of venom from the reptiles with which he deals.



THE BOOK OF TENANTS

ROBERT P. TRISTRAM COFFIN

Drawings by the Author

IT is a convenient way of settling the old dispute as to the relative importance of Oxford and Cambridge, as I have found by experience, to point out that Geoffrey Chaucer, who knew the best wines, wives, and stories of his time, mentions only two Cambridge men to three Oxonians. And the Cantabrigians were only North Country boors whose combined intellectual resources were needed to outwit a mere miller of Trumpington; nor was there any artistry in their triumph. But Chaucer's Oxonians were princes in their way. There was the lean scholar who went in for Aristotle, silence, plain clothes, and moral tales such as that of Grisilde; there was that other quite different clerk whose sweet breath was spent on *Angelus ad virginem* and winning words that won his landlord's wife; and, last of all, the most intriguing of the trio, Jankin, the Wife of Bath's fifth husband. It was Jankin who had the *Book of Wicked Wives*. He read it to his spouse, and richly she deserved to hear it, being of an amorous tooth and inclined to love by the stars she was born under. But it is not my purpose to retell her story, how she lost her patience, how the *Book of Wives* lost three leaves, Jankin his temper, and eventually the control of his wife when she made the most of the blow he gave her.