



In medieval Europe, frogs and toads were synonymous with evil and witchcraft and toads are depicted as the familiars and alter-egos of witches. Almost all writings of the time portray the toad in a negative fashion (frogs are hardly mentioned) and Shakespeare refers to them as 'ugly and venomous'. Even today, toads are not welcome in some places and are thought to cause warts, while superstitions concerning toads were commonplace in parts of England and North America until recently. Kenneth Grahame's *The Wind in the Willows*, published in 1908, characterizes Toad as pompous and unreliable, but he redresses the balance by also describing him as intelligent and witty. In other children's tales from Europe, frogs are princes in disguise waiting only for a maiden's kiss.

Poison dart frogs and South American Indians

South American Indians of the Emberá Chocó group of tribes from the Pacific slopes of the Andes in Colombia use at least three species of poison dart frogs to tip their blowgun darts: *Phyllobates aurotaenia*, *P. bicolor* and *P. terribilis*. The poison consists of steroidal alkaloids in the frogs' skin secretions, of which the most powerful is produced by the golden poison dart frog, *P. terribilis*. Its secretions are 20 times as toxic as those from any other species of poison dart frog making it dangerous to handle – even contact with the skin can result in a painful burning sensation through any small scratch, and the Indians protect their hands with leaves when handling them. Experimentally, the poison from a single



frog was enough to kill at least 20,000 mice when injected under the skin. Extrapolating to humans this is equivalent to six or seven average-sized people though comparing toxicity between mice and humans is not always completely accurate.

The Indians make their blowguns from a length of straightened palm wood that is split down the middle. Then they make a semicircular groove in each half before whipping them back together. The darts are made from hard slivers of palm wood about 21–23 cm (8 1/4–9 in) long. A fine spiral groove is cut in the final 2–3 cm (4/5–1 1/16 in) of the point and this holds the poison. The darts are charged with poison in two ways. For *P. aurotaenia* and *P. bicolor*, the frogs are impaled on sticks and may be held over a fire. This causes them to secrete enough toxin from their skin for up to 20 or 30 darts, which are then pushed into a piece of plantain to dry. In the case of *P. terribilis*, however, the darts are simply wiped over the skin of a living frog; they are collected and kept in small wicker baskets. When they need the frogs, they pin them down using short sticks. Each frog, known locally as 'kokoi', is used to charge two or three darts before being allowed to hop away. This species is apparently abundant and replacing them is relatively easy. The Indians use the blowguns and darts mainly for hunting but occasionally for fighting.

LEFT The world's most poisonous animal is the golden poison dart frog, *Phyllobates terribilis*. It is used by native people in parts of Colombia to tip their blowgun darts.