

to stagnate here forever at my feet, or crawl onward yet another sluggish league into the sea. So may Lethe look, or Styx: the nightmare of a flood.

There is dreary monotony in Italian rivers, once they have reached the plain. They are livelier in their upper reaches. At Florence — where those citron-tinted houses are mirrored in the stream — you may study the Arno in all its ever-changing moods. Seldom is its color quite the same. The hue of rusty iron in full spate, it shifts at other times between apple-green and jade, between celadon and chrysolite and eau-de-nil. In the weariness of summer the tints are prone to fade altogether out of the waves. They grow bleached, devitalized; they are spent — withering away like grass that

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has lain in the sun. Yet with every thunderstorm on yonder hills the color-sprite leaps back into the waters.

Your Florentine of the humbler sort loves to dawdle along the bank on a bright afternoon, watching the play of the river and drawing a kind of philosophic contentment out of its cool aquatic humors. Presently he reaches that bridge — the jewelers' bridge. He thinks he must buy a ring. Be sure the stone will reflect his Arno in one of its moods. I will wager he selects a translucent chrysoptase set in silver, a cheap and stubborn gem whose frigidly uncompromising hue chimes in, mysteriously, with his own temperament. His is not the cult of fire, but of that other element — cold, playfully yielding, relentless.

THE WAY OF THE SERPENT

BY J. ARTHUR THOMSON

VERY few animals at the Zoo showed any fear of snakes suddenly brought into their presence, and we doubt if man has any instinctive dread either. Among the exceptions at the Zoo were various monkeys, and it is conceivable that long ago it may have been of survival value in that race to have an ingrained constitutional antipathy, which some would call racial memory, to the deadly tree-snakes, which wind their way from branch to branch in the tropical forest. During man's aboreal apprenticeship such an inborn prejudice might likewise have been of value, but there is little evidence of its reality; and, apart from special cases of extraor-

dinary attraction and repulsion, the dislike that the majority of men have for snakes is sufficiently accounted for by wise tradition on the one hand, and careless mis-education on the other. It has a shrewder basis than the widespread antipathy that women have or mice, for the grip that the snake has taken of human imagination is readily intelligible in terms of its practical fearsomeness. Its eerie movements, its elusiveness, and its uncanny ways in general. A puncture from these slender fangs and the strong man passes; the python breaks the mammal's bones in its coils, and swallows a creature much stouter than itself; a brown

snake appears out of the brown soil — it is the earth's living essence; it sloughs the outermost layer of its skin, bearing an imprint of all the scales which are imbedded beneath it, and appears all fresh and glistening — it has the secret of eternal youth; its movements are very perplexing; can we wonder that legitimate inferences and natural non sequiturs have given serpents a unique place in man's imaginings? A snake coils around the tree of Igdrasil; a snake forms the couch of Vishnu; a snake is the crest of the crown of one of the Egyptian gods; a snake climbs up the staff of Æsculapius; has any other creature insinuated itself so intricately into human life? As Ruskin said, the snake is a divine hieroglyph of the demoniac power of the earth, and it commands our admiration if we cannot bring ourselves to give it respect. In Britain, there is no excuse for holidayers being proud of killing an adder, which is quite worthy of the little it asks of a place in the sun; and to batter to death the gentle and innocent grass snake is as silly as jumping on a cauliflower.

The chief zoological interest of snakes is in the adaptations which every corner of the body illustrates. More strikingly than many animals, though not more really than any other, the snake is a bundle of adaptations. But this suggests far too wide a theme; we wish to consider only 'the way of the serpent upon a rock,' which the ancient sage confessed to be too wonderful for him. We admit that it is too wonderful for us also, but it is a problem worth nibbling at, and it must be granted that the movement of a snake to one who knows the architecture of the body is not so hopelessly wonderful as it is to the unsophisticated observer, who sees a limbless, cylindrical creature moving with a mysterious celerity which his own does not for the moment

surpass as much as he wishes. First of all we must consider the shape of the body, which is so well suited for sneaking through holes, for gliding among the thick herbage, and in some cases for burrowing in the ground. The sea-snakes have a laterally compressed tail. It is interesting to recall the limbless forms among amphibians and among lizards, for, in their likeness to snakes, they illustrate what is technically called convergence, a resemblance between unrelated animals which have become similarly adapted to similar conditions of life. Internally, these worm-like amphibians and lizards are very different from snakes, but the external resemblance is often very close. It is a common and not altogether easy exercise for a young student of zoology to have to distinguish between a burrowing Cæcilian (which is a limbless amphibian), a burrowing amphisbænid (which is a limbless lizard), and a thorough-going burrowing snake such as Typhlops. The big ventral scales which usually mark off a snake at a glance are replaced by uniform small scales in the burrowers; and the Cæcilians, though belonging to a naked class, have often small scales imbedded in their skins. The snake's elongation of body must be of very ancient standing, for there is no trace of a breast-bone such as is found in a glow-worm (a limbless lizard), and it is only in rare cases that there is any vestige of a hip-girdle and a hind-limb. He must be rather dull whose imagination is not stirred by observing the clawlike spurs of a big python — the dwindling vestiges of a pair of hind-limbs which the unknown ancestors of snakes must have possessed. We must not linger over the snake's shape, but it is instructive to notice that it affects the lie of internal organs. Thus there is not room for two lungs, and the left one is much the smaller; the liver is an

elongated organ; the kidneys are in a line with one another, not opposite as usual. The effects of the elongation of the snake's body are far-reaching, but it should be noted that it concerns the trunk and not the tail, the latter being usually quite short.

If snakes evolved from a stock common to them and to lizards, as seems highly probable, one of the notable steps was the loss of limbs, and it is interesting to remember that while the vast majority of lizards have two pairs well developed, there are a few with only fore limbs, a few with only hind limbs, and a few with none at all. What more can the skeptic desire? But the loss of limbs demands some other instruments of locomotion, and everyone knows that the snake has found these in its elongated ribs which are attached, by ligament, to the large scales crossing the ventral surface of the body. There are sometimes nearly three hundred vertebræ, and all of these, except the first and those of the short tail, bear ribs. These ribs are worked by many muscles and move like ours, headward and tailward, and when the edges of the strong transverse scales grip the roughnesses of the ground the movement of the associated ribs pushes the body forward. Ruskin was not far from the mark when he wrote: 'The snake literally rows on the earth with every scale for an oar; it bites the dust with the ridges of its body,' for two factors coöperate—the contraction of skin musculature which raises the scales so that their strong posterior margin catches on the ground, and the pull of the ribs which brings the scales into place again, and in so doing pushes the long body forward. It is a beautiful sight, the correlated action of these hundred oars at different parts of the body 'all with the same calm will and equal way'—'a wave, but without

wind! a current, but with no fall,' 'one soundless, causeless march of sequent rings, and spectral procession of spotted dust, with dissolution in its fangs, dislocation in its coils.' 'Startle it,' Ruskin continues, 'the winding stream will become a twisted arrow—the wave of poisoned life will lash through the grass like a cast lance.' In the ordinary gliding there is a suggestion of the wave-like appearance one sees in a big millipede, which is probably due to the limbs being moved in sets. Dr. Charles Owen, in his quaint *Essay Towards a Natural History of Serpents*, reckons both millipedes and centipedes as 'serpents,' and says: 'In these multipedes the mechanism of the body is very curious; in their going, it is observable that on each side of their bodies every leg has its motion one regularly after another, so that their legs, being numerous, form a kind of undulation, and thereby communicate to the body a swifter progression than one could imagine where so many short feet are to take so many short steps, that follow one another rolling on like the waves of the sea.' Many years ago, Sir Ray Lankester found it very difficult to analyse the order of the centipede's going, and came to the conclusion that if the animal had to study the question itself, it would not get on at all. He quoted the verses:

A Centipede was happy quite

Until a toad in fun

Said, 'Pray, which leg moves after which?'

This raised her doubts to such a pitch,

She fell exhausted in the ditch,

Not knowing how to run.

But although the movements of multipedes are not easy to follow, they are not so puzzling as those of 'nullipedes,' as snakes may be called. For in centipedes and millipedes the jointed legs are in a very direct way oars that press against the ground and lever the animal forwards, whereas in snakes, as

we have seen, there are no projecting appendages and the leverage is more complicated, ribs and scales working together with correlated movements.

Of the ordinary gliding movement Sir Richard Owen said: 'If the observer have the nerve to lay his hand flat in the reptile's course, he will feel, as the body glides over the palm, the surface pressed, as it were, by the edges of a close-set series of paper-knives, successively falling flat after each application.' But there is a second swifter mode of locomotion by successively bending and almost with a jerk straightening portions of the body. The vertebræ have great mobility, sideways, but almost no dorso-ventral freedom, and in the quick lateral wriggling, it is probably advantageous that they should have deep ball-and-socket joints and two pairs of articulating processes instead of the single pair usual in other animals. Moreover there is a wedge-like process on the anterior surface of each vertebra which fits into a corresponding depression on the posterior surface of the one in front. These structural specializations are surely adaptive to obviating the risk of dislocation in the very rapid movements, which reach a climax when the snake strikes or springs. Well might Sir Richard Owen allow himself some enthusiasm: 'It is true that the serpent has no limbs, yet it can outclimb the monkey, outswim the fish, outleap the jerboa, and,

suddenly loosing the close coils of its crouching spiral, it can spring into the air and seize the bird upon the wing: all these creatures have been observed to fall its prey. The serpent has neither hands nor talons, yet it can outwrestle the athlete, and crush the tiger in the embrace of its ponderous overlapping folds.' Outclimb the monkey, outswim the fish, outleap the jerboa, outwrestle the athlete, and crush the tiger — surely, a miracle of mobile strength! There is nothing left, says another enthusiast no doubt with ophidiophilia, save cross a horse-hair rope, get off a sheet of perfect ice, and swallow a porcupine.

We cannot leave 'the way of the serpent upon a rock' without noting that its consummate movements without limbs illustrate one of the main methods of organic evolution — making apparent new things out of very old things. The elephant's trunk is a very long nose; the spider's spinnerets are transformed abdominal limbs, and so probably is the sting of a bee; the delicate chain of three links — hammer, anvil, and stirrup — which transmits vibrations from the drum of our ear to the essential organ of hearing which is deeply imbedded in bone was once part of the commonplace framework of the jaws. So the snake's locomotor apparatus, by which a nullipede becomes a multipede, what is it but a transformation of old-fashioned ribs?

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ECONOMICS, TRADE, AND FINANCE

MEXICO: A BRITISH VIEW

SOME time ago, describing the condition of Mexico, we said that unless her government succeeded in maintaining order to the extent she had failed to do in the recent past serious trouble was brewing for the Republic. Various reports are current of the murder of American citizens and British subjects, and the United States Government and our own are naturally demanding that full inquiries should be made regarding the truth of these reports, and if they prove to be true, the Mexican Government will be held responsible for failing to protect the lives of foreigners resident in its territory. Practically, there is not, and has not been for some years now, an effective government in Mexico. General Villa is very little better than a bandit, and exercises his authority over only a comparatively small area in the north-west of the Republic. President Carranza has really no effective control over the greater part of Mexico, although he affects to exercise jurisdiction over the greater part of the Republic. Until quite recently both Carranza and Villa, although they levied blackmail on the property of foreigners, derived their revenue from exploiting the railways and the mining enterprises, which for the most part are foreign owned. So far as the railways are concerned, Carranza in particular has derived the enormous revenue he enjoys from seizing the earnings of the lines, which are worked for the benefit of his government; but he pays nothing to the stockholders who own these lines. Both he and Villa have paid more respect to the rights of the mine

owners, otherwise the mines would not be worked at all, as neither of them has at his command competent engineers capable of working them. Above all, both Carranza and Villa have had the sense up to the present to respect at least the lives of foreigners; but apparently, the situation appears to have got beyond the control of both these chiefs. Carranza's position was difficult enough while Villa confined his activities to the western mountains; but since he has become more aggressive, during last winter, and in the spring of the present year, and particularly since he destroyed part of the main line from Mexico City, the president appears to have lost whatever little control he had over the greater part of Mexican territory.

Of course, the position, both of President Carranza and of General Villa, is exceedingly difficult, and unless Carranza could succeed in defeating Villa the difficulties which have apparently come about were inevitable. There is no proper government, and consequently no regular industry can be carried on in the Republic. A country between three and four times the size of France, with one of the finest climates in the world, and capable of growing everything, from European cereals to the rich products of the tropics, and with a highly fertile soil, is constantly on the verge of famine. Practically, the government, such as it is, lives by the robbery of foreigners. There is no constitution that is respected by anybody; no regular taxes are or can be levied; but the bandits of the two contending factions make raids from time to time, mainly on the property of foreigners,