that when the calking and concreting have been completed, there will be no question whatever as to its dryness and security.

SOME MECHANICAL ADAPTATIONS IN ANIMALS.

BY R. LYDEKKER.

Every one of the higher animals is in some way mechanically adapted to its mode of life and surroundings; a horse or an antelope being from one point of view a living galloping or trotting machine. Putting such examples on one side, there are numerous cases of more peculiar adaptations to which attention may be confined.

Taking climbing animals first, it may be noted that a number of species, such as Old World monkeys and squirrels, present no special modifications for a life in the trees, the essential being that they should have the power of rotating the forearm on the upper portion of the limb and that their toes should be mobile, and furnished with nails or claws.

There is, however, a group of African rodents, designated scaly-tailed squirrels, the members of which seem to have felt the necessity of additional aid for the purpose of tree-climbing. They have accordingly developed on the under surface of the tail certain structures which may be compared to the climbing-irons used by workmen. These take the form of a few transverse rows of large, triangular, horny scales, with their points directed backward. These scales, when pressed against the bark of a tree, must afford material aid in climbing. Another group of animals in which "climbing irons" have been developed is that of the scaly anteaters, or pangolins, of India and Asia—creatures which look more like living fir-cones than mammals. The scales—much larger than those of the scaly-tailed squirrels—cover both surfaces of the body, as well as the head and limbs, so that it can scarcely be supposed they have been developed for climbing. Indeed, only a few species climb; but these have found the assistance afforded by the scales on the under side of value in an ascent, and habitually make use of them as climbing-irons.

Quite a different type of climbing, or rather hanging, apparatus has been developed in the sloths of tropical America, which spend their time in the tree-tops, where they remain suspended back-downward by their hook-like claws. These claws, which may be three or two, have been modified from ordinary claws, and afford a striking instance of adaptation to an abnormal mode of life. The thumb of bats is likewise modified into a hood-like claw—also used for suspending purposes when the creatures hang head upward. Generally, however, bats suspend themselves head downward by the hind claws, grasping power being retained by the toes, so that the modification has not been carried to the same extent as in sloths, in which the claws act in a mechanical manner.

Certain bats appear to have found their hook-like thumbs and hind feet insufficient for suspension, and have made use of the sucker principle for this purpose. This mode of suspension has been developed independently in two distinct bats, one a native of Brazil and the other of Madagascar. In the Brazilian species the suckers take the form of stalked disks attached to the palms of the thumbs and the soles of the feet. The suckers of the Malagasy species are horseshoe-like. By means of the suckers these bats are able to ascend vertical surfaces. Very curious is it to note the similarity between the suckers of these bats and those on the arms of cuttle-fishes. The geckos which run up the walls and over the ceilings of houses in warm countries, afford another instance of the sucker principle. Bats are not the only mammals which have availed themselves of the sucker. In the Malay islands and the Philippines dwell large-eyed and slender-limbed little lemur-like creatures known as tarsiers, whose habits are nocturnal. In these weird little animals the tips of the toes are expanded into cushion-like disks, capable of acting as suckers, by means of which they ascend such smooth surfaces as the stems of bamboos.

Hoofed, or ungulate, mammals, such as sheep, pigs, camels, and elephants, have given up using their fore-limbs in a hand-like manner, and employ them solely for progression. Consequently, tree-climbing is out of their line. In Africa and Syria there occur, however, certain representatives of the order known as rock-rabbits, or hyrax, the Syrian species being the one referred to in the Bible as the coney (the old name of the rabbit). Certain African hyraxes have, however, taken to tree-climbing, and the way they manage it is this: In each foot the sole is somewhat cup-shaped, and by the aid of muscular action the center can be more elevated, so that when the edges are applied to the bark the foot acts like a sucker.

This sucker-like action in the feet of the tree-hyraxes is probably of recent origin, since it is certain that these animals have taken to an arboreal life at a late stage in their career. Enlisting the services of the tail to act as a fifth hand in climbing, is, on the other hand, in all probability a feature of great antiquity, seeing that it occurs in the American opossums, which are among the oldest of mammals. Doubtless, however, this development of grasping power in the tail has occurred independently in several groups. It is found not only in the American opossums, but also in their Australian cousins, which naturalists designate phalangers, and likewise in most South American monkeys, as well as in the tree-anteaters and tree-porcupines of America. In all these the extremity of the tail has a portion of its lower or upper surface naked, and marked by transverse ridges and grooves, which when applied to a bough by curling the tail-tip round it, give great grasping power. The fact that either the upper or the lower surface of the tip may be naked, implies the independent origin of the grasping power in different groups. Prehensile tails are more common among mammals inhabiting the forests of tropical America than anywhere else. The kinkajou, a relative of the raccoon, is a creature in which this feature is developed. So great is the grasping power of tails of this type that opossums and spider-monkeys when shot will remain suspended. In spider-monkeys the thumb has disappeared, although whether this is connected with the development of grasping power in the tail is not easy to decide. Probably there is no connection between the two features, the loss of the thumb being the commencement of the reduction of the hand to the hook-like organ of the sloths.

None of the animals mentioned above use their tails for any other purpose than grasping boughs, or, in the case of opossums, the caudal appendages of their parents. The Australian rat-kangaroos have, however, gone one better than this, for they employ their tails for carrying grass and other herbage for building their nests. Whether these prehensile tails are inherited from arboreal ancestors, may be a question, although they are probably a new development.

The trunk of the elephant, when contrasted with the tail of the kangaroo-rat, affords an example of the fertility in resource in animal development. In this case the specialization has proceeded farther than in the kangaroo-rat, so that the trunk is capable of serving many of the purposes of a hand. One of the most remarkable points connected with this organ is that it has been developed in the group of ungulate mammals which, as already mentioned, have abandoned the use of their fore limbs as hands, and become specialized for progression on the ground. The elephant's trunk (a development of the nose and upper lip) is therefore in one sense a confession of failure and consequently a sort of makeshift arrangement. By this I mean that in the elephant group the abolition of hands would not work, and consequently some other contrivance had to be invented to take their place.

One more instance and I have done. The antelopes and their kin are the descendants of short-limbed marsh-loving animals with large four-toed splay feet adapted to support them on yielding ground. Antelopes, on the other hand, are made for racing over hard, open plains, and their limbs are consequently long and slender, with the lateral pair of hoofs on each foot small and useless or wanting. Certain African antelopes, and more especially the situtunga of the equatorial lakes, have, however, gone back to the habits of their four-toed ancestors, and pass their time in the water or on the yielding mud of the great lakes. Now although there may be a reversion in the matter of habits, there is never any going back in nature as regards structure, and consequently the rudimentary lateral toes in these water-antelopes could not be restored to their original size. Nature is, however, resourceful, and the way in which she has managed matters in this instance is by elongating the two main hoofs, thereby giving to the situtunga a power of sustaining itself on yielding ground to as great an extent as was the case with its many-toed forerunner.

THE WATER SUPPLY OF THE UNITED STATES.

Water is by far the most important among the vast natural resources of the United States; and with the growth of cities and towns, and the advance in sanitary science, its importance is becoming more strongly emphasized each year. While large cities spend scores of millions of dollars to secure a supply of pure water, millions of acres of arid land offer agricultural possibilities provided irrigation can reach them. The rapid settling of the country adds to the problem; for while it calls for additional supply, it at the same time contaminates surface waters. The pioneer may drink from the nearest stream; the town dweller must be chary of his own well. Like other natural supplies, water has suffered in the past—and is still suffering—from neglect and waste. The consequences of deforestation—the spring floods and changing river beds; here scoured and there silted—are well known. When a well is tapped, it is at once declared "inexhaustible." In answer to this, the ground-water level in northern Indiana has fallen ten feet in ten years.

Water is a vital necessity, but it is also of great economic value. Water power for the generation of energy, water depth for the navigation of our rivers and canals, the transportation of water for irrigation purposes, are problems in which vast capital and much labor are invested. Many large projects calling for the use of water have been doomed to failure, owing to the fact that plans were made and work undertaken without sufficient knowledge of the conditions governing the supply.

The investigation of water supply is too broad a problem for State handling. Many streams traverse more than one State, and the needs of one may be the handicap of another. The United States Geological Survey has therefore been commissioned to undertake the work. Special appropriations have been made by Congress, and for several years systematic records have been made of river flow, with the view of ultimately determining all the important features governing the flow of the principal streams of the country. The more important streams are being first measured; stations are established on them, and maintained for a period long enough to insure adequate average records. When sufficient data have been obtained, the work is discontinued at that point, and transferred to some other stream. During 1906 flow was studied at about 700 stations, distributed along the principal rivers throughout the United States. In addition to these records, data in regard to precipitation, evaporation, water power, and river profiles were obtained in many parts of the country.

Correct measurement of surface river flow calls for a skilled collecting of data, and much after-calculation. But it is straightforward work when properly undertaken. In the case of underground supplies of water, the problem is complicated by the difficulty of obtaining complete data. Until the folding and faulting of geologic horizons are more fully known than they are at present, it will not be possible to make the fullest or most economical use of underground water supplies. It is unfortunate that while many deep borings have been made, samples of the cuttings have been carelessly preserved or labeled, or even destroyed. In some of the Western States, where the rainfall is slight, future prosperity depends on the tapping or transportation of water. In many cases an adequate supply is stored under foot, waiting to be tapped. If the geologic horizons were fully mapped, it would be possible to indicate the exact spot for borings, to obtain the maximum flow of water. Under present chance methods of boring, some wells gush out and send millions of gallons of water to waste; others flow feebly or cease altogether. Sometimes a well is sunk which robs some other well of its flow, and in some districts of artesian wells the water level is gradually falling.

Many eastern and southern sections of the country are to-day suffering from ignorant tampering with water or water-collecting areas in past years, and a similar carelessness in the West of to-day might lead to similar trouble there in the future. It is well that the seriousness of the question is fully understood at headquarters, and is being gradually appreciated throughout the country. With wider knowledge comes a hope that this greatest of our natural resources will be developed in a broad-minded, conservative manner.

THE CURRENT SUPPLEMENT.

The current Supplement, No. 1659, presents an unusual number of practical and useful articles. In the first place, we must mention Bradley Stoughton's excellent contribution on the Modern American Blast Furnace, in which the practical aspects of smelting are considered. The value of original research to applied science and engineering forms the subject of a brief paper. Mr. Henry C. Ter Meer writes on a method of constructing a modified electrical meter bridge, which is of such design that it can be made by anyone possessing a little mechanical skill, and at a cost which should not exceed five dollars. Mr. J. H. Morrison's paper on the development of armored war vessels passes to an eighth installment. "How Monazite is Mined" is the title of an article which should appeal to every householder, inasmuch as the mineral enters so largely into the composition of Welsbach and other forms of incandescent gas mantles. E. Ramakers contributes a copiously illustrated article on the laying of the Pupin telephone cable under Lake Constance in Switzerland. Felix Singer writes on aluminium coils, and prophesies for them an important future. The work of Berthelot, Mendeléeff, and Moissan is excellently reviewed. Dr. H. Liepmann, in an article on the left hemisphere of the brain, tells much that is new about the influence of the brain on the use of the arms and hands. Charles F. Holder tells how marine animals, such as starfishes, are photographed in their native element. The discus thrower of Castel Porziano, one of the famous statues of the Greek sculptor Myron, has probably been incorrectly restored, if we may judge by some fragments of an ancient marble copy which were discovered in July, 1906. The probable appearance of the discus thrower is depicted and described.