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AQUATIC ENGINEERS.

Perhaps nothing strikes the earnest and reverent student of natural history more thoughtfully than the special adaptations of certain creatures to distinct habits of life. They are so numerous that his studies are beset by them at every step. To him it is overwhelming proof of creational wisdom and goodness, for by this specialization animal structures attain the highest degree of mechanism, and brute intelligence soars to its loftiest flights.

The beaver offers us such an example of mental and animal adaptation as we here speak of, and in it the principle is perhaps more interestingly developed, on account of the evident manner in which its application varies in degree, according as circumstances may require.

The habits of the European and the American species differ in some degree. The former do not habitually build the famous dams and huts, which the latter are so well known for, and in the construction of which they show such a degree of ingenuity and sagacity that we have not hesitated to call them "Aquatic Engineers."

Formerly the European beaver was most abundant, and had a very extensive geographical distribution. Its decrease in numbers and extinction in localities appear to be in proportion to the spread of population and the development of civilization. The beaver loves solitary rivers and streams. As man becomes civilized he requires those rivers to sail his vessels upon, and their currents to turn his mills with. The beaver, therefore, must retire.

The American beaver is now enjoying a fine time of it. It is now rarely found east of the Missouri river; although it once ranged from the most easterly to the most westerly point of the American continent, and in the other direction from Labrador to New Mexico. No other American animal has suffered so much from the hands of the hunter and trapper as the beaver. Some of our readers may remember the time when "beaver hats" were all the rage. This was in the days before "silk" hats were thought of. European fashion affected that style of hat, and the beaver was hunted down to satisfy it. The Hudson Bay Company then imported no fewer than eighty thousand beaver skins in a year into Great Britain alone! The ease with which the fur could be felted was their chief recommendation. But the introduction of "silk" hats came most opportunely for the American beaver, otherwise it would by this time have been hunted to utter extinction. The consequence is that beaver-trapping, to which many men devoted themselves more than a quarter of a century ago, no longer pays, and is practically given up. The beavers, like all other rodents, are animals which multiply very rapidly, and so we find they are fast taking up their old positions on the lakes, rivers, and creeks of North America, where quiet and solitude still reign supreme.

Our readers have doubtless heard of the rapidity with which beavers can cut down trees. Before speaking as to the reason for this, it will be worth our while to note the peculiar structure of the tools with which the beaver works. These are its teeth. The two incisors, or "cutting teeth," in the upper and lower jaws, are very largely developed. The teeth

which are usually placed next to them in other animals (the "canines") are absent; so that we can see how arrangements are thus made for the enormous growth of the incisor teeth. These are long and curved, and are only covered with hard enamel in front, the sides and hinder parts being unprotected. It follows, therefore, that the hinder part wears away soonest, and thus a sharp chisel-like edge is always kept on the front enamelled portion. These chisel-shaped incisor teeth are supplied with persistent pulps, so that they grow during the whole life of the beaver, and it thus becomes imperatively necessary that it shall gnaw in order to prevent the growth from being a nuisance and evil. This is one reason why rats and mice gnaw so much, and not because they are always seeking food. The manner in which the lower jaw is jointed on to the skull, so as to allow the to-and-fro movement we call gnawing or nibbling, is peculiar to the rodents as an order. In the carnivorous animals the movement is up and down, like that of a pair of scissors, and is especially adapted for cutting. In the herbivorous animals generally it is sidewise, or has a rolling, mill kind of motion, as in oxen and sheep. In the beaver family it is the motion

house. The smallest and simplest are six or seven feet high, round in plan, and about three feet in diameter. Such a one would hold from three to five tenants. Others are larger, and are in fact a sort of beaver barracks. If possible all have dykes or moats running round them, filled with water; for beavers are poor travellers on land, and always prefer taking to the water if possible. The huts or barracks are double-roomed, the upper being dry, and the lower communicating with the water both by the means of admission and exit. The walls of the house are built first of boughs and twigs, filled in with pebbles, and compacted with mud. They are so strong that the powerful claws of the wolverine (one of the beaver's sworn foes) cannot tear them down. As soon as an enemy attacks the dwelling, the inmates quietly retreat by their aquatic chamber, and so escape. Not unfrequently as many as two or three hundred beavers will associate in one colony, so that the river banks form a lively scene. These all combine to construct the dam which arrests the flow of the river or stream. If the current of this be slow and weak, the dam thrown across will be carried in a straight line. Here it is that the engineering instincts of the beaver are most remarkably exhibited.

and the work, although done entirely by night, increases with a rapidity which seems quite to have astonished all actual observers. In order to cut down the numerous trees and boughs to be used in these architectural and engineering operations, the chisel-shaped teeth are brought into use. The beaver sits on its hindquarters, and gnaws at the tree at the level of its own head. It gnaws the trunk all round, much after the fashion with which a woodcutter attacks at a tree he wishes to fall. Like the woodcutter, also, the beaver works most on the side it wishes the tree to fall towards. As soon as the tree is down, assistance is rendered by its companions in cutting off the boughs, or in carrying the tree away piecemeal to be used for the engineering purposes above mentioned.

The wonder is to find such ingenuity exercised for so small a purpose. The dams thus erected last for years, and not unfrequently the wood of which they are largely composed sprouts, so that a fringe of living vegetation marks its position. The houses or huts are annually repaired for winter use, so that the principle of economy of labor is also studied by these patient and harmless little animals. One hardly knows which most to admire—the Almighty goodness which works in them and by them, or the perfection in which that wisdom adapts otherwise feebly-organized animals to such special conditions of life!—*Christian Weekly.*



THE AMERICAN BEAVER.

we give to a rasp or a file when we are using it. The muscles attaching and working the jaws have to be fixed in different positions, according as the above movements are required.

A good deal has yet to be written about the tails of animals. Undoubtedly the old notion that the beaver used its horizontally-flattened tail, (denuded of hair like that of a rat), as a sort of trowel, is not true to the extent it was once imagined. But there seems no reason to question that the tail is used to give the last finishing stroke to the mud which plasters over the erection of twigs and stones and mud which build up the walls of its lodge or hut.

The beavers prove themselves to be aquatic engineers most in the way in which they construct the dam or weir across the streams they frequent. During the summer even the American beavers lead solitary lives—we see nothing of dam-building or hut-making at that time. But just before the leaves begin to fall is their "busy time." These animals then collect in numbers, and combine to form their winter colony of huts. These are of various sizes, according to the number of tenants they are to

A straight dam is the weakest, from a mechanical point of view, and this kind is only used in shallow or weak currents, where no other kind is required. But in rivers where the currents are powerful, such an obstacle would be carried away immediately. Under such circumstances, therefore, we find the beaver erecting one of a bow-shape, with the convex side towards the current. This is the strongest plan that could be devised, and little or no additional materials are required. The beavers are not only well aware of this, but we find that the corner curvature of their dam varies in proportion to the strength of the current it is opposed to.

In the construction of this dam, also, considerable engineering instinct is shown. The reader has seen a sea-wall, thickest at the base and thinnest at the top. This is the principle adopted by beavers. The thickness of the dam varies from a diameter of twelve feet at the bottom to two feet at the top. It is first all planned with rough logs; then come boughs of trees, stones, and mud. The latter is carried in the forepaws of the animals, handfuls at a time. Their industry is truly marvellous;

"THERE'S DUST ON YOUR GLASSES."

I don't often put on glasses to examine Katy's work; but one morning not long since I did so upon entering a room she had been sweeping. "Did you forget to open the windows when you swept, Katy?" I enquired; "this room is very dusty." "I think there is dust on your eye glasses, ma'am," she said modestly. And sure enough the eye glasses were at fault, and not Katy. I rubbed them off and everything looked bright and clean, the carpet like new, and Katy's face said,—"I'm glad it was the glasses and not me this time. This has taught me a good lesson, I said to myself upon leaving the room, and one I shall remember through life."

That evening Katy came to me with some kitchen trouble. The cook had done so and so, and she had said so and so. When her story was finished, I said smiling: "There is dust on your glasses Katy, rub them off, you will see better." She understood me and left the room.

I told the incident to the children and it is quite common to hear them say to each other, "Oh there's dust on your glasses." Sometimes I am referred to, "Mamma, Harry has dust on his glasses; can't he rub them off?"

When I hear a person criticising another, condemning perhaps a course of action he knows nothing about, drawing inferences prejudicial to the person or persons, I think right away "there's dust on your glasses, rub it off." The truth is, everybody wears these very same glasses, only the dust is a little thicker on some than others and needs harder rubbing to get it off.

I said this to John one day, some little matter coming up, that called forth the remark: "There are some people I wish would begin to rub, then," said he. "There is Mr. So and So and Mrs. So and So, they are always ready to pick at some one, to slur, to hint, I don't know, I don't like them." "I think my son John has a wee bit on his glasses just now," he laughed and asked, "What is a body to do?" "Keep your own well rubbed up, and you will not know whether others need it or not," "I will," he replied. I think as a family we are all profiting by that little incident, and through life will never forget the meaning of—"There is dust on your glasses."—*Maud Manning, in N. Y. Observer.*

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