in this soil, with parts of the limbs still attached. The trunk of the tree, of which we present a section, with portions of the limbs adhering, is flattened and almost turned to lignite by pressure and lapse of time. But what is still more interesting are the cones or fruit which the tree bore. These cones are about an inch in length and somewhat resemble those of a species of conifer, different, however, from any known species. We place before you other remains of this ancient vegetation."

Judge Holmes, in commenting upon the specimens, stated that marine deposits had been found in a peculiar stratum which was supposed by geologists to extend as far south as the mouth of the Ohio River, and that the tusks referred to in the paper would be a valuable discovery if they proved to be those of a walrus.—*Globe Democrat*.

[AMERICAN JOURNAL OF SCIENCE.]

RESTORATION OF BRONTOSAURUS

By Professor O. C. MARSH.

NEARLY all the bones here represented belonged to a single individual, which, when alive, was nearly or quite fifty feet in length. The position here given was mainly determined by a careful adjustment of these remains. That the animal at times assumed a more erect position than here represented is probable, but locomotion on the posterior limbs alone was hardly possible.

The head was remarkably small. The neck was long, and, considering its proportions, flexible, and was the lightest portion of the vertebral column. The body was quite short, and the abdominal cavity of moderate size. The legs and feet were massive and the bones all solid. The feet were plantigrade, and each footprint must have been about a square yard in extent. The tail was large, and nearly all the bones solid.

The diminutive head will first attract attention, as it is smaller in proportion to the body than in any vertebrate hitherto known. The entire skull is less in diameter or actual weight than the fourth or fifth cervical vertebra.

A careful estimate of the size of *Brontosaurus*, as here restored, shows that when living the animal must have weighed more than twenty tons. The very small head and brain, and slender neural cord, indicate a stupid, slow moving reptile. The beast was wholly without offensive or defensive weapons, or dermal armature.

In habits, *Brontosaurus* was more or less amphibious, and its food was probably aquatic plants or other succulent vegetation. The remains are usually found in localities where the animals had evidently become mired.

bones were found in position and the other bones at the base of the skull were undisturbed, a careful search was made for the stapes, but no indication of it was found. Its absence in this specimen, so well preserved, would indicate that it was wanting in this genus if not in the other Sauropoda.

COLUMELLA PRESENT.

In a skull of *Brontosaurus* in which the bones, although displaced, were in very perfect preservation, a pair of bones were found which apparently are the columellæ. They are elongated, flattened bones, with the shaft somewhat constricted in the middle, and twisted. Their length corresponds to the elevated posterior part of the skull in this genus.

HYOID BONES.

There are two pairs of hyoid bones in the Sauropoda. They are elongated, rodlike, and somewhat curved. In *Brontosaurus excelsus*, they are 210 and 130 mm. in length respectively.

Among the other points of interest in the skull of the *Sauropoda* are the following:

The parietal bones are very short, and form but a small portion of the brain case. They are composed chiefly of the flattened arched processes, which meet with the squamosals at their outer ends. There is no parietal foramen. The squamosals lie upon the par-occipital processes. They have a short deep groove for the reception of the post-frontal. On their lower part, which descends in front of the par-occipital process, they expand into a thin, spoon-shaped form, which fits over the head of the quadrate. The quadrate has an oval, rounded head, and slender shaft. Below, it is firmly united to the pterygoids. On the outer side, the quadrato-jugals are attached. These bones are elongate, and slightly sigmoid in shape. The lower end is rodlike, and curved forward, descending below the articular surface of the quadrate. The pterygoids are tri-radiate bones, with the posterior ends cup-shaped, resembling the partially closed human hand. This cavity, somewhat restricted by a thumb-like process, receives the basi-ptyergoid process.

THE VERTEBRÆ.

There are twenty-seven precaudal vertebræ in *Brontosaurus*, of which the first twelve bear pleurapophyses, or hatchet bones, united to the centra, and may hence be called true cervicals. Of the remaining twelve which bear free ribs, the thirteenth, fourteenth, and fifteenth have the surface for the articulation of the head of the rib on the centrum, below the neural suture.

All the precaudal vertebræ have large cavities in the cen-

ORDER SAUROPODA. Herbivorous.

Feet plantigrade, ungulate; five digits in manus and pes; second row of carpal and tarsal bones unossified. Pubes projecting in front, and united distally by cartilage; no post-pubis. Fore and hind limbs nearly equal; limb bones solid. Sternal bones parial. Premaxillary bones with teeth. Precaudal vertebræ hollow. Each sacral vertebra supports its own transverse processes.

Family *Atlantosauridae*. Anterior vertebræ opisthocælian. Ischia directed downward, with extremities meeting on median line. Anterior caudals with lateral cavities. A pituitary canal.

Family *Morosauridae*. Anterior vertebræ opisthocælian. Ischia directed backward, with sides meeting on median line. Anterior caudals solid. Pituitary fossa only.

Yale College, New Haven, July 12, 1883.

THE MUSK CATTLE OF AMERICA.

By Dr. G. A. STOCKWELL.

DURING the earlier days of our continent, and just prior to the "drift period," the plains and valleys of that which is now the central portion of the United States nourished considerable herds of dwarfed cattle, clothed in long, hairy fleece—the *Bos bombrifrons* and *Bos latriformis*, described by Leidy. Possibly, also, the remains of oxen found in upper Siberia and the Lachoo Island may have been of the same or a kindred race, as well as the *Bos pullasii* of De Kay; while the fossil relics of Eschscholtz Bay, Greenland, and the valley of Treetholt River, of Alaska, are almost identical with an existing form. To-day, however, the Old World exhibits no representatives of the race, while in the New the immediate descendants, if such they are, are confined to the extreme and most dreary portions of North America, and to a range that is gradually becoming more and more restricted in its southern and western limits.

Evidences are not wanting that musk oxen ranged at a comparatively recent date far into the borders of the wooded belt, descending as low as the southern shores of Hudson's Bay, to the west reaching the valley of the Yukon and sterile shores of West Georgia, Alaska, non-fossilized remains being frequently brought to light. Scarce a century since, Samuel Hearne observed their fresh tracks within two miles of Prince of Wales Fort, now Churchill House, and every autumn brought hundreds about the north shores of Athabasca Lake; but now many a weary mile must be traversed from either point ere a single individual of the species is encountered, few descending below latitude 65° N. Indeed, the limits of the race are almost exclusively those of

RESTORATION OF BRONTOSAURUS EXCELSUS, MARSH. (One-eightieth natural size.)

Among the new points in the skull of the Sauropoda recently determined, are the following:

PITUITARY FOSSA.

In *Morosaurus*, the pituitary fossa is comparatively shallow, much like that in the crocodile and many birds, being connected with the under surface of the skull by the two usual divergent foramina for the passage of the internal carotid arteries. In *Apatosaurus*, however, it is remarkably different. Here the fossa becomes enlarged into a vertical canal, which, expanding below, communicates by a wide transverse orifice with the pharyngeal cavity. The arterial foramina are here canals thinly covered over with bone, and open just within the rim of the lower orifice. The pituitary cavity itself has a firm, smooth wall throughout. The openings are both transverse, and oval in shape. The upper one is eighteen by six millimeters in its diameters; the lower opening thirty by twelve.

This remarkable connection of the cerebral cavity with the alimentary canal is an embryonic character, and corresponds to the condition observed in the chick at the fifth day of incubation. This peculiar feature appears to be a family character of the *Atlantosauridae*.

POST-OCCIPITAL BONES.

In two genera of the *Sauropoda* (*Morosaurus* and *Brontosaurus*), and probably in all members of this order, there is a pair of small bones connected with the skull which have not hitherto been observed in any vertebrates. These bones, which may be called the *post-occipital* bones, were found in position in one specimen, and with the skull in several others. When in place, they are attached to the occiput just above the foramen magnum, and extend backward and outward, overlapping the lateral pieces of the atlas, thus protecting the spinal cord at this point, which would otherwise be much exposed.

These bones are short, flattened, and slightly curved, resembling somewhat a riblet. The anterior end is thickened and rugose for an attachment to a roughened surface on the exoccipital just above and outside the foramen magnum. The shaft is flattened from above downward, and gradually converges to a thin posterior end. In *Morosaurus grandis*, these bones are about 65 mm. in length, and 30 along the surface which joins the occiput. They correspond in position to the muscle in mammals known as the *rectus capitis posterior minor*.

In the existing Cormorants (*Graculus*) a single slender bone is articulated to the occiput on the median line. This, however, does not correspond to the bones here described. To distinguish it from the post-occipitals, it may be called the *nuchal* bone.

STAPES WANTING.

In the skull of *Morosaurus* in which the post-occipital

trum, communicating exteriorly with the surface by means of large lateral foramina. This cavernous structure of the vertebræ gradually decreases posteriorly, until in the anterior caudal vertebræ it is confined to a small pocket above the transverse process. The neural arches of the presacral vertebræ contain numerous deep cavities. The pleurapophyses of the cervical vertebræ are also reticulate in their structure, and some of the anterior ribs have small but deep fossæ below the tubercle.

POST-METAPOPHYSES.

On the last two or three cervical vertebræ of *Brontosaurus* there is a convoluted ridge of bone over the posterior zygapophyses. In the anterior dorsals, this ridge becomes stronger and more elongated, forming a distinct protuberance. These processes have not hitherto been described. As they are analogous to the processes in mammals known as metapophyses, they may bear the same general name, being distinguished as the post-metapophyses. The term pre-metapophyses should then be applied to the processes in mammals.

The post metapophyses probably serve for the attachment of ligaments in the place of the neural spine, which is here wholly wanting.—These processes, which are at first oblique in position, gradually become more vertical and stouter, and, coalescing at their bases, finally become united throughout, and are thus converted into the neural spine.

FETAL DINOSAURUS.

Remains of a very small dinosaur were found in immediate relation with the type specimen of *Morosaurus grandis*. These remains, which consist of a complete femur, the larger portion of both humeri, and several vertebræ, show no essential differences from the large specimens except in size, and indicate an animal of perhaps seven feet in length, and little more than two feet in height. The imperfect ossification of these bones indicates that the animal was very young, and it seems probable that it was fetal. The only other similar case known in the *Dinosauria* is the apparent embryo observed by the writer in *Compsognathus*.

CLASSIFICATION.

The various genera of the *Sauropoda*, and in fact of the *Dinosauria* in general, cannot at present be distinguished by the detached teeth. In one form, however, the teeth are quite peculiar and the dentition appears to offer generic characters. The maxillary teeth of this form have been referred to *Stegosaurus*, as they were first found in connection with the remains of that genus. Later investigations indicate that they belong to the *Sauropoda*, and there is some evidence that they are the teeth of *Diplodocus*.

The main characters of the order *Sauropoda*, and of the two families now known to belong to it, are as follows:

the Barren Grounds—that practically treeless and barren waste that stretches from Great Slave and Bear Lakes, east to the extreme verge of Melville Peninsula, and north to the shores of the Polar Sea, embracing its bewildering maze of islands.

On the hither side of the Atlantic we are accustomed to speak of the animals as *oxen*, out of deference to certain osteological characteristics, merely adding the prefix of *musk* as a specific indication, bestowed in consequence of the effluvia always given off by all members of the race, old and young, male or female, though most marked in summer, particularly with old bulls in August, which is the wooing season. Our insular brethren, the English sportsmen more particularly, insists upon the title of *musk sheep*, basing upon certain characteristics of the hair with which they are clothed, a faint ovine contour of head and horns, the small round extremity like that of the sheep or hare, and the modest stature, which is more than exceeded by the famous Kyle kine, or dwarfed Highland cattle. The horns, however, are smooth and round, lacking the three-cornered, wrinkled appearance and peculiar symmetrical curve of the ram, while the nose and muzzle, the flat forehead, the peculiar character of hoof, and general anatomical outlines are unmistakably bovine. Nevertheless, the similarities, especially under cursory inspection, are sufficiently marked to lead to many curious and interesting muddles, more particularly as science has assumed a middle or neutral position and denominates it the *musk sheep-ox*—*Oribos moschatrus*.

Taking all circumstances into consideration, including habits, form, and range, the musk-ox is a somewhat remarkable as well as anomalous animal. Imagine, if possible, a creature scarce five feet long from tip of its outstretched nose to the root of tail, but a yard high, or, at most, three feet six at the withers, and weighing but four or five hundred pounds when in prime condition; a small body set low on its legs and appearing considerably larger than it really is in consequence of its heavy fleece of hair that on the neck, brisket, flanks, and under parts attains a length of half a yard, hanging considerably below the knee; a pair of small, intensely wicked blue eyes, set well forward; a soft, downy muzzle, with two enormous nostrils that seem almost blended into one; pointed ears, three inches long and of equal breadth in their middle, but nearly hidden by the surrounding hair; trim, deer-like legs, set in hoofs of prodigious size, and a pair of huge horns falling down on each side of the head with a forward curvature; imagine all this, and you have a faint perception of the *tout ensemble*.

The most astonishing features, perhaps, are the horns, hoofs, and fleece, the first and last having no parallels among existing forms of life. The horns of an old male are ponderous affairs, weighing perhaps fifty pounds, joined at their bases, where they have a circumference of two feet, then fall over the sides of the head with an outward ten-

dency and slight forward curve, tapering rapidly, and suddenly turn up in hard black pointed tips an inch or two above the level of the eye; yet their measurements along the curve are not in excess of their diameter at the center of the fine head. Those of the cow, however, are considerably smaller, are nine inches in circumference at the base, and nine inches apart, springing directly from the angle of the frontal bone, and measure but a foot or fourteen inches along the curve, and the polished points, instead of turning up, are projected forward in a horizontal line just below the level of the eye.

The hoofs are so exactly like those of the Barren Ground caribou or northern reindeer, as to require an expert hunter to distinguish the tracks of the one from the other, though it is claimed for those of the deer that they are a trifle narrower and more pointed. The frog of the hoof is soft and exceedingly elastic, and, moreover, well padded with the long hair that hangs down about the fetlock, and grows even between the divisions of the hoof. The divisions, too, are widely separated, even up into the pastern, allowing great lateral spread, and the external half is longer, more pointed, and overlaps and curves about its fellow when the foot is at rest. The lateral hoofs, which in domestic cattle are merely rudimentary, and serve no apparent purpose, are enormously prolonged, with an outward and backward inclination in order to reach the ground, and consequently afford a greater bearing surface to each foot—a wise provision of nature that enables the creature to traverse the vast morasses and swamps of its habitat in summer, or move lightly over deep snows in winter. The edges of the hoofs, too, are extremely sharp and clean cut, permitting the wearer to race at full speed over ice or frozen snow, traverse broken ground, or to scale considerable heights with all the ease and agility of the goat; they also constitute powerful weapons for offence or defense.

The tail, which is scarce more than four inches long, and formed like that of the bear, is so hidden by the hair of the surrounding parts as to be practically invisible, and long was supposed to be entirely wanting. Mr. Ellis, in the published account of his voyages to Hudson's Bay, nearly two centuries ago, asserts that the Innuits ("Eskimo," he calls them) made of the tails of musk oxen peculiar ugly caps, the long hairs of which fall to the breast and shoulders, shrouding the face, and which were worn as a protection against mosquitoes. He must have fallen into an error, however, since the hairs on the tail are but about three inches in length, and the "mosquito wigs," Hearne informs us, are constructed from the long, coarse hairs of the brisket or flanks.

The fleece consists of two coats, the long, coarse hair of the coat proper, and a finer one beneath, very close, compact, and woolly in character, in midwinter having almost the consistency of felt. It is this thick undercoat that enables its wearer to withstand the rigors of an extreme Arctic winter, even in the highest latitudes, and which has been seized upon as a pretext for denominating the animal a *sheep* rather than *ox*. The prevailing impression is that "wool" is confined to sheep, but experience proves that with but very few mammals the external covering is a variable mixture of hair and wool. Of the two extremes of hair, one is rigid, shining, coarse, and well fixed, constituting the "jarre" of manufacturers, and which exists nearly alone in the ordinary conditions of the horse and ox. The other hair, or down, hidden under the first, and developed by removal to higher latitudes, or by marked attention to breeding, is distinguished by being more curled and tangled, and more dull than "jarre," as well as much finer; and this is the "wool" which exists nearly alone in the Merino sheep and Cashmere goat, and greatly preferred by manufacturers not only because of its fineness and tendency to curl, but also because it bristles with little scaly asperities (due to its mode of development) which render it more adapted for felting and transformation into tissues. Under such circumstances "wool" cannot be held indicative of race or family, but of breeding, and of a wise provision of nature to enable her creatures to secure and retain latent animal heat as it may be required for comfort and existence. And this is its purpose with the musk ox; and, having served that purpose, becomes loosened in the spring and drops out, being aided by the frequent rollings and scrapings the animal indulges in, until by midsummer only the long "jarre" remains. The season is so short, however, that the new fleece quickly appears, and grows so rapidly that by the time winter again appears the wearer is fully prepared to encounter it.

Musk ox "wool" is of a light gray color, and of such exceeding fineness and delicacy of texture as to have excited the admiration of all who have beheld it; and it is claimed that could it be obtained in sufficient quantities, it would quickly replace the product of the silk worm in all the finer manufactures. The dreary, inhospitable, and almost inaccessible solitudes inhabited by the animal, however, effectually precludes such a possibility, though on several occasions articles of clothing have been made of it, though produced as objects of curiosity rather than for any commercial purpose. Something like a century and a half since, an enterprising Frenchman, one M. Jeremie, caused some of this fleece to be woven into a pair of hose which were presented to one of the mistresses of the King of France, and which not only commanded the admiration of all who beheld them, but excited the cupidity and jealousy of all the high born dames at court, even to the queen herself.

Though considerable numbers of musk oxen winter in extreme latitudes, both on the mainland and the islands of the Arctic Sea, a portion, at least, more particularly those of the eastern extremities of the Barren Grounds, become migratory with autumn, moving toward the west and south, where they linger until the advent of spring, when they retrace their steps, feeding slowly, and keeping pace with the rapidly springing vegetation. These migrations, too, are irregular—more general during certain years than others, at times amounting to virtual depopulation, but without seeming relation to severities of season or climate. They are more apt to occur after an unfortuitous summer, if the testimony of native tribes may be taken, and hence it may be presumed they depend solely upon food supply. At times they appear in overwhelming numbers in the vicinity of Wager Bay, Chesterfield Inlet, the Coppermine, and Great Bear and Slave Lakes, until the landscapes are fairly black with moving herds, while on other occasions, though present, they are remarkable only for the infrequency with which they are encountered.

Commonly the shores from Wager to Repulse Bay are well inhabited throughout the year, and Chas. Francis Hall remarks the frequency with which he met them to the northward of Repulse Bay, along with other forms of game peculiar to the region, especially during the winter he visited King Williams' Land and the shores of the Gulf of Boothia. Both going and returning, there was no lack, his note book chronicling the killing of ninety musk oxen alone,

and causing him to give expression to the following: "Oh, would that I could have met Crozier and his party twenty-one years ago with the facilities I have had on this journey! I am sure I could have saved the whole company. I say it with no egotistical feeling, but with a confidence of what I know of the country."

Even in the smaller islands of the polar archipelago, musk oxen are not necessarily absent even in summer, since they are powerful swimmers, and so much at home in the water that considerable stretches of sea do not impede their progress. They have several times been encountered in Greenland, in spite of the general assertions and popular belief that they are unknown to the island; and they visit, if they are not constant inhabitants, Cumberland, Cockburn, and North Devon Islands, and even Grinnell's Land. Sir John Franklin, in assuring us of their intrepidity in taking to water, and their almost unexampled natatory powers, relates the killing of one on an island miles away from any other land, and which, during an examination and careful exploration the day before, revealed no form of animal life greater than Arctic foxes and hares; and the damp condition of the fleece of the ox was of itself sufficient evidence of the journey it had performed.

There is no doubt concerning the excessive hardihood of a race that inhabits so bleak and inhospitable a region, and even here evinces a preference for stony and rocky grounds almost barren of vegetation; and consequently the sustenance usually obtained must be of the most simple and primitive character, and limited chiefly to lichens and mosses. Hearne declares they have a fondness for grasses, preferring to any other form of food, but that they also browse largely on the branches of such trees as they may encounter within their reach. The contents of stomachs examined also reveal the remains of bark, twigs, and leaves of dwarfed firs, willows, and birches, such as grow in the immediate vicinity of the numerous water courses in the Barren Grounds, beside the reindeer moss (*Cladonia rangiferina*) and the *tripe de roche* (genus *Gyrophora*). In certain localities, too, they have been observed feeding upon Labrador tea plants (*Ledum palustre*) and also the black-crow berry (*Empetrum nigrum*), which grows even more abundantly in the wastes of the far north than on the sterile hills of New Hampshire. But in winter their food must consist largely of the caribou or reindeer moss, and such lichens as may be uncovered from beneath the snow with the aid of the sharp hoofs; and the animal is possessed of such unerring instinct or smell that such a thing as failure is unknown. Apropos of the *Cladonia rangiferina*, and more especially the *tripe de roche* which figures so largely in the annals of Franklin, Richardson, and Back, and upon which they sustained life for days at a time, it may be mentioned that they are very rich in alcohol—another convincing argument that alcohol is far more of a food than ultra reformers are willing to admit.

As with most ruminating creatures, musk oxen are naturally and essentially gregarious; more so perhaps in winter than in summer, in order to obtain the full advantage of mutual warmth. Herds of various size are encountered, from those of three and four or half a dozen individuals up to eighty, one hundred, and more, and each gathered under the direction and immediate leadership of some patriarchal bull who has won the distinction at point of horn and hoof in many a fiercely contested battle; and this leadership is retained through life, or until overpowered and driven forth from the herd by some agile and active rival. These old chieftains are often of considerable age, as evinced by the character of their horns, the wrinkled eyelids, deep set sockets, prolonged hoofs, and general grizzled appearance. With them "might is right," and, in consequence, the number of bulls is very few in proportion to cows in the herd, and in the largest rarely exceeds three or four; while the number of males found each year, more especially in autumn, by trappers and hunters, gored and trampled to death by their fellows, or so maimed as to have fallen a prey to the fierce gray wolf of the North, proves that their love jousts and tournaments are no common affairs, but conducted with a fierceness and bitterness of spirit that ends only with complete annihilation. Again, during the rutting season, the old leader of a harem is so insufferably jealous of his mistresses that he can scarce allow himself time to feed in his watchfulness, and flies at every living thing that ventures to approach, even running after and bellowing fiercely at foxes or ravenous birds of prey that may chance to alight in the vicinity. And in spite of his diminished form and appearance, he is no despicable foe for even man to encounter at this season, quickly assuming the offensive, and charging with a fierceness and wickedness indicative of his purpose if opportunity favors. Fortunately, however, in spite of certain natural agility, he is much more adroit in a rush than otherwise, and cannot bring up with the agility essential to a quick wheel or turn, and may be easily avoided by nimbly stepping to one side; and once out of his range of vision, he quickly forgets his rage, often apparently forgetting the *causa belli* the moment he has plunged by in headlong career; the peculiar set of the eyes, too, which allow of but limited range, renders it a matter of little difficulty to avoid his glances.

The cow brings forth but a single calf, either during the last of May or first weeks of June. She separates from the herd prior to her accouchement, and remains absent for four or five weeks, hiding her offspring in some quiet retreat, and watching over it with constant solicitude lest it should be discovered by wolves or males of her own race. She is very fierce, too, now, exhibiting a disposition akin to that of her amorous lord, with the advantage of being quicker on foot, and using hoofs and horns with equal dexterity. A cow has been known to put to flight a pack of a dozen wolves, though not until half their number strewed the ground as trophies to her courage and prowess. During these weeks of solitude, her calf is but a helpless and weakly thing, all head, muzzle, and legs, scarce able to stand alone, much less totter after her; after the fourth week, however, it grows rapidly, and when two months old is able to feed and care for itself nearly as well as any member of the herd.

The Innuits hunt the musk oxen with spears and dogs alone, depending upon the latter to keep the herd together; certain as long as the dogs bay, not one will stir from the post he has taken. No sooner are the curs released than the herd form a circle with tails toward the center, presenting on the exterior circumference only a solid ring of battering foreheads and sharp horns. The dogs seem to occupy their sole attention, for the men approach within a dozen feet or little more and ply their spears, withdrawing them after each thrust by a line attached to the handle and held in a coil in the left hand. Now and then an enraged and wounded bull or cow ventures on a charge, when it is avoided by a quick leap to the right or left; and soon the herd is so decimated they take refuge in flight. One peculiarity the musk ox has

when preparing for battle is the whetting of the points of his horns, first one and then the other, alternately, against some rock or boulder, and in the absence of these, drawing them across his fore legs.

The Coppermine and Dog-rib Indians, however, stalk the herds, creeping up from the leeward by taking advantage of every hollow and depression, or intervening bush or rock, until within shooting distance. This is not usually a difficult matter, except during the season of rut, since they are not especially alert while feeding. Indeed, it is sometimes possible to move up within shooting distance in the level open, by merely standing motionless when one of the herd lifts its head, moving rapidly and noiselessly as the heads are all down, taking care, of course, that the herd do not get the wind. Guns are used to some extent, but do not appear to excite any particular alarm on the part of the cattle, who merely lift their heads at the report, appear astonished at the fall and death throes of their comrades, and then huddle closer together and go on feeding; and in this way the better part of a herd may sometimes be bagged before they become sufficiently alarmed to take to their heels. Arrows and bows also are used to good effect by these natives, the latter being a unique engine of its kind, consisting merely of three pieces of fir neatly tied together and whipped with sinew, the center alone of which is bent, the two forming the ends lying in the same straight plane as the bow string. Another mode of hunting is to build extensive ranges of stone or turf hillocks, behind which a portion of the hunters hide, while others, making a wide circuit, come down upon the herds from the windward, driving them up slowly to their comrades, who are thus enabled to select at leisure the calves and most desirable cows at will.

When in good condition, the flesh of cows and calves is by no means unpalatable, smacking more of venison than of beef, but coarser in fiber, a trifle less juicy, perhaps, and scarce so well flavored; and great care must be needs taken in dressing to prevent contamination and consequent musky flavor of the meat. The flesh of lean animals, however, is always musky, and of old bulls both musky and rank, so much so as to be utterly uneatable, and is rejected even by the strong stomach of the savage, save under the compulsion of hunger and starvation. The fat is well flavored and by many trappers and fur traders esteemed an excellent substitute for butter; it is exceedingly hard and clear, and pure white in color, or white faintly tinged with azure.

The musky odor, which may sometimes be detected a mile away to the leeward of a herd with the wind blowing strongly, is decidedly unpleasant, sharp, and penetrating. It is common to both sexes alike, though strongest in old males, especially during the breeding season; and while it undoubtedly bears a marked relation to the sexual function, is nevertheless apparent throughout the entire glandular system. It is excessive in connection with the intromittent organ of the male, where it seems to proceed from a gummy secretion that exudes from the prepuce and glands—a species of smegma, perhaps; and hard and dried resin taken from males killed nearly two centuries since, and preserved in the British Museum, still give out the peculiar odor, without apparently having lost in the least its intensity. Hearne supposed the odor to be connected with the functions of the kidney, or perhaps a secretion of the urethra, a mistake not at all unnatural to one ignorant of the physiology of these organs and of the generative functions; it may, however, yet prove to be a secretion of glands analogous to those of Cowper and Bartolini in the human race.

A musk ox hide, when dried, weighs not far from ten pounds; and that of an old bull is of such exceeding toughness as to be used in lieu of sole leather, being much more durable. The hides of cows are softer and finer, and when dressed after the Indian fashion are equal to the finest chamois in softness and pliability, are almost impervious to cold or water, and possess the happy faculty of never shrinking or becoming harsh when submitted to the prolonged action of moisture. They are much sought after for coats, shirts, leggings, and moccasins, and in the manufacture of the sleeping bags so essential to the comfort of every traveler in the far North, some thousands of skins being utilized in this way every year. As it is, the demand is far in excess of the supply, and consequently few or no skins find their way to market.

Illustrative of the chances of accident that will occasionally occur to the hunter and sportsman, and the presence of mind essential to one who essays a wild life and hopes to return in safety from a trip to the comparatively unknown tracts of the northern portions of the continent, I subjoin two anecdotes as related by that prince of sportsmen, Captain Parker Gillmore:

"The ice had just disappeared from the rivers, and the thought struck me that an alteration in diet of fish for fowl would be most acceptable to the palates of the encampment. A couple of miles distant was the river, and in an hour I had secured more trout than I was disposed to carry; so, work being over, I treated myself to a pipe. While enjoying my tobacco, a wading bird, of a description I never before saw, lit close by me. It was so tame that I threw several stones at it, almost with success, for the distance was not over ten or fifteen yards, before it took to wing and went further down the stream. Anxious to procure a new specimen, I followed until almost a mile lay between me and my fish. To save distance in returning, I determined to cut across the angle formed by the bend of the river, and had progressed about half way when I saw a female musk ox coming after me. When a lad in the Highlands, I had been dreadfully punished by a tup, and the remembrance of the event had not yet been forgotten. A mountain ram is a small beast compared with my pursuer, but he was able to do enough mischief. The ground was roughly sprinkled with boulders, some of great size, and for the most inaccessible of these I made the best speed I could muster, and only succeeded in gaining a place of safety when the cow's horns were within a foot or two of my hurries. For over an hour she kept watch of me; and worse than all, when I got back to my fish, some vermin or other had carried all the best ones off, and it was getting too late to catch a fresh mess. When at the fort the Indians soon explained the reasons of this unprovoked attack, and proved the correctness of their assertion by shooting the mother next morning and bringing the calf home, which we were unable to keep alive for over three days, much to the regret of all.

"Again, in stalking some caribou, eight musk oxen crossed directly between me and the deer. I was well hid at the time, so that they came unsuspectingly within thirty yards. In a moment I gave them both barrels. To the first shot an old bull dropped and rolled into the ravine; the second barrel crippled a three-quarters grown cow so badly that I knew less than a mile would lay her up. In my hurry to secure the old one, without loading I hurried to the ravine. There he was, as I thought, in the last struggle. Down I jumped into the hollow, which was about ten feet deep;

but no sooner did he see me than up he got, and, head down, charged. I turned tail, and fortunately scrambled out a wiser man; for deil tak me if ever I gang near any o' them again without baith powther and lead in my gun."

[KANSAS CITY REVIEW.]

THE SOLAR ECLIPSE OF MAY 6, 1883.

WE cull the following items from the reports of Professors Holden, Hastings, and others, regarding the journey to Caroline Island and the phenomena of the eclipse as observed by them on May 6. Professor Holden's report is made to Professor C. A. Young, Chairman of the Eclipse Committee of the National Academy of Sciences, and contains some details concerning the voyage and the stay of the observers on the island which, while out of the usual run of official reports, will be none the less interesting to the readers of the *Review*. Prof. E. S. Holden belongs to the U. S. Naval Observatory, but is temporarily in charge of the Washburn Observatory, at Madison, Wisconsin, and was the principal officer of the American Expedition.

Journey from New York to Colon (1,989 miles), from Colon to Callao (1,722 miles), and from Callao to Caroline Island (4,324 miles). The six members of the American party sailed from New York March 1, 1883, on the Pacific mail steamship *Acapulco* (Capt. W. Shackford), and arrived at Colon March 11, after touching at Castle Island, March 7, to send off a mail. At Colon the expedition was joined by the English photographic party. As the steamer on the west coast of South America did not leave until the evening of March 12, the American party remained in Colon till the morning of that day, and went thence to Panama.

Every day during May a rehearsal for the eclipse observations was gone through with, and two days before May 6 everything was in complete readiness. On the morning of May 6 there were three showers and several persistent banks of clouds. The sky was clear at first contact (about 10 h. 3 m. local m. t.), cloudy at intervals till near totality, clear during totality, except slight haze during the first minute of totality, cloudy a few minutes after third contact, and finally clear at fourth contact. The observations of the various parties may be considered to have been successful. But the success was owing to the apparent accident of the dissipation of a local cloud. I am more than ever convinced that my conclusion to go to Flint Island, had I found the French party occupying Caroline Island, was a sound one.

On the twenty-third day out from Callao, we sighted one of the islands of the Marquesas group, and at 8 A. M., of April 20, Caroline Island was seen as a low green streak on the horizon. We had come 4,324 miles in twenty-nine days, mostly under sail (an average of 149 miles per day) without seeing a single sail or any land, except Magdalena Island, of the Marquesas, which we had gone out of our course to sight. I cannot refrain from quoting here Darwin's entry in his "Journal of a Voyage in the *Beagle*," under date of December 19, 1835: "We now consider that we have nearly crossed the Pacific. It is necessary to sail over this great ocean to comprehend its immensity. Moving quickly onward for weeks together we meet with nothing but the same blue, profoundly deep ocean. Even within the archipelagoes the islands are mere specks, and far distant one from the other. Accustomed to look at maps drawn on a small scale, where dots, shading, and names are crowded together, we do not rightly judge how infinitely small the proportion of dry land is to the water of this vast expanse."

It must be remembered that we knew absolutely nothing of Caroline Island, except that it had been inhabited in 1874 by at least one white man and some thirty natives. The boat landing was known to be somewhere on the southwestern side, and an "entrance to the lagoon" was spoken of on the eastern side. The *Hartford* approached the island from this side, and from end to end there was nothing to be seen but a line of heavy breakers, then a strip of white beach, and above this a growth of trees, the highest of which were cocoa palms. Finally in among these was seen the gable roof of a European house, but no inhabitants. Coasting round the island, everywhere surrounded by high surf, the *Hartford* came opposite the place where the boat-landing was reported, and the whaleboat was lowered, and *Lient* Qualtrough sent in her to land, if possible. It seems all very simple now, after Caroline Island, its reefs, its lagoon, and its landing are as familiar to us as the beaches of New England; but at the time it was all quite strange and new. The advent of a man and dog on the reef was an event. It seemed to settle one thing at least, and that was that we should find some assistance in landing. But the native disappeared, and *Lient* Qualtrough was left to find his own way among the breakers, which he did in a capital manner. The ocean reef forms a solid wall all round the island, except at one narrow and crooked entrance, just wide enough for a boat and oars, and through this entrance each boat must come, or be broken into bits against the steep face of the coral wall. The whaleboat returned shortly with the news that there were four native men, one woman and two children on the island, that two frame houses were standing, and that we could land at once.

At high water this ocean reef was covered to a depth of about thirty inches, and at low water to about ten inches. The boxes were then lifted from the boat, and transported by carrying parties to the high water mark, a distance of 1,400 feet. This transport had to be made over the ragged surface of the ocean reef and through water of a depth varying from one to three feet, as I have said. From high-water mark, other carrying parties transported the boxes along the beach of the lagoon and across the island to the site of our observatories (some 1,300 feet further), which had been selected by Dr. Hastings and myself. On board the *Hartford* I had prepared a plan of the proposed camp; the position of each observatory was fixed on the ground by a stake, and to this stake all the boxes of each instrument were brought. In this way all proceeded in an orderly manner. By the evening of the twenty-first all the boxes and baggage of the expedition were landed, as well as bricks, cement, lumber, etc., for the observatories.

The entire party slept on shore also; and I shall never forget the quiet rest of that cool night after the intensely hot day of active work. Our hammocks were swung on the wide veranda of one of the houses, close to the beach of the mirror-like lagoon. The wind was cool and fresh as it blew through a break between two of the islands and directly from the open sea, the monotonous roar of whose surf was incessantly heard. The nearly full moon was overhead, and the long fronds of the cocoa palms made grotesque shadows on the level ground. Occasionally there would be heard the shrill cry of some sea bird flying over, and other than this and the roar of the breakers there was nothing to disturb the quiet and rest which came as a fitting conclusion to our restless month at sea.

During the 22d of April the *Hartford* remained by the island, and a force of carpenters and bricklayers proceeded rapidly with the construction of our observatories. By night-time the observatories belonging to myself, Dr. Hastings, and Mr. Preston were up, and piers of brick or wood completed. The brick piers of the English party were well under way, and were completed on the 23d by Mr. Wood, who thus added a new profession to his former acquirements.

The *Hartford* sailed at 6 P. M. of the 22d for Tahiti, and some of us went to the ocean reef to see her off. Besides her lights we saw those of *l'Eclairer*, the man-of-war which was bringing the French eclipse expedition. Early on the morning of the 23d I met the *maitre d'equipage* of the *l'Eclairer* on the reef, and gave him such information as to the landing, etc., as I was sure would be of use. Shortly after this the French party came on shore for the day, and the morning was spent in aiding them to select a site for their observations, etc. This party consisted of M. Jansen, director of the Observatory of Astronomical Physics of Meudon; M. Trouvelot, assistant of the Meudon Observatory; M. Pasteur, photographer of the Meudon Observatory. These gentlemen were accompanied by M. Tachini, director of the Observatory of the Roman College; M. Palisa, astronomer of the Imperial Observatory of Vienna. Besides these astronomers there were seventeen of the crew of *l'Eclairer* left on shore, making the French party twenty-two in number. Thus the total population of the island was fifty-one in all, including natives. Our relations with the gentlemen of the French expedition were throughout of the most cordial character. So far as our researches lay in the same direction, we worked together to a common end. It was a pleasure to us to be able to extend to them what aid was possible, and to receive the same in return.

During the remaining days of April everything was making progress toward complete readiness for observations of the eclipse. The observatory of Dr. Hastings and my own were completed by April 27, and each of us used a six-inch equatorial for some hours each night in an examination of the southern sky. During the course of this we detected some new doubles and red stars, a list of which is given later.

The vision was not especially good, and comparatively few hours were given to telescopic work, owing to the impossibility of obtaining a quiet sleep during the day. Still, new double stars were found. This shows that if a suitable telescope were to be used in a favorable place in the southern hemisphere, at Quito or Santiago for example, a great number of new objects could be catalogued in a comparatively short time. It appears to me that this expedition is worth making. Immediately after the eclipse we commenced preparations for departure. These occupied May 7 and 8, and at 5 P. M. of May 9 the *Hartford*, with the expedition on board, took her departure for the Sandwich Islands. We left Caroline Island with mingled feelings of pleasure and regret. Each one of us had at least some one thing left to do or to see, and yet it was a pleasure to leave the place where our mission had been accomplished, and to meet our friends in the ship, who were endeared to us by that intimacy which sea life induces.

It may be added, as Professor Holden's modesty excluded it from his report, that there was a spirited race between the French and American expeditions, of four thousand miles from the coast of South America. Each desired to reach Caroline Island ahead of the other in order to secure first choice of locations.

[To be continued.]

THE USE OF PARIS GREEN.

ALMOST every week we find paragraphs in our exchange papers recommending the free use of Paris green for destroying insects on fruit trees and garden vines, and about equally often accounts are published of cases where human beings or valuable domestic animals are poisoned by coming in contact with the Paris green, either upon food eaten, or by particles of the poison dust getting into sores or scratches in the flesh. The *New England Farmer* does not oppose the judicious use of Paris green for the destruction of the potato beetle and some other insects, but we would have our readers remember that this is a poison that is as dangerous to man and animals as to insects, and that too great caution cannot be observed in its use. And first, it should be known that an almost infinitesimal amount, if eaten by an insect, will cause death in a few hours. When using the poison upon potato vines, or upon fruit trees, the aim should be to make the green go over as much ground as it will effectually cover.

We have known of several potato fields being badly injured the present season by too free use of the dust upon the leaves. A leaf killed by the green is as useless to the plant as one eaten by the bug. We have generally applied the poison dry, and mixed with very fine plaster of Paris at the rate of one part in weight to one hundred parts of the plaster, and then without making a very heavy application the beetles have been thoroughly cleaned out. It is only necessary to have the poison remain on the leaves two days to destroy all that partake of it. Later hatchings may require subsequent applications. As the insects are found upon the tenderest leaves, those which grew last, there is no necessity for dusting over the whole of a large hill of vines, but a little poison shaken into the central portions of the stems will be quite as effectual. If one has a large field to treat, it would be well to cover the mouth and nose with a thin cloth wet in cold water, while doing the work, and special caution should be taken against getting a particle of the dust into any flesh wounds or sores on the hands, feet, or face.

The past season, we have applied the poison in water, through a small sprinkler, which worked better than anything else previously tried. One teaspoonful of the pure green in two and a half to three gallons of water was found sufficiently powerful to destroy all the weevils within two or three days after the application. This is putting it on so thin that no color could be seen on the leaves, but it was there, nevertheless, and the beetles probably ate it more readily than if mixed with plaster, which is always more or less gritty.

For applying to trees, the water application is doubtless far best, but the poison cannot safely be used in an orchard that is being pastured, nor on trees to which horses are liable to be hitched, nor would we be willing to sprinkle trees in mowing fields, or corn fields, where the fodder was soon to be cut for feeding. Nor would we use the poison upon any fruit that was nearing ripeness. The application to apple trees for destroying the canker worm and codling moth, should be made early in the season only; the later broods of the codling moths must be treated by other means.

All utensils used for applying the poison should be tho-

roughly cleansed before being put away, and the partly used packages must be tightly wrapped, marked, and stored where children will not get them. Empty cans and boxes that have contained the green should not be left carelessly lying about in the fields or out-buildings, as we have too often found them, but should be carefully burned or buried. Potato tops that have been poisoned ought not to be fed to cattle nor thrown in the pig pen. Fear may be foolish, but caution is wisdom.—N. E. Farmer.

HOMES FOR THE POOR.

ACCORDING to facts collected by the *New York Tribune*, it pays, in London, to spend money directly in the line of public sanitary and economic improvements. A company in London holding 3,300 houses, built for rental to workmen, laborers, and factory operatives, receives an income of five per cent annually. This same company is extending its work to North London, where it has secured an extensive area of 100 acres. This will be known as Noel Park, and will comprise 2,600 houses and a recreation ground of eight acres. The *Tribune* says that the best friend the tenement population of New York could have would be the man to build several blocks of model homes for working people, complete in their sanitary appointments and well lighted and well ventilated, and to make ten or twelve per cent upon the investment. Let one man succeed in doing this, and a fair share of the capital now going into the luxurious apartment houses of the rich would be invested in habitations for humble laborers and their families.

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