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ART. I.—*On the Natural History of the German Marmot (Hamster).*
By W. WEISSENBORN, Ph. D.

HAVING been engaged, at different periods of my life, in studying the habits of the German marmot, I have made various communications on this curious animal to foreign scientific societies, more especially to the Zoological Society of London; in consequence of which Mr. Charlesworth did me the honour of wishing me to draw up a more complete article on a creature which presents so many interesting and uncommon features, both in its organization and habits, and with which the English, luckily for their agricultural population, have, in their own country, no opportunities of becoming acquainted. I have, therefore, arranged all the materials I could collect on the subject from authentic sources, especially from Dr. Sulzer's monograph, as far as it has not become obsolete, adding to them such of my own observations as I thought sufficiently substantiated and interesting, and now venture to submit my article to the readers of the Magazine of Natural History.

I shall begin with a general statement of the most prominent features which render the epithet of "curious" applicable to the German marmot.

1. Its peculiar outward form, in which that of several other rodents is blended. It has the truncated snout, cleft upper lip, and downcast under lip, of the hare; the shape of the trunk approaches to that of the rat, though it be fuller, whilst the hamster possesses the short tail of the *Hypudæus arvalis*, Illig. As to the relative size of the head, it stands between the rat and the guinea-pig (*Cavia Cobaya*, Illig.)

2. The colour of its hair, which presents the great peculiarity of being *black* all over the belly, and of a *much paler*

tint (greyish brown) on the upper part of the body, in the common variety.¹

3. The buccal pouches, which the German marmot has in common with but few animals, and which in it are comparatively larger than in any other.

4. Its subterranean habits, which besides present many curious peculiarities.

5. Its hybernation. And

6. Its moral disposition, especially the courage in defending itself, which it has in common with the badger; and its ferocity in devouring its congeners, which it has in common with the mole.

Synonyms.—Both the zoologist, and the more general amateurs of knowledge, may, in many instances, feel interested in knowing the different names which apply to the same animal in different countries or writings. These synonyms often clearly indicate the localities where the creature is indigenous, and where it is not so. Such as German marmot, or marmotte de Strassbourg, will at once show, that our animal is originally neither found in England, nor in France proper. In the latter country it was once even exhibited in a strolling menagerie, under the curious name of “un animal sauvage d’Allemagne, nommé, ‘Fruges consumere nati.’” The German name ‘hamster’ has found its way into the Scandinavian (as also into the Dutch) languages; and the great Linnæus procured his first specimens from an illiterate herbalist, named Dietrich, residing at a little village called Ziegenhain, near Jena, whom Linnæus took for a member of the university, when he wrote to him,—“Mittas mihi, quæso, animal *Hamster* dictum.” As to the true vernacular names of the German marmot, we may distinguish two sets, viz., those which are an imitation of the yelling sound uttered by the animal when irritated; as *Krictsch*, Germ.; *Krziczieti*, Illyr.; *Skrzeczeck*, Pol.; *Sskrecek*, Boh.; *Schurks*, Serb.; *Gringie*, Hung.; *Surka*? Tartar; the Latin name of *Cricetus*, which Albertus Magnus appears to have first used, is perhaps derived from

¹ This feature would stand quite isolated among all our indigenous quadrupeds, but for its existence in the badger, which coincidence, in my opinion, deserves the attention of the physiologist, as both these species are crepuscular, winter-sleepers, and live underground. The cause of this peculiar coloration in these two animals, may perhaps be traced to some general law of nature, the more so as the mole, which is strictly subterranean, is altogether black, although the exclusion of light be, in general, a hindrance to the development of pigments. Also in the German marmot, there is a great tendency to become black all over the body, and the black variety is extremely common in some localities, whereas albinos have been met with only in a few instances.

κρίζω, I scream:—and such as have, or appear to have, a different origin, as *Arlan*, Tart.; *Bakuk*, Bashkir; *Tsharligan*, Osljak; *Chomäk*, *Karbush*, Russ. In Germany the animal has several names of that class, as *Kornferkel*, corn-farrow; *Kornhamster*, corn-storer; and is most commonly called *Hamster*.

CRICETUS, Cuv. GEN. CHAR.—Teeth much like those of the rat; tail short, hairy; buccal pouches, as in some of the apes, widened into large bags, which serve for carrying home food.

CRICETUS frumentarius.

DESCRIPTION.—*Length* of the largest male specimens from the tip of the nose to that of the tail, up to 15 inches Eng. of which the tail measures scarcely more than 2, the grown female being smaller by about one fourth. *Weight*, up to 1 $\frac{3}{4}$ lb. *Shape*.—Trunk rather broad than high,¹ clumsy; head oval, nose truncated, upper lip cleft, under lip short and hanging down; incisor teeth partially exposed; eyes moderately large, as well as projecting and almost circular; ears large, rounded; feet rather short, formed more for digging than for running, with five toes, the thumb being very short in the fore feet, and furnished with an obtuse nail, whereas the other nails are long, hooked, and grooved below; five callosities in the sole of the fore feet, and six in that of the hind feet; tail short, tapering, and becoming rather bare towards the point. *Colour*.—Greyish brown (hare-coloured) above, and black beneath, with three large yellowish spots on each side occupying the flanks, the regions above the shoulders, and that behind the cheeks, the latter spot being continued towards and round the mouth. Cheeks, regions round the ears, and anus russet; feet white. There is a black variety, rather common in several neighbourhoods,² with only the nose and feet white, and a mixed breed of the common and black variety is said to exist, and to be grey. Albinoes are very scarce, but have been occasionally met with.

Senses.—The organ of *vision* is moderately developed; the iris is dark brown, and it is difficult to distinguish it from the pupil, so that the whole visible portion of the eye-ball appears of a dark colour. As it is protected only by a few short bris-

¹ A fresh-killed hamster, when thrown at random on the ground, will lie on its back or belly, whilst a rat will more commonly lie on one of its sides.

² The black variety was very scarce near Gotha about 1770, when a specimen was exhibited at court as a great curiosity; whereas in the beginning of this century they were of rather common occurrence there. Among three dozen which I procured about eleven years ago from the vicinity of the borough of Buttelsstädt, five English miles from Weimar, there were four or five black ones.

bles, forming eye-brows, we must suppose that the animal digs with its eyes shut; whereas above ground it must keep them wide open, as they are the chief instruments for finding food in the dusk. The *smell* is very obtuse, as indicated by the truncated nose. The *hearing* is acute, as indicated by the large *conchæ*, and it is by the assistance of the ear that the hamster is chiefly warned of the approach of its enemies, when it will directly rise and sit in an erect posture, like the hare. The *taste* is probably the most developed of the senses, the tongue being very voluminous, and the animal very fond of varying its food. The *touch* is rather nice, as the hamster will grasp nuts &c. with its fore-paws, and open or eat them in the manner of the squirrel, though far less skilfully. As to the *common feeling*, it must be extremely obtuse, as the hamster does not show the least pleasure in being caressed, and though it flies into a passion at the least touch, and screams when wounded, these are symptoms of ill temper and fury rather than of sensibility.

Movements.—The locomotion of the hamster is slow, particularly if compared with that of animals of the same size and order, for instance, the rat. It is easily overtaken by man, even when making towards its burrow with all possible speed. When fighting, its movements are violent and heavy, often missing their object. They are most appropriate to its subterraneous habits, as digging, creeping, and climbing up and down perpendicular tubes.

Anatomical peculiarities.—The *buccal pouches* are two membranaceous sacs which have a wide communication with the cavity of the mouth, from whence they extend between the skin and the muscles, along the neck and the shoulders, in a somewhat converging direction, so that the shut ends are nearer each other than the open ones in the buccal cavity.—These bladders are attached along their inner sides, by cellular fibres and membranes, to the muscles beneath, and by more delicate ones to the skin. Their posterior end is surrounded by flat muscular fibres, which unite to form a flat and rather strong muscle. These two muscles continue to converge, and are attached, close under the *musculus quadratus*, to the *fascia* of the *latissimus dorsi*. The membrane of these bladders is very thin and permeable to the air, wherefore they soon become shrivelled when blown out and tied by a ligature. Their outer surface is perfectly smooth, but the inner one is closely covered with longitudinal and parallel dotted lines, the dots being almost square, and constituting mucous cells or glandules; wherefore the inside of the bladder is constantly wet and slippery, or it would easily be

torn by its contents, which often present rough or sharp surfaces. Between their two attachments these bladders, when empty, extend like two loose narrow canals; but when full, they are oval, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ broad, wherefore their periphery, where it is widest, measures about $5\frac{1}{2}$ inches.—When these pouches are filled with food, or blown up by the animal, its head and neck look as broad again. I scarcely need say that these pouches present the convenient means of carrying home food; they contain about $1\frac{1}{2}$ ounce of corn each, or a corresponding quantity of green fodder. The animal empties them by stroking them from behind with its fore paws; the muscle which has been mentioned perhaps facilitates this operation by its contractions. The anatomical characters do not, however, show the possibility of these pouches being contracted in the manner of the urinary bladder; nor could anything like peristaltic motion be discovered in fresh-killed specimens, which were still convulsed. They may serve as a sort of craw or first stomach, as in almost every hamster that has been dissected, there were found in them a few grains in a state of maceration; and I have also observed that the hamster fills its pouches with animal food, of which he never lays in a store at home. However, the animal often eats the grain just as it finds it, and therefore this use of the pouches is not absolute. The *stomach* is double; the first or left one, into which the *œsophagus* opens, offering nothing peculiar in its form, except that the mouth of the *œsophagus* is situated at the right extremity of it, which is in the mesial line, whilst the whole of that stomach is situated to the left of it. The valve of the *cardia* or *œsophagus* shuts so closely upwards, that the stomachs may be inflated from the *pylorus*, and dried in that state, after tying the *duodenum*, without a ligature being put round the *œsophagus*.—This is a sure proof of the hamster not being a ruminating animal, although his stomach is double. Near the *cardia* the first stomach opens to the right into the second, which is more rounded, reddish, smoother and more shining outside, and has thicker coats than the first; it is situated to the right of the mesial line, rather higher than the first, and is a little smaller. The two unite by the first being, as it were, inserted into the second, into which it sends two processes, and there is a rudimentary valve between them, which cannot, however, effectually prevent the regurgitation of the chyme, which is much more fluid in the first than in the second stomach. The *rugæ* are much more prominent in the first than in the second, which, on its right and upper side, communicates with the *duodenum*, without the intervention of a valve. The *intestine*

is thin and narrow, presenting almost the same width throughout; the inner coat is much furred, and the *cæcum* is very large in proportion, as when pulled out it is half as long as the animal, and its capacity twice that of the stomachs.—There is no *gall-bladder* in the five-lobed liver, but the bile empties itself directly through the biliary canal, which is formed by the union of five branches; this structure appears to bear some relation to the irritable nature of the creature. The *glands* are in general very large and numerous. One, which is situated in the groove between the shoulders, is particularly remarkable for its size and relations. It is often more than 1 inch long, $\frac{1}{2}$ an inch broad, and 2 or 3 lines thick in the middle. The *vein* which comes from it penetrates between the fifth and sixth ribs, on the right side of the spine, and opens into the *vena impar*, which is ascending there, and which in the hamster, as in some of the *Amphibia* and *Ruminantia*, is *paired*, one branch being to the right and the other to the left of the spine, but the latter branch is much larger than the former. The *artery* of the said gland is comparatively small, and the same may be said in general of the arteries in proportion to the veins. The weight of the *brain* is to that of the whole body about as 1 : 193; this organ is therefore very small. The *cerebrum* is about three times the weight of the *cerebellum*; its surface is smooth and without sinuosities, which bears a relation to the great stupidity and stubborn disposition of the creature. The *testes* are eight or nine times as large, from May to August, as they are at other seasons; they are nearly the size of pigeons' eggs when fully developed. The animal can draw them within the cavity of the *abdomen*, which provision is necessary, as they would otherwise be often exposed to dangerous pressure in their enlarged state.

These are the most remarkable anatomical features which are peculiar to the German marmot: the dental system presents nothing anomalous, there being 12 molar and 4 incisor teeth, as in the rat. I ought not, however, to pass over in silence two oblong spaces in the integuments, one on each side of the spine, and parallel with it. They are situated at a short distance in front of the thighs, and are not always directly perceptible, as the common hair often closes over them. But if the hair be blown aside or divided with the fingers, two spots may be observed, each about an inch in length and $\frac{1}{3}$ of an inch in breadth, slightly tapering towards their extremities, where the hair is much shorter than on the other parts of the body, and of a dusky brown colour, rather stiff, and lying close to the skin. In very young specimens, when the

hair is just beginning to appear, these *bristly spots* are distinctly visible from their blackish colour, the hair being there in a more advanced state and of a stronger nature. These spots may also be perceived on the flesh-side of the skin, by the roots of their stiff hairs: at a later period the relation is inverted, the rest of the body becoming covered with denser and longer hairs, so as to make these spots appear paler on the flesh-side of the skin. The physiological cause of these spots it is difficult to point out, the skin being there of the same thickness and consistency, and not more firmly attached than anywhere else. As to their end, Dr. Sulzer, whose excellent observations on the hamster were published in 1774, confessed that he could not imagine what it might be. Agricola was aware of their existence, but did not trouble himself about knowing their purpose, as he took them for the effect of an accidental cause. In treating on the hamster, he says, "In terræ cavernis habitat angustis, et idcirco pellis, quâ parte utrimque coxam tegit, a pilis est nuda."—(De re metallica et animalia subterranea. Basil, 1657, folio, p. 486). In my opinion, the end of these spots is very evident, as they appear destined to protect, by their bristly hair which lies close to the skin, the very portions of the latter which would be most exposed to being chafed in the burrows, on account of the proximity of the hip-bones, if left without some special defence. The furriers know these spots very well, and are obliged to cut them out and repair the fur, lest it should look unseemly.

Habitat, Habits, &c.—The hamster is met with in the whole tract of countries extending between the Rhine and the Ural mountains, and between the German sea and Baltic to the north, and the Danube to the south, wherever it finds its congenial soil. It is said also to exist in Siberia, but is nowhere more common than in Thuringia. Its proper soil is a deep alluvial mould, with a substratum of clay; districts where the ground is dry, strong, and stony, have nothing to fear from the ravages of the hamster. In the former description of land it is sometimes found even on the slope of low hills, but there it never multiplies to any extent.

Daily course from the beginning of March to the middle or end of October, (the period of active life).—During the day the hamster sits in its burrow, rolled up like a ball, with the head bent under the chest; so at least we must conclude from the observation of specimens kept in captivity. About sunset the animal begins its first ramble, which lasts till about midnight, when it rests till an hour before sunrise, in order to take then a second ramble, which it continues until the glare

of morning drives it back into its dark habitation. It is only in dark and gloomy weather that the hamster is ever found above ground whilst the sun is fairly above the horizon.—During these rambles the movements of the animal are commonly slow; its digitigrade walk is uncouth and creeping, almost like that of the hedge-hog, and its first object is to procure grain and other vegetable food, wherewith to fill its pouches. But as soon as it hears a noise, it raises itself upon its hind legs, and stands plantigrade, like a bear;¹ and if the object of its attention be some living prey, as a mouse, it quickens its pace into a gallop, or “ventre-à-terre.” Whilst quietly walking about its occupations, it is sometimes heard to utter a succession of short growling sounds; but when irritated, even only by some noise, its voice is squeaking and shrill, and in the height of passion it is not unlike that of a pig when about to be killed. In collecting food, when the fore-part of its pouches becomes filled, it strokes them backwards with its paws, to make room for a new supply. It does not thrash the ears with its paws, as has been advanced, but picks them very dexterously with its teeth, whilst holding them between its fore paws. When the pouches of the hamster are full, the animal walks home, to add their contents to its store. When surprised on its way by an enemy, it empties its pouches by quickly striking that region with its fore paws, whereby the corn is projected to the distance of a few feet, whereupon it is ready to fight. When the pouches are full it cannot fight.

Food.—The hamster, like several of the rodents, is omnivorous, but it is more so than any other. Its vegetable diet, during the summer, consists of green fodder of very different descriptions, especially *Medicago sativa*, and other species of that genus, *Hedysarum Onobrychis*, the different common species of *Vicia*, *Lathyrus*, *Convolvulus*, *Veronica*, *Potentilla anserina*, *Papaver Rhœas* and *Argemone*, *Alsine media*, salads, cabbages, &c.—these are also found in their burrows at that season. Roots or bulbs are never met with there, although the hamster will readily eat carrots, turnips, potatoes, &c., as well as fruit, in captivity. In autumn and winter the vegetable food of the hamster consists exclusively of seeds, as rye, wheat, oats, barley, peas, vetches, horse-beans, millet, &c. and these are stored up for hybernation. Notwithstanding this great variety of vegetable food with which nature and

¹ In this posture the hamster will stand five minutes or longer, staring attentively, but with a very stupid expression, at some object before him, for instance, the flame of a candle. One of the fore paws then generally hangs down lower than the other.

agriculture spread his table, the hamster is even more carnivorous than herbivorous; that is to say, he prefers animal food whenever he can have it. His own species, rats, mice, small birds, lizards, May-bugs and other chafers, caterpillars &c., are greedily devoured by him. In eating vertebrated animals he always begins with the head. When a sparrow or other small bird, whether alive or dead, is presented to the hamster, the first and evidently instinctive action of the latter is to break the wings. I have kept several dozens of this animal in large rooms, providing them with a great variety of green fodder, seeds, and artificial dishes, yet every night the weakest of the company were devoured, and others so severely wounded that they had no chance of escape the next night. By this fondness for animal food the hamster in some degree makes amends for his depredations, for there is no useful animal to which he is dangerous, not even to the partridge, as the same fields near Gotha in which the hamsters swarm, are well stocked with that bird. Besides, in captivity he eats, with great delight, all sorts of pastry, bread, butter, cheese, broth, &c., and is apt to become a great gourmand. On the other hand, he is not at all addicted to drinking, nor particular in the choice of it. He can live four weeks without water, and his health will not suffer; and in the fields, as his rambles do not extend far, he must often content himself for long periods with dew and the juices of succulent herbs. In this he is, no doubt, greatly assisted by being underground about twenty hours out of the twenty-four, which must prevent perspiration in a great degree.

Disposition.—The celebrated Professor Blumenbach used to say in his lectures, when treating on the *Mus decumanus*, "Thank heaven, gentlemen, that species is not as big as an elephant; if it were so, the human race would have ceased to exist long ago." The same might not be said, it is true, with an equal degree of probability about the hamster, as he is greatly deficient in that cunning and agility which would render the ferocity of the *Mus decumanus* so dangerous and destructive, if great physical power were superadded to its other qualities; yet in point of brutal ferocity the hamster surpasses even that rat. The latter is more sociable, more gregarious in its habits; it will not kill and devour its congeners, though of an exceedingly sanguinary disposition, except when hard pressed by hunger; whilst the hamster never falls in with another individual of its own species, without trying to make it its prey, the weaker, if not killed, generally making its escape more or less severely wounded. Even the

two sexes live together and in peace only during the few days of each breeding season.¹ With this single exception the hamster may be said to be constantly at war with every living creature or moving object which happens to come near him. It will jump with equal fury at a waggon-wheel or at a horse travelling along a road which a hamster is about to cross in the same place, and a young hamster will sometimes do so as well as an old one. Horses have now and then been frightened by the screams and bites of this little animal in the dusk of the evening, so as to run away. From men or dogs the animal will commonly, though not always, try to escape; it then takes the nearest course to its burrow, from which it is seldom at a great distance. When its pouches are full, it always takes to its heels at first, and if its burrow be only at the distance of twenty or thirty yards, it tries to regain it with its cargo, but never fails to pop its head out of the hole, screaming furiously in defiance. If the burrow be farther off, it tries to get a little a-head of its pursuer, in order to have time to empty its pouches; whereupon it rises upon its hind legs and faces its enemy, blowing (whereby the pouches become distended), squeaking, screaming, and jumping against the intruder to the height of from one to two feet. When the enemy retreats a little, the hamster hops after him like a frog. At such times the animal is quite beside itself with fury, caring for no wounds, and fighting till death.² Old hamsters do not usually retreat before man, when sitting before their burrows with their pouches empty; I have myself killed several under such circumstances.

Some breeds of dogs, as pointers and large terriers, soon acquire a knack of killing hamsters at one bite, by catching them by the middle of the chest; but when the animals are better matched, the combat is protracted, and the hamster often succeeds in gaining its burrow, after repeatedly beating back the dog. This obstinacy in fighting, in spite of all wounds not absolutely mortal, makes the hamster gain the victory over the rat. A combat between old individuals of the two species, lasts very long, but ends with the death of the rat. In short, as far as my own experience goes, I must believe the hamster to be the most courageous animal. Unfortunately there is no other commendable feature in his dis-

¹ For further proofs of the ferocious and reckless disposition of the hamster, see also below, under the head of *Propagation*.

² The bites of the hamster penetrate to the depth of half an inch, but are not particularly dangerous, even when the animal is furious.

position; he is perfectly untameable, and cannot be broken by any sort of education.¹

(*To be continued.*)

ART. II.—*Illustrations of the Geology of the South East of Dorsetshire.* By THE REV. W. B. CLARKE, A.M., F.G.S.

(*Continued from page 238.*)

FROM this examination of the composition of the coast line, we have now to advert to the phenomena presented by it, in connection with the underlying chalk. And I have, first, to remark, that if my attempt to explain the singular conformation of the curved and vertical chalk beds at Ballard Head (see Mag. Nat. Hist. Sept. 1837) needed any further elucidation, we have the fullest evidence of the vertical up-cast of the whole of the chalk between the Ballard Head fault and Old Harry Point, not only in the derangements on the Studland side, and in the perpendicular rents or fissures through the nearly horizontal chalk beds, but in the inclination of the plastic clay beds at the Red Rock cliff. For there is no means of explaining that inclination, but the supposition of the chalk having been bodily up-heaved, and lifting with it the plastic clay beds, which became, in consequence, tilted up at the point of contact and for some little distance, and broken into portions by the giving way of the soft strata at those parts now occupied by the ravines which lead from the sea to the village of Studland. It is also clear, that if such were the case at a distance from the chalk, the beds would, beyond the last point of fracture, retain their original horizontality, which is the case farther off from Studland. This will appear very plainly, if we see by the map that the plastic clay abuts upon the chalk on the north side of Ballard Down, far away from the vertical chalk, and, therefore, nothing but an elevation of the chalk *en masse*, or a depression beyond Studland, subjecting the northern end of the inclined beds to a down-cast motion (for which there is no evidence in the vicinity), can have produced the phenomena presented by the Red Rock and adjacent cliffs.

In order to explain this more fully, it must be mentioned that the Studland rock is, in some degree, a separate portion of the plastic clay. Seen from a distant elevation, such as the hills on the north side of Poole Harbour, Studland appears to be a small table-land lying on the edges of the east and north slopes of the chalk, and separated from the moun-

¹ Mr. Lens quotes an instance of an albino which became very tame.

ART. II.—*On the Natural History of the German Marmot (Hamster).* By W. WEISSENBORN, Ph. D.

(Continued from page 483).

ENEMIES.—Dogs of almost any breed are very eager to destroy the hamster, but never devour it. They are, I believe, in many neighbourhoods the great means of preventing the hamster from multiplying to an injurious extent. Many a plodding citizen is working for the good of the community, in wending his way homewards, accompanied by his dog, from some distant ale-house in the dusk of the evening; for whilst he talks on politics, his dog is more usefully occupied in killing hamsters in the neighbouring fields, which in several instances have been thoroughly got rid of, pro tempore, along the roads leading to places of public resort, where the ale happened to be good. The fox destroys a great many hamsters, but their most inveterate enemy is the pole-cat, which wages the same unrelenting war against the hamster, as the weasel does with the rat. The pole-cat makes its chief food of the hamster during autumn, penetrating into its burrows, and taking up its abode there, if convenient, where he lays up a store of often as many as ten dead hamsters. This is a well known feature in the habits of the pole-cat, as for instance, in the neighbourhood of rivers large stores of eels have been found in the burrow of that animal. The large owls are also among the enemies of the hamster. On the means employed by man to destroy this animal, we shall treat further below. But I ought to mention among its enemies, two parasitic creatures, both discovered by Dr. Sulzer. The first is the *Acarus criceti* (ovalis, albus, pellucidus, pedibus æqualibus, æquè dissitis, obtusis); this mite is about half as large as the head of a flea; it has eight equidistant feet of equal length and thickness, which are as long as the body is broad. The foremost pair has eight joints, those farther behind have more. They are hairy and truncated. Head pointed, very small, with two *antennæ*, that are twice as long as the head, and after embracing the latter converge towards their extremities. They resemble the feet, but are naked. When the insect is replete with blood, its belly, which is bristly here and there, looks red. It runs rather quick, is found on old and young, even sucking specimens, and does not leave the animal during its winter sleep, which it does not share. The hamster diggers are often bitten by these *Acari*, which cause severe burning and itching, as they dig themselves into the skin. After eight or ten hours, however, all pain ceases, and the parasite cannot continue in existence on man

for any length of time. Sulzer has moreover found in the *duodenum* a tape-worm, but which he could extract only in fragments. It was extremely flimsy, and its joints were broader than long.

Propagation.—About the end of April the hamsters begin to copulate. The male visits the female in her burrow, and resides with her for a few days only. They then evince sufficient mutual love to defend each other. Sometimes two males meet in the burrow of the same female, when a furious battle begins, which ends in the death or flight of the weaker. The manner in which they copulate is not known, as this act takes place underground, and has never been observed in captivity, although much pains have been taken to make them propagate in rooms. As soon as the act is completed the female drives the male away. The duration of pregnancy is not known, but it is about four weeks. Many females have been taken when the males were with them. They grew big and thin again, without their litter appearing; this is explained by an observation of Dr. Sulzer's, who *saw* a female which he had kept for some time, in the very act of devouring a young one to which she had just given birth. He killed her, and found in the *uterus* six others which were capable of living. When taken out of the foetal membranes they were blueish, but became almost as red as blood when dry. Six hours after, nascent hairs were distinctly perceived. When a female is caught with her litter, she will continue to suckle them. The young are born blind and naked, but with the full number of their teeth. Their blindness lasts eight or nine days. The number of one litter is from 6 to 18, according to the age and size of the female, which brings two litters at least every year. As the young of the first litter get fit for propagation within the same season, an old female may produce up to 100 individuals of her species in one year. The age to which the animal lives appears to be eight or ten years. The young grow very rapidly, and begin to dig when but a fortnight old. It is a curious fact, that though the male and female, when alone, will make a stout defence, when dug after by men, long before they are driven to the farthest end of their burrows, yet the female, when with her litter, will leave them in the lurch, stop the turn-again passage of her burrow with earth, and dig away as fast as she can, often as many as four or five feet from the place where she has left her young ones, before one can get at her. Were she to dig in a perpendicular, instead of a horizontal direction, she might be almost sure to escape for good.

Burrows.—The subterraneous habitations of the hamster

are differently constructed, according to the age, sex and soil. Yet what all the burrows have in common with each other, may be reduced to the following terms. Each burrow has two openings at least, one of which descends obliquely, the other perpendicularly. The former is excavated from without, the latter from within, wherefore the whole of the earth which is carried above ground is lying before the former, which is called the *creeping hole*, whilst the other bears the name of the *plunging hole*, and may often be sounded with a wand, to the depth of 3 or 4 feet. But before it opens into one of the chambers it always bends a considerable way to one side. As the chambers are situated between the creeping and plunging-holes, it is generally found that when a burrow has only two holes, the bend of the plunging-hole is turned towards the creeping-hole. The external openings of the two holes are at the distance of at least 4, sometimes as many as 10, feet from each other. The creeping-hole is not in such constant use as the other, and in an inhabited burrow it is regularly found stopped with earth at about 1 foot from its mouth, for a length of about half a foot. The plunging-hole is never stopped in summer. A hamster-burrow is at once known from either that of the mole or of the *Mus amphibius* by the heap of earth never being hemispherical, but rather flat and spreading, and by its presenting the sub-soil on its surface. The chambers which approach more or less to the oval shape, are more vaulted in the ceiling than in the floor. Their volume is between that of an ox-bladder and four times that size. The one serving for the habitation (the *nest-chamber*) is commonly small, and furnished with a litter of soft and fine straw. It is the nearest to the creeping-hole. It commonly presents three openings, one in the continuation of the creeping-hole, one leading to the plunging-hole, and one communicating with the store chambers, of which there are one, two, three, or more. The passage which leads to the creeping-hole becomes wider at a short distance from the nest-chamber, and there the hamster deposits its excrements. The *store-chambers* contain each from one to twelve pounds of corn or other seeds. Young individuals construct only one, which is not even large; but the old, especially males, which have much leisure to lay up stores, have sometimes as many as five store-chambers of the largest size, containing up to 65lbs. of corn, or 1 cwt. of horse beans together. If large seeds, as horse beans, peas, vetches, &c., be at hand, the store is commonly larger in proportion. The chambers are completely filled with the seeds, which are rammed into them so as to constitute true *silos*. Sometimes the passages lead-

ing from one chamber to the other are likewise filled with corn, &c. The corn and other seeds are collected at random, as they present themselves most conveniently during the nightly rambles of the hamster. If the chambers are found filled with a particular kind of seed each, this is merely accidental. Thus sometimes summer corn is found in one chamber, and winter corn in another, but a hamster whose burrow happens to be in a winter field of rye, wheat, &c., will first collect of this, and after the field has been reaped, he will be obliged to resort to some other field, where the harvest is still standing. Often rye, wheat, peas, vetches, flax-husks, &c., are all, or partly, found mixed together in the same chamber. Sometimes, below these store-rooms others are found, into which the seeds have been transported when they have begun to germinate. I need therefore scarcely say that the hamster does not show any sense of order in collecting, nor does he bite out the germ or *corculum* of the seeds, to prevent them from germinating, as has been advanced. The burrow where the female has her young, differs in some essential points. It has but one creeping, but often as many as eight plunging-holes, distributed over a space of 8 or 10 feet in diameter. These plunging-holes all terminate in the nest-chamber, and such a burrow is generally abandoned as soon as the mother drives her young away from her. The young dig, during the first months of their independance, burrows only two feet deep, in which there is but one nest and one store-chamber, the latter containing but 4 or 5 lbs. of seeds, and which have but one creeping and one plunging-hole. The young of the first litter, which propagate the same season, dig larger burrows in autumn, and all intermediate sizes between the largest and smallest may then be found. The depth of the burrows is determined by the nature of the soil and the seasons. Those in stony and strong land are less deep than those in loose, rich mould. Those constructed in spring, when no corn is collected, are comparatively shallow. The later in the season the deeper they are constructed, and the winter-burrows often descend to the depth of six or seven feet.

(To be continued.)

there is not a close correspondence between the two. In contradistinction to the common trout, the flesh of the white trout is of richer flavour, and of a deeper orange colour; its skin is much thicker and more oily, its colour bright silvery, with the exception of the back, which is darker; it is destitute of orange spots. It is taken abundantly in salt water, and very seldom in fresh.

After breakfast I resumed my knapsack and turned my back on Roundstone, amidst pelting rain. I saw two eagles soaring in circles far above the summit of Urrisbeg, and others sailing majestically on their way to and from the Twelve Pins. I stopped awhile at the salmon-fishery: to this spot the anglers of England—the real knowing ones—find their way, and, enveloped in Mackintoshes, stand for hours at the pools, whipping them with a fly. I saw an extremely fashionable-looking man at this locale; he was accompanied by a Mr. Larry, a very knowing native, who killed the fish of which he—the Englishman—was to be supposed the executioner. The salmon were pounded in, like sheep in a fold, and patiently awaited the evening's hawl; the Englishman threw his fly with untiring diligence, and drew it spinning over the water; the huge salmon leaped around it almost every second, and I saw Larry hawl to shore a fish of at least eight pounds weight; this will doubtless cut a conspicuous figure in my unknown countryman's journal: it was on the 17th of July, 1839.

Ballinahinch, like most of the towns laid down in the maps of Cunnemara, is a single house, the residence of the Martin of Galway for the time being, a man possessing land sufficient for a German principality. It is a pleasant spot, surrounded by the wildest scenery that can be imagined, and the bog half covered with the beautiful *Menziesia*.

(*To be continued.*)

ART. II.—*On the Natural History of the German Marmot (Hamster).* By W. WEISSENBORN, Ph. D.

(*Continued from page 536.*)

HYBERNATION.—About the beginning or middle of October the hamsters shut their burrows, first the creeping-holes and then the plunging-holes. With occasional interruptions, they fill the whole length of the passages, with earth formed into little rounded lumps of the size of a pea or French bean, which, though they be rammed together very firmly, and ef-

fectually keep out the cold, yet admit of a partial circulation of air. The nest is of the average size of an ox-bladder, and filled with the softest straw. It communicates with the store-chambers, as before stated; and the animal continues awake for about two months, during which it consumes about two thirds of its stores and becomes very fat, till the winter fairly sets in, when it becomes torpid. After the middle of February one generally finds the first hamsters that are awake;¹ but unless the sun shine very warm, they do not open their holes, but occupy themselves with digging new canals, &c., as it would seem merely for the sake of exercise. At this season one finds but two or three handfuls of corn left. About the middle of March they usually begin to open their burrows, commencing with the plunging-hole, which they throw open very widely, so that it resembles the burrow of a rabbit. They abandon their winter-burrows soon after, and dig new ones; they take rambles and collect young weeds, as well as the fresh-sown summer corn, whereby they become very injurious. The male awakes from his winter sleep sooner than the female; and herein we may observe a very interesting provision of nature. The female, on account of the care necessary to be bestowed on her progeny, not having time to collect so large a store as the male, digs her winter-burrow much deeper, whereby she the sooner becomes torpid, and awakes later than the male; and but for this many would die of hunger. All the hamsters which have been dug out in winter were males, the females lying so deep that the traces of their burrow have been lost before getting at them. They seldom open their holes before the beginning of April.

When a torpid hamster is dug out, it is found lying on one side, rolled up in a lump; the head being under the belly, which is embraced by the fore-paws, the hind-paws being joined above the snout. The animal is perfectly clean, and the hairs, especially the whiskers, beautifully arranged. The hairs are stiff, and their becoming pliant marks the first stage of the animal's awaking. The eyes are closed; and if opened by artificial means, they shut again spontaneously. The animal does not breathe. When opened in this torpid state, it does not show any symptom of feeling pain, although the

¹ As an exception, I have a few times seen hamsters, even at an earlier season, *basking* before the creeping-hole of their burrows, *in the sunshine of a bright winter day*. The *creeping-hole* was thrown wide open on such occasions; the animals retreated on my approach; and had they not, in every instance of that sort, peeped out again in defiance, with their well-known squeaking, I could not positively state that I had seen hamsters behaving thus in the middle of winter.

respiration returns at long intervals; the heart contracts only fourteen or fifteen times in a minute; whereas, in the animal when awake, it does so at least one hundred and fifty times. The blood is far more bright and fluid than in summer, and its surface is covered with oily spots. The intestines are motionless, and neither alcohol nor sulphuric acid are able to make them contract: they are partly filled with chyme and excrements. The fat is rather solid, and the bladder partly filled with urine. A torpid hamster may be carried in the pocket for miles from the fields without awaking. If brought into a moderately warm room it gradually awakes: the feet by degrees assume a more natural position; the breathing begins with deep and rare inspirations; the animal is then sensible to stimuli of various kinds; it stretches itself, utters a disagreeable rattling sound, and at last opens its eyes. It then totters about as if intoxicated, and frequently falls on one side in trying to attain a sitting posture. When this point has been gained it remains quiet for a while, then walks about and directly begins to eat if food be thrown before it. The time in which they become perfectly awake in a moderately warm room, is two hours in very cold weather, when their sleep is proportionately sound, but much less in warm weather.

The principal external cause of the torpidity of the hamster is the lowness of the temperature of the medium in which it happens to be. Underground a temperature of $+6^{\circ}$ or 7° Reaum. is competent to effect it; when kept in a box above ground, the animal will fall asleep at a temperature of $+5^{\circ}$ R., but awake from time to time. In heated rooms the state of torpidity never takes place; but although the hamster will thus sometimes live through the winter, it is drowsy, ill, and often dies. It is evident that the closing of the burrows, by which the external agents are in a great measure excluded, must be instrumental in bringing about the torpid state much earlier than it would otherwise take place. Then, I suspect, the influence of the earth itself has a similar tendency; this opinion I may support by the following observation. In my youth, in company with a few more boys, I once gave chase to a pair of dormice (*Myoxus nitela*). We secured one, the other entered a hole in the slope of a sandy hill. I went home to fetch the necessary instruments and returned in about half an hour, and after digging only a length of a few feet, I found the dormouse fast asleep, though the burrow continued much farther. Thinking I had killed the animal with the pickaxe, I took it carefully in my hand, when, after having handled it a short time, it made its escape so rapidly that only the skin of its tail remained between my fingers. I succeeded how-

ever in catching it again, and found that it had sustained no other injury.

As to the physiological points which appear to be most closely related to the hybernation, they are, 1st, the great development of the venous in proportion to the arterial system; 2ndly, the peculiar composition of the blood, which never perfectly coagulates, the more solid parts retaining a certain degree of fluidity, and the more watery portion not becoming transparent and nearly colourless, as in most other animals, but constituting a crimson-coloured fluid; when the hamster is torpid, these qualities of the blood exist to a greater degree than in summer: and lastly, the condition of the fat, which, as in other winter-sleepers, for instance, the badger, hedgehog, dormouse, bat &c. is oily, and chiefly composed of elaine.¹

Injury and Use.—As the hamsters consume a great quantity of valuable green fodder as well as corn, from the time it begins to ripen, during spring, summer, and autumn,—and as an old one sometimes lays up a winter store of 1 cwt. of horse-beans, or 65 lbs. of corn, &c., which is lost to the proprietor or farmer, it may be imagined what a calamity this animal must be to the agricultural population, where the soil is favorable to its excessive multiplication, and where no extraordinary means are resorted to, in order to check its propagation. It is true that nature herself puts a stop to the hamsters' multiplying to an indefinite extent, by epizootics, or other causes, which cannot be precisely determined;² but she does so much later than the interest of man requires.—The parishes which are much infested with this nuisance, have therefore, from an early period, paid premiums out of their public money for dead hamsters which were brought to the proper office. Latterly this has been done in several dominions of Germany with more regularity, and more systematically than before; and as I think it will interest the readers of this journal, I shall communicate here an extract from the official records kept at the mansion-house of Gotha, and comprehending a period of twenty-one years. It commences in 1817, when a general crusade was undertaken, which had the

¹ Haller's opinion, that the right auricle of the heart loses its sensibility latest, among all the organs, is confirmed in a striking manner in the instance of the hamster. If, in a living hamster, the heart be exposed by laying open the chest, it will continue to beat for about seven minutes, then become motionless for a short time, whereupon the right auricle begins to beat alone, the pulsations being at first about 110 in a minute, continuing for an hour and a half or even two hours, and becoming gradually slower, till at last only two are observed within a minute.

² Migrations of this animal have never been observed, as far as I know; but in some years it is scarce, without the cause being known.

effect of greatly reducing the number of hamsters; and since that period the magistracy have succeeded in preventing the multiplication of the animal from becoming a public calamity.

Years.	Number of Hamsters delivered at the mansion-house of Gotha.	Sums paid in Premiums.		
		Doll.	Gros.	Pfen.
1817	111,817	2,237	19	7
1818	13,054	197	21	1
1819	22,370	285	14	7
1820	7,331	103	14	6
1821	8,689	122	20	8
1822	19,087	273	14	6
1823	5,429	88	23	1
1824	12,084	181	23	10
1825	14,248	205	15	0
1826	7,002	148	7	10
1827	14,735	320	19	8
1828	6,133	125	13	7
1829	5,686	112	11	3
1830	10,049	234	0	1
1831	18,953	397	7	9
1832	8,288	186	9	8
1833	886	20	19	7
1834	2,692	49	15	9
1835	2,282	39	4	3
1836	1,101	21	3	6
1837	1,923	43	0	0
Total,..... 286,839		5,396	19	9 ¹

During this whole period old females were paid for at the rate of 1 groschen (1½d.) each, old males at 6, 4, or 3 pfennige in different years, and young ones at 1 pfennig² throughout.

If we look back to more remote times, we find that in the years 1699, 1710, 1751, and 1761, orders were issued by the government of Gotha to destroy the hamsters. They must have been very numerous in the beginning of the eighteenth century, as in 1721, 54,429 (19,145 old and 35,284 young) hamsters were paid for at the mansion-house of Gotha, as well as 25,707 in the neighbouring villages. After the middle of the same century their numbers had decreased, as the registers kept at the mansion-house of Gotha record 27,574 (6629 old and 20,945 young) from Michaelmas 1768 to Michaelmas 1769, and 22,812 (7244 old and 15,568 young), during the twelve months beginning with Michaelmas 1771.

It ought to be understood that the whole of the fields be-

¹ From this table it appears that very wet years are as favourable to the increase of the hamster as dry and hot ones. For 1817 was a very wet year as well as its predecessor, and yet in the five years of 1822, 1825, 1827, 1830 and 1831, the hamsters contrived to become comparatively very numerous.

² There are 12 pfennige to a groschen. One fourth of the premiums was paid out of the public funds, and three fourths by the proprietors or farmers.

longing to the town of Gotha comprise an area of less than 7000 English acres.

Although the injury done by the hamsters greatly overbalances their usefulness, yet the latter is by no means trifling. They firstly destroy a great many field-mice, larvæ, insects, and other vermin; then their fur is esteemed for lining coats, night-gowns, &c., as being light and durable. A good one is paid at the rate of 1½d. Lastly, their flesh is a very good and wholesome dish, and but for the stupid prejudice which prevails against it, the more easy classes of society might relish it as much as the ancient Romans did that of marmots and dormice.¹ However, it is thrown away to rot, and thought fit food only for gipsies or the poorest people, who do consume it in some neighbourhoods. The gardeners of Erfurt do, and the poor people in Silesia are said to eat a great many hamsters. *Hünerwolf* (see *Ephem. Nat. Cur.* Dec. II. Ao. viii. obs. 16, pag. 59) says that a poor *old* labourer at Arnstadt in Thuringia, who had for some time wholly subsisted on hamster-corn and hamster-meat, died of a sort of leprosy. This is the only instance in which bad consequences have been ascribed to that description of food, and the conclusion is evidently fallacious, as the man in question was probably affected with scabies senilis.

Besides, the stores which the hamsters collect in their burrows are partially reclaimed by such people as possess or farm no land. Where hamsters abound, they effect a sort of equitable arrangement between the proprietors or farmers and the cottagers. The hamster insists on his natural *right* to steal the corn, and the cottager avails himself of the positive law to sacrifice the thief and possess himself of the stolen property. At Gotha the hamster-diggers have to take out a license. They are mostly labourers or soldiers, and if skilled in this branch of their profession they gain a good livelihood. From March till St. John's day, when the fur of the hamster is finest, they dig after the animal merely for the sake of the fur and the premium, which they get on producing the skins at the mansion-house, where the tails are cut off and burnt. The hamster-diggers have the right to dig even in the fields sown with white crops till St. John's day, but they must fill the excavation again with the earth, which they need not do in the stubble fields. Then there is a pause till the winter-corn is cut, when they dig both for the animal and the store

¹ For the table, the hamster should be obtained about the time that the animal first becomes torpid (about the beginning of November), when it is in high condition, and may be killed without exciting its passion.

in the burrows, which however is very small at that season, and never exceeds 8 lbs. But after the summer-corn has been reaped, and throughout the autumn, the trouble of the hamster diggers is much better repaid, as they often find 50lbs. or more of corn in one burrow. The wheat and rye are cleaned and washed by them, and after having become dry they are as good for household purposes as any other. Barley, oats, peas, beans, french-beans, &c., obtained in this manner are commonly sold at half the price of what they cost in the market, and used for feeding pigs or poultry, without the same careful preparation to which wheat and rye are subjected. At the season when the hamsters are persecuted only for obtaining the skins, a skilful hamster-digger may catch (and has often caught) as many as 120, both young and old, on the same day; and in autumn, when two comrades commonly work together, a pair of hamster-diggers have sometimes obtained 400lbs. of corn, &c., within the same time.

Methods of catching and destroying the hamster.—The most usual way in which the animal is caught, is by digging it out of its burrow. For this operation a spade is used, and a peculiar kind of instrument consisting of an iron rod about a foot and half long, and having a sharp hook on one end, and a little shovel or scraper on the other. The hook is used to pull the animal out as soon as it makes its appearance in the course of the operation of digging, which begins from the creeping-hole; the scraper serves to keep the canal clear and to loosen the contents of the store-chambers. Besides, the people have sacks, into which to put the hamsters, corn, &c. They see the burrows at a considerable distance by the heap of earth. When this is small, and the holes are narrow and little distant from each other, they know that the inhabitant is young, that there is scarcely any corn, and that they will get only 1 pfennig for the trouble of digging out such a burrow, as the skin is of no value. Therefore they leave such a hamster alone, that he may grow old and profitable. But if the burrow have many plunging-holes, which are smooth and not mouldy, they know that it is inhabited by a female with her young. It is then worth while to dig after a litter of from five to eighteen young ones, which are got at with but little trouble. Formerly, when only 3 pfen. were paid for the old one at the mansion-house, she was allowed to escape, in order that she might bring more grist to the mill by producing a fresh litter, and she is sure to make the best of her way by digging onward in an horizontal direction; but now, as her price is 1 gro. there is inducement enough to dig

after her, and quarter is no longer granted her. If the heap before the creeping-hole be very large, and mixed with much chaff and pieces of straw,—and if a well-trodden plunging-hole exist at the distance of six feet or more,—the burrow belongs to an old male; and the hamster-digger exults in the prospect of a good prize. If the season be not far advanced, the people possess themselves only of the stores, sparing the old knowing fellow, not out of gratitude, but that he may collect another store that very season. No legislation, unless incompatible with true justice can prevent the hamster-diggers from doing what they think most profitable to themselves, so far as the killing or sparing of the animals is concerned.¹

The hamsters are also easily caught in traps set before their holes. The different kinds of rat-traps will answer the purpose with more certainty for the hamster than for the rat, the former being far less cautious. The trap in most general use is a pot dug into the ground, the cover of which shuts when the hamster enters to take the bait. There is also a very simple trap, the construction of which is founded on the irritable disposition of the hamster. In the middle of a board ten inches square, is made a hole four inches in diameter. A strong nail projects from each side of the board, near the rim of the hole; the sharp points of the nails are bent into the hole, so as to be opposite each other, with a distance of about two inches between them. There are nooses at the four corners of the board, which is fixed over the plunging-hole by means of pegs driven into the ground. In trying to leave or to enter its burrow, the hamster glides over one of the nails and is pricked by the other, upon which the animal gets into a passion, and in rushing violently backwards, after having been repeatedly wounded by the point opposite, he is impaled by the nail over which he first glided.

The animal may also be forced to leave its burrow by pouring into it a large quantity of water, which is perhaps the most convenient method, if a large tun or a cart can be had, and the object be merely to destroy the animal, without obtaining its stores.

Weimar, August 25th, 1839.

¹ The laws which were given for the cercles of Magdeburg and Halberstadt, in August 1696 and May 1714, were more arbitrary. The proprietors were ordered to deliver at the justice's, each year, fifteen hamster-skins for every rood (30 acres) of land; and the cottagers had each to furnish ten skins. For every skin that was wanting in these numbers, they had to pay a fine of 2 groschen.