

Hibernating mammals.

An article on hibernating mammals, by Dr. C. C. Abbott, in *Science*, No. 65, contains several statements the correctness of which I am inclined to challenge. For example: Dr. Abbott says, "Of the thirty or more mammals found here [central New Jersey], thirteen species are supposed to be hibernating animals. These are four species of bats, two of moles, three squirrels, one ground squirrel, one marmot, one jumping-mouse, and one *Hesperomys*."

If it is true that the red squirrel, 'two moles,' and 'one *Hesperomys*' hibernate in the latitude of central New Jersey, the fact is sufficiently interesting and important to merit a detailed account of the evidence upon which an announcement seemingly so extraordinary and improbable is based.

Further on, the doctor states that the common star-nosed moles "form commodious nests, placing a good deal of fine grass in them. Here, indifferent to freshets, they remain all winter, and, as they can lay up no food, sleep, I suppose, through the entire season. The fact that these moles are unaffected by being submerged during the spring freshets is an interesting fact." Here, it will be observed, the author not only asserts that the star-nosed moles 'remain all winter' in their nests; but, without adducing a single fact in proof, he even goes so far as to assume that they are 'submerged during the spring freshets,' and goes on to say, "I think that the animals must have been thoroughly soaked for from forty-eight to seventy-two hours, the ordinary duration of the high water." Now, it is a very easy matter for these semi-aquatic animals to betake themselves to higher ground when driven from their usual haunts by freshets; and this is exactly what usually takes place, as I have ascertained by personal observation.

In the Adirondack region, where snow covers the ground for five or six months of the year, the star-nosed mole does not hibernate. At the approach of winter, it sinks its galleries below the depth to which frost penetrates, and still finds an abundance of earthworms, which at all seasons constitute a large share of its food. When the snow has attained the depth of a metre or a metre and a half, as it commonly does here during January and February, the frost gradually leaves the ground, and both moles and earthworms again approach the surface. The moles sometimes burrow up through the snow; and I have captured them while running about on a stiff crust, through which they were unable to bore in time to make good their escape.

The red squirrel is well known to be the hardest of his family. Disdaining to hibernate, he remains active throughout the continuance of excessive cold. When fierce storms sweep over the land, he retires to his nest, to re-appear with the first lull in the wind, be the temperature never so low. I have frequently observed him when the thermometer ranged from 30° to 40° below zero, Centigrade, but could never see that he was troubled by the cold. While running on the snow, he often plunges down out of sight, tunnels a little distance, and, re-appearing, shakes the snow from his head and body, whisks his tail, and skips along as lightly, and with as much apparent pleasure, as if returning from a bath in some rippling brook during the heat of a summer's afternoon.

Dr. Abbott, after commenting upon the fact that the jumping-mouse (*Zapus Hudsonius*) lays up no store of provision for winter, while the white-footed mouse (*Hesperomys leucopus*) invariably hoards, says, "However this may be, the fact remains that both these rodents are quite sensitive to cold, and hiber-

nate as soon as winter sets in; yet how very differently is this faculty exercised!"

The white-footed mouse is the last animal of which I should say, 'sensitive to cold.' Like the red squirrel, it is one of the hardest of rodents, and in our northern forests it remains active throughout the long and severe winters. It is not known to hibernate; and, except during very stormy weather, its footprints can always be seen, dotting the snow in various directions.

If animals that are active in winter throughout the north-eastern part of the United States and much of British North America should be found hibernating in a mild climate like that of central New Jersey, the fact would be of unusual interest; but, since its acceptance must upset the well-known laws that govern the physiological process of hibernation, it becomes expedient to sift well the evidence upon which such statements rest. C. HART MERRIAM.

Experiments with reflections.

The accompanying figures, though not perfectly accurate copies of photographs I have made, are at least truthful representations of reflections obtained from, 1°, rectilinear striations upon a polished plane; 2°, circular striations upon a disk; 3°, circular striations upon a sphere.

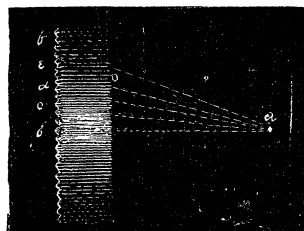


FIG. 1.

In fig. 1 the direct rays from a luminous point, *a*, touching the rectilinear striations at *b*, return to the eye a brilliant reflection of the luminous point; the divergent rays at *c*, *d*, *e*, *f*, returning the same with decreasing brilliancy as the remoter striations are reached. Thus a band of light is reflected perpendicular to the striations, of uniform transverse diameter, and with an intenser luminosity at the central point. If the striations are upon a finely polished surface, the outline of the luminous point is preserved in the reflection quite sharply, whether circular or otherwise.

If the striations are circular and concentric from circumference of a disk, — the centre of the disk, the light, and the eye occupying the same plane, and the face of the disk perpendicular to it, — the reflection is two equal sectors, with their luminous apices united at the centre of the disk, as in fig. 2. The diameters of the intercepted arcs depend upon the angle formed by the incident and reflective rays. Variations of the light, disk, or eye, in position, produce every degree of difference between the two sectors.

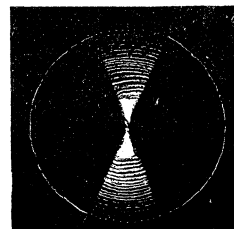


FIG. 2.

If the striations are upon a polished sphere, and

are parallel with its equator, the axial extremities become well-defined poles.

Place the equator of the sphere, the light, and the eye, in the same plane, and the axis of the sphere vertical to it. Make the reflective angle as acute as possible. The reflection is a central luminous point



FIG. 3.



FIG. 4.

at the equator in a vertical band terminating acutely toward either pole, fig. 3. If the reflective angle is about 90° , the reflection is crescentic, fig. 4. When the sphere is placed remote from the light and the eye, with its axis inclined toward the light, the reflection is a luminous point at its proximal pole, fig. 5.

If the sphere is brought nearer the light, thus increasing the reflective angle, a short curved tail de-

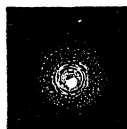


FIG. 5.



FIG. 6.

velops, fig. 6. This increases in length as the sphere is approached to the light, until, at close proximity, a , in fig. 7, results. Removal of the reflecting surface at any latitude on the sphere interrupts the reflection, as at c , fig. 7. The interposition of a comparatively small opaque body before the light, when the inclined sphere is in *very* close proximity to the light, divides the reflection, — a, b , fig. 7. Multiple sources of light multiply the reflections, which describe different curves, all radiating from, though not always reaching, the pole. The greater the sphere in relation to the source of light, the more perfectly the form of the luminous point is reflected. If circular, it appears as a disk or brilliant nucleus. The extension of the reflection toward the equator constitutes a diverging train or tail.

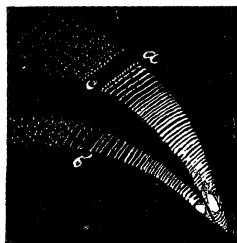


FIG. 7.

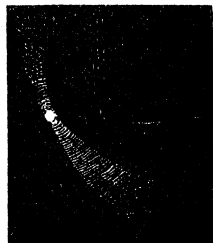


FIG. 8.

Changes in the positions of the three factors produce a limitless variety of figures, which are suggestive of various cometic forms: for instance, fig. 8, two opposite spherical sectors, the analogue of figs. 1

and 2. The resemblance of the reflections to cometic appearances is increased if the striated reflecting sphere, with the inclined axis maintained, is made to describe about a light approximately the form of a comet's orbit; then all the changes exhibited by a comet, from the first nebulous point to the fully-developed tail, are illustrated upon its surface, including the changes in the position of the tail in relation to the light, which occur during the small curve of a comet's orbit. The reflections describe all the radii between a and b , fig. 9. It is surprising to what extent cometic behavior may be illustrated upon the polished spheres: position, elongation, abbreviation, disappearance, annular images, irregular images, are all quite possible.

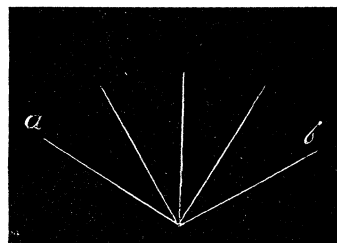


FIG. 9.

If an hypothesis may be ventured, it is briefly this: if a sphere of meteoric dust of a diameter exceeding the greatest length of the comet's train, having an axial rotation and inclination, does actually traverse the comet's orbit, such a rotation would convert its superficial inequalities, varying densities, and possibly its individual atoms, in effect, into continuous striae, parallel with its equator; and such inclination would place it in position to reflect the images which comets display. Discussion of the hypothesis is reserved.

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Not a few of the readers of *Science* are looking upon the new departure in biology in Philadelphia with high hopes that it may become one of our most valued possessions. They regard it as a new and therefore great opportunity. But they will be sadly disappointed if its officers give themselves up largely to merely routine teaching, or are satisfied in taking a position towards biological science in any large degree conservative. The United States is a poor field, or is rapidly becoming so, for the perpetuation of ancient methods in one of the youngest and most vigorously growing of the sciences. And if any one cares to profit by experience, let him reflect upon those steps, which, within ten years, have led up to one of our most valued institutions, — the Johns Hopkins university, — or to the almost incredible success of the Naples station. Broadly speaking, their conditions of prosperity have been two, — on the one hand, money;