NEST-BUILDING FISH, GASTEROSTEIDÆ.

A. W. ROBERTS.

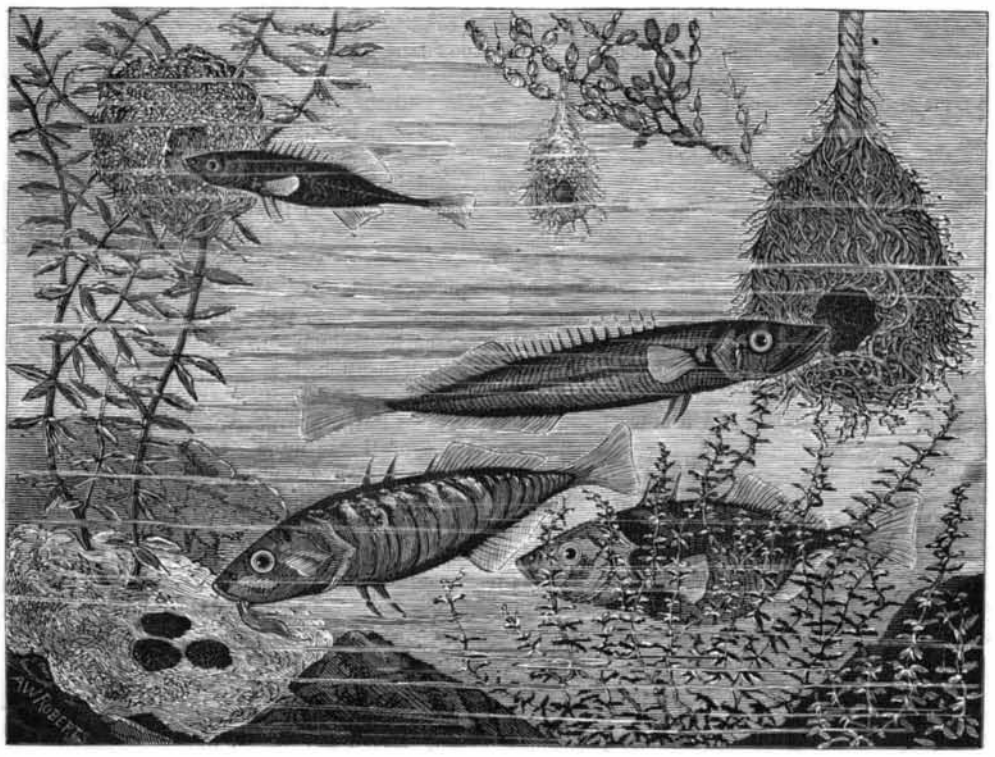
There is nothing more repulsive than exaggeration in natural history. Surely the phenomena themselves are wonderful enough for the healthy mind if properly set forth. Readers and students are not drawn to the study of nature by such means; indeed, the overdrawn statements, or the classifying of odd and unusual facts, as if of ordinary and regular character, will soon repel the earnest seeker for knowledge, and even the searcher for wholesome entertainment.

The nest-building stickleback is a good subject for this kind of pseudo-science. Sticklebacks *are* wonderful fish, and with them many wonderful things are possible. I know of no other fish that harmonize their colors to the surroundings as do the sticklebacks. Take the many-spined stickleback as an example. In a pond at Maspeth, L. I., which has a bottom of white clay, and was so situated as to be under the full glare of sunlight nearly all day, the color of the sticklebacks was that of a dirty white. A half a mile beyond this pond was a ditch containing peaty water; here the same variety of sticklebacks were brown. A few yards beyond this ditch was a hole, the bottom of which was black creek mud; here the sticklebacks were jet black, even to their eyes. The male fish of the varieties *Gasterosteus biaculeatus* and *aculeatus*, are more wonderful still, as illustrations of this fact. The first indication that a male stickleback, of either of the above named varieties, is about to construct a nest is the taking on of green and red colors, the eye at the same time becoming blue. When the nest is completed, and the time has come to either coax or drive the female to deposit her ova in the nest, then the colors of the male become wonderfully intense, the red becoming almost luminous. The male retains these colors till he abandons the young sticklebacks to shift for themselves.

In nature the male stickleback always selects material for his nest that is in keeping and harmony with the surroundings. This is a wise precaution for masking the contents of the nest from other fish, particularly sticklebacks, who are very fond of their own ova. In the engraving, at lower left-hand corner, a male of the three-spined stickleback (*Gasterosteus biaculeatus*) is shown carrying in his mouth material for the nest, while Mrs. Stickleback, heavy with ova, waits behind the plants for the completion of the nest.

The following description of how a sticklebackery was established is taken from the "Young Scientist." I know it to be truthful in every particular:

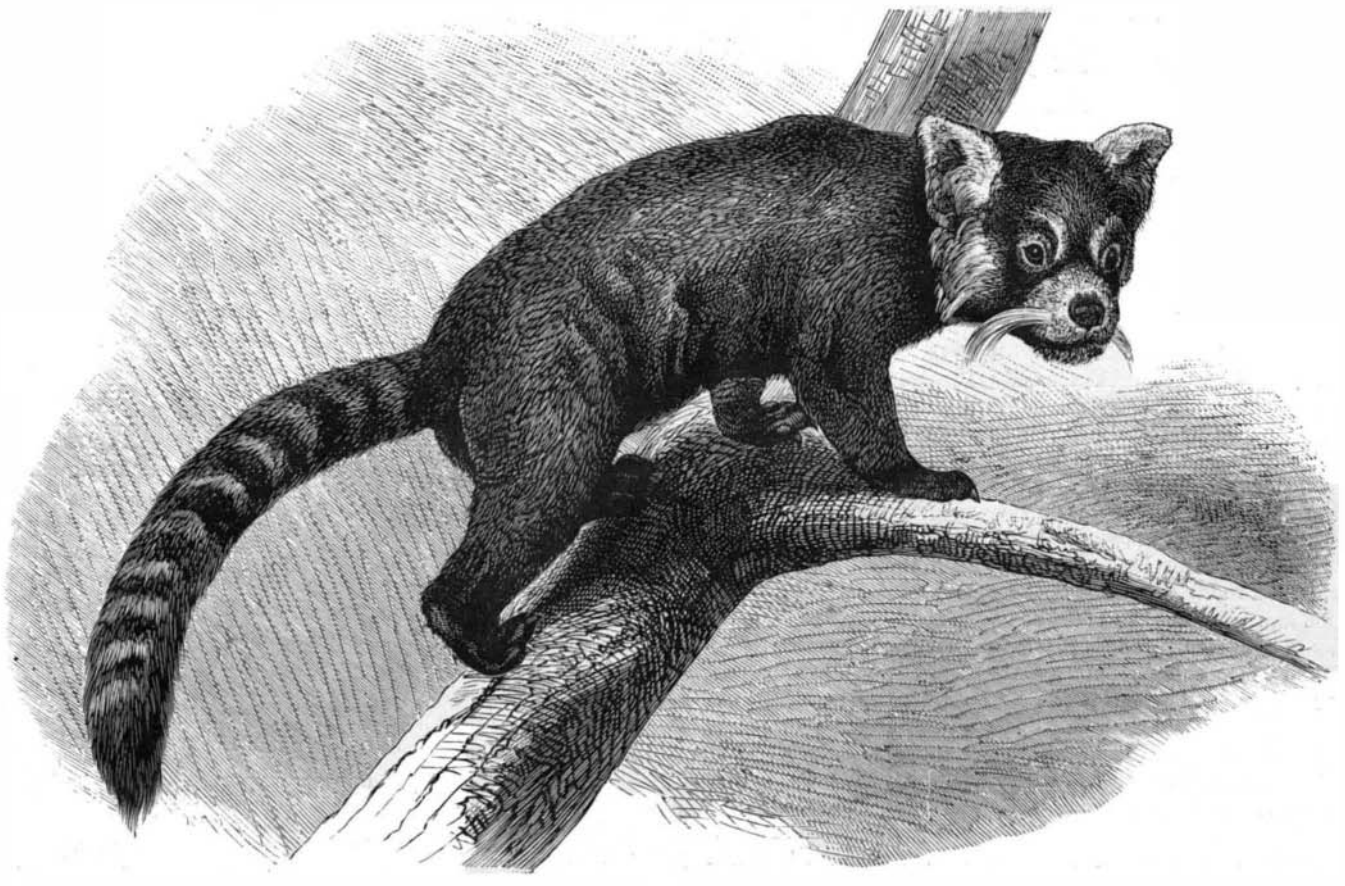
"Up in the hayloft was a box of window glass; taking a number of panes of glass, I formed in a washtub a series of compartments, in the following manner: From the center of the tub the panes of glass radiated till they came in close contact with the sides of the tub, thus forming a series of acute angles; the bottom edges of the glass were then crowded down through the three inches of sand till they rested on the bottom of the tub. In the apexes of the angles bunches of mermaid weed were planted; this also helped to sustain the glass compartments, as well as to keep up a thorough oxygenation of the water. In each compartment I placed a pair of sticklebacks, giving them a meal of angle worms before leaving them for the night. Next morning, when I examined the tub, to my great surprise, many nests had been built during the night; in some of them the bright yellow eggs showed plainly through the openings of the nest. Every nest was being vigorously ventilated by the male fish, who were hard at work fanning a current of water on them with their pectoral fins. In one compartment a male fish was tearing off small pieces of confervæ that grew on the mermaid weed, which he carried in his mouth to the nest, packing it down with his nose. After placing several mouthfuls in this way, he fastened the pieces together more compactly by pressing them down with the underside of his body, at the same time exuding a marine glue, so to speak, that cemented all together securely. In the center and on the top of each nest were four orifices, and into these the male, after a considerable display of anger and much labor, at last drove the female, her head projecting far enough out to allow her to breathe. In a few minutes the male drove her out of the nest head first, he now passing through the nest and over the eggs, just to see if Mrs. Stickleback had laid her eggs in the proper place, and to make things all right. In an instant he was out, flaring all over with blue, green, and orange, his eyes looking like small turquoises. When the openings of the nest became too large, he contracted them by patching on more confervæ. Over the nest he remained day and night, changing from one opening to another, constantly fanning a current of water through them. Whenever poor Mrs. Stickleback showed herself, her mate drove at her fiercely, biting her till she was glad to hide in the mermaid weed. The trouble was that she would have eaten all the eggs if she had had a chance, and he knew it. For this reason I took all the females out as soon as they had deposited their eggs. As each nest was completed and the eggs deposited, I withdrew the glass partitions; but terrible battles taking place between the males, I had to replace them. Even then they would try to fight each other through the glass. When all the eggs were hatched, and the bottom of each compartment seemed alive with young sticklebacks, I removed all the male fish and glass partitions, and in a few weeks was the happy possessor of a large school of inquisitive, restless baby sticklebacks."



NEST-BUILDING FISH, GASTEROSTEIDÆ.

The many-spined stickleback (*Gasterosteus occidentalis*) is called by dealers the "nine-spined" stickleback. At the upper left hand corner of the engraving is shown the nest and male of this variety. It is very seldom that the many-spined build when in confinement; I have known of only one instance, which occurred when connected with the aquaria at Barnum's (old) Museum. Unfortunately the nest was torn to pieces by a number of small eels before the eggs had hatched. The drawing here presented was made from a sketch I made of the nest as soon as it was completed. This nest was constructed in the branches of a mass of *Ludwigii*, and was composed of small fragments of dead aquatic plants and confervæ. The fibrous structure of the confervæ, and the thready consistency of the glutinous excretion of the male, had been utilized for securely binding the nest to the branches of the *Ludwigii*. The male of this variety becomes black during the season of incubation. I have known this variety of stickleback to ascend small fresh water streams of Long Island, many miles above the brackish water, and remain there for several seasons before returning to the ocean. The largest sized specimen I have ever taken of this variety was two and a half inches long, which is very uuusual. When a number of these nine-spiners are placed in an aquarium they are very apt to school and boss everything in the tank.

To the right-hand side of the engraving is a representation of the fifteen-spined stickleback (*Gasterosteus spinachia*) and nest. This fish is a native of England. He is a long-bodied, long-snouted fish. On certain parts of the English coast these fifteen-spiners have at times swarmed the coast in such vast quantities that they were used for manuring the land. The nests (says the "Naturalist's Library") of the fifteen-spined stickleback are about eight inches in length and pear-shaped, formed of branches of common fucus and various corallines. These are all bound together in one confused compact mass, by means of a thread run through and round in every conceivable direction. This thread is of great length, and as fine as ordinary silk, and somewhat elastic, whitish, and formed of some albuminous secretion. The eggs are laid in the middle of the nest, in several irregular masses of about an inch in diameter, each consisting of many hundred ova, which are of the size of ordinary shot, and of a whitish or amber color. It would appear that the fish must first deposit its spawn amid the growing fucus, and afterwards gather its branches together round the eggs, at the same time weaving and incorporating all the rubbish that is lying or floating round the nucleus. Mr. Couch mentions a case where a pair of fifteen-spined sticklebacks made their nest in the loose end of a rope, and from which the separated strands hung out about a yard from the surface, over a depth of four or five fathoms, and to which the materials could only be brought, of course, in the mouth of the fish, from the distance of about thirty feet. The nest was formed of the usual aggregation of the finer sorts of the red and green seaweeds, but were so matted together in the hollow formed by the untwined strands of the rope, that the mass constituted an oblong ball of nearly the size of the fish, in which had been deposited the scattered assemblage of spawn. This was bound into shape with a thread



PANDA OR WAH.—[See next page.]

of animal substance, which was passed through and through in various directions, while the rope formed an outside covering to the whole. A picture of this nest is shown in the illustration.

On our neighboring coast are several varieties of sticklebacks. The two best varieties as nest builders are *Gasterosteus biaculeatus* and *G. aculeatus*. They are distinguished by the two prominent spines on the back and a smaller spine just in front of the dorsal fin. The size of these varieties varies from two and a half inches to three inches. The body is covered on each side with a series of narrow vertical plates. The general color of these varieties is olive green on the back and that of oxidized silver on the sides.

These fish reach our coast in schools from the ocean during the early part of March. This year they were taken by collectors as early as February. I have seen the margins of ditches of brackish water on Long Island fairly alive with both sticklebacks and sheepshead lebias that had been deposited there by the spring tides. The sticklebacks and lebias were nesting side by side in perfect harmony.

Some years ago I knew of a pond of water that had become land locked from the tide that had flowed into it from Wallabout Bay. In this pond were hundreds of three-spined sticklebacks, whose habits had undergone a complete change, viz., five and oftentimes as many as ten females had spawned in one nest, the male fish in attendance always increasing the size of the nest to cover the extra deposits of ova, and at the same time taking entire charge of all the masses of eggs. These sticklebacks had become very much dwarfed. Both in nature and in artificial confinement the male stickleback always selects for the situation of the nest a sunny spot. A good illustration of this fact was that of a stickleback that had nested in a self-supporting tank, which was so situated that the sun shone on it for only half an hour each day, and that in a far off corner from where the nest was situated. So anxious was the male fish to obtain the benefit of this sunlight that every day he carried the mass of eggs in his mouth and placed them on the branches of an aquatic plant, where the sun's rays were strongest, after which he replaced them in the nest.

At one time I had a tank of sticklebacks at Barnum's, the bottom of which consisted of plain sand. In this tank were a large number of ripe sticklebacks, but not a particle of nesting material. One morning, greatly to my surprise, I noticed in each of the lower corners of the tank a male in full color hovering over masses of brownish material, with that peculiar vibratory motion of the male stickleback when ventilating the eggs. On taking out one of the masses I discovered it to be composed of fine-cut chewing tobacco.

I have often placed obstructions on the nest of a stickleback during its formation, the male always removing them when not too heavy to carry in his mouth. The male when building constantly tests the specific gravity of the materials selected. He having selected what appears to be a suitable fiber, he carries it a little way, then projects it from his mouth a short distance, and watches it fall; if it falls rapidly it is taken, if slowly it is rejected. When the young sticklebacks wander too far from the nest the male takes them in his mouth and deposits them near the nest. The eggs of the stickleback at first are of a light yellow color, but as they approach maturity they become darker; in course of time minute black spots appear, which are the eyes of the young fish inside of the eggs. The eggs of stickleback can be hatched very easily, by placing them in slightly running water, or by changing the water twice a day. The young fish are apt to die unless they are placed in water containing large quantities of animalcula, which they devour in large quantities. For this reason, as soon as the umbilical sack is absorbed they should be placed in a tub, or other vessel wherein the water has been under the influence of sunlight and the action of plants for some weeks, thus securing an abundant supply of natural food.

The best places to collect sticklebacks in the vicinity of New York is in the standing ditches on Long Island; also at the rear of Gunther's Railroad Station at Coney Island. The ditches back of the railroad station at Canarsie generally contain hundreds of sticklebacks in the months of March, April, and May.

THE PANDA, OR WAH.

There are few of the mammalia which are decorated with such refulgently beautiful fur as that which decks the body of the wah or panda, as it is also called.

This beautiful creature is a native of Nepal, where it is known under the different names of panda, chitwa, and wah —the last mentioned name being given to it on account of its peculiar cry. The fur of the panda is of a bright rich chestnut-brown, which rapidly darkens into a peculiarly rich black upon the ribs and the outside of the legs. The head is of a whitish-fawn color, with a ruddy chestnut spot under each eye. The tail is of the same chestnut hue as the body, and is marked with a series of dark rings. The head is very short and thick muzzled, presenting a curious contrast to the coaitis and racoons. See engraving on previous page.

It is generally found among the trees that grow near rivers and mountain torrents, but does not seem to occur in sufficient numbers to render its beautiful fur an object of commercial value. This is the more to be regretted, as the coat of the panda is not only handsome in appearance, but is very thick, fine, and warm in texture, being composed of a double set of hairs, the one forming a thick woolly covering to the skin, and the other composed of long glistening hairs that pierce through the wool and give the exquisitely rich coloring to the surface of the fur. The soles of the feet are not merely defended by nailed and thickened cuticles, but are furnished with a heavy covering of woolly hair, which in some species is of a light gray color, and in others of a snowy white, that contrasts strangely with the deep rich black of the legs and paws.

The food of the panda is usually of an animal character, and consists chiefly of birds, their eggs, and the smaller mammalia and insects, many of which it discovers on the trees whereon it is generally found.

Luminous Fungi.

There are no phenomena associated with fungi that are of greater interest than those which relate to luminosity. The fact that these plants under some conditions give out a phosphorescent light has long been known; and every school-boy is familiar with the luminous property possessed by rotting wood ("fox-fire"), and which is due to the mycelium of a fungus pervading its substance. This luminosity of fungi has been observed in various parts of the world, and where the species has been fully developed it has generally been found to be one of the toadstools belonging to the genus *Agaricus*. One of the best known species is the *Agaricus olearius* of Southern Europe, which was examined by Tulasne with especial view to its phosphorescence. In his introductory remarks, he says that four species only of the Agarics that are luminous appear at present (1848) to be known. One of them is the species just mentioned, another, *A. igneus*, comes from Amboyna; the third, *A. noctilucus*, has been discovered at Manila; and the last, *A. gardneri*, is produced in the Brazilian province of Goyaz upon dead leaves. The Agaric of the olive tree (*A. olearius*), which is itself very yellow, reflects a strong brilliant light, and remains endowed with this remarkable property while it grows, or, at least, while it appears to preserve an active life and remains fresh. The phosphorescence is at first, and more ordinarily, recognizable at the surface of the gills; but in many cases, and among more aged fungi, the gills cease to give out light, and the stipe throws out a brilliant glare. Tulasne, who examined this subject very carefully, infers from his experiments that the same agents—oxygen, water, and warmth—are perfectly necessary to the production of phosphorescence as much in living organized beings as in those which have ceased to live. In either case, the luminous phenomena accompany a chemical reaction, which consists principally in a combination of the organized matter with the oxygen of the air; that is to say, in its combustion, and in the discharge of carbonic acid which thus shows itself. Mr. Gardner has graphically described his first acquaintance in Brazil with the phosphorescent species which now bears his name (*A. gardneri*). It was encountered on a dark December night, while he was passing through the streets of Villa de Natividate. Some boys were amusing themselves with a luminous object, which at first he supposed to be a large fire-fly, but on making inquiry he found it to be a beautiful phosphorescent toadstool, which, he was told, grew abundantly in the neighborhood on the decaying leaves of a dwarf palm. The whole plant gives out at night a bright light somewhat similar to that emitted by the larger fire-flies, having a pale greenish hue. From this circumstance, and from growing in a palm, it was called by the inhabitants "Flor de Coco." The number of recognized luminous species of *Agaricus* is not large, though three or four others may be enumerated in addition to those already cited. Of these, *A. lampas*, and some others, are found in Australia; and Dr. Hooker speaks of the phenomena as common in Sikkim, but he was never able to ascertain with what species it was associated. As regards Australian species, interesting information is given in regard to two by Mr. James Drummond, in a letter from Swan River. These grew on stumps of trees, and had nothing remarkable in their appearance by day, but by night emitted a most curious light, such as he had never seen described in any book. One species was found growing on the stump of a *Banksia*, which was surrounded by water. It was on a dark night, when passing, that the curious light was first observed. When the fungus was laid upon a newspaper, it emitted by night a phosphorescent light, enabling persons to read the words around it, and it continued to do so for several nights with gradually increasing intensity as the plant dried up. In the other instance, which occurred some years after, Mr. Drummond, during one of his botanical trips, was struck by the appearance of a large toadstool, measuring sixteen inches in diameter, and weighing about five pounds. This specimen was hung up to dry in the sitting-room, and on passing through the apartment in the dark it was observed to give out the same remarkable light. The luminous property only ceased when the plant became dry.

In the current number of the *Gardener's Chronicle*, the Rev. M. J. Berkeley describes still another species, new to science, recently received by him from the Andaman Islands, and which, though small in size, exceeds in brilliancy any species that has hitherto been observed. In this species, which Mr. Berkeley names *Agaricus emerici*, the entire substance of the fungus is described as being most brilliantly luminous. There are a few other fungi belonging to genera other than *Agaricus*, which have been observed to be luminous under certain conditions; *Thelephora phosphorea* and *Polyporus sulfureus*, for example, the latter being a common American species. In all the cases of phosphorescence recorded as occurring in these cryptogamic plants, the light emitted is described as of the same character, varying only in intensity. It answers well to the name applied to it, as it seems remarkably similar to the light emitted by some living insects and other animal organisms, as well as to that evolved, under favorable conditions, by dead animal matter—a pale, bluish light, resembling that emitted by phosphorus as seen in a dark room.

A New Fiber.

In the Paris Exhibition was shown a sample of a fiber named *Malachra rotundifolia*, sent from Bombay. This plant is, however, only found in South America—at least so says Dr. King, to whom the supposed *Malachra rotundifolia* was sent for identification, and he states that it is *Malachra capitata*, not *Malachra rotundifolia*. As a fiber, be it what may, it undoubtedly deserves attention, for it is said to be quite equal to jute. The following is the description given of it: "The fiber is in length from eight feet to nine feet, has a silvery appearance, with a peculiar luster, and is almost as soft as silk. In passing the fiber through the machinery damped with oil and water, as is commonly done with Bengal and Koukan jute, yarn was produced strong enough and nearly equal to that made from the second quality of Bengal jute. If the plant is carefully grown and well looked after, the fiber would then no doubt rank fully equal to Bengal and Bombay jute. Owing to the high prices ruling for jute in Bengal and elsewhere, the new fiber, if carefully prepared, would command a ready sale at 3·12 rupees to 4 rupees per Indian maund." There appears to be no difficulty in growing this plant, which belongs to the natural order of *Malvaceæ*, in Bengal, marshy places within the tropics being considered favorable to its growth, and there is, therefore, every reason why a fair trial should be made of its apparently valuable properties. The fiber is prepared in precisely the same way as jute, but requires to be steeped directly it is cut, as exposure to the sun dries and hardens the stems, preventing the easy removal of the bark from them, and rendering the fiber itself coarser in quality than it would otherwise be.

Human Filariæ and Mosquitoes.

The new investigations of Dr. Manson, communicated to the Quekett Club recently, appear to afford positive proof of a singular habit on the part of the filariæ. These microscopic worms periodically pass in and out of the circulation. Dr. Manson gives a table showing the hours of the day and night at which they are either present or absent in the blood. The worms are remarkably punctual in keeping to their appointed times. The evening inrush to the circulation commences about half-past seven, the over-crowding attaining its maximum at midnight. Into the clinical bearings of the subject it will be time to enter when the remarkable evidence brought forward by Dr. Manson has been fully published in the "Transactions" of the Club. In addition to some introductory remarks by himself, the President read brief communications on the subject of filariæ from Drs. Somerville, Mortimer-Granville, J. Bancroft, J. L. Paterson of Bahia, and others. The meeting was well attended, and in the course of the discussion which followed, Dr. Stephen Mackenzie stated that he had at present under his care, in the London Hospital, a patient from Calcutta, with chyluria. Although Dr. Lewis had found filariæ in the blood of this man in India, Dr. Mackenzie's efforts to find the filariæ had at present been unattended with success. The interest of the various papers was much increased by the exhibition of drawings and specimens of the filariæ in all the stages of growth hitherto observed. Numerous infested mosquitoes were also shown.—*Lancet.*

New Observations concerning Bees.

Mr. E. A. Thompson writes to the *American Naturalist* that certain moths, *Plusia precationis*, having been caught by their tongues in the pollen-pockets of *Physianthus albens*, an Asclepiad plant, were stung to death and devoured by what were supposed to be ordinary honey-bees. Dr. Hermann Müller considers the fact of the moths being thus entrapped new and interesting; but mentions that his brother, Fritz Müller, in South Brazil, has observed bees eagerly licking the juice dropping from pieces of flesh which had been suspended to dry in the air. Mr. Darwin suggests that the bees may possibly tear open the bodies of the moths in order to get at the nectar contained in their stomachs. Both these distinguished naturalists recommend further observation. It is stated by Prof. A. J. Cook, of the Michigan Agricultural College, that bees kill the drones not by stinging, but by tearing with the mandibles.

Causes of Fatigue in Reading.

An important study has been made of this subject by Dr. Javal, director of the Laboratory of Ophthalmology of the Sorbonne, published in the *Annales d'Oculistique*. The fatigue of the eyes which is so often complained of by literary men he believes due to a permanent tension of accommodation; reading requires constant, steady strain of the eyes, while many other occupations demanding close, do not need constant, sight. His researches extend to the question of great economical importance: Given a surface of paper and a number of words to print upon it, what rule will secure the maximum of legibility? The answer is: Other things being equal, the legibility of a printed page does not depend on the height of the letters, but on their breadth. This fact is of special importance in the preparation of school books, and Dr. Laval's suggestions should receive the attention of publishers, type founders, and school boards.