his followers. Such are the iron Innuits of the unwarmed igloos of the Arctic.

A recently constructed igloo is more comfortable than one long used, the alternating heat and cold of the day and night soon converting the latter into a translucent mass of ice, that becomes uncomfortably chilly on a cold night; besides, the steam from the cooking and the moisture from the breath congeal upon the roof, and, in the course of ten or twelve days, become so thick as to form a base for a constant liliputian snow-storm, which is disagreeable beyond measure. One of the most conspicuous comforts of arctic travelling is the constant changing of igloos.

(*To be continued.*)

BALFOUR'S LAST RESEARCHES ON PERIPATUS.

AT the time of his death, the late lamented Prof. F. M. Balfour was engaged upon an investigation of the anatomy and development of Peripatus, the lowest known form of Tracheata (insects). Unfortunately, he left his work far from complete; but two friends, Mr. Sedgwick and Professor Moseley, both thoroughly competent, have undertaken and completed the grateful task of editing what could be gathered from Balfour's material. We have, however, hardly more than a descriptive account of the anatomy and development of the animal. We miss the fruitful thought with which Balfour enriched his writings before committing them to the press.

The article is published in the April number of the *Quarterly journal of microscopical science*, and is accompanied by numerous beautiful plates. A portion of these were drawn by Miss Balfour. Their excellence graces this quiet expression of a sister's close relation to a gifted brother.

Balfour's investigations were directed especially upon Peripatus capensis. The memoir opens with a careful description of the external characters of the species. The account of the legs is the first satisfactory one published. The number of legs is variable, but usually there are seventeen pairs. Each leg has the form of a cone, with a pair of claws at the apex: it bears a succession of rings of papillae, but towards the tip the papillae in part fuse together to form three ventrally placed pads. The foot is distinct, being separated by a constriction from the upper part of the limb, and has several pads upon its ventral surface, and bears the two conical recurved claws. On the middle of the ventral line of junction of the leg with the body lies the opening of the segmental organs. The disposition of this opening on the fourth and fifth legs is slightly different. The last leg has a papilla with a slit-like gland opening at its apex. The gland itself is large, and runs far forward, and is probably a modified crural gland.

Part II. is a monograph of the internal anatomy. In the *alimentary canal*, a nearly straight tube slightly longer than the body, five parts may be distinguished. 1. The buccal cavity. Its opening is surrounded by a tumid lip, covered by a soft skin raised into papilliform ridges. Attached to the median dorsal wall of the cavity is a muscular protuberance (tongue), covered by the oral epithelium, and furnished with organs of special sense, like those in the skin, and with chitinous teeth. On each side of the tongue is placed the jaw, with recurved chitinous teeth. The jaws are, no doubt, modified limbs: their structure and action are minutely described. The salivary glands open into the buccal cavity by a short common duct, are variable in length, but stretch usually two-thirds the length of the body. They consist of two parts: the first runs backward as a wide, straight tube; the second runs forward and upward, is small in diameter, and apparently branching in the figures, though the fact is not mentioned in the text. The anterior end of the first part serves as a duct, and is lined by a cubical-celled epithelium; while the rest of the same part is

FIG. 1. Horizontal section through the head: *trp*, tracheal pit; *sal*, salivary gland; *M*, mouth; *s d*, common salivary duct; *J*, jaw; *o j*, outer jaw, or muscular portion; between the two jaws lies the section of the tongue.

glandular, and lined by very elongated epithelial cells with their nuclei at their bases. 2. The pharynx is a highly muscular tube, with a triangular lumen, which extends from the mouth to about half way between the first and second pair of legs. (It appears to me that the author is in error when he states that such a structure is not characteristic of insects.) 3. The oesophagus, on the dorsal wall of which occurs the junction of the two sympathetic nerves. 4. The stomach, by far the largest part of the alimentary tract, has its walls irregularly, not segmentally, folded. The walls themselves are composed principally by the internal epithelium, the cells of which are elongated, fibre-like, with their nuclei about one-fourth of the way from the base; and around their bases are short cells irregularly scattered, and having round nuclei. 5. The short rectum is chiefly remarkable because the circular muscular layer is *outside* the internal layer formed of isolated longitudinal bands.

The *nervous system* is particularly interesting; for it consists of two ventral cords united by numerous transverse bands, and having an enlargement corre-

sponding to each leg. The cords are united in front, above the oesophagus, to form the cephalic ganglia, and are also united behind over the anus. The arrangement of the commissure and nerves of the ventral cords is minutely described. The supra-oesophageal ganglia give origin to the immense antennary nerves, and a few small epidermal nerves; laterally, one-third of the way back, the optic nerves, and two pairs of smaller nerves near the optic; still farther back, a large median nerve from the dorsal surface;

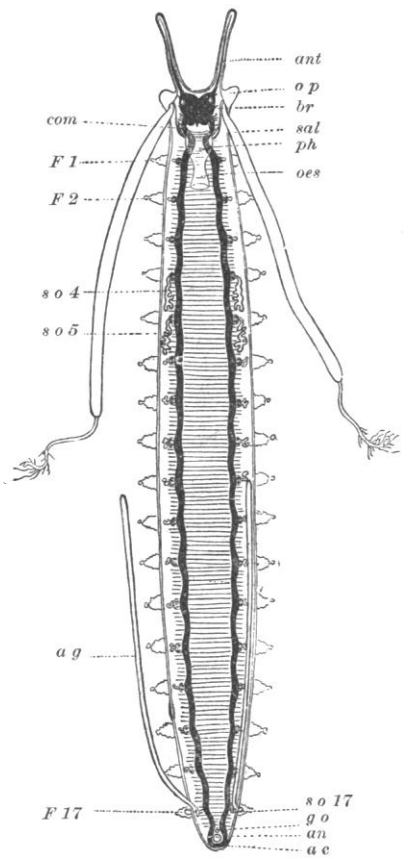


FIG. 2. General anatomy; the digestive tract is supposed to be excised; the nervous system is represented in black: *ant*, antenna; *o p*, oral papilla; *br*, brain; *sal*, salivary gland; *ph*, pharynx; *oes*, oesophagus; *com*, commissures; *F 1*, *F 2*, *F 17*, feet; *s o 4*, *s o 5*, *s o 17*, segmental organs; *a g*, accessory gland; *g o*, genital opening; *an*, anus; *a c*, anal commissure.

from the ventral surface, the sympathetic nerves, which follow the grooves of the pharynx, and unite upon the dorsal wall of the oesophagus. The ganglion-cells are confined, for the most part, to the surface in the supra-oesophageal ganglia, and to the ventral layer in the longitudinal cords. On the under side of each lobe of the brain is a conical protuberance of ganglion-cells, which Grube regards as an organ of hearing; but Balfour questions that interpretation.

The *skin* resembles that of other insects. The cuticle is thin, and forms a separate conical cap over each cell. The surface of the cuticle is dotted over with minute spinous tubercles. Scattered over the skin are organs of special sense, which I think resemble the olfactory organs of insects; but Balfour regards them as tactile. Each is a broad, conical, cuticular spine supported by large specialized sensory cells.

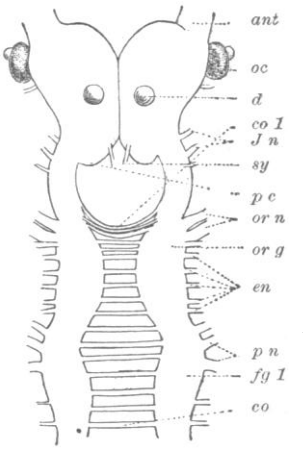


FIG. 3. Anterior portion of nervous system: *ant*, antennal nerve; *oc*, eye; *d*, ventral appendages; *co 1*, first commissure; *J n*, nerves of the jaw; *sy*, sympathetic nerves; *p c*, posterior lobe of brain; *or n*, nerves of the oral papillae; *or g*, ganglion of oral nerves; *en*, lateral nerves of ventral chords; *p n*, pedal nerves; *fg 1*, enlargement corresponding to pedal nerves; *co*, commissure.

The *tracheae* arise from openings between the ridges of the skin. Each aperture leads into a pit formed by the invaginated skin; and from the bottom thereof springs a bunch of fine tracheal tubes, which display large adherent nuclei on their walls, and transverse lines indicating the presence of a spiral fibre. The openings form two rows (subdorsal) on the back, and two rows on either side of the median ventral line; they are also found on the feet, around the bases of the feet, and on the head.

The *muscles* of the jaws are alone striated: all others are unstriated. The muscles of the body form an external double layer of circular fibres, an inner layer of longitudinal muscles forming five bands (one

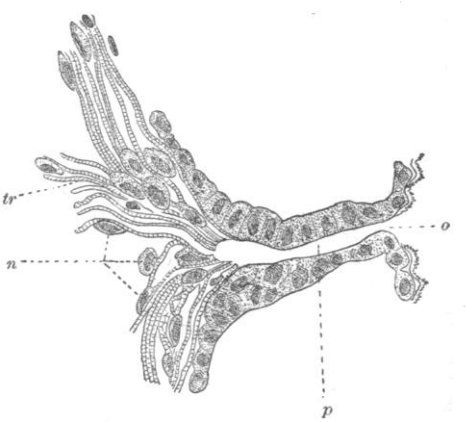


FIG. 4. Section of tracheal orifice: *o*, external orifice; *p*, pit; *tr*, tracheae; *n*, tracheal nuclei.

being median and ventral), and vertical septa of transverse fibres (one septum on each side of the alimentary canal): so that the body-cavity is divided into three regions, — a median, containing the alimentary tract, slime-glands, etc.; and two lateral, containing

the nervous system, salivary glands, segmental organs, etc.

The *vascular system* is imperfectly known. Balfour describes a dorsal tube without apparent muscular walls as the probable representative of the heart, and mentions a less distinct ventral vessel. (Cf. note.)

The *segmental organs*, which were first recognized by Balfour,[1] conform to the structures designated by the same name in annelids. They consist of: 1°. a vesicular portion opening to the exterior; 2°. a coiled portion, which is again subdivided into several sections; 3°. a terminal section ending by a somewhat enlarged opening into the lateral compartment of the body-cavity. The first two pairs, corresponding to the fourth and fifth legs, differ somewhat from the rest, which are all similarly constructed. They are lined by an epithelium, which varies in character in the different parts of the organs: in the first portion, the cells are large, flattened, and have large protuberant nuclei; the second portion has a columnar epithelium in its outer part, in which, further, two regions may

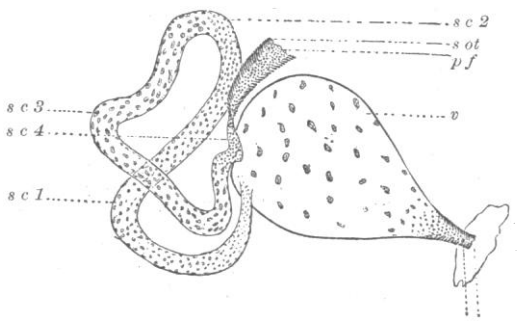


Fig. 5. Part of segmental organ: *o s*, external opening of the segmental organ; *d*, terminal portion of duct; *v*, vesicle; *s c*, *1*, *2*, *3*, *4*, successive portions of segmental canal: *p f*, internal opening; *s ot*, terminal portion.

be distinguished histologically; a third region within this outer part has large, flat, granular cells, with disk-like nucleolated nuclei; while a fourth region, the innermost of the middle portion again, has a lining of small columnar cells. The inner portion has a thick columnar epithelium crowded with oval nuclei, and opens with reflected lips into the body-cavity.

The *generative organs* are briefly described by the editors, who do not, however, deal with their histology. The male organs consist of a pair of testes, a pair of prostates, and vasa deferentia and accessory glandular tubules. The female organs consist of a median unpaired ovary and a pair of oviducts, which are dilated for a great part of their course to perform a uterine function, and which open behind into a common vestibule communicating directly with the exterior. In all the legs except the first there are glandular bodies. The large accessory gland opening in the last leg of the male is probably a modification of one of the series for which the name 'crural glands' is proposed.

Part III., also entirely written by the editors, treats of the development. This contains illustrations, serving to accompany the notice published in the Royal society's proceedings (Science, i. **453**); certain requisite explanations are added; then follow descriptions and figures of older embryos than had been previously described by Balfour. Special attention is called to the following more important facts:—

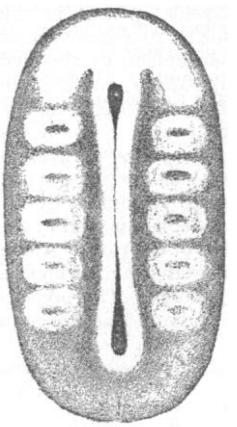


Fig. 6. Embryo, 'stage C,' with five somites: *a*, anal (?) end. The lips of the blastopore have united in the middle.

"1. The greater part of the mesoblast is developed from the walls of the archenteron.

"2. The embryonic mouth and anus are derived from the respective ends of the original blastopore, the middle part of the blastopore closing up.

"3. The embryonic mouth almost certainly becomes the adult mouth; i.e., the aperture leading from the buccal cavity into the pharynx, the two being in the same position. The embryonic anus is in front of the position of the adult anus, but in all probability shifts back, and persists as the adult anus.

"4. The anterior pair of mesoblastic somites give rise to the swellings of the pre-oral lobes and to the mesoblast of the head.[1]

"There is no need for us to enlarge upon the importance of these facts. Their close bearing upon some

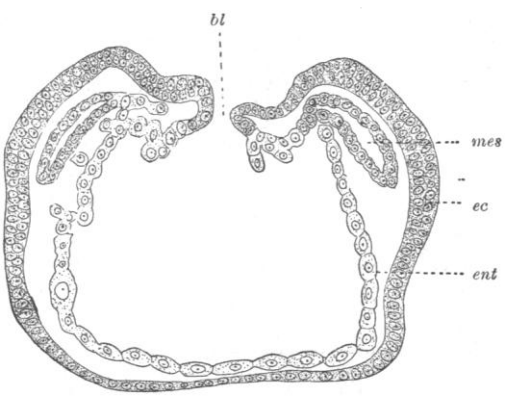


Fig. 7. Section through the open blastopore of the embryo drawn in fig. 6: *bl*, blastopore; *mes*, mesoderm; *ec*, ectoderm; *ent*, entoderm.

of the most important problems of morphology will be apparent to all."

The paper terminates with a few appropriate and telling quotations from Balfour's 'Comparative embryology.' The memoir displays the best qualities

[1] Balfour: *Quart. journ. microsc. sc.*, xix. 1879.

[1] "We have seen nothing in any of our sections which we can identify as of so-called mesenchymatous origin."

of Balfour's work, and can only enhance the respect which all biologists feel for him.

[NOTE. — Since writing this notice, I have learned of the paper since published by Gaffron upon Peripatus (*Schneider's Zoologische beiträge*, i. 33). The original I have not seen, but only a notice in the *Biologisches centralblatt*, iii. 319. From the latter it appears that Gaffron has independently observed many of the facts discovered by Balfour, and in some respects has added to them. The following is the abstract of his description of the heart. "As in the tracheate arthropods, it lies in a special pericardial sinus, completely embedded in a cellular mass, most developed laterally. Its walls are perforated by fissures, corresponding to the body-segments, and which must be sought in the upper half of the tube. Along the dorsal median line runs a round cord, which is held (probably wrongly) to be a nerve. The pericardial sinus and the body-cavity communicate through numerous oval openings in the septum."]

CHARLES SEDGWICK MINOT.

LETTERS TO THE EDITOR.

Prairie warbler in New Hampshire.

Several seasons ago the prairie warbler (Dendroeca discolor Bd.), was found nesting at Northfield in New Hampshire, in June I believe, though I cannot give the exact date. Two of the nests, however, and an egg, are preserved, and place the identity beyond question.

The locality was a high, bush-grown pasture in the vicinity of a town; and the nests were pitched about head-high from the ground, in the crotch of a thornbush. The birds made no demonstrations at the approach to their haunts, but retired noiselessly, seeking to screen themselves from view. One nest contained three eggs, a second four. They are substantially the same, finely and firmly wrought, cup-shaped structures, with a well-turned rim. In the latter instance, the external depth is 2½ inches, the internal 1¼; outer diameter 2½, inner 1½. The nest is composed essentially of bark strippings, Andromeda chiefly, fine grass, and blasted vegetable fibre intermingled, and lined with hairs and the reddish filaments of Polytrichum. The exterior is covered with much cobweb silk and some soft compositaceous substance, which serves to compact the whole and secure it in position.

The egg is pointed at one end, dull white, rather finely and sparsely specked with lilac and marble markings, aggregating in a circle about the crown, measures .68×.50 inches, resembling occasional specimens of the chestnut-sided warbler.

So far as I am aware, there is no previous authentic record of this warbler breeding north of Massachusetts in New England. F. H. HERRICK.

Kalmia.

In your issue for Aug. 17, Dr. Abbott doubts if Kalmia grows sufficiently large to be used for making spoons. The abundant thickets of Kalmia latifolia, beautiful but troublesome, are among the clearest recollections of my youth in southern New Hampshire. This shrub is there familiarly known as 'spoonhunt;' and its stems, near the ground, are not infrequently three or four inches in diameter.

CHAS. H. CHANDLER.

Ripon, Wis., Aug. 23, 1883.

Letters in a surface film.

Can any one suggest an explanation of the phenomenon described below?

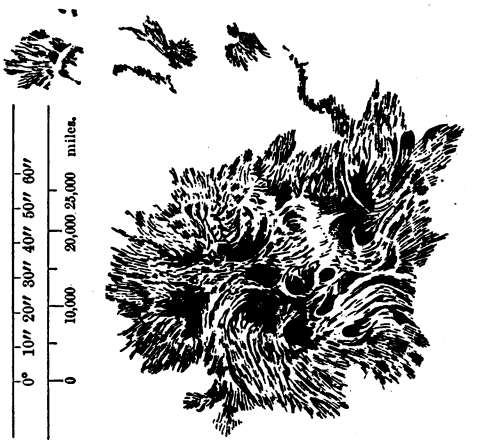
In a box four feet square, and sunk five feet below the surface of the ground, was a water-meter connected with pipes for supplying a factory. Over the face or dial of this meter was a cast-iron cover, on the outside of which the maker's name was inscribed in raised letters. During the spring thaws, the box was half full of surface-water, submerging the top of the meter some eight or ten inches. After a time a greasy film collected on the water, and in this film appeared a counterpart of the raised letters. That it was not a reflection or other optical illusion, was proved by carefully introducing a shovel under these filmy letters, when they were raised and taken outside of the box, being still visible.

In the course of a few hours, fresh letters would appear on the surface. A. P. H.

Boston, Aug. 28, 1883.

An interesting sun-spot.

Owing to a misunderstanding, the scale given with the sketch of a sun-spot, in the letter from S. P. Langley and F. W. Very (SCIENCE, ii. 266), was



printed too large. We reproduce the illustration showing the spot, with a corrected scale. — ED.

A CRITIQUE OF DESIGN ARGUMENTS.

A critique of design arguments. A historical review and free examination of the methods of reasoning in natural theology. By L. E. HICKS, Professor of geology in Denison university, Granville, Ohio. New York, *Charles Scribner's Sons*, 1883. 11 + 417 p. 8°.

THAT men can talk about the most serious problems without passion, is certainly shown by our author, whose candor and excellent aims have already been recognized on all hands. For the rest, we must regard the book with mixed feelings. When we undertook to read it, we did not go forth to see a reed shaken by the wind, nor did we find such; we did not venture to look for a prophet, nor did we find one: but we were prepared for just a