'hollow of the back.' The moose-arrows used by this tribe have a double barb forward, as in the common arrow, while one side is prolonged for two or three inches into a series of barbs; and these have the effect of working inward with the motion of the animal, if it be only wounded. In hunting moose, while these animals are crossing the streams or lakes, so one of my interpreters said who had traded among them many times, they do not hesitate to jump on the animal's back in the river, leaving the canoe to look after itself, and despatch the brute with a hand-knife. Of course, a companion is needed in a canoe to get the carcass ashore, and secure the captor's canoe.

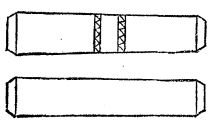

FIG. 8.

Small black flies were now commencing to be annoyingly numerous, and were added to the plague of mosquitoes, that never left us. The bars, that were some protection from the latter, were of no use against the former. Nearly directly opposite the village the perpendicular bluffs shown in the first illustration ceased; and from here on, the hills on both sides of the river commenced to grow higher and even mountainous in character. About thirty-four miles beyond the Selkirk a very conspicuous mountain stream came in from the south, which I named after Prof. A. R. C. Selwyn of Ottawa. The river was still very full of islands, however, many of which are covered with tall spruce, and look very picturesque in the almost cañon-like river-bottom, the steep hillsides being nearly barren of such heavy timber. At this time our attention was called to a singular phenomenon, while riding on the raft, and especially noticeable on quiet, sunny days. I refer to a very conspicuous crackling sound, which was not unlike that of fire running through cedar-brush, and which the men attributed to a pelting on the raft from underneath by a shower of pebbles brought up by the swift current, and which would have been a good-enough theory as far as the sound was concerned; but measurements in these places invariably revealed no bottom for a sixteen-foot sounding-pole, and, when going over shallower and swifter water with pebbly bottoms, the crackling ceased. It being always in deep water of a boiling nature, figuratively speaking, I attempted to account for it in a manner explained by fig. 9. The raft *x*, drifting with the arrow, passes from a shallow to a deep stretch of water. The Yukon is very swift (we drifted that day, July 16, forty-seven and a half geographical miles in eleven hours and fifty minutes), and the pebbles, carried forward over the shallow part, and reaching *a*, are carried forward and literally *dropped* on a gravel-bank at some point forward, as *b;* and, water being a good conductor of sound, a person on a floating craft, during quiet days, would distinctly hear this falling, when it would not be heard if they were simply rolling along the bottom in swifter water. The suddenness with which the crackling commenced, and the gradual manner in which it slowly died out, also help this idea. A series of soundings before and after these sounds would have settled this theory; but it occurred so seldom (once or twice, or possibly three times, a day in this part of the river), that it was impossible to foretell it so as to do so, unless one kept sounding all day. It was noticed in a much less degree on the lower river, but probably would not have been observed if previous experience, of a more marked character, had not brought it before us. Some twenty or twenty-five miles below the Ayan town, we saw a large black bear about halfway up the hillsides of three thousand feet altitude, and, not far from this, three mountain goats near the summit. A number of Ayan graves were seen on the banks of the river, resembling, in general, the one photographed at Selkirk.

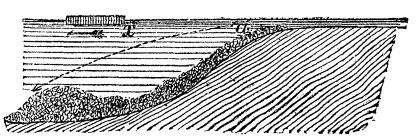

FIG. 9.

(To be continued.)

DEVELOPMENT OF SIPUNCULUS NUDUS.

DR. HATSCHEK adds to the list of his valuable embryological memoirs a very elaborate and interesting paper on the development of the gephyrean, Sipunculus nudus.

The cleavage is unequal, and results in the formation of about twenty-four cells, of which *seven* form the endoderm, and *seventeen* the ectoderm. The endodermal cells are arranged in three pairs on the lower pole of the egg, with an odd cell at the hind end. This stage corresponds to a blastula with a single wall of cells enclosing a cleavage-cavity. The odd endodermal cell is the mother-cell of the mesoderm, and is called the 'primary mesoderm cell' in the following stages. An invaginate gastrula is formed; and during this stage the primary mesoderm cell divides, thus giving a pair of mesoblasts at the

posterior border of the blastopore. During the closure of the blastopore, which begins at the hind border and progresses towards the anterior border, the pair of mesoderm cells pass inward, taking up a position between the ectoderm and the endoderm. The blastopore closes completely; but the last (anterior) portion to close corresponds in position with the inner opening of the oesophagus, which is an ectodermal invagination.

Almost as soon as the gastrulation begins, the ectoderm becomes clothed with cilia, which pass through the pores of the zona radiata, and are thus in a position to set the embryo, together with its envelope, in motion.

One of the most interesting features of the development is the formation of an embryonic envelope at the expense of the ectoderm, only a portion of the ectoderm entering into the embryo proper. The ectodermal parts of the embryo arise from two separate portions of the ectoderm; viz., (1) a group of cells at the animal pole, and (2) the ectoderm cells of the blastoporic rim. The former, called the 'head-plate,' bears a long tuft of cilia, and later gives rise to the supra-oesophageal ganglion: the latter, called the 'trunk-plate,' forms the body, including the oral and post-oral region of the head. The rest of the ectoderm is employed in forming the embryonic envelope, or serosa, which arises as a fold around the trunk-plate during the closing of the blastopore. The fold gradually closes up over the plate, and thus brings about conditions similar to those seen in insects. The inner layer of the fold, however, does not form an amnion, but is gradually absorbed in the trunk-plate. The head-plate stretches a short distance under the serosa, but is not completely enveloped. During the closure of the blastopore, the mesoblastic bands begin to form as two rows of cells budded off from the two mesoblasts, henceforth called 'pole cells of the mesoderm.'

Very early in the gastrula stage a circular groove forms around the head-plate, thus forming a boundary-line between the plate and the serosa. This groove is formed by the retreating of the protoplasm of the cells in this region from the egg-membrane. In the same manner is formed a dorsal canal, leading out of the ring-canal, and stretching along the dorsal side, terminating in the free edge of the fold around the trunk-plate. As this fold closes up over the trunk-plate, and its inner layer is gradually taken up by the plate, there is formed a cavity between the plate and the outer layer of the fold, or the serosa. The ring-canal, the dorsal canal, and this cavity, form together a system of amniotic cavities.

The main axis of the gastrula, which joins the animal with the vegetative pole, does not coincide with the long axis of the larva. The animal pole of the gastrula axis corresponds to the anterior pole of the larva, but the vegetative pole is carried forward on the ventral side to a point about midway between the mouth and the hind end; and this bending of the gastrula axis brings the 'pole cells of the mesoderm' exactly opposite the animal pole, at the posterior extremity of the larva. This change in axial relations is brought about by the growth of the trunk-petal. That part of this plate which lies behind the pole cells shifts its position to the dorsal side, and thus pushes the pole cells forward. The extension of the trunk-plate on the dorsal side is soon followed by expansion on the ventral side. This growth of the trunk-plate not only changes the axial relations, but also brings it into continuity with the head-plate, thus effecting a union of the two hitherto separate ectodermal portions of the embryo.

The fully-formed embryo has a post-oral, ciliated band in the equatorial zone, close behind the mouth, and is attached to the egg-membrane and the serosa at the cephalic end. The escape of the embryo from the egg-membrane and the serosa requires several hours, and is attended with changes of the external form, especially in the region of the head-plate, that are not easily described without the aid of figures. It is the hind end of the body that first breaks through the envelopes. The rupture is made at the pole opposite the head-plate, and gradually increases in size as the body elongates, and forces its way outward. While the body is thus liberated, the head-plate is pulled away from the serosa and the membrane, but remains fastened at several points by string-like elongations of its substance. The serosa and membrane now form a sort of helmet, which the embryo bears about for some hours, and then throws off.

Only two days and a half are consumed in the embryonic development, while the larval period, upon which the embryo now enters, and during which it leads a pelagic life, continues for an entire month. During this period the larva grows rapidly, without undergoing any important changes in form or in inner organization, except the formation of the ventral nerve-cord and the histological differentiation of the muscles.

At the end of this period the larva is changed by a quick metamorphosis into the adult form. The metamorphosis is characterized by the loss of the ciliated band, the degeneration of the accessory organs of the oesophagus, the narrowing of the stomach, and the acquisition of the dorsal vessel. These changes seem to be correlated with the abandonment of a free pelagic life. The rapid growth does not take place uniformly in all parts, but most energetically at the hind end of the body. This 'polarity of growth' is characteristic of metameric and many non-metameric animals.

At the beginning of the larval period no part of the nerve system is fully differentiated. During this period the ventral nerve-cord arises, not by the concrescence of symmetrical halves, but as a single median thickening of the ectoderm. The development and separation of this cord from the epithelium progresses from the anterior end of the body backward. The oesophageal commissures form later than the ventral cord; and their development progresses in the opposite direction, beginning at the anterior end of the cord, and advancing towards the head-plate. Last of all arises the supra-oesophageal ganglion from the deeper cells of the head-plate, which bears the two pigment eye-spots. The com-

missures begin as a single string, which forks anteriorly to form the oesophageal ring.

The muscular sack consists of an outer ring-muscle layer and an inner layer of longitudinal fibres.

The blood-vessel system belongs to the latest formations. The dorsal vessel has, for the most part, an asymmetrical position, beginning on the dorsal side of the oesophagus, and running along the left side of the alimentary canal, to end in the region of the dorsally placed anus.

During the metamorphosis the nephridial organs undergo a rapid transformation; the cilia and ciliated funnels disappearing, and the looped portions being reduced to vesicles.

In conclusion, Hatschek discusses the phylogenetic relationship of Sipunculus nudus with Phascolosoma and the annelids. Sipunculus agrees with the annelids in the formation of the germ-lamellae and the gastrula, in the origin of the mesoderm from two primary mesoblasts, in the splitting of the mesoblastic bands into a visceral and a parietal leaf, in the closure of the blastopore, and in the formation of the oesophagus at the point which marks the last portion of the blastopore to close, but differs in having an embryonic envelope, and especially in the absence of any trace of metamerism.

The larva has some characters in common with the Trochophora, which plays so important a *rôle* in the worms and mollusks; but these are such as are generally preserved, even after the Trochophora stage is passed. The points of agreement are, an ectoblastic stomodaeum and proctodaeum and entoblastic mesenteron, and the head-plate (*scheitelplatte*): the points of difference are, absence of a pre-oral ciliated band, weak development of the head in comparison with the body, the possession of a secondary body-cavity (*coelom*), and the absence of provisional head-kidneys and head-muscles.

The absence of any sign of metamerism forms the most important objection to the derivation of the Sipunculidae from the annelids.

Hatschek concludes that the class Gephyrea must be broken up, the Echiuridea forming a sub-order of the chaetopods, and the Sipunculidae allowed to stand in the place hitherto occupied by the Gephyrea, i.e., next to the annelid class. C. O. WHITMAN.

THE MEETING OF THE AMERICAN MEDICAL ASSOCIATION IN WASHINGTON.

THE thirty-fifth annual session of the American medical association was held in Washington, D.C., early in May, beginning on the 6th, and closing on the morning of the 9th.

The mornings were devoted to the transaction of routine business by the general association; and the afternoons, to the meetings of the different sections, the reading of papers, and the discussions resulting therefrom.

The attendance of delegates was very large, the number registered exceeding thirteen hundred. The interest in the exercises was great, and the amount of work done may be favorably compared with that of any previous meeting of the association. A detailed criticism of the individual papers presented, or of the work done in preparation for them, would be out of place and impossible. The several authors will have full justice in the columns of the *Journal* of the association. A review of the meeting as a whole may be of interest, however, together with a consideration of some of the more important incidents which may bear fruit that will affect the community at large.

The first thing that will bear criticism is the enormous amount of material that was placed upon the programme. In the section for the 'Practice of medicine,' etc., besides the leading paper of the first afternoon, there were eight others ready for presentation on the same day. Inasmuch as the session did not begin until 2.30 P.M., there was, of course, no possibility of doing justice to all this work. The possibility of *injustice*, however, was very great, not only in the shortening of the discussions, which should be the most important part of the work, and which should form the channel for the presentation of new or original work by those taking part, but also in the non-presentation of some of the papers at all. This latter point is to be deplored, for the reason that any one who has once put himself to the trouble of preparation, only to suffer disappointment, is not likely to repeat the experiment in the future. Thus, the society may be deprived of the pleasure and profit to be derived from listening to men who may have results of importance to communicate.

Another thing that should be put a stop to in the future, and this once for all, is the action of some of those who took part in the discussions, in reading from manuscript which could not, by the wildest stretch of the imagination, be considered as having been 'notes,' and which in many cases bore only the faintest relation to the subject in hand. An attempt in this way to present a paper where it had no business to be, was fortunately defeated on the afternoon of the third day of the meeting; but this was the only instance of a protest upon the spot that we know of. The invitation to take part in a discussion should be declined, if the recipient does not feel himself sufficiently well equipped to speak in any but this cut and dried fashion. The idea of a discussion, it should be needless to state, is to call out the individual opinions of participants, and not to afford an opportunity for the introduction of papers not on the programme.

A resolution urging the various medical schools of the country to adopt a higher standard for graduation was passed, and should be of interest to all who are concerned about the medical attendance upon their families. If this action should bear fruit, it alone would be enough for the association to have accomplished at one meeting. The loose manner in which so many of the schools of the country grant their diplomas, and the ill effects of such action, can only be fully appreciated by the medical profession itself. Every member of society, however, is, or