Table VIII. (Special Data.)

Number of cases in which the Stature of individual Brothers was found to deviate to various amounts from the Mean Stature of their respective families.

Number of brothers in each family	4	5	6	7
Number of families	39	23	8	6
Amount of deviation.	Number of cases.	Number of cases.	Number of cases.	Number of cases.
Under 1 inch	88	62	20	21
1 and under 2	49	30	18	14
2 and under 3	15	17	5	6
3 and under 4	4	3	3	1
4 and above	..	3	2	..

II. "The Early Development of *Julus terrestris*."* By F. G. Heathcote, M.A., Trin. Coll. Cam. Communicated by Professor M. Foster, Sec. R.S. Received January 6, 1886.

The following are the principal results of my investigations on the early development of *Julus terrestris* since June, 1882.

When laid the eggs are oval in shape, white, and covered with a thick chitinous chorion. The nucleus is situated in a mass of protoplasm in the centre of the ovum. This mass of protoplasm is of irregular shape, but its long axis corresponds with that of the ovum. From it, anastomosing processes radiate in all directions, forming a network throughout the egg. The yolk-spherules are contained within the meshes of this network. The nucleus is not a distinct vesicle but its position is marked by chromatin granules. There is no nucleolus.

Early on the second day the nucleus and the central mass of protoplasm apparently divide into two parts. But this division is not complete, the two resulting masses with their nuclei remaining connected by a network of protoplasm. Each of these divides in the same incomplete manner, so that we now have four segments all connected together. This process is continued until there are a considerable number of segmentation masses present, and early on the

* Mr. J. D. Gibson Carmichael, F.L.S., has kindly identified the species for me as *Julus terrestris*, Leach, 1814.

third day the first formation of the blastoderm begins. Early on the third day some of the segmentation masses make their appearance on the outside of the ovum at different parts, and there undergo rapid division, the resulting cells spreading out to form the blastoderm. At the close of the blastoderm formation, the ovum consists of an external layer of flat cells—the epiblaast—with deeply stained oval nuclei, these cells being continuous on the one hand with one another, and on the other with the cells in the yolk by means of fine processes of protoplasm. The cells in the interior of the yolk are the direct descendants of the first segmentation masses. They constitute the hypoblast.

The fate of these hypoblast cells is various; some of them are employed in the formation of the mesoblastic keel which I am about to describe, that is, in the formation of the splanchnic and somatic mesoblast. Another part gives rise to the hypoblastic lining of the mesenteron, while a third part remains in the yolk after the mesenteron is formed, and gives rise to mesoblast cells which are employed in the formation of various muscles and of the circulatory system.

With regard to the retention of the primitive connexion of the cells of the ovum until this stage, nothing of the sort has, I believe, been described before except by Sedgwick in Peripatus. The most important part it seems to me is not the connexion of cell to cell but of layer to layer by means of processes of the cells.

About the middle of the fourth day several of the hypoblast cells approach the epiblast in the middle line of what will eventually be the ventral surface of the embryo. This is the first beginning of a mesoblastic keel such as Balfour has described for *Agelena labyrinthica*. When a fair number of these cells are assembled in the middle line of the ventral surface a change takes place in the cells of the epiblast just outside them. They become more rounded, their nuclei become round; in fact they come to resemble the cells which I have described as assembling immediately below them.

The epiblast cells in the middle ventral line after altering their shape increase by division and take a considerable share in the formation of the keel. The hypoblast cells below them also increase, and on the fifth day the mesoblastic keel is complete. Both epiblast and hypoblast have taken part in the formation of this keel.

At the end of the sixth day the keel is still present, but the cells of which it is composed are becoming elongated in the direction parallel to the surface. At the same time they continue to multiply and spread themselves out so as to form two definite layers within the epiblast. These are the splanchnic and somatic layers of the mesoblast. The cells of the splanchnic and somatic mesoblast are connected.

On the seventh and eighth days the keel gradually disappears, and the layers of mesoblast spread round a great part of the embryo, rather more than half way round. On the ventral surface the epiblast cells assume a columnar form, thus giving rise to the ventral plate.

The mesoblast now becomes thicker on each side of the middle ventral line. Both layers are concerned in this thickening, and at these points the two layers become indistinguishable. Outside the thickenings, that is further away from the middle ventral line, the two layers are closely applied to each other, and to the epiblast as before. The effect of these changes is that the greater part of the mesoblast is now arranged in two parallel longitudinal bands along the ventral surface of the embryo; these bands being connected across the middle line by a thin portion consisting of a single layer.

The two longitudinal bands now begin to be constricted off into the mesoblastic somites. The latter are formed from before backwards, and their position corresponds with that of the future segments of the body. The number of the somites is eight, corresponding with that of the eight segments with which the embryo is finally hatched. The somites are at first solid, afterwards a cavity appears in them.

Early on the ninth day the stomodæum is formed as an invagination of the epiblast near one end of the ventral surface. Shortly after the first formation of the stomodæum, the proctodæum appears as a shallow somewhat wide invagination of the other end of the ventral surface.

The body-segments already established by the segmentation of the mesoblast now become more apparent, each being marked by a deep transverse furrow in the epiblast. The hypoblast cells are still present within the yolk, but are gradually becoming collected in the median line, just below the mesoblastic bands. The stomodæum and proctodæum become more deeply invaginated, extending a considerable distance into the yolk, and at the same time the hypoblast cells begin to form the mesenteron, arranging themselves around a central lumen.

On the tenth day the ventral flexure is formed by a deepening of the transverse furrow between the seventh and eighth segments. It is, therefore, first formed nearer the anal end of the embryo. As the furrow deepens and the embryo increases in size, the last segment grows in length. At the same time the embryo curves round towards the ventral surface. The effect of this is that the end segment is bent round against the head. The eighth segment is considerably longer than the others except the head, and the tissues there show a considerable difference. Even as late as the twelfth day, when the nervous system is far developed in all other parts of the body, in the eighth segment the tissues are imperfectly differentiated, the nerve

cords not showing any ganglia, but lying on the epiblast and not quite separated from it. At a later period of development the anal segment is constricted off from this segment, while from its anterior part the future segments formed in the course of development are developed.

Just before the appearance of the ventral flexure the embryo develops a cuticular envelope over the whole surface of the body. This is the so-called amnion of Newport. Just before the formation of the ventral flexure the nervous system is formed. The first traces of this consist in a thickening of the epiblast on each side of the middle line. This is soon followed by the formation of a shallow furrow between the thickened parts; this longitudinal furrow corresponds with that described by Metschnikoff in Strongylosoma. The bilobed cerebral ganglia are formed first, and the nerve cords are formed from before backwards, a pair of ganglia being present for each segment except the last. The posterior portion of the nerve cords is completed at a considerably later stage of development. The nerve cords are widely separated, but are connected by a thin median portion. In later embryonic life they are closely approached to one another, and almost form one cord.

On the eleventh day the embryo has increased considerably in size. The ventral flexure is complete, and the animal lies with the long end segment folded closely against the rest of the body, the end of the tail being against the stomodæum. The nervous system is now completely separated from the epiblast, and the epiblast has assumed the adult form. It now separates a second membrane like that which is formed on the tenth day.

The splanchnic layer of mesoblast covers the mesenteron, the stomodæum, and proctodæum.

Within the yolk, which is still present in great quantity in the body cavity, there are present a number of hypoblast cells. These, as have already been mentioned, give rise to the circulatory system and to various muscles. They may, therefore, be now considered as mesoblastic cells which have been directly derived from the hypoblast.

On the twelfth day the Malpighian tubes are formed as blind outgrowths of the proctodæum, the nervous system is further developed, and the first rudiments of the appendages begin to appear. Late on this day the animal is hatched with only the rudiments of its appendages. I propose to reserve a full description of this stage for a future paper.