der Segmentierung) zu erkennen. Dabei schreitet die Vermehrung der Zellen von den ventralen nach den seitlichen Theilen des Keimstreifens fort. Dies ist besonders deutlich, wenn man die bogenförmigen Querreihen von ihrem lateralen Rande bis zur ventralen Medianlinie verfolgt. In vielen derselben findet sich in irgend einer Zelle eine Mitose; lateralwärts vor dieser ist dann die Zellreihe einfach; medialwärts ist sie in zwei Reihen gespalten. Ausnahmen von diesen Regeln finden sich nur selten, und solche Keimstreifen bieten eben durch die Anordnung der Zellen und Mitosen dem Auge ein sehr zierliches Bild dar.

Alles, was ich hier mitgetheilt habe, bezieht sich nur auf das Ectoderm. Eine entsprechende Regelmäßigkeit der Anordnung der Zellen in den inneren Keimschichten habe ich bis jetzt nicht nachweisen können. Auch möchte ich noch hinzufügen, daß in keinem Stadium größere Urzellen (Teloblasten) am Hinterende des Keimstreifens nachgewiesen werden konnten. Vielmehr gehen die Zellen des Keimstreifens hier in gewöhnliche Blastodermzellen (oder Ectodermzellen) über.

Wenn sich die einzelnen Organe anlegen, wird die Regelmäßigkeit der Zellenanordnung in den betreffenden Regionen aufgehoben; die Zellen drängen sich zwischen einander und die Mitosen finden nach allen beliebigen Ebenen statt. Dies läßt sich zunächst an den Neuralwülsten erkennen, später auch an den Extremitätenanlagen. Zwischen den aus einzelnen segmentalen Abschnitten bestehenden Neuralwülsten ist jedoch noch eine Zeit lang die oben erwähnte einfache, mediane Zellreihe deutlich erkennbar. Sie erstreckt sich nach vorn bis in den Kopftheil des Embryo hinein. Wenn wir von dieser medianen Zellreihe absehen, schreitet also die Auflösung der Reihen von der Ventralseite nach der Dorsalseite fort. An der Bildung der Neuralwülste betheiligt sich, so viel ich sehen kann, nur eine der ursprünglichen Längsreihen von Zellen; doch möchte ich mich hierüber nicht allzu apodiktisch aussprechen. An der Bildung der Extremitäten dagegen sind jederseits mehrere Längsreihen betheiligt.

Kopenhagen, im Mai 1892.

4. The formation of the Germ-layers in the Isopod Crustacea.

(Preliminary Notice.)

By Dr. J. Playfair McMurrich, Cincinnati.

eingeg. 25. Mai 1892.

The method of formation of the germ-layers in the Crustacea is a problem for which many solutions have been proposed, but which cannot yet be said to be satisfactorily understood. It is difficult to harmonize the various accounts which have been given, and all lack one important feature, viz. a thorough description of the segmentation processes and a tracing back of the germ-layers to their parent cells or groups of cells. In many forms difficulties which our present technique has not been able to satisfactorily overcome lie in the way of such a study, and it was with peculiar pleasure that I discovered an Isopod, *Jaera albifrons*, Leach, in which conditions were favorable for a thorough study of a typical centrolecithal segmentation. Since I wish to defer the final publication of my results until I shall have had an opportunity of studying the large amount of material from other species which I possess, I have thought it well to give a preliminary statement of the results of my study of *Jaera*. Owing to the character of this notice references to previous observations on Isopods will be omitted, and I shall content myself with a bare statement of the facts I have observed.

The egg of *Jaera* when passed into the brood-pouch is of a bright grass-green color, and is enclosed by a single envelope, the chorion: it is somewhat oval in shape, and has at the centre a stellate mass of protoplasm containing the nucleus, while a thin layer of peripheral protoplasm encloses the yolk. A continuity of the peripheral and central protoplasms cannot be distinguished clearly in mature eggs, but in ovarian eggs about half grown a delicate protoplasmic network can be easily seen extending between the two, the yolk granules lying in the meshes.

Two polar globules are formed at the extremity of the short axis of the egg, and about the same time a second enveloping membrane, the yolk membrane, is formed. The first cleavage is at right angles to that of the polar globule divisions, and affects only the nucleus and the central mass of protoplasm, the peripheral protoplasm and the yolk remaining undivided. The second cleavage affects the same parts; one of the two nuclei divides in a plane at right angles to the first division, while the other forms its spindle at an angle of more than 45° to it, and by a subsequent rotation the two nuclei so produced have the line joining them at right angles to that joining the products of the other nucleus.

A somewhat similar phenomenon occurs at the third cleavage. The two nuclei situated at one end of the egg divide at right angles to the division of their parent nuclei, and one of the nuclei at the other end divides at right angles to these two, while the fourth nucleus divides at an angle of 45° to all the rest. There is thus produced at one extremity of the egg (Fig. 1) a circle of four nuclei, and at the other a circle of three nuclei surrounding a fourth. This last is the ancestor of the endoderm cells. The fourth division produces sixteen nuclei, two of which belong to the endoderm. The circle of three which surround the primitive endoderm nucleus have divided to form a circle of six nuclei, and to this circle a seventh nucleus is added by a longitudinal division of one of the four nuclei of the other extremity of the egg. The endodermal pole of the egg consequently presents two endoderm nuclei surrounded by a circle of seven nuclei; in the rearrangement of the nuclei which takes place before the next division the number of nuclei in the circle is reduced to six by the migration toward the ectodermal pole of one of those formed by a division of a nucleus originally belonging to the endodermal pole. The six nuclei thus arranged are the parent nuclei of the mesoderm.

Up to this stage there has been no division planes visible at the surface of the egg, but, when it is completed, the nuclei with their

Fig. 1.

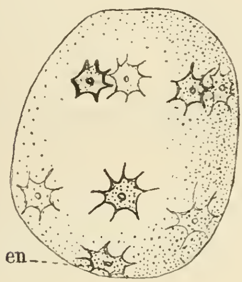
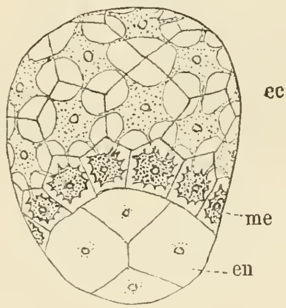


Fig. 2.



surrounding protoplasm have reached the surface, and the next division, by which thirty-two cells are formed, shows itself by a division of the yolk as well as by a division of the nuclei. The cell-divisions are superficial however, the great mass of central yolk remaining undivided. A remarkable differentiation of the cells also manifests itself at this stage; the endodermal cells are increased to four, and show their nuclei only or rather their protoplasm is not concentrated around their nuclei, but is disseminated throughout the yolk. These are surrounded by a circle of twelve mesoderm cells, whose protoplasm is strongly concentrated around the nuclei, while the rest of the egg is occupied by sixteen scattered cells in which the degree of concentration of the protoplasm around the nuclei is intermediate between that occurring in the mesoderm and endoderm cells. Fig. 2 will afford a better idea of the appearance of an egg at this stage than can be given by words.

It is a noticeable fact that in this stage the egg is a syncytium, at least the sixteen ectodermal cells and the mesoderm cells seem to be connected by protoplasmic processes. It seems probable that so long as the nuclei are below the surface that a syncytium exists, but as they, with their protoplasm, begin to separate from the yolk, they become distinct, as in later stage, when the cells lie upon the surface of the yolk substance, no traces of connections between the various cells can be made out.

The following divisions appear to go on regularly up to the 128-cell stage, after which irregularities supervene. At about this stage a concentration of both mesoderm and ectoderm cells towards the ventral surface of the egg, which is plainly marked out in the 32-cell stage by the eccentric position of the four endoderm cells, occurs; in this concentration the mesoderm cells take precedence, forming eventually a closely aggregated patch of cells, lying immediately in front of the peculiar endoderm cells. A little later, in front of this the ectoderm cells aggregate to form a somewhat heart-shaped mass, the head-lobes, a few scattered cells only remaining on the dorsal surface of the egg. Still later the mesoderm cells begin to divide parallel to the surface, so that a plug of cells is produced projecting down a short distance into the yolk, forming the so called blastodisc of the Crustacean egg.

At about this time however a semicircle of cells may be made out in some cases surrounding the front margin of the blastodisc. They are more distinct in *Cymothoa* than in *Jaera*, where however they can be clearly perceived in later stages. They are ectodermal, and soon begin to divide, the division being repeated always in the same plane, so that each cell gives rise to a chain of cells running forward from it, similar to the chains produced by the teloblasts of *Lumbricus* or *Clepsine*. By this growth the teloblasts, for so these cells may be termed (they correspond to the cells of the »budding Zone« described for *Astacus* by Reichenbach), are pushed back over the mesoderm cells, the semicircle becoming first straight and then concave forwards, and the mesoderm is forced below the surface of the egg. There is no invagination of the blastodisc whatever, the ectoderm simply grows back over it. In the same manner the endoderm cells are excluded from the surface of the egg, but in this case there is an actual immigration, the cells sinking down into the interior of the yolk, and becoming the »vitellophags«. The account of the segmentation given above necessarily implies absence of any cells in the interior of the egg at stages earlier than this (except of course in the earliest stages when all the nuclei are imbedded in the yolk); there is no »retarded migration« to the surface of any cells, but all the vitellophags are derived from cells whose ancestors reached the surface of the egg.

The cells of the mesoderm plug, soon after their over-growth by the ectoderm, scatter, the majority passing forwards to form the mesoderm of the head and anterior body region, while others, apparently taking on a teloblastic function, are carried back along with the ectodermal teloblasts, and give rise to the mesoderm of the posterior portions of the body.

These statements are, in many respects, very divergent from those of previous authors on Isopod embryology. They are given however after a careful study of the problems involved as presented in *Jaera*, and as definite proofs of their correctness as are possible will be given later. In the meantime it may be stated that, if correct, they serve to bring into closer harmony the modes of formation of the germ layers of those Crustacea of which we possess an adequate account. Up to the present I have not been able to make a thorough study of *Asellus* and *Porcellio*, the two forms which I hope to study for comparisons with *Jaera*, but I have seen enough of their segmentation to feel confident that in the earlier stages it is identical with that of *Jaera*, but a much greater number of cells is formed before the concentration towards the ventral surface, which results in the formation of the blastodisc, occurs; and furthermore I have not been able to make out as yet any such structural distinctions between the endoderm and mesoderm as occur in *Jaera*.

It is worthy of notice that the longitudinal axis of the embryo is at right angles to the first cleavage plane.

University of Cincinnati, U. S. A., May 9th 1892.

II. Mittheilungen aus Museen, Instituten etc.

Linnean Society of New South Wales.

May 25th, 1892. — 1) Catalogue of the described Hymenoptera of Australia. Part II. By W. W. Froggatt. This part, in which 528 species are recorded, completes the catalogue, and is concerned with the following families: *Scoliidae, Pompiliidae, Sphegidae, Larridae, Nyssonidae, Philanthidae, Crabronidae, Bembecidae, Masuriidae, Eumenidae, Vespidae, Andrenidac,* and *Apidae*. — 2) On twenty-one new species of Australian Lepidoptera. By T. P. Lucas, M.R.C.S.E. The species described as new are all from Queensland, and include representatives of the *Bombycina, Geometrina,* and *Noctuina*. One new genus, allied to *Rivula*, is proposed. — 3) Further Notes