distinguished, many of which may be illustrated by a great number of special examples and which all amount to this: that an atom or a group linked to N or O shows an inclination to pass from this atom to the nucleus and then always (or nearly so) changes place with the H atoms occupying para- and ortho-places. Whether the meta-places are occupied or not does not affect this isomerisation process.

If we now limit ourselves to nitric acid it may be observed that the idea that in the nitration of aniline derivatives (best in the case of those containing NHX instead of NH_2) the nitro-group should always combine first with the nitrogen forming nitramines, before passing on to the nucleus, has already been suggested by BAMBERGER and confirmed by experiment. After Dr. BLANKSMA's experiments we arrive at a similar conclusion as regards the formation of nitrated phenols. This is confirmed by another observation of Dr. BLANKSMA that if the phenol-hydrogen of symmetric dinitrophenol is replaced by methyl, the ready bromination or nitration is no longer possible. Efforts will be made to prepare the as yet unknown nitrates of the phenols and, if successful, their behaviour will be closely studied.

Physiology. — "*On the development of the entoderm, of* KUPFFER's *vesicle, of the mesoderm of the head and of the infundibulum in Muraenoïds*" (preliminary paper), by Dr. J. BOEKE. (Communicated by Prof. T. PLACE).

(Communicated in the meeting of January 25, 1902).

In his well-known paper on pelagic eggs of the Gulf of Naples, RAFFAELE described five species of big pelagic eggs, which were found in the plankton of the Gulf during the months of August and September, which he suggested that might belong to different members of the Muraenoïd group.

In 1893 and 1896 GRASSI and CALANDRUCCIO confirmed this theory, but they did not study the eggs closer.

During the summer of 1900 and 1901 I had the good fortune to secure several hundreds of these eggs during a stay at the Stazione Zoologica at Naples, and was enabled to study all the stages of development of the embryos until the critical period. The description and suggestion of RAFFAELE I found to be perfectly true, and moreover I collected three other species of eggs, which although undoubtedly belonging to Muraenoïd species, could be distinguished sharply from the other five spp., described by RAFFAELE. From these they differed in the dimensions of the yolksphere and the perivitelline space, in

the number, and the distribution of the oil-drops in the yolk, in the character of the egg-capsule and in different characters of the more developed embryos. These eggs however were very rare and could only be secured in small numbers.

The processes of development which I am about to describe in this paper, were studied therefore exclusively on the eggs of the spp. RAFFAELE already described. My efforts to keep the fry alive more than a few days after the yolk had been absorbed, being unsuccessful, I could not identify distinct species of larvae with distinct spp. of Muraenoïds.

I therefore will follow the example of RAFFAELE, and write Muraenoïd N°. 1, Mur. N°. 2 etc. Mur. N°. 1 is his spec. 6, Mur. N°. 2 his spec. 7 etc.

In describing the development of the entoderm and KUPFFER's vesicle, I will begin by calling attention to the paper by F. B. SUMNER on KUPFFER's vesicle and its relation to gastrulation and concrescense, published last year.

SUMNER maintains that KUPFFER's vesicle in Teleosts and Ganoïds (Amia) is formed by a solid or hollow invagination of the superficial layer („Deckschicht"). Before the closure of the blastopore the superficial layer by proliferation of its cells forms a thickening at the hind part of the embryo, that SUMNER called the prostomal thickening in connection with KUPFFER's theory of gastrulation in Teleosts. In Muraenoïd eggs, of which he could study some stages, he found a material in which the process was to be followed „with almost diagrammatic distinctness". But being short of Muraenoïd material he could not determine accurately the relations between the prostomal thickening and the entoderm. From one of his drawings (page 60 cross section of a young Noturus embryo) seems to follow, that he thinks it probable, that chorda and mesoderm are derived from the entoderm and that the entoderm is formed at least partially from the proliferation of the superficial layer.

Having an abundance of Muraenoïd eggs to study, I was able to follow the entire process and obtained the following results: as soon as — the cleavage-process being ended — the cells at the blastodermmargin begin to invaginate inward, the cells of the superficial layer, which everywhere else are flat and do not partake of the invagination process, begin to increase in size at one point. This increase of size of the cells of the „Deckschicht" is limited to a small area at the hind end of the thickening of the blastoderm, which is the first indication of the embryonic shield. There, at the edge of the blastodermring, the cells of the superficial layer thicken, become

rather cilindrical, and divide parallel to the surface of the egg, so that one of the daughtercells travels inward.

At a somewhat later stage of development, when the blastoderm has spread further over the surface of the yolk, and the embryonic shield is to be seen clearly, a median section gives the following view: the invagination of the blastoderm is sharply defined. At the hind end of the embryonic shield the cells of the superficial layer, which everywhere else are flat and separated by a sharp line from the periblast, are cilindrical with the long axe at right angles to the surface of the egg, and send a tongue of cells inward between the invaginated layer of the blastoderm and the periblast. This is to be concluded from the direction of cell division in the projecting layer of cells. This tongue of cells consists of loosely packed cells, reaches inward almost as far as the invaginated layer of the blastoderm and is distinctly separated from it.

The thickened part of the superficial layer SUMNER called „prostomal thickening". Beneath it are to be seen many nuclei in the periblast and often one gets the impression as if cells from the periblast partake of the process and travel inward with the other cells of the prostomal thickening. However I could not state it with a sufficient amount of certainty. On cross sections (parallel to the blastoderm-ring) the inward proliferation of the superficial layer may also be sharply separated from the other blastodermcells. The cells of the invaginated layer of the blastoderm form in the median line the chorda. The sideparts become the mesodermic plates. The proliferation of the superficial layer (with cells from the periblast?) form the gut-entoderm (some cells are separated in the course of development, and seem to form primary blood-corpuscles. At least, they do not take a part in the forming of any particular layer).

At the closure of the blastopore the superficial layer forms an invagination and in this manner KUPFFER's vesicle is formed, just as SUMNER described it in his paper. [1])

In different Muraenoid spp. however the forming of KUPFFER's vesicle does not take place in the same way. In some spp. (viz. Mur. N°. 2) the invagination of the „Deckschicht" (or the overgrowing of the prostomal thickening by the tail-knob) begins some time before the closure of the blastopore, in other spp. (viz. Mur. N°. 1, N°. 3) it begins much later, as the blastopore is nearly closed and

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[1]) RAFFAELE too saw a transitory communication of KUPFFER's vesicle with the exterior in the Muraenoïds.

the periblast almost entirely overgrown. The first mode of development gives rise to a KUPFFER's vesicle, bounded on the dorsal side with epithelium, on the ventral side with periblast, the second to a KUPFFER's vesicle almost entirely bounded with epithelium.

The wall of KUPFFER's vesicle is continuous with the wall of the gut. The dorsal row of cells forms the hypochorda.

It would lead us too far to describe the later development of the gut, the concentration of cells towards the median line, the folding and forming of the gut-tube. I will here restrain myself to show, how in these Teleosts the secondary entoderm — the gut-entoderm — is formed independently of the chorda and the mesodermic plates, and how the chorda is differentiated out of the median part of the invaginated layer of the blastoderm. For that seems to me to be of great value to understand rightly the processes of development that take place in the head-part of the embryo.

In following the development of the head on median sagittal sections, as are lying before me in sufficient quantities and of different stages of development, the observer sees, that in the stage in which the central nervous system forms only a solid keel and there is as yet nothing to be seen of the optic vesicles, the chorda, until the point where in later stages it ends, is composed of flat disk-like cells, but then grows thinner and can be traced as two rows of cells dorsally of the entoderm to the foremost part of the head, where they form a big mass of cells lying in front of the brain and beneath the point where the anterior neuroporus is formed. The cells of the entoderm can everywhere be distinguished sharply from the prolongation of the chorda, except in the foremost part, where in median sections it was difficult to distinguish them from each other. As soon as the optic vesicles are formed, the infundibulum develops and pushes the mesodermcells away. On median sections the prolongation of the chorda is now to be followed until it reaches the infundibulum. In front of the infundibulum the anterior mesodermmass is then to be seen. The ectoderm grows inward beneath this mass of cells and unites with the entoderm. But the cells of the entoderm not containing any particles of yolk here, and being only distinguishable by their position from those of the other layers, I cannot yet fix accurately the point where the entoderm and the ectoderm fuse. The ectoderm seems always to be sharply separated from the anterior mesodermmass, that in later stages forms the sceletogenous tissue of the fore-head.

In following the further development of the mesoderm of the head in median sections, the chorda is seen to be rounded off and to be separated from the anterior row of cells; by the growth in length

of the region of the fourth ventricle the cleft between the top of the chorda and the anterior row of cells widens. This anterior row of cells is then to be seen to extend to the infundibulum, and is at both sides connected with the head-mesoderm.

At first solid, it becomes hollow, is shortened and lays itself closely at the back of the infundibulum; finally it disappears altogether. It seems to be the homologon of the connection-piece of the head-mesoderm described for selachians by BALFOUR and MARSHALL, closely studied by VAN WIJHE, the „Sclerotomcommissur" of KILLIAN.

In now examining cross-sections through the head, we see that the mesoderm on both sides of the chorda does not break up (as is the case with the other Teleosts) into mesenchym, without being segmented, but that the somites of the trunk are continued without break as far as the auditory and farther on as far as the optic vesicles. These somites are, it is true, smaller and not as regular as the somites of the trunk, but everywhere myotomes and side-plates are to be distinguished very sharply. There is no trace of mesenchym until a late period.

There where the chorda is rounded off as a distinct rod, the myotomes on both sides are separated from the chorda and from each other, more in front behind (and in young stages beneath) the infundibulum they are united by the connection-piece mentioned above. The somites are to be traced up to the foremost part of the head, where the optic vesicles are formed. They do not seem to be connected with the anterior mesoderm mass.

In later stages of development the posterior somites of the head become hollow. The lumina fuse with each other, and the somites become small epithelial vesicles, which enlarge and form the head cavities; by the connection-piece they are connected with each other. The anterior walls of the head cavities and the solid somites lying in front of the head cavities form the eye muscles, but at present I cannot tell from which somites the different eye-muscles are formed. For the same reason I cannot fix the exact number of the head-somites, for, although the segmentation of the head-mesoderm into somites is to be seen in longitudinal sections as clearly as the peculiar form of the somites (as real myotomes) in cross-sections, I could not until now follow the different somites in their entire development. To make the necessary plastic reconstructions of the section-series time failed me and I am not sure if it will be possible at all, for especially the foremost somites break up after a time into mesenchym and are to such a degree compressed by the hind wall of the optic vesicles, that it is difficult to recognise them as different

somites. Before long I hope in a full paper to work out this theme with drawings and plastic reconstructions. In this preliminary communication I will confine myself to describing the forming of distinct somites in the head of Teleosts, independent of the entoderm and entirely analogue with the myotomes of the trunk, and to showing the signification of the connection-piece as a simple prolongation of the chorda.

Before ending I beg to be allowed to give some more data on the structure and the development of the infundibulum in the Muraenoïds. The description of the structure of the infundibular organ I gave in the „Anatomischer Anzeiger", after further examination appeared to be perfectly true. The big cells I described in the infundibulum of Muraenoïd embryos, with a protoplasmic conical protuberance and a crown of small vesicles on it, I could distinguish with great clearness in the living larvae. The crown of small vesicles showed itself with the same regularity as in the stained sections, they were standing on a distinct protoplasmic conus and the whole complex was sharply bounded off from the other parts of the brain. What I had concluded already from peculiar alterations of the form of the cells, viz. that the protoplasmic conus was able to alter its form, I could confirm by studying the living embryos. Several times I saw one of the big sensory cells prolong its protoplasmic conus and draw it back again. In no case I saw one of the small vesicles fall off or lying free in the lumen of the infundibulum.

In my first communication I had overlooked the description of the infundibular gland by STUDNICKA in his paper on the ependym, published last year. He described the same crown of small vesicles on the cells of the infundibular gland in different fishes (Selachians, Teleosts, Ganoids), and takes them for a product of the secretion of the gland cells. From my description and from the fact, that they develop out of cilia, which I could state by studying the intermediate stages, it seems to me to follow, that this conclusion cannot be the right one, and that we have to see in the saccus vasculosus not a gland, but a sense-organ. For adult anguillae I could confirm the statements of STUDNICKA. But here too, the small vesicles are sitting on distinct „Basalkörperchen", and continue in the cell as a bundle of thin but distinct fibres. In all the embryos of Teleosts I studied in this direction (Hippocampus, Syngnathus acus, Clupea spp., Uranoscopus, Mullus barbatus, Lepidopus caudatus, Scorpaena scrofa, Fierasfer acus) the same structure of the saccus vasculosus was to be seen.

As to the function of the infundibular organ, it seems to me

that the abundance of blood capillaries around the organ seems to point to a connection with the regulation of the blood pressure in the cerebrum or the pressure in the ventricles, as VON CYON maintained to be the case for the entire hypophysis. Some experiments I made on the live embryos, seemed to confirm this conclusion.

Kolozsvár, January 1902.

Physics. — "*Ternary systems.*" (1st part). By Prof. J. D. VAN DER WAALS.

THE PRINCIPLE OF CONTINUITY FOR A TERNARY SYSTEM.

The equilibrium phenomena of a binary mixture at a given temperature may be illustrated geometrically by a surface, where volume and composition serve as abscissas and the free energy as ordinate. In the second part of my Continuity I have discussed the shape of such a surface and I have demonstrated what conclusions may be drawn from the properties of such a surface $\psi = f(x, v)$.

If we have a ternary system, for which two quantities x and y are required for the determination of the composition, then

$$\psi = f(x, y, v)$$

and so such a geometrical representation cannot be used. Though the geometrical representation is not necessary for the deduction of the conditions of equilibrium, and though it is not even possible to use it with increasing number of the components, yet for a binary mixture the great advantages of the graphical treatment have been sufficiently proved to continue employing it as long as we can.

For a ternary system we find the means of effecting this in the properties of the ζ-function, according to the rule of equilibrium given by GIBBS, that at given T and p the substance arranges itself in such a way that the value of ζ is as small as possible. At given T and p the value of ζ is only dependent on x and y, and so the geometrical representation can again be used.

If we think a ternary mixture as composed of $1 - x - y$ molecules of the first substance, of x molecules of the second substance and y molecules of the third substance in homogeneous phase, we obtain the value of ζ, as I have given it. (Verslag van 25 Sept.