

# General metabolism during gastrulation



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report: General Metabolism during Gastrulationreport? ATP,?( )ATP

Gastrulation is the most active phase of morphogenetic activities of different types of blastomeres during which there are complex or intense chemical processes in the cells which affect both their metabolising and their fine structure. There is an increase of nuclear material at the expense of cytoplasmic substances. Breakdown assimilation of reserve materials is also going on. The metabolism during gastrulation can be studied under the following heading: Catabolism: The morphogenetic movements during gastrulation cause an increased expenditure of energy rich ATP molecules and consequently, an increased oxidation. The oxygen consumption during the gastrulation shows a further increase as compared to the cleavage stages and with the blastula. During gastrulation the food reserves (e. g. , glycogen and yolk) are oxidized for the manufacturing of ATP molecules.

Oxidation of glycogen: Glycogen is one of the substance particularly involved in the supply of energy during gastrulation in amphibians and other animals.

The amount of glycogen becomes considerably diminished in the invaginating cells of the dorsal lip of the blastomere 31% of the glycogen is lost during gastrulation whereas in other parts of the embryo glycogen loss is only from 1% to 9% in the same time. Rapid breakdown of glycogen in the dorsal lip suggests a particular active respiration in this area. Break down of yolk. Besides glycogen, the yolk of the blastomeres is broken down for energy metabolism or assimilation.

The breakdown of yolk granules has been investigated both electron microscopically and biochemically. With the electron microscopy, it can be seen that in amphibian embryos, the first change in the yolk platelets consists in the disappearance of the amorphous or granular peripheral layer which contains, besides proteins, considerable quantities of ribonucleic acids. The disappearing material goes into solution in the cytoplasm and becomes available for synthetic process.

The solubilization of the peripheral layer occurs in the invaginating chordamesoderm during gastrulation in the neural plate during late gastrulation and neurulation and still later in the epidermis. The solubilization of the crystalline core (main body) of the yolk platelets occurs considerably later, and in endoderm, it is delayed till just preceding the stage when the larvae start feeding. Biochemically, the solubilization of the yolk platelets can be recorded either spectrophotometrically by the decrease of light absorption of the yolk platelets in a microscopic preparation or by separating the yolk platelets from homogenates of embryos and measuring their protein content. By both methods it was shown that there is a rapid decrease of yolk platelet protein in the invaginating chorda mesoderm starting from the beginning of gastrulation and a slower decrease in the ectoderm in neurulation stages.

Anabolism: The anabolic chemical activities of gastrulation includes following important events:(a) Nucleic acid synthesis: During gastrulation, synthesis of different kinds of nucleic acid molecules occurs. The replication of DNA is needed for the duplication of chromosomes during each mitosis of gastrulation. The onset of gastrulation actually takes place at the molecular level by the start of transcription of DNA dependent rRNA molecules. The rate of transcription of new mRNA and tRNA molecules become greatly increased during Gastrulation which indicate towards the possibility of increased protein synthesis in the cytoplasm.(b) Protein synthesis: During the gastrulation, there is a sharp increase in protein turnover and in particular protein synthesis. The source of materials for the protein synthesis is mainly the protein yolk, contained in the eggs of most animals. The protein

turnover after the beginning of gastrulation seems to be essentially different from what had been going on during cleavage.

The new proteins are qualitatively different from those present in the egg. These different kinds of proteins are manufactured in gastrula, only due to active participation of parental genes in the production of new mRNA molecules during this phase. In amphibians and sea urchins, it has been found that their gastrulae contain antigen proteins which are capable of causing the formation of antibodies, which were not present before.  
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