INTRODUCTION

In recent years, our knowledge of the precocious chemodifferentiation in the so called mosaic eggs has improved considerably. The study of these eggs with modern histochemical methods has brought to light the presence of certain substances, which are at first distributed evenly throughout the egg protoplasm, but are localised into definite regions of the egg during the early stages of development.

The observations of Spek (1930–1934) on the "bipolar differentiation" of the eggs of diverse invertebrate animals and of Teleosts have shown that in these eggs, prior to or immediately after the beginning of cleavage, a rearrangement of the egg substances occurs, which leads to an accumulation of acid materials in the vegetative and of alkaline substances in the animal half of the egg. Recent researches (Ries & Gersch 1936, Raven 1938) prove that especially the accumulation of the acid albuminous yolk in the vegetative egg hemisphere is responsible for the occurrence of this difference in pH between the two hemispheres of the egg.

The observations of Ries & Gersch (1936) on Aplysia show that not only the pH, but also the rH of the egg protoplasm differs in different regions of the egg. Gersch & Ries (1937) have studied with the aid of vital dyes and indicators the arrangement of substances in the eggs of various marine animals, and the distribution of these substances during cleavage to particular regions of the embryo. Ries (1937) showed that vitamin C, glutathion and various enzymes (benzidine-peroxidase, indophenol-blue-oxidase, leucomethylene blue-oxidoreductase) in some marine eggs have a definite localisation in the uncleaved egg and become incorporated into particular blastomeres during cleavage.

In the light of these facts, it seems reasonable to suppose that these substances have something to do with the determination
of the cells. As a matter of fact, RIES (1939) has shown that in the Ascidian egg the differentiation of muscle cells is dependent upon the presence of a special protoplasm, which is characterized by its riches in certain oxydases and peroxydases. In Tubifex the pole plasms, which determine the differentiation of the embryo, as is shown by the experiments of PEnners (1924–25), are very rich in indophenolblue-oxydase too (LEHMANN 1941a). On the other hand, it would be premature to attribute to these substances, which can be detected with our present histochemical methods, the value of specific organ-forming substances. In fact, this notion of organ-forming substances has lost, in recent years, something of its positiveness. More and more, it has been made clear that the assumption of a specific substance, being responsible for the development of the cells, into which it has become incorporated, to some special organ of the embryo, is rather simplistic. The determination of the cell appears to depend on an equilibrium of the substances it contains; not the presence of a single substance, but rather the quantitative and spatial relation of various substances is determinative. So PEltRERA (1940) concludes from his experiments on the eggs of Aplysia that “con tutta probabilità, la complicata architettura ooplasmatica sia in queste uova sede di un complesso sistema di equilibri istochimici, legati ad ossidasi, riduttasi, acido ascorbico, glutatione ed altre sostanze, che non possono venir turbati, senza che ciò influisca sull’armonia dei processi dello sviluppo”. It is noteworthy that all these substances play a part in cell metabolism; their primary action seems to affect, therefore, the metabolic processes of the cell.

Little is known about the factors, which are responsible for the localisation of the egg substances in their definitive positions. The remarkable fact that in some eggs after abnormal stratification of the egg protoplasm by centrifuging a redistribution of the egg substances occurs, which may lead to a restoration of the normal arrangement of materials (RAVEN 1938, PEltRERA 1940), proves that these factors reside in those parts of the egg protoplasm, which resist the displacing action of centrifugation. They may correspond, therefore, to the factors determining the polarity and bilaterality of the egg; probably, they are located in the cortical layer of the egg.

As a matter of fact, MOTOMURA (1935) has shown that in the eggs of Amphibia and Echinoderms the cortical cytoplasm is