

Specific Gravity of Cell Types in Differentiating Central Nervous System of Chick

It has recently been shown that in the differentiating CNS of the chick there is a quantitative difference in at least some of the cellular constituents¹⁻⁴. At the same time, the volume of the nerve cells also alters along with histogenesis⁵. For this, a survey has been made to study if there is a variation in the specific gravity of the cell types of the 4 different regions (viz. fore-, mid- and hind-brain and of the spinal cord) of the differentiating CNS of white leghorn chick embryos at 6-20 days of incubation. The study may reveal the total quantity of relative cell constituents that should be present in a nerve cell of a specific volume at a particular phase of differentiation.

Material and methods. For determination of specific gravity, the method of LINDHAL and THUNQVIST⁶ was followed. The freshly dissected tissue was passed through a fine-meshed silk to separate mechanically the cells, and then stored in a moist chamber. Specific weight gradients of sucrose were obtained by careful layering of its solutions in glass distilled water. The following percentages of sucrose solutions were used: 3, 2.5, 2, 1.8, 1.6, 1.2, 1 and 0.5. The dimensions of the graduated tube were 105 × 11 mm. The heights of the layers of the different

The uniformly maximum value of the specific gravity of all the cell types in 18-day-old embryos is obviously a very interesting feature of the study.

Though apparently the various parts of the differentiating CNS do not show any relationship so far as the specific gravity of the cell types is concerned, it may be observed from the Table that the specific gravity of the cell types of the fore-, mid- and hind-brain are very much statistically similar, as those values are always less than the c.d. value at 5% level. But while the values for the fore- and the mid-brain are quite different from those of the spinal cord, as evident from comparison of parts at 5% level, the values of the hind brain and those of the spinal cord are similar in behaviour. This phenomenon fits well with the fact that the anterior part of the primitive streak gives rise to the fore-brain while the posterior part of the streak gives rise to the spinal cord⁸. The other 2 regions of the CNS, viz. mid- and the hind-brain, emerge through the middle part of the streak. Thus, during individuation, the differentiating cell types in the antero-posterior direction of the medullary plate maintain the original relationships.

Means of specific gravity of cell types of differentiating CNS of chick

Parts of CNS	Days								mean
	6	8	10	12	14	16	18	20	
Fore brain	1.0046	1.0038	1.0044	1.0062	1.0042	1.0046	1.0078	1.0066	1.0053
Mid brain	1.0042	1.0040	1.0064	1.0054	1.0034	1.0036	1.0074	1.0060	1.0050
Hind brain	1.0048	1.0042	1.0046	1.0042	1.0052	1.0044	1.0070	1.0044	1.0049
Spinal cord	1.0036	1.0036	1.0038	1.0046	1.0038	1.0038	1.0078	1.0050	1.0045
Mean	1.0043	1.0039	1.0048	1.0051	1.0041	1.0041	1.0075	1.0055	1.0049

For comparison of part, mean, c.d. at 5%, 0.000469; at 1%, 0.00063.

sucrose solutions were 1 cm deep. A number of the separated cells from a particular tissue were carefully introduced by means of a fine pipette into the tube containing the layers of the sucrose solutions. The movements of the cells were followed and the layer in which the cells just immersed was recorded, and the specific gravity of the sucrose solution of that layer was found by means of a specific gravity bottle. Each observation was repeated 3 times and each type of the experiment was made 5 times to get a statistical average value. All the experiments were carried out at 21°C.

Results and discussion. The specific gravity of the different cell types is shown in the Table.

It may be observed that the specific gravity of the cells of a particular tissue does not show a linear pattern throughout the incubation period. It has been shown¹⁻⁴ that concentrations of some nerve components, viz. lipids, RNA, nitrogen, glutamic acid and water, do not maintain identical increase or decrease with respect to one another during epigenesis. Differentiation of a cell depends on the relative concentration and association of cell components arranged in a definite proportion and order⁷. It is thus expected that the concentrations of all the cell components present in a definite volume lead to the establishment of a definite specific gravity for that cell type at that particular phase of differentiation.

Zusammenfassung. Es wird gezeigt, dass das Gewicht der Nervenzellen ihrem Herkunftsort aus dem Neuralrohr entspricht, das heisst, Vorderhirnzellen sind schwerer als Rückenmarkszellen.

A. BANERJEE and A. BOSE

Zoology Department, Kalyani University,
Kalyani (Nadia, W.B., India), 5 November 1968.

1. J. MEDDA and A. BOSE, Wilhelm Roux Arch. EntwMech. Org. 159, 267 (1967).
2. J. MEDDA and A. BOSE, Wilhelm Roux Arch. EntwMech. Org. 159, 459 (1967).
3. J. MEDDA and A. BOSE, Experientia 23, 740 (1967).
4. A. L. ROMANOFF, in *The Avian Embryos* (McMillan Co., New York 1960), p. 216.
5. A. L. ROMANOFF, in *The Avian Embryos* (McMillan Co., New York 1960), p. 236.
6. P. E. LINDAHL and L. O. THUNQVIST, Experientia 21, 94 (1965).
7. C. H. WADDINGTON, in *New Patterns in Genetics and Development* (Columbia University Press, New York and London 1962), p. 2.
8. C. H. WADDINGTON, in *Principles of Embryology* (George Allen and Unwin, London 1956), p. 187.