Chapter - XI

Determination of Specific Gravity in the Cells of Differentiating Liver of Chick
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INTRODUCTION

From the studies of other chapters of the thesis, it has been found that, in the differentiating liver of chick, there is a quantitative difference of the various cellular constituents, e.g. carbohydrates, lipids, proteins, nucleic acids and amino acids (Chapter - III, IV, V, VI and IX), at different developmental stages. At the same time the volume of the liver cells also alters along with histogenesis (Chapter-II). Specific gravity of cells depends on the total quantity of relative cell constituents of a specific volume. Since differentiation of a cell depends on the relative concentration and association of cell components arranged in definite proportion and order (Waddington, 1956, 1962; Banerjee and Bose, 1969), it is expected that the concentrations of all the cell components present in a definite volume will lead to the establishment of a definite specific gravity for that cell type at that particular phase of differentiation. For this reason, a survey has been made to study if there is a variation in the specific gravity of liver cells at different developmental stages of chick embryo.
MATERIAL AND METHOD

The eggs of white leghorn hen were incubated at a constant temperature of 38°C with 75% relative humidity. For determination of specific gravity, the method of Lindahl and Thunquist (1965) was followed. The freshly dissected liver 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, 1.2, 1 and 0.5. The dimension of the graduated tube were 105 x 11 mm. The heights of the layers of the different sucrose solutions were 1 cm deep. A number of the separated cells from the liver 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 experiments was made 5 times and the mean values were recorded. All the experiments were carried out at 21°C.

OBSERVATION

The results of the survey of specific gravity of liver cells have been shown in Table-I. It was found that the specific
The changes in the specific gravity during differentiation of liver in chick.

Fig.-1
gravity gradually declined from 6th to 10th day of incubation, and the values were 1.12, 1.073 and 1.039 on the 6th, 8th and 10th day of incubation, respectively. From the 10th to 20th day of incubation, the specific gravity of the cells remained essentially constant, except during 16th and 18th day, when the specific gravity was found to be highest. During 16th to 18th day of incubation the specific gravity of liver cells was 1.15, (Table-I and Fig.-1).

Table-I

Specific gravity of liver cells at different developmental stages of chick embryo

<table>
<thead>
<tr>
<th>Age in days</th>
<th>6 days</th>
<th>8 days</th>
<th>10 days</th>
<th>12 days</th>
<th>14 days</th>
<th>16 days</th>
<th>18 days</th>
<th>20 days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1.12</td>
<td>1.073</td>
<td>1.039</td>
<td>1.039</td>
<td>1.039</td>
<td>1.15</td>
<td>1.15</td>
<td>1.039</td>
</tr>
</tbody>
</table>

DISCUSSION

Since specific gravity of cells depends on the total quantity of relative cell constituents of a specific volume (Banerjee and Bose, 1969), the quantitative accumulation of various chemicals in the liver cells might have some correlation with its cell size and specific gravity. The data of the specific gravity of liver cells showed the downward trend from the 6th to the 10th day of incubation (Table-I, Fig.-1). During this time, liver cell
size was increased (Chapter-II), protein and carbohydrate contents also increased (Chapter-III and V), but the lipid content decreased (Chapter-IV). So, inspite of the increase of carbohydrates and proteins, the lower value of specific gravity in this period might be due to the increase of cell size and decrease in contents of lipids and others.

From the 10th to 14th day of incubation, the specific gravity remained constant. During this period the cell size remained more or less constant, lipid and carbohydrate concentrations decreased, but the protein content increased. During 16th to 18th day of incubation, when the specific gravity of liver cells was highest, there was an enormous increase of carbohydrates and lipids; the protein content was comparatively higher, and the cell size also was increased. Thus during 16th and 18th day, the accumulation of carbohydrates, lipids and proteins was much faster than the increase of cell size, thereby resulting the increase of specific gravity.

The period after 18th day was characterized by the increase of cell size, lipid and protein contents, but the carbohydrate concentration declined significantly. The value of specific gravity in this time was similar as it was before the 16th day of incubation.

The observations and discussion lead to suggest that there is a definite relation of the specific gravity with the quantity of various chemicals and the cell size. It seems that
there is a general tendency of the differentiating liver cells to maintain a constant specific gravity, inspite of the increase and decrease of different chemicals. The increase and decrease in the quantity of various chemicals, particularly carbohydrates, lipids and proteins, and also the variation of the liver cell size are balanced in such a way, so that the differentiating liver cells can maintain a constant specific gravity. The maintenance of constant specific gravity is disturbed during the 6th to the 8th day, and also during the 16th to the 18th day of incubation. With regard to the maintenance of specific gravity, it may be said that the differentiating liver cells are unbalanced between the 6th and 8th day, and also between the 16th and 18th day of incubation.

SUMMARY

Specific gravity of liver cells was determined during the 6th to the 20th day of incubation. It was found to remain constant throughout the period, except during 6th to 8th day, and during 16th to 18th day of incubation, when the value of specific gravity was higher. The increase and decrease in the quantity of various chemicals, and also the variation of cell size were balanced in such a way, so that the differentiating liver cells show a general tendency to maintain a constant specific gravity. The maintenance of constant specific gravity was disturbed or unbalanced at two periods - one between 6th and 8th day, and the other between 16th and 18th day of incubation.
REFERENCES


