THE EFFECT OF DESOXYRIBONUCLEOPROTEINS OF THE
REGENERATING RABBIT'S LIVER ON THE REGENERATION
OF MOUSE LIVER

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Previous investigations have shown that during thermal fractionation of nucleoproteins isolated from the liver
of the rabbit or ox, fractions are obtained which differ in their relative proportions of nitrogenous bases [1]. These
proportions differ in the desoxyribonucleoprotein (DNP) fractions isolated from the normal and regenerating liver of
the rabbit; these fractions differ in their action on the regeneration of mouse liver [2]. After intravenous injection
of the 1st fraction of the DNP isolated from the regenerating liver of rabbits into mice from which the left lateral
lobe of the liver had been removed, the weight of the regenerating liver on the 3rd day after the injection was 15%
greater than the corresponding weight in control animals. This difference was due to hypertrophy of the liver cells
and of their nuclei. Injection of the 1st fraction of DNP from normal rabbit's liver had no such effect.

In the present research we investigated the effect of the 1st fraction of the DNP isolated from the regenerating
liver of a rabbit on the distribution of the nucleic acids in the cells of the regenerating liver of mice, on the dimen-
sions of the cell and its nucleus and cytoplasm, and on the size and number of nucleoli.

EXPERIMENTAL METHOD

The method of obtaining DNP was described in previous papers [1, 2]. Experiments were carried out on 30 mice
weighing 18-20 g, from which the left lateral lobe of the liver was removed. The animals were divided into three
groups. The mice of the first group received, on the 2nd day after the operation, an injection of 0.1 ml of a solution
of the 1st fraction of DNP from regenerating liver (DRL), containing 17 µg of DNA, into the caudal vein. The mice
of the second group received an injection of the same volume of a solution of the 1st fraction of DNP from normal
rabbit's liver (DNL). The third group of animals (controls) received an injection of saline solution of the same con7
centration as that containing the DNP fractions. The mice were sacrificed 4 days after the operation. The liver was
fixed in cold 80% ethyl alcohol and cut into sections 7-8 µ thick. The sections were stained with azure-eosin, with
methyl green-pyronine, and by Feulgen's method.

Measurements were made by means of a screw ocular micrometer, using a 15X ocular and a 120X objective.
Mononuclear liver cells of mice receiving DRL injections (7) and of control animals (5) were measured. In each case
100 cells were measured, in two diameters, and also their nuclei and nucleoli in two diameters, and the nucleoli were
counted. The area (S) of the cell, nucleus, and nucleolus was calculated. The area of the cell was taken to be the
product of the two diameters. The area of the nucleus was calculated by the formula for the area of an ellipse, and
the area of the nucleolus by the formula for the area of a circle.

EXPERIMENTAL RESULTS

Two types of distribution of RNA in the liver cells during the interphase were observed in the liver sections from
the control animals (Fig. 1, a): in the first, RNA granules filled the whole cytoplasm of the liver cell uniformly; in
the second, the RNA granules formed a "belt" around the nucleus, rather like a string of beads in appearance. In the
second type, the rest of the cytoplasm remained free and the granules were large.

After injection of the DRL, only the first type of distribution of RNA in the cytoplasm of the liver cells was ob-
served (Fig. 1, b). The RNA granules were of various sizes - from very large to very small, - giving the impression
of a "washed-out" basophilia. The granules were irregular in shape. The amount of RNA in both the cytoplasm and the nucleoli increased sharply over that present in the controls.

After injection of DNL, the distribution of RNA granules in the cytoplasm of the liver cells was largely the same as in the controls. However, the number of cells with a bead-like distribution of RNA was greatly increased. The RNA granules were larger and stained more intensively with pyronine than in the controls, and the appearance of "washed-out" basophilia was not observed. The nucleoli stained more intensively with pyronine than in the controls. The cells contained more RNA than in the control animals, but significantly less than after injection of DRL (see table). Both in the control preparations and in the liver of the mice receiving injections of DNL and DRL, variations in the degree of basophilia occurred. In all cases the more strongly basophilic areas were mainly concentrated around the blood vessels (around the central veins and at the periphery of the lobules), but after injection of DRL they occupied a much larger area than after injection of DNL or physiological saline.

The RNA granules in the cells in a stage of mitosis in all three groups of mice were fine and gelatinous, and were uniformly situated in the cytoplasm at a short distance from the nucleus.

Hence, the injection of the first fraction of DRL affected both the character of the distribution of RNA and its amount in the cells of the regenerating liver. This indicates changes in the metabolism and mobilization of the RNA in the cells and, possibly, an increase in protein synthesis in the liver.

The DNA content in the nuclei of the liver cells was low in all three groups of animals. It was slightly greater after injection of DRL than in the controls. Previous investigations [2] also showed that injection of DRL and DNL does not affect the mitotic activity of the regenerating liver.

Effect of Desoxyribonucleoproteins on the RNA Content in the Cells of the Regenerating Mouse Liver

<table>
<thead>
<tr>
<th>Injection of DRL</th>
<th>Injection of DNL</th>
<th>Injection of physiological saline (control)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mouse No.</td>
<td>Amount of RNA</td>
<td>Mouse No.</td>
</tr>
<tr>
<td>1</td>
<td>++</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>+++</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>+</td>
<td>3</td>
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<tr>
<td>4</td>
<td>++</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
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<tr>
<td>6</td>
<td>++++</td>
<td>6</td>
</tr>
<tr>
<td>7</td>
<td>++++</td>
<td>7</td>
</tr>
<tr>
<td>Mean</td>
<td>+++</td>
<td>+++</td>
</tr>
</tbody>
</table>

Legend: ++ very small amount of RNA; +++ moderate; ++++ large amount of RNA