

the differences which appear in the averages as given in Table I do not seem sufficient to us to draw such a conclusion, because of the error inherent in the technical methods employed in making blood counts.

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Hepatectomy in the Salamander with Special Reference to Hemopoiesis and Cytology of the Liver Remnant.

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In the salamander, *Triturus viridescens*, granulocytopoiesis is normally restricted almost completely to the subcapsular region of the liver, erythrocytopoiesis and thrombocytopoiesis to the spleen. A relatively very slight granulocytopoietic activity occurs in the intestinal mucosa. As previously reported, splenectomy does not effect a compensatory erythrocytopoietic or thrombocytopoietic activity in the lympho-granulocytopoietic envelope of the liver. Following splenectomy the processes of erythrocyte and thrombocyte production are shifted to the general circulation.¹ The reverse experiment also gives a negative result; hepatectomy effects no compensatory granulocytopoietic activity in the spleen. Since the same ancestral cell, the lymphoid hemoblast, occurs in both regions, as a mesenchymal derivative, it must be concluded that certain specific conditions in spleen and liver are restrictive as regards hemocytopoietic stimuli. The differential stimuli for erythrocyte and granulocyte formation presumably inhere in some element in the character of the blood supply; the perihepatic granulocytopoietic region contains a very meager vascularization as compared with the abundant sinusoidal venous system of the spleen.

Total hepatectomy results in death within 9 days (20 specimens). The survival time is uninfluenced by coincident splenectomy. Removal of half of the liver (left and middle lobes) produces no noticeable hemopoietic effects (30 specimens). Such experimental animals lived until killed during the third month for study of the remaining liver tissue. These one-lobe livers show no microscopic evidence of regeneration. The remaining lobe, however, is somewhat enlarged by the twenty-seventh day, and has apparently

¹ Jordan, H. E., and Speidel, C. C., *Am. J. Anat.*, 1930, **46**.

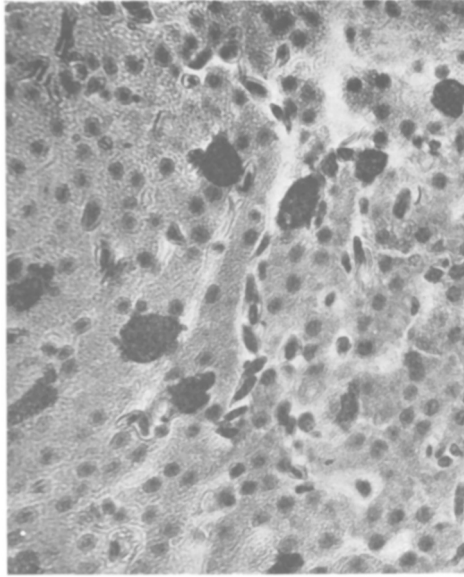


FIG. 1.

Photomicrograph of small typical area of liver of salamander 36 days after the removal of the complete left lobe. The histology is essentially normal. The black irregularly spheroidal areas are collections of pigmented macrophages lodged in sinusoids. The pigment is a derivative of disintegrated erythrocytes. Magnification 300 diameters. Helly fixation, eosin-azure stain.

effected satisfactory histologic and physiologic restoration (Fig. 1). The effect of semi-hepatectomy appears to be one of compensatory hypertrophy. Since no proliferative activity was observed at the several progressive stages studied the exact method of this hypertrophy remains uncertain. The enlargement is due in part to a thickening of the granulocytopenic capsule, where very active mitosis occurs apparently in compensation for the loss of the excised portion. Individuals splenectomized at the time of removal of half of the liver (15 specimens), without marked injury to the blood supply or bile duct, also remained alive and apparently normal for over 2 months.

Removal of variable but relatively small apical portions of the left hepatic lobe produces no noticeable hyperplastic regeneration (30 specimens). At the end of 24 hours the cut surface is generally covered by a blood clot. Immediately beneath the clot for a variable depth there occurs a variable degree of histolysis of hepatic cells accompanied by a shrinkage of the entire region. Between the second and sixth days a peritoneal membrane forms beneath the thrombus and completely covers the reorganized parenchyma. By the ninth day this regenerated portion of the capsule has become

slightly thickened by the addition of fibrous connective tissue. No subcapsular granulocytopoietic tissue has appeared in the region of section by the end of the tenth day.

Excision of more than one-half of the liver produces marked alterations in the remnant (10 specimens). In these experiments there occurred absolutely no regeneration in the region of section, either from ducts or parenchyma. Within the healed-over remnant the hepatic cells enlarge and the parenchyma becomes loosened into irregular cords of cells separated by wide sinusoids (Fig. 2). The

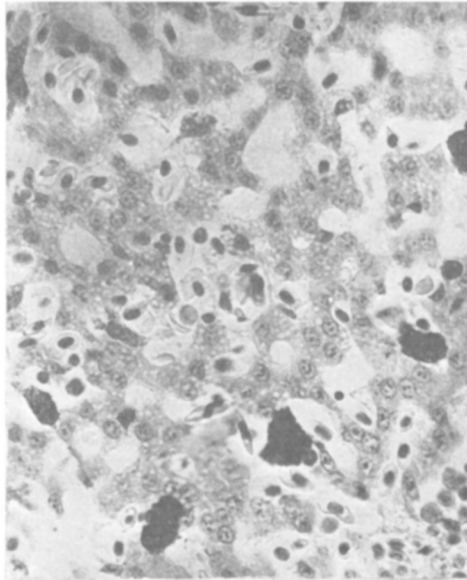


FIG. 2.

Photomicrograph of typical area of remnant of liver 6 days after removal of most of the liver and all of the spleen. Note the enlargement of the sinusoids and the coincident stretching and thinning of the cords, and the vacuolization of the cytoplasm of the constituent hepatic cells. Helly fixation, eosin-azure stain. Magnification 300 diameters.

individual cells appear perfectly healthy, but the cytoplasm contains numerous vacuoles. The granulocytopoietic layer is greatly depleted. By the nineteenth day the cells have enlarged still more and the parenchyma has become largely dissociated (Fig. 3). The granulocytopoietic layer has disappeared except for an occasional cell. The liver cells still appear healthy, but stain less deeply blue with eosin-azure and the cytoplasm is more extensively vacuolated. The lobular remnants of this size are apparently incapable of effective restoration. This contrasts sharply with the results following the removal of large portions of the liver in the dog, as reported by

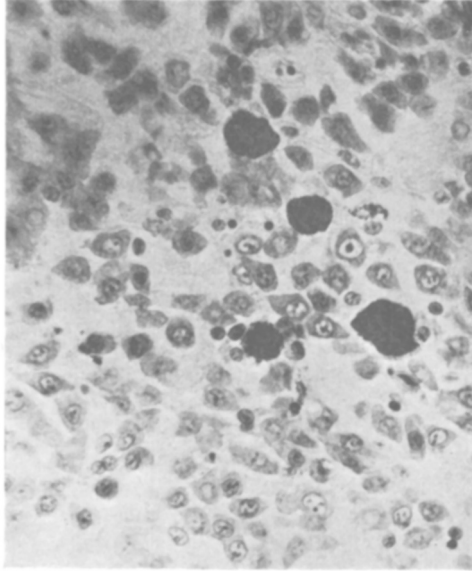


FIG. 3.

Photomicrograph of typical area of remnant of liver 19 days after removal of apical three-fourths. Note the complete dissociation of the parenchyma. Helly fixation, eosin-azure stain. Magnification 300 diameters.

Fishback.² Considering the relatively low evolutionary position of the salamander the apparent lack of regenerative capacity of the hepatic epithelium seems remarkable.

In this set of experiments the mortality was fairly high before the nineteenth day, but a few specimens lived several days beyond this time. Death was due no doubt in large measure to internal hemorrhage; in part to the anemia following an extensive disintegration of circulating erythrocytes. The regressive changes in the liver remnant must probably be attributed in large part to the disturbance of the blood supply.

The result of semi-hepatectomy depends upon the type of section. If the plane of division is sagittal, leaving a complete right or left lobe, a variable degree of compensatory hypertrophy takes place. When the section is made horizontally, separating distal halves of left, right and middle lobes, the same sequences of stages follow, ending in dissociation of the hepatic cords, as when only a small proximal portion is left.

² Fishback, *Arch. Path.*, 1929, 7.