

than do the rough. It is interesting, therefore, to note these differences in the electrophoretic mobility velocities of avian and bovine tubercle bacilli from S. and R. colonies.

The E.M.F. used in all of these experiments was 42 volts.

The distance between the electrodes in the cell was 3.5 cm.

4775

Observations on the Pathogenesis of the Myeloid Leucemia of Fowls.*

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In a preceding communication¹ a new transmissible strain of leucemia has been briefly described. In the subsequent passages of this strain several of the inoculated birds died of intercurrent diseases chiefly of an acute or subacute inflammatory process of the upper respiratory tract. Birds dying of such infections but not inoculated with leucemic material did not show the pathological changes characteristic for the leucemias. The early death of several birds permitted a study of the pathogenesis of myeloid leucemia. A conspicuous result is obtained when the sequence of events in the development of the organ and blood changes is reconstructed from the following table which includes all the autopsies of 2 recent passages.

An extensive hyperplasia of the bone marrow unaccompanied by a rise in the number of the circulating white blood corpuscles appears to be the first marked pathological change which follows the inoculation of leucemic blood (Stage I). The hyperplasia of the bone marrow consists of an enormous extravascular proliferation of myelocytes and their precursors replacing the fatty tissue and narrowing the blood sinuses. Following this alteration of the bone marrow there is a rise in the number of white corpuscles in the peripheral circulation due to an invasion of cells similar to those found in the bone marrow, but extramedullary blood formation is absent (Stage II). There is a tendency for a further increase of the immature

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¹ Furth, J., *PROC. SOC. EXP. BIOL. AND MED.*, 1929, xxvii, 155.

TABLE I.

Number of chicken	Material used for inoculation	Amount injected	Time from inoculation until death	Hyperplasia of bone marrow	Blood changes (white cells)	Extramedullary blood formation
467	plasma 361	cc. 2.0	days 47	none	none	none
480	"white cell layer" 361	1.0	3	moderate†	"	"
477		0.75	7	doubtful	"	"
478						
476		0.5	21	extreme	moderate increase	incipient
479		0.25	21	advanced	none	none
475	0.5	23	much advanced	moderate increase	moderate	
473	"red cell layer" 361	1.0	7	none	none	none
471		1.5	12	slight	"	"
468		1.0	20	much advanced	slight increase	incipient
470		0.5	23	extreme	moderate increase	none
469		0.5	35	much advanced	increase none	"
362	blood 266	2.5	36	extreme	enormous increase	moderate
361		2.5	40	"	enormous increase	"
356	organ emulsion 266	2.5	15	slight	none	none
354		2.5	77	extreme	enormous increase	advanced
350	filtrate 266	3.0	70	none	none	none

† The hyperplasia of the bone marrow of this bird was mixed, lymphocytic and myelocytic, whereas in all other cases the hyperplasia was almost exclusively myelocytic and myeloblastic.

The autopsy findings of birds of other passages are similar to those of the above series.

granulocytic elements in the blood stream, a concentration of the latter in the smaller blood vessels (leucostasis) and the development of extramedullary granulocytopenic foci (Stage III). The organs most commonly involved are the liver and the spleen. In the liver, the myeloid tissue begins to proliferate in the periportal connective tissue about the adventitia of the vessels extending by extravascular growth. The type of cells found in these foci are similar to those seen in the bone marrow. Mitotic figures are usually numerous in the bone marrow as well as in the extramedullary blood-forming tissues. They are not unfrequent in the circulating blood.

These findings furnish experimental support for the view derived

from human pathology (*Cf.* Askanazy²) that leucemia is the sequence of a tumor-like proliferation of the bone marrow which, in a few instances, is the sole site of the pathological process. A mere entrance of immature elements into the blood stream as is the case when leucemic blood injected into the vein of healthy animals does not result in extramedullary blood formation. This appears to take place only after extreme hyperplasia of the bone marrow has been established.

4776

Changes of Blood Gases and Lactic Acid After Exercise in Patients With Rheumatic Heart Disease.

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(Introduced by R. H. Halsey.)

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It has been demonstrated by a number of investigators¹ that changes in the oxygen unsaturation, carbon dioxide combining power, and lactic acid content of the venous blood occur in normal individuals after exercise. These changes seem to bear a definite relation to the amount of work performed. Very slight, or no differences are observed following mild exercise. When the exercise or amount of work performed is increased, greater changes are noted. The changes consist of an increase in the oxygen unsaturation and lactic acid content, and a decrease in the carbon dioxide combining power.

The object of the present study was to determine what changes occurred in the oxygen unsaturation, lactic acid, and carbon dioxide combining power of the venous blood in patients with rheumatic heart disease after performing measured amounts of work. The cases included in this study were children between the ages of twelve and sixteen years, with various valvular and muscular defects caused by the rheumatic infection. Their response to effort was

² Askanazy, M., *Handbuch der speziellen pathologischen Anatomie und Histologie*, V. I. pt. 2, Berlin, 1927.

¹ Lundsgaard, C., and Möller, E., *J. Biol. Chem.*, 1923, iv, 315, 477, 599; Barr, D. P., and Himwich, H. E., *J. Biol. Chem.*, 1923, iv, 525, 539; Barr, D. P., Himwich, H. E., and Green, R. P., *J. Biol. Chem.*, 1923, iv, 495; Hewlett, A. W., Barnett, G. D., and Lewis, J. K., *J. Clin. Inv.*, 1926, iii, 317.