1500 mg. per 100 gm., the free cholesterol at approximately 350 mg. per 100 gm. These figures are subject to considerable variation. Similarly the phospholipid content of the lymphocyte appears to be in the neighborhood of 600 mg. %, the free cholesterol about 150 mg. %.

The parallelism between free cholesterol and phospholipid adds another bit of evidence to support the hypothesis that these 2 substances are closely related in the vital economy of the cell. Since phospholipid and free cholesterol vary in amount according to the predominating type of cell, it would appear that, for the most part, these 2 lipids serve in the *structural* make-up of the cells. On the other hand, the remaining lipid fractions are apparently present in varying amount in both types of cells, suggesting that they are transitory or metabolic in nature.

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Experimental Pulmonary Edema.*

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The frequent occurrence of pulmonary edema as one of the characteristic pathological findings in experimental shock, and following the shock syndrome in human cases, suggested methods by which it might be reproduced. Widespread congestion and petechial hemorrhages predominate as visible changes in rapidly developing shock while in cases in which the shock syndrome develops more gradually there are few petechiae, and edema is more marked.[1]

Hemo-concentration is recognized as a constant feature in shock. It results from the transudation of the plasma through vascular walls. Krogh,[2] Lewis,[3] and Landis[4] support the generalization

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1 Moon, V. H., and Kennedy, P. J., Pathology of Shock. *Arch. Path.*, 1932, **14**, 360.

2 Krogh, A., Anatomy and Physiology of the Capillaries. 2nd ed. 1929, Yale Univ. Press.

3 Lewis, Thos., Blood vessels of the Human Skin and Their Responses. 1927, Shaw & Sons, London.

4 Landis, E. M., Capillary Pressure and Capillary Permeability, *Phys. Rev.*, 1934, **14**, 404. Micro-injection Studies of Capillary Permeability, *Am. J. Physiol.*, 1927, **82**, 217.

that any agent or condition resulting in capillary injury increases the permeability of the capillary walls. Edema of the tissues may result by this mechanism. Moon, *et al.*,[5] found hemo-concentration ante-mortem, and congestion and edema post-mortem in shock arising from various causes.

Experiments were arranged for producing shock of gradual development and sub-lethal degree. A dog weighing 5.4 kg. was given daily subcutaneous injections of 7.5 mg. of histamine phosphate per kg. of body weight, diluted with saline solution 1:250. During 5 days the red cell count rose gradually from 7,200,000 to 9,400,000 and the hemoglobin increased correspondingly—a hemo-concentration of approximately 30%. The animal was killed and examined. Marked congestion of capillaries and venules in the lungs, liver, kidneys and intestines and marked edema of the lungs were found. The alveolar walls were swollen and there was much free fluid in the alveolar spaces. The perivascular spaces were distended with fluid, rich in albumen and containing numerous erythrocytes.

Similar findings resulted when guinea pigs were given subcutaneous injections of 0.5 mg. of histamine per kg. twice daily.

Gluteal muscle was aseptically excised from a freshly killed normal dog. This was finely minced and suspended in saline solution. Twenty grams of muscle substance was introduced into the peritoneal cavity of a dog weighing 6.5 kg. Within 48 hours the red cell count rose from 6,450,000 to 7,970,000 and the hemoglobin from 95 to 125%, indicating hemo-concentration of about 25%. The dog died of shock within 72 hours. Marked pulmonary edema and congestion as described above, were present.

A dog weighing 4.8 kg. received 4.8 gm. of sodium glycocholate in sterile 20% solution intravenously. He died of circulatory collapse almost immediately. There was marked congestion of the venules and capillaries in all the viscera. This was especially prominent in the lungs. Here there was acute edema and numerous capillary hemorrhages.

Another dog weighing 6.4 kg. was given daily intravenous injections of sodium glycocholate, 0.4 gm. per kg. During 6 days his red cell count rose from 6,550,000 to 8,800,000 and his hemoglobin from 85 to 120%. The postmortem findings were as previously described, and the pulmonary edema was extremely marked.

[5] Moon, V. H., Changes in Blood Concentration Incident to Shock. *J. Lab. and Clin. Med.*, 1933, **19**, 295. Das Schocksyndrom. *Deutsch. med. Wchnschr.*, 1934, **44**, 1667. The Shock Syndrome in Medicine and Surgery, *Ann. Int. Med.*, 1935, **8**, 1633.

Various barbiturates produce dilatation of the peripheral vascular structures. In our experience the venules and capillaries are particularly affected. We have seen the characteristic shock syndrome develop in dogs following the intravenous injection of sodium pheno-barbital in a dosage of 0.3 mg. per kg. Postmortem findings in such cases were the same as following shock from other causes. Prolonged intoxication was produced by giving to a dog weighing 7.2 kg., 0.3 gm. per kg. of sodium pheno-barbital, twice daily by mouth. A total of 12.1 gm. was given in 4 days. His red cell count rose from 5,150,000 to 6,950,000, and the hemoglobin from 85% to 120%. He died on the fifth day. There was marked congestion of the serous membranes and intense congestion of the liver, lungs and kidneys. Quantities of reddish frothy fluid flowed freely from the bronchi. This fluid had a specific gravity, 1.028, equal to that of the blood serum. Edema of the lungs was extreme.

Another dog, weighing 6 kg., received 9.0 gm. of sodium phenobarbital during 11 days. His red cell count rose from 5,300,000 to 7,300,000 accompanied by a corresponding increase in the hemoglobin. Bubbling respiratory rales could be heard at a distance of 10 feet from the animal during the last 3 days of treatment. He died on the twelfth day, and the postmortem findings were identical with those in the previous barbital-treated dog. In addition to these findings there was extensive secondary pneumonia of the type described by Moon[6] in clinical cases following shock of sublethal degree.

Summary. Pulmonary edema may be produced experimentally by the use of agents which produce injury to capillaries. The shock syndrome occurs with varying degrees of rapidity. Experimental shock of gradual development is accompanied by pulmonary edema. This reproduces the features of pulmonary edema which develop in man following severe intoxications. This type of pulmonary edema leads to terminal pneumonia in both human and experimental cases.

[6] Moon, V. H., Origin of One Type of Secondary Pneumonia. *Am. J. Path.*, 1933, **9**, 899.