PHYSIOLOGY

Phagocytosis by Synovial Cells

THE ability of synovial cells to phagocytose small particulate matter has long been accepted for haemosiderin and can be readily demonstrated in such cells in ordinary histological sections from cases of chronic haemarthrosis[1]. Only now is the full phagocytic power of the synovial cell beginning to be recognized. Thus, it has been shown that not only a variety of small particulate substances like ferritin[2], gold[3], thorotrast[4], iron dextran[5] and carbon[6] when injected into the joint space are readily taken up by these cells but that entire erythrocytes[7] can also be ingested in this fashion (Fig. 1). This is indeed remarkable because usually erythrocytes are fragmented before phagocytosis by macrophages[8].

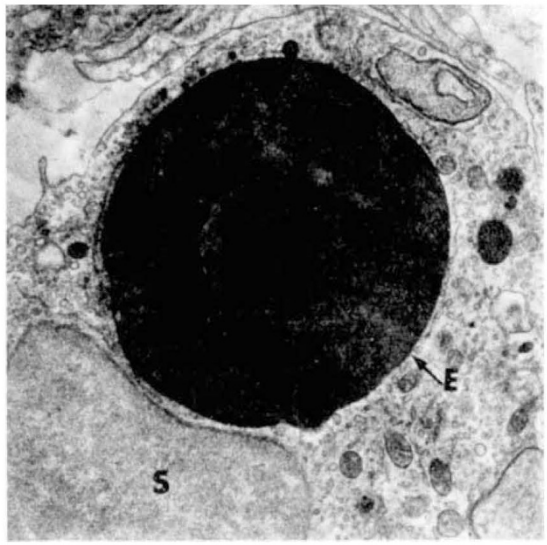

Fig. 1. Synovial cells (*S*) with phagocytosed erythrocyte (*E*) (×10,000).

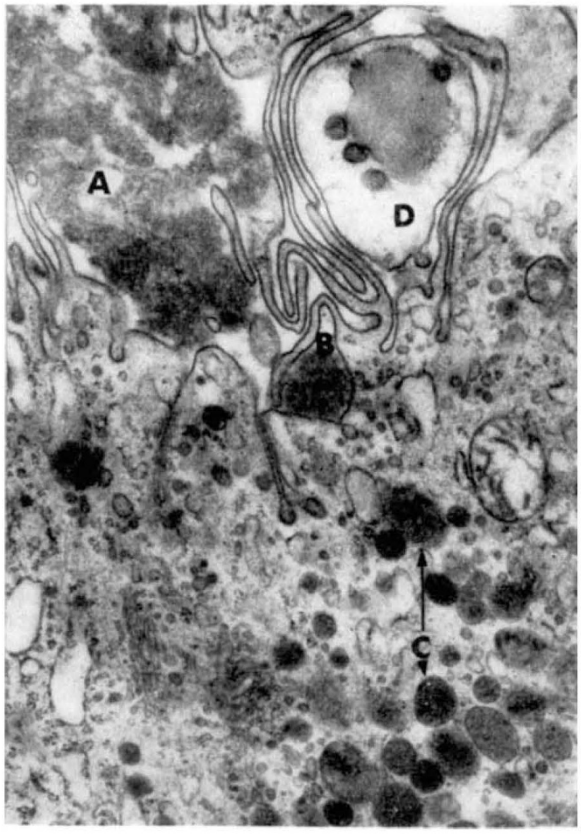

Fig. 2. Synovial cell phagocytosing "fibrinoid" material and a cell fragment. "Fibrinoid" material is seen lying free in joint space at *A*, and embraced by a filopodium at *B*. Similar material can be seen in phagosomes at *C*. A cell fragment surrounded by filopodia is seen at *D* (×19,500).

During the course of our investigations of the ultrastructure of rheumatoid synovium we have collected further evidence about the phagocytic potentials of the synovium. In this condition cellular debris and "fibrinoid" material are frequently found in the joint space, and this is rapidly phagocytosed by the synovial cells. Fig. 2 shows some "fibrinoid" material lying in the joint space at *A*. This material can also be seen trapped between the cell wall and a filopodium at *B*. Furthermore, morphologically similar material can be demonstrated within the cell, usually in single membrane bound bodies (*C*). These appearances are compatible with the idea that "fibrinoid" material is being phagocytosed and incorporated into the synovial cell to form phagosomes. Phagocytosis of a cell fragment containing what appears to be a lipid droplet and four lysosomal bodies is seen at *D*.

Thus it is now evident that the synovial cell can phagocytose a large variety of small and large particles and that its phagocytic powers match and in some instances perhaps even excel that of the macrophage, the classical scavenger which plays a fundamental part in the removal of particulate debris in various pathological states.

This work was supported by a grant from the Rheumatism and Arthritis Council.

F. N. GHADIALLY
S. ROY

Department of Pathology,
University of Sheffield.

Received December 28, 1966.

[1] Collins, D. H., *J. Bone and Joint Surg.*, **33B**, 436 (1951).
[2] Muirden, K. D., *Arthritis and Rheum.*, **6**, 289, abstract (1963).
[3] Norton, W. L., and Ziff, M., *Arthritis and Rheum.*, **9**, 589 (1966).
[4] Cochrane, W., Davies, D. V., and Palfrey, A. J., *Ann. Rheum. Dis.*, **24**, 2 (1965).
[5] Ball, J., Chapman, J. A., and Muirden, K. D., *J. Cell Biol.*, **22**, 351 (1964).
[6] Adams, W. S., *Lab. Invest.*, **15**, 680 (1966).
[7] Roy, S., and Ghadially, F. N., *Ann. Rheum. Dis.*, **25**, 401 (1966).
[8] Essner, E., *J. Biophys. Biochem. Cytol.*, **7**, 329 (1960).

Influence of Sleep Deprivation on Iron Metabolism

AMONG the basic factors which have a bearing on iron metabolism and its serum level certain attention has been paid during the past two decades to the influence of biological rhythms[1] and various stressing stimuli[2]. In conjunction with this we decided to make use of an experimental set-up which involves the prolonged and complete upset of the basic biological rhythm of the alternation of wakefulness and sleep—that is, sleep deprivation. This work was stimulated in particular by the finding of an extreme drop of plasma iron (revealed in preliminary experiments) during the 120th hour of vigilance in four experimental subjects[3].

The level of plasma iron was investigated daily in six men and two women[4], the total serum binding capacity for iron in four[5] and in all subjects the urinary iron excretion[6]. Blood specimens were collected between 7 and 8 a.m. during the control period before the experiment, then during five days of sleep deprivation and then during the recovery period. In the women the iron absorption from the digestive tract in serum was investigated after administration of six tablets of 'Ferronat *C*'*. Because the plasma iron level may be influenced by the administered preparation, however, the two above mentioned experi-

* One tablet of 'Ferronat *C*' Spofa contains 200 mg ferrum gluconicum and 20 mg ascorbic acid, that is, 1 tablet = 22 mg ferrous iron.