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NUTRITION AT THE CELLULAR LEVEL

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Chairman's introductory remarks

By J. N. DAVIDSON, *Department of Biochemistry, University of Glasgow*

It is obvious that any discussion of nutrition at the cellular level must involve some preliminary consideration of the structure and function of the mammalian cell. Fortunately it has been found possible during the last few years by a combination of techniques, electron microscopy, cytochemistry and differential centrifugation of the subcellular components of disrupted cells in suitable media, to achieve a considerable degree of correlation between morphology and biochemical function.

A schematic diagram of a 'typical' animal cell is shown in Fig. 1. In the centre is the nucleus containing a meshwork of densely staining deoxyribonucleoprotein (the chromatin of the histologists) which gives rise to the chromosomes during preparation for mitotic division and which contains deoxyribonucleic acid (DNA), the carrier of genetic information. The nucleus contains one or more dense spherical

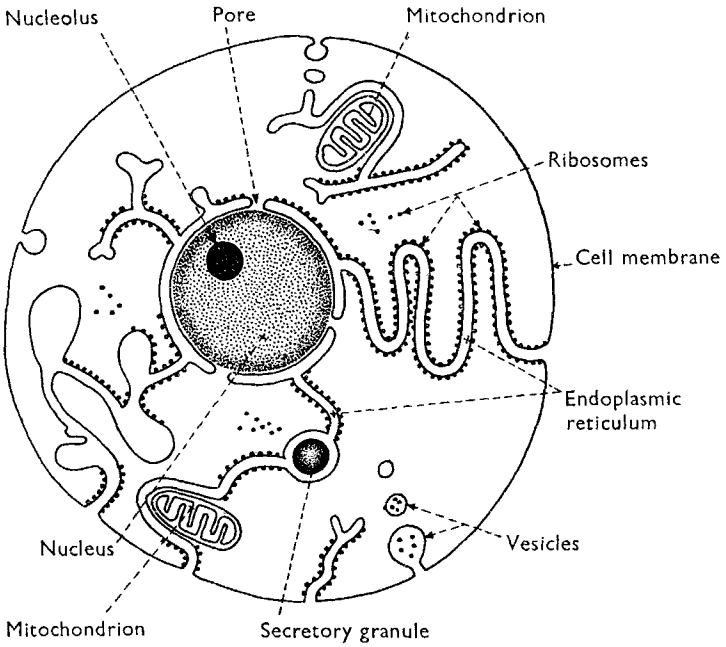

Fig. 1. Schematic representation of a 'typical' animal cell.

bodies termed nucleoli and is surrounded by a double membrane pierced at intervals by pores.

Surrounding the nucleus is the cytoplasm in which are embedded various inclusions such as granules of secretion, globules of fat, and the thread-like or rod-like bodies known as mitochondria (dimensions 0·5–5 μ by 0·3–0·7 μ). They are bounded by a double membrane, the inner layer of which is folded so as to produce a number of partitions and compartments. The mitochondria (of which there are about 400 in a liver cell) contain the enzymes responsible for oxidative phosphorylation and are the site of the production of high-energy compounds (such as adenosine triphosphate) in the cell.

The cytoplasm of the cell also contains a complex meshwork of canals and vesicles known as the endoplasmic reticulum or ergastoplasm with membranes about 5 mμ thick separating the content of the tubules and vesicles from the general matrix of the cytoplasm. It is believed by some authorities that these tubules form a series of canals leading from the exterior of the cell to the nucleus. The surface of the tubules and vesicles in some areas is studded with small round electron-dense particles (diameter 10–20 mμ) known as ribosomes. They consist of about equal amounts of protein and ribonucleic acid (RNA) and are the organelles in which protein synthesis takes place in the cell. Ribosomes also occur free in the cytoplasm unattached to reticular membranes. Indeed, in certain types of cell (intestinal epithelium, tumour cells) the endoplasmic reticulum is scanty and most of the ribosomes are in the free state.

The general cell matrix or cell sap in which the endoplasmic reticulum and mitochondria are embedded contains a RNA of low molecular weight (soluble or transfer RNA) which in the process of protein synthesis is involved in the transfer of activated amino acids to the ribosomes.

When cells are disrupted in a suitable medium and are subjected to the process of differential centrifugation in order to separate the various subcellular components in accordance with their size and density, the remains of the endoplasmic reticulum appear in the form of microsomes (diameter 60–150 mμ) from which the ribosomes may be detached and separated by treatment with sodium deoxycholate.

Genetic determination of nutritional requirements

By J. A. Roper,* *Department of Genetics, University of Glasgow*

Introduction

A clear understanding of the genetic control of nutritional requirements came only after the fruitful union of biochemistry, genetics and microbiology. However, to present any account of the genetics of nutrition without a brief discussion of earlier fundamental work is to lose perspective.

The physician Garrod (1902, 1923), working on rare inherited metabolic disorders of man, such as alkaptonuria and cystinuria, was the first to show that genes act

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