

Classification of cell structures: a functional approach demonstrated on Sertoli cell with a minireview on its structure and functions**

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Abstract: We describe functional classification of the cell structures using the Sertoli cell as a model. According to this classification, eukaryotic cell consists of six functional mutually co-operating systems (compartments). The systems are: (1) the cell surface, which serves as a membrane barrier, receives chemical signals and transports molecules into and out of the cell; (2) the nucleus – the nucleolus – ribosomes – rough endoplasmic reticulum – Golgi system includes organelles which code, decode, synthesize and secrete proteins; (3) the vacuolar system involved in intracellular traffic and transport related to secretion and intracellular digestion; (4) the smooth endoplasmic reticulum is a site of lipid synthesis and detoxification system of the cell; (5) the mitochondria are organelles providing energy for the cell; and (6) the cytoskeleton is a structural framework of the cell and enables movement of organelles and inclusions within a cell. The Sertoli cell is a unique cell having many functions; more than any other cell of the body. It enabled us to demonstrate all six cellular systems. We also briefly review up-to-date knowledge of Sertoli cell structure and function.

Key words: cell compartments, Sertoli cell structure and function, minireview.

Abbreviations: GER, granular endoplasmic reticulum; MNB, multivesicular nuclear body; NCS, nuclear channel system; SER, smooth endoplasmic reticulum.

Introduction

For more than 50 years the cell has been described to consist of structureless cytoplasm (hyaloplasm, cytosol) which contains organelles and inclusions (paraplasm). Organelles are considered the inner organs of the cell while cell inclusions are lifeless accumulations of metabolites (lipid globules, glycogen, secretory droplets, protein crystals and pigments) which are not needed to support the life of the cell. Such a classification of a cell is man-made and artificial. CHEVILLE (1994) proposed a functional approach of classification of the cell. In this article we present Cheville's compartmentalization of cell structures into six systems using Sertoli cell as a model on the basis of our results of more than 25-years-study of Sertoli cell in 12 mammalian species (mouse, rat, dog, cat, fox, ram, billy goat, bull, stallion, boar, roe-buck, fallow-deer and artificial bull cryptorchids). We also briefly review the structure and function of Sertoli cells.

Structural systems of the cell and their function

The cell may contain following six distinct but interrelated operational systems.

(1) *The surface of the cell.* Each eukaryotic cell is covered by plasma membrane (cell membrane) serving as a selective barrier which enables transport of molecules into and out of the cell and receipt of physical and particularly of chemical signals. The cell surface may form specialized structures mainly microvilli, cilia and intercellular junctions.

(2) *The nucleus – nucleolus – ribosomes – granular endoplasmic reticulum (GER) and Golgi complex* is the system including organelles which code and decode the genome, and produce and secrete proteins/glycoproteins. The pale, eukaryotic nucleus with prominent nucleolus and an extensive GER is found in the cells which produce large quantities of proteins.

(3) *The vacuolar system* transports substances inside the cell among the cellular organelles and dis-

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