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REVIEW

Polyamines: metabolism and implications in human diseases

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Summary Classically, polyamines is a family of molecules (i.e. putrescine, spermine, spermidine) derived from ornithine according to a decarboxylation/condensative process. More recently, it has been demonstrated that arginine can be metabolised according to the same pathway leading to agmatine formation. Polyamines are essential for the growth, the maintenance and the function of normal cells. The complexity of their metabolism and the fact that polyamines homeostasis is tightly regulated support the idea that polyamines are essential to cell survival. Multiple abnormalities in the control of polyamines metabolism might be implicated in several pathological processes. This paper summarises the knowledge about polyamines metabolism and point out the importance of these molecules as a target for the development of therapeutic tools and nutritional strategy.

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Introduction

The polyamines belong to a very wide range of biogenic amines, that are involved in many physiological functions, in particular immunity.

These ubiquitous chemical entities play an important role in cell growth and proliferation and in the synthesis of proteins and nucleic acids. They are also involved in the repair of the extracellular matrix, cell adhesion and certain signalling processes. Polyamine depletion has been shown to inhibit cell proliferation and migration, or cause defective embryo development, whereas over-accumulation of polyamines induces apoptosis and cell transformation.

Much research has been carried out on these substances to elucidate their place in cell physiology and to determine their role in the control of nutritional status, especially their trophic action on the gut.

Structure

The "aliphatic polyamine" term, or more simply polyamine, is used to designate three compounds (Fig. 1) derived from ornithine after an initial decarboxylation step,[1] namely

- putrescine [1,4-butane diamine or tetramethylenediamine],
- spermidine [*N*-(3-aminopropyl)-1,4-butane diamine or aminopropyl-tetramethylenediamine],
- spermine [*N*,*N*′-bis(3-aminopropyl)-1,4-butane diamine or diaminopropyl-tetramethylenediamine].