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Role of Apoptotic signaling pathways in the immune system

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Abstract: Cell death is an essential element of life in multicellular organisms, playing roles in development, defense, and homeostasis. Apoptosis is the most common mode of cell death in animals, especially when it occurs as part of normal physiology. In the past, apoptosis was focused on the caspase, a family of cysteine proteases. Now, apoptosis is classified into types I, II, and III PCD: type I PCD is the classic apoptosis, the well know caspase-dependent apoptosis; type II PCD's morphology characters are the appearance of the autophagic and double membrane of vacuole; type III PCD occurs without the condensate chromatin and has not been well-known. Type II and type III PCD are caspase-independent apoptosis. This review will focus on the apoptosis signal pathway and some ligands that have been linked to apoptosis, with a focus on concluding apoptosis from two perspectives, in vivo, and in vitro cells, so that we can better understand the network of cell death and provide the results of the most recent research. On the other hand, this review focuses on apoptosis in immune system physiology. Aspects of apoptotic signal transduction, as well as the role of apoptosis in immunological development, are discussed in the various reviews.

Keywords: Physiology, Immune system, Development.
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Introduction

Apoptosis is a programmed cell death (PCD) required for normal cell function. The word "apoptosis" comes from the Greek language meaning "falling off" or "dropping off" of petals from flowers or leaves from trees in the autumn. Following the apoptosis research came in the third period in recent years; scientists began to research the molecular mechanism of apoptosis and to use this cell death for clinical treatment. Some key proteins in the procession of apoptosis have been found, such as Bcl-2 family protein, caspase-3, caspase-8, caspase-9, Bid, and Bax. This review will focus on the apoptosis signal pathway and some ligands that have been linked to apoptosis, with a focus on concluding apoptosis from two perspectives, *in vivo* and *in vitro* cells, so that we can better understand the network of cell death and provide the results of the most recent research i.e. it focuses on apoptosis in immune system physiology.

Apoptosis research timeline: Cell death is necessary for body homeostasis; necrosis, apoptosis, and pyroptosis are the three types of cell death currently studied. The term apoptosis was originally used in 1972, and some years ago, pyroptosis was known by the symbol of a hole in the cell membrane that released inflammatory chemicals. The study of apoptosis began in the nineteenth century. Sydney Brenner, Horvitz, and John E Suston were awarded the Nobel Prize in Medicine in 2002 for their contributions to apoptosis research. They are pioneers in organ development and genetic and systemic regulation-programmed cell death research. Sydney Brenner's contribution is the creation of a *C. elegans* nematode model. Suston then discovered the *C. elegans* cell lineage and the first gene (Nuc-1) associated with apoptosis. *Caenorhabditis elegans* is still the standard model