Preface

Tissue homeostatic responses to change of environmental conditions, genetically-programmed transformations, injury, and a variety of diseases require adjustment and/or reconstitution of the cellular content in order to support physiological balance, development and remodeling. Since the late 1950s and early 1960s the above events have been closely associated with a phenomenon named "autophagy" {a term derived from a Greek word meaning "self" (*auto*) and "eating" (*phagy*) [1]}. Current paradigm considers autophagy as an evolutionary conserved and strictly regulated lysosomal pathway employed by eukaryotic cells to degrade unnecessary or compromised organelles, cytoplasmic and endocytosed materials and invaded pathogens [2-4]. The morphology of autophagy was first identified in mammalian cells in the 1950s, and extensive morphological and pharmacological studies defined the basic steps of this process [5, 6]. Thus, it has been described several different types of autophagy based on (i) nature of cellular target (autophagosomes "cargo") of degradation, (ii) the mechanism of "cargo" delivery to lysosomes, and (iii) the pathways for delivery of "cargo" materials to autophagosome constructions [3-5, 7]. Thereby, formation of autophagosomes, double-membrane vacuoles lacking enzymes that are originated from the membrane of different organelles, is a major morphological feature of macroautophagy (often referred in the chapters of this book as autophagy), and autophagosomes *per se* serve for sequestration and delivery of intracellular components to lysosomal processing [2, 4-7].

The autophagy research has witnessed a remarkable growth since the initial description of autophagosomes that were seen by electron microscopy [1,2,4,6,7]. In particular, during past decade this topic has attracted widespread attention due to discovery of autophagy-related genes, autophagy-regulatory mechanisms, and invention of new autophagy research techniques [2,4,7]. Thus it has been determined that macroautophagy is controlled by the highly conserved *atg* –genes (*atg* for autophagy-related genes) [2-8]. Suppression of these genes and impairment or dysregulation of autophagy are associated with severe diseases and aging, and are shown to cause death in cell and animal models [2-4, 8, 9]. Therefore, overall autophagy is considered to be adaptive and protective cellular mechanisms [4,5,10]. Interestingly, as many other crucial pathways, autophagy plays dual role under normal and pathological conditions. In addition to the well-known role of autophagy in cell survival, autophagy-mediated type II programmed cell death has long been proposed [4,10,11]. The autophagic cell death was originally reported in tissues subjected active development and remodeling. That effect seems to be analogous to apoptosis in similar metamorphoses. However, the proposed function of autophagy in cell death is not restricted to the developmental programmed cell death; it also extends to cell death that occurs under various

pathological conditions, e.g., immune disorders, tissue degeneration, gastrointestinal impairment, infections, *etc.* [2-4, 8-12]. Presumably, uncontrolled activation autophagy capable of massive removal of subcellular structures such as mitochondria, can be detrimental to the cell and tissue functions.

The objectives of the book "Autophagy: Principles, Regulation and Roles in Disease " are to give an up-to-date overview of biomedical aspects of autophagy research, a large interdisciplinary field emerging on intersection of (i) cell, developmental, and cancer biology, (ii) tissue remodeling and plasticity, aging and longevity; (iii) immunology, microbiology, toxicology, and pathobiology; (iv) regenerative and adaptive biomedicine; and (v) pharmacology. The provided analyses emphasize that in-depth understanding of the paradoxical role of autophagy in promoting cell death and survival is crucial for development of target therapy of autophagy-driving diseases. Giving a wide-angle perspective on biomedical aspects of autophagy we addressed this book to a broad audience of readers from students to practicing clinicians. Each chapter of this book is supplemented with extensive lists of references that include sources of the original data and concepts.

The field is expansive and the book is divided into three parts: Part 1 – Autophagy and immunity, immune disorders, inflammation and infection; Part 2 – Autophagy in cancer research and cancer therapy; Part 3 - Autophagy response to injury, metabolic and degenerative disorders, and exposure to nanomaterials.

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