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# The Ageing Immune System and Health

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Valquiria Bueno • Janet M. Lord  
Thomas A. Jackson  
Editors

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 Springer

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## Preface

The world population is undergoing a major demographic shift. As birth rates decline and people live longer due to advances in public health and medical science, the proportion of people over 65 is increasing. Moreover, people over 85 are the fastest growing section of society and often referred to as the “oldest old”. However, while life expectancy is rising at a rate of approximately 2 years per decade, this is not accompanied with a similar increase in disability-free life expectancy. So people are living longer, but in poorer health. However, as we age, we observe a greater heterogeneity of ability and health. The variation in, say, walking speed is far greater in a group of 70 year olds, than in a group on 20 year olds. This makes the study of ageing and the factors driving that heterogeneity of health and functional ability in old age vital.

Infectious disease in older people is associated with greater morbidity and mortality, so it is plausible that age-related changes to the immune system are central to this. The influenza virus is associated with greater hospitalisation and mortality in older people, and older people are more susceptible to complications of infection such as delirium. The study of the immune system across the lifespan has demonstrated that as we age the immune system undergoes a decline in function, termed immunosenescence. However, as discussed in Chaps. 1 and 2 the decline in function is not universal across all aspects of the immune system, and neither is the magnitude of functional loss similar between individuals. The theory of inflammageing, which represents a chronic low grade inflammatory state in older people, has been described as a major consequence of immunosenescence, though lifestyle factors such as reduced physical activity and increased adiposity also play a major role. Importantly, inflammageing may well explain the greater burden of disease in older people as increased systemic inflammation has been associated with greater risk of most of the age-related conditions including cardiovascular disease, cancer, sarcopaenia and dementia.

In poor health, older people accumulate disease, described as multimorbidity. This in turn means traditional single system based health care becomes less valid as each system affected by disease impacts on other systems. This leads some older people to be at greater risk of adverse events such as disability and death. The syndrome of this increased vulnerability is described as frailty, and increasing fundamental evidence is emerging that suggests immunosenescence and inflammageing

may underpin frailty and this is discussed in Chap. 9. Thus frailty is seen as one clinical manifestation of immunosenescence.

The understanding of how the immune system changes with age and can potentially be manipulated will impact on our current knowledge of older people living healthy lives and also can direct actions on how to improve the care of older people in ill health. The major aim is to improve disability-free life expectancy, so thereby adding life to years. The role that increasing physical activity may play in reducing immunosenescence and ill health in old age is covered in Chap. 10.

Despite the importance of the ageing immune system on both good and poor health in older people, there is a dearth of textbooks bringing together all aspects of the topic. In this book we aim to present up-to-date reviews on the key topics in the understanding of Ageing, Immune System, and Health. It is aimed at fundamental scientists and clinicians with an interest in ageing or the immune system. Each chapter aims to highlight current knowledge and also highlight knowledge gaps to stimulate further research.

Chapters include state-of-the-art reviews on immunosenescence in both the innate and adaptive immune systems. Others follow ageing and immunity in specific systems; lung senescence and epigenetics, as well as specific disease processes; cancer and cytomegalovirus infection. Vaccination is discussed in relation to older people, and the clinical and fundamental aspects of frailty are discussed.

Our goal is that improved recognition of the role played by a compromised immune system in ill health in old age, combined with the understanding that this can to a large extent be attenuated by lifestyle choices, will result in public health policy that ensures old age is enjoyed and not endured!

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