

PREFACE

Aging is as inevitable as the change of seasons, from spring to summer, and then winter to fall. As we age, mobility, strength, and stamina all decline. These are the classic signs of aging. The aging process is written in our genes. As the telomere length recedes, the rate of cell division declines, and the fabric of our bones and skin lose their resilience, leading to the loss in vitality.

Yet, remarkable progress has been made in the understanding of the aging process, and in turn how to slow its progress. A vitally important arsenal in anti-aging is the minimization of oxidation, or rusting, of the body. Free radicals that result from oxidation can interfere with the natural repair process in the cells, leading to genetic damage that increases the rate of aging. Proper nutrition and exercise play significant roles in slowing the effects of aging. Nutrients with anti-oxidant properties act at the microscopic level to counteract the damaging effects of free-radicals, and in turn maintain the integrity of the structure of the cells in the body. Exercise act at the macroscopic level to strengthen muscle, joint, and bones as well as increase the functions of the cardiovascular, respiratory, and hormonal systems to better counteract the physical and emotional stresses of daily life.

Nevertheless, there is only so much nutrition and exercise can do to stem the tide of aging. Eventually, some body parts will begin to break down over time. The baby boomers, who have dominated the social, economic, political demographics of the population over the last half century, will now dominate the search for elixirs and remedies to hold back the ravages of time as they age and their body parts begin to malfunction. Repair or replacement of the body parts provides a means in a sense to reverse the aging process. Biomedical engineers have built components or devices to assist and revitalize the aging human body. Indeed, it is now not too extraordinary to find senior persons who have had surgery for cataract, monovision, Lasik, heart bypass, hip, knee,

and/or cochlear implants. Thus, the maturing of the baby boomers also heralds the age of the bionic man, who is literally composed of various replacement organs or biomechanical parts.

The purpose of this book is to provide a comprehensive and up-to-date scientific source of biomedical engineering principles of “replacement parts and assist devices” for the bionic man. It covers biomechanical, biochemical, rehabilitation, and tissue engineering, as well as applications in cardiovascular, visual, auditory, and neurological systems. It can serve as a text or reference for students, scientists, and laymen interested in the fundamental underlying principles of biomedical devices and procedures, as well as recent advances in transplant, gene therapy, and stem cell research. The book’s emphasis on fundamental principles that are reviewed within relevant chapters ensures the content will remain relevant and useful for years to come.

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