

Preface

Why another bone book? I agreed to edit this book because there is no similar book that I know. There are excellent texts covering bone mechanics (e.g., by Cowin) and musculoskeletal biomechanics (e.g., by Bartel, Davy and Keaveny; Martin, Burr and Sharkey; Mow and Huijskes), and equally excellent (and massive) texts covering bone biology/aging/osteoporosis (e.g., by Marcus, Feldman, Nelson and Rosen; Rosen, Glowacki and Bilezikian). In these texts, the topic of bone biomechanics and aging is just a small part of a larger agenda. Here my goal was to narrow the focus and devote an entire volume to the questions: What changes in bone(s) occur with aging or osteoporosis that are relevant to bone strength? How do we predict bone strength? How do osteoporosis drugs affect bone strength? What changes occur with aging that are relevant to bone mechanobiology? There has been a lot of research on these questions in the past 40 years, but no single volume that attempts to review it. The assembled chapters offer such a review. They highlight many age-related phenomena that are irrefutable, but also point to issues that are debatable or not fully explored. Aging studies are difficult whether they use animals, human subjects or post mortem material, and there is still much work to be done.

The first five chapters address the biomechanics question. [Chapter 1](#) covers changes in bone structure and strength at the whole-bone level, while [Chaps. 2–5](#) cover changes in properties at the trabecular and cortical bone tissue level, with focus on microstructure, composition and microdamage. [Chapter 6](#) reviews recent attempts at integrating our knowledge of structure, strength and loading to predict fracture risk. [Chapter 7](#) reviews the effects of osteoporosis drug treatments on bone strength and fracture. The next four chapters address the mechanobiology question. [Chapter 8](#) reviews mechanoresponsiveness and aging at the cellular level. [Chapters 9 and 10](#) review mechanoresponsiveness in animal experiment, with focus on aging and sex hormones, respectively. Lastly, [Chap. 11](#) reviews clinical evidence that loading influences bone in the setting of aging/osteoporosis.

Even a modest volume like this takes a large collective effort. I heartily thank each of the authors who contributed chapters to this volume. They generously gave of their time to write and revise their chapters. I hope that readers will find our efforts were worthwhile.



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