Preface

With the development of modern technology, people are exposed to increased magnetic fields. Here we specifically focus on static magnetic field (SMF), which means the magnetic field strength does not change over time. SMF is different than the dynamic or time-varying magnetic field. For example, cellular phones or microwaves are pulsed magnetic fields with different frequencies, which belong to dynamic magnetic fields and will not be discussed in this book. Most commonly seen SMFs are the household magnets, the core component in magnetic resonance imaging (MRI) machines in hospitals, magnetic elevation trains, as well as the weak but widely existed earth magnetic fields. They are all SMFs, with different intensities. The magnetic field intensities people are exposed to vary from 0.05 mT (earth magnetic fields) to almost 10 T (high-field MRI in preclinical research).

To set up a safety standard for human exposure to SMFs, there are many related researches studying the effects of the magnetic fields at molecular, cellular, animal, as well as human body levels. Accordingly, WHO (World Health Organization) and ICNIRP (International Commission on Non-ionizing Radiation Protection) have published some guidelines for the SMF exposure of human bodies to ensure that people are not overexposed. At the same time, magnetic therapy, which was never in the mainstream medicine, has wide applications by many people as alternative or supplementary treatments. Most of them are currently used in pain relief, as well as some other nonurgent applications. However, the magnetic therapies in general are not substantiated by enough sound scientific proofs. Only with proper and detailed knowledge, people could try to maximize the proper usage of SMFs in our daily lives without hurting our bodies. We need to undertake serious and practical research into the magnetic effects on the biological systems so that we will have practical knowledge, both medically and scientifically.

It should be mentioned that we will not cover magnetic nanoparticle studies, which have a fast growing trend and have promising therapeutic applications for future medical treatments; we will focus on the externally applied magnetic fields on human and animal objects, but not the magnetic fields produced within living

organisms (biomagnetism). We try to cover most aspects of biological effects of SMFs on human cells but also want to apologize for any missed research findings that are not included in this book. Our goal is try to provide people with an overview of the current understanding of the biological effects of SMFs and hope to encourage more scientists to get involved in this field so that we can get a clearer view of this field in the near future.

There are three contributors to this book. All of them have done and are still currently working on the biological effects of magnetic fields. They are:

Dr. Xin Zhang, principal investigator at the Chinese Academy of Sciences, High Magnetic Field Laboratory, Hefei, China (Chaps. 1, 2, 4, and 6)

Dr. Kevin Yarema, associate professor of biomedical engineering at the Johns Hopkins University School of Medicine, USA (Chaps. 3 and 7)

Dr. An Xu, principal investigator at the Institute of Technical Biology and Agriculture Engineering, Hefei Institutes of Physical Science, Chinese Academy of Sciences, Hefei, China (Chap. 5)

Hefei, China — Xin Zhang
Baltimore, MD, USA — Kevin Yarema
Hefei, China — An Xu

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Zhang, X.; Yarema, K.; Xu, A.

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