Foreword

A primary motive of modern science is to improve the human condition. We explore the natural world, uncover its inner workings, and develop tools to protect ourselves from its dangers and preserve its wonders. To be useful and meaningful, scientific research cannot be conducted in isolation from society. The struggle to understand natural laws requires us to consider the social context through which we experience them. Successful technologies must be designed to integrate with the culture in which they will be used, and the impact of their implementation upon society should be observed and directed. This book examines the complex dynamics at the intersection of society and science in the context of one our most basic challenges, human health, and one of the most rapidly advancing fields, genomic medicine.

Genomics, the study of the structure and function of an organism’s complete set of genetic material, has begun to reveal a new depth of understanding of the mechanisms that govern all living things. Because of the universality of DNA and of the basic principles of genome function, this research has the power to help solve many of the scientific and technological challenges faced by our society.

How can we put knowledge of the genome to practical use? We are beginning to appreciate the potential of genomes to act as scientific crystal balls, through which we will someday be able to glimpse an outline of an individual’s future. This is despite the fact that biology is not deterministic in itself. Instead, we now recognize the genome as a dynamic record of nature and nurture, an organism’s genetic inheritance and its adaptations to environment. Experience, or “nurture,” is written onto the genome in the form of molecular editor’s marks that influence what genes are expressed and when. The more we learn about how these processes work, the clearer our vision of an individual’s future will become.

The applications for genomic research are almost limitless. Modern-day microbe hunters will scan through bacterial genomes and find the strain that produces the next life-saving antibiotic or the next cancer treatment. Traits that we prize in food and fuel crops—greater yield, faster growth, resistance to climate change or to disease—will be read from one genome and then written into others, days of efficient laboratory work replacing years of uncertain breeding experiments. Biomedical engineers will unlock the developmental programs of a patient’s cells and grow new tissues and organs to heal damage caused by injury or disease. Treatment for mental illnesses will focus on prediction and prevention, rather than the current dubiously successful alleviation of symptoms.

This final example exemplifies the great promise that genomic research holds for the field of medicine: the power to anticipate outcomes rather than reacting to them—the predisposition of an individual toward an illness, the likely course of that illness, and the probable success of different treatment strategies. To implement the ideas and innovations produced by this research, we must integrate them with diverse cultures, health care practices, political structures, and economies around the globe.
The great value of this book lies in its exploration of the incredible range of challenges that have emerged as genomic medicine becomes a reality. William Ebomoyi has used the broad perspective gained through extensive experience in community health in the United States and abroad to pull together many instructive examples of health disparities that could be remediated through genomic medicine. His synthesis of biological, cultural, political and economic factors highlights both recent progress and existing barriers.

Dr. Ebomoyi’s holistic treatment of the interplay between genomic medicine and public health is important and timely. Considering how to integrate these emerging technologies into society will help us secure healthier futures for people from every background, for citizens of every nation. The intellectual challenge we all face is to help create tools to build a better world, and also to consider how to use them well.

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