

## CONTENTS

1. Plants and Human Health 3
  - Our Early Relationship with Plants 5
  - Plants as Medicine 12
2. Bioprospecting for Medicines from Plants 14
  - Ethnobotany and Medicine 16
  - Modern Drug Discovery and Indigenous Cultures 20
  - Plants and Modern Drug Discovery 23
  - Examples of Medicines Derived from Plants 27
  - Impact of Biopiracy, Preservation of Biodiversity 37
  - Intellectual Property Rights for Indigenous People 38
  - Conclusions 41
3. The Lure of Herbal Medicine 43
  - History 45
  - The Bioactive Compounds in Herbal Medicinal Plants 50
  - Traditional Indian Medicine 56
  - Traditional Chinese Medicine (TCM) 62
  - What Nonscientists Should Know about Herbal Medicines 71
  - What Scientists Need to Know about Herbal Medicines 75
  - Could Herbal Medicine and Western Medicine Complement Each Other? 77
  - Conclusions 79
4. Farming Medicines from Plants 82
  - Why Farm for Pharmaceuticals in Plants? 83
  - New Production Systems 86
  - How Does It Work? 87
  - Technologies Used to Design Plants Expressing Biopharmaceuticals 89
  - Clinical Trials of Therapeutic Proteins Produced in Plants 97
  - Allergies, Oral Tolerance, and Dose Response Relationships to Plant-made Vaccines 101

|    |  |     |
|----|--|-----|
|    | The Scale-Up and Commercialization Opportunities for Plant-derived<br>Therapeutic Proteins | 102 |
|    | Plant Production Platforms for Molecular Farming   | 104 |
|    | Molecular Farming Requires Its Own Unique Set of Regulatory<br>Guidelines                  | 104 |
|    | Conclusions  | 105 |
| 5. | Superfood: Functional and Biofortified Foods   | 107 |
|    | The Science behind Functional Foods  | 108 |
|    | Functional Foods and Human Genetics  | 111 |
|    | The Mediterranean Diet: The Ideal Diet?  | 112 |
|    | Do Dietary Supplements Work?   | 121 |
|    | Functional Foods as Superfoods?  | 122 |
|    | Biofortified Foods and Hidden Hunger   | 123 |
|    | Can Biofortified Foods Make a Difference?  | 132 |
|    | Conclusions  | 133 |
| 6. | Food Security, Climate Change, and the Future of Farming                                   | 135 |
|    | Norman Borlaug and the Green Revolution  | 137 |
|    | The Green Revolution Missed Africa   | 142 |
|    | Agricultural Makeover: Sustainable Intensification   | 145 |
|    | Up-and-Coming Technologies: Crop Improvement   | 146 |
|    | Improved Farming Techniques  | 151 |
|    | Environmental Uses for Plants  | 155 |
|    | Agricultural Sustainability and Organic Food   | 158 |
|    | Conclusions  | 162 |
| 7. | The Future   | 164 |
|    | Foods as Drugs   | 165 |
|    | What Will the Food Industry Look Like?   | 168 |
|    | An Urban Answer to Increased Food Production: Vertical Farms                               | 169 |
|    | Agricultural Sustainability and Protection of Biodiversity:<br>A Daunting Challenge        | 171 |
|    | Biodiversity and the Search for New Medicines  | 172 |
|    | The Importance of Public Perception in Shaping Our Future                                  | 174 |
|    | Regulating Agricultural Innovations Can Be a Double-Edged<br>Sword                         | 175 |
|    | Conclusions  | 177 |

*Notes* 179

*References* 181

*Index* 191