

# Content

## **1. *Behind the Soundbite* 1**

- Communication Gap in Science 1
- History of Nutrition Science 3
  - Scurvy, Beriberi, Pellagra 3-4
- Science and Nutrition Today 5
- Behind the Sound Bite 7

## **2. *Scientific Method* 9**

- Forming a Hypothesis 9
- Observation vs. Intervention 10
- Retrospective vs. Prospective 10
- Cross-Sectional vs. Longitudinal 10
- Sampling 11
- Controlling Variables 12
- Research Animals 14
- Clinical Trials 17
- Evaluating Data 18
- Reporting, Verifying Scientific Studies 19
  - Claim of Cold Fusion 20
- Buyer Beware 21
- Alternative Medicine 22
- Summary 23

## **3. *Chemistry* 25**

- Atoms 25
  - Nuclear Fusion 26
  - Atomic Weight 29
- Molecules 29
  - Molecular Formulas 31
    - Calculating the Amount of a Mineral in a Supplement 32
- Chemical Bonds 32
  - Ions and Ionic Bonds 33
  - Covalent Bonds 34
- Chemical Reactions 35
- Acids and Bases 35
- Energy 36
  - Caloric Value of Food 37
    - Practical Applications of Calculating Food Calories 38
- Summary 39

## **4. *Dietary Recommendations* 41**

- Essential Nutrients 41
  - Water 41
  - Energy-Providing Nutrients 43
  - Vitamins 43
  - Minerals 44
- Determining Amounts Needed 44
- Recommendations 45
  - Recommended Dietary Allowances (RDAs) 46
  - Daily Values (DVs) 47
  - ChooseMyPlate.gov Eating Guide 48
  - Dietary Guidelines for Americans 48
- Practical Application of Dietary Guides 49
- Dietary Supplements 51
- Summary 54

## **5. *Energy-Providing Nutrients* 55**

- Carbohydrate 55
  - Sugar 55
  - Complex Carbohydrate 57
    - Starch, Glycogen 57
  - Fiber 58
- Alcohol 59
- Fat 59
  - Concentrated Sources of Calories 59
  - Functions of Fat 61
  - Triglycerides, Fatty Acids 62
    - Saturated vs. Unsaturated Fatty Acids 62
    - Hydrogenated Fat 62
      - Trans Fatty Acids 65
    - Oxidation of Double Bonds 65
    - Omega Double Bond 65
    - Fatty Acids Essential in the Diet 66
    - Lecithin 66
    - Cholesterol 67
  - Protein 68
  - Summary 71

## **6. Digestive Tract 73**

- Mouth 75
  - Taste, Sweetness 75
  - Tooth Decay 76
    - Mouth Bacteria 76
    - Saliva 77
    - Sites of Decay 78
    - Fluoride, Feeding the Bacteria 79
- Esophagus 80
- Stomach 80
  - Acid, Intrinsic Factor 81
  - Stomach Cancer 81
- Small Intestine 82
  - Duodenal Ulcers 85
  - Lactose Intolerance 85
- Colon 86
  - Gas 87
  - Diarrhea, Constipation 87
  - Diverticulosis 88
  - Colon Cancer 88
- Summary 89

## **7. Circulatory System 91**

- Heart 91
- Blood Vessels, Blood Pressure 93
- Blood 95
  - Red Blood Cells 95
    - Hemoglobin 95
    - Athletic Competition 95
  - Anemia 96
    - Iron-Deficiency Anemia 96
      - Iron in Foods 97
      - Iron Supplements 98
      - Iron Toxicity 98
      - Hemochromatosis 98
    - Folate-Deficiency Anemia 99
    - Pernicious Anemia 100
  - White Blood Cells, Platelets 101
  - Plasma Proteins 102
    - Antibodies, Albumin 102
    - Clotting Factors 103
    - Lipoproteins 104
- Summary 105

## **8. Atherosclerosis 107**

- Premature Death 108
- Risk Factors 110
  - High LDL-Cholesterol 110
  - Genetic Predisposition 110
  - Smoking, High Blood Pressure 111
  - Male Gender 112
  - High Blood-Homocysteine 112
- Treatment 112
- Prevention 113
  - Smoking 113
  - Blood Pressure 113
    - Sodium, Alcohol 114
  - Blood Cholesterol 114
    - Saturated and Trans Fat 115
    - Fiber 115
    - Dietary Cholesterol 116
    - HDL-Cholesterol 116
    - Omega-3 Fatty Acids 117
  - Medication 118
- Summary 119

## **9. Cells and Metabolism 121**

- Cell Structure 123
  - Cell Membrane 123
- Metabolism 123
  - Enzymes, Coenzymes 123
  - B-vitamins 124
    - Niacin-Tryptophan-Pellagra 124
  - Energy-Releasing Reactions 124
    - Anaerobic Energy Production 124
    - Aerobic Energy Production 126
    - Athletic Performance 127
      - Types of Muscle Cells 127
      - Oxygen Delivery 128
      - Glucose Supply 128
  - Energy-Requiring Reactions 129
    - Protein Synthesis 129
- Storing Excess Calories 129
- Maintaining Blood Glucose 130
  - Carbohydrate-Free Diets 130
  - Blood Glucose 131
  - Diabetes 132
  - Hypoglycemia 133
- Summary 133

## **10. Genes, Proteins, and Viruses 135**

- Genes and DNA 135
- How a Cell Makes Protein 136
  - Copying and Delivering the Recipe 136
  - Making the Protein 137
- DNA Analysis 138
  - Human Genome Project 138
  - Pharmacogenomics 138
  - Precision Medicine 138
  - Molecular Paleontology 138
  - DNA Fingerprinting 138
- Viruses 140
  - HIV 141
- Biotechnology 145
  - Making Human Protein 145
  - Gene Therapy 146
  - CRISPR-cas9 147
  - Cloning 148
  - Plant Genetics 148
- Mutations 149
  - Sickle-cell Anemia 150
  - Spontaneous Mutations 151
- Summary 152

## **11. Dietary Protein 153**

- Evaluating Dietary Protein 153
  - Protein Quality 154
    - Amino Acid Content 154
    - Limiting Amino Acid 155
    - Complementing Proteins 155
  - Amount of Dietary Protein 156
- Protein Requirements 156
  - Effect of Inadequate Calories 157
  - Effect of Dietary Source of Protein 157
  - Recommended Dietary Allowance (RDA) 157
  - Protein Requirements of Athletes 158
- Protein Deficiency 159
- Excess Dietary Protein 159
- Moderation in Protein Intake 160
- Vegetarian Diets 161
- Summary 163

## **12. Cancer 165**

- Trends in Cancer Rates 165
  - Current Cancer Statistics 167
  - Death Rates, Diagnosis Rates 167
- Biology of Cancer 168
  - Ames Test 170
- Assessing Risk 171
  - Direct Contact: Breathing, Eating, Drinking, Chewing 171
  - Colon Cancer 173
  - Cancer at Remote Sites 174
  - Bladder Cancer 174
  - Liver Cancer 174
  - Breast Cancer 175
  - Prostate Cancer 176
  - Testicular Cancer 177
- Treatment 177
  - Survival Rates 178
- Prevention 178
  - Diet and Cancer 179
  - Carotenes/Carotenoids 180
  - Carcinogens 181
- Summary 181

## **13. Energy Requirements 183**

- Basal Metabolism 184
  - Age 184
  - Hormones 186
    - Thyroid Hormone 187
    - Iodine, Goiter 187
    - Goitrogens 188
    - Excessive Thyroid Hormone 188
    - Miscellaneous Factors 188
- Physical Activity 190
- Energy Expended Upon Eating 191
- Adaptations for Survival 192
- Obesity 193
  - The Urge to Eat 193
  - Hunger, Appetite 193
  - Satiety 194
  - Genes vs. Environment 196
- Summary 197

#### **14. Musculoskeletal System 199**

- Muscle 199
  - Exercise, Anabolic Steroids 200
  - Growth Hormone 201
  - Aging, Muscle Contraction 202
- Bone 203
  - Bone Nutrients 204
    - Vitamin D 204
    - Calcium 206
    - Vitamin C 207
    - Phosphorus 208
  - Osteoporosis 208
    - Risk Factors 209
    - Prevention 211
- Periodontal Disease 211
- Summary 213

#### **15. Nervous System 215**

- Neurons 216
- Transmission of Nerve Impulses 216
  - Neurotransmitters 217
    - Nerve-Muscle Junction 219
  - Stimulants, Caffeine 220
  - Inhibitors 220
    - Alcohol 222
      - Withdrawal, Wernicke-Korsakoff Syndrome 222
      - Fetal Alcohol Effects 223
- Diet and the Brain 223
  - The Developing Brain 224
    - Lead 224
  - Food and Mood—The Tryptophan Connection 227
    - Tryptophan Transport into the Brain 227
    - Tryptophan Supplements 227
  - Nutrients and Brain Dysfunction 229
    - Alzheimer's Disease 230
- Diet and Behavior 230
- Summary 231

#### **16. Food Safety 233**

- Natural Chemicals in Plants 233
  - Natural toxins 234
- Food Additives 235
  - Safety Legislation 236
    - GRAS List 236
    - Assessing Risk 236
    - "Macro-Additives" 238
- Pesticides Applied to Food Crops 239
  - Integrated Pest Management 240
- Environmental Contaminants 240
- Microbial Hazards 240
  - Keep Them Out 241
  - Keep Them From Growing 241
  - Kill Them 243
    - Botulism 244
      - Infant Botulism 245
      - E. Coli O158:H7 245
    - Tracking Microbial Contamination 246
- Hazard Analysis Critical Control Points (HACCP) 247
- Consumer Confusion 247
- Summary 249

#### **Appendix 251**

- A-1: Measurement Conversion Factors 251
- A-2: Periodic Table of Elements 252
- A-3: Elements 254
- A-4: Adult Recommended Intakes, Daily Values, Upper Limits 255
- A-5: Vitamins and Minerals 256
- A-6: Readings, References, Study Questions 258
- A-7: Glossary 266

#### **Index 275**