

contents

Preface ix



Introduction: Nutritional Terms and Definitions 1

The Study of Nutrition 2

History of Research and Development in Pet Foods 3

Domestication 3

Scientific Research in Pet Foods and Nutrition 4

The Scientific Process 5

Observation 5

Hypothesis 6

Experimentation 6

Analysis and Interpretation 7

Present Focus in Companion

Animal Nutrition 7

Nutritional Principles 8

Conservation of Matter and the First Law of

Thermodynamics 8

Metabolism, Growth, and Reproduction 9

Required Nutrients 9

Veterinary Technical Information and Practical

Application 11

Words to Know 12

Study Questions 12

Further Reading 13



The Life Cycle and Nutrient Requirements 15

The Neonate 15

Weaning 17

Growth 18

Adulthood and Maintenance 20

Adult Females 22

Aging 23

Veterinary Technical Information and Practical

Application 24

Words to Know 24

Study Questions 25

Further Reading 25



Glucose and Fatty Acids: Providers of Body Structure and Function 27

Types and Functions of Carbohydrates 27

Simple Carbohydrates 28

Complex Carbohydrates 30

Types and Functions of Fats 33

Simple Fats 34

Chemistry of Fats and Hydrocarbons: Our Energetic

Friends 35

Complex Fats 45

Veterinary Technical Information and Practical

Application 46

Words to Know 47

Study Questions 47

Further Reading 47



Amino Acids and Proteins: Providers of Body Structure and Function 49

Amino Acids—Building Blocks of Life 49

Proteins—Structure and Function of Life 52

Types and Functions of Proteins 55

Nonprotein Nitrogen 58

Veterinary Technical Information and Practical

Application 60

Words to Know 60

Study Questions 60

Further Reading 60



Vitamins: Cofactors for Nutrient Metabolism 61

Role and Function of Vitamins 61

Fat-Soluble Vitamins 65

Special Roles of Fat-Soluble Vitamins 65

Veterinary Technical Information and Practical

Application 67

Words to Know 67

Study Questions 68

Further Reading 68



6

Minerals: Providing Many Functions 69

Major Functions of Minerals 69

- Minerals for Bone, Muscle, and Nerve Function 69
- Minerals for Ionic Balance for Cell Life 70
- Minerals in Metabolism 71
- Interactions of Minerals in Metabolism 73

Control and Management of Minerals 74

- Veterinary Technical Information and Practical Application 77
- Words to Know 77
- Study Questions 77
- Further Reading 77

7

The Basics of Nutrient Requirements: Water, Energy, and Protein 79

Functions of Water 79

- Water Balance in the Body 80

Oxygen, Respiration, and Energy 83

- Energy: The Ability to Do Work 84
- Tricarboxylic Acid Cycle 85
- Use of Amino Acids for Energy 85
- Electron Transport 87

Energy Nutrition 87

The Net Energy System 88

- Determining Energy Requirements 89

Energy, Food Intake, and Obesity 96

Determining Nitrogen Balance: Defining Growth and Production 97

Measuring Protein Quality 98

Amino Acid Metabolism and Protein Use 100

- Veterinary Technical Information and Practical Application 103
- Words to Know 103
- Study Questions 104
- Further Reading 104

8

Getting Ready to Make Foods: Ingredients, Preparation, and Processing 105

Introduction 105

Types of Feedstuffs 106

- Energy Feeds 106
- Protein Feeds 107

Fiber Feeds 108

Meat Meals, Processed 108

Mineral and Vitamin Sources 110

- Mineral Supplements 110
- Vitamin Supplements 110

Processing and Preparation of Feed Ingredients and Feeds 112

- Types of Processing 113
- Removing Toxins and Inhibitors 116
- Effects of Processing on Palatability 118
- Additives in Pet Foods 119

Veterinary Technical Information and Practical Application 121

- Words to Know 122
- Study Questions 122
- Further Reading 122

9

Formulation, Analysis, and Labeling: Foods to Meet Requirements 125

Diet Formulation: Basic Process 125

Types of Pet Foods 131

- Generic Foods 131
- Private Label 131
- Popular Brands 131
- Premium Brands 131

Forms of Pet Foods 132

- Dry 132
- Soft-Moist or Semi-Dry Foods 132
- Canned (Wet or Moist) 132

Pet Food Labeling 133

- Guaranteed Analysis 134
- List of Ingredients 134
- Nutritional Purpose or Adequacy 135
- Name, Species, Contact, Weight 136

Analysis of Diets 136

- Palatability: How Well the Animal Likes or Eats the Food 136
- Acceptability: How Well the Food Is Used and Meets the Requirements 136

Determining Food Nutrient Content 137

- Feed Chemistry: Proximate Analysis 137
- Van Soest System (or Detergent System) 138

Expressing Nutrient Content 138

Regulation of Pet Foods and Labels 139

- National Research Council 139
- Association of American Feed Control Officials 141
- The Food and Drug Administration 141

Physical Evaluation of Food 141

**Supplementation 142**

Other Possible Supplements 143

Calculation of Ration Composition 144

Algebraic Method of Balancing a Ration 145

Veterinary Technical Information and Practical Application 146

Words to Know 146

Study Questions 147

Further Reading 147

**10****Nutrition of Canines through the Life Cycle 149****Introduction to Remaining Chapters 149****Goals and Objectives for Puppies 150**

Preparing for Weaning 151

Orphaned Puppies 154

Growing Dogs 155

Mature Dogs: Goals and Objectives 159

Performance Dogs: Goals and Objectives 162

Gestating and Lactating Dogs 163

Senior Dogs: Goals and Objectives 165

Nutritionally Related Problems of Dogs 167

Renal Damage, Aging, and Dietary Protein 167

Gastrointestinal and Liver Diseases 168

Food Allergies and Management 169**Genetic Problems, Nutrigenetics, and Nutrigenomics 172****Supplementation, Special Situations, and Myths 174**

Supplementation with Vitamins, Minerals, or Special Supplements 174

Supplementation with Human Food 174

Fruits and Vegetables 175

Hip Dysplasia 175

Veterinary Technical Information and Practical Application 176

Words to Know 176

Study Questions 176

Further Reading 176

**11****Nutrition of Cats, the True Carnivores 179****Characteristics of Cats 179**

True Carnivore 179

Lack of Dietary Glucose 180

Amino Acid Nutrition 180

Fat Nutrition 182

Vitamin Nutrition 182

Mineral Metabolism and Urinary Acid-Base Balance 183

Life-Cycle Nutrition of Cats 185

Suckling and Weaning 185

Growth 185

Female Reproduction 187

Lactation 189

Aging 190

Veterinary Technical Information and Practical Application 190

Words to Know 191

Study Questions 191

Further Reading 191

**12****Nutrition of Nonruminant Herbivores: Horses 193****Digestive Physiology Of The Horse 193**

Fat Digestion in Horses 195

Life-Cycle Nutrition 196

Foals 196

Growth 197

Adulthood and Maintenance 201

Exercise and Exercise Physiology 201

Practical Feeding for Exercise 206

Nutrition and Reproduction 208

Aging Horses 209

Other Problems In The Nutrition Of Horses 210

Azoturia 210

Hyperkalemic Periodic Paralysis 212

Myths, Secrets, and Facts 212

Potential Poisoning Of Horses 214

Veterinary Technical Information and Practical Application 214

Words to Know 215

Study Questions 215

Further Reading 215

**13****Nutrition of the Rabbit, a Lagomorph 217****The Specialized Lagomorph**

Digestive System 217

Life-Cycle Nutrition of the Rabbit 219

Suckling Phase 219

Growth 220

Adult Maintenance 221

Reproduction 221

Old Age 222



- Gastric Stasis—Trichobezoars (Hairballs) 222
 Veterinary Technical Information and Practical Application 223
 Words to Know 224
 Study Questions 224
 Further Reading 224

14

Llamas and Alpacas: Ruminant Companions 225

Introduction 225

Ruminant Digestion and Nutrition 226

Practical Diets and Feeding 229

- Suckling and Growth 230
 Maintenance and Reproduction 231
 Gestation and Lactation 234
 Work and Exercise 234

Veterinary Technical Information and Practical Application 234

Words to Know 235

Study Questions 235

Further Reading 235

15

Nutrition of Ornamental Birds 237

Types of Birds 237

- Order Psittaciformes 237
 Order Passeriformes 238
 Orders Anseriformes and Galliformes 238
 Order Falconiformes 239

Digestive Physiology of Birds 240

Life-Cycle Feeding Management 242

- General 242
 Growth and Reproduction 243
 Energy 243
 Essential Fatty Acids 244
 Vitamins and Minerals 244
 Molt 245
 Carbohydrates 246
 Grit 246

Practical Diets and Feeding Management 247

Veterinary Technical Information and Practical Application 248

Words to Know 249

Study Questions 249

Further Reading 249

16

Nutrition of Aquarium Fish 251

What Kind of Fish? 251

Digestion of Fishes 252

Metabolism of Fishes 253

- Energy Metabolism and Temperature 253
 Nitrogen and Amino Acid Metabolism 253

Special Problems/Management of Fish 257

- Minerals and Vitamins in Fish Nutrition 257

Feeding Management for Water Quality 259

- Feed Quality and Selection 259

Veterinary Technical Information and Practical Application 260

Words to Know 260

Study Questions 260

Further Reading 261

17

Nutrition of Rodents 263

The Order Rodentia 263

Housing 265

Specific Families of Rodents 266

- Rats and Mice (*Rattus Norvegicus*, *Mus Musculus*) 266
 Gerbils 266
 Guinea Pigs and Cavies (*Cavia Porcellus*) 268
 Hamsters 269

Veterinary Technical Information and Practical Application 270

Words to Know 270

Study Questions 270

Further Reading 271

18

Nutrition of Reptiles 273

General Saurian Digestion, Metabolism, and Nutrition 273

- Water 276
 Nitrogen and Energy 276
 Vitamins and Minerals 278
 Metabolic Bone Disease 278
 Feeding Herbivores 280
 Feeding Omnivores and Carnivores 280
 Chelonia: Turtles and Tortoises 282

Veterinary Technical Information and Practical Application 283

Words to Know 283

Study Questions 284

Further Reading 284

Index 285