# Contents

#### Preface vii

# 1. What are viruses, and how were they discovered?

Introduction 1
The history of the discovery of viruses 7
References 52
Recommended Reading 53

#### 2. Viruses and their particles

Viruses and their particles 55 Virions 58 References 81 Recommended reading 81

#### 3. Virus origins and genetics

The structure and complexity of
virus genomes 83
Origins of viruses 84
From what did viruses evolve? 85
The origins of modern eukaryote viruses 90
Of ERVs and EVEs 105
The complexity of virus genomes 110
Molecular genetics 112
Virus genetics 113
The global virome 121
Epidemiology 122
Summary 123
References 123
References 123
Recommended reading 124

#### 4. Virus genomes and their replication

Overview of virus replication 125
Entrance into cells and viral genome
replication 126
Genome replication and gene expression 143
Assembly of virions 154
Summary 165

References 165 Recommended reading 166

### 5. Expression of virus genomes

Expression of genetic information 167
Virus genome coding strategies 177
Transcriptional control of expression 202
Posttranscriptional control of expression 206
Summary 214
References 215
Recommended reading 215

#### 6. Infection and immunity

Virus infection of prokaryotes 217
Virus infections of plants 223
Immune responses to virus infections in animals 229
Innate immune responses 230
Adaptive immune responses in vertebrates 239
RNA interference 246
Virus-host interactions 249
The course of virus infections 258
Prevention and therapy of virus infection 262
Viruses as therapeutics 267
Chemotherapy of virus infections 268
Summary 277
References 277
References 277
Recommended reading 278

#### 7. Viral pathogenesis

Mechanisms of cellular injury 280
Viruses and immunodeficiency 282
Acquired immunodeficiency syndrome
(AIDS) 283
Virus-related diseases 286
Bacteriophages and human disease 289
Cell transformation by viruses 290
Cell transformation by retroviruses 294
Cell transformation by DNA viruses 296

#### vi

Viruses and cancer 300 Summary 305 References 306 Recommended reading 306

## 8. Panics and pandemics

New, emerging, and re-emerging viruses 307
Re-emerging viruses 309
Plant viruses 325
Novel human viruses 327
Zoonoses 329
Biowarfare and bioterrorism 351
Summary 353

Contents

References 353 Recommended reading 355

# 9. Subviral agents: Deltaviruses and prions

Hepatitis delta virus 357 Prions 360 Molecular biology of prions 367 References 372 Recommended reading 372

Appendix 1 373 Index 379