

Contents

Why a natural history of dinosaurs? ix

To the student ix

To the instructor x

Dedication xiii

Part I: Reaching back in time 1

1 To catch a dinosaur 3

Chapter objectives 3

Tales of dinosaurs 4

Fossils 4

Collecting 9

Summary 16

Selected readings 17

Topic questions 17

2 Dinosaur days 18

Chapter objectives 18

When did dinosaurs live and how do we know? 20

Continents and climates 24

Climates during the time of the dinosaurs 27

Summary 29

Appendix 2.1: Chemistry quick 'n dirty 29

Selected readings 30

Topic questions 31

3 Who's related to whom – and how do we know? 32

Chapter objectives 32

Who are you? 34

Evolution 34

Phylogenetic systematics – the reconstruction of phylogeny 36

Box 3.1: Wristwatches: when is a watch a watch? 42

Science and testing hypotheses 45

Summary 45

Appendix 3.1: What is “evolution”? 46

Selected readings 48

Topic questions 48

4 Who are the dinosaurs? 51

Chapter objectives 51

Finding the history of life 52

In the beginning 52

Tetrapoda 55

Box 4.1: Fish and chips 58

Box 4.2: What, if anything, is a “reptile”? 62

Diapsida 63

Dinosaurs 65

Origins 67

Box 4.3: Stance: it's both who you are and what you do 68

Ornithischia and Saurischia 70

Summary 71

Selected readings 72

Topic questions 73

Part II: Ornithischia: armored, horned, and duck-billed dinosaurs 75

What makes an ornithischian an ornithischian? 76

Chew on this! 77

Ornithischia: the big picture 79

Selected readings 83

5 Thyreophorans: the armor-bearers 85

Chapter objectives 85

Thyreophora 86

Eurypoda: Stegosauria – hot plates 87

Box 5.1: The poetry of dinosaurs 92

- Box 5.2: Dino brains 93
- Eurypoda: Ankylosauria – mass and gas 95
- The evolution of Thyreophora 102
- Summary 105
- Selected readings 106
- Topic questions 107
- 6 Marginocephalia: bumps, bosses, and beaks 108**
- Chapter objectives 109
- Marginocephalia 110
- Marginocephalia: Pachycephalosauria – In Domes We Trust 110
- The evolution of Pachycephalosauria 117
- Marginocephalia: Ceratopsia – horns and all the frills 118
- The evolution of Ceratopsia 128
- Summary 130
- Selected readings 132
- Topic questions 133
- 7 Ornithopoda: the tuskers, antelopes, and “mighty ducks” of the Mesozoic 135**
- Chapter objectives 135
- Ornithopoda 136
- Box 7.1: Hypotheses that didn’t float 139
- The evolution of Ornithopoda 149
- Summary 152
- Selected readings 152
- Topic questions 153
- Part III: Saurischia: meat, might, and magnitude 155**
- Saurischia: the big picture 156
- Selected readings 159
- 8 Sauropodomorpha: the big, the bizarre, and the majestic 161**
- Chapter objectives 161
- Sauropodomorpha 162
- Prosauropoda 163
- Sauropoda 165
- Box 8.1: Every breath you take 172
- The evolution of Sauropodomorpha 175
- Box 8.2: The recapitulation of “*Brontosaurus*” 179
- Summary 183
- Selected readings 184
- Topic questions 184
- 9 Theropoda I: nature red in tooth and claw 187**
- Chapter objectives 187
- Theropoda 188
- Theropod lives and lifestyles 189
- Box 9.1: *Triceratops* spoils or spoiled *Triceratops*? 202
- The evolution of Theropoda 205
- Summary 209
- Selected readings 209
- Topic questions 211
- 10 Theropoda II: the origin of birds 213**
- Chapter objectives 213
- Birds 214
- Archaeopteryx* and the ancestry of living birds 217
- Box 10.1: *Plus ça change* . . . 225
- Feathers without flight 226
- Summary 231
- Selected readings 232
- Topic questions 233
- 11 Theropoda III: early birds 235**
- Chapter objectives 235
- Mesozoic birds 236
- Evolution of Aves 240
- Box 11.1: Molecular evolution and the origin of Aves 241
- Summary 243
- Selected readings 244
- Topic questions 244

Part IV: Endothermy, endemism, and extinction 247

12 Dinosaur thermoregulation: some like it hot 248

Chapter objectives 249

The way they were 250

Temperature talk 250

Dinosaur endothermy: the evidence 250

Box 12.1: The “skinny” on metabolism 251

Box 12.2: Warm-bloodedness: to have and to have hot 252

Box 12.3: In the tracks of dinosaurs 254

Box 12.4: Dinosaur smarts 256

Box 12.5: Weighing in 263

Summary 267

Selected readings 268

Topic questions 269

13 The flowering of the Mesozoic 271

Chapter objectives 271

Dinosaurs in the Mesozoic Era 274

Box 13.1: The shape of tetrapod diversity 278

Box 13.2: Counting dinosaurs 280

Plants and dinosaurian herbivores 282

Box 13.3: Dinosaurs invent flowering plants 287

Summary 287

Selected readings 288

Topic questions 289

14 A history of paleontology through ideas 291

Chapter objectives 291

The idea of ideas 292

In the beginning 292

Box 14.1: Indiana Jones and the Central Asiatic Expedition of the American Museum of Natural History 293

The nineteenth century through the mid-twentieth century 295

Box 14.2: Sir Richard Owen: brilliance and darkness 296

Box 14.3: Dinosaur wars in the nineteenth century: boxer versus puncher 298

Box 14.4: Louis Dollo and the beasts of Bernissart 301

The second part of the twentieth century to today 303

Box 14.5: Rollin’ on the river 304

Box 14.6: “Mr Bones” 306

Box 14.7: Tendaguru! 307

Box 14.8: Baron Franz von Nopcsa: nationalism, Transylvanian dinosaurs, and espionage 309

Summary 315

Box 14.9: Young Turks and old turkeys 316

Selected readings 318

Topic questions 319

15 The Cretaceous–Tertiary extinction: the frill is gone 321

Chapter objectives 321

How important were the deaths of a few dinosaurs? 322

Geological record of the latest Cretaceous 322

Biological record of the latest Cretaceous 327

Box 15.1: Extinction 329

Box 15.2: Dinosaurs: all wrong for mass extinctions 335

Extinction hypotheses 336

Box 15.3: The real reason the dinosaurs became extinct 340

Summary 342

Selected readings 343

Topic questions 344

Glossary 345

Figure credits 361

Index of subjects 363

Index of genera 374