

Index

Pages in *italics* indicate a figure; those in **bold** indicate a table.

- Acacia* spp. availability in Africa 177
- acetic acid
 - effect on epithelial cell proliferation 400–1, 403
 - effect on insulin release in sheep 397–8
 - effect on pancreatic exocrine secretion 399
- acidosis in folivorous marsupials 380–1
- Adansonia* availability in Africa 176
- Aepycerus melampus* *see* impala
- Africa, potential woody plant foods for humans in 166–92
- Agavaceae pollen nutrients 117
- alfalfa
 - energy from 343
 - in vole diets 325–35
- algae amino acid profiles 95, 96
- alkaloids 371
 - frequencies in plants 71
- allelochemicals
 - effects and cost for mammalian herbivores 370–91
 - effects on digestion 379–80
 - effects on growth 385
 - excretion rate 382–3, 384–5
 - physiological effects 380–3
 - primate handling of 161, 162
 - types 371–2
- alloenzymatic digestion 11, 196, 264, 269
- allometry-based models relating body size to digestive strategy 340–5
- Aloe* availability in Africa 176
- Alouatta* *see* monkey, howler
- Alticola roylei* stomach 317
- amino acid
 - absorption 265
 - composition in seeds 89
 - composition of muscle 95
- imbalance in fungi 132
- in nectar 111
- non-protein 371
- profiles of animal nutriments 95–6
- savings, TBSP and 374
- structure in plants 91
- supply manipulation by milk 88
- synthesis 264
- transport, future study of 428
- ammonia absorption from hindgut 361
- ammoniagenesis capacity in lagomorphs 382
- Amphibolurus nuchalis* *see* lizard
- amylase
 - contents of plants, nutritional niche and 136
 - digestion in rodents 318
 - secretion in ruminants, effects of SCFA on 399
- amylolytic reservoir theory 318
- anatomy of gut 4–8
- animal matter, components of 413, 415
- Anomalurus* spp. *see* squirrel, flying anteater, gut surface area of 70
- antelope
 - diet 61
 - digestive adaptations 349
 - relationship between body mass and energy from microbial fermentation 342
- ants: guild concept 145
- anus function 420
- Aotus trivirgatus* *see* monkey, owl/night apes, diet in 68
- aphids, amino acids in diet of 91
- arabinose, taste thresholds in primates for 154, 156–7
- Artemesia*, monoterpenes in 372
- Arvicola terrestris* *see* vole, water arvicoline rodents *see* microtine rodents

- Ateles* spp. *see* monkey, spider
 autocatalytic reactions 33, 34
 autoenzymatic digestion 11, 196, 264, 269
 automatic image analyser for gut samples 241
- baboon diet 170
Balanites aegyptiaca availability in Africa 175
Baluchitherium 18
 baobab tree availability in Africa 176
 bark
 availability in Africa 174, 177
 composition 161, 162
 digestion 291
 bats
 dentition 211
 fruit-eating and flower-visiting, nutritional ecology of 103–27
 pollen digestion 116–17
 protein ingestion 111–12
 protein requirements 114–15
 seed passage in 210
 batch reactor model 28–29, 30
 performance 31
Bauhinia petersiana availability in Africa 176
 beaver body mass 316
 beef amino acid profiles 96
 beta-cell stimulation by SCFA 397–8
 bettong
 diet 76
 digestive tract data 266
 see also woylie
 bile, purpose of 196
 biotransformation of absorbed allelochemicals 377–9
 birds
 breeding season 88–9
 colonic separation mechanisms 302–3
 crops in 40
 digestion models in 44–8
 fruit-eating and flower-visiting, nutritional ecology of 103–27
 –plant interaction evolution, nectar nutrients and 117–18
 wax digestion in frugivores 109–11
 birth weight gain 94
 blind coelenteron 29
 blood flow of digestive tract 396–7
 blood sucking insects 90
 body mass
 effect on detoxification 382–3
 estimates for Cenozoic mammals 10, 12–13
 food retention time and 357
 in foregut fermenters, dietary fibre and 341
 mastication of fibrous diet and 360
 metabolism and 92, 93, 235–6
 relationship with digestive strategy and dietary scope 338–62, 421, 422–4
- relationship with energy from microbial fermentation 342
 of rodents, gut morphology and digestive performance and 315–23
 of voles 326
 body weight, gut area/volume ratio and 251–2
Bolomys lasiurus, seed passage in 210
 see also rat
Bombycilla cedrorum *see* waxwing, cedar
Bos primigenius *see* cow
 bovid nutrient profiles 142, 145
Bradypterus tridactylus *see* sloth, three-toed browsers
 dentition 212–13
 optimum diets 60
 TBSP in 373
 trophic classification 75
 bushbuck nutrient profitability spectrum 145
 butyric acid
 effect on epithelial cell proliferation 400–1, 402
 effect on gut motility 393, 395–6
 effect on insulin release in sheep 397–8
 effect on pancreatic exocrine secretion 399
 bypass structures in marsupials and eutheria 264–86
- Cactaceae* pollen nutrients 117
 caecal and colic areas
 adaptations in rodents 316
 fermenters 7, 265, 287
 allelochemical handling by 376
 arboreal mammals 348
 coprophagy in 60
 definition 7, 338
 dietary fibre and 341–2, 343–5
 digestion and food quality 16–18, 19
 equine 303
 fibre-feeding in 356
 future study of 428
 marsupial, TBSP in 374
 models 56–61
 offsetting of digestive constraints in 362
 separators and non-separators 350–2
 galliform 302
 see also hindgut
 caecotrophes 289–92, 300, 305–6
 caecotrophy
 in arboreal mammals 351–2
 in rodents 354
 offsetting physiological limits in small herbivores 361
- caecum
 anatomy 246–7
 in birds 302–3
 fermenter model 31
 gum digestion in 67

Index

433

- in lemming 294–8
 microflora in herbivores 140, 141–3
 purpose 196
 in rat 299
 surface area 220–31
 in voles, fibre in diet in 333–4
- Callimico goeldii* see monkey, Goeldi's
Callithrix spp. see marmoset
Caluromys philander see opossum, woolly
Calypte costa see hummingbird
Cambretum paniculatum availability in Africa 176
 camelid forestomach 29
Canis lupus see dog
Capra aegagrus see goat
Capreolus capreolus see deer, roe
 caprylic acid effects on gut motility 393, 395
 capybara body mass 316
 carbohydrates
 in fruits 108
 in gums 67
 metabolism 392
 carnivores
 dentition 207–8
 fermentation in 58
 gut surface area 70, 225
 trophic classification 75
 carnivory in herbivores 87–92
Carollia perspicillata see bat
Castor canadensis see beaver
 cat
 caecal and colic areas 246, 254, 256
 digestive tract data 266
 Pallas', gut surface area 225
Catagonus wagneri see peccary, Chacoan
 caterpillar amino acid profiles 96
 cattle
 adaptation to diet 59
 mastication 60
 rumination establishment 280
 transit time in 16
Cavia aperea see guinea pig
Cebuella pygmaea see marmoset
 cell
 content in diet, energy intake and 357, 358
 proliferation *in vitro*, effects of SCFA on 399–400
 wall carbohydrates 264
 cellulose in plants 264
 digestion 54
 by rodents 318
 Cenozoic mammals of Europe, food and digestion of 9–24
Cercopithecus aethiops see monkey, West Africa green
 cereal seed amino acid profiles 97, 98
Cervus dama see deer, fallow
- cetacean gut surface area 70
 chamois
 digestion and food quality 16–17
 digestive tract data 266
 stomach 271, 272
 chemical composition
 of living matter 413, 414
 of plant rewards, bird/bat preferences and 104–18
 chemical defences of plants 71
 chemical reactor digestion model 26–53, 345
 chewing see mastication
 chicken amino acid profiles 96
 chinchilla
 colonic separation mechanisms 294, 300
 nitrogen concentration in caecal contents, caecotrophes and faeces 293
 chipmunk
 diet 319
 diet digestibility 355
 digestion 319–21
 yellow-pine, animal material in diet of 315
 digestive performance 319
 chitin 4
 chymosin 88
 cloacal mixing 37
 clay in diet 71
 cnidarian blind coelenteron 29
 coati gut surface area 225
Colobus spp. see monkey, colobus
 colon
 equine 304
 lemming 294–8
 purpose 196
 rat 299
 receptors for SCFA 404
 sampling in nutria 239
 sampling in rabbit 239
 separation mechanisms 288–304
 in birds 302–3
 in equines 303–4
 in lagomorphs 288–92
 in marsupials 292–3
 in rabbits 288–92
 in rodents 294–301
 surface area 220–31
Commiphora spp. availability in Africa 176
 comparative functional anatomy, food classification and 76, 79
 comparative physiology, food classification and 76, 80
 compartmental models of digestion 27
 congeners 138–9
 continuous-flow stirred tank reactor model 28, 30, 32–44, 55–59
 performance 32–33
 validation 35–41

- coprophagy 59–60
 corpus gastricum 270
 cottonseed lysine deficiency 98
 cottontail, colonic separation mechanism in 292
 cow
 caecal and colic areas 246, 248–9, 254, **256**
 digestive tract data **266**
 large intestine 249, 250–3
 coypu
 caecal and colic areas 248, 254, **256**
 colon sampling 239
 colonic separation mechanisms 294, 300
 digestive tract data **266**
 intestinal area to volume relationship 257–60
 large intestine 250–3
 nitrogen concentration in caecal contents, caecotropes and faeces **293**
Cricetomys gambianus see rat, African giant
Cricetus cricus see hamster
 critical stress intensity factor 421, 425
 crop milk 89–90
 crypts of Lieberkühn 244–5
 CSTR see continuous-flow stirred tank reactor model
 Cuisian era food and digestion 12
 cyanogenic glycosides 371
- deer
 fallow, digestive tract data **266**
 forest, seeds in diet of 211
 roe, digestion and food quality 16–17
 stomach morphology **351**
Dendroica spp. see warbler
Deomys colonic separation mechanisms 298
Didelphis sp. see opossum
 diet
 adaptation to food availability 411–12
 adaptability of gut to 234
 differentiation in New World primates 150–65
 optimum 60–1
 teeth and 207–14
 vs body size and digestive characteristics 67, 421, **422–4**
- digesta
 load estimation 359
 separation mechanisms offsetting physiological limits in small herbivores 361
 see also food
- digestibility reducers 371
- digestion
 alloenzymatic 11, 196, 264, 269
 autoenzymatic 11, 196, 264, 269
 of Cenozoic mammals in Europe 9–24
 widening of types 14
- and foraging in herbivores 313–14
 gut form and 195–6
 models 8, 25–53
 rate in mammals 198
 strategies grouping 11
 types of marsupial and eutheria **266–7**
- digestive performance in rodents, gut morphology and body size and 315–23
- dikdik nutrient profitability spectrum **145**
- Dioscorea* spp. see yams
- Dipodomys microps* see kangaroo-rat dog
 caecum 248, 249, 254
 digestive tract data **266**
 effects of SCFA on insulin release in 397–8
 gut motility 395
 ileal brake in 47
 large intestine 249, 250–3
 neonatal 87
 stomach **271, 272**
- Dolichotis patagonum* see mara
- dolphin gut surface area **70**
- donkey, nitrogen concentration in caecal contents and faeces of **293**
- duiker, niche segregation in 138–9, **140**
- Dumetella carolinensis* lipid-rich fruit ingestion by 109
- duodenum
 innervation 5
 purpose 196
- earthworm amino acid profiles 96
- Echinochloa pyramidalis* seeds 89
- ecological
 classification of food 75–6, **78–9**
 view of niche partitioning 141–3
- egg amino acid profiles 96
- Eidolon helvum*, sucrase and maltase in 107
- eland, nutrient profitability spectrum in **145**
- elastic modulus of food 421, 425
- elephant
 digestion and food quality in 16–17
 fermentation in 56
 gut sampling 239–40
 endocrine pancreatic secretion
 in non-ruminants, effects of SCFA on 398–9
 in ruminants, effects of SCFA on 397–8
- energy
 budget and metabolism, costs of allelochemicals in diet on 383–4
 content of carnivore diet 90
 metabolism regulation 392
 relationship with body mass 342
 requirement, mass-specific 287
 requirement estimates 359–60
- enterocyte differentiation in guts 242
- enteron 29

Index

435

- enzyme digestion 87–8
- enzymes, biotransformational 377–8
- equilibrium maintenance requirement 92, 93
- Equus przewalskii* *see* horse
- Erethizon dorsatum* *see* porcupine
- Erinaceus europaeus* *see* hedgehog
- erodium seeds 89
- Eucalyptus* spp.
 - causing acidosis 380–1
 - monoterpenes in 372
- Euoticus elegantulus* 67
- euphonias, gut design in 108–9
- Eutamias amoenus* *see* chipmunk
- Eutheria
 - TBSP in 373
 - weaning time and bypass structures in 264–86
 - evolutionary biology food classification and 76, 80
 - exocrine pancreatic secretion, effects of SCFA on 399
 - exudates as food 67
- faecal marker-passage studies 27
- faeces of rabbit 288–9
 - see also* coprophagy
- Faidherbia albida* toxicity 170
- fats in seeds 66, 175
- fatty acid
 - absorption in rabbits 291
 - products of digestion 264
 - short chain, from gut microbes 392–408
 - use by herbivores 54
- faunivores 4, 265
 - caecal volume 249
 - of Cenozoic era 9–21
 - food classification and 81
 - gut surface area 70
 - large intestine 250–3, 255
 - use by herbivores 54
- Felis* spp. *see* cat
- fermentation 7
 - capability of guts 248
 - in equines 303
 - in herbivores 287
 - of milk 267
 - role in digestion 15–16
 - SCFA and 392–408
 - see also* foregut and caecal-colic fermentation
- fibre
 - content in leaves 212
 - in diet 69
 - of herbivores 313–14
 - decreasing body size and 337–69
 - digestibility by rabbits and rodents 321
- integrated processing response and 324–36
- large intestine adaptations for 287–309
- Ficus* spp. availability in Africa 177
- finch, Darwin's, hatchling diet of 89
- fir, monoterpenes in 372
- fishmeal amino acid profiles 96, 98
- florivores 4, 265
 - of Cenozoic era 9–21
 - food classification and 81, 82
 - larvae 90–1
- flower-visiting birds and bats, nutritional ecology of 103–27
- fluid secretion in ruminants, effects of SCFA in 399
- flycatcher, lipid-rich fruit ingestion by 108
- folivores 4
 - acidosis in marsupial 380–1
 - arboreal mammalian, digestive adaptations in 348–53
 - feeding styles of 346–8
 - metabolic rate in 353–4
 - food classification and 81
 - trophic classification 75
 - gut surface area 70
- food
 - abrasiveness 204–5
 - absorption efficiency 252
 - categorisation relevant to oral processing 197–218
 - classification 74–86, 414–15, 426
 - types 77–82
 - coatings 198
 - edibility 65–69
 - external physical characteristics 201, 202
 - flow 205
 - input characterisation 201–2
 - intake control 427–8
 - internal mechanical properties 201, 205–7, 421, 425
 - of Cenozoic mammals in Europe 9–24
 - range widening 14
 - particle fracture 198, 205–6, 213
 - strength 202
 - particle shape 203–4
 - particle size 198
 - teeth and 202–3
 - retention time *see* retention time
 - stickiness 204
 - toughness 202
 - toxicity 70–2
 - transit times *see* transit time
 - volume in mouth 203
 - foraging in herbivores 313–14
 - forbs availability in Africa 178
 - foregut
 - alloenzymatic digestion 11

- foregut *cont.*
 anatomy in arboreal mammals 350
 as amylolytic reservoir 318
 as CSTR 29
 development in ruminants 400, 401
 fermenters 7, 264–5, 278
 allelochemical handling by 376
 arboreal mammals 348
 diet in 339–40
 dietary fibre and decreasing body mass in 341–62
 digestion and food quality in 16–17
 early 21
 fibre-feeding in 356
 models 56–61
 non-ruminating digestion and food quality 18
 nutritional niche 130–6
 forestomach *see* foregut
 fornix gastricus 270
 fossil mammals of Cenozoic era 9–21
 fossorial herbivores, trophic classification of 75
 fox
 bat-eared, gut surface area 225
 red, gut surface area 225
 fructose
 in fruit 105–7
 taste thresholds in primates for 151–2, 153–4, 155–6, 158, 161
 frugivores 4
 competition among 66
 correlation with specialised or generalised plant species 108
 dentition 211–12
 gut surface area 70
 trophic classification 75
 wax digestion in birds 109–11
 fruit
 availability in Africa 174, 175, 178
 carbohydrates 108
 composition, bird/bat preferences and 104–5
 dentition and 208–9
 in diet of mammals and marsupials 340
 lipids in 108–9
 Myristicaceae 66
 phanerogamous 66
 production in rain forest 67
 protein in 113–15
 pulp, sugars in 106
 seeds in 19
 sugar in 105–7
 fruit-feeding bird studies 44–8
 fruit-eating birds and bats, nutritional ecology of 103–27
 fungi, nutritional niche and 132
 Gaborone area in Africa, potential woody plant foods for humans in 166–92
 galah diet 89
 gall bladder absence in frugivores 111
 gallotanin, taste thresholds in primates for 152
 gastric *see* stomach
 gastro-intestinal tract *see* gut
 geese, urine transport in 302
 gene expression, effects of SCFA on 400
 geophagy 71
Geospiza spp. *see* finch, Darwin's gerbil
 caecal and colic areas 247, 248, 254, 256
 guild concept 145
 intestinal area to volume relationship 257–60
 large intestine 250–3
 gibbon
 dentition 211
 diets 68
 glider, greater
 colonic separation mechanism 293
 diet in 347
 digestive adaptations 349
 metabolic rate 353
Glossophaga soricina *see* bat
 glucagon
 effect on epithelial cell proliferation 400–1
 release from pancreas by SCFA 398
 glucose
 absorption model 44–8
 in fruit 105–7
 goat
 caecal and colic areas 248–9, 254, 256
 large intestine 249, 250–3
 microbial detoxification by 375–6
 SCFA effects on pancreatic amylase release in 399
 gorilla biomass 67
 graminivores *see* grazers
 granivores trophic classification 75
 grasses
 cell content, energy requirements and 357
 rubisco in 98
 in vole diets 325–35
 grasshopper diet 95
 grazers
 of Cenozoic era 9–21
 food classification and 82
 trophic classification 75
 optimum diets 60
 TBSP in 374
Grewia availability in Africa 175, 176
 grouse caeca 303
 growth rate, allelochemicals effects on 385
 guanaco digestive tract data 266

Index

437

- guar gum effect on epithelial cell proliferation 403
 guild concept 145–6
 guinea pig
 caecal and colic areas 247, 248, 254, **256**
 colonic separation mechanisms 294, 300
 intestinal area to volume relationship 257–
 60
 large intestine 249, 250–3
 nitrogen concentration in caecal contents,
 caecotrophes and faeces **293**
 gums 67
 availability in Africa **174**, 177, 178
 composition 150–1, 161, 162
 exudate in fungi 132
 gusto-facial reflex 71–2
 gut
 absorptive capacity 249
 analysis by food classification 75–86
 anatomy 4–8
 area ratios 249
 clearance time 8, 40
 design, in frugivore specialists/generalists
 108–9
 in herbivores 140
 linear 69
 in microtine rodents 325
 principle 235–6
 retention time and 324
 in sciurid and microtine rodents 319–20
 in voles 325–35
 differentiations between marsupials and
 eutheria **275**
 epithelial cell proliferation 399–403
 form and function 3–8
 external factor influence on 235
 form of selected regions of 195–6
 fullness, cessation of feeding and 359, 361
 function, in arboreal mammals 348–53
 chemical reactor theory and 345–6
 and parts **418–20**
 gross surface area 219–33
 microorganisms role in digestion 15–16
 morphology, in arboreal mammals 348–53
 future studies 426–7
 groupings 254
 in rodents, body size and digestive per-
 formance and 315–23
 motility effects of SCFA on 396–7
 in non-ruminants 395–6
 in ruminants 393–5
 mucosal blood flow of 396–7
 purpose 195
 size in voles 328–35
 structure optimisation for specific diets
 54–62
 terminology 7–8
 variations 4
 volume ratio 219, 248
 to metabolic requirements 319
 weight, body weight and 93
- hamster
 digestive tract data **266**
 dwarf, caecal and colic areas 247, 254, **256**
 intestinal area to volume relationship
 257–60
 large intestine 250–3
 golden, caecal and colic areas 248, 254, **256**
 intestinal area to volume relationship
 257–60
 large intestine 250–3
 Harare area in Africa, potential woody plant
 foods for humans in 166–92
 hare
 caecotrophy 305–6
 colonic separation mechanism 292
 nitrogen concentration in caecal contents,
 caecotrophes and faeces **293**
 sodium wastage in 381
 haustra 7
 hedgehog digestive tract data **266**
Hemibelideus spp. *see* possum
 hen, urine in colon of 302
 herbivores 4
 caecal volume 249
 carnivorous 87–102
 dentition 213
 food availability in Cenozoic era 15
 food classification and 76
 foraging and digestion in 313–14
 handling of allelochemicals 370–91
 integrated processing response in small
 mammal 324–36
 large intestine 250–3, **255**
 microbial fermentation 287
 optimum gut structure 54–62
 rodent 316
 small, lack of colonic separation mechan-
 isms 304–5
 trophic classification **75**
 herbivory, niche partitioning and 128–49
Heterocephalus glaber *see* mole rat, naked
 hexanoic acid effects on gut motility 393, 395
 hexose
 absorption model 44–48
 in nectar 106
 hindgut
 definition 7, 287
 innervation 5
 see also caecal and colic areas
 hippuric acid excretion in sheep 385
Homo sapiens *see* human
 honeyeater, protein ingestion by 112

- horse
 caecal and colic areas 248, 254, **256**
 colonic separation mechanisms 303–4
 digestion and food quality 16–17
 digestive tract data **266**
 energy requirement 287
 fermentation in 56
 large intestine 249, 250–3
 nitrogen concentration in caecal contents and faeces **293**
 optimal gut in 59
- human
 caecal and colic areas 246, 248, 254, **256**
 digestive tract data **266**
 gut motility 395
 infant 87
 intestinal area to volume relationship 257–60
 large intestine 249, 250–3
 microbial ecosystem in gut 278–9
 potential woody plant foods in Africa 166–92
 stomach **271, 272**
 tubers in diet of 69
- hummingbird
 protein ingestion 111–13
 sucrase activity in 107
- hummingbird-pollinated plant species 106
- hunter-gatherers 69
- Hydrochoerus hydrochaeris* see capybara
- Hydromys* colonic separation mechanisms 298
- Hyemoschus aquaticus* see water chevrotain
- hyrax
 gut surface area 70
 rock, lack of colonic separation mechanisms 304–5
- Hystrix cristata* see porcupine
- ileal
 brake 47
 purpose 196
- impala, nutritional niche of 138
- insect
 diet of 90
 herbivores, allelochemicals effects on 370
- insectivores
 avian frugivores 112, 113
 bats 115
 gut surface area 70
 trophic classification **75**
- insulin release in sheep, effects of SCFA on 397–8
- integrated processing response in herbivorous small mammals 324–36
- intestine, large *see* large intestine
- intestine, small *see* small intestine
- invertebrate production in rain forest 67
- jejunum purpose 196
see also small intestine
- kangaroo
 caecum 246, 254
 diet 339
 eastern grey, digestive tract data **266**
 fermentation in 56
 forestomach 29, 350
 marker-passage studies 42, 43
see also tree kangaroo
- kangaroo-rat
 diet 339
 digestive adaptations **349**
 nitrogen concentration in caecal contents, caecotrophes and faeces **293**
- ketone bodies effects on insulin release in non-ruminants 398
- koala
 caecal and colic areas **256**
 colonic separation mechanism 293
 diet 347
 digestive adaptations **349**
 digestive tract 352
 gut surface area **222**
 marker-passage studies 42, 44
 metabolic rate 353
 microbial detoxification of allelochemicals 376
 retention times 352
 urinary glucuronic acid excretion in 384–5
- kudu nutrient profitability spectrum **144–5**
- Kyphosus cornelii* *see* reef-fish
- lactase digestion 87–8
- lactation time of marsupials and eutheria **266–7**
- lactivory 88
- lagomorphs
 colonic separation mechanism 292
 gut design 245
 sodium wastage in 381–2
- Lagothrix lagothrica* *see* monkey, woolly
- Lama guanaco* *see* guanaco
- large intestine
 absorptive capacity 249
 adaptations for fibrous foods 287–309
 anatomy 5, 6–7
 in caviomorph rodent **301**
 equine 303, 304
 fermenters, digestion and food quality in 17–18, 19
 function **419–20**
 length 249
 purpose 196

Index

439

- in rabbit 288
 /small intestine ratios 248–55
 surface enlargement determination 234–63
- larks: guild concept 145
- leaves 65
 availability in Africa 174, 176
 cell content, energy requirements and 357
 dentition and 213–14
 in diet 67–9
 of mammals and marsupials 340
 of primates 347
 digestion 291
 fibre content 212
 litter production 67
 nutrients 138–9 protein amino acid profiles 97, 99
 rubisco in 98
 tannins and phenolics in 360–1
 terpenes in 383
 toughness 212
 utilisation by duikers 138–9, 140
see also folivores
- legume seed amino acid profiles 97, 98
- lemming
 body mass 316
 diet 354
 food retention time 325
- Scandinavian, caecotrophy in 306
 colonic separation mechanisms in 294–8
 nitrogen concentration in caecal contents,
 caecotrophes and faeces of 293
 wood, colonic nitrogen concentration in 296, 297
- Lemmus lemmus* *see* lemming
- lemur
 diet 68
 sportive, digestive adaptations 349
 digestive tract 351–2
- Leontopithecus rosalia* *see* tamarin, golden lion
- Leontopithecus* spp. *see* tamarin
- Lepidoptera larvae 90, 91
- Lepilemur* *see* lemur, sportive
- Leptonycteris curasaoe* *see* bat
- Lepus* spp. *see* hare
- Leucaena* handling by goats 375–6
- lignin in plants 264
- Lindackeria laurina* digestion by avian frugivores 110
- lipase contents of plants, nutritional niche and 136
- lipids
 digestion by vertebrates 110–11
 in fruit 108–9
 metabolism 392
- lizard
 carnivory 90
- metabolism 95
 lorikeet, rainbow, marker-passage studies in 48
 loris diet 68
 lysine deficiency in seeds 98
- Macaca* *see* monkey; macaque
- macaque, rhesus, gut surface area in 224
- Macropus* spp. *see* kangaroo or wallaby
- maintenance energy, body weight and 92, 93
- mammal classification, ecological 75
- manatee caecum 246, 254
- mandrill gut surface area 225
- mara
 body mass 316
 gut surface area 225
- Markea neurantha* pollen nutrients 117
- marker-passage studies 27, 35–44
- marmoset
 gut surface area 223
 taste discrimination and diet differentiation 150–65
- marmot
 body mass 316, 319
 diet 319
 digestion 319–21
- marsupials
 caecal and colic areas 256
 colonic separation mechanism 292–3
 diet 339–40, 347
 folivorous, acidosis in 380–1
 forestomach 350
 gut surface area 70, 222
 leaves in diet 340
 metabolic rate 353
 TBSP in 374
 weaning time and bypass structures in 264–86
- mass-specific energy requirements 287
- mastication 60, 197
 of fibrous diet, body mass and 360
 process description 199–201
 rate of 203 reasons for 197–8
- meconium 88
- Meleagris gallopavo* *see* turkey
- Meriones unguiculatus* *see* gerbil
- Mesocricetus auratus* *see* hamster, golden
- metabolic
 age concept 92
 effects of allelochemicals 380–3
 rate, in arboreal mammals 353–4
 dietary fibre and 341–5
 energy requirement estimates from 359–60
- metabolism, body size and 92–95
- methionine deficiency 98
 in pollen 117

- Mezettia parviflora* seed properties 210
 microbes
 in coprophagy 59
 in foregut fermenters 56
 microbial
 activity products 264
 colonisation of digestive tract 265–7
 fermentation *see* fermentation
 modifications to handle allelochemicals 375–6
 synthesis role in digestion 15–16
 microflora in herbivores 133–4, 140
 microorganisms
 retention time 288
 savings by colonic separation mechanisms 306
 microtine rodents
 diet 318
 digestibility of 354–6
 digestion 319–21
 digestive tract 319
 integrated processing response in 324
 teeth 316–18
Microtus spp. *see* vole
 microvilli enlarging gut surface area 245–6
 midgut loop innervation 5–6
 milk
 amino acid profiles 96
 digestion in neonates 265
 microbial fermentation 267
 in neonatal diet 87–90
 protein incorporation 95
Milletia atropurpurea seed properties 210, 211
 minerals in plants 71
 mistletoes, dichotomy in 108
 models
 for digestive processes 8
 for gut function 8, 25–53
 mole rat
 caecal and colic areas 248, 256
 large intestine 249, 250–3
 naked, colonic separation mechanisms 301
 mollusc amino acid profiles 96
 monkey
 colobus, diet 347
 fermentation in 56
 gut design 348, 350
 gut surface area 70
 metabolic rate 353
 minerals in diet 71
 dentition 211–12
 diets 68
 eastern black-and-white colobus, gut surface area 225
 Goeldi's, gut surface area 223
 taste discrimination and diet differentiation 150–65
 howler, diet 59, 347
 digestive adaptations 349
 fermentation in 56
 metabolic rate 353
 langur, stomach morphology 351
 owl/night, gut surface area 223
 seeds in diet of 209–10, 211
 spider, diet 59
 black, gut surface area 224
 vervet, niche segregation 138
 West African green, gut surface area 224
 woolly, gut surface area 224
 monoterpenes, volatile 372
 mouflon digestion and food quality 16–17
 mouse
 caecal and colic areas 247, 248, 254, 256
 intestinal area to volume relationship 257–60
 large intestine 250–3
 metabolism 95
 pouched, niche segregation in 140, 143
 mucosal blood flow of digestive tract 396–7
 murids, diet digestibility in 354–6
Mus musculus *see* mouse
 muscle amino acid composition 95
 musculature of gut 7
 muskrat
 body mass 316
 caecal and colic areas 248, 254, 256
 digestive tract data 266
 intestinal area to volume relationship 257–60
 large intestine 249, 250–3
 stomach 271, 272
Myocastor coypus *see* coypu
 myomorph rodents diet 318
Myopus schisticolor *see* lemming, wood
Myrica spp.
 availability in Africa 175
 avian digestion of wax from 109–10
Mystromys albicaudatus *see* rat, white-tailed

Nasua nasua *see* coati
 nectar
 availability in Africa 174, 176
 nutrients, bird-plant interactions and 117–18
 protein in 111–13
 sugar in 105–7
 nectar-feeding birds
 preferences 104
 studies 44–8
 neonates
 avian frugivores, protein ingestion by 113
 milk diet 87–90

Index

441

- weaning time 264–86
 weight gain 94
 niche partitioning, herbivory and 128–49
 nitrogen
 concentration in gut contents of rats 298,
 299
 in caecal contents, caecotrophes and
 faeces **293**
 in colon of caviomorph rodents 300
 in colon of wood lemming colon 296, 297
 requirements of neonatal avian frugivores
 114
 sources in foods 414, 416, 417
nutria *see* coypu
nutritional
 classification of food 75–76, **79**
 ecology of fruit-eating and flower-visiting
 birds and bats 103–27
Nyctereutes procyonoid *see* raccoon-dog
- Ochna pulchra* availability in Africa 175
Ochotona *see* pika
 oesophagus function 195, **418**
 oilbird
 nitrogen requirements 114
 wax digestion by 110
 Oligocene era food and digestion 12–13
 oligophagy **81**
 omnivores 4
 of Cenozoic era 9–21
 fermentation in 58–9
 TBSP in 373
 trophic classification **75**
Ondatra zibethicus *see* muskrat
 opossum
 digestive tract data **266**
 stomach **271, 272**
 woolly, gut surface area **222**
 optical planimeter for gut samples 241–2
 oral cavity functions 195, **418**
 oral processing of food 197–218
 orang-utan, seeds in diet of 211
 Orleanian era food and digestion **13**
Oryctolagus cuniculus *see* rabbit
Orzomys spp. *see* rat, rice
Otocyon megalotis *see* fox, bat-eared
Ovis ammon *see* sheep
Ovis ammon musimon *see* mouflon
 owl caeca 303
- pademelon, red-necked, digestive tract data
266
 palaeo-ecological classification of food 75
 pancreas, purpose of 196
 pancreatic secretion
- endocrine, in non-ruminants, effects of
 SCFA on 398–9
 in ruminants, effects of SCFA on 397–8
 exocrine, effects of SCFA on 399
 pangolin gut surface area **70**
Parinari curatellifolia availability in Africa
 175
 passage time *see* transit time
 passerine-pollinated plant species 106
 peccary
 Chacoan, digestive tract data **266**
 stomach **271, 272**
 seeds in diet of 211
 pectin effect on epithelial cell proliferation
 403
 penguin, emperor, crop milk in 90
 perissodactyl digestion 9
 see also horse
Petaurus spp. *see* squirrel, flying
Petauroides volans *see* glider, greater
Petrogale inornata *see* wallaby, unadorned
 rock
 PFR *see* plug-flow reactor model
 phanerogamous fruits 66
 pharynx function 195, **418**
Phascolarctos cinereus *see* koala
Phenacomys longicaudis stomach **317**
 phenolics
 in diet of folivorous marsupials 381
 in leaves 360–1
Philander opossum *see* opossum
Phodopus sungorus *see* hamster, dwarf
 physiological models of digestion 27
 phytophages *see* florivores
 pig
 caecal and colic areas 246, 248, 254, **256**
 diet, lysine-deficient 98
 digestion and food quality 16–17
 digestive tract data **266**
 large intestine 249, 250–3
 neonatal 87
 pigeon crop 89
 pika, colonic separation mechanism in 292
Piliostigma availability in Africa 175
 pine seeds in diet of chipmunk 315
 plant
 cell digestion 54
 contents 91–2
 matter, components of 413, **415**
 Platyrhini primates, chemical perception in
 66
 plicae circulares 7
 plicae semilunares 7
 plug-flow reactor (PFR) model 29, 30, 55–61
 performance 32
 validation 35–41
 poëphages *see* grazers

- poikilothermic maintenance-demand rate 88
 poikilotherms 94–5
 polar bear body reserves 87
 pollen in food 116–17
 pollination of flowers by birds and bats 104
 polyethylene marker studies 41–3
 polyphages *see* omnivores
 porcupines body mass 316
 possum
 brushtail, diet 347
 digestive adaptations 349
 lack of colonic separation mechanisms 304–5
 handling of tannins 372
 ringtail, caecotrophy 306
 colonic separation mechanism 292–3
 diet 347
 digestive adaptations 349
 digestive tract 351–2
 metabolic rate 353
 nitrogen concentration in caecal contents, caecotrophes and faeces of 293
 potassium levels in lagomorph diet 381–2
 potoroo
 digestive tract data 266
 stomach morphology 351
 long-nosed, gut surface area 222
Potorous apicalis *see* potoroo, long-nosed
 pregastric fermenters *see* foregut fermenters
Presbytis cristata *see* monkey, langur
Presbytis rubicunda, seeds in diet of 211
see also monkey, colobus
 primates
 dentition 211–12
 feeding styles 347
 gum-eating 67
 gut surface area 222–5
 leaves in diet 340
 New World, taste discrimination and diet differentiation in 150–64
Procavia habessinica *see* hyrax, rock
 propionic acid
 effect on epithelial cell proliferation 400–1, 403
 effect on gut motility 395–6
 effect on insulin release in sheep 397–8
 prosimians, gum-eating 67
 proteinases 88
 proteins
 amino acid profiles 95, 97, 98, 99
 availability in milk 265
 contents in fruit 113–15
 in herbivore diet 142
 in nectar 111–13
 in seeds 175
 metabolism 392
 synthesis 264
 proximal nutrient analysis 104, 105
Pseudocheirops spp. *see* possum
Pseudocheirus spp. *see* possum
 pyrrolizidine alkaloids degradation in sheep 376
 PYY intestinal peptide role in SCFA effects 403
 quebracho 372
Quelea quelea diet 89
 quinine hydrochloride, taste thresholds in primates for 151–2, 153, 155, 157–8, 159, 161, 162
 quokka, digestive tract data 266
 rabbit
 caecal and colic areas 247, 248, 254, 256
 colon sampling 239
 colonic separation mechanisms 288–92
 coprophagy 59
 digestive tract data 266
 fermentation in 56
 gut sizes 325
 gut surface area 70
 intestinal area to volume relationship 257–60
 large intestine 247, 250–3, 288
 nitrogen concentration in caecal contents, caecotrophes and faeces 293
 sodium wastage in 381–2
 raccoon-dog gut surface area 225
 rainfall seasonality in Africa, 166, 167, 171, 172
 rank-abundance curves 128–9
 rat
 African giant, foregut 318
 nutritional niche 138
 amino acid profiles 96
 caecal and colic areas 248, 254, 256
 colonic separation mechanisms 294, 298–300
 effect of SCFA on epithelial cell proliferation in 403
 effects of SCFA on insulin release in 397–8
 gut motility 395
 hindgut 317
 intestinal area to volume relationship 257–60
 kangaroo- *see* kangaroo-rat
 large intestine 249, 250–3
 nitrogen concentration in caecal contents, caecotrophes and faeces 293
 rice, gut surface area 230
 seed passage in 210
 skin toughness 208

Index

443

- white-tailed, foregut of 318
 nutritional niche 136, 137–8, 139–40,
 141–3
- Rattus norvegicus* *see* rat
- reactor model *see* chemical reactor model
- receptor mechanism for SCFA 393, 403
- rectum purpose 196
- reef-fish diet 90
- reptile carnivory 90
- residence time 40
 definition 8
- retention time of food 288
 definition 8
- distributions in digestion models 35–41
- food intake and 324
- in koalas 352
- in rodents 318, 321
- in ruminants 16
- reticulorumen 29
- Rhus* availability in Africa 175
- ribose, taste thresholds in primates for 154,
 156–7
- ribulose bisphosphate carboxylase/oxygenase
 98
- robin
 lipid-rich fruit ingestion by 109
 wax digestion by 109–10
- rodents
 colonic separation mechanisms 294
- coprophagy 59
- diet 340, 348
- digestive adaptations 349
- fermentation in 56
- gut surface area 70, 225
- seeds in diet of 210, 211
- terrestrially foraging 354–6
- roots
 availability in Africa 174, 176
- digestion 291
- rubisco 98–9
- rumen
 epithelial cell proliferation, effect of SCFA
 on 400–1
 unicells amino acid profiles 96
- ruminants 277
 of Cenozoic era 9–21
 classification 339
 dietary fibre and decreasing body size in
 337
 digestion 264–5
 and food quality 16–19
 effects of SCFA on digestive tract motility
 in 393–5
 effects of SCFA on endocrine pancreatic
 secretion in 397–8
 on exocrine pancreatic secretion in 399
 fermentation chamber 249
- food classification and 76
- forestomach CSTR 29
- gut surface area 70
- nutrient profiles 141–2
- optimum guts in 59
- stomach morphology 351
- transit time in 40–1
- rumination
 establishment in sheep 279
 role in digestion 16
- ¹⁰³Ru-phen marker studies 42, 44
- Rupicapra rupicapra* *see* chamois
- sacciform region of kangaroo forestomach 29
- Saccostomus campestris* *see* mouse, pouched
- Saguinus* spp. *see* tamarin
- salivary
 modification to handle allelochemicals
 373–5
- proteins role, future study of 428
- samango niche segregation 138
- Sarcophilus harrisii* *see* Tasmanian devil
- Sauromalus obesus* growth rate 90
- SCFA *see* short chain fatty acids
- scirids
 diet 318–19
 digestibility 354–6
 digestion 319–21
 digestive tract 319
 teeth 315
- Sciurus griseus* *see* squirrel, Western grey
- seabirds, PFR-type digestion in 34
- seals, gut surface area in 70
- seeds
 access to 19
 amino acid profiles 97
 availability in Africa 174, 175–6
 dentition and 209–13
 in diet for hatchlings 89
 of mammals and marsupials 340
- digestion 291
 adaptation for eating 4
- dispersal 66
 by birds and bats 104, 109
- food in 66
- fracture toughness 210–11
- in fruit pulp, nutrient concentration and 115
- Setonix brachyurus* *see* quokka
- sheep
 amino acid profiles 96
 caecal and colic areas 248–9, 256
 degradation of pyrrolizidine alkaloids by
 376
 digestive tract data 266
 effect of SCFA on epithelial cell proliferation
 in 400–1
 effects of SCFA on insulin release in 397–8

- sheep *cont.*
 effects of SCFA on pancreatic amylase release in 399
 fermentation in 16
 lactation and weaning times 279–80
 large intestine 249, 250–3
 marker-passage studies 42, 43
 phenolic acid effects on 385
 rumination establishment in 279
 short chain fatty acids (SCFA) from gut microbes 392–408
 shrew, metabolic rate of 93–4
 shrubs *see* woody plants
Sicista subtilis hindgut 317
 skin toughness, dentition of carnivores and 208
 sloth
 fermentation in 56
 three-toed, diet 347
 digestive adaptations 349
 digestive tract data 266
 forestomach 350
 metabolic rate 353
 stomach morphology 351
- small intestine
 PFR 29
 purpose 196, 419
 surface area 220–31
- sodium
 content in earth 71
 wastage in rabbits 381–2
- soya meal amino acids 98
- Spalax ehrenbergi* *see* mole rat
- Sparmacian era food and digestion 12
- specialised-generalised plant/frugivore dichotomy 108–9
- Spermophilus columbianus* *see* squirrel, Columbian ground-squirrel
 Columbian ground-, digestive performance 319–21
 diet 319
 seeds in 211
 flying, diet in 348
 ground, marker-passage studies in 42, 43
 gut surface area 70
 teeth 315
 Western grey, gut surface area 225
- starch
 in seeds 66
 in tubers 69
- Steatornis capensis* *see* oilbird
- stem digestion 291
- stimulus-response studies 35–41
- stomach
 adaptations in rodents 316–21
 anatomy 7, 270–1
 design in arboreal mammals 350, 351
- differentiation of marsupials and eutheria 266–7
 human 270
 innervation 5
 lesser curvature differentiation 266, 269–70
 purpose 195, 419
 surface area 220–31
- Streptococcus bovis* in koalas 376
- sucrase activity in bats and hummingbirds 107
- sucrose
 absorption model 45–8
 in nectar 105–7
 taste thresholds in primates for 152–3
- sugar
 in plants, evolution of 118
 in nectar and fruit 105–7, 112
- Sus scrofa* *see* pig
- swallow, wax digestion by 110
- Syconicteris australis* *see* bat
- Sylvilagus* *see* cottontail
- symbionts 90
- Synaptomyz cooperi* stomach 317
- Tachycineta bicolor* *see* swallow
- taeniae 7
- Talpa europaea* *see* vole
- tamarin
 golden lion 155
 gut surface area 223
 taste discrimination and diet differentiation 150–65
- tanagers, gut design in 108–9
- tannic acid 372
 taste thresholds in primates for 158, 160, 161–2
- tannin-binding salivary proteins (TBSP) 373–5
- tannins 371–2
 degradation 374
 effect on digestion 379–80
 in leaves 360–1
- Tarsipes rostratus* pollen digestion 117
- Tasmanian devil, digestive tract data in 266
- taste
 abilities 427
 buds 66
 bitter substances and 71
 discrimination, and diet differentiation 150–65
 in New World primates 150–65
- TBSP *see* tannin-binding salivary proteins
- teeth
 adaptation to food types 202–5
 in rodents 315, 317–18
 diet and 207–13
 food contact with 197–218
 food properties and 425

Index

445

- friction with food 205
 shapes 206, 425
 in small vs larger species 360
 wear from abrasive food 204
- Terminalia* spp. gums 67
- terminology 4–8
 for stomachs 269
 for fermentation strategies 7
- terpenes
 absorption 376
 in diet of folivorous marsupials 381
 effects on digestible energy 383
 excretion 385
- Tertiary mammals *see* Cenozoic mammals
- thermo-regulation 94
- Thylogale thetis* *see* pademelon
- Toxicodendron* spp., avian digestion of wax from 109
- toxins 371
 in plants, defences in herbivores and 128
 primate handling of 151, 161
- tragulids, digestive adaptations 349
- transit time
 definition 8
 in digestion models 39–40
 in foregut fermenters 133
 in frugivores 107
 eating carbohydrate-rich fruits 110
 influences on 359
 in large intestinal fermenters 16–17
 in ruminants 16, 18–19
 shortening by SCFA 395
- tree kangaroo
 diet 348
 digestive adaptations 349
 metabolic rate 353
- tree-shrew, seed passage in 210
- Trichosurus vulpecula* *see* possum, brushtail
- tubers in diet 69
- tubiform stomach of wallaby 29
- tubular guts 29
- tunica mucosa 270
 differentiation of marsupials and eutheria 266–7
- tunica muscularis 269–70
 differentiation of marsupials and eutheria 266–7
- turbellarian enteron 29
- Turdus migratorius* *see* robin
- turkey
 nitrogen concentration in caecal contents and faeces of 293
 urine transport in 302–3
- Turolian era food and digestion 13
- turtle, painted, carnivory in 90
- UDP glucuronosyl transferase activity 378
- ungulates
 gut surface area 70
 nutrient profiles and 141, 144–5
- urinary
 energy losses 383–4
 glucuronic acid excretion, as index of detoxifying ability 378
 in koalas 384–5
 losses of sodium in lagomorphs 381–2
- urine in colon of dehydrated hens 302
- valeric acid
 effect on gut motility 395
 effect on insulin release in sheep 397–8
- vegetable amino acid profiles 97
- videoplan analysing system for gut samples 241
- vitamin B₁₂ in plants 91–2
- vole
 body mass 316, 326
 caecal and colic areas 247, 248, 254, 256
 colonic separation mechanisms 298
 diet 354
 cell content 357
 digestibility 355
 digestion 319–21
 digestive tract data 266
 effects of allelochemicals on 384, 385
 energy requirement 287
 food retention time 325
 gut surface area 230
 intestinal area to volume relationship 257–60
 large intestine 250–3
- meadow, digestive tract in 352
- integrated processing response in 324–35
 prairie, food retention time in 325
- Townsend, digestive performance in 319
- water, hindgut in 317
- nitrogen concentration in caecal contents, caecotrophes and faeces in 293
- Vulpes vulpes* *see* fox, red
- wallaby
 diet 339
 digestion model 29–30
 forestomach 350
 milk diet 88
 red-necked *see* pademelon
 stomach morphology 351
 tammar, digestive tract data in 266
 unadorned rock-, digestive tract data in 266
- warbler
 diet 110
 wax digestion by 110

Cambridge University Press

0521020859 - The Digestive System in Mammals: Food, Form and Function

Edited by D. J. Chivers and P. Langer

Index

[More information](#)

446

water chevrotain, digestive tract data in **266**
water content of foods **414, 416, 417**
wax digestion in avian frugivores **109–11**
waxwing, cedar
 food transit times in **110**
 nutritional budget of **119**
 marker-passage studies **42–3, 47–8**
weaning time in marsupials and eutheria
 264–86
whales, gut surface area of **70**
wildebeest nutrient profitability spectrum **144**
wombat, fermentation in **56**
woodpeckers, wax digestion by **110**

Index

woody plant foods in Africa, potential for
humans **166–92**
woylie, nutritional niche of **132, 134, 136**
Xeroderris stuhlmannii toxicity **170**
yams **69**
Zea mays seed fracture toughness **211**
zebra, nutrient profitability spectrum of **144**
Ziziphus mucronata availability in Africa **176**
zoophages *see* faunivores