

INDEX

A

ABO blood groups, distribution 243
 absolute dating 299, 314
 carbon-14 dating 300–1, 314–15
 limitations 300, 301
 methods 302
 potassium–argon dating 299–300, 315–16
 accelerator mass spectrometry (AMS)
 radiocarbon dating 301
 accuracy of data 10
 acetabulum 330
 acetylcholine 91, 92
 Acheulian tools 359, 363
 achromatopsia 253
 acidic secretions 161
 acquired reflexes 64
 action potential 56–7, 58, 59, 66
 active immunity 174
 adenine 199, 200, 275
 adrenal cortex 38, 40, 113
 adrenal glands 37–8
 role in blood sugar regulation 113
 adrenal medulla 37–8, 40, 113, 118
 adrenaline 38, 40, 65, 113
 adrenocorticotrophic hormone (ACTH)
 33, 34, 113
 adult-onset diabetes 208–9
 afferent division of the PNS 89, 90
 afferent neurons 50
 agglutination 171
 airborne transmission of diseases 159
 alarm reaction 92–3
 albinism 235
 aldosterone 38, 40
 and kidneys 136
 alimentary canal 133
 all-or-none response 56
 allele frequencies 234
 and bottleneck effect 253
 changes due to gene flow 243
 and founder effect 252–3
 and genetic drift 251–3
 and natural selection 246–7
 and speciation 254
 alleles 234, 243
 Allison, Anthony 249–50, 262
 alpha cells 39, 111
 alpha thalassemia 250
 Alzheimer's disease 215
 amine hormones 30
 amino acids 237
 sequencing 282–4, 289–90
 anaemia 249
 androgens 39, 40
 aneuploidy 238
 animal parasites 158
 animals in manufacture of vaccines,
 ethical issues 179, 180, 187

animals in research, code of care 9
 annealing (DNA replication) 271–2
 annotation 284
 anterior lobe of the pituitary gland 33
 hormones released 33, 34
 antibiotic resistance 181
 investigating 187–90
 antibiotics 180–1
 impact of overuse 181
 types of 181
 antibodies 169, 170
 action of 171
 active sites 169
 interaction with antigens to inactivate
 the antigens 171
 antibody-mediated immunity 168, 169,
 170–2
 summary 173
 antidiuretic hormone (ADH) 34, 35, 65
 and kidneys 135
 antigen–antibody complex 169
 antigen-presenting cells 170
 antigens 169
 active sites 169
 antiviral drugs 181–2
 antler tools 362
 aortic body 140
 apes 323, 325, 334
 classification 345
 see also humans; primates
 appendix 309
 arachnoid mater 80
 archaeologists 298
Ardipithecus ramidus 345, 366
 arithmetic mean 12
 artefacts 298
 artificial immunity 173, 174
 artificial selection 200
 ascending tracts 87
 Ashkenazi Jews, Tay-Sachs disease in 253
 association areas (cortex) 83
 association neurons 50
 attenuated microorganisms 175
 Aurignacian tools 362, 363
 australopithecines
 age range and cultural period 363
 fossil evidence 350–1
 physical features 351–2
 tools used by 358
Australopithecus 350–2
 anamensis 345
Australopithecus aethiopicus 346
Australopithecus afarensis 296, 345,
 346, 347, 348, 350
 comparison with *A. africanus* 353
 'Lucy' 296, 351
Australopithecus africanus 345, 347,
 350, 354
 comparison with *A. afarensis* 353

Australopithecus garhi 345, 347
 autonomic division (autonomic nervous
 system) 90–3
 differences in motor pathways from
 somatic divisions 91
 fight-or-flight response 92–3
 functions 90
 nerve fibres 91
 parasympathetic and sympathetic
 division impulse effects on organs
 and tissues 91, 92, 93
 autonomic reflex, observing 97
 autonomy 278
 average 12
 axon terminal 48, 59
 axons 48, 50, 51

B

B-cells 168, 170, 172
 bacilli 156
 bacteria 155–6
 antibiotics 180–1
 classification by shape 156
 diseases 158
 identification 156
 non-pathogenic 155
 size of 156
 bacterial cell, structure 155
 bacterial transformation, investigating
 218–22
 bactericidal antibiotics 181
 bacteriophages 157, 201, 204, 205
 bacteriostatic antibiotics 181
 basal ganglia 81, 83
 base pairs 200
 behaviour and homeostatic mechanisms
 148
 beta cells 38, 111
 beta thalassemia 250
 bicarbonate ions 140
 bile pigments 132
 bioinformatics 284
 biotechnology 199
 cell replacement therapy and tissue
 engineering 215–16
 gene therapy 213–15
 recombinant DNA 176, 199–206
 synthetic hormones 207–12
 bipedalism 328
 adaptation to 328
 advantages of 334
 evolutionary process from quadruped-
 alism 328–33
 bipolar neurons 50, 51, 52
 birth rate 246
 Black, Davidson 354–5
 bladder 133
 blade tools 361, 362, 363
 blood calcium levels, regulation 37

- blood clotting 108
- blood sugar levels regulation 38–9, 105, 106, 109–14
 adrenal glands role 113
 by insulin and glucagon 111, 112
 investigation 222
 liver role 110–11
 organs involved 110
 pancreas role 111–12
 summary 113–14
- blood vessels and heat loss 117
- blunt ends (DNA) 202, 205
- body fluid composition regulation 130–7
- body fluids
 distribution 130–2
 maintaining fluid balance 132
 transmission by transfer of 158
 types of 131
- body stature, and natural selection 247
- body temperature
 and high fever 108, 166
 prevention from falling 118–19
 prevention from rising 119–20
 temperature tolerance 121–2
- body temperature regulation 62, 115–22
 blood vessels and heat loss 117
 in cold conditions 120
 heat gain and heat loss 115–16
 in hot conditions 120
 hypothalamus control 118–19, 120–1
 preventing body temperature from falling 118–19
 preventing body temperature from rising 119–20
 shivering and heat gain 118
 skin and temperature regulation 116
 sweating and heat loss 117–18
 temperature receptors 116
- bone marrow 168
- bone tools 360, 362
- bonobos 323, 325
- bottleneck effect 253
- brain 79, 81–5
 cranial nerves 88
 dissection 95–6
 external view 81
 neurons 49, 50
 protection 79–81
 structure 81–5
- brain size
 hominin species over time 347–8
 primates 326–7
- breathing
 and carbon dioxide concentration 140–1
 chemoreceptors role 140
 control of 139
 and exercise 142
 and hydrogen ion concentration 141
 and oxygen concentration 140
 voluntary control of 142
- breathing rate, investigating 147–8
- broad-spectrum antibiotics 181
- Broom, Robert 353
- brow ridges 335, 348, 353, 355, 356
- burins 362
- C**
- C-shaped spinal curve in apes 329, 330
- calcitonin 36, 39
- calcium ions 59
- canines (teeth) 334–5, 348, 351
- capsule 155
- carbon dioxide 132, 139, 140, 142
- carbon dioxide concentration, and breathing 140–1
- carbon-14 dating 300–1, 314–15
- cardiac centre 85
- carotid body 140
- carrier protein 55
- carrying angle 330–1
- case studies 5
- cell body 48, 50, 51
- cell-mediated immunity 168, 169, 172–3
 summary 173
- cell membrane 155
 action potential development 56–7
 potential difference across a 54–6
- cell replacement therapy 215–16
- cell wall 155
- cellular respiration 109, 116, 139
- central canal 87
- central chemoreceptors 141
- central nervous system (CNS) 51, 79–87, 90
 brain 81–5
 protection of 79–81
 spinal cord 86–7
 structure and functions 87
- central thermoreceptors 116
- centre of gravity 332
- cerebellum 81, 84
 cross-section 84
 functions 84
 location 84
- cerebral cortex 81, 82
 functional areas 83
 functions 82–3
 lobes and their functions 82, 83
 relative size, primates and hominins 326–7, 347–8
- cerebral hemispheres 82, 83, 84
- cerebrospinal fluid (CSF) 80, 81, 87
 functions 81
- cerebrum 81–3, 326
 cross-section 82
- cerumen 162
- chemicals
 affecting breathing 140–1
 effect on transmission of nerve impulses 60
- chemoreceptors 62, 140
 and breathing 141
- childbirth, positive feedback during 108
- chimpanzees 280, 283, 284, 323, 324, 345
 behaviour 4
 carrying angle 331
- comparison with modern humans and Neanderthals 368
- curvature of the spinal column 330
- foramen magnum 329
 walking 333
- chloride ions 55
- chromosomal mutations 234, 237
 conditions caused by 240–1
- cilia 161
- circulatory system 139
- clones 170
- clothes making 361
- cocci 156
- coccyx 309
- codons 237, 282
- cold conditions
 behavioural response 119
 body temperature regulation 118–19, 120, 121
- cold receptors 116
- column graphs 15
- common ancestry 280, 281, 283, 306–9, 346
- communicable diseases 155, 158–9
- comparative anatomy 306–9
- comparative embryology 306
- comparative genomics 279–80
- comparative protein sequences 282–4
- complement system 165
- conduction (heat) 116, 117
- conduction of nerve impulses 54–8
 along myelinated fibres 58–9
 along unmyelinated fibres 58
- confidentiality 278
- connector neurons 50
- contact transmission 158
- contagious diseases 158
 vaccination and herd immunity 178
- controlled experiments 4–5
- controlled variables 9
- controlling variables 9
- convection 116, 117
- convolutions 82, 326
- core body temperature 62, 119, 121, 122, 166
- corpus callosum 81, 84
- correlation of rock strata 302
- corticosteroids 38, 40
- cortisol 38, 40, 113
- coughing 162
- cranial capacity 327, 346, 347–8, 365
- cranial nerves 88
- cranium 79, 327
- Creutzfeldt-Jakob disease, human variant (vCJD) 205
- Cro-Magnon people 356, 361, 363
- cultural evolution 358–64
- culture 358
- curvature of the spinal column 329–30
- cystic fibrosis (CF) 214, 240, 242
- cytochrome C 283
- cytokines 170, 172
- cytoplasm 155
- cytosine 199, 200, 275

cytosol 131
 cytotoxic T-cells 172

D

Daphnia, synapse response 67–70

Dart, Raymond 350, 367

Darwin, Charles

influences on 245–6

On the Origin of Species 246

route taken by HMS *Beagle* 244, 245

theory of evolution through natural

selection 244, 246

theory of natural selection 246

data

errors and limitations in 11, 12

presentation 15–16

processing 12–14

secondary 12

types of 11

dating fossils 299

absolute dating 299–302, 314–16

relative dating 36, 299, 302–4

dehydration 137

deletion mutations 237, 238, 239

denaturation (DNA replication) 271

dendrites 48, 50, 164

dendritic cells 164, 170

dendrograms 310

dental arcade 335, 348, 351

dental formula 334

dentition 335–6, 348

deoxynucleotide triphosphates 275

deoxyribose 200, 275

dependent variable 8

depolarisation 56

depolarised membrane 56

descending tracts 87

diabetes 207

treatment 209

Type 1 208, 209

Type 2 208–9

diabetes mellitus 207–9

diaphragm 139

diarrhoea 163

diastema 334

dideoxynucleotides (dideoxynucleotide triphosphate) (ddNTPs) 276

structure 276

use in DNA sequencing using Sanger's

method 277

'dig' sites 298

digits, mobility of 327–8

diphtheria 175

discussion (scientific reports) 18

diseases

caused by pathogens 158

communicable 155, 158–9

deaths from diseases commonly

vaccinated against, Australia 175

non-specific defences against 160–7

prevention and treatment 175–82

specific defences against 160, 167–74

technology used to treat 199–223

transmission 158–9, 184–6

see also bacteria; viruses

DNA (deoxyribonucleic acid) 199–200

amplification, and polymerase chain

reaction 271–3

base pairs 200

change in the 237–9

double helix structure 200

and gene mutations 235

mitochondrial 28

nitrogen bases 199, 200

processing of 271–8

providing evidence of evolution

279–81

viral 155, 156, 157, 181

DNA fingerprint 273

DNA ladders 274

DNA ligase 203, 205

DNA polymerase 272, 273

DNA profiling, and gel electrophoresis

273–4

DNA replication, using PCR 271–3

DNA sequencing 275–7

models 289

DNA strands, cuts produced by

restriction enzymes 202, 205,

286–8

DNA vaccines 206

dopamine 65

dorsal root 89

dorsal root ganglion 89

double helix 200

Down syndrome 240–1

karyotype 240

droplet transmission 158, 159

Dubois, Eugène 367

Duchenne muscular dystrophy 240

Dunker population, Pennsylvania,

genetic drift 252, 253

duplication mutations 238

dura mater 80

E

Ebola 178

effector neurons 50

effectors 63, 64, 91, 106

efferent division of the PNS 90

electrical charge 54

embryology, comparative 306–7

embryonic stem cells 215

endocasts 237, 347, 348

endocrine dysfunction 41

endocrine glands 29, 30, 32–9

endocrine system 29–31

comparison with nervous system in

communication within the body

63–4

role in homeostasis 106

endocrine tissues 3

endogenous retroviruses (ERVs) 280

endonucleases 202

enzyme amplification 31

equity 278

erect posture 328

adaptations to 328–32

striding gait 333

errors in data 11, 12

erythropoietin (EPO) 39

ethical behaviour 8

ethical considerations

animals in manufacture of vaccines

179, 180, 187

with genetic information 278

ethics 8–9

ethidium bromide 274, 275

evaporation 116, 117

evolution 233

comparison of hominin species 350–7

cultural 358–64

development of theory of 244–6

hominins 233, 345, 346–9

horse 296, 297

see also natural selection

evolution, evidence of

bioinformatics 284

comparative anatomy 306–9

DNA evidence 279–81

fossils 296–305

protein sequences 282–4

evolutionary relationships, phylogenetic

trees 310–13, 317, 325, 365

excretion 132

kidneys 133–4

organs involved in 132–3

exercise, and breathing 142

exocrine glands 30

exophthalmia 210

experiments *see* investigations

extension (DNA replication) 272–3

external defences against disease

161–2

extracellular fluid 54, 131

extrapolation 15

F

factor VIII 205

faeces 132

feedback 106

feedback systems 105–6

blood glucose regulation 38–9, 105,

106, 109–14

common features 106

negative feedback 31, 37, 38–9, 107–8,

135, 141

positive feedback 108

femur 330

fever 108, 166

plotting a 186

filtration 134

fire, use of 360

fissures 82

flagella 155

flake tools 363

production of 360, 361

flow charts 16

fluid balance, maintaining 132

follicle-stimulating hormone (FSH)
33, 34, 205
foot 331–2
foramen magnum, position of 329
fossil pollen grains 304
fossil record, problems with 304–5
fossilisation, and soil type 297
fossils 296–305
 dating 299–305
 discovery of 298
 formation 297
 index fossils 302, 304
 location 297
founder effect 252–3
frameshift mutations 238, 239
frequency 14
frequency distribution 14
frequency table 14
frontal lobe 82, 326
functional neurons 50
fungal diseases 158

G

Gage, Phineas 96–7
Galapagos Islands 245
ganglia 88, 89, 91
gas concentration regulation 139–42
gel electrophoresis 277
 and DNA profiling 273–5
 simulation 286
gene flow 244
 barriers to 244, 255
gene mutations 234, 235, 237
 conditions due to 240
gene pool 234
 and founder effect 252
 and lethal recessives 253
 and migration 243, 244
 and natural selection 246, 247, 250
 and speciation 254–5
gene therapy 213–15
 cystic fibrosis 214
 Huntington's disease 215–16
 Type 1 diabetes 214
genetic drift 251–2
 founder effect 252–3
genetic engineering 201–6
genetic information, ethical
 considerations 278
genetically modified organisms (GMO)
 201
geneticists 234
genome 279
genotypes 233
geographical barriers to gene flow 244
germlinal mutations 236
germline mutations 236
gibbons 280, 284
Glass, Bentley 252, 253
GloFish 205
glucagon 39, 40, 65, 111
 effects on blood glucose levels 112
glucocorticoids 113
glucometer 109
gluconeogenesis 111, 112
glucose 30, 31, 38, 109
 fate of in the small intestine 110
 in the liver 110–11
 in the pancreas 111–12
 see also blood sugar regulation
glucose–glycogen conversions 110
 stimulated by adrenal gland hormones
 113
 stimulated by pancreatic hormones
 111
glycogen 38, 110, 111
glycogenesis 111
glycogenolysis 111, 113
goitre 211
Golden Rice 201
gonadotropins 31
gonads 39
gorillas 184, 283, 307, 308, 323, 324
 brow ridge 335
 foot 332
 pelvis 330
 posture 329
Gracile australopithecines 346
granulated leucocytes 163
graphs 15
Graves' disease 210
great apes 280, 323
grey matter 49, 81, 86, 87
growth hormone (GH) 33, 34, 205
guanine 199, 200, 275
gyrus 82

H

haemoglobin 248, 249, 250, 262, 284,
 289
hafting 361
hairs, as barrier against disease 161
half-life 300
hand washing, investigating
 effectiveness 183–4
'Handy man' 354, 363
Hashimoto's disease 211
heart 39
heart muscle 91
heat exhaustion 122
heat gain 115–16
 and shivering 118, 119, 166
heat loss 115–16
 and blood vessels 117
 and sweating 117–18, 119–20
heat production 116
heat receptors 116
heat stroke 121
heated room experiment 123
Helicobacter pylori 3
helper T-cells 170, 172–3
heparin 165
hepatitis B vaccine 206
herd immunity 178–9
heritability of the mutation 236
heterozygote advantage 250
histamine 165
histogram 14
holding our breath 142
home bases 358
homeostasis 29, 31, 105–9
 and behaviour 148
 blood sugar regulation 38–9, 105, 106,
 109–14
 body fluid composition 130–7
 body temperature regulation 62,
 115–22
 feedback systems 105–6
 gas concentration regulation 139–42
 negative feedback 31, 37, 38–9, 107–8
 positive feedback 108
 stimulus–response–feedback model
 106
Hominidae
 changes in the relative size of the
 cerebral cortex 326–7
 characteristics 325–6
 classification 345
 locomotion – adaptations to bipedalism
 and quadrupedalism 328–34
 skulls 365–6
 variation within the 325–35
 see also hominins; humans; primates
hominins
 adaptations for erect posture 328–32
 anatomical trends 349
 characteristics that separate them
 from other hominids 345
 comparison of species 350–7
 cranial capacity 327, 346, 347–8, 365
 cultural evolution 358–64
 evolutionary trends 233, 345, 346–9
 prognathism and dentition 348–9
 skulls 365
 see also humans
Homo erectus 345, 346, 347, 348, 354–5,
 356
 age range and cultural period 363
 tools used by 359–60
Homo ergaster 305, 346, 347
Homo habilis 345, 346, 347, 348, 354
 age range and cultural period 363
 tools used by 359
Homo heidelbergensis 346, 347
Homo neanderthalensis 345, 346, 347,
 355–6
 age range and cultural period 363
 comparison with *H. sapiens* 357
 tools used by 360–1
Homo rudolfensis 347
Homo sapiens 345, 346, 347, 348, 355,
 356–7
 age range and cultural period 363
 comparison with *H. neanderthalensis*
 357
 tools used by 360–2
homologous structures 306–8
homozygous recessive 250
hormonal secretions, control 31

- hormone–receptor complex 30
hormone receptors 31
hormones 30–1
 clearance 31
 impact on functioning of cells 30
 and nerves, comparison in
 communication function 63–4
 released by other endocrine glands 35, 36, 37–8, 39–40
 released by pituitary gland 33, 34–5
 synthetic 207–12
 see also specific hormones, e.g.
 thyroxine
horse evolution 296, 297
hot conditions
 behavioural response 120
 body temperature regulation 119–20, 121
Human Genome Project 213, 279
human immunodeficiency virus (HIV) 157
human papilloma virus (HPV) vaccine 206
humans
 adaptations to bipedalism 328–33
 advantages of bipedalism 334
 are they unique? 368
 brain size 326–7
 carrying angle 330–1
 centre of gravity 332
 classification within the Primate order 323–4
 common ancestor 280, 281, 283, 306–9, 346
 comparative anatomy 306–9
 comparative genomics 279–80
 cranial capacity 327, 346, 347–8
 curvature of the spinal column 329–30
 endogenous retroviruses 280
 evidence for evolution 367–8
 foot 331–2
 foramen magnum 329
 jaw 330
 knee 331
 mitochondrial DNA 281
 mobility of the digits 327–8, 337–8
 muscle tone 332
 pelvis 330
 posture 329
 protein sequences 283, 284
 skull 356
 striding gait 333, 338–9
 teeth, number and shape of 334
 upright stance 332, 334, 335, 338–9
 see also hominins; *Homo sapiens*
humoral response 168, 170–2, 173
hunter-gatherers 359
hunting 359, 360
Huntington's disease 215–16
hydrogen ion concentration, and breathing 141
hydrogen ions 140
hyperglycaemia 207
hyperpolarisation 57
hyperpolarised membrane 57
hyperthyroidism 210
hyperventilation 142
hypophysis 32
hypothalamus 32, 33, 62, 81, 85
 and body temperature regulation 118–19, 120–1
 connection to pituitary gland 32, 33
 and fever 166
 functions 32, 85
 inhibiting factors 33
 location 32, 85
 releasing factors 32, 33
 and water level regulation 134, 135, 136
hypothermia 122
hypothyroidism 211–12
- I**
immune response 168–9
 antibody-mediated immunity 168, 169, 170–2, 173
 cell-mediated immunity 168, 169, 172–3
immune system 168
immunisation 175, 176
immunity 173
 types of 173–4
immunoglobulins 169
inactivated vaccines 176
incisors 334, 335
independent variable 9
index fossils 302, 304
induced mutations 236
infectious diseases 155, 178
inflammation 164, 166
 signs of 164
inflammatory response 164–5
influenza vaccination 178
influenza virus 157, 178
infundibulum 32, 33
ingestion (as means of disease transmission) 158
inhibiting factors 32, 33
innate reflexes 64
insertion mutations 237, 238, 239
insula 82, 83
insulin 30, 31, 38–9, 40, 41, 110
 and diabetes 207–8, 209
 effect on blood glucose levels 111, 112
 manufacture using recombinant DNA technology 205, 209
insulin-dependent diabetes 208
intercellular fluid 131
intercostal muscles 139
interferons 166
internal non-specific defences against disease 163
 fever 166
 inflammatory response 164–5
 phagocytosis 163–4
- interneurons 50
 direction of nerve impulses 51
interpolation 15
interstitial fluid 131
intracellular fluid 54, 131
intravascular fluid 131
inversion mutations 238
investigations
 conducting 6–16
 reporting on 17–20
 types of 3–6
involuntary muscles or glands 91
iodine deficiency 211
ionising radiation, as mutagen 235, 256–9
ions 54, 55, 56
islets of Langerhans 38, 39, 111
isolation 244, 254, 255
isotopes 300
- J**
jaw 330, 334, 335, 352, 353, 357
- K**
kidneys 39, 133–4
 and aldosterone 136
 and antidiuretic hormone 135
 and associated organs 133
killer T-cells 172, 173
Klinefelter's syndrome 242
 karyotype 241
knee 331
- L**
Lactobacilli 155
Laetoli footprints 350, 351
leakage channels 54, 55
Leakey, Louis 354
learnt reflexes 64
lethal recessives 242, 253
leucocytes 163
Levallois technique 360, 361
levothyroxine 212
ligation 203
limitations of data 11–12
line graphs 15
Linnaeus, Carolus 245
lipid envelope 156, 157
lipogenesis 111
lipolysis 112
literature review 8
live attenuated vaccines 175
liver, role in blood sugar regulation 110–11
locomotion – adaptations to bipedalism and quadrupedalism 328–34
Loewi, Otto 66–7
longitudinal arch 331
longitudinal fissure 82
longitudinal studies 5–6
lumbar region 329
lungs
 excretion of carbon dioxide 132
 muscles moving air in and out of 139

- luteinising hormone (LH) 33, 34
 Lyell, Charles 245
 lymph nodes 167
 lymphatic system 167
 lymphocytes 167, 168, 172
 lymphoid tissue 168, 170, 172
 lysozyme 162
- M**
- macrophages 163, 170, 173
 Magdalenian cultural period 362, 363
 malaria
 distribution 248
 and sickle-cell anaemia 249–50, 262
 transmission by mosquitoes 159
 Malthus, Thomas 245–6
 mass immunisation programs 177
 mast cells 165
 mean 12
 measles 175, 178
 measurement error 11
 mechanoreceptors 62
 median 13
 medulla oblongata 81, 85, 141
 location 85
 role 85
 melatonin 35
 membrane potential 54, 57
 change in 57
 resting 54, 55, 56
 memory cells 170, 172, 173
 meninges 80
 metabolic rate 116, 120
 metabolic water 132
 metatarsals 331
 methylene blue 274
 micropipettes 274
 Mightypharm research 21
 migration 243–4
 missense mutations 237
 mitochondrial DNA (mtDNA) 281
 evidence from 281
 inheritance 281
 mobility of the digits 327–8
 models 16, 106
 molars 334, 348
 number of cusps 335
 third (wisdom teeth) 309, 348
 monkeys 280, 323, 325, 328, 334
 monocytes 163, 164
 monosomy 242
 mosquitoes, as vectors 159
 motor areas (cortex) 83
 motor axons 87
 motor division of the PNS 90
 motor fibres 88, 89
 motor neurons 50, 63, 64
 direction of nerve impulses 51
 Mousterian industry 360, 363
 movement of fluid, as defence against
 disease 162
 mucous membranes 161
 mucus 161
- multiple drug resistance 181
 multipolar neurons 50, 51, 52
 muscle tone 332
 mutagenic agents 235
 mutagens 235
 mutants 234
 mutations 234
 causes 235, 236, 256–9
 change in the DNA 235–9
 chromosomal 234, 237, 240–2
 classification by their effect 237
 conditions due to 240–2
 extent of 237
 gene 234, 235, 237, 240, 242
 heritability 236
 types of 235–40
 myelin 83
 myelin sheath 48–9
 functions 49
 myelinated fibres 48, 87
 transmission along 58–9
- N**
- Napier, John 354
 narrow-spectrum antibiotics 181
 nasal cavity 161, 162
 natural immunity 173, 174
 natural selection 244, 245
 and allele frequencies 246–7
 Darwin's theory of 246
 examples of 247–50
 investigating 259–60
 modelling 260–1
 nature's balance 246
 Neanderthal people 355, 363, 368
 burial of their dead 361
 tool making 360–1
 negative feedback systems 31, 37, 38–9,
 107–8, 135, 141
 nephron 133
 function 134
 nerve cells 48–52
 nerve fibres 48, 52
 nerve impulses 51, 54–60
 and action potentials 56–7,
 58, 59
 chemical effects on transmission 60
 conduction 54–8
 and potential difference across a cell
 membrane 54–6
 size of 59
 in a spinal reflex 64
 transmission 58–9
 transmission across a synapse
 59–60
 nerves 52
 cross-section 52
 and hormones, comparison in
 communication function 63–4
 types of, PNS 88–9
 nervous system 79
 autonomic nervous system 90–3
 central nervous system 79–87, 90
- comparison with endocrine system
 in communication within the body
 63–4
 functional organisation 90
 peripheral nervous system 79, 88–93
 role in homeostasis 106
 neurilemma 49
 neuromuscular junction 49, 60
 neurons 48, 52
 functional types 50
 involvement in spinal reflex 63, 64
 model 66
 structural types 50–1, 52
 structure 48–9
 and synapses 49–50
 neurotransmitters 49, 60, 65, 91, 92
 discovery 66–7
 neutral mutations 237
 neutrophils 163, 164
 nictitating membrane 308
 nipples on males 309
 nitrogenous bases 199, 200, 275
 nociceptors 63
 nodes of Ranvier 49, 58
 nodulator 106
 non self-antigens 169
 non-disjunction mutations 238
 at meiosis I and meiosis II 239
 non-specific defences against disease
 160
 external defences 161–2
 internal defences 163–6
 lymphatic system 167
 protective reflexes 162–3
 nonsense mutations 237
 noradrenaline (norepinephrine) 38, 40,
 65, 91, 113
 nucleotides 200, 275
 joined in a section of DNA 276
 structure 275
- O**
- observations 3–4
 occipital lobe 82
 oestrogens 39, 40
 Oldowan tools 358, 363
 oligodendrocytes 49
 opposability 327–8
 orangutans 323, 324, 325
 organic compounds 301
 osmoreceptors 62, 134, 135, 136
 osmotic concentration 131
 osmotic pressure 131
 outliers 12, 13
 ovaries 39, 40
 oxygen 139, 140
 oxygen concentration, and
 breathing 140
 oxytocin (OT) 34, 35, 65, 108
- P**
- pain receptors 63, 64
 palindromic recognition site (DNA) 202

- pancreas 38–9, 40
 role in blood sugar regulation 111–12
- pancreatic hormones 38–9, 111
- pancreatic islets 38
- Paranthropus aethiopicus* 345
- Paranthropus boisei* 345, 346, 347
- Paranthropus robustus* 345, 346, 347, 353
- parasitic diseases 158
- parasympathetic division
 (parasympathetic nervous system)
 90, 91, 92
 effects of stimulation 93
- parathormone 37
- parathyroid glands 36–7, 39
- parathyroid hormone (PTH) 37, 39
- parietal lobe 82
- Parkinson's disease 215
- partial monosomy 242
- passive immunity 173, 174
- Pasteur, Louis
 experiments 19–20
 validating his experiments 22
- Patau syndrome 241
- pathogens 155
 animal parasites 158
 bacteria 155–6, 158
 fungi 158
 non-specific defences against 160–7
 specific defences against 167–74
 transmission of 158–9, 184–6
 types of 155–8
 viruses 156–7, 158
- pebble tools 358
- peer review 17
- 'Peking Man' 354
- pelvis, of gorilla and humans 330
- penicillin 4–5, 181
- pentadactyl limbs 327
- peptic ulcers 3
- percentage change 14
- percentages 14
- peripheral chemoreceptors 141
- peripheral nervous system (PNS) 51, 79,
 88–93
 afferent division 89, 90
 efferent division 90
 types of nerves 88–9
- peripheral thermoreceptors 116
- pertussis 175
- phages 157, 201, 204, 205
- phagocytes 163, 165
- phagocytosis 163–4
- phenotypes 233
- phenylketonuria (PKU) 236
- phosphate groups 200, 275
- phospholipid bilayer 54
- phrenic nerve 139
- phylogenetic trees 310–11
 drawing 311–12, 365
 investigating 317
 of primates 311, 325
- pia mater 80
- pineal gland 35
- Pingelap population, achromatopsia in 253
- pituitary gland 32–5
 anterior lobe 33, 34
 hormones released 33, 34–5
 and hypothalamus 32–3
 location 32
 posterior lobe 33, 34, 35
- placenta 39
- plasma 131
- plasma cells 169, 170
- plasma membranes 131
- plasmids 155, 204, 205
- point mutations 237–8, 248, 249
- polarised membrane 56
- poliomyelitis (polio) 175, 177, 178
- polymerase chain reaction (PCR) 271
 and amplifying DNA 271–3
 models 289
- population 234
- positive feedback 108
- post-synaptic membrane 60
- posterior lobe of the pituitary gland
 33, 34
 hormones released 34, 35
- potassium–argon dating 299–300, 315–16
- potassium ions 55, 56
- potential difference 54
 across a cell membrane 54–6
- power grip 328, 337, 338, 352
- precision grip 328, 337, 338, 352
- prehensile digits 327
- premolars 334
- presentation of data 15–16
- pressure receptors 62
- presynaptic membrane 60
- prevention of diseases 175
 vaccines 175–80
see also treatment of diseases
- primary response 170
- primates
 brow ridges 335, 348, 353, 355, 356
 carrying angle 330–1
 centre of gravity 332
 changes in the relative size of the
 cerebral cortex 326–7
 characteristics 324
 dentition 335–6, 348
 foot 331–2
 hierarchy 323–4
 humans as 323–4
 jaw 330, 334, 335, 352, 353, 357
 knee 331
 locomotion – adaptations to bipedalism
 and quadrupedalism 328–34
 mobility of digits 327–8
 muscle tone 332
 pelvis 330
 phylogenetic tree 311, 325
 prognathism 330, 335, 348–9, 352,
 353, 357
 skulls 337, 365–7
see also chimpanzees; gorillas;
 hominins; humans
- primers 271, 272
- principle of superposition 302, 303
- privacy 278
- processing data 12–14
- progesterone 39, 40, 115
- prognathism 330, 335, 348–9, 352, 353,
 357
- prokaryotes 155
- prolactin (PRL) 33, 34
- prosimians 325
- protection of the central nervous system
 79–81
- protective reflexes 63, 162–3
- protein channels 54–5
- protein hormones 30
- protein sequences, as evidence of
 evolution 282–4
- pseudounipolar neurons 51, 52
- pus 163, 164, 165
- pyramidalis muscles 309
- pyrogens 166
- ## Q
- quadrupedalism, evolutionary process
 to bipedalism 328–34
- qualitative data 11
- quantitative data 11
- ## R
- radiation 116, 117
- radiocarbon dating 300–1, 314–15
- radioisotope methods of dating 299–301
 investigating 314–16
- random genetic drift 251
- range 13
- rates 13
- ratios 13
- reabsorption 134
- reaction times 71
- receptor neurons 50
- receptor proteins 30, 31
- receptors 61, 63
 feedback systems 106
 types of 61–3
- recessive mutations 242
- recognition sequence 201
- recognition site 201
- recombinant DNA 176, 199–206
- recombinant DNA technology 200–1
 development 201–5
 DNA ligase 203
 examples of use 205
 for insulin manufacture 209
 restriction enzymes 201–3
 simplified diagram 204
 terminology 205
 and vaccines 205–6
 vector use 204
- recombinant vaccines 205–6
- recombinant yeast 206
- reference to other works 16
- reflex arc 63
 components 63

- reflexes 63–4
 investigating 70–1
 learnt 64
 properties 63
- refractory period 57
- relative dating 299, 302–4
 stratigraphy 302–4, 316
- relay neurons 50
- releasing factors 32, 33
- reliability of results 10
- renal artery 133
- renal vein 133
- repetition 9–10
- replication 9–10
- repolarisation 57
- repolarised membrane 57
- respiratory centres 85, 139, 140
- respiratory system 138
- resting membrane potential 54, 55, 56
- restriction enzymes 201–3, 205, 273
 effect on lambda DNA 286–8
 examples 203
 investigating 217–18
- reverse transcriptase 280
- RNA 156, 157, 181
- S**
- S-shaped spinal curve in humans 329, 330
- Saccharomyces cerevisiae*, effect of ultraviolet radiation on 256–9
- safety 8
- saltatory conduction 58, 59
- Sanger's method of DNA sequencing 275, 276–7
- saturation (hormone receptors) 31
- scaffold 215
- scavenging 359
- Schwann cells 49
- scientific investigations
 case study 19
 reporting on 17–18
- scientific method 6–8
- scientific report format 18
- sebum 161
- secondary data 12
- secondary response 170
- secretion 30, 134
- selection 254, 255
- selective agent 246
- selective breeding 200
- self-antigens 169
- sense organs 61
- sensory areas (cortex) 83
- sensory axons 87
- sensory fibres 88, 89
- sensory neurons 50, 63, 64
 direction of nerve impulses 51
- Sewall Wright effect 251
- sex chromosomes
 monosomy 242
 trisomy 241–2
- sex hormones 39
- shelters, building of 359
- shivering and heat gain 118, 119, 166
- sickle-cell anaemia 248–50
 distribution 249
 investigating 262
 and malaria 249–50, 262
- silent mutations 237
- Sinanthropus pekinensis* 354
- skeletal muscle 91
- skin
 as defence against disease 161
 showing receptors 62
 showing sweat glands 117
 and temperature regulation 116–17
 vasoconstriction effects 117, 118, 166
 vasodilation effects 117, 119, 165
- skin arterioles 118, 119
- slime layer 155
- small intestine 39
- smallpox 177
- sneezing 162
- sociocultural barriers to gene flow 244
- sodium ions 55, 56, 57, 60
- sodium–potassium pump 55–6, 136
- soil type, effect on fossilisation 297
- Solutrean culture 362, 363
- somatic division (somatic nervous system) 90
 difference in motor pathway to autonomic division 91
- somatic mutation 236
- somatic sensory neurons 89, 90
- special creation 244
- speciation 254–5
- species 254
- specific defences against diseases 160, 167–74
- spinal column, curvature 329–30
- spinal cord 79, 86–7, 89
 cross-section 86, 89
 functions 87
 neurons 48, 49, 50
 position 86
 protection 79–81, 86
 and reflexes 63, 64
- spinal nerves 89, 139
- spinal reflex 63
- spinal reflex arc 63
- spirilla 156
- spontaneous mutations 236
- staggered cut (DNA) 202, 205
- steady state 105
- stem cells 215
- steroid hormones 30
- sticky ends (DNA) 202, 205
- stimuli
 and feedback systems 105, 106
 and receptors 61–3
- stimulus–response–feedback model 106
- stomach 39
- stomach juices 161
- stone tools 358, 359, 360
- straight cut (DNA) 202
- stratigraphy (for dating fossil material) 302–4, 316
- striding gait 333, 338–9
- structural neurons 50–1, 52
- struggle for existence 246
- sub-unit vaccines 176
- subspecies 255
- substitution mutations 237, 238
- sulci 82
- suppressor T-cells 173
- surveys 5
- survival of the fittest 246
- sweat 117, 161
- sweat glands 117, 132
- sweating, and heat loss 117–18, 119–20
- sympathetic division (sympathetic nervous system) 90, 91, 92
 effect of stimulation 93
 fight-or-flight response 92–3
- synapses 49–50, 63
 transmission across a 59–60
- synthetic hormones 207–12
- synthetic nucleotides 276
- T**
- T lymphocytes 37, 172
- T-cells 168, 170
 response to, in cell-mediated immunity 172–3
- tables 15
- Taq polymerase 273
- target cells 30
- target organs 30
- Tay-Sachs disease (TSD) 242
 in Ashkenazi Jews 253
 and tuberculosis 250
- technology used to treat diseases 199–223
 gene therapy 213–15
 recombinant DNA 176, 199–206
 synthetic hormones 207–12
- teeth
 hominins 348
 number and shape of, primates 334–5
- temperature receptors 116
- temperature regulation, and skin 116–17
- temperature tolerance 121–2
- temporal lobe 2
- testes 39, 40
- testosterone 39, 40
- tetanus 175
- thalassemia 250
- theory of evolution, development of 244–6
- theory of natural selection 246
- thermocycling 271
- thermoreceptors 61, 116, 166
- thermoregulation 62, 114–23
 hypothalamus role 118–19, 120–1
- third molars (wisdom teeth) 309
- thirst centre 136
- thirst response 136–7
- threshold 56
- thumb
 mobility 327–8, 337–8
 opposability 327–8

- thymine 199, 200, 275
 thymosins 37, 39
 thymus 37, 39, 168
 thyroid disorders 210–12
 thyroid gland 36, 39, 210, 211
 thyroid hormone 211, 212
 investigating 223
 thyroid-stimulating hormone (TSH) 33, 34, 119, 210
 thyroxine (T4) 36, 39, 119, 210, 211, 212
 tissue engineering 215–16
 tissue fluid 131
 Tobias, Phillip 354
 tools
 trend in 364
 used by australopithecines 358
 used by *Homo erectus* 359–60
 used by *Homo habilis* 359
 used by *Homo neanderthalensis* 360–1
 used by *Homo sapiens* 360–2
 total drug resistance 181
 touch receptors 62
 toxoid vaccines 176
 toxoids 176
 tracts 83, 87
 transcellular fluid 131
 transgenic organisms 201, 205
 translocation mutations 238
 transmissible diseases 155
 transmission of diseases 158–9
 investigation 184–6
 transmission of the nerve impulse 58–9
 across a synapse 59–60
 chemical effects 60
 myelinated fibres 58–9
 unmyelinated fibres 58
 transverse arch 331–2
 treatment of diseases
 antibiotics 180–1
 antivirals 181–2
 tri-iodothyronine (T3) 36, 39, 210, 211
 trial and error 5
 trilobites 303
 trisomy 240
 sex chromosomes 241–2
 trisomy 13 241
 trisomy 21 240–1
 tuberculosis, and Tay-Sachs disease 250
 Turner syndrome 242
 karyotype 241
- Type 1 diabetes 208, 209
 gene therapy 214
 insulin injections 208, 209
 Type 2 diabetes 208–9
- U**
 ubiquitous proteins 282
 ultraviolet radiation 235
 effect on *Saccharomyces cerevisiae* 256–9
 uncontrolled variables 9
 undifferentiated B-cells 170
 unipolar neurons 50, 51, 52
 unmyelinated fibres 48, 49
 transmission along 58
 urea 133
 ureter 133
 urethra 133
 urinalysis, simulated 144–7
 urine 134, 135
- V**
 vaccination 175, 176
 factors to consider 179–80
 and herd immunity 178–9
 of populations 177–9
 recommended schedule for
 Australians 177
 safety 179
 schedule 176–7
 vaccine manufacture 179
 ethical issues 179–80, 187
 investigating the testing of animals
 in 187
 production using recombinant
 DNA methods 176
 vaccines 175–80
 delivery 176
 and recombinant DNA technology
 205–6
 social, cultural and ethical factors
 179–80
 traditional types 175–6
 validity 10
 variables 9
 variation 246, 254, 255
 vasoconstriction 117, 118, 166
 vasodilation 117, 119, 165
 vasomotor centre 85
 vasopressin 34
 vector transmission (pathogens) 158, 159
- vectors (genetic engineering) 204, 205
 ventral root 89
 Venusians, natural selection in 259–60
 vertebrae 79
 vertebral canal 79
 vestigial structures 306, 308–9
 vibrio 156
 viral replication 157
 virulence 175, 176
 viruses 156–7
 antiviral drugs 181–2
 diseases 158
 genetic material 156, 157, 181, 280
 size of 156
 structure 157
 visceral sensory neurons 89, 90
 visualising DNA 274
 voltage-gated calcium ion channel
 59, 60
 voltage-gated channels 54, 56–7,
 59, 60
 voltage-gated potassium channels 57
 voltage-gated sodium channels 56
 voluntary control of breathing 142
 vomiting 162
- W**
 Wallace, Alfred Russell 244, 246
 Warren, Robin 3
 water
 in the body 130
 movement through plasma
 membranes 131
 movement through various parts of
 the body 136
 water balance
 kidneys and aldosterone 136
 kidneys and antidiuretic hormone 135
 thirst response 136–7
 water intake 132
 water intoxication 137
 water levels, controlling 134–7
 water loss 132, 133, 134, 137
 water vapour 132
 white matter 81, 83, 84, 86, 87
 whooping cough 178
 wisdom teeth 309, 348
 World Health Organization (WHO) 177
- X**
 X-rays 235