

# Index

Page numbers in *italics* denote figures, those in **bold** denote tables.

- A blood group **336**  
 AB blood group **336**  
 abciximab **319**, 320  
 ABO blood group system 334–5, 336, **336**, 337  
   antibodies 334, **336**  
   haemolytic disease of newborn 352  
   and venous thrombosis 306  
 ABVD regimen 211  
 acanthocytes 23  
 acanthocytosis 325  
 aciclovir 259  
 acquired haemolytic anaemias 68–71  
   chemical and physical agents 71  
   immune 68–70, **68**, 69, 70  
   infections 71  
   march haemoglobinuria 70  
   red cell fragmentation syndromes 70, 70, **70**  
 actin 19  
 activated partial thromboplastin time (aPTT) 276, **276**  
   coagulation disorders **294**, **299**  
 activated protein C (APC) 275, 275, 304  
 activation domain 8  
 acute hyperviscosity syndrome 221  
 acute lymphoblastic leukaemia (ALL)  
   186–96  
   BCR-ABL1 positive 194–5  
   classification 188, **188**, **189**  
   clinical features 188, 188, 189  
   CNS-directed therapy 193  
   cytogenetics/molecular genetics 189–91, 190, 191  
   immunological markers **189**  
   incidence and pathogenesis 187, 187  
   intensification (consolidation) therapy 192–3  
   investigations 188–9, 189, **189**  
   maintenance therapy 193–4  
   minimal residual disease 192, 193  
   prenatal origin 187  
   prognosis **194**, 196, 195  
   relapse 193, 194  
   remission induction 192  
   specific therapy 192, 192, 194  
   supportive therapy 192  
   toxicity of therapy 194  
 acute myeloid leukaemia (AML) 145–55  
   blood film 150  
   classification **146**, 147–8  
   clinical features 148, 148, 149  
   cytogenetics/molecular genetics **146**, 149, 151, **151**, 152  
   incidence 147  
   investigations 148–9, **149**  
   older patients 153  
   outcome 154, 155  
   pathogenesis 147, 147  
   prognosis **151**, 153  
   relapse 154  
   stem cell therapy 153  
   treatment 149, 151–3, 152–4  
 acute promyelocytic leukaemia 149  
   treatment 152–3  
 ADAMTS13 267, 285, 285, 286  
 adaptive immune system 88  
 adhesion molecules 8  
 adriamycin **142**  
   BEACOPP regimen 211  
 adult T-cell leukaemia/lymphoma 203, 204, 226  
 African iron overload 43  
 age effects *see* older patients  
 AIDS *see* HIV/AIDS  
 Alder's anomaly 93  
 alemtuzumab **143**  
   aplastic anaemia 246  
   CLL 201  
 alkylating agents 140, 141, **142**  
   *see also individual drugs*  
 ALL *see* acute lymphoblastic leukaemia  
 all-trans retinoic acid (ATRA) 141, 144, 152  
   ATRA syndrome 153  
 allele-specific priming 85  
 allergic reaction to blood transfusion 342  
 allogeneic stem cell transplantation 236, 255–62  
   chimaerism analysis 256  
   complications 256–61, **258**  
   donor leucocyte infusions 261, 262  
   graft failure 260  
   graft-versus-leukaemia effect 261, 261  
   HLA system 255–6, 255, **256**  
   post-transplant lymphoproliferative diseases 261–2, 262  
 alloimmune haemolytic anaemias 70  
 alternative complement pathway 109, 109  
 amegakaryocytic thrombocytopenia 244  
 aminocaproic acid 280  
 $\gamma$ -aminolaevulinic acid 16, 29  
 AML *see* acute myeloid leukaemia  
 amplification enzyme system 109  
 amplifications 130  
 amyloidosis 23–9, **239**, 239  
 anaemia 19–25, **20**  
   aplastic 91, 243–7  
   blood film 22–3, 23  
   bone marrow in 23–4, 24  
   of chronic disorders 37, **37**, **38**, 322, **322**  
   classification **22**  
   clinical features 20–1, 21  
   congenital dyserythropoietic 249  
   global incidence 19–20  
   haemolytic *see* haemolytic anaemias  
   HIV/AIDS 328  
   hypochromic 27–40, 28  
   ineffective erythropoiesis 24–5, 25  
   iron deficiency 32–7  
   laboratory findings 33, **38**  
   lead poisoning 39  
   leucocyte and platelet counts 22  
   macrocytic 49, 58–9, **58**  
   malignant disease 322, 323  
   megaloblastic *see* megaloblastic anaemia  
   microangiopathic haemolytic 70, 322  
   neonate 349–50, 349  
   older patients 322  
   pernicious 52–3, **53**  
   pregnancy 347, 347  
   of prematurity 350  
   red cell indices 21  
   refractory **178**  
   renal failure 325, 325  
   sideroblastic 38–9, 38, **38**, **39**  
   *see also specific types*  
 anaplastic large cell lymphoma 226  
 androgens in aplastic anaemia 246  
 aneuploid cells 127  
 angioimmunoblastic lymphadenopathy 226  
 angular cheilosis 34, 54  
 ankyrin 19  
 anthracyclines 141, **142**

- anti-emetics in haematological malignancies 137
- antibiotics 139  
cytotoxic **142**, 143
- antibody-dependent cell-mediated cytotoxicity 106
- anticardiolipid antibodies **307**
- anticoagulants 312–18, *312*  
direct-acting parenteral 315  
heparin **299**, 312–15, **313**  
oral 315–18, **315–17**  
vitamin K antagonists 315–18, **315–17**  
*see also specific drugs*
- antigen-presenting cells (APCs) 109
- antigen-receptor gene rearrangements 107, *107*, *108*
- antigenic specificity 103
- antiglobulin test 65, 340, *340*
- antihæmophilic factor *see* factor VIII
- antihuman globulin 340
- antimetabolites 141, *141*, **142**, 143
- antiphospholipid syndrome 307
- antiplatelet drugs 287, 318–20, *319*, **319**
- antithrombin deficiency 305
- antithymocyte globulin 246
- antiviral drugs 139
- apixaban **317**, 318
- aplastic anaemia 91, 243–7, *243*  
causes **243**  
clinical features 245–6, *245*  
congenital (Fanconi anaemia) 244, *244*  
diagnosis 246  
idiopathic acquired 244  
laboratory findings 246  
pathogenesis 244  
secondary causes 245  
treatment 246–7
- apoptosis 9–10, *9*
- argatroban 315
- arsenic **143**, 144
- arterial thrombosis 303, *303*, **303**
- Ashwell-Morell receptor 266
- asparaginase *141*, **143**, 144
- aspergillosis 139–40, *139*, *140*
- aspirin 319, **319**  
platelet function disorders 287, *288*  
polycythaemia vera 171
- atherosclerosis *see* arterial thrombosis
- ATRA syndrome 153
- atrophic gastritis 33, 35, 37, 53
- Auer rods *150*
- autoimmune gastritis 35, 52
- autoimmune hæmolytic anaemias 68–70, *69*  
classification **68**
- cold 69–70  
warm 68–9, *69*
- autoimmune (idiopathic) thrombocytopenic purpura 282–3, *282*  
*see also* idiopathic thrombocytopenic purpura
- autologous blood transfusion 343–4
- autologous stem cell transplantation 254, *255*
- automated blood cell counter *12*
- autotransfusion 343–4
- azacytidine **142**  
myelodysplasia 184
- azathioprine *141*
- B blood group **336**
- B cells 103–4  
functional aspects **105**  
immunodeficiency **113**
- B-cell chronic lymphoid leukaemias 198–203
- B-cell prolymphocytic leukaemia 202, *202*
- B-cell receptor 104, *105*
- bacterial infections  
in cancer patients 138–9  
haematological changes 327–8  
and haematological malignancies 125  
transfusion-related **339**, 342
- band neutrophils 89, *89*
- Barr bodies 94
- basket cells *23*
- basophil leucocytosis (basophilia) 97
- basophils **12**, 88, 88, 90  
blood count **20**, **88**
- BCL-2 9
- BCR-ABL inhibitors **142**, 143
- BCR-ABL1 mutation 161, 187, 194–5
- BEACOPP regimen 211
- Bence-Jones protein 232
- bendamustine **142**
- benign ethnic neutropenia 95
- Bernard-Soulier syndrome 266, 287
- bilirubin 61
- biopsy of bone marrow 24, *24*, **25**
- bisphosphonates 237
- bivalirudin 315
- blackwater fever 329
- bleeding disorders 278–89  
abnormal bleeding 279, **279**  
thrombocytopenia *see* thrombocytopenia  
vascular 279–80, **279**
- bleeding time 277
- bleomycin *141*, **142**, 143  
BEACOPP regimen 211
- blood cells 12, *12*, **12**, *13*  
count *see* blood count  
*see also* red cells; white cells
- blood coagulation *see* coagulation
- blood components 343–5, *343*
- blood count **20**, **88**, 276  
*see also specific cell types*
- blood disorders and venous thrombosis 307
- blood donors 334, **335**  
*see also* blood transfusion
- blood film 276  
acute myeloid leukaemia *150*  
adult T-cell leukaemia/lymphoma 203  
ALL *190*  
anaemia 22–3, *23*  
autoimmune hæmolytic anaemia *69*  
B-cell prolymphocytic leukaemia 202  
 $\beta$ -thalassaemia major *79*  
CLL *199*
- blood film CML, *159*, *163*  
diffuse large B-cell lymphoma *224*  
eosinophilic leucocytosis *97*  
G6PD deficiency *67*  
hairy cell leukaemia *203*  
hereditary spherocytosis *65*  
iron deficiency 34, *34*, *35*  
large granular lymphocytic leukaemia *203*  
liver disease *325*  
lymphocytosis *112*  
malignant disease *323*, *324*  
mantle cell lymphoma *223*  
megaloblastic anaemia *55*  
microangiopathic hæmolytic anaemia *70*  
multiple myeloma *235*  
myelodysplasia *183*  
myelofibrosis *174*  
non-Hodgkin lymphoma *218*  
renal failure *325*  
sickle cell anaemia *84*  
splenic atrophy *117*  
thrombocythaemia *173*  
thrombotic thrombocytopenic purpura *286*
- blood groups  
antibodies 334, **336**  
determination of *340*, *340*  
serology 339–40  
*see also individual blood groups*
- blood loss *see* haemorrhage
- blood products  
haematological malignancies 136–7  
irradiated **342**  
post-stem cell transplant 259  
reduction of use 342–3  
*see also* blood transfusion

- blood salvage 344
- blood transfusion 333–45, 334  
 autologous 343–4  
 bacterial contamination 342  
 blood group serology 339–40  
 complications 340–2, **341**  
 cross-matching and pre-transfusion tests 340, 340, **341**  
 hazards of 338–9, **338, 339**  
 iron overload 44, 44, 45, 342  
 massive transfusion syndrome 287  
 post-transfusion purpura 284, 342  
 protection of recipient **338**
- bone morphogenetic protein (BMP) 30
- bone marrow 2, 2  
 ALL 188  
 anaemia 23–4, 24  
 biopsy 24, 24, **25**  
 failure 245  
 HIV/AIDS 329  
 iron stores 34, 35  
 myelodysplasia 180  
 pluripotent stem cells 3  
 red cell aplasia 247  
 stroma 4, 4  
 transplantation 251  
 trephine biopsy 24, 24, **25**
- Borrelia burgdorferi* **339**
- bortezomib 141, 143, **143**  
 mantle cell lymphoma 223  
 multiple myeloma 237  
 VMP regimen 235
- bosutinib **142, 160**
- bridging anticoagulation 316–17
- Brucella melitensis* **339**
- Burkitt lymphoma 224–5, 225  
 cytogenetics **217**  
 immunophenotype **217**
- burr cells 325
- C-reactive protein 332
- C282Y mutation 43
- CALR (calreticulin) mutation 166, 167, **172**
- Candida* infections in cancer patients 140
- CAR (chimeric antigen receptors) 194
- carfilzomib **143**  
 multiple myeloma 235, 237
- caspsases 9
- CD2 **189**
- CD3 **189**
- CD7 **189**
- CD10 **189**
- CD11c **147**
- CD13 **147**
- CD14 **147**
- CD19 **189, 194**
- CD20 antibodies 201
- CD22 **189**
- CD33 **147**
- CD39 270
- CD41 **147**
- CD42 **147**
- CD52 antibodies 201
- CD61 **147**
- CD64 **147**
- CD79a **189**
- CD117 **147**
- Cdks 8
- CDT regimen 235
- cell cycle 8
- central nervous system lymphoma 224, 225
- central venous catheters 136, 136
- centroblasts 111
- centromere 128, 129
- cerebral lymphoma 224, 225
- checkpoints 8
- Chédiak-Higashi syndrome 93, 94, 95
- chelation therapy 45–7, 46
- chemical exposure  
 acquired haemolytic anaemias 71  
 haematological malignancies 124
- chemokines 92–3
- chemotaxis 92  
 defects 93
- children  
 blood count **88**  
 Burkitt lymphoma 224–5, 225  
 haemolytic uraemic syndrome 286  
 iron requirements **33**  
 juvenile myelomonocytic leukaemia 184  
 myelodysplasia **178**  
 sites of haemopoiesis **2**  
*see also* neonates
- chimaerism 256
- chimeric antigen receptors (CAR) 194
- chlorambucil **142**
- 2-chlorodeoxyadenosine **142**
- CHOP regimen 223
- Christmas disease *see* haemophilia B (Christmas disease)
- Christmas factor *see* factor IX
- chromosomes 127–9, 128, 129
- chronic disorders, anaemia of 37, **37, 38, 322, 322**
- chronic eosinophilic leukaemia 164
- chronic lymphocytic leukaemia (CLL)  
 198–202  
 classification **198**  
 clinical features 198–9, 198, 199  
 course 202  
 cytogenetics **217**  
 immunophenotype **200, 217**  
 laboratory findings 199–200, 199  
 molecular tests 200, **200**  
 pathogenesis 198  
 prognosis **202**  
 staging 200, **201**  
 treatment 200–2
- chronic lymphoid leukaemias 197–204  
 B-cell 198–203  
 diagnosis 198  
 T-cell 203–4  
*see also specific types*
- chronic myeloid leukaemia (CML) 156–64, **157**  
 accelerated phase disease 162–3  
 atypical 184  
 clinical features 159  
 genetic mutations **166**  
 laboratory findings 159, 159  
 Philadelphia chromosome 157–8  
 prognostic scores 159  
 stem cell therapy 162, 163  
 treatment 160–2, 160–3, **160, 162**
- chronic myelomonocytic leukaemia 180, 184
- chronic neutrophilic leukaemia 164
- ciclosporin  
 aplastic anaemia 246  
 CLL 201
- cidofovir 259
- classical complement pathway 109, 109
- clg **189**
- CLL *see* chronic lymphocytic leukaemia
- clofarabine **142**
- clonal abnormalities **128**
- clonal progression 125, 127, 127
- clopidogrel 287, 288, **319, 320**
- Clostridium perfringens* 328, 328
- CNS *see* central nervous system
- coagulation 270–3  
 amplification 272–3, 272  
*in vivo* 270–1  
 initiation 271  
 physiological limitation 274  
*see also* haemostasis
- coagulation cascade 270, 271
- coagulation disorders 290–301  
 acquired 296–301, **296**  
 circulating antibodies 300–1  
 disseminated intravascular coagulation 287, 297–300, 298  
 haemophilia A 291–5

- coagulation disorders (*continued*)  
 haemophilia B (Christmas disease) **293**, **294**, 295  
 hereditary 291–6, 291  
 liver disease 297  
 malignant disease 322–3, **324**  
 massive transfusion syndrome 287, **299**, 301  
 renal failure 326  
 von Willebrand disease **294**, 295–6, **295**
- coagulation factors **271**, **273**  
 assays 277  
 circulating antibodies 300–1  
 inhibitors 275  
 vitamin K deficiency 296–7, 297  
*see also specific factors*
- cobalamin 49
- cold autoimmune haemolytic anaemias 69–70
- colony-stimulating factor (CSF) 90
- colorectal carcinoma 36
- complement 109, 109
- compression paraplegia 237
- compression ultrasound 308
- computed tomography *see* CT
- conditioning of stem cells 253
- congenital dyserythropoietic anaemia 249
- congestive heart failure 326
- conjunctival pallor 21
- connective tissue disorders 279  
 haematological changes 324  
*see also specific conditions*
- contrast venography 308
- Coombs' test 65, 340, 340
- cords of spleen 117, 117
- corticosteroids **142**, 143  
 idiopathic thrombocytopenic purpura 283
- coumarins *see* warfarin
- Coxiella burnettii* **339**
- CRAB acronym 231
- Creutzfeldt-Jacob disease 339, **339**
- cross-matching of blood 340, 340
- cryoprecipitate 344
- CT  
 multiple myeloma 233  
 non-Hodgkin lymphoma 219, 220
- CT pulmonary angiography 309, 309
- cyclin-dependent protein kinases *see* Cdks
- cyclins 8
- cyclophosphamide **142**  
 BEACOPP regimen 211  
 CHOP regimen 223  
 CLL 200  
 R-CVP regimen 222
- cytogenetics  
 ALL 189–91, 190, 191  
 AML **146**, 149, 151, **151**, 152  
 Burkitt lymphoma **217**  
 CLL **217**  
 diffuse large B-cell lymphoma **217**  
 follicular lymphoma **217**  
 hairy cell leukaemia **217**  
 lymphoma **217**  
 lymphoplasmacytic lymphoma **217**  
 MALT lymphoma **217**  
 mantle cell lymphoma **217**  
 myelodysplasia **179**
- cytokinesis 8
- cytomegalovirus infection  
 haematological changes 328  
 post-stem cell transplant 259  
 transfusion-related 338
- cytosine arabinoside 141, **142**
- cytotoxic drugs 140–3, 141, **142–3**
- D-dimer 277  
 deep vein thrombosis 308  
 pulmonary embolus 309
- dabigatran **317**, 318
- dasatinib **142**, **160**
- daunorubicin **142**
- DDAVP 267, 293–4, 296
- decitabine **142**, 184
- deep vein thrombosis 308, **308**  
 prophylaxis 318  
*see also* thrombosis
- deferasirox 45, 46
- deferiprone 45–6, 46
- deferoxamine 46
- deletions 129, 130
- demethylation agents 141, **142**, 144
- dendritic cells 97, **98**, 109  
 neoplasms 226
- deoxycoformycin **142**
- deoxyhaemoglobin 17
- 1-diamino-8-D-arginine vasopressin *see* DDAVP
- Diamond-Blackfan syndrome 244, 247, **248**
- differentiation syndrome 153
- diffuse large B-cell lymphoma 223–4, 224  
 cytogenetics **217**  
 immunophenotype **217**
- dihydrofolate reductase 51, 52
- diploid cells 127
- dipyridamole 287, 320
- direct antiglobulin test (DAT) 340
- disseminated intravascular coagulation 287, 297–300, 298
- clinical features 298–9, 299  
 laboratory findings 299, **299**  
 pathogenesis 297–8, **298**  
 treatment 299–300, **300**
- divalent metal transporter 1 *see* DMT-1
- DMT-1 29, 30
- DNA methylation 179
- DNA microarrays 131, 132
- DNA-binding domain 8
- Döhle bodies 93
- Donath-Landsteiner antibody 69–70
- donor leucocyte infusions 162, 253, 261, 262
- driver mutations 125, 147
- drug interactions, oral anticoagulants 315, **316**, **317**
- drug-induced disorders  
 aplastic anaemia **243**  
 haematological malignancies 124  
 immune haemolytic anaemias 70, 70  
 neutropenia 95  
 platelet function 287, 288  
 thrombocytopenia 281, **281**, 284, 284
- Duffy blood group system **336**
- duplications 129, 130
- dyskeratosis congenita 244
- Eastern Cooperative Oncology Group (ECOG) Performance Status 136, **136**
- echinocytes 23
- eculizumab 247
- edoxaban **317**
- Ehlers-Danlos syndrome 279
- electrocardiogram in pulmonary embolus 308
- elliptocytes 23
- elliptocytosis 19  
 hereditary **64**, 65, 65
- eltrombopag 246, 283, 284
- Embsden-Meyerhof pathway 18, 18  
 defects 67–8
- endothelial cells 273, 274
- enteropathy-associated T-cell lymphomas 226
- eosin-5-maleimide 65
- eosinophils **12**, 88, 88, 90  
 blood count **20**, **88**
- eosinophilic granuloma 98
- eosinophilic leucocytosis (eosinophilia)  
 causes 96–7, 97, **97**  
 myeloid neoplasms **166**
- epigenetic changes 129, 130–1
- epigenetics 8–9, **8**, 130, 178
- Epstein-Barr virus (EBV) 111–12  
 antibody 113  
 post-stem cell transplant 259

- eptifibatide **319**, 320  
 erythroblasts *13*  
 erythrocyte sedimentation rate 330, 332  
 erythrocytes *see* red cells  
 erythrocytosis (primary polycythaemia) 168, **168**  
 erythropoiesis 11–26  
   assessment of 25  
   ineffective 24–5, 25  
 erythropoietin 5, **6**, 13–16, *15*, 326  
   clinical uses **16**  
   and haemoglobin production *15*  
   indications for therapy 16  
   thrombocythaemia **172**  
 essential thrombocythaemia *see*  
   thrombocythaemia  
 etoposide *141*, **142**  
   BEACOPP regimen 211  
*ETV6-RUNXI* translocation 187  
 extramedullary haemopoiesis 118  
 extravascular haemolysis 63
- 18F-fluorodeoxyglucose *see* FDG  
 factor I 270, 273, **273**  
 factor II **271**, **273**  
 factor IIa inhibitors **317**  
 factor III **271**, 272, 273, 275  
 factor V **271**, **273**  
   deficiency 296  
 factor V Leiden mutation 304–5, 305  
 factor VII **271**, **273**  
   deficiency 296  
   freeze-dried concentrates 344  
   recombinant activated 294  
 factor VIII **271**, **273**, 293  
   autoantibodies 300  
   deficiency *see* haemophilia A  
   inhibitors 294  
   raised, in venous thrombosis 306  
   recombinant 293  
 factor IX **271**, **273**  
   deficiency *see* haemophilia B (Christmas disease)  
 factor IX-prothrombin complex  
   concentrates 344–5  
 factor X **271**, **273**  
   deficiency 296  
 factor Xa inhibitors **317**  
 factor XI **271**, **273**  
   deficiency 296  
 factor XII **271**  
 factor XIII **271**, 273, **273**  
   deficiency 296  
 familial amyloidosis **238**  
 familial polycythaemia **75**
- Fanconi anaemia 244, 244, 245  
 FDG-PET in Hodgkin lymphoma 209–10, 210  
 FEIBA 300  
 Felty's syndrome 324  
 ferrireductase 31  
 ferritin  
   hyperferritinaemia **42**  
   iron in **28**  
   regulation 29  
   serum levels **20**, 35, 36  
 ferroportin 31, 32  
 fertility in cancer patients 137  
 fetomaternal alloimmune thrombocytopenia 350  
 fetus/fetal  
   haemoglobin **16**, 73, 74, 81  
   sites of haemopoiesis **2**  
   *see also* neonates  
 fibrin (factor I) 270, 273, **273**  
 fibrin-stabilizing factor *see* factor XIII  
 fibrinogen **271**, 272–3  
   defects 306  
   quantitation **276**  
   raised, in venous thrombosis 306  
 fibrinolysis 275–6, 276  
   tests of 277  
 fibrinolytic agents 318  
   contraindications **319**  
 Fitzgerald factor (high molecular weight kininogen) **271**  
 Fletcher factor (prekallikrein) **271**  
 flow cytometry 131, 132, 133  
   ALL **189**  
   platelet function 277  
 fludarabine *141*, **142**  
   CLL 200  
 fluorescence *in situ* hybridization (FISH) 131, 131  
 FOG-1 14  
 folate **50**, 51–2  
   absorption, transport and function 51  
   red cell **20**, **57**  
   reduction 52  
   serum **20**, **57**  
   structure 51  
 folate deficiency 53  
   causes **53**  
   clinical features 53–6, 54–6, **54**  
   diagnosis 56–7, **57**  
   pregnancy 347  
   tests for cause 57, **57**  
   treatment 57–8, **57**, 58  
 follicular lymphoma 222–3, 222  
   cytogenetics **217**  
   immunophenotype **200**, **217**
- fondaparinux 315  
 foscarnet 259  
 fresh frozen plasma (FFP) 344  
 fungal infections in cancer patients 139–40, 139, 140
- G1 phase 8  
 G2 phase 8  
 ganciclovir 259  
 gastritis  
   atrophic 35, 37, 53  
   autoimmune 35, 52  
 GATA-2 4, 14  
 Gaucher's disease 99, 99, 100  
 gene segments 107, 107  
 gene sequencing 131  
 gene therapy in haemophilia A 294  
 genetic markers 133–4, 133, 134  
 genetics  
   ALL 189–91, 190, 191  
   AML **146**, 149, 151, **151**, 152  
   CML **166**  
   haematological malignancies 124–7, 125–7, **126**  
   pre-implantation genetic diagnosis 85  
 germinal centre *111*  
 giant cavernous haemangioma 279  
 Gilbert's disease 64  
 glandular fever *see* infectious mononucleosis  
 Glanzmann's thrombasthenia 266, 287  
 glossitis 32, 54  
 glucose-6-phosphate dehydrogenase  
   deficiency 66–7, 66, 67  
 glutathione deficiency 67  
 glycophorin **147**  
 glycoprotein IIb/IIIa inhibitors **319**, 320  
 golf ball cells 77  
 graduated compression stockings 318  
 graft-versus-host disease 256, 258  
   acute 257, 258, **258**  
   chronic 258  
   post-transfusion 342  
 graft-versus-leukaemia effect 261, 261  
 granulocyte colony-stimulating factor (G-CSF) 5, **6**, 90  
   clinical uses 91  
   effects of 91  
 granulocyte-macrophage colony-stimulating factor (GM-CSF) 90  
 granulocytes 88, 89–90, 89  
   concentrates 344  
   *see also specific types*  
 granulopoiesis 90–1, 90, 91  
 growth factor receptors 6–8, 7  
 growth factors 4–6, 5, **5**, **6**

- haem 16, 30, 32  
 haem enzymes **28**  
 haemangioblasts 2  
 haematinics, normal values **20**  
 haematocrit **20**  
 haematological malignancies 122–34, 123, 135–44  
   aetiology 124–5, 124  
   diagnostic methods 131–3, 131–3  
   ECOG status 136, **136**  
   genetic abnormalities associated with 129–31, 129, 130  
   genetic markers 133–4, 133, 134  
   genetics 124–7, 125–7, **126**  
   incidence 123, 123  
   specific therapies 140–4, 141, **142–3**  
   supportive therapy 136–40  
   *see also specific therapies*  
 haematoma **279**  
 haematopoietin receptor superfamily 6  
 haemochromatosis **42**, 43–4, 43  
 haemoglobin 2, 13, 16–17, **16**, 73  
   and erythropoietin production 15  
   fetal-adult switch 74  
   function 17, 17  
   genetic disorders of 74–86, **75**  
   hereditary synthesis disorders 68  
   iron in **28**  
   molecular aspects 73–4, 73, 74  
   myelofibrosis **174**  
   normal values 20, **20**  
   oxygen dissociation curve 17, 20  
   prenatal diagnosis of genetic disorders 85, 86  
   synthesis 16–17, 16, 17, 73  
   thrombocythaemia **172**  
   *see also anaemia*  
 haemoglobin A **16**, 73  
 haemoglobin A2 **16**, 73  
 haemoglobin Barts **75**, 76, 76  
 haemoglobin C 80, 84, 85  
 haemoglobin Constant Spring 76  
 haemoglobin D 81, 85  
 haemoglobin E 81, 85  
 haemoglobin F **16**, 73, 81, 85  
 haemoglobin H 77, 80  
 haemoglobin Lepore 77, 81  
 haemoglobin S 17, 80, 85  
   *see also sickle cell anaemia*  
 haemoglobinaemia 63  
 haemoglobinuria 63, 64  
   march 70  
   paroxysmal cold 69–70  
   paroxysmal nocturnal 62, 246, 247, 247  
 haemolysis **75**  
 haemolytic anaemias 60–71  
   acquired 68–71  
   autoimmune *see* autoimmune haemolytic anaemias  
   classification 62, **62**  
   clinical features 62, 63  
   hereditary 64–8  
   intravascular/extravascular haemolysis 63, **63**, 64  
   laboratory findings 63  
 haemolytic disease of newborn 350–2, 351, 352  
   ABO incompatibility 352  
 haemolytic transfusion reactions 340–2, **341**  
 haemolytic uraemic syndrome 285, 285, 286  
   Rh incompatibility 350–2, 351, 352  
 haemophagocytic lymphohistiocytosis 98, 98  
 haemophilia A 291–5  
   antenatal diagnosis 291  
   carrier detection 291  
   clinical features 291, 292, 293  
   disease severity **293**  
   gene therapy 294  
   laboratory findings 291, **294**  
   molecular genetics 291, 291, 292  
   prophylaxis 294  
   treatment 293–4  
 haemophilia B (Christmas disease) 295  
   disease severity **293**  
   laboratory findings **294**, 295  
 haemopoiesis 1–10  
   extramedullary 118  
   regulation of 4, 7, 91  
   sites of 2, 2, **2**  
   stem and progenitor cells 2–4, 3  
 haemopoietic growth factors 4–6, 5–7, **5**, **6**  
   aplastic anaemia 247  
 haemopoietic progenitors 2, 3  
 haemorrhage  
   massive 345  
   retinal 21  
 haemorrhagic cystitis 260  
 haemorrhagic disease of newborn 296  
 haemosiderin 28  
 haemosiderinuria 63, 247  
 haemostasis 265, 273–5  
   disorders of 306  
   haematological malignancies 137  
   platelet plug 274–5  
   pregnancy 348  
   tests of 276–7, **276**  
   vasoconstriction 273–4  
   *see also blood coagulation*  
 Hageman (contact) factor *see* factor XII  
 hairy cell leukaemia 202–3, 203  
   cytogenetics **217**  
   immunophenotype **200**, **217**  
 Hand-Schüller-Christian disease 98  
 haploid cells 127  
 haploidentical stem cell transplantation 256  
 haptoglobins 61  
 Heinz bodies 24, 67, 71  
*Helicobacter pylori* 33  
   chronic idiopathic thrombocytopenic purpura 282  
   haematological malignancies 125  
   MALT lymphoma 221–2  
   pernicious anaemia 52  
 hemojuvelin 30, 43  
 HEMPAS 249  
 Henoch-Schönlein syndrome 280, 280  
 heparin 312–15, **313**  
   administration and laboratory control 313–14  
   bleeding during therapy 314  
   haemostasis tests **299**  
   indications 313  
   low molecular weight **313**, 314  
   mode of action 313, 313  
   osteoporosis 315  
   unfractionated 313–14, **313**  
 heparin-induced thrombocytopenia 314–15, 314  
 hepatitis, transfusion-related 338, **339**  
 hepcidin 29–30, 31, 43  
 hereditary haemolytic anaemias 64–8  
   elliptocytosis **64**, 65, 65  
   glucose-6-phosphate dehydrogenase deficiency 66–7, 66, 67  
   South-East Asian ovalocytosis 65  
   spherocytosis 64–5, **64**, 65  
 hereditary haemorrhagic telangiectasia 279, 280  
 herpes viruses 139  
   post-stem cell transplant 259  
   transfusion-related **339**  
 heterophile antibodies 112–13  
 hexose monophosphate shunt 18  
*HFE* gene 43  
 high molecular weight kininogen (Fitzgerald factor) **271**  
 histiocytes 97, **98**  
 histiocytic cell neoplasms 226  
 HIV/AIDS  
   cerebral lymphoma 224, 225  
   haematological changes 328, 329  
   transfusion-related 338, **339**

- HLA system 255–6, 255, **256**  
 inheritance 257  
 and stem cell transplantation 256
- HLA-restricted T cells 109
- Hodgkin lymphoma 205–12  
 advanced stage 211  
 clinical features 206, 206, 207  
 diagnosis and histological classification  
 207, 207, 208, **208**  
 early stage 211  
 FDG-PET 209–10, 210  
 haematological and biochemical findings  
 206–7  
 history and pathogenesis 206  
 late effects 212  
 prognosis **210**, 212  
 Reed-Sternberg cells 133, 206, 207  
 relapse 211–12  
 response to treatment 211  
 staging 208–9, 209, **209**  
 treatment 210–12, **210**, 211, 212  
 WHO classification **208**
- Howell-Jolly bodies 24, 117, 120
- human albumin solution (4.5%) 344
- human albumin solution (20%) 344
- human leukocyte antigen *see* HLA
- human T-cell leukaemia virus, transfusion-related 338
- Hurler's syndrome 94
- hydrops fetalis **75**, 76, 76, 352, 352
- hydroxocobalamin **57**
- hydroxodaunorubicin, CHOP regimen 223
- hydroxycarbamide 85, 141, **142**  
 polycythaemia vera 170, 171
- hydroxyurea *see* hydroxycarbamide
- hypercalcaemia 237
- hyperdiploid cells 127  
 ALL 190, 191
- hyperferritinaemia **42**
- hyperglobulinaemia 287
- hyperhaemolysis syndrome 342
- hyperhomocysteinaemia 306
- hypersplenism 119–20, **120**
- hypertensive disorders, thrombocytopenia of 348
- hyperviscosity syndrome 240, 240
- hypochromic anaemias 27–40, 28  
 anaemia of chronic disorders 37, **37**, **38**  
 differential diagnosis **38**, 39  
 iron deficiency *see* iron deficiency anaemia  
 lead poisoning 39  
 sideroblastic anaemia 38–9, 38, **39**
- hypodiploid cells 127  
 ALL 190, 191
- hypomethylating agents 184
- hyposplenism 120, **120**  
 infection prevention 121, **121**
- hypothyroidism 327
- ibrutinomab **143**
- ibrutinib **106**, 141, **142**  
 CLL 201  
 mantle cell lymphoma 223
- idarubicin **142**
- idelasib **106**, **142**, 201
- idiopathic acquired aplastic anaemia 244
- idiopathic thrombocytopenic purpura (ITP)  
 282–3  
 acute 283  
 chronic 282–3  
 clinical features 282–3  
 diagnosis 283  
 pathogenesis 282, 282  
 pregnancy 348  
 treatment 283  
 warm autoimmune haemolytic anaemia  
 association 68–9, 69  
*see also* autoimmune thrombocytopenic purpura
- Igs *see* immunoglobulins
- imatinib 141, **142**, 143, **160**
- immune function, splenic control 117
- immune haemolytic anaemias  
 alloimmune 70  
 autoimmune 68–70, 69  
 drug-induced 70, 70
- immune response 109–11, 110, 111
- immunity  
 adaptive 88  
 innate 88
- immunodeficiency 113–14, **113**  
*see also* HIV/AIDS
- immunoglobulins 106–7, 106, **106**  
 gene rearrangements 107, 107, 108  
 idiopathic thrombocytopenic purpura  
 283
- IgA **106**
- IgG **106**
- IgM **106**
- isotypes 106  
 pooled 345  
 replacement 202  
 subclasses 106
- immunohistology (immunocytochemistry)  
 133, 133
- immunological markers **147**
- immunological memory 103
- immunoparesis 232
- immunosuppressants in idiopathic thrombocytopenic purpura 283
- indirect antiglobulin test (IAT) 340
- infections 327–30, **327**, 328–30  
 bacterial 327–8  
 cancer patients 138–9, 138  
 haemolysis 71  
 hyposplenic patients 121, **121**  
 kala-azar (visceral leishmaniasis) 329, 330  
 malaria 329, 329  
 parasitic 329, 330, 331  
 post-stem cell transplant 258–60, 259, 260  
 and thrombocytopenia 283  
 toxoplasmosis 329  
 transfusion-related 338–9, **338**, **339**  
 viral 328  
*see also* HIV/AIDS
- infectious mononucleosis 111–12
- inferior vena cava filter 318
- inflammation, and venous thrombosis 306
- innate immune system 88
- interferon- $\alpha$  **143**, 144  
 chronic myeloid leukaemia 162  
 polycythaemia vera 171
- interferon- $\gamma$  5
- interleukins 5, **6**, 90
- intermittent compression devices 318
- international normalized ratio (INR) 315
- interphase 8
- interstitial pneumonitis 259, 260
- intravascular haemolysis 63, **63**, 64
- iron  
 absorption 30–1, **30**, 31, 32  
 body distribution/transport 28–30, **28**, 29, 30  
 daily cycle 29  
 dietary 30  
 oral 36–7, **37**  
 parenteral 37  
 requirements 31–2, **33**  
 serum levels **20**, 34–5, 36
- iron chelation therapy 45–7, 46, 79  
 aplastic anaemia 247  
 myelodysplasia 182
- iron deficiency anaemia 32–7  
 blood film 34, 34, 35  
 causes 32–3, 33, **33**  
 clinical features 32, 34  
 investigations 35–6, 36  
 laboratory findings **38**  
 pregnancy 347  
 red cell indices 34  
 treatment 36–7, **37**

- iron overload 41–7  
 African 43  
 assessment 42, **42**, 43  
 causes **42**  
 chelation therapy 45–7, 46  
 haemochromatosis **42**, 43–4, 43  
 transfusional 44, 44, 45, 342
- iron refractory iron deficiency anaemia (IRIDA) 37
- iron regulatory protein 29
- iron response elements 29
- isochromosome 129
- ITP *see* idiopathic thrombocytopenic purpura
- JAK inhibitors 171
- JAK proteins 6, 8
- JAK/STAT pathway 6
- JAK2 mutation 166, 167, **169**, **172**
- Janus-associated kinase proteins *see* JAK proteins
- juvenile myelomonocytic leukaemia 184
- kala-azar (visceral leishmaniasis) 329, 330
- karyotype 127, 128  
 analysis 131
- Kell blood group system **336**, 337
- kernicterus 351
- Kidd blood group system **336**
- kidney  
 myeloma 235  
 renal failure 325–6, 325, **325**
- Kleihauer test 351, 351
- koilonychia 21, 32, 34
- Kupffer cells 275
- labile factor *see* factor V
- lactate dehydrogenase 286
- Langerhans' cell histiocytosis 98, 98, 226
- large granular lymphocytic leukaemia 203–4, 203
- lazy leucocyte syndrome 93
- lead poisoning 39
- lenalidomide **143**  
 CLL 201  
 mantle cell lymphoma 223  
 multiple myeloma 236, 237  
 myelodysplasia 182
- Lepore syndrome 77, 81
- lestaurtinib 171
- Letterer-Siwe disease 98
- leucocyte adhesion molecules 92
- leucocytes *see* white cells
- leucodepletion 343
- leucoerythroblastic reaction 94–5, 94, **95**
- leukaemia  
 acute lymphoblastic (ALL) 186–96  
 acute myeloid (AML) 145–55  
 acute promyelocytic 149, 152–3  
 chronic eosinophilic 164  
 chronic lymphoid 197–204  
 chronic myeloid (CML) 156–64, 184  
 chronic myelomonocytic 180, 184  
 chronic neutrophilic 164  
 classification 146, **146**  
 diagnosis 146–7, 146, **147**  
 vs. lymphoma 214  
*see also specific types*
- leukaemoid reaction 94, 322
- Lewis blood group system **336**, 337
- Li blood group system **336**
- liver disease 326–7, **326**  
 coagulation defects 297  
 haemostasis tests **299**
- Loa loa* 331
- low molecular weight heparin **313**, 314
- lupus anticoagulant 300–1  
 and venous thrombosis **307**
- Lutheran blood group system **336**
- lymph nodes 110
- lymphadenopathy 114, 114
- lymphoblastic lymphoma 225
- lymphocytes **12**, 88, 88, 102–15, 103  
 antigen receptors 105  
 B cells 103–4, 105, **105**  
 blood count **20**, **88**  
 circulation 106  
 natural killer cells 104, 106  
 T cells 103–4, 105, **105**
- lymphocytosis 111–13, **111**  
 clinical features 112  
 diagnosis 112–13, 112  
 differential diagnosis 113  
 heterophile antibodies 112–13  
 infectious mononucleosis 111–12  
 non-Hodgkin lymphoma 203  
 pleomorphic atypical 112, 112  
 treatment 113
- lymphoid organs 103, 104  
 secondary 110
- lymphoma  
 HIV/AIDS 224, 225  
 Hodgkin *see* Hodgkin lymphoma  
 non-Hodgkin *see* non-Hodgkin lymphoma  
 T-cell 225–6  
 vs. leukaemia 214  
*see also specific types*
- lymphopenia 113
- lymphoplasmacytic lymphoma  
 cytogenetics **217**  
 immunophenotype **217**
- lymphoplasmacytoid lymphoma 221, 221
- lymphoproliferative diseases, post-transplant 261–2, 262
- lysosomal storage diseases 99–101  
 Gaucher's disease 99, 99, 100  
 Niemann-Pick disease 99, 101
- M phase 8
- macrocytes 23
- macrocytic anaemia 49, 58–9, **58**  
*see also* megaloblastic anaemia
- macrophage colony-stimulating factor (M-CSF) 5, **6**
- macrophages 92
- macrospherocytes 23
- magnetic resonance imaging *see* MRI
- major histocompatibility complex (MHC) 256, **256**  
*see also* HLA system
- malaria 329, 329  
 transfusion-related 338–9, **339**
- malignancy  
 dendritic cells 226  
 haematological 122–34, 123, 135–44  
 haematological changes 322–3, 323, 324, **324**  
 histiocytic cells 226  
 myelodysplastic/myeloproliferative 184, **184**  
 myeloid **166**  
 plasma cells **231**  
 and venous thrombosis 306  
*see also named diseases and tumours*
- malignant disease *see* neoplasms
- MALT lymphoma 221–2, 222  
 cytogenetics **217**  
 immunophenotype **217**
- mantle cell lymphoma 223, 223  
 cytogenetics **217**  
 immunophenotype **200**, **217**
- MAP kinase 6
- march haemoglobinuria 70
- marginal zone lymphomas 221–2, 222
- massive haemorrhage 345
- massive transfusion syndrome 287, 301  
 haemostasis tests **299**
- mastocytosis 175, 175  
 genetic mutations **166**
- matriptase 2 30
- May-Hegglin syndrome 93, 94, 281
- mean cell haemoglobin (MCH) **20**
- mean cell volume (MCV) **20**, 21
- megakaryocytes 182, 265–6, 266, 267



- megaloblastic anaemia 49, **49**, 93  
 biochemical basis 51, 52  
 clinical features 53–6, 54–6, **54**  
 laboratory findings 55–6, 55, 56  
 treatment 57–8, **57**, 58  
*see also* folate; vitamin B12
- melphalan **142**  
 MTP regimen 235  
 multiple myeloma 235
- men, iron requirements **33**
- menorrhagia 33
- 6-mercaptopurine 141, **142**
- mesenchymal stem cells 4
- methaemalbuminaemia 63
- methaemoglobinaemia 17, **75**
- methotrexate 141, **142**
- methylenetetrahydrofolate reductase 306
- MGUS 229, **231**, 232, 237–8, 238
- microangiopathic haemolytic anaemia 70, 322
- microcytes 23
- microRNAs 131
- minor histocompatibility antigens 256
- mitogen-activated protein kinase *see* MAP kinase
- mitosis 8
- mitoxantrone **142**
- mixed phenotype acute leukaemia 148
- MN blood group system **336**, 337
- molecular genetics  
 ALL 189–91, 190, 191  
 AML **146**, 149, 151, **151**, 152  
 CLL 200
- momelotinib 171
- monoclonal antibodies 141, **143**  
 idiopathic thrombocytopenic purpura 283  
 non-Hodgkin lymphoma 220  
*see also named antibodies*
- monoclonal B-cell lymphocytosis (MBL) 198
- monoclonal gammopathy of undetermined significance *see* MGUS
- monoclonal immunoglobulins, associated diseases **229**
- monocyte colony-stimulating factor (M-CSF) 90
- monocytes **12**, 88, 88, 89, 89, 92  
 blood count **20**, **88**  
 disorders of function 92–4, 92, 93
- monocytosis 96, **97**
- monospot test 112
- MR pulmonary angiography 309
- MRI  
 cerebral lymphoma 224  
 deep vein thrombosis 308
- haemophilia A 292  
 non-Hodgkin lymphoma 219
- mucosa-associated lymphoid tissue lymphoma *see* MALT lymphoma
- mucosal bleeding **279**
- multiple myeloma 229–37  
 clinical features 231–2, 232–5, 239  
 diagnosis 231  
 pathogenesis 229, 230, **231**  
 prognosis 237  
 relapse 237  
 smouldering 229, 231, **231**  
 supportive care 237  
 treatment 235, 233–7, 236
- Mycoplasma pneumoniae* 328
- mycosis fungoides 226, 226
- myeloablative conditioning 253
- myeloblasts 89, 89
- myelodysplasia 91, 177–86  
 classification **178**, 179–80  
 clinical features 180, 182  
 cytogenetic abnormalities **179**  
 diagnosis 181  
 genetic abnormalities 182  
 high-risk syndromes 184  
 laboratory findings 180, 183  
 low-risk syndromes 182  
 prognostic score **179**, **180**  
 treatment 182, 184
- myelodysplastic syndromes *see* myelodysplasia
- myelodysplastic/myeloproliferative neoplasms 184, **184**
- myelofibrosis 173–5  
 clinical features 174  
 genetic mutations **166**, 167  
 laboratory findings 174, 174  
 survival score **174**  
 treatment 174–5
- myeloid growth factors 90–1, 91
- myeloma *see* multiple myeloma
- myeloma kidney 235
- myelomonocytic leukaemia  
 chronic 180, 184  
 juvenile 184
- myeloproliferative disease 165–76, 166, **166**, 287  
 JAK2 mutation 166, 167  
 mastocytosis **166**, 175, 175  
 myelofibrosis **166**, 167, 173–5  
 polycythaemia 168–72  
 thrombocythaemia **166**, 167, 172–3, **172**, 173, **173**
- Mylotarg® **143**
- myoglobin, iron in **28**
- nail bed pallor 21
- natural killer cells 104, 106
- neonates 348–52  
 anaemia 349–50, 349  
 blood coagulation 350  
 blood count **88**, 348–9, 349  
 fetomaternal alloimmune thrombocytopenia 350  
 haemolytic disease of newborn 350–2, 351, 352  
 haemorrhagic disease of newborn 296  
 hydrops fetalis **75**, 76, 76, 352, 352  
 polycythaemia 350
- neoplasms *see* malignancy
- neural tube defects 55, 55
- neutropenia 91, 95–6  
 autoimmune 96  
 benign ethnic 95  
 causes **95**  
 clinical features 96, 96  
 congenital 95  
 cyclical 95  
 diagnosis 96  
 drug-induced 95  
 HIV/AIDS 328  
 idiopathic benign 96  
 management 96  
 refractory **178**
- neutrophil leucocytosis 93, 94–5, 94, **95**  
 causes **94**
- neutrophils **12**, 88, 88, 89, 89  
 blood count **20**, **88**  
 disorders of function 92–4, 92, 93  
 precursors 89, 89
- Niemann-Pick disease 99, 101
- nilotinib **142**, 143, **160**
- nitric oxide 270
- non-Hodgkin lymphoma 213–27  
 cell of origin 214, 216  
 cellular origins 215  
 classification 214, **214**, 215  
 clinical features 216  
 cytogenetics/genetic analysis 217–18, **217**, 218  
 high-grade 214, 223–5  
 histology 216, 217  
 HIV/AIDS 328  
 imaging 219, 220  
 laboratory investigations 216–17  
 low-grade 214, 220–3  
 lymphocytosis 203  
 pathogenesis 216, **216**  
 prognostic index **218**  
 staging 218  
 T-cell lymphomas 225–6

- non-Hodgkin lymphoma (*continued*)  
 treatment 220  
*see also specific subtypes*
- non-myeloablative conditioning 253
- NOTCH signalling pathway 188  
 ALL 191  
 NOTCH-1 4
- nutritional support of cancer patients 137–8
- O blood group **336**
- obinutuzumab **143**, 201
- oestrogen therapy, and venous thrombosis 307
- ofatumumab **143**, 201
- older patients  
 acute myeloid leukaemia 153  
 haematological changes 322
- oncogenes 125
- oral anticoagulants 315–18, **315–17**  
 bridging anticoagulation 316–17  
 direct acting 317–18, **317**  
 drug interactions 315, **316**  
 INR 315  
 length of anticoagulation 315  
 overdose 316, **316**  
*see also specific drugs*
- osteopetrosis 249  
 haematological changes 330
- osteoporosis, heparin-induced 315
- osteosclerotic myeloma (POEMS syndrome)  
 237
- ovalocytosis, South-East Asian 65
- oxyhaemoglobin 17
- P blood group system **336**, 337
- packed cell volume (PCV) **20**
- pacritinib 171
- pain in haematological malignancies 138
- pancytopenia 243, **243**  
 malignant disease **324**
- Pappenheimer bodies 24, 117, 120
- paraproteinaemia 107, 229, 229
- parasitic infections 329, 330, 331  
 transfusion-related **339**
- paroxysmal cold haemoglobinuria 69–70
- paroxysmal nocturnal haemoglobinuria 62,  
 246, 247, 247
- parvovirus B19 248  
 transfusion-related **339**
- passenger mutations 125
- Pearson's syndrome 38
- PD-1 212
- Pelger abnormality 180, 183
- Pelger-Huët anomaly 93, 94
- pencil cells 23
- pentose phosphate shunt 18
- periarteriolar lymphatic sheath 117, 117
- peripheral blood stem cell (PBSC)  
 transplantation 251
- peripheral T-cell non-Hodgkin lymphoma,  
 unspecified 225
- pernicious anaemia 52–3  
 associations **53**
- PET  
 Hodgkin lymphoma 209–10, 210  
 multiple myeloma 233  
 non-Hodgkin lymphoma 219, 220
- petechiae **279**
- PFA-100 test 277  
 coagulation disorders **294**
- phagocytes **12**, 88
- phagocytosis 92–3, 92  
 defects 93  
 killing and digestion 93
- Philadelphia (Ph) chromosome 157–8, 191
- phosphatidylinositol 3 kinase *see* PI3 kinase
- PI3 kinase 6, 8
- PIVKA factors 296
- plasma cells 103  
 neoplasms **231**
- plasma cell leukaemia 237
- plasma thromboplastin antecedent *see* factor  
 XI
- plasma viscosity 332
- plasma volume **168**
- plasmin 275  
 inactivation 276
- plasminogen 275
- platelets **12**, 265–70  
 adhesion 269  
 aggregation 267–8, **294**  
 amplification 268  
 anaemia 22  
 antigens **147**, 266  
 concentrates 344  
 destruction 282–7  
 failed production 281, **281**  
 function 267–70  
 inhibitors of function 270  
 malignant disease 322–3, **324**  
 plug 274–5  
 procoagulant activity 268  
 production 265–6, 266, 267  
 release reaction 268  
 structure 266, 269  
 transfusion 283, 289
- platelet count **20**, 266  
 coagulation disorders **294**, **299**  
 myelofibrosis **174**  
 raised **173**  
 thrombocytopenia **172**
- platelet function disorders 287–9  
 Bernard-Soulier syndrome 266, 287  
 diagnosis 288–9, 288  
 drug-induced 287, 288  
 Glanzmann's thrombasthenia 266, 287  
 hyperglobulinaemia 287  
 renal failure 326  
 storage pool diseases 287  
 uraemia 287  
*see also myeloproliferative disease*
- platelet function tests 277
- platelet-derived growth factor (PDGF) 270,  
 303
- platinum derivatives 144
- pleomorphic atypical lymphocytosis 112,  
 112
- pletixafor 251
- pluripotent stem cells 2–4, 3
- Pneumocystis carinii* 259, 260
- POEMS syndrome (osteosclerotic myeloma)  
 237
- point mutations 129, 129
- polycythaemia 168–72  
 apparent 172  
 classification 168, **168**  
 differential diagnosis 172  
 genetic mutations **166**, 167  
 malignant disease 322  
 neonate 350  
 primary (erythrocytosis) 168, **168**  
 secondary **168**, 172
- polycythaemia vera 168–71  
 clinical features 169–70, 169, 170  
 congenital causes 171  
 course and prognosis 171  
 diagnosis 169, **169**  
 genetic mutations **166**  
 laboratory findings 170, 170  
 treatment 170–1, 171
- polymerase chain reaction (PCR) 134, 134
- pomalidomide **143**  
 multiple myeloma 235, 237
- ponatinib **160**
- positron emission tomography *see* PET
- post-capillary venules 106
- post-thrombotic syndrome 318
- post-transfusion circulatory overload 342
- post-transfusion purpura 284, 342
- post-transfusional iron overload 44, 44, 45,  
 342
- post-transplant lymphoproliferative diseases  
 261–2, 262
- postoperative venous thrombosis 306
- prasugrel 287, 320
- pre-implantation genetic diagnosis 85

- prednisolone  
 ALL 189  
 autoimmune haemolytic anaemia 68, 201  
 BEACOPP regimen 211  
 CHOP regimen 223  
 ITP 283, 284  
 MTP regimen 235  
 R-CVP regimen 222
- pregnancy 347–8, 347, 348  
 anaemia 347, 347  
 folate/vitamin B12 deficiency 347  
 haemostasis and thrombosis 348  
 thrombocytopenia 347–8, 348
- prekallikrein (Fletcher factor) **271**
- prenatal diagnosis in haemoglobin disorders 85, 86
- primary cold agglutinin disease 69–70
- prion diseases, transfusion-related 339, **339**
- procarbazine, BEACOPP regimen 211
- proconvertin *see* factor VII
- progenitor cells 2–4, 3, 12–13
- prolymphocytic leukaemia  
 B-cell 202, 202  
 T-cell 203
- promyelocytes 89, 89
- prostacyclin 268, 270, 270
- protein 4.1 19
- protein C 275, 275  
 concentrate 345  
 deficiency 305
- protein S 275  
 deficiency 305–6
- prothrombin allele G20210A 306
- prothrombin (factor II) **271**, **273**
- prothrombin time 276, **276**  
 coagulation disorders **294**, **299**
- proto-oncogenes 125, 125
- protozoal infections  
 and haematological malignancies 125  
 transfusion-related **339**  
*see also* malaria
- pseudodiploid cells 127
- pseudopolycythaemia 168
- psychological support of cancer patients 137
- pulmonary angiography 309
- pulmonary embolus 308–9, 309  
 prophylaxis 318
- purpura 280, 280, 281  
 post-transfusion 284, 342  
 thrombotic thrombocytopenic 285, 285, 286
- pyruvate kinase deficiency 67–8
- 5q-syndrome 180
- R-CHOP regimen 223
- R-CVP regimen 222–3
- R-FC regimen 200
- R-ICE regimen 224
- radiation-induced disorders 124
- radiography  
 ALL 189  
 haemophilia A 292  
 interstitial pneumonitis 260  
 multiple myeloma 233, 235  
 pulmonary embolus 308
- radionuclide scanning 239
- radiotherapy  
 CLL 201  
 multiple myeloma 237
- rasburicase 137
- RD regimen 235
- reactive systemic AA amyloidosis **238**
- recombinases 107
- red cells **12**, 17–19  
 abnormalities 23  
 amplification and maturation 14  
 anaemia 21, **22**  
 antigens 334, **335**  
 destruction 61, 61  
 DNA content 14  
 erythrocyte sedimentation rate 330, 332  
 folate **20**, **57**  
 inclusions 24  
 malignant disease **324**  
 membrane 18–19, 19  
 metabolism 18, 18  
 metabolism defects 66–8, 66, 67  
 packed 343, 343  
 splenic control of integrity 117  
 volume **168**
- red cell aplasia 247–9, 247, **248**
- red cell count **20**
- red cell fragmentation syndromes 70, 70, **70**
- red cell indices  
 anaemia 21, 34  
 iron deficiency 34  
 normal **20**
- red pulp of spleen 117, 117
- Reed-Sternberg cells 133, 206, 207
- refractory anaemia **178**  
 with excess blasts **178**, 180  
 with ring sideroblasts (RARS) **178**
- refractory cytopenia  
 with multilineage dysplasia (RCMD) **178**  
 with unilineage dysplasia (RCUD) **178**
- refractory neutropenia **178**
- refractory thrombocytopenia **178**
- renal failure 325–6, 325, **325**
- reticulocytes 24
- reticulocyte count **20**  
 anaemia 22, **22**
- reticuloendothelial system 61, 92
- retinal haemorrhage 21
- trans*-retinoic acid **142**
- Rh blood group system 335, **336**  
 genotypes **338**  
 haemolytic disease of newborn 350–2, 351, 352  
 molecular genetics 337
- rheumatoid arthritis, haematological changes 323–5, 324
- Rickettsia rickettsii* **339**
- ring sideroblasts 38, 38, **178**, 180, 183
- rituximab **143**  
 CLL 200  
 idiopathic thrombocytopenic purpura 283  
 non-Hodgkin lymphoma 220
- rivaroxaban **317**, 318
- romiplostim 283
- Rosai-Dorfmann disease 99
- ROTEM (thromboelastometry) 277, 301
- rouleaux formation 234
- ruxolitinib 141, **142**  
 polycythaemia vera 171
- schistosomiasis 329
- Schwachman-Diamond syndrome 95, 244, 249
- SCL 4
- scurvy (vitamin C deficiency) 280, 280
- self-renewal 2, 3, 4
- senile purpura 280
- serum free light chain assay 232, 233
- Sézary syndrome 226
- sicca syndrome 261
- sickle cells 23
- sickle cell anaemia 80, 81–5  
 antenatal diagnosis 86  
 aplastic crises 83  
 clinical features 81–4, 82–4  
 haemolytic crises 83  
 laboratory findings 84  
 molecular pathology 81  
 organ damage 83–4, 83, 84  
 treatment 84–5  
 vaso-occlusive crises 82, 83
- sickle cell trait 80, 85
- sideroblastic anaemia 38–9, 38, **39**  
 laboratory findings **38**
- signal transducer and activator of transcription *see* STAT
- signal transduction 6–8, 7
- signal transduction inhibitors **142**, 143

- sinus histiocytosis with massive lymphadenopathy 99
- slg **189**
- small lymphocyte lymphoma 220  
immunophenotype **217**
- smouldering myeloma 229, 231, **231**
- solitary plasmacytoma 237
- somatic hypermutation 200
- somatic mutation 107
- South-East Asian ovalocytosis 65
- spectrin 19
- spherocytosis 19, 328  
hereditary 64–5, **64**, 65
- spleen 116–21  
anatomy and circulation 117, 117  
atrophy 117  
cords of 117, 117  
enlarged *see* splenomegaly  
extramedullary haemopoiesis 118  
functions 117  
hypersplenism 119–20  
hyposplenism 120, **120**, 121, **121**  
imaging 118, 118, 119  
red pulp 117, 117  
white pulp 117, 117
- splenectomy 79, 120, **120**  
idiopathic thrombocytopenic purpura 283  
myelofibrosis 175
- splenic pooling 287
- splenomegaly 118–19, **120**  
Felty's syndrome 324  
marginal zone lymphoma 222  
myelofibrosis 174  
platelet distribution 286  
polycythaemia vera 169
- SRSF2* mutation 184
- starry sky appearance 225
- STAT 6
- stem cells  
homing 4  
mesenchymal 4  
mobilization 4  
pluripotent 2–4, 3
- stem cell transplantation 250–63  
acute myeloid leukaemia 153  
allogeneic *see* allogeneic stem cell transplantation  
aplastic anaemia 246–7  
autologous 254, 255  
bone marrow cells 251  
chronic myeloid leukaemia 162, 163  
CLL 202  
conditioning 253  
haploidentical 256
- idiopathic thrombocytopenic purpura 283
- indications **251**
- myelodysplasia 184
- peripheral blood stem cells 251
- post-transplant engraftment/immunity 253–4, 254
- potential donors **251**
- principles 251, **251**
- procedure 252
- stem cell processing 251, 253, 253
- umbilical cord blood cells 251
- stercobilin 61
- stercobilinogen 61
- steroid purpura 280
- stomatocytes 23
- storage pool diseases 287
- streptokinase 318
- Stuart-Prower factor *see* factor X
- subacute combined degeneration of cord 53, 54, 55
- superficial venous thrombosis 307
- systemic amyloid light chain amyloid disease 238–9, **238**, 239
- systemic diseases, haematological changes 321–32  
anaemia of chronic disorders 322, **322**  
congestive heart failure 326  
hypothyroidism 327  
infections 327–30, **327**, 328–30  
liver disease 326–7, **326**  
neoplasms 322–3, 323  
non-specific monitoring 330–2, **331**  
older patients 322  
osteopetrosis 330  
renal failure 325–6, 325, **325**  
rheumatoid arthritis 323–5, 324  
systemic lupus erythematosus (SLE) 325
- T cells 103–4  
functional aspects **105**  
HLA-restricted 109  
immunodeficiency **113**
- T-cell chronic lymphoid leukaemias 203–4
- T-cell lymphomas 225–6
- T-cell prolymphocytic leukaemia 203
- T-cell receptor, gene rearrangements 107, 108
- T helper cells 110
- target cells 23
- TdT **189**
- tear drop poikilocytes 23
- telomerase 129
- telomere 128, 129, 129
- TET2* mutation 127, 184
- tetrahydrofolate 306
- thalassaemias **75**  
 $\alpha$ -thalassaemia syndromes **75**, 76, 76, 77  
 $\beta$ -thalassaemia major 76–9, 77, 78  
 $\beta$ -thalassaemia minor 79, 81  
classification **75**  
 $\delta\beta$ -thalassaemia 81  
geographical distribution 75  
haemoglobin in 73, 74  
thalassaemia intermedia 43–4, **75**, 79–81, **79**, 80, 81  
thalassaemia major 43, 44, **75**
- thalassaemia trait **75**, 79, 81  
laboratory findings **38**
- thalidomide **143**  
MTP regimen 235  
multiple myeloma 236, 237
- thrombasthenia 266, 287
- thrombin 270–1, 272
- thrombin time 276, **276**  
coagulation disorders **299**
- thrombocythaemia 172–3  
clinical features **172**, 173  
course 173  
diagnosis 172–3  
genetic mutations **166**, 167  
laboratory findings **172**, 173, 173, **173**  
prognosis and treatment 173  
survival **172**
- thrombocytopenia 281–7  
with absent radii 244  
amegakaryocytic 244  
antiphospholipid syndrome 307  
causes **281**  
drug-induced 281, **281**, 284, 284  
fetomaternal alloimmune 350  
haemolytic uraemic syndrome 285, 285, 286  
heparin-induced 314–15, 314  
of hypertensive disorders 348  
infection-related 283  
liver disease 297  
malaria 329, 329  
massive transfusion syndrome 287, 301  
platelet destruction 282–7  
platelet function disorders 287–9  
platelet production failure 281, 281, **281**  
post-transfusion purpura 284, 342  
pregnancy 347–8, 348  
refractive **178**  
splenic pooling 287  
thrombomimetics 289  
viral infections 328
- thrombocytopenic purpura, autoimmune 282–3, 282

- thromboelastography 277, 300, 301  
 thromboelastometry 277, 301  
 thrombolytic therapy 287, 318–20, 319, **319**  
 thrombomimetics 289  
 thrombophilia 307–8  
 thrombopoietin (TPO) 5, **6**, 265, 268  
 thrombopoietin-receptor agonists 283  
 thrombosis 302–10, 311–20  
   anticoagulants 312–18  
   antiplatelet drugs 318–20, 319, **319**  
   arterial 303, 303, **303**  
   fibrinolytic agents 318  
   older patients 322  
   post-thrombotic syndrome 318  
   pregnancy 348  
   prophylaxis 318  
   venous *see* venous thrombosis  
 thrombotic thrombocytopenic purpura 285, 285, 286  
 thromboxane A2 268, 270  
 ticagrelor 320  
 tirofiban **319**, 320  
 tissue factor *see* factor III  
 tissue factor pathway inhibitor (TFPI) 272  
 tissue plasminogen activator (TPA) 275, 276, 318  
 tissue plasminogen activator inhibitor (TPAI) 275  
 total iron-binding capacity **20**, 34–5, 36  
 toxoplasmosis 329  
 trabecular arteries 117, 117  
 tranexamic acid 280  
 transcobalamins 49  
 transcription factors 8  
 transferrin 28, **28**  
   regulation 29  
 transferrin receptor 1 regulation 29, 30  
 transforming growth factor- $\beta$  5  
 transfusion reactions 340–2, **341**  
 transfusion-related acute lung injury (TRALI) 342  
 transfusional iron overload 44, 44, **44**, 45  
 translocations 129–30, 129, 130  
 treosulfan 253  
*Treponema pallidum* **339**  
 tropical splenomegaly syndrome 119  
 trypanosomiasis 329, 330  
 tuberculosis 328  
 tumour lysis syndrome 137  
 tumour necrosis factor (TNF) 5, **6**, 90, 256  
 tumour-suppressor genes 125  
 tyrosine kinase inhibitors 141, **142**  
   chronic myeloid leukaemia 160–1, 160, **160**, 161  
   response to therapy 160–2, 160–2, **162**  
   *see also individual drugs*  
 tyrosine kinases 125  
 ultra-large von Willebrand factor multimers 285, 285  
 umbilical cord cell transplantation 251  
 uraemia 287  
 vaccination of hyposplenic patients 121, **121**  
 vascular bleeding disorders 279–80, **279**  
   acquired 279–80  
   connective tissue disorders 279  
   giant cavernous haemangioma 279  
   hereditary haemorrhagic telangiectasia 279, 280  
 vascular endothelial growth factor (VEGF) **6**  
 vasoconstriction 273–4  
 VCD regimen 235  
 venesection in polycythaemia vera 170  
 venous stasis 306  
 venous thrombosis 303–7  
   acquired risk factors 306–7, **307**  
   deep vein thrombosis 308, **308**  
   hereditary risk factors 304–6, **304**  
   pathogenesis 303–4  
   postoperative 306  
   pulmonary embolus 308–9, 309  
   superficial 307  
 ventilation perfusion scintigraphy 309  
 vinblastine **142**  
 vinca alkaloids 141, **142**, 143  
 vincristine **142**  
   BEACOPP regimen 211  
   CHOP regimen 223  
   R-CVP regimen 222  
 viral infections  
   cancer patients 139  
   haematological changes 328  
   and haematological malignancies 124–5  
   post-stem cell transplant 259, 259, 260  
   post-transfusion hepatitis 338, **339**  
   transfusion-related 342  
   *see also* HIV/AIDS  
 vitamin B12 49–51, 49  
   absorption 49, 50, **50**  
   biochemical function 51, 51  
   neuropathy 53, 54, 55  
   prophylactic 58  
   serum **20**, **57**  
   transport 49  
 vitamin B12 deficiency 52–3  
   causes **52**, 53  
   clinical features 53–6, 54–6, **54**  
   diagnosis 56–7, **57**  
   pregnancy 347  
   tests for cause 57, **57**  
   treatment 57–8, **57**, 58  
 vitamin C deficiency (scurvy) 280, 280  
 vitamin K antagonists 315–18, **315–17**  
 vitamin K deficiency 296–7, 297  
 von Willebrand disease 295–6  
   classification **295**  
   laboratory findings **294**, 295  
   treatment 295–6  
 von Willebrand factor 266, 267, 269, 295  
   ultra-large 285, 285  
 VRD regimen 235  
 VTD regimen 235  
 Waldenström's macroglobulinaemia 221, 221  
 warfarin **317**  
   drug interactions 315, **316**  
   haemostasis tests **299**, **315**  
   overdose 316, **316**  
   vitamin K deficiency 296  
 warm autoimmune haemolytic anaemias 68–9, 69  
 Weibel-Palade bodies 267, 285  
 white cells 87–101, 102–15  
   abnormal 93  
   anaemia 22  
   antibodies 342  
   donor leucocyte infusions 162, 253, 261, 262  
   malignant disease 94, 322, **324**  
   *see also specific types*  
 white cell count **20**, **88**  
   myelofibrosis **174**  
   thrombocythaemia **172**  
 white pulp of spleen 117, 117  
 WHO classification **208**, 354–6  
 Wilson's disease 71, 326  
 Wiskott-Aldrich syndrome 95, 281  
 women  
   iron requirements **33**  
   pregnancy 347–8, 347, 348  
*Wuchereria bancrofti* 331  
 X-ray *see* radiography  
*Yersinia enterocolitica* **339**  
 Zieve's syndrome 325, 326











