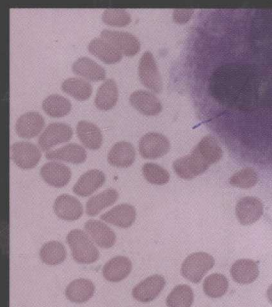
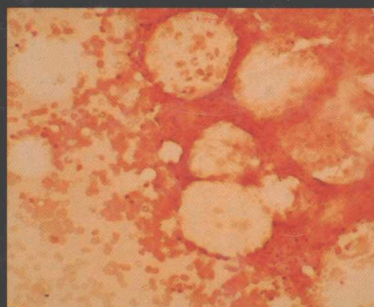
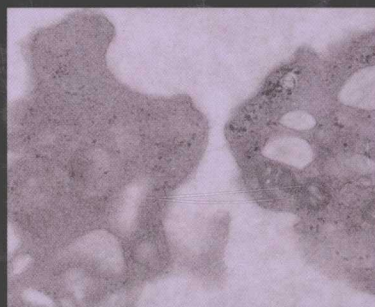


Laboratory Hematology Practice

Edited by Kandice Kottke-Marchant
with Bruce H. Davis



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International Society for
Laboratory Hematology

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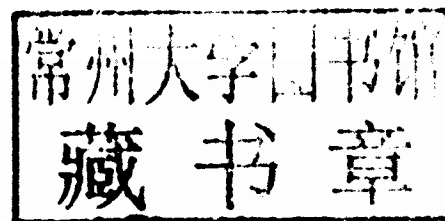
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Preface

Hematologic disorders range from some of the most common medical conditions, like anemia and leukocytosis, to some of the most rare and perplexing conditions, like inherited thrombocytopenia and mast cell disorders. Yet, due to the relatively easy accessibility of blood samples, hematology is a rapidly evolving area of medical knowledge that has seen a virtual explosion of diagnostic laboratory testing and therapeutics in the past decade. Common diagnostic methods range from visual peripheral blood and bone marrow morphology to flow cytometric analysis of erythrocytes, leukocytes and platelets, to functional testing of hemostasis proteins and platelets, to electrophoretic hemoglobin analysis and molecular DNA and RNA analysis of leukemias and lymphomas.

Laboratory Hematology Practice is a new textbook focused on a practical approach to understanding the diagnostic utility of new hematology laboratory testing, how to critically assess new testing technology and how to implement, interpret and manage new assays and new technology in the laboratory. Most hematology textbooks focus on disease pathophysiology and patient management, but gloss over the details of laboratory diagnosis, an important aspect of patient care. Laboratory testing is complex and there are many details of accurate laboratory testing, from method selection to assay validation, quality control, results reporting and interpretation. Thus we chose to focus on diagnostic methodologies for this book and structured it along technology lines instead of by disease category. Technologies covered include cellular analysis, flow cytometry, molecular diagnostics, bone marrow analysis, hemostasis and thrombosis testing, special hematology techniques, point-of-care testing and information management. Emphasis is placed upon the use of established and emerging technologies in the diagnosis of hematologic disorders, but also includes operational aspects of laboratory testing, such as proper sample collection, quality control, informatics and laboratory management. Unique features of *Laboratory Hematology Practice* are incorporation of international standards for laboratory practice, methods for evaluation of testing technology, and online access to book content and figures. We hope that *Laboratory Hematology Practice* will provide practical informa-

tion and fill a niche in the field as it will help laboratorians critically understand, assess, implement and manage a wide variety of hematologic technologies ranging from cellular analysis to hemostasis testing and molecular diagnostics. We hope this text will become a welcome addition to the library of every practicing hematologist, hematopathologist, laboratory scientist in hematology, and trainees in these areas of medical and laboratory practice.

This project was sponsored by the International Society for Laboratory Hematology (ISLH). The ISLH arose out of a series of symposia on "Technological Innovations in Laboratory Hematology" organized by Dr Berend Houwen that started in Lake Louise, Canada in 1983. Dr Houwen and Dr Bruce Davis then led an international group of laboratory professionals in the formation of ISLH in 1992. In addition to Drs Houwen and Davis, the original founding ISLH Directors were Dr Brian Bull, Dr Ralph Green, Professor Samuel Machin, Dr Robert Pierre, Dr Elkin Simson and Dr Noriyuki Tatsumi. The goal of ISLH is "to further the interests of laboratory hematology as a professional activity and to provide a forum for its members for the exchange of new ideas and information on the subject of laboratory hematology". It is the only international society specifically focused on the technological and laboratory aspects of hematology. Since 1992, the ISLH has grown to an international organization that holds annual meetings around the globe, with over 700 members from over 50 countries. The ISLH has developed strong affiliations with many national hematology societies. The ISLH originated as a society focused on aspects of cellular analysis and has grown to incorporate dissemination of knowledge in hemostasis and thrombosis, hematologic molecular diagnosis, bone marrow morphology, standards and guidelines, hematology informatics, hemoglobinopathies and point-of-care testing. The ISLH publishes a scientific journal, the *International Journal of Laboratory Hematology*. Given the focus on technological advances in laboratory hematology, it is truly fitting that this textbook, *Laboratory Hematology Practice*, should be sponsored by the ISLH.

It is with gratitude and respect that we pay tribute and dedicate this book to two of the original ISLH Directors who

have passed away, Dr Berend Houwen and Dr Noriyuki Tatsumi. Dr Berend Houwen (1941–2004), the co-founder of ISLH, was most recently Corporate Medical Director of Beckman Coulter, preceded by Associate Professor of Pathology at Loma Linda University and Associate Professor of Pathology & Medicine at the University of Calgary. Berend was a man of vision and determination, who was a champion for laboratory hematology and published widely on many aspects of laboratory hematology testing, most notably flow cytometry, microcytic anemia, hematology testing errors, red cell volume distribution and red cell indices. Dr Noriyuki Tatsumi (1937–2010) was most recently Professor of Clinical and Laboratory Medicine at Osaka City

University. Dr Tatsumi was a leader in standardization and quality assurance of hematological testing and carried out a wide range of investigation in the field of laboratory hematology. In addition to many years of dedication to ISLH, he founded the Japanese Society for Laboratory Hematology (JSLH) in 2000. These two original ISLH Directors exemplify the passion for laboratory hematology and for lifelong research and education, which we hope pervades every page of this textbook.

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7/1/11

Abbreviations

1P	one parameter	ASO	allele specific oligonucleotide
2P	two parameter	ASPCR	allele-specific polymerase chain reaction
2D-DIGE	two-dimensional difference gel electrophoresis	AT	antithrombin
A	adenine (deoxyadenylate)	ATLL	adult T cell leukemia/lymphoma
AABB	American Association of Blood Banks	ATM	mutated in ataxia telangiectasia
7-AAD	7-aminoactinomycin D	ATP	adenosine triphosphate
ABC	activated B-cell	ATRA	all- <i>trans</i> -retinoic acid
AC	Alternating current	AVK	anti-vitamin K therapy
AC/DC	Alternating current/direct current	AZF	acetic acid-zinc-formalin
ACD	acid citrate dextrose	BAC	bacterial artificial chromosome
aCGH	array comparative genomic hybridization	B-ALL	B-cell acute lymphoblastic leukemia
aCL	anticardiolipin antibodies	BCP-ALL	B-cell precursor acute lymphoblastic leukemia
ACMG	American College of Medical Genetics	BCR	breakpoint cluster region
aCML	atypical chronic myelogenous leukemia	BCSH	British Committee for Standards in Haematology
ACS	acute coronary syndrome	β 2-GPI	β 2-glycoprotein I
ACT	activated clotting time	bHLH	basic helix-loop-helix
Act	activity	BL	Burkitt lymphoma
ADAMTS-13	a disintegrin and metalloproteinase with a thrombospondin type 1 motif, member 13	B-LBL	B-lymphoblastic lymphoma
ADP	adenosine diphosphate	BM	bone marrow
Ag	antigen	BMT	bone marrow transplantation
AIDS	acquired immune deficiency syndrome	bp	base pairs
AILT	angioimmunoblastic T-cell lymphoma	2,3-BPG	2,3-bisphosphoglyceric acid
ALCL	anaplastic large cell lymphoma	B-PLL	B-cell prolymphocytic leukemia
ALK	anaplastic lymphoma kinase	BREC	B-cell receptor excision circle
ALL	acute lymphoblastic leukemia	C	constant region; cytosine (deoxy cytidylate)
AML	acute myeloid leukemia	C4 _b -BP	C4 _b binding protein
AMP	Association for Molecular Pathology	Ca	calcium
ANAE	α -naphthyl acetate esterase	CaCl ₂	calcium chloride
ANBE	α -naphthyl butyrate esterase	CADP	collagen plus adenosine diphosphate
ANSI	American National Standards Institute	CAE	chloroacetate esterase
AP	antiplasmin	cAMP	cyclic adenosine monophosphate
APC	activated protein C; allophycocyanin	CAP	College of American Pathologists
APCR	activated protein C resistance	CAPRIE	Clopidogrel versus Aspirin in Patients at Risk of Ischaemic Events
aPL	antiphospholipid antibodies	CB	collagen binding
APS	antiphospholipid syndrome	CBC	complete blood count
APTT	activated partial thromboplastin time	CBF	core-binding factor
ARMS	amplification refractory mutation system	CBF β	core binding factor beta
ASM	aggressive systemic mastocytosis		
aSNP	array single nucleotide polymorphisms		

Abbreviations

CBS	cystathionine- β -synthase	cRNA	complementary RNA
CCD	charge-coupled device	CRP	C-reactive protein
CD	cluster of differentiation	CRTH2	chemo-attractant homologous receptor expressed on T-helper 2 cells
CDAII	congenital dyserythropoietic anemia type II	CSA	Canadian Standards Association
cDNA	coding DNA; complementary DNA	CSF	cerebrospinal fluid
CDR	complementarity determining region	CSR	class-switch recombination
CE	Comformité Européenne	CT	computerized tomography
CEBPA	CCAAT/enhancer binding protein- α	C _T	cycle threshold
CEL	chronic eosinophilic leukemia	CTAD	citrate, theophylline, adenosine, dipyridamole
CEP	centromere-enumeration probes	CTCL	cutaneous T-cell lymphoma
CEPI	collagen plus epinephrine	CV	coefficient of variation
CF:C	clotting factor coagulant activity	Cy3	cyanine 3
CGH	comparative genomic hybridization	Cy5	cyanine 5
cGMP	cyclic guanosine monophosphate	Cy7	cyanine 7
CH3	methyl group	CYP2C9	cytochrome P450 2C9
CHAMP	CHat AMP	CZE	capillary zone electrophoresis
CHARISMA	Clopidogrel for High Atherothrombotic Risk and Ischemic Stabilization, Management and Avoidance	D	diversity region; diagnosis
CHARM	comprehensive high-throughput arrays for relative methylation	DAB	3,3'-diaminobenzidine
CHCM	cellular hemoglobin concentration mean	DAF	decay acceleration factor
ChIP	chromatin immunoprecipitation	DAPI	4',6-diamidino-2-phenylindole
cHL	classical Hodgkin lymphoma	dAPTT	dilute APTT
CHOP	cyclophosphamide, doxorubicin, vincristine and prednisolone	DAT	direct antiglobulin test
CISH	chromogenic <i>in situ</i> hybridization	DC	dual color
CLIA	Clinical Laboratory Improvement Amendments	DCBA	dual-color break-apart
CLL	chronic lymphocytic leukemia	DCDF	dual-color dual-fusion
CLL/PL	chronic lymphocytic leukemia with increased prolymphocytes	DCFDA	dichlorodihydrofluorescein diacetate
CLSI	Clinical and Laboratory Standards Institute	DCIP	dichlorophenolindophenol
CML	chronic myelogenous leukemia	ddNTP	dideoxy nucleoside triphosphate
CMML	chronic myelomonocytic leukemia	DEPC	diethylpyrocarbonate
CMOS	complementary metal-oxide semiconductor	D-FISH	double-fusion fluorescence <i>in situ</i> hybridization
CMS	Center for Medicare Services	DGGE	denaturing gradient gel electrophoresis
CMV	cytomegalovirus	dhfr	dihydrofolate reductase
CNL	chronic neutrophilic leukemia	dhps	dihydropteroate synthase
CN LOH	copy-neutral loss of heterozygosity	DI	deformability index
CNS	Central nervous system	DIC	disseminated intravascular coagulation
CO ₂	carbon dioxide	DICOM	Digital Imaging and Communications in Medicine
CODIS	Combined DNA Index System	DLBCL	diffuse large B-cell lymphoma
COG	Children's Oncology Group	DLCL	diffuse large cell lymphoma
COSHH	control of substances hazardous to health	DMSO	dimethyl sulfoxide
COX-1	cyclooxygenase-1	DNA	deoxyribonucleic acid
CP	cancer procoagulant	DNase	deoxyribonuclease
CPDA	citrate-phosphate-dextrose-adenine	DOT	Department of Transportation
CpG	cytosine-phosphate-guanine dinucleotide	dpi	dots per inch
CPT	current procedural terminology	dPT	dilute PT
CR	complete remission	dRVVT	dilute Russell's Viper Venom Time
CR1	complement receptor type 1	dsDNA	double-stranded DNA
		DTI	direct thrombin inhibitor
		DVT	deep vein thrombosis
		EBV	Epstein-Barr virus
		EC	endothelial cell

ECD	electron coupled dye	FVIII B	factor VIII binding
ECM	extracellular matrix	FVIII:C	factor VIII coagulant activity
ECTA	European Concerted Action on Thrombophilia	FVL	factor V Leiden
EDP	EDTA-dependent pseud thrombocytopenia	FXa	activated factor X
EDTA	ethylene diamine tetraacetic acid	FX:C	factor X coagulant activity
ED-WORTY	EDTA with wortmanin and tyrphostin	FXI:C	factor XI coagulant activity
EIA	enzyme immunoassay	FXII:C	factor XII coagulant activity
ELISA	enzyme-linked immunosorbent assay	<i>g</i>	relative centrifugal force
ELN	European LeukemiaNet	G	guanosine; gauge (deoxyguanylatl)
EMA	eosin-5-maleimide; epithelial membrane antigen	GB	gigabyte
EORTC	European Organisation for Research and Treatment of Cancer	G-CSF	granulocyte colony stimulating factor
EPCR	endothelial protein C receptor	GCB	germinal center B-cell
EPI	epinephrine	GCT	giant cell tumor
ERG	v-ets erythroblastosis virus E26 oncogene homolog	Ge	Gerbich
ERIC	European Research Initiative on CLL	GGCX	γ -glutamylcarboxylase
ES	extra signal	GGs	Globin Gene Server
ESI	electrospray ionization	GM-CSF	granulocyte-macrophage colony stimulating factor
ESR	erythrocyte sedimentation rate	G6PD	glucose-6-phosphate dehydrogenase
ET	essential thrombocythemia	GP	glycoprotein
FAB	French–American–British	GPI	glycosylphosphatidylinositol
FACS	fluorescence-activated cell sorting	GPIBA	glycoprotein Ib α
FBI	Federal Bureau of Investigation	GS	Gepriifte srchorhoit
Fc ϵ RI	high-affinity immunoglobulin E Fc receptor	G-TBF	Giemsa stained thick blood film
Fc γ RI	high-affinity immunoglobulin G Fc receptor	GTG	G-banding with trypsin treatment and Giemsa stain
Fc γ RIIa	immunoglobulin G Fc receptor IIa	GTLLF	Groupe de Travail sur les Leucémies et Lymphomes Francophone
FCS	fetal calf serum	GVHD	graft-versus-host disease
FDA	Food and Drug Administration	GVT	graft- <i>versus</i> -tumor
FDP	fibrin degradation product	Hb	hemoglobin concentration
FEU	fibrinogen equivalent unit	HCDD	heavy chain deposition disease
FFP	fresh frozen plasma	HCT	hematocrit
FGFR	fibroblast growth factor receptor	HE	hereditary elliptocytosis
FICTION	fluorescence immunophenotyping and interphase cytogenetics as a tool for the investigation of neoplasms	H&E	hematoxylin and eosin
FII:C	factor II coagulant activity	HEP	Human Epigenome Project
FISH	fluorescence <i>in situ</i> hybridization	HES	hypereosinophilic syndrome
FITC	fluorescein isothiocyanate	HFE	hemochromatosis gene
FIX	factor IX	HGP	Human Genome Project
FIX:C	factor IX coagulant activity	HGVS	Human Genome Variation Society
fL	femtoliter	HHV8	human herpes virus 8
FL	follicular lymphoma	HiCN	hemiglobincyanide
FLAER	FLuorescent AERolysin	HIPa	heparin-induced activation assay
FLT3	fms-like tyrosine kinase 3	HIPAA	Health Insurance Portability and Accountability Act
FRET	fluorescence resonance energy transfer	HIT	heparin-induced thrombocytopenia
FSC	forward scatter	HIV	human immunodeficiency virus
FSP	fibrin split products	HL	Hodgkin Lymphoma
FV:C	factor V coagulant activity	HLA	human leukocyte antigen
FVII: C	factor VII coagulant activity	HLDA	human leukocyte differential antigen
		HMW	high molecular weight
		HMWK	high molecular weight kininogen
		HPC	hematopoietic precursor and progenitor cells

Abbreviations

HPF	high-power field	ISCN	International System of Cytogenetic Nomenclature
HPFH	hereditary persistence of fetal hemoglobin	ISI	international sensitivity index
HPLC	high-performance liquid chromatography	ISLH	International Society for Laboratory Hematology
HPPK	hereditary pyropoikilocytosis	ISM	indolent systemic mastocytosis
HRP	horseradish peroxidase	ISO	International Organization for Standardization
HRP2	histidine-rich protein 2	ISTH	International Society on Thrombosis and Hemostasis
HRT	hormone replacement therapy	ITD	internal tandem duplication
HS	hereditary spherocytosis	ITP	idiopathic thrombocytopenic purpura
HSP	heat shock protein	IU	international unit
HSTCL	hepatosplenic T-cell lymphoma	IVD	<i>in vitro</i> diagnostic
HSV	herpes simplex virus	J	joining region
HTLV-I	human T-lymphotrophic virus type I	JAK2	Janus kinase 2
HUMARA	human androgen receptor	JCAHO	Joint Commission on the Accreditation of Healthcare Organizations
HUPO	Human Proteome Organization	JCI	Joint Commission International
HUS	hemolytic uremic syndrome	JMML	juvenile myelomonocytic leukemia
IAT	indirect antiglobulin test	JPEG	Joint Photographic Experts Group
ICA	index of circulating anticoagulants	K ₂ -EDTA	dipotassium ethylene diamine tetraacetic acid
ICC	International Color Consortium	K ₃ -EDTA	tripotassium ethylene diamine tetraacetic acid
ICSH	International Council for Standardization in Haematology	Kbp	kilo base pairs
IEC	International Electrotechnical Commission	KCl	potassium chloride
IEF	isoelectric focusing	KCT	kaolin clotting time
iFISH	interphase fluorescence <i>in situ</i> hybridization	kDa	kilo Dalton
Ig	immunoglobulin	Kde	kappa-deleting element
IgA	immunoglobulin A	KIR	killing inhibitory receptor
IgG	immunoglobulin G	LA	lupus anticoagulant
IgH	immunoglobulin heavy chain	LAIP	leukemia-associated aberrant immunophenotype
IGHV	immunoglobulin heavy-chain variable region	LAN	local area network
Igκ	kappa light chain	LBL	lymphoblastic lymphoma
Igλ	lambda light chain	LCDD	light chain deposition disease
IgM	immunoglobulin M	LCR	locus control region
IL-1b	interleukin-1b	LDH	lactate dehydrogenase
IL2	interleukin-2	LD-PCR	long-distance polymerase chain reaction
IL4	interleukin-4	LDT	laboratory developed test
IL-8	interleukin-8	LELY	low expression allele Lyon
ILD	immunophenotypic leukocyte differential	LEPRA	low expression allele Prague
IMGT	ImMunoGeneTics	LGL	large granular lymphocyte; large granular lymphocytosis
IMW	intermediate molecular weight	LIS	low ionic strength
INR	international normalized ratio	LL	lymphoplasmacytic lymphoma
IP	intellectual property	LM	length mutation
IP3	inositol triphosphate	LMW	low molecular weight
IPF	immature platelet fraction	LMWH	low molecular weight heparin
IPI	International Prognostic Index	LOQ	Limit of Quantitation
I-PIG	International PNH Interest Group	Lp(a)	lipoprotein(a)
IPSS	International Prognostic Scoring System	LPD	lymphoproliferative disorder
IQ	installation qualification	LPS	lipopolysaccharide
IRF	immature reticulocyte fraction		
IRIS	International Randomized Study of Interferon and STI571		
IRP	international reference preparation		
IS	international standard		

LSI	locus-specific identifier	MPN	myeloproliferative neoplasm
LSRB	length sedimentation reaction in blood	MPO	myeloperoxidase
LUC	large unstained cells	MPV	mean platelet volume
M	monitoring therapy	MRD	minimal residual disease
M	molar	MRE	major regulatory element
MAC	membrane attack complex	MRI	magnetic resonance imaging
MAGE	MicroArray and Gene Expression	mRNA	messenger RNA
MALDI	matrix-assisted laser desorption/ionization	MS	mass spectrometry; methionine synthetase
MALDI-TOF	time of flight		
MALT	mucosa-associated lymphoid tissue	MS/MS	tandem mass spectrometry
MAQC	MicroArray Quality Control	MTC	major translocation cluster
MASS	methylation assessment of single samples	MTHF	methylenetetrahydrofolate
Mb	mega base pair	MTHFR	methylenetetrahydrofolate reductase
mBAND	multicolor-banding fluorescence <i>in situ</i> hybridization	μ-BCR	micro breakpoint cluster region
M-BCR	major breakpoint cluster region	μL	microliter
m-BCR	minor breakpoint cluster region	MYH9	non muscle myosin heavy chain
MCF	mean channel fluorescence	MYH11	smooth muscle myosin heavy chain
MCH	mean cell hemoglobin	MZL	marginal zone B-cell lymphoma
MCHC	mean cell hemoglobin concentration	NADH	nicotinamide adenine dinucleotide
MCL	mantle cell lymphoma	NAIT	neonatal alloimmune thrombocytopenia
MCV	mean cell volume	NAP	neutrophil alkaline phosphatase
MD	medical doctor	NAP-2	neutrophil activating protein-2
MDS	myelodysplastic syndrome	NASA	naphthol AS acetate esterase
MDS-U	myelodysplastic syndrome-unclassified	NASCOLA	North American Specialized Coagulation Laboratory Association
MeDIP	methyated DNA immunoprecipitation		
MELD	model for end stage liver disease	NASDA	naphthol AS-D acetate esterase
MESF	molecules of equivalent soluble fluorochrome	NBF	neutral buffered formalin
MFI	mean fluorescent intensity; median fluorescent intensity	NBU	Nijmegen-Bethesda unit
M-FISH	multicolor fluorescence <i>in situ</i> hybridization	NCCLS	National Committee for Clinical Laboratory Standards
MGG	May–Grünwald–Giemsa	NCI	National Cancer Institute
MgSO ₄	magnesium sulfate	NEMA	National Electrical Manufacturers Association
MGUS	monoclonal gammopathy of undetermined significance	NEQAS	National External Quality Assessment Service
MHC	major histocompatibility complex	ng	nanogram
MHOP	molecular oncology for paraffin	NHANES	National Health and Nutrition Examination Survey
MIAME	Minimum Information About a Microarray Experiment	NHL	non-Hodgkin lymphoma
MIRL	membrane inhibitor of reactive lysis	NIBSC	National Institute for Biologic Standards and Control
mL	milliliter	NIH	National Institutes of Health
MLD	morphological leukocyte differentiation	NINDS	National Institute of Neurological Disorders and Stroke
MLL	myeloid lymphoid lineage; mixed lineage leukemia	NK	natural killer
MLPA	multiple ligation-dependent probe amplification	NL	normal
MNDA	myeloid cell nuclear differentiation antigen	nm	nanometer
MO	molecular oncology	NO	nitrous oxide
MoAb	monoclonal antibody	NPM1	nucleophosmin
MPC	mean platelet component	NPP	normal pooled plasma
MPCM	maculopapular cutaneous mastocytosis	NRBC	nucleated red blood cell
		NSE	nonspecific esterase
		NSTEMI	non-ST-elevation myocardial infarction

Abbreviations

OASIS	Organization for the Assessment of Strategies for Ischemic Syndromes	PLT	platelet
OB	obstetric	PMBL	primary mediastinal large B-cell lymphoma
OD	optical density	PMF	primary myelofibrosis
OS	overall survival	PML	promyelocytic leukemia
OQ	operation qualification	PMN	polymorphonuclear neutrophil
P	prognosis	PMP	platelet microparticle
PACS	Picture Archiving and Communication Systems	PMT	photomultiplier tube
PAI-1	plasminogen activator inhibitor-1	PNA	peptide nucleic acid
PAP	plasmin/antiplasmin complex	pNA	paranitroaniline
PAR	protease-activated receptor	PNET	primitive neuroectodermal tumor
PAS	periodic acid–Schiff	PNG	Portable Network Graphics
PB	peripheral blood	PNH	paroxysmal nocturnal hemoglobinuria
PBS	phosphate buffered saline	PNP	platelet neutralization procedure
PBSC	peripheral blood stem cell	pO ₂	partial pressure of oxygen
PC	protein C; plasma cell	POC	point-of-care
PCA	principle component analysis	PPACK	D-phenylalanine-proline-arginine -chloromethylketone
PCL	plasma cell leukemia	PPi	pyrophosphate
PCM	plasma cell myeloma	PPP	platelet poor plasma
pCO ₂	partial pressure of carbon dioxide	PQ	performance qualification
PCR	polymerase chain reaction	PS	protein S
PCT	platelet-crit	PSM	probability state model
PCV	packed cell volume	PT	prothrombin time; prothrombin
PDGFR	platelet-derived growth factor receptor	PTCL-US	peripheral T-cell lymphoma, unspecified
PDW	platelet distribution width	PTD	partial tandem duplication
PE	phycoerythrin; pulmonary embolism	PTLD	post-transplant lymphoproliferative disorder
PerCP	peridinin chlorophyll protein	PTT	partial thromboplastin time
PET	polyethylene terephthalate	PT-VWD	platelet-type von Willebrand disease
Pf	<i>Plasmodium falciparum</i>	PV	polycythemia vera
PF1.2	prothrombin fragment 1.2	Pv	<i>Plasmodium vivax</i>
PF4	platelet factor 4	PvMSP1	<i>Plasmodium vivax</i> merozoite surface protein-1
PFA	platelet function analyzer	QBC	quantitative buffy coat
PfATPase	<i>Plasmodium falciparum</i> adenosine triphosphatase	QC	quality control
PfMSP	<i>Plasmodium falciparum</i> merozoite surface protein	<i>r</i>	correlation coefficient
pg	picogram	RA	refractory anemia
PGE ₁	prostaglandin E1	RAEB	refractory anemia with excess blasts
PGR	progression	RAEB-t	refractory anemia with excess blasts in transformation
PHA	phytohemagglutinin	RAG	recombinase-activating gene
PhD	Doctor of Philosophy	RARS	refractory anemia with ringed sideroblasts
PI	propidium iodide	RBC	red blood cell count
PIG-A	phosphatidylinositol glycan complementation class A	RCMD	refractory cytopenia with multilineage dysplasia
Plgn	plasminogen	RCo	ristocetin cofactor
PK	prekallikrein	RCPA	Royal College of Pathologists of Australasia
PL	phospholipid; prolymphocyte	RCUD	refractory cytopenia with unilineage dysplasia
PLA	platelet antigen	RDW	red cell distribution width
PLATO	Platelet Inhibition and Patient Outcomes	RECORD	Regulation of Coagulation in Orthopedic Surgery to Prevent Deep Venous Thrombosis and Pulmonary Embolism
PLC	phospholipase C		
P-LCR	platelets large cell ratio		
pLDH	<i>Plasmodium</i> lactate dehydrogenase		
PLL	prolymphocytic leukemia		

RE-LY	Randomized Evaluation of Long Term Anticoagulant Therapy	SSOP	sequence-specific oligonucleotide probe
RFLP	restriction fragment length polymorphism	s_t	total imprecision
RFS	relapse free survival	STEMI	ST-elevation myocardial infarction
RGB	red, green and blue	STR	short tandem repeat
Rh	Rhesus	s_w	within-run imprecision
RHAG	Rhesus-associated glycoprotein	$s_{y/x}$	standard deviation of the regression line (deoxythymidylate) thymine
RI	refractive index	T	(deoxythymidylate) thymine
RIA	radio immuno assay	TAFI	thrombin-activatable fibrinolysis inhibitor
RIPA	ristocetin-induced platelet agglutination	TA-GVHD	transfusion-associated graft-versus-host disease
RNA	ribonucleic acid	T-ALL	T-cell acute lymphoblastic leukemia
RNase	ribonuclease	t-AML	therapy-related acute myeloid leukemia
ROC	receiver operating characteristic	TAR	thrombocytopenia with absent radii
ROTEM	rotational thromboelastometry	TAT	thrombin antithrombin complex
RPMI	Roswell Park Memorial Institute	TBNK	T, B and NK cell
RQ-PCR	real-time quantitative polymerase chain reaction	TC	triple-color
RR	relapse risk	TCR	T-cell receptor
rRNA	ribosomal RNA	TD-FISH	tricolor double-fusion fluorescence <i>in situ</i> hybridization
RSS	recombination signal sequence	TDI	template-directed dye-terminator incorporation
RT	reptilase time	TdT	terminal deoxynucleotidyl transferase
RT-PCR	reverse transcription polymerase chain reaction	TEG	thromboelastography
S	switch region	TEM	transmission electron microscopy
SAH	S-adenosylhomocysteine	TF	tissue factor
SAM	S-adenosylmethionine	T-FISH	target fluorescence <i>in situ</i> hybridization
s_b	between-run imprecision	TFPI	tissue factor pathway inhibitor
SBB	Sudan black B	THF	tetrahydrofolate
SBPE	single base primer extension	TIFF	tagged image file format
SC	single-color	TKR	Total knee replacement
SCD	sickle cell disease	T-LBL	T-acute lymphoblastic lymphoma
SCT	stem cell transplantation	TM	thrombomodulin
SD	standard deviation	T_m	melting temperature
SDI	standard deviation index	t-MDS	therapy-related myelodysplastic syndrome
SDS-PAGE	sodium dodecyl sulfate polyacrylamide gel electrophoresis	TMEP	telangiectasia macularis eruptiva perstans
SELDI	surface-enhanced laser desorption/ionization	TNF α	tumor necrosis factor α
S-FISH	suspension fluorescence <i>in situ</i> hybridization	TOF	time-of-flight
SHM	somatic hypermutation	TPA	12- <i>O</i> -tetradecanoylphorbol-13-acetate
SKY	spectral karyotyping	tPA	tissue plasminogen activator
SLE	systemic lupus erythematosus	T-PLL	T-cell prolymphocytic leukemia
SLL	small lymphocytic lymphoma	TPO	thrombopoietin
SLVL	splenic lymphoma with villous lymphocytes	TRAP	tartrate-resistant acid phosphatase
SM	systemic mastocytosis	TRITON-TIMI	TRial to Assess Improvement in Therapeutic Outcomes by Optimizing Platelet Inhibition with Prasugrel-Thrombolysis In Myocardial Infarction
SmIg	surface membrane-bound immunoglobulin	TT	thrombin time
SNP	single nucleotide polymorphism	TTI	tissue thromboplastin inhibition
SOM	self-organizing map	TTP	thrombotic thrombocytopenic purpura
SRA	serotonin release assay	TxA_2	thromboxane
SSC	Science and Standardization Committee; side scatter	UFH	unfractionated heparin
SSCP	single-strand conformation polymorphism	UK	United Kingdom
		UL	Underwriters Laboratories
		UMP	uridine monophosphate