IMMUNOPHENOTYPING REFERENCE TABLE

FOR HAEMATOPOIETIC MALIGNANCIES

CHRONIC

DISEASES =>	Mature B-Cell Neoplasms												Mature T-Cell and NK-Cell Neoplasms											
WHO 2008 Classification (see ref.1)	B-CLL/SLL	B-Cell Prolymphocytic Leukemia	Splenic Marginal Zone Lymphoma	Hairy Cell Leukemia	Lymphoplasmacytic Lymphoma	Heavy Chain Diseases	Plasma Cell Myeloma	MALT Lymphoma	Nodal Marginal Zone Lymphoma	Follicular Lymphoma	Mantle Cell Lymphoma	Diffuse Large B-Cell Lymphoma, NOS	Burkitt Lymphoma	T-Cell Prolymphocytic Leukemia	T-Cell LGL Leukemia	Chronic Lymphoproliferative Disorders of NK Cells	Aggressive NK-Cell Leukemia	Adult T-Cell Leukemia / Lymphoma	Enteropathy-Associated T-Cell Lymphoma	Type II Enteropathy-Associated T-Cell Lymphoma	Hepatosplenic TCL	Subcutaneous Panniculitis-Like TCL	Mycosis Fungoides	Sézary Syndrome	Peripheral T-Cell Lymphoma, NOS	Angioimmunoblastic T-Cell Lymphoma	Anaplastic Large Cell Lymphoma, ALK positive
ICD-O code =>	9823/3	9833/3	9689/3	9940/3	9671/3	9762/3	9732/3	9699/3	9699/3	9690/3	9673/3	9680/3	9687/3	9834/3	9831/3	9831/3	9948/3	9827/3	9717/3	9717/3	9716/3	9708/3	9700/3	9701/3	9702/3	9705/3	9714/3
in red = BETHESDA first pass markers (see ref. 2.)																											
CD45																											
CD2																											
CD3														7													
CD4															9										14		
CD5																											
CD7																											
CD8														8		11									14		
CD10																											
CD11b																											
CD13																											
CD14																											
CD15																											
CD16																											
CD19																											
CD20																											
CD33																											
CD34																											
CD38																											
CD56																											
CD117																											
HLA-DR																											
κ or λ clonality												6															
in blue = further useful surface markers																											
CD1a																											
CD11c																											
CD21																											
CD22																											
CD23																											
CD25																											
CD26																											
CD30																											
CD35																											
CD43																											
CD45R0																											
CD49d	Px																										
CD52																											
CD57																											
CD79b																											
CD81																											
CD94															9												
CD103																											
CD123																											
CD138																											
CD178																											
CD279																											
Alk-1																											
CCR4																											
KIR family isoforms															9	12											
FMC7																											
TCRαβ																					13						
TCRγδ															10												
All Ig, heavy chains (surface)												1								3	4	5					
in green = useful intracellular markers																											
CD3 (intra)																											
CD79a (intra)																											
Bcl2																											
Bcl6																											
Cyclin D1																											
FoxP3																											
Granzyme-B																											
Ig, heavy chains (intra): IgM																											
κ or λ clonality (intra)																											
Ki-67																											
Perforin																											
TdT																											
TIA-1																											
ZAP-70	Px																										

ACUTE

DISEASES =>	Acute Myeloid Leukemia															B Lymphoblastic Leukemia / Lymphoma									T Lineage			
WHO 2008 Classification (see ref.1)	AML with t(8;21)	AML with inv(16)	APL with t(15;17)	AML with t(9;11)	AML with t(6;9)	AML with inv(3)	AML (megakaryoblastic) with t(1;22)	AML NOS with minimal differentiation, NOS	AML without maturation, NOS	AML with maturation, NOS	AML acute promyelocytic leukemia, NOS	AML acute myelomonocytic leukemia, NOS	AML acute monoblastic / monocytic leukemia, NOS	AML acute erythrocytic leukemia, NOS	AML acute megakaryoblastic leukemia, NOS	AML acute basophilic leukemia, NOS	AML acute panmyelosis with myelofibris, NOS	B-ALL / B-LBL, NOS				B-ALL / B -LBL with t(9;22)	B-ALL / B-LBL with t(v;11q23)	B-ALL / B-LBL with t(12;21)	B-ALL / B-LBL with hyperdiploidy	B-ALL / B-LBL with hypodiploidy	B-ALL / B-LBL with t(15;14)	B-ALL / B-LBL with t(1;19)	T Lymphoblastic Leukemia / Lymphoma			
ICD-O code =>	9896/3	9871/3	9866/3	9897/3	9865/3	9869/3	9911/3	9872/3	9873/3	9874/3		9867/3	9891/3	9840/3	9910/3	9870/3	9931/3	9811/3				9812/3	9813/3	9814/3	9815/3	9816/3	9817/3	9816/3	9837/3			
Older / Distinct Sub-Classification			- FAB M3		- FAB M7		- FAB M0	- FAB M1	- FAB M2		- FAB M3	- FAB M4	- FAB M5	- FAB M6	- FAB M7			Pro-B-ALL (B-I)	Common-B-ALL (B-II)	Pre-B-ALL (B-III)	B-ALL (B-IV)								Pro-T-ALL (T-I)	Pre-T-ALL (T-II)	Cortical T-ALL (T-III)	Medullary T-ALL (T-IV)
in red = BETHESDA first pass markers (see ref. 2.)																															
CD45																															
CD2																															
CD3																															
CD4																														19	19
CD5																															
CD7																															
CD8																														19	19
CD10																															
CD11b																															
CD13			15								15																				
CD14																															
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CD24																															
CD25																															
CD36																															
CD41																															
CD42b																															
CD61																															
CD64												16																			
CD65																															
CD66c (KOR-SA3544)																															
CD68																															
CD71																															
CD99																															
CD123																															
CD163																															
CD203c																															
CD235a																															
NG2 (Clone 7.1)																															
All Ig, heavy chains (surface)																															
in green = useful intracellular markers																															
CD3 (intra)																															
CD22 (intra)																															
CD41 (intra)																															
CD61 (intra)																															
CD79a (intra)																															
Ig, heavy chains (intra): IgM																															
Lysozyme																															
MPO																															
PAX5																															
TdT																															

Chart for Icons	Dim when positive	Variable when positive	Bright when positive
Always negative			
Most negative			
Most positive			
Always positive			

1 Waldenström macroglobulinema (ICD-O code=9761/3) is found in a significant subset of patient suffering of LPL with BM involvement and an IgM monoclonal gammopathy of any concentration.
2 In Heavy Chain Diseases, intra Ig heavy chains are not always IgMs.
3 Typically IgM+, and less often IgA+ or IgG+.
4 IgD is positive in a minority of the cases.
5 IgM+/-, IgD, IgG or rarely IgA.
6 More frequently with Lambda than Kappa restriction.
7 The membrane expression of CD3 may be weak.
8 25% of patients coexpress CD8 with CD4, a feature almost unique to T-PLL. 15% are CD4-neg, CD8-pos.
9 Expression of CD94/NKG2 and KIR families of receptors can be detected in 50% or more of cases.
10 Uncommon variants include CD4 TCRα/β-pos cases and TCRγ/δ-pos cases. Approximately 60% of the latter express CD8, the remainder are CD4/CD8-neg.
11 Abnormal uniform expression of CD8 can be seen.
12 KIR-pos cases preferentially express activating receptor isoforms.
13 If TCRα/β-positive, expect different immunophenotype for the rest of the markers.
14 A CD4-pos/CD8-neg phenotype predominates in nodal cases. CD4/CD8 double positivity or double negativity is at times seen.
15 CD13 with heterogeneous expression.
16 Co-expression of CD15 and strong CD64 is characteristic of monocytic differentiation.
17 CD25 is highly associated with t(9;22) B-ALL, at least in adults.
18 NG2 is characteristically expressed and is relatively, though not absolutely, specific.
19 The cortical T stage shows a double positive (CD4-pos/CD8-pos) phenotype. The medullary T stage expresses only either CD4 or CD8.

KEYS:

ALK	Anaplastic Lymphoma Kinase
ALL	Acute Lymphoblastic Leukemia
AML	Acute Myeloid Leukemia
B-CLL/SLL	B-Cell Chronic Lymphocytic Leukemia / Small Lymphocytic Lymphoma
B-LBL	B-Cell Lymphoblastic Lymphoma
BM	Bone Marrow
FAB	French American British
ICD-O	International Classification of Diseases for Oncology codes, according to the 4th edition
LPL	Lymphoplasmacytic Lymphoma
MALT	Mucosa-Associated Lymphoid Tissue
NOS	Not Otherwise Specified
Px	Prognostics
TCL	T-Cell Lymphoma
T-LGL	T-Cell Large Granular Lymphocyte Leukemia
T-PLL	T-Cell Prolymphocytic Leukemia
WHO	World Health Organization

REFERENCES:

1. WHO Classification of Tumours of Hæmatopoietic and Lymphoid Tissues, 4th Edition, Swerdlow SH, Campo E, Harris NL, Jaffe ES, Pileri SA, Stein H, Thiele J and Vardiman JW (Eds.): IARC Press, Lyon (2008).
2. Wood BL, Arroz M, Barnett D, DiGiuseppe J, Greig B, Kussick SJ, Oldaker T, Shenkin M, Stone E and Wallace P, "2006 Bethesda International Consensus Recommendations on the Immunophenotypic Analysis of Hematolymphoid Neoplasia by Flow Cytometry: Optimal reagents and reporting for the flow cytometric diagnosis of hematopoietic neoplasia." Cytometry Part B (Clinical Cytometry), 72B:S14-22 (2007).

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