Characteristics of 27 Human T-Cell Leukemia Cell Lines With/Without T-Cell Receptors of T3-Ti$\alpha\beta$ or T3-Ti$\gamma\delta$ Complex *

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A. Introduction

The advances in the study of human leukocyte differentiation and its immunobiological function have been greatly facilitated by developments in four areas of methodology: first by the establishment of stable permanent leukemia cell lines of various origins, secondly by the development of numerous specific heterologous antibodies to various leukocyte differentiation antigens, thirdly by the introduction of many functional assays of both hematopoietic progenitor cells and mature leukocyte subsets, and fourthly by the development of recombinant DNA technology.

We have been interested in characterizing both permanent leukemia-lymphoma cell lines and fresh uncultured leukemia-lymphoma cells by means of multiple marker analysis which includes morphologic, immunobiologic, cytogenetic, enzymatic, virologic, functional, and molecular parameters [8, 9]. At present there are a total of 111 proven human leukemia-lymphoma cell lines which are being maintained and characterized in the laboratory. Of these cell lines, 35 were identified as those T-cell lines representing each of the 5 stages in the T-cell differentiation and maturation previously described, namely T-blast-I, -II, -III, -IV, and -V, respectively, in the order of maturation [9]. The advantages of utilizing leukemia-lymphoma cell lines are threefold: individual leukemia-lymphoma cell line presents an expanded monoclonal population, the marker profile reflects an arrested stage of various discrete points of hematopoietic cell differentiation, and stability and availability are high and unlimited. Furthermore, all characteristics except cytogenetic findings found in the leukemia-lymphoma cell lines are not tumor specific, but these characteristics appear to be the normal gene products often of vital significance in immunobiology [4, 8, 9].

The present report is a brief account in the expression of T-cell antigen receptor complex among 27 T-cell leukemia-lymphoma cell lines.

B. Materials, Methods, Results, and Discussion

As previously reported [8, 9, 12], the established leukemia cell lines and those cell lines transformed in vitro by HTLV-I infection were maintained in RPMI 1640 medium supplemented with heat-inactivated fetal calf serum in the standard procedure. Care was taken to maintain the cell cultures in an exponential growth phase in order to optimize the experiments. A standardized membrane immunofluorescence test using appropriate

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Table 1. T-cell leukemia-lymphoma cell lines with/without Ti-$\alpha\beta$ or Ti-$\delta\gamma$ (%)

Cell line	Cell stage	TdT	CD3 Leu-4	CD4 Leu-3a	CD8 Leu-2a	TcR WT-31	TcR Delta-1	CD10 BA3	CD10 NU-N1	CD34 MY10	CD5 Leu-1	CD7 3A1	CD25 TAC	CD28 Kolt-2	HLA-DR HLA-Dr	HLA-DP B7/21	HLA-DQ Leu-10
$CD3^+$ Ti-$\alpha\beta^+$ Ti-$\delta\gamma^-$																	
CCRF-CEM	T-II	100	100	100	0	100	0	100	100	90	100	100	0	100	0	0	0
HPB-ALL	T-II	100	100	100	100	100	0	100	100	0	100	100	0	90	0	0	0
HPB-MLT	T-II	100	100	100	100	100	0	100	100	0	100	100	0	100	0	0	0
HD-Mar-2	T-II	100	100	100	90	100	0	100	100	0	100	100	0	100	0	0	
TALL-1	T-III	100	100	100	100	50	0	0	0	0	100	100	0	90	0	0	
MOLT-16	T-III	100	100	10	0	100	0	0	0	0	100	100	0	90	0	0	0
JURKAT	T-III	60	100	50	0	100	0	0	0	0	90	90	0	50	0	0	
MAT	T-IV		70	0	0	60	0	0	0	0	90	100	0	100	0	0	0
H9	T-V	0	95	80	0	100	0	0	0	0	100	20	0	0	100	100	
ED-S	T-V	0	100	100	0	100	0		0		100	0	100	0	90	100	
ATL-35T°	T-V	0	100	100	0	50	0	0	0		100	100	100	0	100	100	100
$CD3^+$ Ti-$\alpha\beta^-$ Ti-$\delta\gamma^+$																	
DND-41	T-II	100	100	100	0	0	80	100	100	0	80	100	0	80	0	0	0
MOLT-13	T-III	100	90	0	0	0	100	0	0	100	90	90	20	100	0	0	
MOLT-14	T-III	100	90	0	0	0	100	0	0	100	100	90	30	100	0	0	
PEER	T-IV	0	90	90	0	0	100	0	20	0	100	100	0	100	0	0	
$CD3^+$ Ti-$\alpha\beta^-$ Ti-$\delta\gamma^-$																	
MKB-1	T-III	50	40	100	0	0	0	70	90	0		100	0	0	0	0	0
HUT-78	T-V	0	50	10	0	0	0	0	0	0	50	10	0	0	100	100	100
$CD3^-$ Ti-$\alpha\beta^-$ Ti-$\delta\gamma^-$																	
MOLT-3	T-III	100	0	100	75	0	0	0	0	70	100	100	0	100	0	0	0
MOLT-4	T-III	100	0	100	75	0	0	0	0	50	100	100	0	90	0	0	0
P12/ICHIKAWA	T-III	100	0	100	60	0	0	0	0	20	100	100	0	10	0	0	
SKW-3	T-IV	0	0	100	90	0	0	0	0	0	100	100	0	100	0	0	0
MOLT-15	T-IV	0	0	0	0	0	0	0	0	20	0	95	0	10		0	
ALL-SiL	T-IV	0	0	90	100	0	0	0	0	0	90	100	0	0		0	0
MT-1	T-V	0	0	0	0	0	0	0	0	0	100	0	100	100	100	100	100
HUT-102	T-V	0	0	100	0	0	0	0	0	0	100	0	100	0		100	100
C5/MJ	T-V	0	0	90	0	0	0	0	0	0	100	80	100	0	100	100	100
ATL-16T°	T-V	0	0	100	0	0	0	0	0		100	0	100	0	100	100	100

antibody reagents, morphologic test, and a few functional tests including IL-1, IL-2, and growth kinetic determinations were carried out. Numerous numbers of murine monoclonal antibody reagents for which the majority had been classified by the International Workshops [3, 7, 11] into the CD categories were used in the study.

Table 1 summarizes the percentage immunofluorescence test results with selected reagents relevant for this report. To determine expression of T-cell receptor (Ti$\alpha\beta$) and (Ti$\gamma\delta$), monoclonal antibodies, WT-31 [13] and TcR Delta-1 [2] were used respectively. In respect to the expression of CD3, four groups ($CD3^+.Ti\alpha\beta^+$; $CD3^+.Ti\gamma\delta^+$; $CD3^+.TcR^-$; $CD3^-.TcR^-$) were identified. Considering the stages of T-cell differentiation [8], T-cell receptor expression and CD3 expression occur in a relatively early stage. It was confirmed that Ti$\alpha\beta$ and Ti$\gamma\delta$ expressions are mutually exclusive and that CD3 expression is obligatory with T-cell receptor expression [1, 4, 14, 15]. Two cell lines with $CD3^+$ lack detectable expression of either forms of TcR. As expected all cell lines with $CD3^-$ were found to be negative for the TcR. Unlike reported "double-negative" T cells in respect to CD4 and CD8 [6, 10, 14], two T-cell lines with Ti$\gamma\delta$ (DND-41 and PEER) were positive for CD4. In view of the reported leukemia T-cell lines with IL-2 production [5], some T-cell lines with Ti$\alpha\beta$ (MOLT-16) or Ti$\gamma\delta$ (MOLT-14) were found to be capable of producing, specifically and nonspecifically, IL-2 with appropriate stimuli (data not shown).

The present study has therefore demonstrated again that these cell lines provide significant materials and possible models for basic research in human immunobiology.

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