An Antigen Common to Chronic Lymphocytic and Hairy Cell Leukemia Cells Not Shared by Normal Lymphocytes or by Other Leukemic Cells

By Julia F. Agee, Fred A. Garver, and Guy B. Faguet

Rabbit xenoantisera and mouse monoclonal antibodies prepared against human chronic lymphocytic leukemia (CLL) B cells were found to react against a single polypeptide chain with a mol wt of 69 kd found on leukemic cells of all CLL (N = 40) and B type hairy cell leukemia (HCL) patients (N = 9) examined. This common CLL-associated antigen (cCLLa) was not detectable on circulating T or B lymphocytes, thymocytes, lymph node and splenic lymphocytes, or bone marrow leukocytes from normal persons. In addition, the cCLLa was not detectable on cultured T or B lymphoblastoid cell lines or on malignant cells from other forms of lymphocytic or myelocytic leukemia. Non-Hodgkin’s lymphoma cells also failed to express the antigen. Autologous cultured lymphoblastoid cell lines were established from residual normal B cells from a CLL patient whose cells were used to generate one of the antisera.

DEFINING the expression of normal antigens on the surface of neoplastic hematopoietic cells has facilitated the elucidation of the cellular origin and differentiation pathways of these cells. Thus, leukemias and lymphomas, traditionally grouped according to histology, cell morphology, and cytochemistry, can now be subclassified based on their membrane markers.12 Cells from patients with acute lymphoblastic leukemia (ALL), for example, exhibit T or B lymphocyte markers or lack both, the latter being associated with a better prognosis.23 In contrast, malignant cells of most patients with chronic lymphocytic leukemia (CLL) express phenotypic markers characteristic of B lymphocytes.4 The SIg of CLL cells with B phenotype has restricted heterogeneity as compared with that found on normal B cells, indicating a monoclonal origin of the leukemic cell.5 The evidence supporting the existence of distinct tumor specific antigens in humans is circumstantial, efforts were made to identify surface antigens uniquely expressed on leukemic cells.6,7 However, early reports of tumor-associated antigens on leukemic cells were met with skepticism in view of their lack of specificity. This and the observation that leukemia appears to be a consequence of a blocked differentiation rather than a loss of growth control8-10 suggest that tumor-associated antigens are probably remnant “differentiation” antigens deleted during the differentiation process of normal cells.

In this communication, we report that CLL and hairy cell leukemia (HCL) share a common but unique antigen which appears distinct from differentiation antigens and is unrelated to antigens previously detected on leukemia or lymphoma cells, including the HTLV-1.

MATERIALS AND METHODS

Cells. Normal and CLL lymphocytes and blasts from leukemic patients were prepared from heparinized peripheral blood by Ficoll-Hypaque gradient modified to remove monocytes.11 CLL cells were obtained from patients with B cell lymphoproliferations with circulating lymphocyte counts >30,000/μL. Promyelocytes were obtained from the buffy coat fraction after dextran sedimentation of venous blood from patients with acute promyelocytic leukemia (APrML). Thymic, splenic, lymph node, and bone marrow cells were teased from fresh biopsy specimens. Erythrocytes were removed from bone marrow samples by hypotonic lysis. B-enriched and T-enriched lymphocyte populations were separated according to the method of Weiner and colleagues.3 B-enriched cells were in some instances prepared by the HEAC rosetting technique.12 B-enriched and T-enriched lymphocyte preparations were consistently >80% and >90% phenotypically homogeneous, respectively. Myeloid and monocytoid cell contamination averaged <3%, respectively, as illustrated in Table 1. Lymphoid cell lines were established from peripheral blood lymphocytes of a CLL patient and of two patients with HCL as outlined by Moore.4 Lymphoblastoid cell lines of B-cell (LS-1, MA-1, SA-1, KS-1, DBA-2, DBA-3, JY, B66, B110, B411, RPMI-1788, IM9, SB, and QIK) or T cell lineage (HSB, CEM, TAR, and MOLT-4), the pluripotent K562 cell line, and a fetal lymphoid cell line were cultured in appropriate media and stored in liquid nitrogen. Target cell preparations were characterized by cytomorphology and by surface marker phenotyping prior to assay. Cell subset distribution in cell preparations is indicated in the text when appropriate.

Cell phenotyping. SIgs were determined by direct immunofluorescence using fluorescein-conjugated antisera specific for IgM, IgG, IgA, and IgD heavy chains and for κ and λ light chains (Meloy Laboratories, Springfield, Va). Other surface determinants were assessed by indirect immunofluorescence assay (IFA) using appropriate monoclonal antibodies commercially available: (OKT series, Ortho Diagnostics, Raritan, NJ; LEU series, Becton Dickinson, Mountain View, Calif; and My, B2, M0, and J-5, Coulter Immunology, Hialeah, Fla).

Anti-CLL antibodies. Xenogeneic antisera were produced in New Zealand white rabbits by biweekly intravenous (IV) injections.
of T lymphocytes from each of three normal individuals who shared two or more HLA antigens with the antisera-generating CLL donor. The combined absorptions accounted for all of the HLA A, B, and C antigens except for aCLL, which uses FITC-conjugated antimyeloid and antimonocytoid monoclonal antibodies. Absorptions were then individually absorbed with peripheral blood lymphocytes (PBL) (2.0 x 10⁵/mL of antiserum) from normal or CLL lymphocyte preparations. Negative controls and anti-B cell antibodies were used as positive controls for both IFA and cytotoxicity studies of lymphoid target cells. Negative controls gave reactivity ranges of ≥ 4% and ≤ 10% for IFA and cytotoxicity, respectively. Positive controls gave reactivity ranges of 87% to 99% and 91% to 99% for normal B and T lymphocytes, respectively, and 64% to 100% for CLL cells regardless of assay used. Specific antmyeloid and antimonocytoid monoclonal antibodies were used mostly to ascertain the extent of nonlymphoid cell contamination of normal or CLL lymphocyte preparations.

**Membrane preparation and partial purification.** Membranes were prepared from leukemia cells obtained by leukopheresis of CLL patients with a WBC count of ≥ 300,000/μL according to a modified published procedure. Lyophilized samples from aCLL-IgG-Sepharose affinity column-purified membranes were dissolved in 10 mmol/L of phosphate buffer, pH 8.0, and applied to a 10-μL column of diethylaminoethane (DEAE)-cellulose (DE-52, Whatman, Inc, Pierce Chemical Co, Rockford, Ill) equilibrated with the same buffer. The protein was eluted with a NaCl gradient made up from 20 mL of .02 mol/L of NaCl, 20 mL of 2 mol/L of NaCl, followed by 10 mL of 3 mol/L of NaCl. One-milliliter fractions were collected, and the protein was located by measuring the absorption at 280 nm.

**Gel electrophoresis.** The homogeneity and mol wt of the antigen was assessed by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) on 12% slab gels. The antigen was dissolved in 0.625 mol/L of Tris-HCL, pH 6.8, containing 0.005% bromophenol blue, 2% SDS, 2% mercaptoethanol, and 10% glycerol, and heated at 100°C for 3 to 5 minutes. Mercaptoethanol and heating treatment were omitted for nonreduced samples. The gels were fixed and stained with Coomassie blue or silver nitrate. The mol wt of protein bands was estimated by extrapolation from a standard curve (mol wt v mobility) using mol wt markers run simultaneously.

**RESULTS**

**Antibody reactivity of antiserum aCLL/aB.** Antiserum aCLL/aB was titered against CLL and normal B lymphocyte target cells as shown in Fig 1. Increasing the antiserum concentration-target cell ratio resulted in greater lysis of CLL cells than of B cells. At the maximum amount of antiserum added, 50 μL, lysis of B cells reached a plateau of 60%, whereas 20 μL of antiserum achieved 100% lysis of malignant CLL cells (cells bearing monoclonal Slg). These results suggested that the antiserum contained different antibodies reacting with both CLL cells and normal B cells, respectively.
or that CLL cells exhibited either greater density of an antigen shared by normal B cells or greater affinity for a common antibody or were more susceptible to complement-mediated lysis than normal B cells were. In an effort to distinguish among the above possibilities, aliquots of antisera aCLL/aB were absorbed with B cells from seven normal subjects or with CLL cells from six patients and were assayed by cytotoxicity against 51Cr-labeled normal B and CLL target cells (Table 2). As shown, enriched B cells (81% SIg positive) from certain normal subjects (Roc, Ta, Gre, Dor) reacted with the unabsorbed antiserum whereas others did not (Ger, Me). Absorption with B cells from any one reacting subject eliminated the antibody activity against B cells from that person and all previously reacting persons. Absorption with B cells from previously nonreacting persons (Ger, Me) failed to remove antibody activity to previously

**Table 2. Cytotoxic Activity of Antiserum aCLL/aB After Absorption With Enriched Normal B Lymphocytes or CLL Cells**

<table>
<thead>
<tr>
<th>Absorbing Cells</th>
<th>Normal B Lymphocytes</th>
<th>CLL Cells</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ROC</td>
<td>TA</td>
</tr>
<tr>
<td>None</td>
<td>27</td>
<td>25</td>
</tr>
<tr>
<td>Normal B Cells</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROC</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TA</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>GRE</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>DOR</td>
<td>—</td>
<td>2</td>
</tr>
<tr>
<td>GRI</td>
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<td>0</td>
</tr>
<tr>
<td>GER</td>
<td>26</td>
<td>25</td>
</tr>
<tr>
<td>ME</td>
<td>27</td>
<td>24</td>
</tr>
<tr>
<td>CLL Cells</td>
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<td></td>
</tr>
<tr>
<td>MIL</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
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<td>LO</td>
<td>24</td>
<td>26</td>
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<tr>
<td>THO</td>
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<td>25</td>
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</tbody>
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**Table 3. Reactivity of the aCLL and aB Antisera After Absorption With Autologous Normal B Lymphocytes**

<table>
<thead>
<tr>
<th>Target Cells</th>
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<th>aB</th>
<th>aCLL</th>
<th>aB</th>
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<tr>
<td>Autologous B Lymphocytes</td>
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</tr>
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<tr>
<td>HAM</td>
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<td>0</td>
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<tr>
<td>MIL</td>
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<td>0</td>
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<tr>
<td>CLL Cells</td>
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<tr>
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<td>BUR</td>
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<td>0</td>
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<tr>
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<td>96</td>
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<td>0</td>
</tr>
<tr>
<td>WAT</td>
<td>100</td>
<td>50</td>
<td>92</td>
<td>2</td>
</tr>
</tbody>
</table>

**CLL, chronic lymphocytic leukemia.**

**Normal B-enriched or CLL cells (0.5 x 10⁶) were incubated with antisera aCLL/aB (60 minutes at 15 °C) and centrifuged; cell-bound antibody was ascertained by ³¹Cr-release antibody-dependent cytotoxicity assay. Results are shown as percentage of lysis of triplicate determinations (SEM < 2%). Values < 10% are considered negative.**
activity of the αβ serum against both normal B cells and CLL cells initially reactive with the αβ antiserum.

**Specificity of the αcLL antibody.** The specificity of the antibody preparation αcLL was further studied on a large panel of donors by both microcytotoxicity and immunofluorescence assays. As illustrated in Table 4, the αcLL antibody reacted with all 40 B-CLL patients tested with a range of lysis of 64% to 100% and a range of fluorescence of 73% to 100%. Included in this group were three patients with prolymphocytic leukemia (PLL). SeD, a cell line derived from a patient with CLL also showed reactivity with the αcLL antibody. In addition, cells from nine patients with Slg-positive HCL were positive for the cCLLa, as were cell lines EH and HK derived from two HCL patients (Faguet and Agee, manuscript in preparation). To ascertain the identity of the antigenic determinant detected by the αcLL on CLL and HCL cells, the following studies were done: Saturating concentrations of αcLL were incubated with 10⁶ B-CLL cells (93% monoclonal Slg positive) before and after absorption for 60 minutes at 15 °C with CLL or HCL cells or with T-enriched (96% OKT³ positive) and B-enriched (83% Sglg positive) lymphocytes from a normal donor at concentrations of 1.5 × 10⁶/mL and assayed by IFA. CLL cell reactivity with unabsorbed antibody (92%) was completely abrogated by absorption with CLL (2%) or HCL cells (2%), but was unaffected by absorption with either normal T (93%) or B (92%) lymphocytes. Similar experiments using cells from two patients with HCL as target cells yielded comparable results. Neither CLL nor HCL cells with non-B phenotypes were available for testing.

PBL, T cells, and B cells from normal subjects showed only background reactivity with the αcLL antibody. Likewise, normal thymus, spleen, and lymph node lymphocytes were equally unreactive, as were bone marrow aspirates from four patients with anemia of chronic illness (Table 4). To evaluate whether the cCLLa represented a B cell differentiation antigen not expressed on mature B cells, the αcLL antiserum was reacted against cells likely to express such differentiation antigens, including cord blood lymphocytes, and 3-, 5-, and 7-day cultures of mitogen-stimulated normal blood lymphocytes. As shown, lymphoid cells from all ten source categories and marrow interface cells failed to express the CLL antigen. The possible expression of the cCLLa on malignant cells of other types of leukemias was also investigated. Leukemias studied were: cALLa-positive and cALLa-negative acute lymphoblastic leukemia (ALL), acute myeloblastic leukemia (AML), acute myelomonoblastic leukemia (AMMoL), acute promymphocytic leukemia (AprML), and chronic myelocytic leukemia (CML) in blast crisis. As shown, none of the 32 leukemia patients examined expressed the cCLLa. Likewise, blood and lymph node lymphocytes from 14 patients with non-Hodgkin’s lymphoma as well as lymph node lymphocytes and splenocytes from three patients with advanced Hodgkin’s disease did not express the cCLLa antigen. Last, 14 lymphoblastoid B cell lines, 4 lymphoblastic T cell lines, 1 fetal lymphoid cell line, and 1 pluripotent hematopoietic cell line also failed to express the cCLLa. Selective expression of the cCLLa described above has been confirmed by mouse monoclonal antibodies (Faguet and Agee, manuscript in preparation).

**Isolation and partial characterization of the cCLLa.**

From 2.5 × 10⁹ CLL cells (B phenotype), 52 mg of membrane protein were recovered with a specific antigen activity of 0.1 U/μg as judged by cytotoxicity inhibition assay expressed as percentage of inhibition of 1 μg of αcLL IgG by 1 μg of membrane protein. Of this, 2.75 mg protein
was recovered after passage through an αCLL-Sepharose affinity column. The immunoabsorbed-bound material had a specific antigen activity of 71 U/μg (710% cCLLa enrichment). Further fractionation by ion-exchange chromatography on a DEAE-cellulose column revealed three distinct peaks: Peak 1 had no activity at concentrations up to 150 μg per well; peak 2 consisted of 1.5 mg protein with cCLLa activity of 156 U/μg protein (1,560-fold enrichment). Peak 3 consisted of a small component (0.8 mg protein) with low activity (2.7 U/μg protein). The specificity of peak 2 is shown by the fact that it did not inhibit lysis of B cells by the αB antiserum at concentrations up to 1,000 times that shown by the fact that it did not inhibit lysis of B cells by the αB antiserum at concentrations up to 1,000 times that required for complete inhibition of αCLL-induced lysis of CLL cells. SDS-PAGE gels of peak 2 revealed a major band with an estimated mol wt of 69 kd both in the presence or absence of β-mercaptoethanol and heating (Fig 2). Two experiments served as controls: (a) Using the above procedure, B cell membranes prepared from 2.5 × 10^9 B lymphocytes were applied to an αCLL-IgG-Sepharose affinity column; (b) an equivalent CLL-membrane preparation was applied to an antiheemoglobin A-IgG-Sepharose column equal in size to the αCLL-IgG-Sepharose affinity column. The immunoabsorbed material recovered from either column (0.56 mg and 0.84 mg of protein, respectively) showed no cCLLa activity at concentrations up to 150 μg of protein per well. In addition, further fractionation of these materials on a DEAE-cellulose column revealed only one peak (peak 1) with no cCLLa reactivity.

Further characterization of the cCLLa by monoclonal antibodies. The identity of the cCLLa was further ascertained as follows: Aliquots of 10^6 B-CLL cells enriched normal T and B lymphocytes were either preincubated with αCLL or not prior to exposure to a panel of monoclonal antibodies. Fresh cells were phenotyped as described in the Materials and Methods section. Cells preincubated with αCLL were assayed by indirect IFA using fluoresceinated goat anti-mouse or goat anti-rabbit antibodies to monitor mouse monoclonal and rabbit xenogeneic antibody binding, respectively. As shown in Table 1, the phenotype of fresh CLL cells and of fresh enriched circulating normal T and B lymphocytes demonstrated homogeneity of lineage. Fresh cells from each subset exhibited only background reactivity when exposed to J-5 and HTLV-I antibodies (a generous gift from Dr. D. Bolognesi, Duke University, Durham, NC). As expected, the LEU-1 antibody reacted with 88.3% of fresh CLL cells and with 92% of fresh T cells and showed background reactivity with fresh B cells. In contrast, the CLL-1 and αCLL antibodies reacted with 85.1% and 82.5%, respectively, of fresh CLL cells but did not react with either fresh normal T or B lymphocytes. The reactivity of LEU-1 with target CLL cells (88.3%) and with normal T lymphocytes (92%) was not altered by preincubation with αCLL (83.9% and 95.3%, respectively). In contrast, CLL-1 reactivity with target CLL cells (85.1%) was completely abrogated (2.9%) by preincubation with αCLL. That competitive binding to the target antigen by αCLL accounts for the abrogation of CLL-1 reactivity is supported by the use of goat anti-rabbit second antibody. Moreover, experiments in which preincubation of the CLL-1 with purified cCLLa completely abrogated its reactivity with target CLL cells demonstrate that the target antigen CLL-1 is indeed cCLLa (manuscript in preparation). Using a large panel of normal and neoplastic cells, CLL-1 reactivity has been demonstrated to parallel that of αCLL (Faguet and Agee, manuscript in preparation). As expected from their respective specificities for antigens other than the cCLLa, reactivity of the other antibodies of the panel was not altered by preincubation with αCLL and is shown in Table 1 as controls. The above observations strongly suggest nonidentity between the cCLLa and LEU-1 antigens and clearly demonstrate that the cCLLa is the common antigenic determinant for both CLL-1 and αCLL.

DISCUSSION

The purpose of the present study was to explore the possible existence of distinct antigenic markers on CLL cells. Sequential absorption of the initial CLL antiserum with AB erythrocytes and HLA-matched peripheral blood lymphocytes resulted in a serum devoid of antibody activity against RBCs and T cells but retaining cytotoxicity against CLL cells and, to a lesser extent, B cells. Differential absorption with a panel of normal enriched B cells or CLL cells of B lineage suggested that the antiserum contained antibodies to an antigen found on 20% to 70% of B cells from ~50% of normal subjects and B-CLL patients and also antibodies against an antigen present on CLL cells but not on normal B lymphocytes. The different susceptibility of the two cell populations to antiserum αCLL/αB is attributed to two distinct antigens rather than to a different density of the same antigen on the two cell populations. This view is supported by the following observations: (a) distinct reactivity patterns after selective absorption with normal B or CLL cells; (b) persistence of anti-CLL activity after absorption with fivefold excess of B lymphocytes bearing free B antigen; (c) failure of autologous normal B lymphocytes to absorb anti-CLL activity, and (d) absence of cCLLa in normal B
membrane preparations as demonstrated by chromato-
graphy studies and binding blocking experiments.

The cCLLa was expressed on most cells from all CLL
patients studied but not on peripheral blood lymphocytes,
riched T and B cells from normal subjects, lymphocytes
isolated from the thymus and spleen, or on other hemat-
opoietic cells. However, these findings do not rule out
the possibility that the antigen may be expressed by a
subset of normal lymphocytes most susceptible to neoplastic
transformation or that it is only transiently expressed early
during differentiation, at a time when lymphocytes may be
particularly susceptible to transformation and maturation
arrest. This is consistent with the findings that CLL cells
appear to be arrested in differentiation at an intermediate
step between the pre-B and mature B lymphocyte stages.23

The cCLLa was not detected on adult or fetal lymphoid cells
or on cultured lymphoblastoid cell lines, in contrast to other
xenoantisera generated against CLL.6,22 In addition, reten-
tion of anti-CLL reactivity after absorption of aCLL with
autologous resident normal B lymphocytes (fully histocom-
patible) was observed with certain reported
reactions pattern has been observed with certain reported
markers in the designation of acute lymphocytic leukemia sub-
groups: Influence on treatment response. Ann NY Acad Sci 428:26,
1984

The clear demonstration of the cCLLa on malignant cells
from nine patients with B-type HCL and three patients with
PLL supports the view that CLL, PLL, and HCL are
intermediary forms of lineage-related disorders4 and sug-
gests a common etiology for cCLLa-positive CLL, PLL, and
HCL. In studies similar to those shown in Table 1, it was
demonstrated that cCLLa is distinct from the HCL antigen
recognized by monoclonal anti-HCL antibodies aHC1 and
aHC29 (a gift from Dr D. Posnett, Rockefeller University,
NY). Other monoclonal antibodies have been developed
against normal and malignant T and B lymphocytes.29-33
However, these antibodies also react with surface determi-
ants shared by malignant and normal lymphoid cells,
contrary to the restricted expression of the cCLLa recog-
nized by aCLL and PLL-1 antibodies. The presence of
HTLV-1 on CLL cells and its potential relationship to
cCLLa were studied by binding and by cross-competition
binding, respectively, using specific monoclonal antibodies
against the major core proteins P1924 and P2435 and cCLLa as
blocking antibody in an IFA. Similar results were obtained
using HCL cells as target cells (not shown). These findings
and the observations that: (a) primary and cultured tumor
cells of HTLV-1 positive malignancies are mature T cells16,17;
(b) human cord blood exposed to HTLV-1 isolates infect T
lymphocytes48; and (c) HTLV-1 sequences were absent in
autologous B cells of patients whose neoplastic T cells
contained HTLV-1 proviral sequences,39 suggest that
cCLLa-positive CLL, PLL, and HCL are not etiologically
related to HTLV-1-induced T cell malignancies. However,
our studies do not exclude an etiologic role for other retrovi-
ruses in B-lymphoid malignancies.

Monoclonal antibodies specific for the cCLLa and B cell
lines expressing this antigen may be of clinical value: Detec-
tion of the cCLLa facilitates the diagnosis of a malignant
lymphoid clone (manuscript in preparation) in a preclinical
and potentially eradicable phase of its development. In
addition, cCLLa-positive cell lines can be used to develop
xenogeneic transplantation models (Faguet and Agee, manu-
script in preparation) to ascertain the potential in vivo
usefulness of cytolytic anti-CCL monoclonal antibodies and
of their cytotoxic conjugates as immunotherapeutic agents.

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REFERENCES

1. Foon KA, Schroff RW, Gale RP: Surface markers on leukemia
and lymphoma cells: Recent advances. Blood 60:1, 1982
2. Pullen JD, Moyett JM, Crist WM, Falletta JM, Roper M,
Dowell B, Van Eys J, Jackson JF, Humphrey GB, Metzgar RS,
Cooper MD: Pediatric oncology group utilization of immunologic
markers in the designation of acute lymphocytic leukemia sub-
groups: Influence on treatment response. Ann NY Acad Sci 428:26,
1984
Coral F, Schlossman SF: Cell surface antigens: Prognostic implica-
tions in childhood acute lymphoblastic leukemia. Blood 55:395,
1980
4. Caligaris-Cappio F, Janossy G: Surface markers in chronic
lymphoid leukemias of B cell type. Semin Hematol 22:1, 1985
5. Aisenberg AC, Block KJ: Immunoglobulins on the surface of
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