

Overview

Useful For

Evaluation of tissues for potential involvement by:

- Chronic lymphoproliferative disorders
- Malignant lymphomas
- Acute lymphoblastic leukemia
- Acute myelogenous leukemia

Reflex Tests

| Test Id | Reporting Name                      | Available Separately | Always Performed |
|---------|-------------------------------------|----------------------|------------------|
| FCINT   | Flow Cytometry Interp, 2-8 Markers  | No, (Bill Only)      | No               |
| FCIMS   | Flow Cytometry Interp, 9-15 Markers | No, (Bill Only)      | No               |
| FCINS   | Flow Cytometry Interp,16 or greater | No, (Bill Only)      | No               |

Additional Tests

| Test Id | Reporting Name                      | Available Separately | Always Performed |
|---------|-------------------------------------|----------------------|------------------|
| FIRST   | Flow Cytometry, Cell Surface, First | No, (Bill Only)      | Yes              |
| ADD1    | Flow Cytometry, Cell Surface, Addl  | No, (Bill Only)      | Yes              |

Testing Algorithm

When this test is ordered, a screening panel and a professional interpretation will always be charged. The screening panel will be charged based on number of makers tested (FIRST for first marker, ADD1 for each additional marker). The interpretation will be set based on markers tested in increments of 9 to 15, or 16 and greater. In addition, reflex testing may occur to fully characterize a disease state or clarify any abnormalities from the screening test. Reflex tests will be performed at an additional charge for each marker tested (FIRST if applicable, ADD1 if applicable).

The tissue panel is initially performed to evaluate for monotypic B cells by kappa and lambda immunoglobulin light chain expression, CD5, CD10, CD19, CD20, and CD23.Increased numbers of blasts and plasma cells are identified by CD45 expression along with side scatter gating. The panel can also evaluate T cells with CD3, CD5, and CD7. Additionally, viability is assessed on all tissue specimens using 7-AAD (7-amino actinomycin d) exclusion.

This panel, together with the provided clinical history and morphologic review is used to determine what, if any, further testing is needed for disease diagnosis or classification. If additional testing is required, it will be added per algorithm to

fully characterize a disease state with a charge per unique antibody tested.

In addition to reflexing flow cytometric panels, fluorescence in situ hybridization (FISH), molecular testing or cytochemical stains may be recommended by the Mayo Clinic pathologist to facilitate diagnosis. They will contact the referring provider or pathologist to confirm the addition of these tests.

If no abnormalities are detected by the initial panel, no further flow cytometric assessment will be performed unless otherwise indicated by specific features of the clinical presentation or prior laboratory results.

**Special Instructions**

- [Hematopathology Patient Information](#)

**Method Name**

Immunophenotyping

**NY State Available**

Yes

**Specimen**

**Specimen Type**

Tissue

**Ordering Guidance**

Order LCMS / Leukemia/Lymphoma Immunophenotyping, Flow Cytometry, Varies if the specimen is a fresh (less than 4 days post-collection), unfixed, non-embedded bone marrow core biopsy, bone or bone lesion. This is an equivalent source for bone marrow aspirate **only in the event of a dry tap** during the bone marrow harvesting procedure. Indicate "dry tap" in performing lab notes or paperwork when submitting this specimen type.

This test is **not intended** for product of conception (POC) specimens. For POC specimens see CMAPC / Chromosomal Microarray, Autopsy, Products of Conception, or Stillbirth.

**Shipping Instructions**

**Specimen must arrive within 4 days of collection.**

**Necessary Information**

**The following information is required:**

1. Pertinent clinical history, including reason for testing or clinical indication/morphologic suspicion
2. Provide the following:
  - Tissue type
  - Location
  - Pathology/diagnostic report, including the client surgical pathology case number

Specimen Required

Submit 1 of the following specimens:

Preferred

**Specimen Type:** Tissue

**Supplies:** Hank's Solution (T132)

**Container/Tube:** Sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent)

**Specimen Volume:** 5 mm(3) or larger biopsy

**Collection Instructions:**

- 1. Place tissue into a sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent).
- 2. Send intact specimen (**do not mince**)
- 3. Specimen **cannot** be fixed.

**Specimen Stability Information:** Ambient 4 days/Refrigerated 4 days

Acceptable

**Specimen Type:** Fine needle aspirate (FNA)

**Supplies:** Hank's Solution (T132)

**Container/Tube:** Sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent)

**Specimen Volume:** Entire collection

**Collection Instructions:**

- 1. Collect FNA and transfer entire collection into a sterile container with 15 mL of tissue culture medium (eg, Hank's balanced salt solution, RPMI, or equivalent).
- 2. Send intact specimen (**do not mince**)
- 3. Specimen **cannot** be fixed.

**Specimen Stability Information:** Ambient 4 days/Refrigerated 4 days

Forms

- 1. [Hematopathology Patient Information](#) (T676)
- 2. If not ordering electronically, complete, print, and send a [Hematopathology/Cytogenetics Test Request](#) (T726) with the specimen.

Specimen Minimum Volume

1 mm(3)

Reject Due To

|                                   |        |
|-----------------------------------|--------|
| Fixed or paraffin-embedded tissue | Reject |
| Minced tissue                     | Reject |
| Dry tissue                        | Reject |

|                                |  |
|--------------------------------|--|
| without<br>transport<br>medium |  |
|--------------------------------|--|

Specimen Stability Information

| Specimen Type | Temperature              | Time | Special Container |
|---------------|--------------------------|------|-------------------|
| Tissue        | Refrigerated (preferred) |      |                   |
|               | Ambient                  |      |                   |

Clinical & Interpretive

Clinical Information

Cellular immunophenotyping, characterizing cells by using antibodies directed against cell surface markers, is generally regarded as a fundamental element in establishing a diagnosis of tissue involvement by hematolymphoid malignancies, when used in conjunction with morphologic assessment. It is also an essential component in subclassification of hematolymphoid malignancies when present.

Reference Values

An interpretive report will be provided.

Interpretation

This test will be processed as a laboratory consultation. An interpretation of the immunophenotypic findings and correlation with the morphologic features will be provided by a hematopathologist for every case.

Normal tissues typically contain a mixture of B cells with polytypic surface immunoglobulin light chain expression and T cells with unremarkable expression of the T cell-associated antigens CD3, CD5, and CD7. Typically, no appreciable blast population is present by CD45 and side scatter analysis.

Cautions

It is well recognized that a negative flow cytometry result does not exclude tissue involvement by hematolymphoid malignancy. This may be attributable to sampling bias, although some malignancies, such as Hodgkin lymphoma, are not detected by this technique.

Viability will be assessed in all tissue specimens. Cases in which the viability is low (<50%) are prone to false-negative results and, therefore, must be interpreted with caution. In cases with viability less than 50%, testing will be attempted but may not be interpretable. Fine-needle aspiration and small biopsy specimens have a higher frequency of low cell counts and poor viability, which may be uninterpretable.

Even when abnormal, in most instances the results of flow cytometry are insufficient for complete subclassification of a hematolymphoid malignancy. Precise subclassification requires correlation with the histopathologic features in paraffin-embedded materials and also, in some instances, the results of cytogenetic analyses.

The tissue used for flow cytometry cannot be subsequently submitted for histopathologic evaluation. For this reason, this technique should be avoided in small biopsy specimens.

**Clinical Reference**

1. Morice WG, Hodnefield JM, Kurtin PJ, Hanson CA. An unusual case of leukemic mantle cell lymphoma with a blastoid component showing loss of CD5 and aberrant expression of CD10. *Am J Clin Pathol.* 2004;122(1):122-127
2. Hanson CA. Acute leukemias and myelodysplastic syndromes. In: McClatchey KD, ed. *Clinical Laboratory Medicine.* Williams and Wilkins; 1994:939-969
3. Jaffe ES, Cossman J. Immunodiagnosis of lymphoid and mononuclear phagocytic neoplasms. In: Rose NR, Friedman H, Fahey JL, eds. *Manual of Clinical Immunology.* 3rd ed. ASM Press; 1987:779-790
4. Witzig TE, Banks PM, Stenson MJ, et al. Rapid immunotyping of B-cell non-Hodgkin's lymphomas by flow cytometry. A comparison with the standard frozen-section method. *Am J Clin Pathol.* 1990;94(3):280-286
5. Jevremovic D, Dronca RS, Morice WG, et al. CD5+ B-cell lymphoproliferative disorders: Beyond chronic lymphocytic leukemia and mantle cell lymphoma. *Leuk Res.* 2010;34(9):1235-1238
6. Jevremovic D, Olteanu H. Flow cytometry applications in the diagnosis of T/NK-cell lymphoproliferative disorders. *Cytometry B Clin Cytom.* 2019;96(2):99-115
7. Shi M, Jevremovic D, Otteson GE, Timm MM, Olteanu H, Horna P. Single antibody detection of T-Cell receptor alpha beta clonality by flow cytometry rapidly identifies mature T-Cell neoplasms and monotypic small CD8-positive subsets of uncertain significance. *Cytometry B Clin Cytom.* 2020;98(1):99-107

**Performance****Method Description**

Flow cytometric immunophenotyping of tissues is performed using the following antibodies:

Tissue Panel: CD3, CD5, CD7, CD10, CD19, CD20, CD23, CD45, 7-AAD, and kappa and lambda immunoglobulin light chains.

Possible Additional Panels: Performed per algorithmic approach:

T-cell Panel: CD2, CD3, CD4, CD5, CD7, CD8, CD45, TRBC1, and gamma/delta

Acute Panel: CD2, CD3, CD5, CD7, CD13, CD15, CD16, CD19, CD20, CD33, CD34, CD36, CD38, CD45, CD56, CD64, CD117, and HLA-DR

Myeloperoxidase (MPO)/terminal deoxynucleotidyl transferase (TdT) (MPO/TdT) Panel: cytoplasmic CD3, CD13, cytoplasmic CD22, CD34, CD45, cytoplasmic CD79a, nuclear TdT, and cytoplasmic MPO

Plasma Cell Panel: CD19, CD38, CD45, CD138, and cytoplasmic kappa and lambda immunoglobulin light chains.(Keren P, McCoy JP, Carey J, eds. *Flow Cytometry in Clinical Diagnosis.* 4th ed. ASCP Press; 2007; Betters DM: Use of flow cytometry in clinical practice. *J Adv Pract Oncol.* 2015;6[5]:435-440)

**PDF Report**

No

Day(s) Performed

Monday through Saturday

Report Available

1 to 4 days

Specimen Retention Time

Remaining tissue 7 days

Performing Laboratory Location

Mayo Clinic Laboratories - Rochester Main Campus

Fees & Codes

Fees

- Authorized users can sign in to [Test Prices](#) for detailed fee information.
- Clients without access to Test Prices can contact [Customer Service](#) 24 hours a day, seven days a week.
- Prospective clients should contact their account representative. For assistance, contact [Customer Service](#).

Test Classification

This test was developed using an analyte specific reagent. Its performance characteristics were determined by Mayo Clinic in a manner consistent with CLIA requirements. This test has not been cleared or approved by the US Food and Drug Administration.

CPT Code Information

- 88184-Flow cytometry; first cell surface, cytoplasmic or nuclear marker x 1
- 88185-Flow cytometry; additional cell surface, cytoplasmic or nuclear marker (each)
- 88187-Flow Cytometry Interpretation, 2 to 8 Markers (if appropriate)
- 88188-Flow Cytometry Interpretation, 9 to 15 Markers (if appropriate)
- 88189-Flow Cytometry Interpretation, 16 or More Markers (if appropriate)

LOINC® Information

| Test ID | Test Order Name                     | Order LOINC® Value |
|---------|-------------------------------------|--------------------|
| LLPT    | Leukemia Lymphoma Phenotype, Tissue | In Process         |

| Result ID | Test Result Name | Result LOINC® Value |
|-----------|------------------|---------------------|
| 19562     | Accession Number | 57723-9             |
| 19569     | Material:        | 81178-6             |
| 19568     | Specimen:        | 31208-2             |

Test Definition: LLPT

Leukemia/Lymphoma Immunophenotyping,  
Flow Cytometry, Tissue

|       |                                 |                 |
|-------|---------------------------------|-----------------|
| 19574 | Final Diagnosis:                | 34574-4         |
| 19563 | Referring Pathologist/Physician | 46608-6         |
| 19564 | Ref Path/Phys Address           | 74221-3         |
| 19565 | Place of Death:                 | 21987-3         |
| 19566 | Date and Time of Death:         | 81956-5         |
| 19567 | Date of Autopsy:                | 75711-2         |
| 19570 | Tissue Discription:             | 22634-0         |
| 19572 | Clinical History:               | 22636-5         |
| 19576 | Revision Description:           | 81317-0         |
| 19577 | Signing Pathologist:            | 19139-5         |
| 19578 | Special Procedures:             | 30954-2         |
| 19579 | SP Signing Pathologist:         | 19139-5         |
| 19580 | *Previous Report Follows*       | 22639-9         |
| 19581 | Addendum:                       | 35265-8         |
| 19582 | Addendum Comment:               | 22638-1         |
| 19583 | Addendum Pathologist:           | 19139-5         |
| 19571 | Microscopic Description         | 22635-7         |
| 19573 | Final Diagnosis:                | 34574-4         |
| 19575 | Special Studies                 | 30954-2         |
| CK139 | LLPT Result                     | No LOINC Needed |