



Beutner
Laboratories

Reference Manual

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**Beutner
Laboratories**

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General Information

INTRODUCTION

Beutner Laboratories was founded by Ernst H. Beutner, Ph.D. ([create hyperlink](#)) and Gloria Beutner in 1992. Development of defined, quantified Immunofluorescent (IF) methods now used for studies of autoimmune skin diseases started with studies of experimental autoimmune thyroiditis at the State University of New York at Buffalo (UB) under the leadership of Ernest Witebsky, M.D. and with guidance from Albert Coons, M.D. at Harvard University.

From 1968 to 1992 Tadeusz Chorzelski, M.D. and his chief, Stefania Jablonska, M.D. of the Warsaw Medical School, Poland joined with Beutner's group at UB in studies that yielded over 125 publications on autoimmunity in skin disease, 5 edited books and 8 summer teaching programs in the 1970's primarily for dermatologists on uses of IF methods in studies of skin immunopathology. Also, from 1965 to 1985 Beutner and his associates at UB led an international effort to introduce defined IF into diverse immunologic studies by quantifying fluorescein to protein ratios and labeled antibody protein content of fluorescein conjugated antibodies. This formed the foundation for the present day reproducible defined immunofluorescence.

Dermal and mucosal autoimmunity has been our focus. Supported by our extensive research and a proven track record, Beutner Laboratories is a specialized reference laboratory for immunopathology of autoimmune bullous and connective tissue diseases, oral pathology, dermatopathology and immunology tests pertaining to dermal oncology. Beutner Laboratories immunology laboratory provides testing for an extensive list of prevalent and esoteric autoimmune diseases using cutting edge diagnostics. We use multiple technologies including direct immunofluorescence (DIF) and indirect immunofluorescence (IIF), enzyme linked immunosorbent assays (ELISA), and immunoblot detection methods to support healthcare practitioners across a wide clinical spectrum of autoimmune bullous and connective tissue diseases.

LICENSURE AND ACCREDITATION

Beutner Laboratories is CLIA and CAP accredited and licensed by the New York State Department of Health and by the states of California, Maryland, Pennsylvania, and Rhode Island.

STANDARDS OF SERVICE

Beutner Laboratories is known for high quality, timely and accurate reports, keen consultations and impeccable customer service. Biological specimens are collected by complimentary courier or express mail service. Reports can be viewed at Beutner online, a convenient HIPAA compliant lab information system. Our laboratory also offers flexible billing options to suit your needs. Healthcare professionals have come to know the expert capabilities of our specialized laboratory, along with our outstanding and personal service.

HOLIDAY COVERAGE

Beutner Laboratories observes the following holidays: New Year's Day, Martin Luther King Jr. Day, President's Day, Good Friday, Memorial Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day, Day After Thanksgiving, Christmas Eve and Christmas Day. Please be aware that we are not staffed on these holidays. Should you have any questions or concerns please contact Customer Care between the hours of 8:00 AM and 3:30 PM prior to the holiday. Commercial courier services may also be delayed or closed on these major holidays, so please check with these couriers before shipping samples.

MEDICAL TEAM

The Beutner Laboratories Medical team draws upon exclusive clinical and research experience, frequently contributing to the scientific literature in the field of immunology. Members of our staff include PhD's, DDS's and MD's, and are certified by the American Board of Medical Microbiology, the American Board of Medical Laboratory Immunology, and American Board of Oral and Maxillofacial Pathology. Clients have ready access to pathologists with expertise in immunopathology, dermatopathology and oral pathology for consultations.

BIOGRAPHIES



Raminder Grover, MD, (D)ABMM | Laboratory Director

Dr. Raminder Grover is a Diplomate of the American Board of Medical Microbiology. She is certified by the New York State Department of Health in Diagnostic Immunology and has years of clinical laboratory experience. She worked with Dr. Beutner for years gaining experience in diagnostic studies for autoimmune skin diseases. She specializes in skin immunopathology, immunofluorescence assays, ELISA and immunoblot assays for the diagnosis of autoimmune skin and mucous membrane diseases. She is a volunteer faculty in the Department of Dermatology at SUNY, Buffalo and also has authored research papers in skin autoimmunity, microbiology and virology.



Mirdza Neiders, DDS, MS, (D)ABOMP | Consultant

A SUNY Distinguished Teaching Professor at University at Buffalo, Dr. Neiders received her bachelor's degree from the Ohio State University and her master's in pathology from the University of Chicago. She earned her dental degree at University of Michigan. Dr. Neiders has certificate of qualification in Diagnostic Immunology from the NYSDOH and specializes in oral and dermal immunopathology for the diagnosis of autoimmune skin and mucous membrane diseases.



Lakshmanan Suresh, DDS, MS, PhD, (D)ABMLI, (D) ABOMP | Technical Director

Dr. Suresh is board-certified in Oral and Maxillofacial Pathology by the American Board of Oral and Maxillofacial Pathology. He is also board certified in Laboratory Immunology by American Board of Medical Laboratory Immunology. He has authored numerous publications and book chapters, holds several patents and maintains research collaborations around the world. He is a Clinical Professor at the State University of New York at Buffalo.



Jill M. Kramer, DDS, PhD, (D)ABOMP | Assistant Director

Dr. Kramer received her PhD and DDS degrees from the University at Buffalo, State University of New York. She completed her specialty training in Oral and Maxillofacial Pathology at Long Island Jewish Medical Center and her post-doctoral studies at the Feinstein Institute for Medical Research. She is a fellow in the American Academy of Oral and Maxillofacial Pathologists and a diplomate in the American Board of Oral and Maxillofacial Pathology. Dr. Kramer is currently an associate professor in the Department of Oral Biology and she holds adjunct appointments within the Departments of Oral Diagnostic Sciences and Microbiology and Immunology at the University at Buffalo. Dr. Kramer conducts NIH-funded research in the area of immune dysfunction in Sjögren's syndrome and she has authored numerous manuscripts detailing the role of immune cells in this disease. She serves as a reviewer for many scientific journals and is an active member of several scientific societies, including the American Association for Dental, Oral and Craniofacial Research, the American Association of Immunologists and the Society for Leukocyte Biology. Dr. Kramer has worked as a diagnostic immunologist and oral pathologist since 2014.



Patricia Farrell, CLT, ASCP | Laboratory Supervisor

Patricia is a NYS Certified Clinical Laboratory Technologist. She did her clinical rotation at Sister's of Charity Hospital in Buffalo, NY and graduated with a Bachelor of Science degree from Daemen College in Amherst, NY. She has over 30 years of clinical laboratory experience in Immunology and Hematology. She was a research contributor in publications regarding Diabetes, Celiac Disease, Antinuclear Antibodies and Paraneoplastic Pemphigus. As the Laboratory Manager at Beutner Laboratories, she is responsible for the day to day operations of the lab and supervising technical and nontechnical staff. She is also responsible for the management of the quality system and compliance of quality activities for the lab.

BILLING INFORMATION

Beutner Laboratories will bill hospitals, reference laboratories, clinics or medical groups. Alternatively, Beutner Laboratories will bill patients' insurance directly, provided all the necessary billing information is supplied at the time services are rendered (See requirements listed below).

1. Beutner Laboratories does not have capitation contract agreements with any HMO's. Due to Knox-Keene regulations, if a third- party payer is initially billed and is denied as an HMO member, these charges will be billed back to the patients.
2. Beutner Laboratories will bill Medicare for tests performed at Beutner Laboratories. If a claim is denied as "not eligible for the specified date(s) of service", the charges will be billed to the patient.
3. Changes to Billing instructions must be supplied within 30 days from the date of the invoice. Beutner Laboratories will not process any billing instruction change requests received after the 30-day period. The charges will remain the patient's responsibility.

If local or state requirements preclude providing the patient's name to ensure confidentiality, Beutner Laboratories will be unable to bill patients' insurance directly; the charges will be billed to the client. All billing discrepancies should be reported to our Billing Department immediately. Our Billing Department is available from 8:00am to 3:30pm EST by calling, 1-800-288-0549 or 1-866-234-5018 (ask for Gina) for Billing and Collections. Our Billing Specialists are available to answer questions and resolve any problems. All bills are due and payable upon receipt.

We are able to bill all insurances and for the list of insurances we participate in, please call our billing department at 1-800-288-0549.

Beutner Laboratories Federal I.D. number is 16-1596380

Professional Courtesy

"Professional Courtesy" testing is strictly prohibited as stated in the Anti-Kick Back Statute U.S.C. 1320a – 7b; therefore, Beutner Laboratories cannot honor request for this service.

Patient Billing

Beutner Laboratories can bill the patient's insurance directly if complete billing information is provided on the Test Requisition Form or a copy of insurance card, front and back, is included at the time the specimen is submitted. Beutner Laboratories Patient Statements are issued immediately following response from insurance. The patient is solely responsible for the charges. Patient bills are due upon receipt.

Third Party Billing

Beutner Laboratories can bill the patient's insurance company directly for tests performed by Beutner Laboratories if the information listed below is provided. Beutner Laboratories will not bill third party payers for referral testing submitted to Beutner Laboratories for performance by a send out laboratory.

Billing Information Requirements (to be entered on Beutner Laboratories Test Requisition form):

- Patient Name
- Patient Date of Birth
- Patient Sex
- Patient Address, including City, State, Zip (if billing a facility, address is not needed)
- Patient Relationship to Subscriber
- Insurance Carrier Name
- Insurance Carrier Address, including City, State, Zip
- Subscriber Name and Date of Birth
- Policy Number or Members ID Group Number
- Requesting Physician Name
- Requesting Physician NPI #
- Diagnosis (ICD-10 Code) applicable to the patient's condition at time of service

Patients are responsible for the yearly deductibles, co-payments and any balance not covered by the insurance company. If insurance payment is not received within 60 days, the patient is billed directly.

Medicare Billing

Beutner Laboratories is a Medicare Provider. If your patient has Medicare coverage, please send us complete information including secondary insurance, if applicable. Beutner Laboratories will bill Medicare and accept 80% assignment. Complete information, including the "New" Medicare number must be entered on the Test Requisition Form or a copy of insurance cards front and back at the time the specimen is submitted. *Please note: Due to HIPAA Transaction Code Standards effective October 16, 2003, a valid diagnosis code is mandatory for billing Medicare. Medicare billing information is not complete and will not be accepted without a valid diagnosis code.*

LMRP and NCD Requirements

Medicare tests listed on the National Coverage Determinants (NCD) & Local Medical Review Policies (LMRP) will not be reimbursed by Medicare without a covered diagnosis code applicable to the patient at time of service. If a diagnosis code cannot be provided that matches the NCD or LMRP requirement, an Advance Beneficiary Notice (ABN) should be obtained from the patient and forwarded with the requisition.

Referrals from Hospitals

Under Medicare rules, Beutner Laboratories can only bill Medicare for a hospital-referred test when the specimen was not collected as part of an inpatient or outpatient encounter, i.e., the specimen was not drawn in a hospital facility or by hospital personnel. All other testing for hospital patients must be billed directly to the hospital.

CPT Codes

CPT codes listed in this Directory are provided only as guidance to assist you in billing. CPT codes listed reflect our interpretation of CPT coding requirements and are subject to change at any time. It is the client's responsibility to verify the accuracy of the codes. A copy of the changes to CPT coding recommendations for 2005 precedes the test listing section. If you have any questions, please refer to the Current Procedural Terminology (CPT) manual published by the American Medical Association. To verify reimbursement, or if you have any questions regarding usage of a CPT code, please contact your local Medicare carrier.

Medical Necessity/Diagnosis Codes

Every third-party bill must have a valid diagnosis code. Please be sure to put the ICD-10 Code(s) applicable to the patient's condition for the specified date of service on the requisition in the box marked "Diagnostic Codes ICD-10". Medicare diagnosis codes must be coded to the highest level of specificity. Please refer to the International Classification of Diseases (ICD-10) manual, as well as the Medical Regulations and Manuals issued or authorized by the Center for Medicare and Medicaid Services (CMS) for diagnosis coding rules and regulations. If the claim is denied due to lack of medical necessity, Beutner Laboratories will send a request for an additional ICD-10 code or other evidence of medical necessity directly to the ordering Doctor.

Specimen Requirements

SPECIMEN COLLECTION KITS ARE AVAILABLE FREE OF CHARGE FROM BEUTNER LABORATORIES. CALL 1-800-288-0549 FOR AN IMMEDIATE SHIPMENT OF COLLECTION KITS.

General Requirements

- Biopsy Specimens for Direct immunofluorescence studies must be collected in Michel's medium (yellow top tube) or Zeus medium. Specimens inadvertently placed in formalin solution and then transferred into Michel's medium may compromise the results (J Am Acad of Dermatol 2011;65:106-11).
- **Biopsy Specimens for H&E should be placed in 10% formalin (blue top tube).**

Serum Studies

- Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place 2-5mL serum into red capped tube provided. If separation facilities are not available, the blood can be sent in the tube used for collection.

T cell Gene Rearrangement Studies

- Whole blood, bone marrow, formalin-fixed, paraffin-embedded (FFPE) tissue block or slides, fresh or frozen tissue are acceptable specimens for the test.
- 3 to 5 mL whole blood, 1 mL bone marrow, Lavender-top (EDTA) tube, yellow-top (ACD) tube and green-top (heparin) tubes are accepted but not preferred
- Five unstained slides at 10 μ M or formalin-fixed, paraffin-embedded tissue block Tissue in RPMI or frozen (A minimum of 2 x 2 x 2 mm).
- Transport Temperature: Refrigerated. For FFPE tissue unstained slides, or tissue in RPMI or frozen

Disease Specific Requirements

BULLOUS DISEASES: INDICATED DIRECT IMMUNOFLUORESCENT (DIF) AND SERUM STUDIES

SKIN LESIONS

If pemphigoid or epidermolysis bullosa acquisita (EBA), anti-cicatricial pemphigoid (AECP) or bullous lupus erythematosus (LE) is suspected:

- Take skin biopsy with ~2/3 normal skin and ~1/3 edge of lesion
- For DIF on 1.0 M NaCl split skin to differentiate between pemphigoid and EBA, AECP and bullous LE, take second biopsy ~3mm from lesion
- Serum studies may also be indicated to determine the specific autoantibodies

If pemphigus is suspected:

- Take skin biopsy with ~2/3 normal skin and ~1/3 lesion edge plus serum for best diagnostic results
- Serum studies are also indicated for confirmation

If dermatitis herpetiformis is suspected,

- Take normal skin ~3 mm from lesion for best results
- Serum tests - EmA and tTG increase sensitivity
- Test for eTG antibodies may also be helpful in ruling out DH

If porphyria or pseudoporphyria is suspected:

- Take skin biopsy with ~2/3 normal skin and ~1/3 lesion edge for best DIF results

If in doubt:

- Take two biopsies — one perilesional, as for pemphigoid, and one normal, as for DH, for best results

If eruptions with other non-disease specific immune deposits are suspected, including lichenoid eruptions or lichen planus or related disorders:

- Take biopsy as for porphyria for DIF and lesional biopsy for light microscopy

MUCOSAL LESIONS

If pemphigoid is suspected:

- Take normal mucosa ~3 mm from lesion or Nikolsky sign

If pemphigus or paraneoplastic pemphigus is suspected:

- Take normal mucosa ~3 mm from lesion or Nikolsky sign plus serum

If erosive lichen planus (LP) is suspected:

- Take mucosal biopsy with ~2/3 normal mucosa and ~1/3 edge of lesion or of Nikolsky sign for best DIF results

HEREDITARY EPIDERMOLYSIS BULLOSA (EB)

If hereditary EB needs to be classified or confirmed:

- Take biopsy of induced lesion in normal skin.

Preferred Skin Site:

- Normal appearing skin preferably upper inner arm just above the elbow.

SPECIAL METHOD OF OBTAINING SPECIMENS

An attempt should be made prior to biopsy to induce microscopic cleavage. The only possible exception would be in patients with generalized junctional or severe generalized recessive dystrophic EB, in whom there is such inherent mechanical skin fragility as to readily demonstrate cleavage planes just with the performance of routine punch biopsy technique. In general, it is suggested that the following be done prior to biopsy of such a skin area:

- The area to be biopsied should be sterilely prepped.
- Using the eraser (cleaned with an alcohol swab) part of a pencil, apply firm pressure downward and then laterally in a rotary fashion (approximately 180 degrees each way for 3-5 times).

If after lifting up the pencil eraser it is obvious that the skin has markedly split, then this procedure should be re-done a bit less vigorously (to at most demonstrate a minimal puckering of the skin) in an adjacent area. However, if absolutely no change is visible after having tried to induce a blister, then one should still biopsy that area in the hope that microscopic cleavage will be noted. For example, the latter is usually the case with localized EB simplex although we can still usually demonstrate cleavage in distant skin if it is pretreated in this manner. 4mm. punch biopsy should then be taken of this area and the entire specimen then placed into immunofluorescence transport medium (BL, Zeus or Michel's).

Under no circumstances should:

- Lesional tissue be sent since frequently it contains multiple artifactual as well as true cleavage planes, thereby making diagnosis very difficult. In addition, the presence of a blister usually is associated with the release of enzymes which tend to digest the skin proteins such that we cannot satisfactorily get antibodies to react with the specific antigens.
- Skin be obtained from the palms or soles, since the overall thickness of that tissue makes it very difficult to demonstrate skin cleavage or early blister formation.

References:

- Fine JD, Eady RAJ, Bauer EA et al. Revised classification system for inherited epidermolysis bullosa: Report of the second international consensus meeting on diagnosis and classification of epidermolysis bullosa. J Am Acad Dermatol. 2000; 42:1051-66.
- Fine JD, McGrath J, Eady RA. Inherited epidermolysis bullosa comes into the new millennium: A revised classification system based on current knowledge of pathogenetic mechanisms and the clinical, laboratory, and epidemiologic findings of large well-defined patient cohorts. J Am Acad Dermatol. 2000; 43:135-37.
- Fine JD, Eady RAJ, Bauer EA et al. The classification of inherited epidermolysis bullosa (EB): Report of the Third International Consensus Meeting on Diagnosis and Classification of EB. J Am Acad Dermatol. 2008; 58:931-50.

CONNECTIVE TISSUE DISEASES: INDICATED DIRECT IMMUNOFLUORESCENT (DIF) AND SERUM STUDIES

If SLE is suspected:

- Take biopsy of sun-exposed, normal skin of forearm for DIF for LE band test and in vivo ANA reaction
- 3-5 mL blood should be collected in red top tube for serum studies for ANA and tests for ARA criteria

If DLE is suspected:

- Take biopsy of untreated lesion of 3 or more months duration in sun-exposed area for DIF and for light microscopy
- Non-sun-exposed areas are of little value

If SCLE or Sjogren's syndrome is suspected:

- Take sun-exposed skin lesion biopsy for DIF for in vivo ANA and blood in red top tube for serum tests for ANA, Ro (SS-A) and La (SS-B) antibodies

If scleroderma is suspected:

- Take biopsy of sun-exposed skin for DIF and C+DIF studies and blood for serum studies (Profile E)

IMMUNE COMPLEX MEDIATED VASCULITIS: INDICATED DIRECT IMMUNOFLUORESCENT STUDIES

If leukocytoclastic vasculitis is suspected, (or most other immune complex vasculitides):

- Take biopsy for DIF of a fresh lesion, less than 48 hours old
- DIF studies of older lesions (more than 72 hours old) yield low sensitivity
- Perilesional normal skin specimens have lower sensitivity for detection of immune complexes by DIF
- Light microscopic biopsy studies are also indicated

If Henoch Schoenlein purpura is suspected:

- Take biopsy of a fresh lesion (less than 48 hours old)
- Light microscopic biopsy studies are also indicated

If stasis dermatitis is suspected:

- Take biopsy for DIF of edge of skin lesion plus adjacent normal skin

MOLECULAR TESTING FOR T CELL NEOPLASMS

If T cell neoplasm is suspected:

- Send (a) 3-5mL whole blood in EDTA, ACD or heparin tube, or (b) skin biopsy in RPMI media, or (c) 5 unstained skin section slides

Disease Specific Testing

BULLOUS DISEASES: BIOPSY STUDIES / SKIN AND MUCOSA

Direct Immunofluorescence (DIF)

Beutner Test Code:

- #001

Routine Panel Tests for the Presence of:

- IgG, IgA, IgM, Fibrin, C3 and IgG4.

Note:

- IgG1 may be added at an additional charge, if greater sensitivity is required.

Methodology:

- Direct Immunofluorescence

Reference Range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 (x immune stains)

Turnaround Time:

- Report availability is within 48 hours from the time of specimen receipt.

Biopsy Site Selection:

- Proper biopsy sites are dependent on the suspected diagnosis.

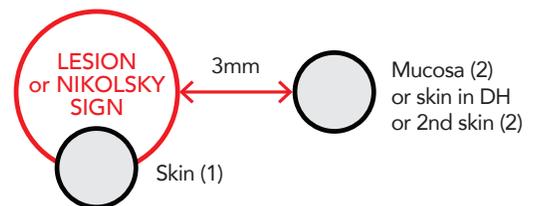
Specimen Requirements:

- The yellow capped tubes provided with Beutner collection kits contain a holding solution for immunofluorescence specimens. A biopsy from a Lesional, Normal and/or Perilesional site should be placed in these collection tubes. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Sample Stability:

- Stable in appropriate solution at room temperature for 10 days.

BLISTERING AND OTHER ERUPTIONS



- (1) Skin biopsy in most pemphigus/ pemphigoid cases.
- (2) Mucosal biopsy or skin biopsy for DH or 2nd skin biopsy for pemphigus or pemphigoid cases.

Differentiation of Bullous Pemphigoid from Epidermolysis Bullosa Acquisita by DIF of 1M NaCl split biopsy (with no vesicles)

Beutner Test Code:

- #002

Methodology:

- Direct Immunofluorescence

Reference Range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 (x immune stains)

Turnaround Time:

- Report availability is within 48-72 hours from the time of specimen receipt.

Biopsy Site Selection:

- Normal skin (3mm from a lesion). This test requires an intact epidermis and dermal-epidermal junction. If the initial DIF (test code#001) reveals epidermal separation, this test cannot be done.

Specimen Requirements:

- The yellow capped tubes provided with Beutner collection kits contain a holding solution for immunofluorescence specimens. A biopsy from a Normal site should be placed in these collection tubes. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Sample Stability:

- Stable in appropriate solution at room temperature for 10 days.

Light Microscopy

Beutner Test Code:

- #003

Methodology:

- Histology processing, staining and Interpretation

Reference Range:

- Not applicable. Detailed interpretation accompanies report.

CPT Code:

- 88305

Turnaround Time:

- Report availability is within a week from the time of specimen receipt.

Specimen Requirements:

- Biopsies for H & E studies should be submitted in 10% formalin containers. Transport at room temperature.

Sample Stability:

- Stable at room temperature indefinitely.

Light Microscopy Consultation Only

Beutner Test Code:

- #004

Methodology:

- Analysis and Interpretation

Reference Range:

- Not applicable. Detailed interpretation accompanies report.

CPT Code:

- 88321

Turnaround Time:

- Report availability is within a week from the time of specimen receipt.

Specimen Requirements:

- H&E slides of skin &/or mucosa specimens submitted in a slide folder will be accepted. If applicable, please send a copy of previous report with slides. Please note that slides cannot be returned. Transport at room temperature.

Sample Stability:

- Stable at room temperature indefinitely.

BULLOUS DISEASES: SERUM STUDIES

Pemphigus/Pemphigoid Antibody Titer – IgG & IgG4

Beutner Test Code:

- #013

Methodology:

- Indirect Immunofluorescence

Substrate:

- Primate Esophagus

Reference Range:

- Negative: <1:10

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- The detection of anti-skin (IC and BMZ) antibodies aids in the diagnosis, and sometimes prognosis, of autoimmune bullous diseases including pemphigus, pemphigoid, cicatricial pemphigoid, and epidermolysis bullosa acquisita (EBA). Epithelial intercellular antibodies are diagnostic for pemphigus and occur in over 90% of patients with active forms. Antibodies to basement membrane antigens of stratified squamous epithelium occur in about 70% of active bullous pemphigoid, 50% of EBA and 10% of cicatricial pemphigoid patients.

Differentiation of Bullous Pemphigoid from Epidermolysis Bullosa Acquisita (EBA) on Split Skin – IgG & IgG4

Beutner Test Code:

- #014

Methodology:

- Indirect Immunofluorescence

Substrate:

- Split Human Skin

Reference Range:

- Negative: <1:5

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Epidermolysis bullosa acquisita (EBA) can mimic bullous pemphigoid (BP) clinically, histologically and immunologically. In this indirect immunofluorescence assay, EBA and BP antibodies can be distinguished by their localization in skin that is split at the lamina lucida. This test and added follow up tests help differentiate EBA/bullous LE/anti-epiligrin cicatricial pemphigoid from bullous pemphigoid.

Desmoglein (Dsg) 1 & Dsg 3 Antibodies

Beutner Test Code:

- #015

Methodology:

- ELISA

Reference Range Values:

Dsg1

Negative: <18

Indeterminate 18-36

Positive > 36

Dsg3

Negative: <19

Indeterminate: 19-37

Positive: > 37

Units:

- Units/mL

CPT Code:

- 83516 x2

Schedule/Turnaround Time:

- Report availability is 2-4 days from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Pemphigus includes a group of often fatal autoimmune blistering diseases characterized by intraepidermal and/or intraepithelial lesions. Pemphigus vulgaris and its variants may present with oral or other mucosal lesions alone or with mucosal plus skin lesions. Pemphigus foliaceus and its variants present with skin lesions alone. Indirect Immunofluorescence studies reveal that both forms of pemphigus are caused by autoantibodies to cell surface antigens of stratified epithelia of mucous membranes and epidermal layer of the skin. These antibodies bind to calcium dependent adhesion molecules in cell surface desmosomes, notably desmoglein 1(DSG-1) in pemphigus foliaceus and desmoglein 3 (DSG-3) in pemphigus vulgaris. Pemphigus vulgaris patients with both mucosal and skin lesions have antibodies to both DSG-3 and DSG-1. The diagnosis of pemphigus depends on biopsy and serum studies that characterize lesions and detect the autoantibodies that cause them. Serum studies afford highly sensitive diagnostic aids. The identification of the reactive antigens as DSG-1 and DSG-3 has made it possible to develop highly specific and sensitive ELISA methods.

Bullous Pemphigoid (BPAG2) 180 & BP (BPAG1) 230 Antibodies

Beutner Test Code:

- #016

Methodology:

- ELISA

Reference Range Values:

- Negative: < 9 Units: Units/mL Positive: ≥ 9

CPT Code:

- 83516 x2

Schedule/Turnaround Time:

- Report availability is 2-4 days from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Bullous pemphigoid (BP) is an autoimmune mediated immunobullous skin disorder found mainly in the elderly population and is characterized by frequent occurring of tense blisters and erythema. Antibodies are directed to the basement membrane zone and are frequently found in the serum of patients. Target antigens of the autoantibodies in BP patient serum are BP230 and BP180, also called BPAG1 and BPAG2.
- Molecular weight of these antigens is 230 kD and 180 kD respectively. BP180 is thought to be the direct target of the autoantibody because of its location, and the autoantibodies against BP230 are thought to be secondarily produced. The antibodies against BP180 are thought to be pathogenic, because the rabbit antibody against mouse in the NC16a region of BP180 forms blisters similar to BP when injected into neonatal mice. The main epitope of BP180 is located in the region close to cell membrane called NC16a and most patient serum reacts with the recombinant NC16a protein. Serum levels of BP180 co-relate with the disease activity.

Paraneoplastic Pemphigus Antibody Titer

Beutner Test Code:

- #017

Methodology:

- Indirect Immunofluorescence

Substrate:

- Rat bladder

Reference Range:

- Negative: <1:10

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Paraneoplastic pemphigus, or PNP, is a rare but often fatal autoimmune blistering disease, with five-year mortality rates approaching 40%. PNP is most commonly associated diagnoses are hematologic malignancies and occasionally sarcomas and other solid-organ malignancies. In children, the most commonly associated cancer is Castleman disease. Indirect immunofluorescence using rat bladder epithelium substrate is a sensitive and specific test, and it is positive in about 80% of cases of PNP. Paraneoplastic pemphigus, or PNP, is a rare but often fatal autoimmune blistering disease, with five-year mortality rates approaching 40%.

Pemphigus Antibody Titer Prognostic Test – IgG & IgG4 (Compares Old & New Sera)

Beutner Test Code:

- #018

Methodology:

- Indirect Immunofluorescence

Substrate:

- Primate Esophagus

Reference Range:

- Negative: <1:10

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.
- Sample Stability: Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.
- Clinical Relevance: The comparison of the titers of anti-skin (IC) antibodies in old and new sera aid in diagnosis and prognosis of pemphigus patients.

Envoplakin Antibody

Beutner Test Code:

- #009

Methodology:

- ELISA

Reference Range:

- Ratio <1.0 Negative Ratio >1.0 Positive

Units:

- Ratio

CPT Code:

- 83516

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt. Please call the laboratory if expedited results are needed.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Paraneoplastic pemphigus (PNP) is a life-threatening form of pemphigus that is associated with a neoplasm (e.g., non-Hodgkin's lymphoma, chronic lymphocytic leukemia, Castleman tumor, thymoma, sarcoma, Waldenstrom's macroglobulinemia). Pathogenesis is based on a combination of humoral and cellular autoimmune responses. Circulating autoantibodies are directed against multiple antigens, including predominantly plakins (envoplakin, periplakin, desmoplakin I, desmoplakin II, epiplakin), plectin, Dsg1, Dsg3 and BP230. Due to their high specificity (91–100%), anti-envoplakin autoantibodies are considered an important diagnostic marker for paraneoplastic pemphigus. This ELISA is 72% sensitive in detecting antibodies to envoplakin in PNP patients.

Endomysial (EmA) Antibody IgA & IgG Antibody

Beutner Test Code:

- #020

Methodology:

- Indirect Immunofluorescence

Substrate:

- Primate Smooth Muscle (Primate Lower Esophagus)

Reference Range:

- Negative: <1:2.5

Units:

- Titer

CPT Code:

- 86231 x2

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- The detection of endomysial antibodies (EmA) aids in the diagnosis of gluten sensitive enteropathy, i.e. celiac disease (CD) and dermatitis herpetiformis (DH). Patients with CD and DH are reported to have antibodies to endomysium, reticulín and gliadin. Of the various antibody markers of CD and DH, EmA of the IgA class seem to be the most sensitive and specific for the diagnosis of DH. Tests for IgA TG2 (tTG or tissue transglutaminase) and for TG3 (eTG or epidermal transglutaminase) by ELISA should also be done for greater sensitivity.

IgA Epidermal Transglutaminase Antibody

Beutner Test Code:

- # 022

Methodology:

- ELISA

Reference Range:

- <16 AU/mL Negative 16-22 AU/mL Grey range >22 AU/mL Positive

Units:

- AU/mL

CPT Code:

- 83516

Schedule/Turnaround Time:

- Assay performed once every two weeks. Report availability is two weeks from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Patients with Dermatitis Herpetiformis (DH) have gluten induced circulating IgA autoantibodies to tissue transglutaminase (TG2) and epidermal transglutaminase (TG3). Recent data indicated that DH is IgA-TG3 immunocomplex mediated disease developing in some gluten sensitive enteropathy (GSE) patients. There is pathogenic TG3 deposition in the papillary dermis and small blood vessels in skin of patients, colocalized with granular IgA deposits. IgA epidermal transglutaminase antibodies ELISA is a sensitive test for initial diagnosis and follow up of patients with DH.

Collagen VII Antibody ELISA (To Rule Out EBA)

Beutner Test Code:

- #023

Methodology:

- ELISA

Reference Range:

- <6.0 U/mL Negative \geq 6.0 U/mL Positive

Units:

- U/mL

CPT Code:

- 83516

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Type VII Collagen is found in the lamina densa and the sublamina densa fibrillar area of the dermal-epidermal junction. The pathogenicity of autoantibodies targeting collagen VII has been independently demonstrated both in vitro, ex vivo and in vivo. Collagen VII autoantibodies specific to COL7 is the current standard for EBA diagnosis (Hashimoto, 2012). Type VII collagen (COL7)-specific autoantibodies were primarily of the IgG isotype and are found in over 75% of the EBA patients (Iwata, 2018). The immunodominant domains of type VII collagen can also be recognized by IgG autoantibodies from patients with bullous lupus erythematosus (BSLE). Anti-type VII collagen autoantibodies can be detected 3 months before the inception of BSLE in patients with SLE. In a study by Grabell (2015) of BSLE, 100% of the patients had circulating Collagen VII antibodies before and during the skin eruption. The healthy and SLE controls did not show any circulating collagen VII antibodies (Grabell, 2015, Ishikawa, 1997). This ELISA (MBL) detects antibodies to autoreactive non-collagenous 1 and 2 (NC1 and NC2) domains of type VII collagen. In a study on suspected patients with EBA/bullous LE by Bain E et al., this test gave 87.5% sensitivity and 100% specificity. Anti-type VII collagen autoantibodies can be detected 3 months before the inception of BSLE in patients with SLE. In a study by Grabell (2015) of BSLE, 100% of the patients had circulating Collagen VII antibodies before and during the skin eruption. The healthy and LSE controls did not show any circulating collagen VII antibodies (Grabell, 2015, Ishikawa, 1997).

Selected Reference:

Hashimoto T, Ishii N, Ohata C, Furumura M. Pathogenesis of epidermolysis bullosa acquisita, an autoimmune subepidermal bullous disease. *J Pathol.* 2012;228:1-7

Iwata, H., Vorobyev, A., Koga, H., Recke, A., Zillikens, D., Prost-Squarcioni, C., ... & Ludwig, R. J. (2018). Meta-analysis of the clinical and immunopathological characteristics and treatment outcomes in epidermolysis bullosa acquisita patients. *Orphanet journal of rare diseases*, 13(1), 153.

Grabell, D. A., Matthews, L. A., Yancey, K. B., & Chong, B. F. (2015). Detection of type VII collagen autoantibodies before the onset of bullous systemic lupus erythematosus. *JAMA dermatology*, 151(5), 539-543.

Ishikawa O, Zaw KK, Miyachi Y, Hashimoto T, Tanaka T. (1997). The presence of anti-basement membrane zone antibodies in the sera of patients with non-bullous lupus erythematosus. *Br J Dermatol.* 136(2):222-226.

Bain EE, Grover RK, Plunkett RW, Beutner EH. Bain EE, Grover RK, Plunkett RW, Beutner EH. Detection of collagen VII autoantibodies to NC1 and NC2 domains of collagen VII by ELISA in suspected epidermolysis bullosa acquisita and bullous lupus erythematosus patients. *J Dermatol Sci.* 2012 Feb;65(2):155-6.

Linear IgA Bullous Dermatitis (LABD), Chronic Bullous Dermatitis of Childhood (CBDC) Antibody Titer – IgA

Beutner Test Code:

- #024

Methodology:

- Indirect Immunofluorescence

Substrate:

- Normal human skin and Split Human skin

Reference Range:

- Negative: <1:5

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Linear IgA Bullous Dermatitis (LABD) is a chronic, acquired, autoimmune blistering disease. It is characterized by subepidermal blistering and linear deposition of immunoglobulin A (IgA) basement membrane antibodies. The disease affects both children and adults. There are some differences in their clinical presentations, therefore the disease in children is termed as Chronic Bullous Disease of Childhood (CBDC). The immunopathology of LABD and CBDC is similar (Venning, 2011). IgA antibodies to BMZ of skin by IIF on split human skin can be detected in about 30% of adult patients with LABD and in almost 75% of children with CBDC. This test helps to differentiate the autoantibodies reacting on the epidermal roof of the split human skin (target antigens are the shed ectodomains of BP180 molecule) from the antibodies reacting on the floor (target antigen is LAD285 and in rare cases type VII Collagen). Patients with LABD may have co-existing IgG antibodies, therefore IIF test for IgG and IgG4 antibodies on Split Human Skin (#014) should also be done.

Selected Reference:

Vanessa A. Venning. Linear IgA Disease: Clinical Presentation, Diagnosis, and Pathogenesis. *Dermatologic Clinics*, 2011;29 (3): 453-458.

BULLOUS DISEASES: SERUM PANELS

Pemphigus

Beutner Test Code:

- #025 Includes Tests: #013 Pemphigus/Pemphigoid antibody titer - IgG & IgG4
#015 Desmoglein (DSG) 3 & DSG 1 Antibodies

Methodology:

- Indirect Immunofluorescence AND ELISA

Substrate:

- Primate Esophagus/ELISA plate

Reference Range:

- Please see individual tests

CPT Code:

- Please see individual tests

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt (profiles will be longer).

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year. Clinical Relevance: Please see individual tests.

Paraneoplastic Pemphigus

Beutner Test Code:

- #026 Includes Tests: #013 Pemphigus/Pemphigoid antibody titer - IgG & IgG4
#013A Pemphigus/Pemphigoid antibody titer - IgG1
#015 Desmoglein (DSG) 3 & DSG 1 Antibodies
#017 Paraneoplastic Pemphigus Antibody Titer - IIF on Rat Bladder
#009 Envoplakin ELISA

Methodology:

- Indirect Immunofluorescence and ELISA

Substrate:

- Primate Esophagus/ELISA plate/Rat Bladder

Reference Range:

- Please see individual tests

CPT Code:

- Please see individual tests

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt (profiles will be longer).

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year. Clinical Relevance: Please see individual tests.

Pemphigoid

Beutner Test Code:

- #027 Includes Tests: #013 Pemphigus/Pemphigoid antibody titer - IgG & IgG4
#014 Differentiation of Bullous Pemphigoid from EBA on Split Skin - IgG & IgG4
#016 BP230 & BP180 Antibodies - ELISA **OR**
#023 Collagen VII Antibody ELISA **OR** Laminin 332 Antibody by IIF

Methodology:

- Indirect Immunofluorescence AND ELISA

Substrate:

- Primate Esophagus/Human Split Skin/ELISA plate

Reference Range:

- Please see individual tests

CPT Code:

- Please see individual tests

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt (profiles will be longer).

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year. Clinical Relevance: Please see individual tests.

IF Mapping for Hereditary Epidermolysis Bullosa

Beutner Test Code:

- #011

Routine Panel Tests:

- Type VII Collagen, Type IV Collagen, Keratin 14, Laminin 332, Plectin, Alpha 6 integrin, Beta 4 integrin, Type XVII Collagen. If needed, additional tests may be done.

Methodology:

- Direct Immunofluorescence

Reference range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 x7-9

Turnaround Time:

- Report availability is within 3-4 days from the time of specimen receipt.

Biopsy Site and Specimen Requirements:

- A skin biopsy of an induced micro-vesicle on normal skin is recommended. Normal appearing skin preferably upper inner arm just above the elbow should be selected for inducing a lesion. The yellow capped tubes provided with Beutner collection kits contain a holding solution for IF mapping. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Special Method of Obtaining Specimens:

- An attempt should be made prior to biopsy to induce microscopic cleavage. The only possible exception would be in patients with generalized junctional or severe generalized recessive dystrophic EB, in whom there is such inherent mechanical skin fragility as to readily demonstrate cleavage planes just with the performance of routine punch biopsy technique. In general, it is suggested that the following be done prior to biopsy of such a skin area:
 - The area to be biopsied should be sterilely prepped and then circled.
 - Using the eraser (cleaned with an alcohol swab) part of a pencil, apply firm pressure downward and then laterally in a rotary fashion (approximately 180 degrees each way for 3-5 times).
 - If after lifting the pencil eraser it is obvious that the skin has markedly split, then this procedure should be re-done a bit less vigorously (to at most demonstrate a minimal puckering of the skin) in an adjacent area. However, if absolutely no change is visible after having tried to induce a blister, then one should wait for 15-20 minutes and then biopsy that area in the hope that microscopic cleavage may be noted. 4mm. punch biopsy should then be taken of this area and the entire specimen then placed into immunofluorescence transport medium (BL, Zeus or Michel's).

UNDER NO CIRCUMSTANCES SHOULD:

- Lesional tissue be sent since it frequently contains multiple artifactual as well as true cleavage planes, thereby making diagnosis very difficult. In addition, the presence of a blister usually is associated with the release of enzymes which tend to digest the skin proteins such that we cannot satisfactorily get antibodies to react with the specific antigens.
- Skin be obtained from the palms or soles, as the overall thickness of that tissue makes it very difficult to demonstrate skin cleavage or early blister formation.

Sample Stability:

- Stable in appropriate solution at room temperature for 5 days.

Clinical Relevance:

- Immunofluorescent (IF) mapping of a skin biopsy taken after inducing a micro-vesicle on normal skin is recommended as a primary diagnostic test for inherited EB. Reactions of antigens along the clefts helps in differentiating EB simplex, junctional EB and dystrophic EB by localizing the plane of cleavage above or below the lamina densa or in the epidermis. The absence of reactions or weak reactions with specific antibodies can point to defective proteins associated with certain forms of inherited EB.
- The biopsy specimen for IF mapping studies is processed in two steps:
 - 1. Primary Screening:**
Primary screening for collagen types IV and VII and keratin 14 for IF mapping and biopsy suitability.
 - 2. Extended IF Mapping:**
For suitable biopsies, tests for plectin, alpha 6 integrin, beta 4 integrin, laminin 332, type XVII collagen, and possibly keratin 5 (if EBS) and beta 3 laminin.
- The interpretations of this test should be correlated and confirmed with electron microscopy and studies for gene mutations.

LUPUS ERYTHEMATOSUS CONNECTIVE TISSUE AND VASCULAR DISEASE: BIOPSY STUDIES / SKIN AND MUCOSA

Direct Immunofluorescence (DIF) for LE (Systemic, Discoid, & Sub-Acute Cutaneous)

Beutner Test Code:

- #005

Routine Panel Tests for the Presence of:

- IgG, IgA, IgM, Fibrin, and C3

Methodology:

- Direct Immunofluorescence

Reference Range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 x4

Turnaround Time:

- Report availability is within 48 hours from the time of specimen receipt.

Biopsy Site Selection:

- Proper biopsy sites are dependent on the suspected diagnosis.

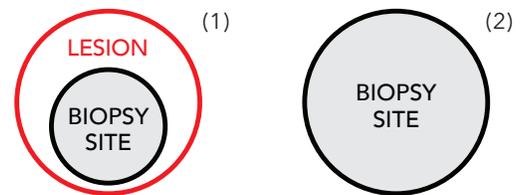
Specimen Requirements:

- The yellow capped tubes provided with Beutner collection kits contain a holding solution for immunofluorescence specimens. A biopsy from a Lesional, Normal and/or Perilesional site should be placed in separate collection tubes. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Sample Stability:

- Stable in appropriate solution at room temperature for 10 days.

COLLAGEN VASCULAR DISEASES



(1) Sun Exposed skin biopsy in most LE cases.
Skin biopsy to rule out Henoch
Schoenlein purpura and vasculitis
(lesion less than 48 hours old)

(2) Skin biopsy to rule out SLE

Direct Immunofluorescence (DIF) for Vasculitis

Beutner Test Code:

- #006

Routine Panel Tests for the Presence of:

- IgG, IgA, IgM, Fibrin, and C3

Methodology:

- Direct Immunofluorescence

Reference Range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 x4

Turnaround Time:

- Report availability is within 48 hours from the time of specimen receipt.

Biopsy Site Selection:

- Proper biopsy sites are dependent on the suspected diagnosis.

Specimen Requirements:

- The yellow capped tubes provided with Beutner collection kits contain a holding solution for immunofluorescence specimens. A biopsy from a Lesional site should be placed in these collection tubes. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Sample Stability:

- Stable in appropriate solution at room temperature for 10 days.

Direct Immunofluorescence (DIF) for Dermatomyositis

Beutner Test Code:

- #007

Routine Panel Tests for the Presence of:

- IgG, IgA, IgM, Fibrin, C3, and C5b9

Methodology:

- Direct Immunofluorescence

Reference Range:

- Detailed interpretation accompanies report.

CPT Code:

- 88346 (x no of biopsies), 88350 x5

Turnaround Time:

- Report availability is within 48 hours from the time of specimen receipt.

Biopsy Site Selection:

- Proper biopsy sites are dependent on the suspected diagnosis.

Specimen Requirements:

- The yellow capped tubes provided with Beutner collection kits contain a holding solution for immunofluorescence specimens. A biopsy from a Lesional site should be placed in these collection tubes. If these tubes are unavailable, submit specimen in Zeus/Michel's fixative. Transport at room temperature.

Sample Stability:

- Stable in appropriate solution at room temperature for 10 days.

LUPUS ERYTHEMATOSUS CONNECTIVE TISSUE AND VASCULAR DISEASE: SERUM STUDIES / SKIN AND MUCOSA

Stratified Epithelium Specific Antinuclear Antibody (SES-ANA) for Chronic Ulcerative Stomatitis

Beutner Test Code:

- #033

Methodology:

- Indirect Immunofluorescence

Substrate:

- Primate Esophagus

Reference Range:

- Based upon selective reactions on substrates used in the differential assay.

Units:

- Titer

CPT Code:

- 88346, 88350

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48 hours from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- The detection of stratified epithelium specific antinuclear antibodies assists in the diagnosis of connective tissue disease, and/or chronic ulcerative stomatitis.

SYSTEMIC CONNECTIVE TISSUE DISEASE: SERUM STUDY PROFILES

SLE Panel (Includes ANA, dsDNA, Ro, La, Sm, U1RNP, RNP70, Ribo P)

Beutner Test Code:

- #043

Methodology:

- Indirect Immunofluorescence (HEp-2) and Fluoroenzyme immunoassay (FEIA)

Substrate:

- HEp2/Phadia

Reference Range:

ANA (Titer)

- Negative <40

dsDNA (IU/mL)

- Negative <10
- Equivocal 10-15
- Positive >10

Ro (SS-A) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

La (SS-B) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Sm (Titer: U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

U1RNP (U/mL)

- Negative <5
- Equivocal 5-10
- Positive >10

RNP70 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Ribo P (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Units:

- Titer, U/mL

CPT Code:

- 86038, 86039, 86255, 86225, 86235 x6

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is within one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year. Clinical Relevance: Please see individual tests.

Mixed Connective Disease Panel (Includes ANA, Sm, U1RNP, RNP70, Jo-1, Scl-70)

Beutner Test Code:

- #044

Methodology:

- Indirect Immunofluorescence (HEp-2) and Fluoroenzyme immunoassay (FEIA)

Substrate:

- HEp2/Phadia

Reference Range:

ANA (Titer)

- Negative <40

Sm (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Units:

- Titer, U/mL

U1RNP (U/mL)

- Negative <5
- Equivocal 5-10
- Positive >10

RNP70 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Jo-1 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Scl-70 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

CPT Code:

- 86038, 86039, 86255, 86235 x5

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is within one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year. Clinical Relevance: Please see individual tests.

Clinical Relevance:

- MCTD is defined by a combination of clinical and serologic features. Patients present with overlapping features of SLE, scleroderma, and polymyositis. The most common clinical manifestations of mixed connective disease are Raynaud's phenomenon, arthralgias, swollen joints, esophageal dysfunction, muscle weakness and the presence of anti-ribonucleoprotein (RNP) antibodies. The disease can be serious with development of pulmonary, kidney, cardiovascular, gastrointestinal and central nervous system manifestations. Serologic findings include a very high ANA titer, often with a speckled pattern, and antibodies directed against a specific ribonuclease-sensitive extractable nuclear antigen, U1RNP. U1RNP antibodies are present in >80% of patients with MCTD. Antibodies to other nuclear antigens have been found in MCTD. Antibodies to dsDNA and Sm are infrequent in patients with MCTD, these are found in 0-8% of patients with MCTD. Anti-Ro antibodies are positive in 13%, Scl-70 and Jo-1 in 7% of patients. Up to 70% of patients will have a positive rheumatoid factor.

Selected Reference:

Ortega-Hernandez OD, Shoenfeld Y. Mixed connective tissue disease: an overview of clinical manifestations, diagnosis and treatment. Best Pract Res Clin Rheumatol. 2012 Feb;26(1):61-72.

Sjögren Syndrome Panel (includes ANA, RF, Ro, La, CENP)

Beutner Test Code:

- #045

Methodology:

- Indirect Immunofluorescence (HEp-2) and Fluoroenzyme immunoassay (FEIA)

Substrate:

- HEp2/Phadia

Reference Range:

ANA (Titer)

- Negative <40

Rheumatoid Factor

- IgM (IU/mL)
 - Negative <3.5
 - Equivocal 3.5-5.0
 - Positive >5

Rheumatoid Factor

- IgA (IU/mL)
 - Negative <14
 - Equivocal 14-20
 - Positive >20

Ro (SS-A) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

La (SS-B) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

CENP (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Units:

- Titer, U/mL

CPT Code:

- 86038, 86039, 86255, 86235 x3, 86431 x2

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is within one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Sjögren's syndrome (SS) is a CTD affecting mainly women, and whose main feature is sicca syndrome. Various organs can be involved in severe forms. Classification criteria include both clinical and immunological parameters. Two different forms are observed: primary SS and secondary SS, which is associated with other CTD. Antinuclear antibody prevalence is estimated between 41.9 and 64% in this disease. The two main antigens recognized by AAb in SS patients are the Ro/SSA (with two subunits, one of 52 kDa and one of 60 kDa) and the La/SSB antigens. The detection of either anti-Ro/SSA and/or anti-La/SSB autoantibodies constitutes one of the classification criteria but their presence is not mandatory for diagnosis. Anti-Ro/SSA autoantibodies are detected in 33–77.1% of primary SS, whereas anti-La/SSB autoantibodies are present in 23–47.8% of primary SS.

Selected Reference:

Didier K, Bolko L, Giusti D, Toquet S, Robbins A, Antonicelli F, Servettaz A. Autoantibodies Associated With Connective Tissue Diseases: What Meaning for Clinicians? *Front Immunol.* 2018 Mar 26;9:541.

Drug Induced Lupus Panel (Includes ANA, dsDNA, Ro, La, Sm, Histone)

Beutner Test Code:

- #046

Methodology:

- Indirect Immunofluorescence (HEp-2) and Fluoroenzyme immunoassay (FEIA)

Substrate:

- HEp2/ELISA/Phadia

Reference Range:**ANA (Titer)**

- Negative <40

dsDNA (IU/mL)

- Negative <10
- Equivocal 10-15
- Positive >10

Ro (SS-A) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

La (SS-B) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Sm (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Histone (Units)

- Negative <1.0
- Weak Positive 1.0-1.5
- Moderate Positive 1.6-2.5
- Strong Positive >2.5

Units:

- Titer, U/mL, Units

CPT Code:

- 86038, 86039, 86255, 86235 x3, 86225

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is within one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Drug-induced lupus (DIL) is an autoimmune phenomenon where drug exposure leads to the development of systemic lupus erythematosus (SLE) like clinical features. More than 100 drugs have been identified as the cause of drug-induced lupus, with the list expanding with the development of newer biologic agents each year. DIL tends to be less severe than SLE, with symptoms usually resolving after discontinuation of the offending agent. The more common drugs implicated include hydralazine, procainamide, isoniazid, chlorpromazine, quinidine, minocycline, methyldopa. Some recombinant biologic agents such as tumor necrosis factor (TNF) antagonists and interferon alpha (IFN- α) also cause ANA's more frequently than clinical lupus. DIL has clinical characteristics in common with late-onset lupus. Upto 10% of SLE are drug induced, and an estimated 15,000-30,000 cases of DIL occur in the US every year. Generally, arthralgias, myalgias, fevers, and serositis are more common in DIL. In contrast, renal involvement, central nervous system disease, malar rash, photosensitivity, and oral ulcers occur less frequently in DIL. The ANA in DIL tends to have a homogeneous pattern, although a speckled pattern may also be seen. Anti-histone antibodies are found in 75% of patients with DIL. However, anti-histone antibodies are also found in patients with idiopathic lupus; therefore, it is not a specific test. These antibodies may persist after the offending drug has been stopped and the symptoms have resolved. The anti-histone antibodies in idiopathic lupus are primarily detected against the H1 and H2B subunits. In contrast, the anti-histone antibodies found in most patients with DIL are directed against the H2A and H2B subunits. In the case of hydralazine, the anti-histone antibodies are directed against H1 and the H3–H4 complex. Besides anti-histone antibodies, antibodies to SSA/Ro and SSB/La can be found in patients presenting with the subacute cutaneous form of DIL. Antibodies to dsDNA are found in approximately half of the patients with idiopathic lupus but in less than 5% of patients with DIL.

Selected Reference:

Solhjo M, Goyal A, Chauhan K. Drug-Induced Lupus Erythematosus. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan 24.

Bruce C. Richardson. Drug-Induced Lupus Erythematosus. Editor(s): Daniel J. Wallace, Bevra Hannahs Hahn. Dubois' Lupus Erythematosus and Related Syndromes (Ninth Edition), Elsevier. 2019, Pages 377-388.

Systemic Sclerosis Panel (Includes ANA, U1RNP, RNP70, Scl-70, CENP, RNA Polymerase III)

Beutner Test Code:

- #047

Methodology:

- Indirect Immunofluorescence (HEp-2) and Fluoroenzyme immunoassay (FEIA)

Substrate:

- HEp2/Phadia

Reference Range:

ANA (Titer)

- Negative <40

U1RNP (U/mL)

- Negative <5
- Equivocal 5-10
- Positive >10

RNP70 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Scl-70 (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

CENP (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

RNA Polymerase III (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Units:

- Titer, U/mL

CPT Code:

- 86038, 86039, 86255, 86235 x4

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is within one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Systemic sclerosis (SSc) is a connective tissue disease characterized by fibrosis, vasculopathy, and autoimmunity. Multiple organs can be involved, and various autoantibodies may be detected in sera of patients with SSc. Hep-2 IIF is a good screening assay for SSc, given its high sensitivity. The centromere pattern (specific for CENP-B antibodies) is highly associated with SSc and a lesser extent, also the nucleolar pattern. Topoisomerase I (Scl 70), centromere (CENPB), and RNA polymerase III are the three most frequent autoantigens recognized in SS. Other SSc-associated antibodies include antibodies to Ro/SSA (mainly 52 kDa subunit, in 15-19% patients), fibrillarin (U3 RNP, in 1.4-8% patients), PM/Scl (in 3-13% patients), Th/To (in 0.2-3.4% patients), and NOR90 (in 6% patients) all of these give a nucleolar pattern by IIF on Hep-2. ANAs are not useful for follow-up in SSc as they remain positive whatever the disease activity. Anti-Scl70 antibodies are detected in 30-40% of SSc sera with an estimated sensitivity of 43% and specificity of about 90%. The associated pattern on Hep-2 cells is speckled and nucleolar. These antibodies are associated with diffuse systemic sclerosis and with a higher risk of pulmonary fibrosis. Anti-centromere (CENP-B) antibodies are associated with limited SSc and with a higher risk of developing pulmonary hypertension. These antibodies are detected in 28-37% of patients with SSc and have a sensitivity of about 44% and specificity of 93%. Anti-RNA polymerase antibodies are associated with diffuse SSc and with a higher risk of scleroderma renal crisis. These are characterized by fine speckled pattern on Hep-2 cells. The antibodies are detected in 3.8-19.4% of patients with SSc with a sensitivity of 38% and specificity of about 94%. Anti-U1-RNP antibodies are found in about 5% of patients with SSc and are associated with a limited form of the disease and with a higher risk of pulmonary hypertension. These antibodies give a coarse speckled pattern on Hep-2 cells by IIF. Anti-U3-RNP antibodies are distinguished by a clumpy nucleolar pattern on Hep-2 cells and are detected in 1.5-8% of patients with SSc. These are associated with rapidly progressive disease.

Selected Reference:

Bossuyt, X., De Langhe, E., Borghi, M. O., & Meroni, P. L. Understanding and interpreting antinuclear antibody tests in systemic rheumatic diseases. *Nature Reviews Rheumatology*. 2020; 16(12): 715-726. Didier K, Bolko L, Giusti D, Toquet S, Robbins A, Antonicelli F, Servettaz A. Autoantibodies Associated With Connective Tissue Diseases: What Meaning for Clinicians? *Front Immunol*. 2018 Mar 26;9:541.

T-Cell Receptor Gene Rearrangement, γ

Beutner Test Code

- #048

Methodology:

- PCR

Reported as:

- Positive (either Monoclonal or Clonal)
- Negative (either Oligoclonal or Polyclonal)
- Indeterminate/Inconclusive CPT Code: 81342

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen: Whole blood, bone marrow, formalin-fixed, paraffin-embedded (FFPE) tissue block or slides, fresh or frozen tissue are acceptable specimens
- Volume: 3 to 5 mL whole blood, 1 mL bone marrow, five unstained slides at 10 μ M or formalin-fixed, paraffin-embedded tissue block, tissue in RPMI or frozen (A minimum of 2 x 2 x 2 mm)
- Container: Lavender-top (EDTA) tube, yellow-top (ACD) tube and green-top (heparin) tubes are accepted but not preferred.
- Transport Temperature: Refrigerated, FFPE tissue unstained slides, or tissue in RPMI or frozen
- Sample Stability: Maintain blood, bone marrow or tissue in RPMI at 2°C to 8°C; FFPE specimens at room temperature; tissue at -80°C.

Clinical Relevance:

- An assessment of T-cell clonality is an important for the evaluation of suspected lymphoproliferative disorders. Historically, Southern blot studies for T-cell receptor beta chain (TCRB) rearrangements have been considered to represent the gold standard for T-cell clonality evaluation. Southern blot studies are labor-intensive and time-consuming for the laboratory and often are impractical for routine practice as they require fresh or frozen tissue and cannot be performed on formalin-fixed, paraffin-embedded (FFPE) material. PCR assays for T-cell receptor gamma chain (TCRG) and/or TCRB rearrangements offer the ability to assess clonality from standard FFPE, but until recently, PCR studies have been limited by a higher false negative rate compared to Southern blot studies.
- T-cell clonality assay that employs primers for both TCRB and TCRG, a combination that has been shown to detect clonality in essentially 100% of T-cell prolymphocytic leukemias, T-cell large granular lymphocyte disorders, and peripheral T-cell lymphomas, unspecified, with somewhat lower rates reported in angioimmunoblastic T-cell lymphomas and anaplastic large cell lymphoma. These assays are designed for detection of clonal T-cell populations in suspected lymphoproliferative disorders using fresh, frozen, or FFPE tissue.

T-Cell Receptor Gene Rearrangements Profile, γ and β

Beutner Test Code:

- #049

Methodology:

- PCR

Reported as:

- Positive (either Monoclonal or Clonal)
- Negative (either Oligoclonal or Polyclonal)
- Indeterminate/Inconclusive

CPT Code:

- 81342, 81340

Schedule/Turnaround Time:

- Assay performed once per week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Whole blood, bone marrow, formalin-fixed, paraffin-embedded (FFPE) tissue block or slides, fresh or frozen tissue are acceptable specimens.
- Volume: 3 to 5 mL whole blood, 1 mL bone marrow, five unstained slides at 10 μ M or formalin-fixed, paraffin-embedded tissue block, tissue in RPMI or frozen (A minimum of 2 x 2 x 2 mm)
- Container: Lavender-top (EDTA) tube, yellow-top (ACD) tube and green-top (heparin) tubes are accepted but not preferred.
- Transport Temperature: Refrigerated, FFPE tissue unstained slides, or tissue in RPMI or frozen

Sample Stability:

- Maintain blood, bone marrow or tissue in RPMI at 2°C to 8°C; FFPE specimens at room temperature; tissue at -80°C.

Clinical Relevance:

- An assessment of T-cell clonality is an important part of the evaluation of suspected lymphoproliferative disorders. Historically, Southern blot studies for T-cell receptor beta chain (TCRB) rearrangements have been considered to represent the gold standard for T-cell clonality evaluation. Southern blot studies are labor-intensive and time-consuming for the laboratory and often are impractical for routine practice as they require fresh or frozen tissue and cannot be performed on formalin-fixed, paraffin-embedded (FFPE) material. PCR assays for T-cell receptor gamma chain (TCRG) and/or TCRB rearrangements offer the ability to assess clonality from standard FFPE, but until recently, PCR studies have been limited by a higher false negative rate compared to Southern blot studies.
- T-cell clonality assay that employs primers for both TCRB and TCRG, a combination that has been shown to detect clonality in essentially 100% of T-cell prolymphocytic leukemias, T-cell large granular lymphocyte disorders, and peripheral T-cell lymphomas, unspecified, with somewhat lower rates reported in angioimmunoblastic T-cell lymphomas and anaplastic large cell lymphoma. These assays are designed for detection of clonal T-cell populations in suspected lymphoproliferative disorders using fresh, frozen, or FFPE tissue.

SARS-CoV-2 Antibody (spike protein)

Beutner Test Code

- #050

Methodology:

- Chemiluminescence (CLIA)

Reference Range:

- <0.8 Negative
- 0.8 - <1.0 Indeterminate
- ≥ 1.0 Positive

CPT Code:

- 86769 x3

Schedule/Turnaround Time:

- Assays are performed twice per week. Report availability is within 3-5 days from the time of specimen receipt.

Specimen Requirements:

- Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Clinical Relevance:

- This CLIA detects IgM, IgA and IgG antibodies to the spike (S) proteins of SARS-CoV-2 virus. Positive results to antibodies against SARS-CoV-2 are generally indicative of an individual's current or prior infection with the SARS-CoV-2 virus or vaccination. However, the duration of these antibodies remaining in circulation is not yet known. These test results should be considered in the context of patient's clinical history, physical examination, epidemiologic exposure and vaccination history. Serological testing should not be used to establish the presence or absence of acute SARS-CoV-2 infection. A negative finding by this test does not preclude acute infection. If acute infection is suspected, direct testing for SARS-CoV-2 is indicated.
- In vaccinated individuals, a positive result with this test and a negative result for antibodies to nucleocapsid proteins (Test #051) suggests that they have produced vaccine-induced antibodies and that they were never infected with SARS-CoV-2.
- IgM isotype antibodies develop within 5 to 7 days indicating recent exposure to the virus. IgG isotype antibodies develop after 10 days and remain in circulation longer. IgA isotype antibody development is variable in its response. Vaccine induced antibodies may be of IgG or IgM isotype.

Selected Reference:

Guo, L., Ren, L., Yang, S., Xiao, M., Chang, D., Yang, F., et. al. (2020). Profiling early humoral response to diagnose novel coronavirus disease (COVID-19). *Clinical Infectious Diseases*.

Zheng, Z et al. (2020) Profile of Specific Antibodies to SARS-CoV-2: The First Report *Journal of Infection* (2020), doi: <https://doi.org/10.1016/j.jinf.2020.03.052>

Long, Q et al. (2020). Antibody responses to SARS-CoV-2 in COVID-19 patients: the perspective application of serological tests in clinical practice. *10.1101/2020.03.18.20038018*.

SARS-CoV-2 Total Nucleocapsid Antibody (IgG, IgA and IgM)

Beutner Test Code:

- #051

Methodology:

- ELISA

Reference Range:

- <0.8 Negative
- 0.8 - <1.0 Equivocal
- ≥ 1.0 Positive

CPT Code:

- 86769

Schedule/Turnaround Time:

- Assays are performed twice per week. Report availability is within 3-5 days from the time of specimen receipt.

Specimen Requirements:

- Collect 5-10 mL of blood in a red top or serum separator tube (preferred). If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Transport the specimen at ambient temperature. If stored prior to shipment, it is stable refrigerated (2-8°C) for 7 days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- SARS-CoV-2 total antibody assay detects IgM, IgG and IgA antibodies to nucleocapsid proteins of SARS-CoV-2 virus. A Positive result by this assay indicates recent or prior exposure to the virus. False positive results may occur with this assay due to cross reactivity from pre-existing antibodies or other possible causes. A negative or equivocal finding does not preclude acute infection. If acute infection is suspected, direct testing for SARS-CoV-2 is indicated.
- Antibodies to SARS-CoV-2 are generally detectable in blood several days after infection, though the duration of time the antibodies are present post infection is not well characterized. It is unknown how long antibodies to SARS-CoV-2 will remain present in the blood after infection and it is not known if they confer immunity to infection.
- The positive percent agreement in 51 serum specimens collected between 2-42 days post onset of clinical symptoms compared to SARS-CoV-2 RT-PCR was 92.16% and negative percent agreement is 99.56%.¹ Another study reported a specificity and sensitivity of 97.4% and 94.9% for total antibodies using the adapted cutoffs (≥ 0.8) with this assay.²

Selected Reference:

Platelia SARS-CoV-2 Total Ab package insert, Bio-Rad Laboratories, Inc.

Tré-Hardy M, Wilmet A, Beukinga I, Favresse J, Dogné JM, Douxfils J, Blairon L. Analytical and clinical validation of an ELISA for specific SARS-CoV-2 IgG, IgA, and IgM antibodies. J Med Virol. 2021 Feb;93(2):803-811.

SARS CoV-2 Comprehensive Antibody Profile

Beutner Test Code:

- #052 Includes Tests: #050 SARS-CoV-2 Antibody (spike protein)
#051 SARS-CoV-2 Total Nucleocapsid Antibody (IgG, IgA and IgM)

Methodology:

- Chemiluminescence and ELISA

Reference Range:

- Please see individual tests.

CPT Code:

- 86769 x4

Schedule/Turnaround Time:

- Assays are performed twice per week. Report availability is within 3-5 days from the time of specimen receipt.

Specimen Requirements:

- Collect 5-10 mL of blood in a red top or serum separator tube(preferred). If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If stored prior to shipment, it is stable refrigerated (2-8°C) for 2 weeks and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Please see Tests 050 and 051

Tissue Transglutaminase Antibody IgA & IgG

Beutner Test Code:

- #053

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Range:

- <7 Units Negative
- 7-10 Units Equivocal
- > 10 Units Positive

Units:

- Units/mL

CPT Code:

- 83516 x2

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- IgA anti-endomysium antibodies (EmA), IgA and IgG anti-deamidated gliadin peptides (DGP), and IgA anti-tissue transglutaminase (tTG) antibodies are considered specific and sensitive serologic markers for gluten sensitive enteropathies such as celiac disease and dermatitis herpetiformis (DH). Although the IgA isotype of these antibodies usually predominates in celiac disease and dermatitis herpetiformis, individuals may also produce IgG isotypes, particularly if the individual is IgA deficient. The sensitivity and specificity of commercially available IgA tTG ELISA tests for the diagnosis of DH have been reported to range from 42% to 99% and 92% to 100%, respectively.

Deamidated Gliadin Antibody IgA & IgG

Beutner Test Code:

- #054

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Range:

- <7 Units..... Negative
- 7-10 Units Equivocal
- > 10 Units..... Positive

Units:

- Units/mL

CPT Code:

- 83516 x2

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- The diagnosis of celiac disease (CD) is based on mucosal changes detected by duodenal biopsy and positive serological tests (anti-tTG antibodies, anti-endomysium antibodies (EmA), and deamidated gliadin peptide (DGP) antibodies). Test for anti-deamidated peptides of gliadin (DGP) have replaced classic anti-native gliadin (AGA) tests. DGP IgG assays have a considerably higher diagnostic accuracy than AGA assays and can replace anti-tTG tests in patients with selective IgA deficiency. The combination of IgG anti-DGP plus IgA anti-tTG assays show greater sensitivity than a single test, with very high specificity. IgG DGP are particularly useful in identifying CD in early childhood (age < 2 years). The reported sensitivity and specificity of Anti-Gliadin DP antibodies in celiac disease is 84.4% and 98.5%. The PPV and NPV have been reported as 98.2% and 86.8% respectively. However, the definitive diagnosis of CD should be based on clinical, molecular, and histopathological findings.

Comprehensive Celiac Disease/Gluten Sensitive Enteropathy Panel

Beutner Test Code:

- #055 Includes Tests: #020 IgA & IgG Endomysial antibodies
#022 IgA Epidermal Transglutaminase Antibodies-ELISA
#053 Tissue Transglutaminase: IgA & IgG
#054 Deamidated Gliadin IgA & IgG

Methodology:

- Indirect Immunofluorescence, ELISA, Fluoroenzyme immunoassay (FEIA)

Reference Range:

Endomysial EMA(IgG/IgA) (Titer)

- Negative <2.5

Epidermal transglutaminase eTG (IgA) (AU/mL)

- Negative <16
- Grey range 16-22
- Positive >22

Tissue Transglutaminase tTG (IgG/IgA) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Deamidated Gliadin DGP (IgG/IgA) (U/mL)

- Negative <7
- Equivocal 7-10
- Positive >10

Units:

- Titer, Units/mL

CPT Code:

- 86231 x2, 83516 x3, 86364 x2

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Please see individual tests.

Rheumatoid Arthritis Panel (Includes Rheumatoid Factor – IgM & IgA and CCP)

Beutner Test Code:

- #056

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Ranges:

- | <u>CCP</u> | <u>RF-IgA</u> | <u>RF-IgM</u> |
|------------------------|-------------------------|----------------------------|
| <7 U/mLNegative | < 14 IU/mLNegative | <3.5 IU/mL..... Negative |
| 7-10 U/mL....Equivocal | 14-20 IU/mL ..Equivocal | 3.5–5.0 IU/mL... Equivocal |
| > 10 U/mL ...Positive | >20 IU/mLPositive | > 5.0 IU/mL..... Positive |

Units:

- Units/mL, International Units/mL

CPT Code:

- 86200, 86431 x2

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Rheumatoid factor (RF) and Cyclic Citrullinated Peptide antibodies (ACPA) are serological biomarkers for diagnosis of Rheumatoid Arthritis (RA). Rheumatoid Factor (RF) is an autoantibody against the Fc portion of immunoglobulin (Ig). Rheumatoid factor IgM, the main isotype identified by RF assays, is found in approximately 70–80% of patients with confirmed RA. The presence of all three RF isotypes (IgG, IgA and IgM) at abnormal levels has high specificity for a diagnosis of RA. However, presence of RF isotypes in any combination may be found in other rheumatic conditions and in healthy individuals. The three RF isotypes (IgM, IgA, and IgG) are detected in 52% of RA patients but in fewer than 5% patients with other connective tissue diseases. Anti-CCP positivity, particularly at high levels, at any time is associated with higher risk of more severe clinical outcomes, higher disease activity and worse radiographic progression. Anti-CCP can also be present in other disease states. The second generation CCP (CCP2) test has high sensitivity and specificity and is currently recognized as the gold standard of testing for anti-CCP antibodies (ACPA). The accumulated specificity and sensitivity from 164 studies performed from 2002 to 2010 showed a sensitivity in early RA to be 61.6% and 75.2% in established RA and specificity of 94.0% (non-RA controls) and 99.0% (healthy controls).

Selected Reference:

Aletaha D, et al. 2010 Rheumatoid arthritis classification criteria: an American College of Rheumatology/European League Against Rheumatism collaborative initiative. *Arthritis Rheum.* 2010;62(9):2569-81.

Derksen VFAM, Huizinga TWJ, van der Woude D. The role of autoantibodies in the pathophysiology of rheumatoid arthritis. *Semin Immunopathol.* 2017 Jun;39(4):437-446.

Paalanen K, Rannio K, Rannio T. et al. Does early seronegative arthritis develop into rheumatoid arthritis? A 10-year observational study. *Clin Exp Rheumatol* 2019; 37:37–43.

Sokolova, M. V., Schett, G., & Steffen, U. (2021). Autoantibodies in Rheumatoid Arthritis: Historical Background and Novel Findings. *Clinical reviews in allergy & immunology*, 1-14.

Vasculitis Panel (Includes ANCA, PR3 and MPO)

Beutner Test Code:

- #057

Methodology:

- Indirect Immunofluorescence (ANCA), Fluoroenzyme immunoassay (FEIA) (MPO, PR3)

Reference Ranges:

- ANCA: Screening dilution 1:20
- Negative or If positive for antineutrophil cytoplasmic antibodies, results are titered to the end point.
- | <u>PR3</u> | <u>MPO</u> |
|------------------------|----------------------------|
| <2 U/mLNegative | < 3.5 U/mL..... Negative |
| 2-3 U/mL.....Equivocal | 3.5-5.0 U/mL.... Equivocal |
| > 3 U/mLPositive | >5 U/mL..... Positive |

Units:

- Titers, Units/mL

CPT Code:

- 86036 x2, 83516 x2

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Antineutrophil cytoplasmic antibodies (ANCA) are the serological markers of some idiopathic systemic vasculitides predominantly afflicting small (medium)-sized blood vessels, such as granulomatosis with polyangiitis (GPA, previously called Wegener granulomatosis), microscopic polyangiitis (MPA) and, to a lesser extent eosinophilic granulomatosis with polyangiitis (EGPA, previously Churg-Strauss syndrome). These vasculitides, in which circulating ANCA are commonly found, are named "ANCA associated vasculitis" (AAV). ANCA are found in 70-95% of patients with GPA and MPA and their prevalence in EGPA is around 30%-40%. The main fluoroscopic patterns of ANCA by IIF are the diffuse, granular cytoplasmic (C-ANCA), and the perinuclear (P-ANCA). C-ANCA is due to the presence of autoantibodies targeting the serine protease proteinase-3 (PR-3). P-ANCA is caused by antibodies directed against multiple antigens, among which the myeloperoxidase (MPO-ANCA) is the most frequent one in AAV. The sensitivity of IIF to detect ANCA ranges from 80-90% and specificity is approximately 80%. P-ANCA and MPO prevalence is 65%-90% in MPA, 70%-90% in pauci-immune necrotizing crescentic glomerulonephritis, 25% in GPA and 30%-40% in EGPA. The disease associations of C-ANCA and PR3 antibodies include GPA (40%-90%), MPA (15-20%), pauci-immune necrotizing crescentic glomerulonephritis (NCGN, 10%), and EGPA (<10%). The definitive diagnosis should be based on clinical signs and symptoms and not on single diagnostic method results. ANCA can be detected in other conditions such as inflammatory bowel disease (IBD), connective tissue disease, rheumatoid arthritis, infections, drug induced vasculitis and drug induced lupus.

Goodpasture Syndrome (Includes Glomerular Basement Membrane IgG (GBM))

Beutner Test Code:

- #058

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Range:

- <7 Units..... Negative
- 7-10 Units Equivocal
- > 10 Units..... Positive

Units:

- Units/mL

CPT Code:

- 83516

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Anti-glomerular basement membrane (GBM) antibody disease is a rare autoimmune disorder characterized by crescentic rapidly progressive glomerulonephritis. Tissue injury is mediated by anti-GBM antibodies that bind glomerular (and alveolar) basement membranes. The target autoantigen has been identified as the noncollagenous domain 1 (NC1) of the α 3-chain of type IV collagen and is found only in basement membranes in the kidney, lung, cochlea and eye. The diagnosis of anti-GBM disease is based upon the demonstration of deposited immunoglobulins in kidney by direct immunofluorescence and detection of circulating autoantibodies. Early detection of circulating anti-GBM antibodies in the context of an acute kidney injury, with or without pulmonary hemorrhage, can direct timely initiation of treatment and improve patient outcome. The specificity and sensitivity of this assay is 100% and 94.7% respectively. Rare instances of false-positive anti-GBM antibody tests may be found in states of polyclonal activation such as in hepatitis C or HIV infection and with diverse renal pathologies. Rare cases of anti-GBM disease without circulating anti-GBM antibodies have been reported.

Antiphospholipid Syndrome Panel (Cardiolipin IgG, IgA, IgM & B2 GP1 IgG, IgA, IgM)

Beutner Test Code:

- #059

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Ranges:

- Anticardiolipin Abs:

IgG	IgA	IgM
<10 GPL Units Negative	< 14 APL Units Negative	<10 MPL Units Negative
10-40 GPL Units.... Weak Positive	14-20 APL Units Equivocal	10-40 MPL Units Weak Positive
> 40 GPL Units Positive	>20 APL Units Positive	> 40 MPL Units Positive
- Beta-2 Glycoprotein 1 Abs (IgG, IgA & IgM):

<7 Units Negative
7-10 Units Equivocal
> 10 Units Positive

Units:

- Cardiolipins: IgG: GPL Units/mL; IgA: APL Units/mL; IgM: MPL Units/mL
- Beta-2 Glycoprotein 1: Units/mL

CPT Code:

- 86146 x3, 86147 x3

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.

Sample Stability:

- Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Antiphospholipid syndrome (APS) is a heterogeneous autoimmune disorder characterized by arterial or venous thromboembolic events and/or pregnancy morbidity in the setting of persistently positive antiphospholipid antibodies (aPL). APS is classified according to the Sapporo criteria. It is defined as the presence of at least one of the clinical criteria and one of the laboratory criteria included in the classification. The three major antiphospholipid antibody tests recognized by the international classification criteria for APS are anticardiolipin antibodies (IgG, IgM), anti-beta 2 glycoprotein antibodies (IgG, IgM) and the lupus anticoagulant (LA). The antiphospholipid antibodies must be present in medium or high titers on two or more occasions at least 12 weeks apart. The Systemic Lupus International Collaborating Units (SLICC) classification includes IgA isotypes of these antibodies as part of the definition of antiphospholipid activity. Positive findings for cardiolipin (IgA) and B2 GP1 (IgA) antibodies fulfill the preliminary laboratory criteria for the diagnosis of Antiphospholipid Syndrome (APS). The diagnosis of APS should not be based solely on these laboratory findings of positive antiphospholipid antibodies (aPL). Suggestive clinical findings must be present. Follow up, repeat tests for these antibodies after 12 weeks is indicated (please see comment). Low titer aPL and lupus anticoagulant can be found in 1%-5% young, healthy adults with a higher prevalence in pediatric populations.

Autoimmune Thyroid Panel (includes Thyroglobulin and Thyroid peroxidase)

Beutner Test Code:

- #060

Methodology:

- Fluoroenzyme immunoassay (FEIA)

Reference Ranges:

- | | |
|----------------------------|----------------------------|
| • <u>Tg</u> | <u>TPO</u> |
| <40 IU/mL Negative | < 25 IU/mL..... Negative |
| 40-60 IU/mL..... Equivocal | 25-35 IU/mL..... Equivocal |
| >60 IU/mL Positive | >35 IU/mL..... Positive |

Units:

- International Units/mL

CPT Code:

- 86800;86376

Schedule/Turnaround Time:

- Assay performed once every week. Report availability is one week from the time of specimen receipt.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 5-10 mL of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.
- Sample Stability: Sample is stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Anti-TPO and Anti-TG antibodies are observed in autoimmune thyroid diseases (AITD) such as Grave's disease (GD) and Hashimoto's thyroiditis (HT). The prevalence of anti-TPO and anti-TG antibodies is high in patients with GD and HT. Besides these, anti-TSHR (anti-thyroid-stimulating hormone receptor) antibodies are also observed in 90% GD patients but only in approximately 0-20% patients with HT. Anti-TG antibody prevalence ranges from 60–80% in HT patients and 50–60% in GD patients. Circulating Anti-TG antibodies can be detected in about 10% of healthy young subjects, in 15% of people >60 years of age and in 10–15% of patients with non-thyroid immune disorders such as rheumatoid arthritis, type 1 diabetes and celiac disease. About 20 - 25% of differentiated thyroid cancer patients have detectable anti-TG antibodies at diagnosis or during treatment. Anti TPO antibodies are detected in 90–95% of AITD patients. Approximately, 90% of Hashimoto's thyroiditis, 80% of Grave's disease and two-thirds of patients with postpartum thyroiditis have detectable TPO antibodies. TPO antibodies can also be found in non-thyroid autoimmune diseases and some normal subjects.

Selected Reference:

Fröhlich, E., & Wahl, R. (2017). Thyroid autoimmunity: role of anti-thyroid antibodies in thyroid and extra-thyroidal diseases. *Frontiers in immunology*, 8, 521.

Spencer, C., & Fatemi, S. (2013). Thyroglobulin antibody (TgAb) methods—strengths, pitfalls, and clinical utility for monitoring TgAb-positive patients with differentiated thyroid cancer. *Best practice & research Clinical endocrinology & metabolism*, 27(5), 701-712.

EBA/Bullous LE (includes primate esophagus and split skin for IgG and IgG4, Collagen)

Beutner Test Code:

- #061

Methodology:

- Indirect Immunofluorescence and ELISA

Reference Ranges:

Monkey Esophagus (IgG/IgG4)

- Negative < 10

Split Skin (IgG/IgG4)

- Negative < 5

Collagen

- Negative < 6.0 U/mL
- Positive ≥ 6.0 U/mL

Units:

- Titer, U/mL

CPT Code:

- See individual tests

Schedule/Turnaround Time:

- See individual tests

Specimen Requirements:

- Collect 5-10 ml of blood in a red top or serum separator tube. If possible, separate serum from clot and place into red capped tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.
- Sample Stability: Stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- See individual tests

Laminin 332 Autoimmunity (includes primate esophagus, split skin for IgG, IgG4, Laminin 332)

Beutner Test Code:

- #062

Methodology:

- Indirect Immunofluorescence

Reference Ranges:

Monkey Esophagus (IgG/IgG4)

- Negative < 10

Split Skin (IgG/IgG4)

- Negative < 5

Laminin 332

- Negative < 10

Units:

- Titer

CPT Code:

- See individual tests

Schedule/Turnaround Time:

- Assay performed daily Monday-Friday. Report availability is within 48-72 hours from the time of specimen receipt. The turnaround time may be more than 72 hours if there is a need to run this test in batches.

Specimen Requirements:

- Specimen need not be refrigerated or frozen. Collect 2-5 ml of blood in a red top or serum separator tube. Minimum volume requested is 2ml. If possible, separate serum from clot and place into red top tube provided with Beutner Laboratories collection kits. If separation facilities are not available, the blood can be sent in the tube used for collection.
- Sample Stability: Stable at ambient temperature during shipment. If sample is stored prior to shipment, it is stable refrigerated (2-8°C) up to five days and frozen (-20°C or lower) up to one year.

Clinical Relevance:

- Mucous membrane pemphigoid (MMP) is a mucosal autoimmune subepithelial blistering disease mediated autoantibodies against various autoantigens in the basement membrane zone (BMZ). The predominant autoantigens are BP180, BP230, laminin 332, integrin alpha 6 beta 4, and collagen VII (COL7) (Egan, 2001). MMP mediated by antibodies to laminin 332 presents with a different clinical presentation and risk. Anti-laminin 332 MMP lesions tend to scar and can result in serious complications depending on the mucosal surface affected. Scarring of ocular mucosa can result in symblepharon, disruption of the tear film, entropion, and/or corneal opacities, all of which may lead to blindness. Other irreversible, severe complications are esophageal, anal stenosis, and urethral strictures. An additional complication of anti-laminin 332 MMP increased relative risk of solid epithelial malignancies, mainly adenocarcinoma affecting the gastrointestinal, genital mucosa, and lungs (Balestri, 2016). Clinically, patients with anti-laminin 332 MMP cannot be differentiated from patients with MMP with autoantibodies against the other main target antigen, BP180, although pharyngeal involvement was reported to occur less frequently in the latter patients. Patients with anti-laminin 332 MMP cannot be differentiated from other variants of MMP based on clinical appearance and can only be distinguished by serological testing. Identification of MMP patients with laminin 332-specific antibodies are essential since 25%-30% of these patients might have a malignancy. The introduction of the laminin 332-specific biochip mosaic developed in 2019 by Goletz et al., provided a widely available standardized test system for the detection of anti-laminin 332 serum autoantibodies. External and internal studies showed that the test showed a sensitivity of 84% and a specificity of 99.8%.

Selected Reference:

Balestri R, Magnano M, La Placa M, Patrizi A, Angileri L, Tengattini V, Bardazzi F. Malignancies in bullous pemphigoid: a controversial association. *J Dermatol* 2016; 43: 125-133.

Egan CA, Lazarova Z, Darling TN, Yee C, Cote T, Yancey KB. Anti-epiligrin cicatricial pemphigoid and relative risk for cancer. *Lancet* 2001; 9: 1850-1851.

Goletz S, Probst C, Komorowski L, Schlumberger W, Fechner K, van Beek N, et al. A Sensitive and Specific Assay for the Serological Diagnosis of Antilaminin 332 Mucous Membrane Pemphigoid. *Br J Dermatol* (2019) 180(1):149-56. doi: 10.1111/bjd.17202