ELISpot

Feline IL-2

Catalog Number EL1890

For the quantitative determination of the frequency of cells releasing feline IL-2.

This package insert must be read in its entirety before using this product.

FOR RESEARCH USE ONLY.
NOT FOR USE IN DIAGNOSTIC PROCEDURES.
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INTRODUCTION

Feline Interleukin 2 (IL-2) is a 16 kDa, α-helical single chain, potentially glycosylated polypeptide that has potent stimulatory activity for antigen-activated T cells (1 - 4). The common form of IL-2 is synthesized as a 154 amino acid (aa) precursor that contains a 20 aa signal peptide plus a 134 aa mature segment that is possibly O-glycosylated (1, 5). The carbohydrate that is present is not necessary for bioactivity (6). Unlike the mouse, there are no glutamine repeats in the N-terminus (1, 7, 8). Mature feline IL-2 shares 78%, 82%, 60%, 64%, 62%, 75%, 62%, and 76% aa sequence identity to mature human (9), dog (10), mouse (11), rat (12), cotton rat (13), pig (14), goat (15), and horse (16) IL-2, respectively. Mammalian cells known to express IL-2 include CD4+ and CD8+ T cells (17), visceral smooth muscle cells (18), eosinophils (19, 20), γδ T cells (21), B cells (22) and dendritic cells (23).

The receptor for IL-2 is complex and consists of three distinct subunits in varying combinations (24, 25). Two of these are ligand-binding and are termed IL-2 Rα and IL-2 Rβ. IL-2Rα is 55 kDa (26) and binds IL-2 with low affinity. IL-2 Rβ is 75 kDa and binds IL-2 with intermediate affinity. Signal transduction is performed by both IL-2 Rβ and a 64 kDa common gamma chain (γc). This signal transducing common gamma chain does not bind IL-2 but does heterodimerize with IL-2 Rβ to form a functional IL-2 receptor. The complex heterotrimeric α-β-γc receptor may arise from IL-2 binding to preformed Rα-Rβ complexes (27).

Functionally, IL-2 is best known for its autocrine and paracrine activity on T cells. It is induced in T cells following the interaction of antigen with TCR. The TCR-Ag interaction drives resting T cells into active G1, inducing IL-2 and IL-2 Rα synthesis and cell proliferation (25, 28). Notably, the levels of available IL-2 can have variable effects. On naive CD8+ T cells, high IL-2 levels can induce cell proliferation with a bias towards cytotoxicity. In the presence of low levels of IL-2, CD8+ T cells preferentially undergo apoptosis with a bias towards cytokine secretion (29). Recent data also suggest IL-2 plays a role in CD4+ T cell function. In conjunction with IL-7, IL-2 promotes Fas-induced death of naive CD4+ T cells, while having minimal effect on activated CD4+ memory lymphocytes. This indicates that IL-2 helps regulate overall T cell number, but not at the expense of cells with a prior memory of antigen exposure (30). In addition, IL-2 seems to play a central role in the expansion and maintenance of CD4+ CD25+ regulatory T cells. Thus, IL-2 may be a key cytokine in the natural suppression of autoimmunity (31).

The Feline IL-2 ELISpot assay is designed for the detection of IL-2 secreting cells at the single cell level, and it can be used to quantitate the frequency of feline IL-2 secreting cells. ELISpot assays are well suited for monitoring immune responses to various stimuli, treatments and therapies, and they have been used for the quantitation of antigen-specific CD4 and/or CD8 T cell responses. Other methods for the assessment of antigen-specific T cell responses, such as the chromium release assay with quantitation by limiting dilution, are tedious, and require previous in vitro expansion of T cells for several days. These assays typically are not suitable for measuring infrequent T cell responses that occur at less than 1 in 1000. ELISpot assays are highly reproducible and sensitive, and can be used to measure responses with frequencies well below 1 in 100,000. ELISpot assays do not require prior in vitro expansion of T cells, and they are suitable for high-throughput analysis using only small volumes of primary cells. As such, ELISpot assays are useful tools for research in areas as diverse as antigen recognition, vaccine development, cytokine secretion and the monitoring of various clinical trials.
PRINCIPLE OF THE ASSAY

The enzyme-linked immunospot (ELISpot) assay was originally developed for the detection of individual B cells secreting antigen-specific antibodies (32, 33). This method has since been adapted for the detection of individual cells secreting specific cytokines or other antigens (34, 35). ELISpot assays employ the quantitative sandwich enzyme-linked immunosorbent assay (ELISA) technique. A monoclonal antibody for IL-2 has been pre-coated onto a PVDF (polyvinylidene difluoride)-backed microplate. Appropriately stimulated cells are pipetted into the wells and the microplate is placed into a humidified 37°C CO₂ incubator for a specified period of time. During this incubation period, the immobilized antibody in the immediate vicinity of the secreting cells binds secreted IL-2. After washing away any cells and unbound substances, a biotinylated polyclonal antibody for IL-2 is added to the wells. Following a wash to remove any unbound biotinylated antibody, alkaline-phosphatase conjugated to streptavidin is added. Unbound enzyme is subsequently removed by washing and a substrate solution (BCIP/NBT) is added. A blue-black colored precipitate forms at the sites of cytokine localization and appears as spots, with each individual spot representing an individual IL-2 secreting cell. The spots can be counted with an automated ELISpot reader system or manually using a stereomicroscope.
Incubate IL-2-secreting cells in an antibody-coated well.

Remove cells by washing. Secreted IL-2 is captured by the immobilized antibody.

Incubate with biotinylated anti-IL-2 antibody.

Incubate with alkaline phosphatase conjugated streptavidin.

Add substrate and monitor the formation of colored spots.
LIMITATIONS OF THE PROCEDURE

- FOR RESEARCH USE ONLY. NOT FOR USE IN DIAGNOSTIC PROCEDURES.
- The kit should not be used beyond the expiration date on the kit label.
- Any variation in pipetting and washing techniques, incubation time or temperature, and kit age can cause variation in density of spots, intensity of specific staining and background level.

PRECAUTIONS

Some components of this kit contain sodium azide, which may react with lead and copper plumbing to form explosive metallic azides. Flush with large volumes of water during disposal.

Do not use reagents from this kit with components from other R&D Systems' ELISpot or ELISA kits and/or components manufactured by other vendors.

Do not remove the flexible plastic underdrain on the bottom of the microplate before or during incubation and development since it may damage the PVDF membrane filters. The underdrain cover may be removed only after completing the incubation with BCIP/NBT chromogen.

Although the toxicity of the chromogenic substrate BCIP/NBT is not currently known, wear gloves to avoid contact with skin. Follow local, state and federal regulations to dispose of used BCIP/NBT.

MATERIALS PROVIDED

Feline IL-2 Microplate (Part 892842) - One 96-well PVDF-backed microplate coated with monoclonal antibody specific for IL-2.

Detection Antibody Concentrate (Part 892843) - 150 μL of a 120X concentrated solution of biotinylated polyclonal antibody specific for IL-2 with preservatives.

Streptavidin-AP Concentrate A (Part 895358) - 150 μL of a 120X concentrated solution of Streptavidin conjugated to Alkaline Phosphatase with preservatives.

Dilution Buffer 1 (Part 895307) - 12 mL of a buffer for diluting Detection Antibody Concentrate with preservatives.

Dilution Buffer 2 (Part 895354) - 12 mL of a buffer for diluting Streptavidin-AP Concentrate A with preservatives.

Wash Buffer Concentrate (Part 895308) - 50 mL of a 10X concentrated solution of a buffered surfactant with preservative.

BCIP/NBT Chromogen (Part 895867) - 12 mL of a stabilized mixture of 5-Bromo-4-Chloro-3’ Indolylphosphate p-Toluidine Salt (BCIP) and Nitro Blue Tetrazolium Chloride (NBT).

Feline IL-2 Positive Control (Part 892844) - 1 vial (3 ng) of recombinant IL-2; lyophilized.

STORAGE

Store the unopened kit at 2 - 8° C. Do not use beyond the kit expiration date. This kit is validated for single use only. Results obtained with opened/reconstituted reagents at a later date may not be reliable.
OTHER SUPPLIES REQUIRED

- Pipettes and pipette tips
- Deionized or distilled water
- Multi-channel pipette, squirt bottle, manifold dispenser, or automated microplate washer
- 500 mL graduated cylinder
- 37 °C CO2 incubator
- Sterile culture media
- Dissection microscope or an automated ELISpot reader

TECHNICAL HINTS

- To minimize edge effect, place the microplate (bottom down) onto a piece of aluminum foil (about 4 x 6 inches). Add cells, cover the microplate with the lid and shape the foil around the edges of the microplate. The foil may be left on the microplate for the rest of the experimental procedure and removed after the BCIP/NBT has been washed off.
- Do not touch PVDF membrane filters with pipette tips when pipetting cells and reagents to avoid damage to the membrane.
- After completion of the experiment, do not dry the microplate at a temperature higher than 37 °C since it may cause cracking of the PVDF membrane filters.
- The 96-well microplate provided in the kit is not sterile. However, due to the short incubation period and the presence of antibiotics in the culture media, microbial contamination has not been a problem during the ELISpot procedure.
- The kit is designed for single use only. The layout of the assay should be carefully planned to maximize the use of the plate and reagents provided.
- The controls listed are recommended for each ELISpot experiment.
  - Positive Control - Use recombinant feline IL-2.
  - Unstimulated/Negative Control - Use the same number of unstimulated cells as stimulated cells.
  - Background Control - Use sterile culture media.
  - Detection Antibody Control - Substitute phosphate buffered saline for Detection Antibody.

REAGENT PREPARATION

Wash Buffer - If crystals have formed in the concentrate, warm to room temperature and mix gently until the crystals have completely dissolved. To prepare Wash Buffer, add 50 mL of Wash Buffer Concentrate to 450 mL of deionized water and mix well.

Feline IL-2 Positive Control - Reconstitute the lyophilized IL-2 with 250 μL of the same culture medium that is used to incubate cells.

Detection Antibody - Tap or vortex the vial to release reagent collected in the cap. Transfer 100 μL of Detection Antibody Concentrate into the vial labeled Dilution Buffer 1 and mix well. For optimal performance, prepare Detection Antibody immediately before use.

Streptavidin-AP - Tap or vortex the vial to release reagent collected in the cap. Transfer 100 μL of Streptavidin-AP Concentrate A into the vial labeled Dilution Buffer 2 and mix well. For optimal performance, prepare Streptavidin-AP immediately before use.
SAMPLE PREPARATION

The types of effector and responder cells used, method of cell separation, mode of stimulation, and length of incubation are to be determined by each investigator.

ASSAY PROCEDURE

Bring all reagents as needed to room temperature, except the Detection Antibody Concentrate and Dilution Buffer 1, which should remain at 2 - 8° C. All samples and controls should be assayed at least in duplicate. An Assay Record Template is provided at the back of this insert to record controls and samples assayed.

1. Fill all wells in the microplate with 200 µL of sterile culture media and incubate for approximately 20 minutes at room temperature.

2. When cells are ready to be plated, aspirate the culture media from the wells. Immediately add 100 µL of the appropriate cells or controls to each well (see Technical Hints for appropriate controls).

3. Incubate cells in a humidified 37° C CO₂ incubator. Optimal incubation time for each stimuli should be determined by the investigator. Do not disturb the cells during the incubation period.

4. Aspirate each well and wash, repeating the process three times for a total of four washes. Wash by filling each well with Wash Buffer (250 - 300 µL) using a squirt bottle, multi-channel pipette, manifold dispenser, or autowasher. Complete removal of liquid at each step is essential to good performance. After the last wash, remove any remaining Wash Buffer by aspirating or decanting. Invert the plate and blot it against clean paper towels. 
   **Note:** Adjust the height of the prongs of the manifold dispenser or autowasher to prevent damage to the membranes.

5. Add 100 µL of diluted Detection Antibody into each well and incubate at 2 - 8° C overnight.


7. Add 100 µL of diluted Streptavidin-AP into each well and incubate for 2 hours at room temperature.

8. Repeat step 4.

9. Add 100 µL of BCIP/NBT Chromogen into each well and incubate for 1 hour at room temperature. Protect from light.

10. Discard the chromogen solution from the microplate and rinse the microplate with deionized water. Invert the microplate and tap to remove excess water. Remove the flexible plastic underdrain from the bottom of the microplate, wipe the bottom of the plate thoroughly with paper towels and dry completely either at room temperature (60 - 90 minutes) or 37° C (15 - 30 minutes).
CALCULATION OF RESULTS

The developed microplate can be analyzed by counting spots either manually using a dissection microscope or by using a specialized automated ELISpot reader. Specific spots are round and have a dark center with slightly fuzzy edges. Quantitation of results can be done, for example, by calculating the number of spot forming cells (SFC) per number of cells added into the well.

REPRODUCIBILITY DATA

Feline peripheral blood mononuclear cells (PBMCs) (5 x 10^5 cells/mL) were stimulated with 50 ng/mL of phorbol 12-myristate-13-acetate and 5 μg/mL calcium ionomycin overnight at 37°C in a 5% CO₂ incubator. The sample was assayed in eight wells (100 μL/well) according to the procedure and analyzed with a dissection microscope.

<table>
<thead>
<tr>
<th>Well</th>
<th>Number of Spots Counted</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61</td>
</tr>
<tr>
<td>2</td>
<td>68</td>
</tr>
<tr>
<td>3</td>
<td>63</td>
</tr>
<tr>
<td>4</td>
<td>60</td>
</tr>
<tr>
<td>5</td>
<td>60</td>
</tr>
<tr>
<td>6</td>
<td>56</td>
</tr>
<tr>
<td>7</td>
<td>59</td>
</tr>
<tr>
<td>8</td>
<td>68</td>
</tr>
<tr>
<td>Observation</td>
<td>Problem</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Following the incubation with BCIP/NBT chromogen and rinsing the microplate with deionized water, the dark-blue background color of filter membrane attenuates visualization and quantitation of spots.</td>
<td>Wet membrane</td>
</tr>
<tr>
<td>The number of spots in the wells that contained the cells is high but their contrast as well as intensity of staining in the Positive Control wells is low.</td>
<td>Underdevelopment may result from using Streptavidin-AP and/or BCIP/NBT solutions that have not been brought to room temperature.</td>
</tr>
<tr>
<td>The number of spots in the wells that contained cells is lower than expected whereas Positive Control wells turned black-blue.</td>
<td>Cell stimulation problem</td>
</tr>
<tr>
<td></td>
<td>Too few cells added to the wells</td>
</tr>
<tr>
<td>Following incubation with BCIP/NBT and drying the microplate, the density of the spots makes it difficult to quantify them.</td>
<td>Too many cells were added to the wells</td>
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REFERENCES

ASSAY RECORD TEMPLATE

This template may be used as a record of samples and controls run in an assay.