ELISpot

Human IL-2

Catalog Number EL202

For the quantitative determination of the frequency of cells releasing human 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

Interleukin 2 (IL-2) is a pleiotropic cytokine produced primarily by antigen- or mitogen-activated T lymphocytes (1-4). Production of IL-2 is induced transiently upon activation of the T cell receptor (TCR) (5-7). IL-2 plays a key role in promoting the clonal expansion of antigen-activated cytolytic $CD8^+$ T cells (CTL). IL-2 stimulates the proliferation of $CD4^+$ T helper cells as well as natural killer (NK) cells. In addition, IL-2 also influences the cytokine production and effector functions of these cells (5-7).

The sequence of human IL-2 cDNA predicts a 153 amino acid (aa) residue precursor glycoprotein containing a 20 aa signal peptide that is cleaved to form the 133 aa mature O-glycosylated protein (8-10). The aa sequence of human IL-2 is highly homologous to non-human primate IL-2 from rhesus macaque (99.4%), pigtailed macaque (98.7%), sooty mangabey (98.7%) and common gibbon (100%) (11, 12). Human IL-2 also shares approximately 65% and 67% aa sequence identity with mouse and rat IL-2, respectively (13-15). Whereas human IL-2 is active on mouse cells, mouse IL-2 is species-specific and has little activity on human cells (13, 16).

Multi-subunit IL-2 receptor complexes containing different combinations of the three IL-2 receptor subunits, IL-2 receptor α, β, and γ_c, have been identified (1, 5, 6, 17). The low-affinity IL-2 receptor containing only the IL-2 receptor α chain does not transduce an IL-2 signal (5, 18, 19). The functional medium-affinity IL-2 receptor complex that transduces IL-2 signals in macrophages and NK cells is made up of the ligand-binding IL-2 receptor β subunit and the non-ligand-binding γ_c subunit (5, 20). The functional high-affinity IL-2 receptor complex that transduces IL-2 signals in activated T lymphocytes is composed of the IL-2 receptor α, β, and γ_c subunits (5).

The Human IL-2 ELISpot assay is designed for the detection of human IL-2 secreting cells at the single cell level, and it can be used to quantitate the frequency of human 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 assays 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 (21, 22). This method has since been adapted for the detection of individual cells secreting specific cytokines or other antigens (23, 24). ELISpot assays employ the quantitative sandwich enzyme-linked immunosorbent assay (ELISA) technique.

A polyclonal antibody specific for human IL-2 has been pre-coated onto a polyvinylidene difluoride (PVDF)-backed microplate. Appropriately stimulated cells are pipetted into the wells and the microplate is placed into a humidified 37 °C CO_2 incubator for a specified period of time. During this incubation period, the immobilized antibody in the immediate vicinity of the secreting cells bind secreted IL-2. After washing away any cells and unbound substances, a biotinylated polyclonal antibody specific for human 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 and appears as spots at the sites of cytokine localization, with each individual spot representing an individual IL-2 secreting cell. The spots can be counted with an ELISpot reader system or using a stereomicroscope.

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.
- Do not mix or substitute reagents with those from other lots or sources.
- Any variation in pipetting and washing techniques, incubation time or temperature, or kit age can cause variation in the density of spots, intensity of specific staining, and background levels.

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 remove the flexible plastic underdrain on the bottom of the microplate before or during incubation and development. It may damage the PVDF membrane filter. The underdrain cover may be removed only after completing the incubation with BCIP/NBT Substrate.
- Do not touch PVDF membrane filters with pipette tips when pipetting cells and reagents to avoid damage to the membrane.
- Upon completing the experiment, do not dry the microplate at a temperature above 37 °C. It may cause the PVDF membrane filters to crack.
- The 96-well microplate provided in this kit is not sterile. Due to the short incubation period and the presence of antibiotics in the culture media, microbial contamination has not been shown to be an issue with this ELISpot procedure.
- This kit is designed for single use only. The layout of the assay should be carefully planned to maximize the use of the provided microplate and reagents.
- The controls listed are recommended for each ELISpot experiment:

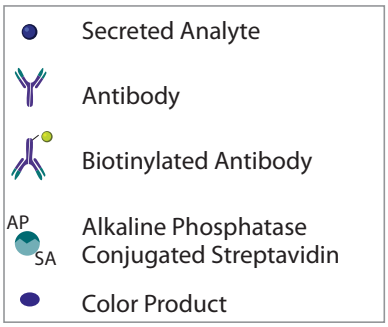
  Positive Control - Use recombinant human IL-2.

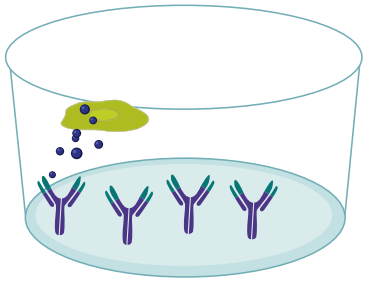
  Unstimulated/Negative Control - Use the same number of unstimulated cells as stimulated cells.

  Background Control - Use sterile culture media.

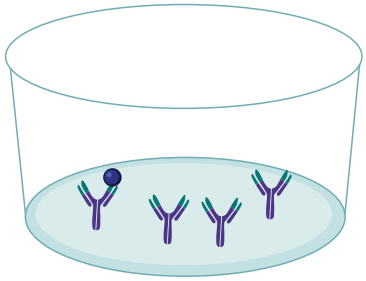
  Detection Antibody Control - Substitute phosphate buffered saline for detection antibody.

ELISpot SCHEMATIC

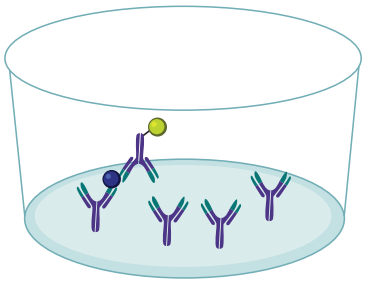




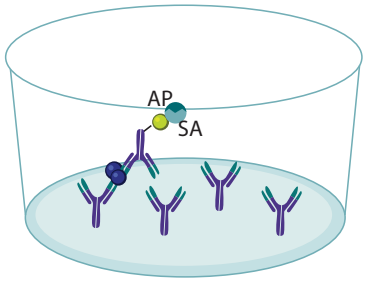
Incubate IL-2-secreting cells in an antibody-coated well.



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

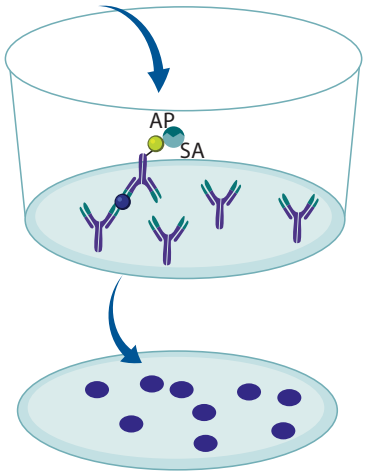


Incubate with biotinylated anti-IL-2 antibody.



Incubate with alkaline phosphatase conjugated streptavidin.

Add BCIP/NBT Substrate



Add substrate and monitor the formation of colored spots.

MATERIALS PROVIDED & STORAGE CONDITIONS

Store the unopened kit at 2-8 °C. Do not use past kit expiration date.
Note: *Results obtained using previously opened or reconstituted reagents may not be reliable. This kit is validated for single use only.*

PART	PART #	DESCRIPTION
Human IL-2 Microplate	890997	96-well PVDF-backed microplate coated with a polyclonal antibody specific for human IL-2.
Detection Antibody Concentrate Human IL-2	890998	150 µL of a 120X concentrated solution of biotinylated polyclonal antibody specific for human IL-2 with preservatives.
Streptavidin-AP Concentrate A	895358	150 µL of a 120X concentrated solution of Streptavidin conjugated to Alkaline Phosphatase with preservatives.
Dilution Buffer 1	895307	12 mL of a buffer for diluting Detection Antibody Concentrate with preservatives.
Dilution Buffer 2	895354	12 mL of a buffer for diluting Streptavidin-AP Concentrate A with preservatives.
Wash Buffer Concentrate	895308	50 mL of a 10X concentrated solution of a buffered surfactant with preservative.
BCIP/NBT Substrate	895867	12 mL of a stabilized mixture of 5-Bromo-4-Chloro-3' Indolylphosphate p-Toluidine Salt (BCIP) and Nitro Blue Tetrazolium Chloride (NBT).
Human IL-2 Positive Control	890999	2 ng of recombinant human IL-2 with preservatives; lyophilized.

OTHER SUPPLIES REQUIRED

- Dissection microscope or an ELISpot reader.
- Pipettes and pipette tips.
- Deionized water.
- Squirt bottle, manifold dispenser, or automated microplate washer.
- 500 mL graduated cylinder.
- 37 °C CO_2 incubator.
- Sterile culture media.

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.

BCIP/NBT is toxic if swallowed, in contact with skin, or if inhaled. It is a highly flammable liquid and vapor may cause serious irritation and damage to organs. Do not eat, drink, or smoke when using this product. Do not breathe fumes. Use only in a well-ventilated area. Keep away from heat, sparks, open flames, and hot surfaces. Keep the container tightly closed.

Some components in this kit contain a preservative which may cause an allergic skin reaction. Avoid breathing mist.

Wear protective gloves, clothing, eye, and face protection. Wash hands thoroughly after handling. Refer to the MSDS on our website prior to use.

REAGENT PREPARATION

Bring all reagents to room temperature, except the Detection Antibody Concentrate and Dilution Buffer 1, which should remain at 2-8 °C.

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.

Human IL-2 Positive Control - Reconstitute the lyophilized Human IL-2 Positive Control with 250 µL of 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 the detection antibody mixture immediately before use.**

Streptavidin-AP Concentrate A - **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 the 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 to room temperature, except the diluted Detection Antibody mixture which should remain at 2-8 °C. All samples and controls should be assayed at least in duplicate.

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 CO_2 incubator. Optimal incubation time for each stimulus 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, 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 the Detection Antibody mixture into each well, and incubate overnight at 2-8 °C. Alternatively, incubation with detection antibodies can be done for 2 hours at room temperature on a rocking platform.
6. Repeat the wash procedure described in step 4.
7. Add 100 µL of diluted Streptavidin-AP into each well, and incubate for 2 hours at room temperature.
8. Repeat the wash procedure described in step 4.
9. Add 100 µL of BCIP/NBT Substrate into each well, and incubate for 1 hour at room temperature. **Protect from light.**
10. Decant the BCIP/NBT Substrate 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 using either a dissection microscope or an 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 to the well.

REPRODUCIBILITY DATA

Peripheral blood mononuclear cells (5 x 10^5/mL) were stimulated with 50 ng/mL of phorbol 12-myristate-13-acetate and 0.5 µg/mL of calcium ionomycin overnight at 37 °C in 5% CO_2 incubator. The sample was assayed in seven wells according to the procedure and analyzed with a dissection microscope.

Well	Number of Spots Counted
1	284
2	288
3	316
4	352
5	240
6	308
7	320

TROUBLESHOOTING GUIDE

OBSERVATION	PROBLEM	CORRECTIVE ACTION
Following the incubation with BCIP/NBT Substrate and rinsing the microplate with deionized water, the dark blue background color of the filter membrane attenuates visualization and quantitation of spots.	The membrane is wet.	Microplates cannot be analyzed accurately until the PVDF filter membranes are completely dry. Wait until the membrane becomes dry (typically 15-30 minutes at 37 °C or 60-90 minutes at room temperature).
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.	Underdevelopment; perhaps the result of using Streptavidin-AP and/or BCIP/NBT solutions that have not been brought to room temperature.	Warm the appropriate reagents to room temperature before adding them to the wells.
The number of spots in the wells that contained cells is lower than expected whereas Positive Control wells turned blue-black.	Cell stimulation problem.	Ensure that reagents used to stimulate the cytokine release from the cells retained their biological activity. One way to check is to perform immunocytochemistry on fixed cells after stimulation.
	Too few cells were added to the wells.	Increase the number of cells added per well.
Following incubation with BCIP/NBT and drying the microplate, the density of the spots makes them difficult to quantify.	Too many cells were added to the wells.	Make dilutions of cells (*i.e.*, 1 x 10^6, 5 x 10^5, 1 x 10^5, 5 x 10^4, 1 x 10^4 cells per well) to determine the optimal number of cells that will result in formation of distinct spots.

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