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1. Description

| | |
|-----------------------|---|
| Components | 1 mL Anti-IL-2 antibodies, mouse conjugated to various dyes. PE 130-092-302 APC 130-092-303 or 0.5 mL Anti-IL-2 antibodies, mouse pure - functional grade 130-095-736 |
| Clone | JES6-5H4 (isotype: rat IgG2b). |
| Capacity | 100 tests or up to 10 ⁹ total cells. The functional grade antibody is supplied at a concentration of 1 mg/mL. |
| Product format | Antibodies are supplied in buffer containing stabilizer and 0.05% sodium azide. Functional grade antibodies are supplied in phosphate-buffered saline (PBS), pH 7.2. Endotoxin levels have been tested and do not exceed 0.01 ng/μg of protein. <i>The functional grade product contains no preservative and is sterile filtered; always handle under aseptic conditions.</i> |
| Storage | Store protected from light at 2–8 °C. Do not freeze. The expiration date is indicated on the vial label. |

1.1 Background information

IL-2 is rapidly secreted by naive T helper cells and by certain subsets of memory T cells upon activation. It promotes growth and differentiation of T cells and has pleiotropic effects on many other leukocytes. Quantitative analysis of IL-2-producing cells can provide important information on the course of immune responses.

Anti-IL-2 antibodies are designed for intracellular staining of IL-2-producing cells. Cells can be stimulated for IL-2-production, e.g. by polyclonal stimulation with mitogens. For induction of IL-2-production by antigen-specific T cells, cells are restimulated with respective antigen. IL-2 can be accumulated in the cells by addition of secretion inhibitors like Brefeldin A. After fixation and permeabilization of the cell sample, IL-2-producing cells can be stained intracellularly with Anti-IL-2 antibodies. Staining of surface and activation markers allows simultaneous flow cytometric analysis of subsets and activation status of the IL-2-producing cells.

Magnetically enriched cells can be stained intracellularly for IL-2 production directly on the MACS® Column. This procedure ensures higher sensitivity of detection and minimizes loss of cells during washing procedures. The protocol is very useful for cytokine analysis of rare cells (see protocol 2.3.2).

1.2 Applications

- Identification and enumeration of IL-2-producing cells by flow cytometry or fluorescence microscopy.
- Identification and enumeration of IL-2-producing antigen-specific T cells upon restimulation with the respective antigen or detection of IL-2-producing T cells upon polyclonal restimulation.
- Monitoring of specificity of antigen-specific T cell lines.
- Analysis of cytokine production of rare cells by solid-phase staining technology, in combination with magnetic enrichment of cells (see protocol 2.3.2).
- The Anti-IL-2 antibody pure - functional grade is suited for functional assays, e.g. neutralization of IL-2 activity.

1.3 Recommended antibody dilution

- Anti-IL-2 antibodies conjugated to PE or APC should be used at a dilution of 1:10.

1.4 Reagent requirements

- Buffer: Prepare a solution containing phosphate-buffered saline (PBS), pH 7.2, 0.5% bovine serum albumin (BSA), and 2 mM EDTA by diluting MACS BSA Stock Solution (# 130-091-376) 1:20 with autoMACS® Rinsing Solution (# 130-091-222). Keep buffer cold (2–8 °C).

▲ **Note:** EDTA can be replaced by other supplements such as anticoagulant citrate dextrose formula-A (ACD-A) or citrate phosphate dextrose (CPD). BSA can be replaced by other proteins such as mouse serum albumin, mouse serum, or fetal bovine serum (FBS). Buffers or media containing Ca²⁺ or Mg²⁺ are not recommended for use.

- Culture medium, e.g., RPMI 1640 (# 130-091-440) containing 5% mouse serum (do not use BSA or FBS because of non-specific stimulation!).
- Reagents for T cell stimulation, e.g., staphylococcal enterotoxin B (SEB), phorbol myristate acetate (PMA)/ionomycin, antigenic peptide or protein. For details refer to the respective data sheet. For more information about antigens refer to www.miltenyibiotec.com.
- Secretion inhibitor, e.g., brefeldin A.
- Inside Stain Kit (# 130-090-477) for the fixation and permeabilization of cells.
- (Optional) Fluorochrome-conjugated antibodies for cell surface staining, e.g., CD4-FITC (# 130-091-608), CD4-PE (# 130-091-607), CD4-APC (# 130-091-611), CD8a-FITC (# 130-091-605), CD8a-PE (# 130-091-603), or CD8a-APC (# 130-091-606). For more information about antibodies refer to www.miltenyibiotec.com/antibodies.
- (Optional) Fluorochrome-conjugated antibodies for intracellular staining of activation markers, e.g., CD154-PE (# 130-092-106), CD154-APC (# 130-092-105). For more information about antibodies refer to www.miltenyibiotec.com/antibodies.

Additional requirements for intracellular cytokine staining in combination with magnetic cell separation (refer to protocol 2.3.2)

- MACS MicroBeads of choice, e.g., CD4 (L3T4) MicroBeads (# 130-049-201).
- MS Columns and suitable MACS Separator (MiniMACS™, OctoMACS™, VarioMACS™, or SuperMACS™ II Separator).
▲ **Note:** Column adapters are required to insert certain columns into the VarioMACS or SuperMACS II Separators. For details refer to the respective MACS Separator data sheet.
- (Optional) Pre-Separation Filters, 30 µm (# 130-041-407) to remove cell clumps.

2. Protocols

2.1 Sample preparation

When working with lymphoid organs, non-lymphoid tissues, or peripheral blood, prepare a single-cell suspension using manual methods or the gentleMACS™ Dissociator.

For details see the protocols section at www.miltenyibiotec.com/protocols.

2.2 *In vitro* stimulation of T cells

▲ Always include a negative control in the experiment. The sample should be treated in exactly the same manner as the stimulated sample, except for the addition of the stimulus.

▲ A positive control should also be included in the experiment.

▲ Do not use media containing any non-mouse proteins, such as BSA or FBS, because of non-specific stimulation.

1. Wash cells by adding medium and centrifuge at 300×g for 10 minutes. Aspirate supernatant.
2. Resuspend cells at a density of 10⁷ per mL in culture medium containing 5% mouse serum. Plate cells in dishes at a density of

5×10⁶ cells/cm². For details refer to section 4. Appendix: Flask and dish sizes for *in vitro* stimulation of T cells.

3. Add an antigen, a control reagent, or a polyclonal stimulus in the appropriate concentration, for example:
 - 1–10 µg/mL peptide
 - 10–100 µg/mL protein
 - 10 µg/mL SEB
 - 20 ng/mL PMA and 1 µg/mL ionomycin
4. Incubate cells for 2 hours at 37 °C and 5% CO₂.
5. Add 1 µg/mL brefeldin A and incubate for an additional 4 hours at 37 °C and 5% CO₂.
6. Collect cells carefully by pipetting up and down when working with smaller volumes or by using a cell scraper. Rinse the dish with cold buffer. Check microscopically for any remaining cells, if necessary, rinse the dish again.

2.3 Intracellular immunofluorescent cytokine staining protocols

2.3.1 Intracellular staining of cells in suspension

▲ It is recommended to stain 10⁶ cells per sample. When working with up to 10⁷ cells, use the same volumes as indicated. When working with higher cell numbers, scale up all reagent volumes and total volumes accordingly (e.g. for 2×10⁷ nucleated cells, use twice the volume of all indicated reagent volumes and total volumes).

1. Wash up to 10⁷ cells by adding 1–2 mL of buffer and centrifuge at 300×g for 10 minutes. Aspirate supernatant completely.
2. (Optional) Stain cell surface antigens that are sensitive to fixation according to the manufacturer's recommendations. Then wash cells by adding 1–2 mL of buffer and centrifuge at 300×g for 10 minutes. Aspirate supernatant completely.
3. Resuspend up to 10⁷ cells in 500 µL of buffer.
4. Add 500 µL of Inside Fix (Inside Stain Kit). Mix well and incubate for 20 minutes in the dark at room temperature.
5. Centrifuge at 300×g for 5 minutes. Aspirate supernatant carefully.
6. Wash cells by adding 1 mL of buffer and centrifuge at 300×g for 5 minutes. Aspirate supernatant carefully.
▲ **Note:** Fixed cells may be stored in azide-containing buffer at 2–8 °C for up to 1 week.
7. (Optional) Stain cell surface antigens that are sensitive to permeabilization with appropriate antibodies according to the manufacturer's recommendations. Then wash cells by adding 1–2 mL of buffer and centrifuge at 300×g for 10 minutes. Aspirate supernatant completely.
8. Wash cells by adding 1 mL of Inside Perm (Inside Stain Kit) and centrifuge at 300×g for 5 minutes. Aspirate supernatant carefully.
9. Resuspend cells in 90 µL of Inside Perm. Add 10 µL of the Anti-IL-2 antibody.
10. (Optional) Add additional staining antibodies to the solution, for example, 10 µL of CD4-FITC (# 130-091-608) and 10 µL of CD154-APC (# 130-092-105).

▲ **Note:** For efficient permeabilization upon intracellular staining the volume of Inside Perm should be at least 5× the volume of staining antibodies.

11. Mix well and incubate for 10 minutes in the dark at room temperature.
12. Wash cells by adding 1 mL of Inside Perm and centrifuge at 300×g for 5 minutes. Aspirate supernatant carefully.
13. Resuspend cell pellet in a suitable amount of buffer for analysis by flow cytometry or fluorescence microscopy. Store cells at 2–8 °C in the dark until analysis. Mix well before flow cytometric acquisition.
 - ▲ **Note:** Samples may be stored at 2–8 °C in the dark for up to 24 hours.
 - ▲ **Note:** Do not use propidium iodide (PI) or 7-AAD staining.
8. Place MS Column in the magnetic field of a suitable MACS Separator.
9. Prepare column by rinsing with 500 µL of buffer.
10. Apply cell suspension onto the column. Collect flow-through containing unlabeled cells.
11. Wash column with 3×500 µL of buffer. Collect unlabeled cells that pass through and combine with effluent from step 10.
12. Remove column from the separator and place it on a suitable collection tube.

2.3.2 Intracellular staining in combination with magnetic cell separation (solid phase intracellular staining)

▲ Work fast, keep cells cold, and use pre-cooled solutions. This will prevent capping of antibodies on the cell surface and non-specific cell labeling.

▲ Volumes for magnetic labeling given below are for up to 10⁷ total cells. When working with fewer than 10⁷ cells, use the same volumes as indicated. When working with higher cell numbers, scale up all reagent volumes and total volumes accordingly (e.g. for 2×10⁷ total cells, use twice the volume of all indicated reagent volumes and total volumes).

▲ For optimal performance it is important to obtain a single-cell suspension before magnetic labeling. Pass cells through 30 µm nylon mesh (Pre-Separation Filters, 30 µm # 130-041-407) to remove cell clumps which may clog the column. Moisten filter with buffer before use.

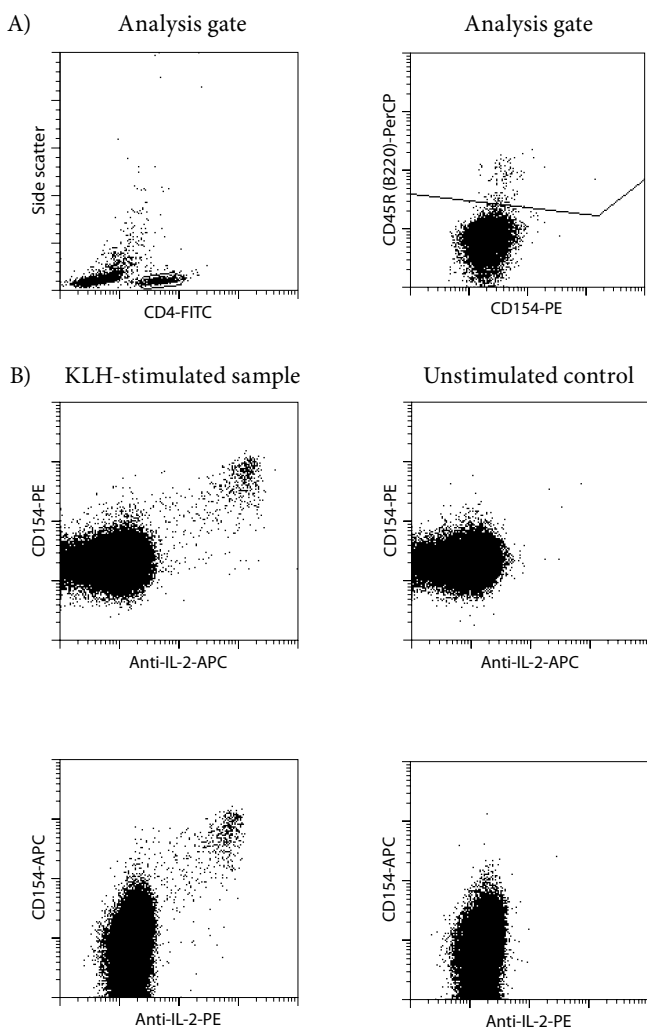
▲ The recommended incubation temperature is 2–8 °C. Higher temperatures and/or longer incubation times may lead to non-specific cell labeling. Working on ice may require increased incubation times.

▲ Always wait until the column reservoir is empty before proceeding to the next step.

1. Wash up to 10⁷ cells by adding 1–2 mL of buffer per 10⁷ cells and centrifuge cell suspension at 300×g for 10 minutes. Aspirate supernatant completely.
2. Resuspend cell pellet in 90 µL of buffer per 10⁷ total cells.
3. Add 10 µL of MACS MicroBeads, e.g., CD4 MicroBeads (# 130-049-201), per 10⁷ total cells.
 - ▲ **Note:** For details on the procedure refer to the respective MACS MicroBeads data sheet.
4. Mix well and incubate for 15 minutes in the refrigerator (2–8 °C).
5. (Optional) Add surface staining antibodies, which are sensitive to fixation, according to the manufacturer's recommendations, and incubate for an additional 5 minutes in the refrigerator (2–8 °C).
6. Wash cells by adding 1–2 mL of buffer per 10⁷ cells and centrifuge at 300×g for 10 minutes. Aspirate supernatant completely.
7. Resuspend cells in 500 µL of buffer.
13. Pipette 500 µL of buffer onto the column. Immediately flush out the magnetically labeled cells by firmly pushing the plunger into the column.
14. Add 500 µL of Inside Fix to the eluted cell fraction and incubate for 20 minutes at room temperature.
15. Place a second MS Column in the magnetic field of a suitable MACS Separator and prepare column by rinsing with 500 µL of buffer.
16. Apply the fixed cell suspension onto the column.
17. Wash cells by rinsing the column with 1×500 µL of buffer, followed by 2×500 µL of Inside Perm.
18. Prepare a solution of 10 µL of Anti-IL-2 antibodies and 90 µL of Inside Perm.
19. (Optional) Add additional staining antibodies to the solution, e.g., 10 µL of CD4 and 10 µL of CD154 antibodies.
 - ▲ **Note:** Do not exceed the total solution volume of 150 µL.
20. Apply the solution onto the column and incubate for 10 minutes at room temperature.
 - ▲ **Note:** The MACS Column has a flow-stop mechanism that will retain the solution in the column.
21. Wash cells by rinsing the column with 2×500 µL of Inside Perm followed by 1×500 µL of buffer.
22. Remove column from the separator and place it on a suitable collection tube.
23. Pipette 500 µL of buffer onto the column. Immediately flush out the magnetically labeled cells by firmly pushing the plunger into the column.
24. Cells are now ready for analysis. Store cells at 2–8 °C in the dark until analysis. Mix well before flow cytometric acquisition.
 - ▲ **Note:** Samples may be stored at 2–8 °C in the dark for up to 24 hours.
 - ▲ **Note:** Do not use propidium iodide (PI) or 7-AAD staining.

3. Examples of immunofluorescent staining with Anti-IL-2 antibodies

Spleen cells from a KLH-immunized mouse were restimulated with or without SEB for 6 hours. After 2 hours Brefeldin A was added. The cells were harvested, fixed, permeabilized, and intracellularly stained with Anti-IL-2-APC, Anti-IL-2-PE, and CD154-APC (# 130-092-105) or CD154-PE (# 130-092-106). Cell surface staining was performed with CD4-FITC (# 130-091-608). Cells were analyzed by flow cytometry. Gating was performed according to the CD4-expression and side scatter properties of the cells. B cells, cell debris and dead cells were excluded from the analysis in a fluorescence 2 versus fluorescence 3 dot plot.



4. Appendix: Flask and dish sizes for *in vitro* stimulation of T cells

For *in vitro* stimulation of T cells (see 2.2) the cells should be resuspended in culture medium, containing 5% of mouse serum, at a dilution of 10^7 cells/mL. The cells should be plated at a density of 5×10^6 cells/cm². Both the dilution and the cell density are important to assure optimum stimulation.

The following table lists culture plate, dish and flask sizes suitable for different cell numbers. It also indicates the appropriate amount of medium to add.

| Total cell number | Medium volume to add | Culture plate | Well diameter |
|--------------------|----------------------|---------------|---------------------|
| 0.15×10^7 | 0.15 mL | 96 well | 0.64 cm |
| 0.50×10^7 | 0.50 mL | 48 well | 1.13 cm |
| 1.00×10^7 | 1.00 mL | 24 well | 1.60 cm |
| 2.00×10^7 | 2.00 mL | 12 well | 2.26 cm |
| 5.00×10^7 | 5.00 mL | 6 well | 3.50 cm |
| Total cell number | Medium volume to add | Culture dish | Dish diameter |
| 4.5×10^7 | 4.5 mL | small | 3.5 cm |
| 10.0×10^7 | 10.0 mL | medium | 6 cm |
| 25.0×10^7 | 25.0 mL | large | 10 cm |
| 50.0×10^7 | 50.0 mL | extra large | 15 cm |
| Total cell number | Medium volume to add | Culture flask | Growth area |
| 12×10^7 | 12 mL | 50 mL | 25 cm ² |
| 40×10^7 | 40 mL | 250 mL | 75 cm ² |
| 80×10^7 | 80 mL | 720 mL | 162 cm ² |
| 120×10^7 | 120 mL | 900 mL | 225 cm ² |

All protocols and data sheets are available at www.miltenyibiotec.com.

Warnings

Reagents contain sodium azide. Under acidic conditions sodium azide yields hydrazoic acid, which is extremely toxic. Azide compounds should be diluted with running water before discarding. These precautions are recommended to avoid deposits in plumbing where explosive conditions may develop.

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