Determination of neutralizing antibodies against IL-23 inhibitors using *iLite*® IL-23 Assay Ready Cells

For research and professional use only. Not for use in diagnostic procedures.

This application note contains a suggested protocol and performance data.
Each individual laboratory must set up their own method and perform relevant validations.

Background

Interleukin 23 (IL-23) is a heterodimeric pro-inflammatory cytokine that shares characteristics with IL-12. Both cytokines contain the p40 subunit which binds to the IL-12Rβ1 receptor chain. However, the two cytokines exert distinct non-redundant biological functions (1). IL-23 has been implicated as an inflammation mediator in several autoimmune diseases and has also been found to promote tumor growth (Ref?). Therapeutic agents targeting both IL-12 and IL-23 cytokines are currently used to treat psoriasis and psoriatic arthritis, and related agents are in clinical testing for a variety of inflammatory disorders (2). Prolonged therapies with IL-23 inhibitors can lead to development of neutralizing antibodies (NAbs), which might counteract the IL-23 antagonist activity of the inhibitors. The *iLite*® IL-23 Assay Ready Cells can be used for measurements of IL-23 inhibitor activity and presence of neutralizing antibodies towards IL-23 inhibitors.

Principle of the assay

The *iLite*® IL-23 Assay Ready Cells are engineered cells optimized to express Firefly luciferase under the control of an IL-23 responsive promoter. When IL-23 binds to its receptor, consisting of the IL-23R and IL-12Rβ1 subunit, it activates the IL-23 regulated Firefly luciferase reporter gene construct. The Firefly luciferase signal can be measured in a luminometer following addition and incubation of luciferase substrate. The Firefly luciferase signal is proportional to the functional activity of IL-23 in the sample. In the presence of inhibitory activity against IL-23, the amount of free IL-23 is reduced, resulting in a decreased stimulation of Firefly luciferase expression. Hence, the Firefly luciferase signal is inversely proportional to the amount of inhibitory activity in a sample. In the absence of IL-23 inhibitor activity and suspected presence of NAbs in test samples, a known amount of drug is spiked in the sample to quench the Firefly signal, and the presence of NAbs is measured as a restored signal.

The *iLite*® IL-23 Assay Ready Cells can therefore be utilized as a highly sensitive assay for determination of neutralizing antibodies against IL-23 inhibitors in human species including serum.

Material and equipment needed

Material and equipment	Suggested supplier	Reference
iLite® IL-23 Assay Ready Cells	Svar Life Science	BM4023
Diluent (RPMI containing 9% heat inactivated FBS + 1% Penicillin-Streptomycin).	Gibco	61870-044 (RPMI 1640) 26140-079 (FBS) 15140-122 (Penicillin-Streptomycin)
Anti-ustekinumab antibody	Bio-Rad	HCA210
Ustekinumab or analogues	NA	NA
IL-23 or analogues	R&D Systems	1290-IL-010
Firefly/Renilla luciferase substrate	Promega	E2920, Dual-Glo Luciferase Assay System
Plate; White walled micro well plate suitable for luminescence	PerkinElmer	6005680

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Microplate Luminometer with appropriate reading software – no filter on luminometer	Contact Svar Life Science for list of recommended suppliers	NA
Incubator, 37 °C with 5% CO_2	NA	NA
Water bath, 37 °C	NA	NA
Single-channel and multi-channel pipettes with polypropylene disposable tips	NA	NA
Polypropylene tubes or plate for dilution	NA	NA
Single-use polypropylene reservoir	NA	NA
Plate shaker	NA	NA
Timer	NA	NA

Protocol

Preparation of neutralizing antibodies against IL-23 inhibitor

An anti-ustekinumab antibody from Bio-Rad has successfully been used to neutralize ustekinumab (IL-23 inhibitor) and restore the IL-23 regulated Firefly luciferase expression in *iLite*® IL-23 Assay Ready Cells (refer to the table and graph below).

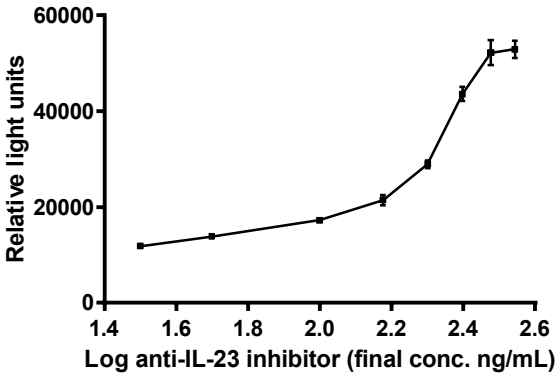

Figure 1. Example of anti-IL-23 inhibitory curve

Final 2.5 ng/mL IL-23 and 2500 ng/mL Ustekinumab	Anti-ustekinumab Suggested solution concentrations, ng/mL
A	2 800
B	2 400
C	2 000
D	1 600
E	1 200
F	800
G	400
H	0

Table 1. Suggested calibrator **solution concentrations** for anti-ustekinumab

Assay preparation and incubation

1. Design a plate layout. It is recommended to perform the test at least in duplicate.
2. Perform a serial dilution of the reference anti-ustekinumab antibody. Ensure matrix consistency between reference antibody, control, and sample solutions.
3. Add 20 µL of the reference anti-ustekinumab antibody dilutions, controls and samples to assigned wells (final concentration will be one-eighth of solution concentration).
4. Add 20 µL of 20 µg/mL ustekinumab to all wells (final concentration will be 2500 ng/mL ustekinumab).
5. Place the lid on the plate, mix and incubate the plate for 30 minutes at 37 °C with 5% CO_2.
6. Add 40 µL of 10 ng/mL IL-23 to all wells (final concentration will be 2.5 ng/mL IL-23).
7. Place the lid on the plate, mix and incubate the plate for 30 minutes at 37 °C with 5% CO_2.
8. Transfer references, controls and samples to new wells, adding 40 µL per well.
9. Thaw a vial of *iLite*® IL-23 Assay Ready Cells in a 37°C water bath with gentle agitation. The cell suspension is mixed very carefully ten times with a pipette to ensure a homogeneous distribution of cells.
10. Dilute 250 µL cells with 5.75 mL Diluent.

11. Add 40 µL diluted cells to each well.
12. Place the lid on the plate, mix and incubate for 5 hours at 37 °C with 5% CO_2.

Adding substrate solutions

13. Equilibrate the plate and the substrate solutions to room temperature.
14. Prepare the **Firefly luciferase** substrate according to the supplier's instructions and add 80 µL per well. Mix and protect the plate from light. After 10 minutes incubation at room temperature read in a luminometer.
15. If appropriate, prepare the **Renilla luciferase** substrate according to the supplier's instructions and add 80 µL per well. Mix and protect the plate from light. After 10 minutes incubation at room temperature read in a luminometer.

Precautions

- This application note is intended for professional laboratory research use only. The data and results originating from following the Application Note should not be used either in diagnostic procedures or in human therapeutic applications.
- Use and handle the material and instruments referenced according to the suppliers'/manufacturers' instructions or product specifications accompanying the individual material and instruments.
- Dispose of all sample specimens, infected or potentially infected material in accordance with good microbiological practice. All such materials should be handled and disposed as though potentially infectious.
- Residues of chemicals and preparations are generally considered as biohazardous waste and should be inactivated prior to disposal by autoclaving or using bleach. All such materials should be disposed of in accordance with established safety procedures.

Proprietary Information

In accepting delivery of *iLite*® Assay Ready Cells the recipient agrees not to sub-culture these cells, attempt to sub-culture them or to give them to a third-party recipient, and only to use them directly in assays. *iLite*® cell-based products are covered by patents which are the property of Svar Life Science AB and any attempt to reproduce the delivered *iLite*® Assay Ready Cells is an infringement of these patents

QUICK GUIDE

Determination of neutralizing antibodies against IL-23 inhibitors using *iLite*® IL-23 Assay Ready Cells

1 Plate 1

- Equilibrate reagents and samples to room temperature – **do not thaw cells and substrate reagents at this stage**
- Serial dilute reference anti-ustekinumab antibody
- Add 20 µL of ref. anti-ustekinumab antibody solutions, controls and samples to pre-assigned wells
- Add 20 µL of ustekinumab to each well

2 Incubation 1 30 min

- Incubate at 37°C with 5% CO_2 for 30 minutes

3 Incubation 2 30 min

- Add 40 µl of IL-23 to all wells
- Incubate at 37°C with 5% CO_2 for 30 minutes

4 Plate 2 Add cells

- Transfer references, controls and samples to new wells
- Thaw the vial of cells in a 37°C water bath. Mix cell suspension with a pipette in order to ensure a uniform solution. Dilute the cells
- Add 40 µL diluted cells to each well

5 Incubation 3 5 hours

- Incubate at 37°C with 5% CO_2 for 5 hours

6 Read plate

- Equilibrate the plate to room temperature
- Prepare the **Firefly luciferase** substrate according to the supplier's instructions and add 80 µL per well. Mix. Protect the plate from light. After 10 min incubation read in a luminometer
- If appropriate, prepare the **Renilla luciferase** substrate according to the supplier's instructions and add 80 µL per well. Mix. Protect the plate from light. After 10 min incubation read in a luminometer

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Troubleshooting and FAQ

Please consult the Svar Life Science website www.svarlifescience.com

References

1. **Oppmann B, Lesley R, Blom B, et al.** *Novel p19 protein engages IL-12p40 to form a cytokine, IL-23, with biological activities similar as well as distinct from IL-12*. Immunity 13: 715–25 (2001).
2. **Teng MW, Bowman EP, McElwee JJ, Smyth MJ, Casanova JL, Cooper AM, Cua DJ.** *IL-23 and IL-23 cytokines: from discovery to targeted therapies for immune-mediated inflammatory diseases.* Nature Medicine 21: 719–729 (2015).