

HEK-Dual™ hTLR4 Cells

Human TLR4-expressing NF-κB & IRF reporter HEK293 cells

Catalog code: hkd-htlr4

<https://www.invivogen.com/hek-dual-htlr4>

For research use only

Version 24C19-AK

PRODUCT INFORMATION

Content

• 3-7 x 10⁶ of HEK-Dual™ hTLR4 cells in a cryovial or shipping flask. **IMPORTANT:** If cells provided in a cryovial are not frozen upon arrival, contact InvivoGen immediately.

- 1 ml of Blasticidin (10 mg/ml). Store at 4°C or at -20°C.*
- 1 ml of Hygromycin B Gold (100 mg/ml). Store at 4°C or at -20°C.*
- 1 ml of Puromycin (10 mg/ml). Store at 4°C or at -20°C.*
- 1 ml of Zeocin® (100 mg/ml). Store at 4°C or at -20°C.*
- 1 ml of Normocin™ (50 mg/ml), a formulation of 3 antibiotics active against mycoplasmas, bacteria and fungi. Store at -20°C.*

*The expiry date is specified on the product label.

• 1 tube of QUANTI-Luc™ 4 Reagent, a luciferase detection reagent (sufficient to prepare 25 ml). Store at -20°C. Avoid repeated freeze-thaw cycles. *Note: This product is photosensitive and should be protected from light.*

• 1 ml of QB reagent and 1 ml of QB buffer (sufficient to prepare 100 ml of QUANTI-Blue™ Solution, a SEAP detection reagent). Store QB reagent and QB buffer at -20°C. QUANTI-Blue™ Solution is stable for 2 weeks at 4°C and for 2 months at -20°C.

Note: Data sheets for all components are available on our website.

Handling Frozen Cells Upon Arrival

Cells must be thawed immediately upon receipt and grown according to handling procedures (as described on the next page) to ensure the best cell viability and proper assay performance.

Note: Avoid freezing cells upon receipt as it may result in irreversible damage to the cell line.

Disclaimer: We cannot guarantee cell viability if the cells are not thawed immediately upon receipt and grown according to handling procedures.

IMPORTANT: For cells that arrive in a shipping flask please refer to the enclosed 'cell recovery procedure'.

Cell Line Stability

Genetic instability is a biological phenomenon that occurs in all stably transfected cells. Cells will undergo genotypic changes resulting in reduced responsiveness over time in normal cell culture conditions. Therefore, it is critical to prepare an adequate number of frozen stocks at early passages. To ensure maximum efficiency, do not passage HEK-Dual™ hTLR4 cells more than 20 times.

Quality Control

- The expression of human TLR4, MD-2, and CD14 has been verified by RT-qPCR and functional assays.
- The stability for 20 passages, following thawing, has been verified.
- These cells are guaranteed mycoplasma-free.

USE RESTRICTIONS

These cells are distributed for research purposes only.

This product is covered by a Limited Use License. By use of this product, the buyer agrees to the terms and conditions of all applicable Limited Use Label Licenses. For non-research use, such as screening, quality control or clinical development, contact info@invivogen.com.

TECHNICAL SUPPORT

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PRODUCT DESCRIPTION

HEK-Dual™ hTLR4 cells are designed to monitor the human Toll-like receptor 4 (hTLR4)-dependent NF-κB and IRF responses in HEK293 cells.

These cells were generated from the HEK-Dual™ cell line through the stable expression of hTLR4, myeloid differentiation factor 2 (MD-2), and cluster of differentiation 14 (CD14). They feature two reporter genes allowing the simultaneous study of the IRF pathway, by monitoring the activity of an inducible secreted Lucia luciferase and the NF-κB pathway by monitoring the activity of an inducible SEAP (secreted embryonic alkaline phosphatase). Lucia luciferase and SEAP activities are readily assessable in the supernatant using QUANTI-Luc™ and QUANTI-Blue™, respectively.

HEK-Dual™ hTLR4 cells are highly responsive to TLR4 agonists, such as lipopolysaccharide (LPS). They show potent NF-κB and IRF responses upon incubation with smooth LPS-EB Ultrapure (UP) and rough LPS-EK UP, when compared to their parental cell line HEK-Dual™.

HEK-Dual™ hTLR4 cells are selectable with Blasticidin, Hygromycin, Puromycin, and Zeocin®.

BACKGROUND

Toll-like receptor 4 (TLR4) is an important pattern recognition receptor in innate immunity and inflammation¹. It is primarily activated by lipopolysaccharide (LPS) and its toxic moiety Lipid A, a core component of Gram-negative bacteria². TLR4 does not directly interact with LPS and requires essential co-receptors, namely lipid-binding protein (LBP), MD-2, and CD14, to extract and deliver monomeric LPS to TLR4³. There are two distinct signaling cascades triggered by the dimerization of TLR4; the MyD88-dependent NF-κB (at the cell surface) and TRIF-dependent IRF pathways (in endosomes). TLR4 signaling is crucial in both acute and chronic inflammatory disorders and is thus an attractive target for novel treatments for conditions such as sepsis and cancer¹.

1. Ou T. *et al.*, 2018. *Front Immunol* 9:1188.
2. Cochet F. *et al.*, 2017. *Int J Mol Sci.* 18.
3. Kuzmich N.N. *et al.*, 2017. *Vaccines (Basel)* 4.
4. Marongiu L. *et al.*, 2019. *J Leukoc Biol* 106:147-60.

SAFETY CONSIDERATIONS

Biosafety Level 2

HEK-Dual™ hTLR4 cells were derived from HEK293 cells (transformed with adenovirus 5 DNA) and thus may require Biosafety Level 2. The biosafety level varies by country. In the United States, HEK293 cell lines are designated Biosafety Level 2 according to the Center for Disease Control and Prevention (CDC). In Germany, HEK293 cell lines are designated Biosafety Level 1 according to the Central Committee of Biological Safety, Zentrale Kommission für die Biologische Sicherheit (ZKBS). Please check with your country's regulatory authority regarding the use of these cells.



Any questions about our cell lines?
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HANDLING PROCEDURES

Required Cell Culture Medium

- **Growth Medium:** DMEM, 4.5 g/l glucose, 2 mM L-glutamine, 10% (v/v) heat-inactivated fetal bovine serum (FBS; 30 min at 56°C), 100 µg/ml **Normocin™**, Pen-Strep (100 U/ml-100 µg/ml)
- **Freezing Medium:** DMEM, 20% (v/v) FBS, 10% (v/v) DMSO
- **Test Medium:** DMEM 4.5 g/l glucose, 2 mM L-glutamine, 10% (v/v) heat-inactivated FBS, Pen-Strep (100 U/ml-100 µg/ml) **without Blastidicin, Hygromycin B Gold, Puromycin, Zeocin®, and Normocin™.**

Required Selective Antibiotics

Blastidicin, Hygromycin B Gold, Puromycin, and Zeocin®

Initial Culture Procedure

The first propagation of cells should be for generating stocks for future use. This ensures the stability and performance of the cells for subsequent experiments.

1. Thaw the vial by gentle agitation in a 37 °C water bath. To reduce the possibility of contamination, keep the O-ring and cap out of the water. Thawing should be rapid.

2. Remove the vial from the water bath as soon as the contents are thawed, and decontaminate by dipping in or spraying with 70% (v/v) ethanol.

Note: All steps from this point should be carried out under strict aseptic conditions.

3. Transfer cells into a larger vial containing 15 ml of pre-warmed growth medium. **Do not add selective antibiotics until the cells have been passaged twice.**

4. Centrifuge vial at 300 x g (RCF) for 5 minutes.

5. Remove supernatant containing the cryoprotective agent and resuspend cells with 1 ml of growth medium without selective antibiotics.

6. Transfer the vial contents to a 25 cm² tissue culture flask containing 5 ml of growth medium without selective antibiotics.

7. Place the flask containing cells at 37 °C in 5% CO₂.

Frozen Stock Preparation

1. Resuspend cells at a density of 3-5 x 10⁶ cells/ml in freshly prepared freezing medium with cold DMEM.

Note: A T-75 culture flask typically yields enough cells for preparing 3-4 frozen vials.

2. Aliquot 1 ml cells into cryogenic vials.

3. Place vials in a freezing container and store at -80°C overnight.

4. Transfer vials to liquid nitrogen for long term storage.

Note: If properly stored, cells should remain stable for years.

Cell Maintenance

1. HEK-Dual™ hTLR4 cells grow as adherent cells. Detach the cells using trypsin for 2-3 min at room temperature (RT).

Note: Prolonged action of trypsin or incubation at 37°C may alter the cell surface expression of receptors.

2. After cells have recovered (after at least one passage), subculture the cells in growth medium supplemented with 10 µg/ml of **Blastidicin**, 200 µg/ml of **Hygromycin B Gold**, 1 µg/ml of **Puromycin**, and 100 µg/ml of **Zeocin®**.

3. Renew growth medium twice a week.

4. Cells should be passaged when a 70-80% confluency is reached. Do not let the cells grow to 100% confluency.

REPORTER ASSAY PROTOCOL

Below is a protocol using **HEK-Dual™ hTLR4** cells together with their parental cell line **HEK-Dual™** to monitor the NF-κB and IRF responses. It is recommended to perform the assay with test medium that does **not** contain **Blastidicin, Hygromycin B Gold, Puromycin, Zeocin®, and Normocin™.**

Induction of HEK-Dual™ hTLR4 cells

Day 1

1. Add 20 µl of a TLR4 ligand (e.g. LPS-EB UP at 100 pg/ml final concentration) per well of a flat-bottom 96-well plate.

2. Include a NF-κB positive control (e.g. **recombinant hTNF-α** at 10 ng/ml), an IRF positive control (e.g. recombinant hIFN-β at 10-1000 U/ml), and a negative control (e.g. endotoxin free water).

3. Gently rinse cells with pre-warmed PBS (5-10 ml for a T-75 flask).

4. Add pre-warmed PBS (2-5 ml for a T-75 flask) and place the cells at 37 °C for 1-5 min. Detach the cells by tapping the flask. Dissociate cell clumps by gently pipetting up and down.

Note: We recommend avoiding the use of trypsin to detach cells for the functional assays (see FAQs online).

5. Prepare a cell suspension of HEK-Dual™ hTLR4 cells at ~280,000 cells per ml in freshly prepared, pre-warmed test medium.

6. Add 180 µl of cell suspension (~50,000 cells) per well.

8. Incubate the plate at 37 °C in a CO₂ incubator for 20-24 h.

Day 2

The NF-κB and IRF induction of HEK-Dual™ hTLR4 cells can be detected using the SEAP reporter with **QUANTI-Blue™** and the Lucia luciferase reporter with **QUANTI-Luc™ 4 Lucia/Gaussia**, respectively.

Detection of the NF-κB response

1. Prepare **QUANTI-Blue™** following the instructions on the enclosed product data sheet.

2. Add 20 µl of induced cell supernatant.

3. Add 180 µl of resuspended **QUANTI-Blue™** per well of a flat-bottom 96-well plate.

4. Incubate the plate at 37 °C for 30 min to 1 hour.

5. Determine SEAP levels using a spectrophotometer at 620-655 nm.

Detection of the IRF response

Below is a protocol for end-point readings using a luminometer with an injector. This protocol can be adapted for use with a luminometer with or without an injector for kinetic measurements.

1. Prepare **QUANTI-Luc™ 4 Reagent** working solution following the instructions on the data sheet.

2. Set the luminometer with the following parameters: 50 µl of injection, end-point measurement with a 4 second start time and 0.1 second reading time.

3. Pipet 10 - 20 µl of cell culture supernatant per well in a 96-well white (opaque) or black plate, or a luminometer tube.

4. Prime the injector with **QUANTI-Luc™ 4 Reagent** working solution

5. Proceed **immediately** with the measurement.

RELATED PRODUCTS

Product	Cat. Code
HEK-Dual™ cells	hkd-nfs
QUANTI-Blue™ Solution	rep-qbs
QUANTI-Luc™ 4 Lucia/Gaussia	rep-qlc4lg1
Blastidicin	ant-bl-1
Hygromycin B Gold	ant-hg-1
Normocin™	ant-nr-1
Puromycin	ant-pr-1
Zeocin®	ant-zn-1

TECHNICAL SUPPORT

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QUANTI-Blue™ Solution

Medium for detection and quantification of alkaline phosphatase in standard and HTS assays

Catalog code: rep-qbs, rep-qbs2, rep-qbs3

<https://www.invivogen.com/ quanti-blue>

For research use only

Version 23C09-MM

PRODUCT INFORMATION

Contents: QUANTI-Blue™ Solution is available in three pack sizes

- **rep-qbs:** 5 x 1 ml of QB reagent and 5 x 1 ml QB buffer, sufficient to prepare QUANTI-Blue™ Solution for **25 x 96-well plates** (500 ml using the standard procedure) or **20 x 1536-well plates** (85 ml using the HTS screening procedure).

- **rep-qbs2:** 10 x 1 ml of QB reagent and 10 x 1 ml QB buffer, sufficient to prepare QUANTI-Blue™ Solution for **50 x 96-well plates** (1 L using the standard procedure) or **40 x 1536-well plates** (170 ml using the HTS screening procedure).

- **rep-qbs3:** 1 x 20 ml bottle of QB reagent and 1 x 20 ml bottle of QB buffer, sufficient to prepare QUANTI-Blue™ Solution for **100 x 96-well plates** (2 L using the standard procedure) or **80 x 1536-well plates** (340 ml using the HTS screening procedure).

Required Material (not provided)

- Sterile water
- Sterile screw cap tube, glass bottle or flask

Storage and stability

- Product is shipped at room temperature. Upon receipt, store QB reagent and QB buffer at -20°C. Product is stable for 1 year at -20°C when properly stored.

- The 20 ml bottles of QB reagent and QB buffer are designed for single use. If required, individual aliquots of QB reagent and QB buffer can be prepared upon receipt or following a single freeze-thaw cycle. Store aliquots at -20°C. **Avoid repeated freeze-thaw cycles.**

Note: During storage, a precipitate may form in the 20 ml bottle of QB reagent and QB buffer. If this occurs, heat the product at 37°C for 30 seconds and vortex until the precipitate disappears. The formation of a precipitate does not affect the activity of the product.

- Reconstituted QUANTI-Blue™ Solution is stable for 2 weeks at 2-8°C and for 2 months at -20°C. Protect from light.

Quality Control

Each lot is thoroughly tested to ensure the absence of lot-to-lot variation.

- Physicochemical characterization (pH, appearance).
- Functional assays using alkaline phosphatase or SEAP-expressing reporter cells.

DESCRIPTION

QUANTI-Blue™ is a colorimetric enzyme assay developed to determine any alkaline phosphatase activity (AP) in a biological sample, such as supernatants of cell cultures. QUANTI-Blue™ Solution changes from pink to a purple-blue color in the presence of AP. Secreted embryonic alkaline phosphatase (SEAP) is a widely used reporter gene. It is a truncated form of placental alkaline phosphatase, a glycosylphosphatidylinositol (GPI)-anchored protein. SEAP is secreted into the cell culture supernatant and therefore offers many advantages over intracellular reporters.

QUANTI-Blue™ is highly sensitive for quantitative measurement. It has a higher saturation threshold than with pNPP (p-nitrophenyl phosphate) resulting in more significant differences between no, low or high AP activity. Another advantage of QUANTI-Blue™ is that it can determine secreted AP activity without disturbing cells, thus allowing the repeated sampling of cell cultures for kinetic studies.

TECHNICAL SUPPORT

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METHODS

QUANTI-Blue™ Solution has been optimized for use in 96-well plates (standard procedure) and in 1536-well plates (high throughput screening procedure).

A. Standard procedure

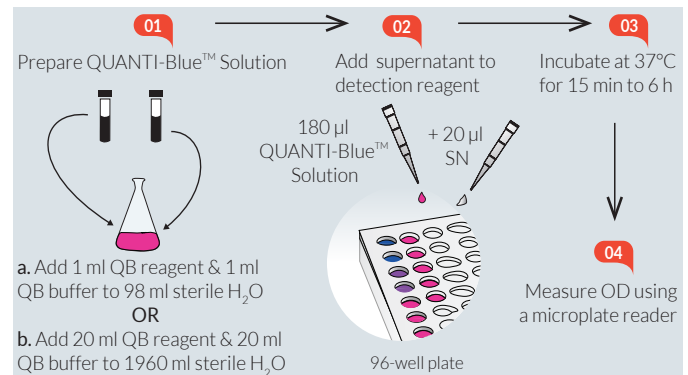


Figure 1. Standard procedure using QUANTI-Blue™ Solution.

The following protocol refers to the use of 96-well plates. Ensure QB reagent and QB buffer are completely thawed before use.

Note: For fast thawing, QB reagent and QB buffer can be placed at 37°C for 2 minutes. Ensure heating at 37°C does **not** exceed 5 minutes.

1. In a sterile bottle or flask, prepare QUANTI-Blue™ Solution by adding:
 - a. 1 ml of QB reagent and 1 ml of QB buffer to 98 ml of sterile water.
 - b. 20 ml of QB reagent and 20 ml of QB buffer to 1960 ml of sterile water.
2. Mix by vortexing and incubate at room temperature for 10 min before use.
3. Use QUANTI-Blue™ Solution immediately or store at 2-8°C or -20°C.
4. Dispense 180 µl of QUANTI-Blue™ Solution per well into a flat-bottom 96-well plate.
5. Add 20 µl of the sample (supernatant of SEAP-expressing cells) or negative control (cell culture medium).
6. Incubate at 37°C for 15 min to 6 h.
7. Measure optical density (OD) at 620-655 nm using a microplate reader.

Note: If the negative control turns purple/blue, it means the fetal bovine serum (FBS) contains alkaline phosphatase. We recommend heating FBS at 56°C for 30 min to inactivate the alkaline phosphatase activity.

For different cell culture plate formats, please refer to the table below:

	96-well plate	24-well plate	12-well plate
QUANTI-Blue™	180 µl	450 µl	900 µl
Supernatant	20 µl	50 µl	100 µl

B. High Throughput Screening (HTS) procedure



Figure 2. High throughput screening procedure using QUANTI-Blue™ Solution.

This procedure has been optimized for use in HTS screening procedures in 1536-well plates. QUANTI-Blue™ Solution is added directly to the cell suspension to reduce liquid handling.

Ensure QB reagent and QB buffer are completely thawed before use.
Note: For fast thawing, QB reagent and QB buffer can be placed at 37°C for 2 minutes. Ensure heating at 37°C does **not** exceed 5 minutes.

1. Dispense cell suspension and test compounds into a 1536-well plate in a volume that does not exceed **5 µl** per well. Incubate cells with test compounds for the desired period of time.
2. Prepare QUANTI-Blue™ Solution by adding:
 - a. **1 ml** of QB reagent and **1 ml** of QB buffer to **15 ml** of sterile water in a sterile 50 ml screw cap tube.
 - b. **20 ml** of QB reagent and **20 ml** of QB buffer to **300 ml** of sterile water in a sterile glass bottle or flask.
3. Mix well by vortexing and incubate at room temperature for 10 minutes before use.
4. Use QUANTI-Blue™ Solution immediately or store at 2-8°C or -20°C.
5. Dispense **2 µl** of QUANTI-Blue™ Solution to the wells containing $\leq 5 \mu\text{l}$ of cell culture in a 1536-well plate.
6. Mix using a plate shaker.
7. Incubate at 37°C for 15 min to 6 h.
8. Measure OD at 620-655 nm.

Note: If the negative control turns purple/blue, it means the fetal bovine serum (FBS) contains alkaline phosphatase. We recommend heating FBS at 56°C for 30 min to inactivate the alkaline phosphatase activity.

RELATED PRODUCTS

Product	Catalog Code
pNifTy2-SEAP (Zeo®)	pnifty2-seap
pSELECT-zeo-SEAP	psetz-seap
HEK-Blue™ Detection	hb-det2
Recombinant SEAP Protein	rec-hseap
Reporter cells	
HEK-Blue™ hTLR2	hkb-htlr2
HEK-Blue™ hTLR4	hkb-htlr4
RAW-Blue™ Cells	raw-sp
THP1-Blue™ NF-κB Cells	thp-nfkb
THP1-Blue™ ISG Cells	thp-isg

For a complete list of InvivoGen's Reporter Cell Lines visit <https://www.invivogen.com/reporter-cells>

TECHNICAL SUPPORT

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QUANTI-Luc™ 4 Reagent

A coelenterazine-based luminescence assay reagent

<https://www.invivogen.com/ quanti-luc>

For research use only

Version 23F27-AK

PRODUCT INFORMATION

Contents

- 1 tube of QUANTI-Luc™ 4 Reagent (20X)

One tube of QUANTI-Luc™ 4 Reagent is sufficient for 5 x 96-well plates (25 ml standard Flash/end-point detection).

Note: This sample cannot be sold separately from the QUANTI-Luc™ 4 Lucia/Gaussia or Renilla kits.

Find more information at <https://www.invivogen.com/ quanti-luc>.

Storage and Stability

- Store QUANTI-Luc™ 4 Reagent at -20°C for up to 12 months.
- After preparation, the working solution is stable for 48 hours at 4°C and 1 month at -20°C. Prepare aliquots to avoid repeated freeze-thaw cycles.

Note: This product is photosensitive and should be protected from light.

Quality Control

Each lot is thoroughly tested to ensure the absence of lot-to-lot variation.

- Physicochemical characterization (pH, appearance).
- Functional assays using recombinant Lucia protein or reporter cells.

DESCRIPTION

QUANTI-Luc™ 4 Reagent is one component of the QUANTI-Luc™ 4 Lucia/Gaussia and QUANTI-Luc™ 4 Renilla kits. It contains the coelenterazine substrate for the detection of secreted Lucia or Gaussia activity in live-cell supernatants, and of intracellular Renilla after cell lysis. The light signal produced correlates to the amount of luciferase protein expressed. It is quantified using a luminometer and expressed as relative light units (RLUs).

METHODS

Preparation of QUANTI-Luc™ 4 Reagent working solution (1X):

1. Dilute the total volume of the 20X tube (1.25 ml) of Reagent into 23.75 ml of sterile water to obtain 25 ml of working solution.
2. Vortex **very briefly** (a few seconds).
3. Use the working solution immediately or store until required for use. QUANTI-Luc™ 4 Reagent working solution can be stored for 48 hours at 4°C or 1 month at -20°C.

Flash detection of Lucia luciferase activity in cell culture medium:

To obtain **end-point readings** using a luminometer **with an injector**.

1. Set the luminometer with the following parameters: 50 µl of injection, end-point measurement with a 4 second start time and 0.1 second reading time.
2. Pipet 10-20 µl of sample per well into a 96-well white (opaque) or black plate, or a luminometer tube.
3. Prime the injector with QUANTI-Luc™ 4 Reagent 1X and proceed **immediately** with the measurement.

To obtain **end-point readings** using a luminometer **without injectors**.

1. Set the luminometer with a 0.1 second reading time.
2. Pipet 10-20 µl of sample per well into a 96-well white (opaque) or black plate, or a luminometer tube.
3. Add 50 µl of QUANTI-Luc™ 4 Reagent 1X to each well or tube.
4. Gently tap the plate several times to mix (do **not** vortex).
5. Proceed **immediately** with the measurement.

RELATED PRODUCTS

Product	Cat. Code
QUANTI-Luc™ 4 Lucia/Gaussia Kit comprising QUANTI-Luc™ 4 Reagent & Stabilizer	rep-qlc4lg1
QUANTI-Luc™ 4 Renilla Kit comprising QUANTI-Luc™ 4 Reagent & Lysis buffer	rep-qlc4r1

TECHNICAL SUPPORT

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