



The Nuclear Receptor Experts™

**Human Estrogen-Related Receptor, Gamma  
(NR3B3, ERR $\gamma$ )  
Reporter Assay System**

**96-well Format Assays**  
Product # IB08021

▪

**Technical Manual**  
*(version 7.1)*

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## Human ERR $\gamma$ Reporter Assay System 96-well Format Assays

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## I. Description

### ▪ The Assay System ▪

This nuclear receptor assay system utilizes proprietary non-human mammalian cells engineered to provide high-level expression of a hybrid form of the **Human Estrogen-Related Receptor Gamma (NR3B3)**. The N-terminal DNA binding domains (DBD) of the native ERR $\gamma$  has been substituted with that of the yeast GAL4-DBD. The reporter gene is beetle luciferase functionally linked to the GAL4 upstream activation sequence (UAS).

As is true *in vivo*, these reporter cells express ERR $\gamma$  that is constitutively active in the (putative) absence of a ligand binding event. Interestingly, the ligand binding domain of ERR $\gamma$  may be occupied by a ligand that further elevates the constitutive activity of the receptor (an agonist response), or one that results in a dose-dependent loss of constitutive active (an inverse-agonist response)<sup>1</sup>. **Figure 2** demonstrates the high constitutive activity of ERR $\gamma$  in the absence of added ligand, as well as agonist and inverse-agonist responses of the receptor upon ligand binding. Therefore, the principle application of this assay system is in the screening of test samples to quantify either *agonist* or *inverse-agonist* activities that they may exert against human ERR $\gamma$ .

ERR $\gamma$  Reporter Cells are prepared using INDIGO's proprietary **CryoMite™** process. This cryo-preservation method yields exceptional cell viability post-thaw, and provides the convenience of immediately dispensing healthy, division-competent reporter cells into assay plates. There is no need for cumbersome intermediate treatment steps such as spin-and-rinse of cells, viability determinations, cell titer adjustments, or the pre-incubation of reporter cells prior to assay setup.

INDIGO Bioscience's Nuclear Receptor Reporter Assays are all-inclusive cell-based assay systems. In addition to ERR $\gamma$  Reporter Cells, this kit provides two optimized media for use during cell culture and in diluting the user's test samples, a reference agonist, Luciferase Detection Reagent, and a cell culture-ready assay plate.

### ▪ The Assay Chemistry ▪

INDIGO's nuclear receptor reporter assay systems capitalize on the extremely low background, high-sensitivity, and broad linear dynamic range of bio-luminescence reporter gene technology.

Reporter Cells incorporate the cDNA encoding beetle luciferase, a 62 kD protein originating from the North American firefly (*Photinus pyralis*). Luciferase catalyzes the mono-oxidation of D-luciferin in a Mg<sup>+2</sup>-dependent reaction that consumes O<sub>2</sub> and ATP as co-substrates, and yields as products oxyluciferin, AMP, PP<sub>i</sub>, CO<sub>2</sub>, and photon emission. Luminescence intensity of the reaction is quantified using a luminometer, and is reported in terms of Relative Light Units (RLU's).

INDIGO's Nuclear Receptor Assay Systems feature a luciferase detection reagent specially formulated to provide stable light emission between 5 and 90+ minutes after initiating the luciferase reaction. Incorporating a 5 minute reaction-rest period ensures that light emission profiles attain maximal stability, thereby allowing assay plates to be processed in batch. By doing so, the signal output from all sample wells, from one plate to the next, may be directly compared within an experimental set.

### ▪ Preparation of Test Compounds ▪

Most commonly, test compounds are solvated at high-concentration in DMSO, and these are stored as master stocks. Master stocks are then diluted to appropriate working concentrations immediately prior to setting up the assay. Users are advised to dilute test compounds to 2x-concentration stocks using **Compound Screening Medium (CSM)**, as described in *Step 2* of the **Assay Protocol**. This method avoids the adverse effects of introducing high concentrations of DMSO into the assay. The final concentration of total DMSO carried over into assay reactions should never exceed 0.4%.

*NOTE:* CSM is formulated to help stabilize hydrophobic test compounds in the aqueous environment of the assay mixture. Nonetheless, high concentrations of extremely hydrophobic test compounds diluted in CSM may lack long-term stability and/or solubility, especially if further stored at low temperatures. Hence, it is recommended that test compound dilutions are prepared in CSM immediately prior to assay setup, and are considered to be 'single-use' reagents.

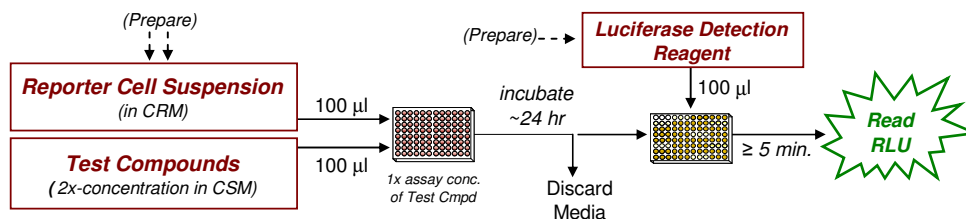
### ▪ Considerations for Automated Dispensing ▪

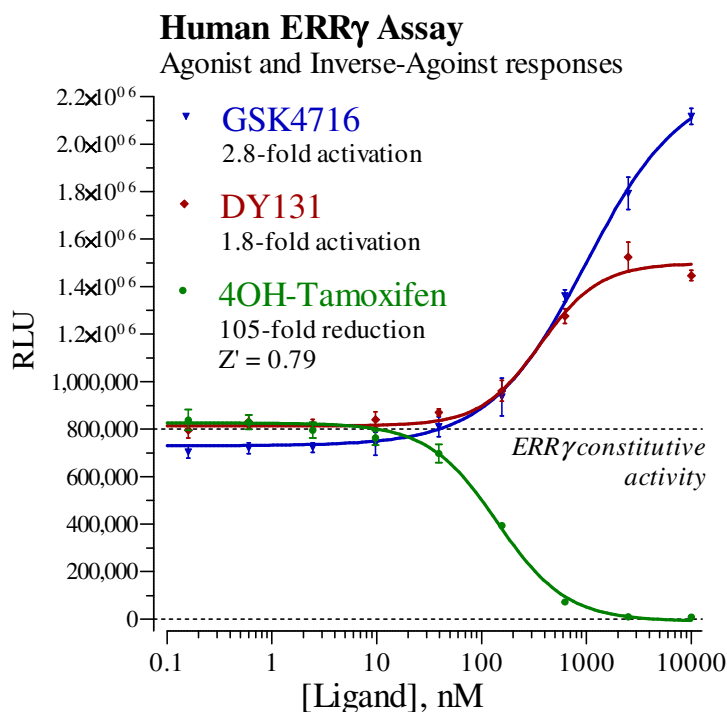
When processing a small number of assay plates, first carefully considered the dead volume requirement of your dispensing instrument before committing assay reagents to its setup. In essence, "dead volume" is the volume of reagent that is dedicated to the instrument; it will *not* be available for final dispensing into assay wells. The following Table provides information on reagent volume requirements, and available excesses.

<b>Stock Reagent &amp; Volume provided</b>	<b>Volume to be Dispensed (96-well plate)</b>	<b>Excess rgt. volume available for instrument dead volume</b>
<b>Reporter Cell Suspension</b> 12 ml <i>(prepared from kit components)</i>	100 µl / well 9.6 ml / plate	~ 2.4 ml
<b>LDR</b> 12 ml <i>(prepared from kit components)</i>	100 µl / well 9.6 ml / plate	~ 2.4 ml

### ▪ Assay Scheme ▪

**Figure 1.** Assay workflow. *In brief*, Reporter Cells are dispensed into wells of the assay plate and then immediately dosed with the user's test compounds. Following 22 -24 hr incubation, treatment media are discarded and prepared Luciferase Detection Reagent (LDR) is added. Light emission from each assay well is quantified using a plate-reading luminometer.





**Figure 2. Agonist and Inverse-Agonist responses of ERR $\gamma$  reporter cells treated with reference ligands.**

ERR $\gamma$  Assays were performed using manual dispensing and following the protocol described in this Technical Manual, using the agonists GSK4716<sup>1</sup> (Tocris) and DY131<sup>2</sup> (Tocris), and the inverse-agonist 4-hydroxy tamoxifen<sup>3</sup> (provided). Luminescence was quantified using a GloMax-Multi+ plate-reading luminometer (Promega Corp.). Values of average relative light units (RLU) and standard deviation (SD) were determined for each treatment concentration ( $n \geq 6$ ).  $Z'$  values were calculated as described by Zhang, *et al.* (1999)<sup>4</sup>. Non-linear regression analyses were performed and values of EC<sub>50</sub> and IC<sub>50</sub> were determined using GraphPad Prism software.

<sup>1</sup> Wang L, *et al.* (2006) X-ray crystal structures of the estrogen-related receptor  $\gamma$  ligand binding domain in three function states reveal the molecular basis of small molecule regulation. *JBC*:**281** (49), 37773-37781.

<sup>2</sup> Yu DD and Barry MF (2005) Identification of an agonist ligand for estrogen-related receptors ERR $\beta$ / $\gamma$ . *Bioorgan. & Med. Chem. Letters*:**15**, 1311-1313.

<sup>3</sup> Zuercher WJ, *et al.* (2005) Identification and structure-activity relationship of phenolic acyl hydrazones as selective agonists for the estrogen-related orphan nuclear receptors ERR $\beta$  and ERR $\gamma$ . *J. Med. Chem.*:**48**, 3107-3109.

<sup>4</sup> Zhang JH, *et al.* (1999) A Simple Statistical Parameter for Use in Evaluation and Validation of High Throughput Screening Assays. *J Biomol Screen.*:**4**(2), 67-73.

$$Z' = 1 - [3 * (SD^{\text{Control}} + SD^{\text{Background}}) / (RLU^{\text{Control}} - RLU^{\text{Background}})]$$

## II. Product Components & Storage Conditions

This Human ERR $\gamma$  Reporter Assay System contains materials to perform assays in a single 96-well assay plate.

The aliquot of ERR $\gamma$  Reporter Cells is provided as a single-use reagent. Once thawed, reporter cells can NOT be refrozen or maintained in extended culture with any hope of retaining downstream assay performance. Therefore, extra volumes of these reagents should be discarded after assay setup.

Assay kits are shipped on dry ice. Upon receipt, individual kit components may be stored at the temperatures indicated on their respective labels. Alternatively, the entire kit may be further stored at -80°C.

To ensure maximal viability, "Reporter Cells" must be maintained at -80°C until immediately prior to use.

The date of product expiration is printed on the Product Qualification Insert (PQI) enclosed with each kit.

<u>Kit Components</u>	<u>Amount</u>	<u>Storage Temp.</u>
▪ ERR $\gamma$ Reporter Cells	1 x 2.0 mL	<b>-80°C</b>
▪ Cell Recovery Medium (CRM)	1 x 10.5 mL	-20°C
▪ Compound Screening Medium (CSM)	1 x 35 mL	-20°C
▪ 4-Hydroxy Tamoxifen, 10 mM (in DMSO) (reference agonist for ERR $\gamma$ )	1 x 30 $\mu$ L	-20°C
▪ Detection Substrate	1 x 6.0 mL	<b>-80°C</b>
▪ Detection Buffer	1 x 6.0 mL	-20°C
▪ 96-well assay plate (white, sterile, cell-culture ready)	1	ambient

## III. Materials to be Supplied by the User

The following materials must be provided by the user, and should be made ready prior to initiating the assay procedure:

### DAY 1

- cell culture-rated laminar flow hood.
- 37°C, humidified 5% CO<sub>2</sub> incubator for mammalian cell culture.
- 37°C water bath.
- 70% alcohol wipes
- 8- or 12-channel electronic, repeat-dispensing pipettes & sterile tips
- disposable media basins, sterile.
- sterile multi-channel media basins (such as the Heathrow Scientific "Dual-Function Solution Basin"), or deep-well plates, or appropriate similar vessel for generating dilution series of reference compound(s) and test compound(s).
- antagonist reference compound (optional).

DAY 2 plate-reading luminometer.

## IV. Assay Protocol

Review the entire Assay Protocol before starting. Completing the assay requires an overnight incubation. *Steps 1-8* are performed on **Day 1**, requiring less than 2 hours to complete. *Steps 9-15* are performed on **Day 2**, and require less than 1 hour to complete.

**DAY 1 Assay Protocol:** All steps must be performed using aseptic technique.

**1.) Remove Cell Recovery Medium (CRM) and Compound Screening Medium (CSM)** from freezer storage and thaw in a 37°C water bath.

**2.) Prepare dilutions of treatment compounds:** Prepare Test Compound treatment media for *Agonist-* or *Antagonist-mode* screens.

Total DMSO carried over into assay reactions should never exceed 0.4%.

Note that, in *Step 6*, 100 µl of the prepared treatment media is added into assay wells that have been pre-dispensed with 100 µl of Reporter Cells. Hence, to achieve the desired *final* assay concentrations one must prepare treatment media with a 2x-concentration of the test and reference material(s). Plan dilution volumes carefully; this kit provides 35 ml of CSM.

**Preparing the positive control:** This ERRγ Reporter Assay System kit includes a 10 mM stock solution of 4-hydroxy-tamoxifen, an inverse-agonist of ERRγ. The following 7-point treatment series, with concentrations presented in 5-fold decrements, provides a complete inverse-agonist dose-response: 5000, 1000, 200, 40.0, 8.00, 1.60, and 0.320 nM, and including a 'no treatment' control. **APPENDIX 1** provides an example for generating such a dilution series.

**3.) First,** retrieve the tube of **CRM** from the 37°C water bath and sanitize the outside with a 70% ethanol swab.

*Second,* retrieve **Reporter Cells** from -80°C storage. Perform a *rapid thaw* of the frozen cells by transferring a 10 ml volume of 37°C CRM into the tube of frozen cells. Recap the tube of Reporter Cells and immediately place it in a 37°C water bath for 5 - 10 minutes. The resulting volume of cell suspension will be 12 ml.

**4.)** Retrieve the tube of Reporter Cell Suspension from the water bath and sanitize the outside surface of the tube with a 70% alcohol swab.

**5.)** Invert the tube of Reporter Cells several times to disperse cell aggregates and gain an homogenous cell suspension. Without delay, transfer the cell suspension into a reservoir and, using an 8-channel pipette, dispense 100 µl of cell suspension into each well of the assay plate.

*NOTE 5.1:* Take special care to prevent cells from settling during the dispensing period. Allowing cells to settle during the transfer process, and/or lack of precision in dispensing uniform volumes across the assay plate *will* cause well-to-well variation (= increased Standard Deviation) in the assay.

*NOTE 5.2:* Users sometimes prefer to examine the reporter cells using a microscope. If so, the extra volume of cell suspension provided with each kit may be dispensed (100 µl/well) into a clear 96-well cell culture treated assay plate, followed by 100 µl/well of CSM (as in *Step 6*). Incubated overnight in identical manner to those reporter cells contained in the white assay plate.

**6.)** Dispense 100 µl of 2x-concentration treatment media into appropriate assay wells.

**7.)** Transfer the assay plate into a 37°C, humidified 5% CO<sub>2</sub> incubator for 22 - 24 hours.

*NOTE:* Ensure a high-humidity (≥ 85%) environment within the cell culture incubator. This is critical to prevent the onset of deleterious "edge-effects" in the assay plate.

**8.)** For greater convenience on Day 2, retrieve **Detection Substrate and Detection Buffer** from freezer storage and place them in a dark refrigerator (4°C) to thaw overnight.

**DAY 2 Assay Protocol:** Subsequent manipulations do *not* require special regard for aseptic technique, and may be performed on a bench top.

9.) 30 minutes before intending to quantify ERR $\gamma$  activity, remove **Detection Substrate** from the refrigerator and place them in a low-light area so that it may equilibrate to room temperature. Gently invert the tube several times to ensure an homogenous solution.

*NOTE:* Do NOT actively warm Detection Substrate above room temperature. If these solutions were not allowed to thaw overnight at 4°C, a room temperature water bath may be used to expedite thawing.

10.) Set the plate-reader to "luminescence" mode. Set the instrument to perform a single 5 second "plate shake" prior to reading the first assay well. Read time may be set to 0.5 second (500 mSec) per well, *or less*.

11.) *Immediately before proceeding to Step 12*, transfer the entire volume of **Detection Buffer** into the vial of **Detection Substrate**, thereby generating a 12 ml volume of Luciferase Detection Reagent (LDR). Mix gently to avoid foaming.

12.) Following 22 - 24 hours of incubation discard all media contents by ejecting it into an appropriate waste container. *Gently* tap the inverted plate onto a clean absorbent paper towel to remove residual droplets. Cells will remain tightly adhered to well bottoms.

13.) Add 100  $\mu$ l of **LDR** to each well of the assay plate. Allow the assay plate to rest at room temperature for at least 5 minutes following the addition of LDR. Do not shake the assay plate during this period.

14.) Quantify luminescence.



## V. Related Products

<b>ERR<math>\gamma</math> Assay Products</b>	
<b><i>Product No.</i></b>	<b><i>Product Descriptions</i></b>
IB08021-32	Human ERR $\gamma$ Reporter Assay System 3x 32 assays in 96-well format
IB08021	Human ERR $\gamma$ Reporter Assay System 1x 96-well format assay
IB08022	Human ERR $\gamma$ Reporter Assay System 1x 384-well format assays
Bulk volumes of assay reagents may be custom manufactured to accommodate any scale of HTS. Please Inquire.	

<b>LIVE Cell Multiplex (LCM) Assay</b>	
<b><i>Product No.</i></b>	<b><i>Product Descriptions</i></b>
LCM-01	Reagent volumes sufficient to perform <b>96</b> Live Cell Assays in 1x96-well, or 2x48-well, or 3x32-well assay plate formats
LCM-05	Reagent in 5x-bulk volume to perform <b>480</b> Live Cell Assays in any combination of 1x96-, 2x48-, or 3x32-well assay plate formats
LCM-10	Reagent in 10x-bulk volume to perform <b>960</b> Live Cell Assays in any combination of 1x96-, 2x48-, or 3x32-well assay plate formats

Please refer to INDIGO Biosciences website for updated product offerings.

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## VI. Limited Use Disclosures

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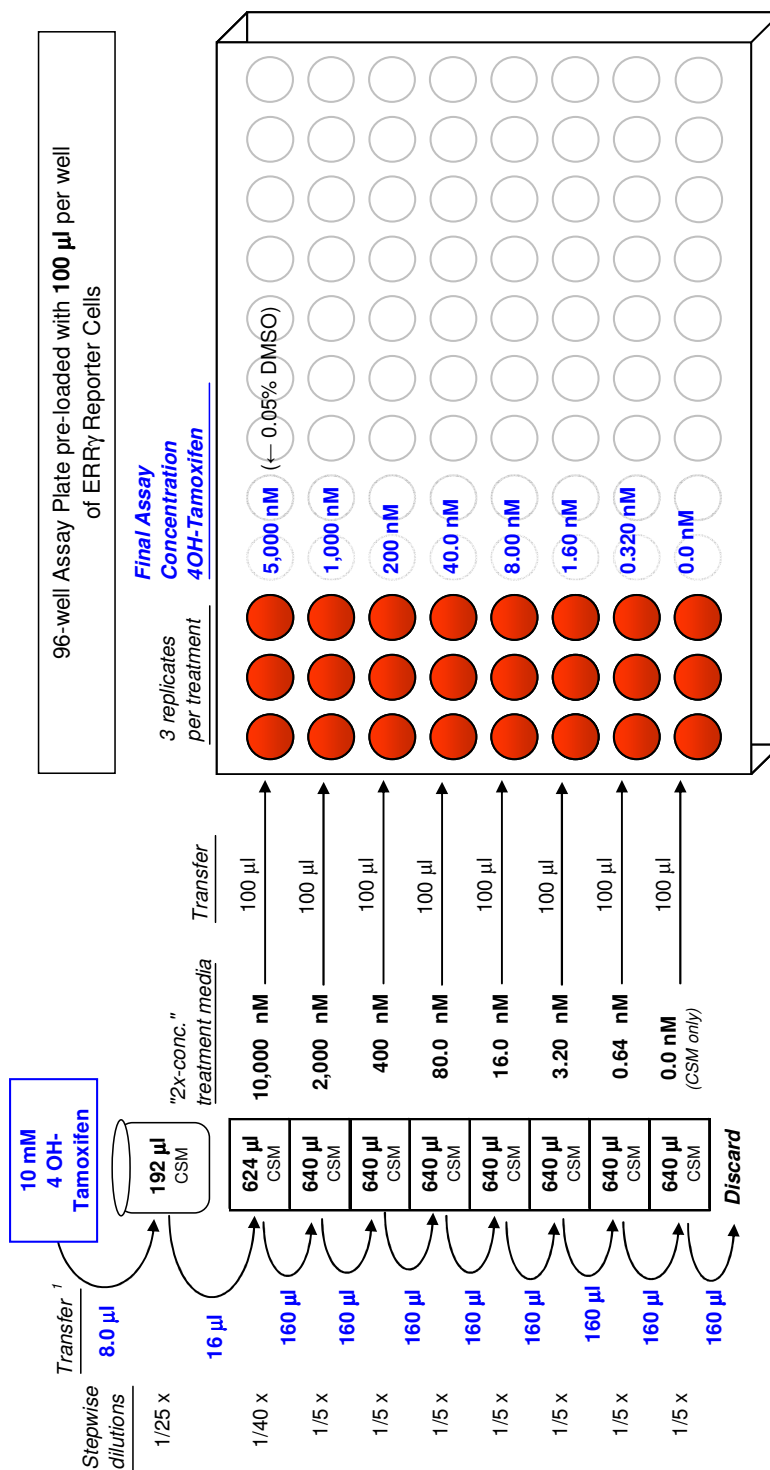
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## APPENDIX 1

Example scheme for the serial dilution of 4OH-Tamoxifen inverse-agonist, and the setup of an ERR $\gamma$  dose-response assay.



<sup>1</sup> For convenience, serial dilutions may be made directly in a dual-function solution basin (Heathrow Scientific) or a deep 96-well plate.