

**Human Estrogen Receptors  
Reporter Assay  
PANEL**

**ER $\alpha$**  (ESR1, NR3A1)

**ER $\beta$**  (ESR2, NR3A2)

**48 Assays each in 96-well Format**  
Product #IB00421-48P

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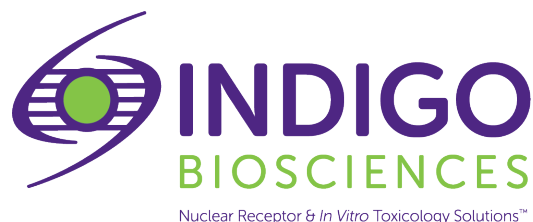
**Technical Manual**  
*(version 7.1)*

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**Human ER Assays PANEL**  
**ER $\alpha$  and ER $\beta$**   
**48 Assays each in 96-well Format**

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## I. Description

### ▪ The Assay System ▪

INDIGO's **PANEL of ER Assays** utilizes non-human mammalian cells engineered to express Human Estrogen Receptors Alpha (ER1; NR3A1) and Beta (ER2; NR3A2), ligand-dependent transcription factors commonly referred to as **ER $\alpha$**  and **ER $\beta$** .

INDIGO's ER Reporter Cells include the luciferase reporter gene functionally linked to a responsive promoter. Thus, quantifying changes in luciferase expression in the treated reporter cells provides a sensitive surrogate measure of the changes in ER activities. Luciferase gene expression occurs after ligand-bound ER undergoes nuclear translocation, DNA binding, recruitment and assembly of the co-activators and accessory factors required to form a functional transcription complex, culminating in expression of the target gene. Unlike some other cell-based assay strategies, the readout from INDIGO's reporter cells demands the same orchestration of all intracellular molecular interactions and events that can be expected to occur *in vivo*.

ER 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 ER 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 Reporter 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.

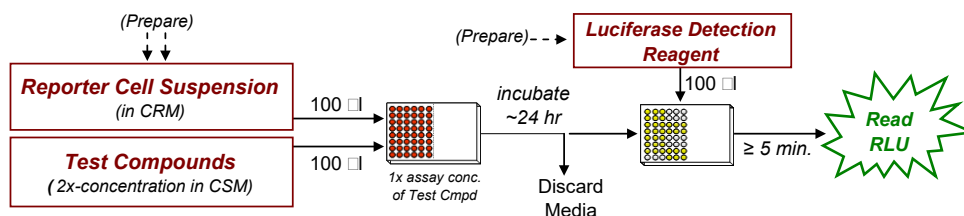
### ▪ Preparation of Test Compounds ▪

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 specially formulated to 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.

### ▪ Assay Scheme ▪

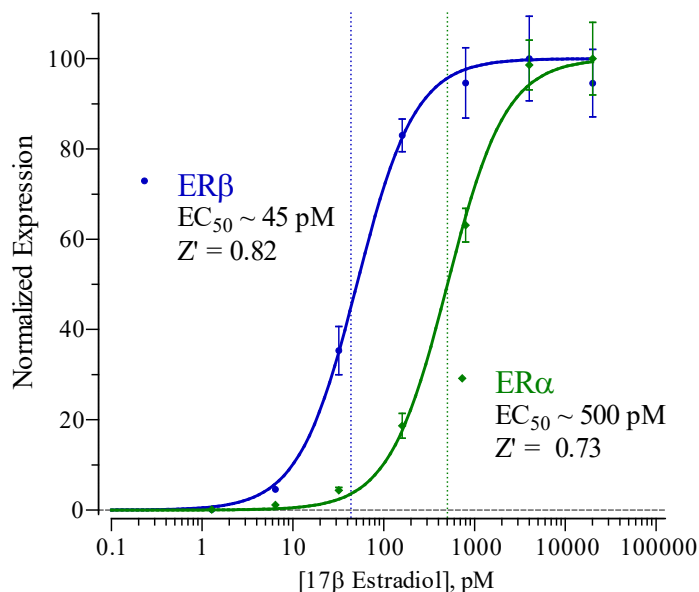
**Figure 1.** Assay workflow. *In brief*, ER Reporter Cells are dispensed into 48 wells of the assay plate and then immediately dosed with the user's test compounds. Following 22 -24 hr incubation, treatment media are discarded and prepared Luciferase Detection Reagent (LDR) is added. Light emission from each sample well is quantified using a plate-reading luminometer.



▪ Assay Performance ▪

### Human ER $\alpha$ and ER $\beta$ Assays

17 $\beta$ -Estradiol Dose-Response Analyses

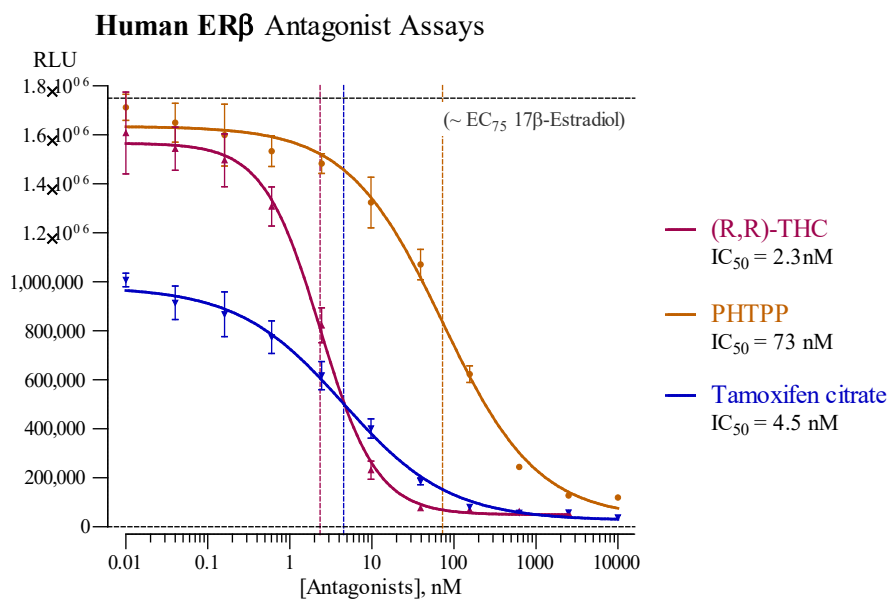
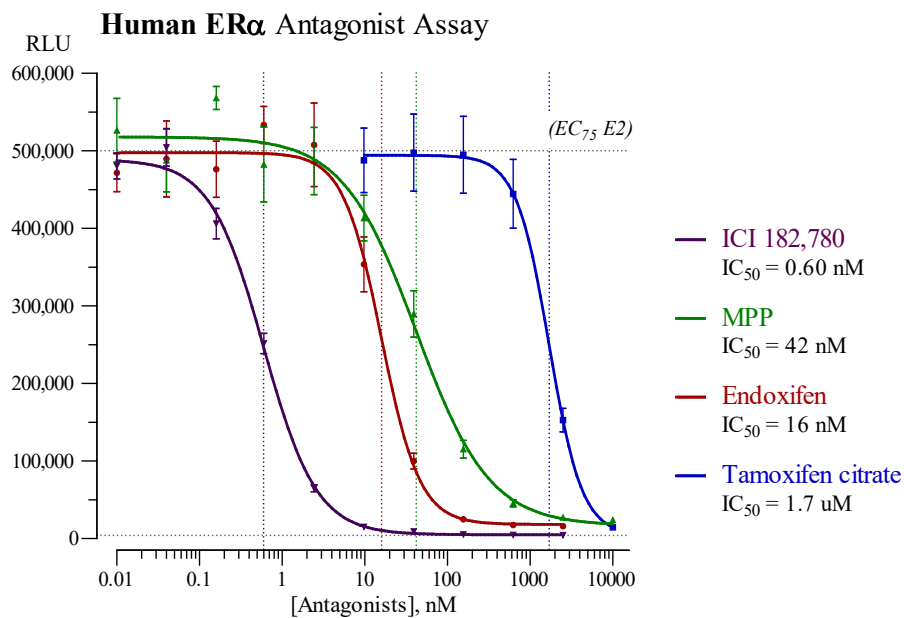


**Figure 2. 17 $\beta$ -Estradiol dose-response analyses of the ER $\alpha$  and ER $\beta$  Assays.**

Dose-response analyses of ER Reporter Cells were performed according to the protocol provided in this Technical Manual. ER Reporter Cells were each treated with 17 $\beta$ -estradiol using an assay concentration range generated in 5-fold increments, as described in Appendix 1. Treatment concentrations of 17 $\beta$ -estradiol were: 20000, 4000, 800, 160, 32.0, 6.40, 1.28 and 0 pM. Luminescence was quantified using a GloMax-Multi+ luminometer. Average relative light units (RLU) and corresponding standard deviation (SD) values were determined for each treatment concentration ( $n \geq 6$ ). Z' values were calculated as described by Zhang, *et al.* (1999)<sup>1</sup>. Non-linear regression analyses and EC<sub>50</sub> determination were performed using GraphPad Prism software.

RESULTS: The ER $\alpha$  assay yielded Z'= 0.73. The ER $\beta$  assay yielded a Z'= 0.82. These data confirm the robust performance of these ER Reporter Assays, and demonstrate their suitability for use in HTS applications.<sup>1</sup>

<sup>1</sup> Zhang JH, Chung TD, Oldenburg KR. (1999) A Simple Statistical Parameter for Use in Evaluation and Validation of High Throughput Screening Assays. *J Biomol Screen.*:4(2), 67-73. 
$$Z' = 1 - [3 * (SD^{Control} + SD^{Background}) / (RLU^{Control} - RLU^{Background})]$$



**Figure 3. Human ER $\alpha$  and ER $\beta$  antagonist-mode Assays**

ER $\alpha$  antagonist assays were performed using Endoxifen, Tamoxifen citrate, ICI182780 and MPP dihydrochloride (all from Tocris). ER $\beta$  antagonist assays were performed using Tamoxifen citrate, PHTPP and (R,R)-THC (all from Tocris). ER Assay setup and quantification of antagonist activities were performed following as described in this Technical Manual. The bulk suspension of reporter cells was supplemented with a 2x-EC<sub>75</sub> concentration of 17 $\beta$ -Estradiol and dispensed into the assay plate at 100  $\mu$ l/well. Cells were then further treated by adding 100  $\mu$ l/well of decreasing 2x-concentrations of antagonist. Assay plates were incubated for ~23 hrs, then processed to quantify ER activities for each treatment condition.

## II. Product Components & Storage Conditions

This Human ER Reporter Assays PANEL contains materials to perform 48 ER $\alpha$  assays and 48 ER $\beta$  assays, all in a single 96-well plate format. All reagents are supplied with sufficient extra volume to accommodate the needs of performing 2 individual groups of assays.

The individual aliquots of ER Reporter Cells and Detection Substrate and Detection Buffer are provided as single-use reagents. Once thawed, reporter cells can NOT be refrozen 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>
▪ ER $\alpha$ Reporter Cells	1 x 1.0 mL	-80°C
▪ ER $\beta$ Reporter Cells	1 x 1.0 mL	-80°C
▪ Cell Recovery Media (CRM)	1 x 10.5 mL	-20°C
▪ Compound Screening Media (CSM)	1 x 35 mL	-20°C
▪ 17 $\beta$ -Estradiol, 100 $\mu$ M (in DMSO) (reference agonist for ER $\alpha$ and ER $\beta$ )	1 x 30 $\mu$ L	-20°C
▪ Detection Substrate	2 x 3.0 mL	-80°C
▪ Detection Buffer	2 x 3.0 mL	-20°C
▪ Plate frame	1	ambient
▪ snap-in, 8-well strips (white, sterile, cell culture treated)	12	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 or deep-well plates, or appropriate similar vessel for generating serial dilutions of test & reference compound(s).
- antagonist reference compounds (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.

### ▪ A word about Antagonist-mode assay setup ▪

Receptor inhibition assays expose the Reporter Cells to a constant, sub-maximal concentration (typically  $EC_{50}$  –  $EC_{85}$ ) of a known *agonist* AND the test compound(s) to be evaluated for antagonist activity. We find that adding the reference agonist to the bulk suspension of Reporter Cells (*i.e.*, prior to dispensing into assay wells) is the most efficient and precise method of setting up antagonist assays, and it is the method presented in *Step 5b* of the following protocol.

This ER Assay Panel kit includes a 100  $\mu$ M stock solution of 17 $\beta$ -Estradiol, a commonly used reference agonist for both ER $\alpha$  and ER $\beta$  (**Figure 2**) that may be used effectively to setup receptor inhibition studies.

- **ER $\alpha$** : 1,500 pM 17- $\beta$ -estradiol typically approximates  $EC_{80}$  in this reporter assay.
- **ER $\beta$** : 150 pM 17- $\beta$ -estradiol typically approximates  $EC_{80}$  in this reporter assay.

**APPENDIX 1** provides a guide for preparing CSM supplemented with 17- $\beta$ -estradiol.

*Note:* In *Step 6*, 100  $\mu$ l of treatment media is combined with 100  $\mu$ l of pre-dispensed [Reporter Cells + agonist]. Consequently, one must prepare the bulk suspension of Reporter Cells to contain a 2x-concentration of the reference agonist.

**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  $\mu$ l of the prepared treatment media is added into assay wells that have been pre-dispensed with 100  $\mu$ l 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 ER Assay Panel kit includes a 100  $\mu$ M stock solution of 17 $\beta$ -Estradiol, a potent agonist of both ER $\alpha$  and ER $\beta$ .

As shown in **Figure 2**, ER $\alpha$  and ER $\beta$  display unique sensitivities to 17- $\beta$ -estradiol. However, we find that both receptors exhibit complete dose-responses to 17- $\beta$ -estradiol using an *assay* concentration series of seven dilutions made in 5-fold decrements, as follows: 20000, 4000, 800, 160, 32.0, 6.40, 1.28, and 0 picoMolar. **APPENDIX 1** provides an example for generating this 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 5.0 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 6.0 ml.

*Third*, work in the cell culture hood to *carefully* mount four sterile 8-well strips into the blank assay plate frame. Strip-wells are fragile. Note that they have keyed ends (square and round), hence, they will fit into the plate frame in only one orientation.

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.) *a. Agonist-mode assays.* Gently invert the tube of ER Reporter Cells several times to disperse cell aggregates and gain an homogenous cell suspension. Without delay, dispense 100 µl of cell suspension into respective strip-wells of the assay plate.

~ or ~

*b. Antagonist-mode assays.* Gently invert the tube of Reporter Cells several times to disperse any cell aggregates, and to gain an homogenous cell suspension. Supplement the 6 ml bulk suspension of Reporter Cells with the desired 2x-concentration of reference agonist (refer to "*A word about antagonist-mode assay setup*", pg. 8). Dispense 100 µl of cell suspension into respective strip-wells 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 *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 the appropriate number of tubes of **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 ER activity, remove the tubes of **Detection Substrate** and **Detection Buffer** from the refrigerator and place them in a low-light area so that they may equilibrate to room temperature. Once at room temperature, gently invert each tube several times to ensure homogenous solutions.

*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.) After 22-24 hours of incubation, remove media contents from each well.

*NOTE:* Because the assay plate is composed of a frame with snap-in strip-wells, the practice of physically ejecting media is NOT advised. Do *not* touch the well bottom, or run the tip of the aspiration device around the bottom circumference of the assay well. Such practices will result in destruction of the reporter cells and greatly increased well-to-well variability. Complete removal of the media is efficiently performed by tilting the plate on edge and aspirating media using an 8-pin manifold (*e.g.*, Wheaton Science Microtest Syringe Manifold, # 851381) affixed to a vacuum-trap apparatus.

13.) Add 100 µl 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>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.

**[www.indigobiosciences.com](http://www.indigobiosciences.com)**

## ***VI. Limited Use Disclosures***

Products commercialized by INDIGO Biosciences, Inc. are for RESEARCH PURPOSES ONLY – not for therapeutic or diagnostic use in humans.

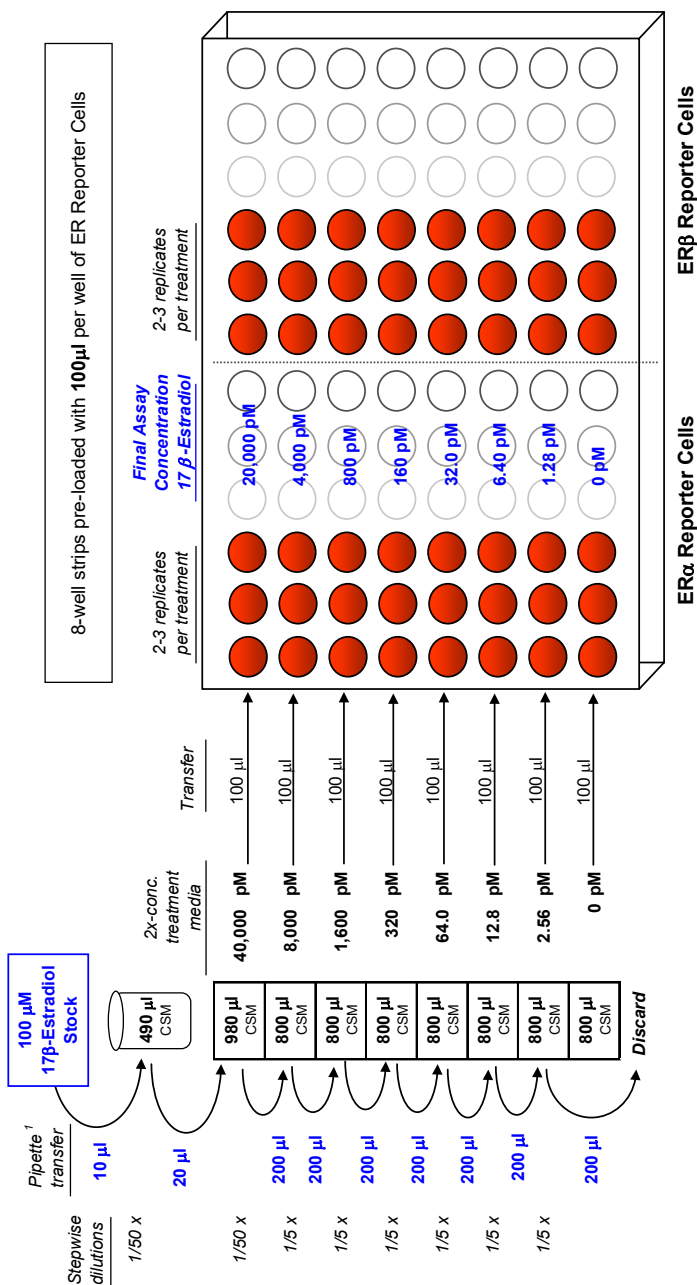
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Product prices, availability, specifications and claims are subject to change without prior notice.

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## APPENDIX 1

Example scheme for the serial dilution of 17 $\beta$ -Estradiol reference agonist, and the setup of ER dose-response assays.



<sup>1</sup> For convenience, serial dilutions may be made directly in a multi-well solution basin or a deep 96-well plate.