



**Zebrafish Peroxisome Proliferator-Activated  
Receptor Gamma  
(nr1c3, PPARG, PPAR $\gamma$ )**

**Reporter Assay System**

**3x 32 Assays in 96-well Format**  
Product # Z00101-32

▪

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

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## **Zebrafish PPAR $\gamma$ Reporter Assay System** **3x 32 Assays in 96-well Format**

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## I. Description

### ▪ The Assay System ▪

This nuclear receptor assay utilizes proprietary mammalian cells engineered to provide constitutive, high-level expression of the full-length **Zebrafish (*Danio rerio*) Peroxisome Proliferator-Activated Receptor Gamma** (NR1C3), a ligand-dependent transcription factor referred to herein as **zfPPAR $\gamma$** .

INDIGO's Reporter Cells include the luciferase reporter gene functionally linked to a zfPPAR $\gamma$ -responsive promoter. Thus, quantifying changes in luciferase expression in the treated reporter cells provides a sensitive surrogate measure of the changes in zfPPAR $\gamma$  activity. The principal application of this functional assay is in the screening of test samples to quantify any functional bioactivity that they may exert against zebrafish PPAR $\gamma$ . In particular, zebrafish reporter assays are used in the monitoring of environmental samples for the presence of bio-active chemical pollutants.

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 zfPPAR $\gamma$  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 assays 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 Assays 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.

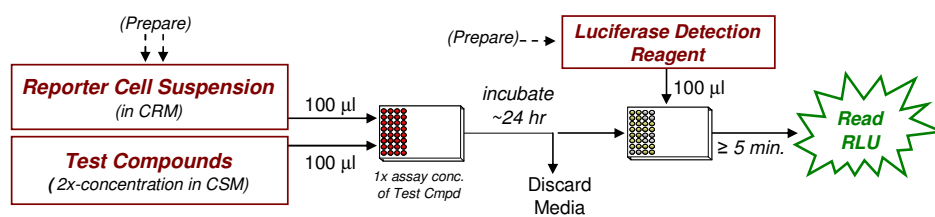
### ▪ Preparation of Test Compounds ▪

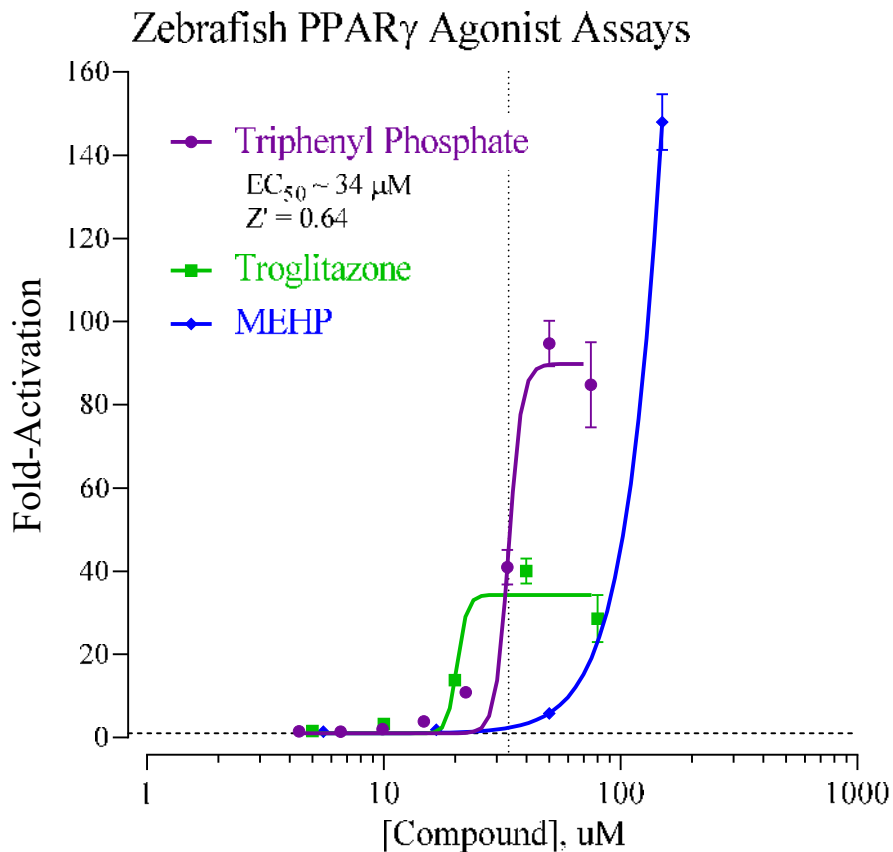
Most commonly, test compounds are solvated at high-concentration in DMSO, and these are stored as master stocks. Master stocks are then diluted to appropriate working concentrations immediately prior to setting up the assay. Users are advised to dilute test compounds to 2x-concentration stocks using **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.

### ▪ 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 2a. Agonist dose-response analyses of the Zebrafish PPAR $\gamma$  Assay.**

Validation of the zfPPAR $\gamma$  Assay was performed following the protocol described in this Technical Manual, using the reference agonists Triphenyl Phosphate (TPP; provided), Troglitazone, and Mono-2-ethylhexyl phthalate (MEHP). zfPPAR $\gamma$  Reporter Cells were treated with concentrations of TPP as described in Appendix 1. Luminescence was quantified using a plate-reading luminometer. Values of average Relative Light Units (RLU; average of  $n = 4$ ), standard deviation (SD), Fold-Activation and Coefficient of Variation (%CV) were determined.  $Z'$  values were calculated as described by Zhang, *et al.* (1999)<sup>1</sup>. Non-linear regression analyses were performed and  $EC_{50}$  values determined using GraphPad Prism software.

<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.

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

## II. Product Components & Storage Conditions

This Zebrafish PPAR $\gamma$  assay kit contains materials to perform three distinct groups of assays in a 96-well plate format. Reagents are configured so that each group will comprise 32 assays. If desired, however, reagents may be combined to perform either 64 or 96 assays.

**Reporter cells are temperature sensitive! To ensure maximal viability the tube of cells must be maintained at -80°C until immediately prior to the rapid-thaw procedure described in Step 3 of this protocol.**

Assay kits are shipped on dry ice. Upon receipt of the kit transfer it to -80°C storage. If you wish to first inspect and inventory the individual kit components be sure to first transfer and submerge the tube of cells in dry ice.

The aliquot of Reporter Cells is provided as a single-use reagent. Once thawed, reporter cells can NOT be refrozen, nor can they be maintained in extended culture with any hope of retaining downstream assay performance. Therefore, extra volumes of these reagents should be discarded after assay setup.

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

<u>Kit Component</u>	<u>Amount</u>	<u>Storage Temp.</u>
▪ zfPPAR $\gamma$ Reporter Cells	3 x 0.60 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
▪ Triphenyl Phosphate, 60 mM (TPP, in DMSO) (reference agonist for zfPPAR $\gamma$ )	1 x 30 $\mu$ L	-20°C
▪ Detection Substrate	3 x 2.0 mL	<b>-80°C</b>
▪ Detection Buffer	3 x 2.0 mL	-20°C
▪ Plate frame	1	ambient
▪ Snap-in, 8-well strips (white, sterile, cell-culture ready)	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

- dry ice bucket (*Step 3*)
- 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-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* sterilized 96 deep-well blocks (*e.g.*, Axygen Scientific, #P-2ML-SQ-C-S), *or* appropriate similar vessel for generating dilution series of reference and test compound(s).
- *Optional*: antagonist reference compound
- *Optional*: clear 96-well assay plate, sterile, cell culture treated, for viewing cells on *Day 2*.

**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 9-14* 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 between EC<sub>50</sub> – EC<sub>85</sub>) of a known agonist AND the test compound(s) to be evaluated for antagonist activity. This zfPPAR $\gamma$  assay kit includes a 60 mM stock solution of **TPP**, an agonist of zfPPAR $\gamma$  that may be used to setup antagonist-mode assays. 40  $\mu$ M TPP typically approximates EC<sub>70</sub> in this reporter assay. Hence, it presents a suitable assay concentration of agonist to be used when screening test compounds for inhibitory activity.

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. Note that, 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. **APPENDIX 1** provides a dilution scheme that may be used as a guide when preparing cell suspension supplemented with a desired 2x-concentration of 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** (first see *Note 5.3*): 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 zfPPAR $\gamma$  Assay kit includes a 60 mM stock solution of **TPP**, a reference agonist of zfPPAR $\gamma$ . The following 7-point treatment series, with concentrations presented in 1.5-fold decrements, provides a complete dose-response: 60, 40, 26.7, 17.8, 11.9, 7.9, and 5.27  $\mu$ M (final assay concentrations). Always include 'no treatment' control wells. **APPENDIX 1** provides an example for generating such a dilution series.

**3.) Rapid Thaw of the Reporter Cells:** *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 and place them directly into dry ice to transport the cells to the laminar flow hood: 1 tube for 32 assay wells, 2 tubes for 64 assay wells, and 3 tubes for 96 assay wells. When ready to begin, place the tube of reporter cells into a rack and, *without delay*, perform a rapid thaw of the frozen cells by transferring a 3.0 ml volume of 37°C CRM into each tube of frozen cells. Recap the tube of Reporter Cells and immediately place it in a 37°C water bath for 5 - 10 minutes. If only one tube of reporter cells is thawed (32 assays), the resulting volume of cell suspension will be 3.6 ml.

*Third*, during the 5 - 10 minutes incubation period, 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. Sanitize the outside surface of the tube with a 70% alcohol swab, then transfer it into the cell culture hood.

5.) *a. Agonist-mode assays.* Gently invert the tube of Reporter Cells several times to disperse cell aggregates and gain a homogenous cell suspension. Without delay, dispense 100  $\mu$ l of cell suspension into each well 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 a homogenous cell suspension. Supplement the bulk suspension of Reporter Cells with the desired 2x-concentration of reference agonist (refer to "A word about antagonist-mode assay setup", pg. 7). Dispense 100  $\mu$ l 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 wish to examine the reporter cells using a microscope. If so, the extra volume of cell suspension provided with each kit may be dispensed (100  $\mu$ l/well) into a clear 96-well cell culture treated assay plate, followed by 100  $\mu$ l/well of CSM. Incubated overnight in identical manner to those reporter cells contained in the white assay plate.

*NOTE 5.3:* Some users find it more convenient to first plate the reporter cells and then prepare their test compound dilutions. That strategy works equally well. Once plated, cells may be placed in an incubator for up to 3 hours before proceeding to *Step 6*.

6.) Dispense 100  $\mu$ l 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 ( $\geq 85\%$ ) 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 vials 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 receptor activity, remove **Detection Substrate** and **Detection Buffer** from the refrigerator and place them in a low-light area so that they may equilibrate to room temperature.

*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:* To read 32 assay wells, transfer the entire volume of 1 vial of Detection Buffer into 1 vial of Detection Substrate, thereby generating a 4 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  $\mu$ l of **LDR** to each well of the assay plate. Allow the assay plate to rest at room temperature for at least 5 minutes. Do not shake the assay plate during this period.

14.) Quantify luminescence.

## V. Related Products

<i>Product No.</i>	<i>Product Descriptions</i>
<b>Human PPAR<math>\gamma</math> Assay Products</b>	
IB00101-32	Human PPAR $\gamma$ Reporter Assay System 3x 32 assays in 8-well strips (96-well plate format)
IB00101	Human PPAR $\gamma$ Reporter Assay System 1x 96-well format assay
IB00102	Human PPAR $\gamma$ Reporter Assay System 1x 384-well format assays
<b>Panel of Human PPAR Assays</b>	
IB00131-32P	PANEL_Human PPAR $\gamma$ , PPAR $\alpha$ and PPAR $\delta$ Reporter Assay 32 assays each in 8-well strips (96-well plate format)
<b>Mouse/Rat PPAR<math>\gamma</math> Assay Products</b>	
MR00101-32	Mouse/Rat PPAR $\gamma$ Reporter Assay System 3x 32 assays in 8-well strips (96-well plate format)
MR00101	Mouse/Rat PPAR $\gamma$ Reporter Assay System 1x 96-well format assay
MR00102	Mouse/Rat PPAR $\gamma$ Reporter Assay System 1x 384-well format assays
<b>Cynomolgus Monkey PPAR<math>\gamma</math> Assay Products</b>	
C00101-32	Cynomolgus Monkey PPAR $\gamma$ Reporter Assay System 3x 32 assays in 8-well strips (96-well plate format)
C00101	Cynomolgus Monkey PPAR $\gamma$ Reporter Assay System 1x 96-well format assay
<b>Zebrafish PPAR<math>\gamma</math> Assay Products</b>	
Z00101-32	Zebrafish PPAR $\gamma$ Reporter Assay System 3x 32 assays in 8-well strips (96-well plate format)
Z00101	Zebrafish Monkey PPAR $\gamma$ Reporter Assay System 1x 96-well format assay
Bulk volumes of assay reagents may be custom manufactured to accommodate any scale of HTS. Please Inquire.	

<b>LIVE Cell Multiplex (LCM) Assay</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 <b>5x bulk volume</b> to perform <b>480</b> Live Cell Assays performed in 5 x 96-well assay plates
LCM-10	Reagent in <b>10x bulk volume</b> to perform <b>960</b> Live Cell Assays performed in 10 x 96-well assay plates
<b>INDIGlo Luciferase Detection Reagent</b>	
LDR-10, -25, -50, -500	INDIGlo Luciferase Detection Reagents in 10 mL, 25 mL, 50 mL, and 500 mL volumes

Please refer to INDIGO Biosciences' website for updated product offerings.

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

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

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“CryoMite” is a Trademark <sup>TM</sup> of INDIGO Biosciences, Inc. (State College, PA, USA).

Product prices, availability, specifications, claims and technical protocols are subject to change without prior notice. The printed Technical Manual provided in the kit box will always be the most currently updated version.

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## APPENDIX 1

Example scheme for the serial dilution of Triphenyl phosphate (TPP) reference agonist, and the setup of a zfPPAR $\gamma$  dose-response assay.

