



Human Retinoic Acid Receptor Alpha
(NR1B1, RARA, RAR α)
Reporter Assay System

3x 32 Assays in 96-well Format
Product # IB02201-32

■

Technical Manual
(*version 6.0*)

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I. Description

▪ **The Assay System** ▪

This nuclear receptor assay system utilizes proprietary non-human cells engineered to provide constitutive, high-level expression of the **Human Retinoic Acid Receptor, Alpha (NR1B1)**, a ligand-dependent transcription factor commonly referred to as RARA or **RAR α** .

INDIGO's Reporter Cells include the luciferase reporter gene functionally linked to a RAR α -responsive promoter. Thus, quantifying changes in luciferase expression in the treated reporter cells provides a sensitive surrogate measure of the changes in RAR α activity. The principle application of this reporter assay system is in the screening of test samples to quantify any functional activity, either agonist or antagonist, that they may exert against human RAR α .

RAR α 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 RAR α 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⁺²-dependent reaction that consumes O₂ and ATP as co-substrates, and yields as products oxyluciferin, AMP, PP_i, CO₂, 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.

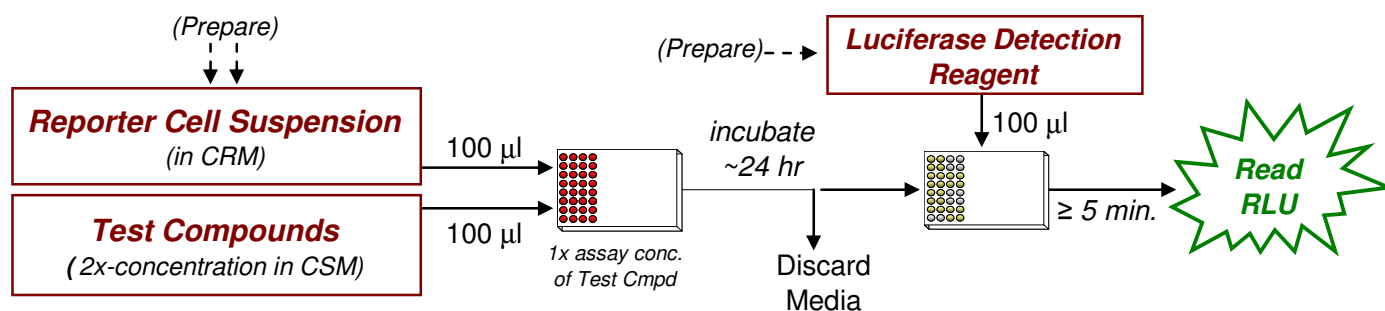
▪ Preparation of Test Compounds ▪

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 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.



▪ Assay Performance ▪

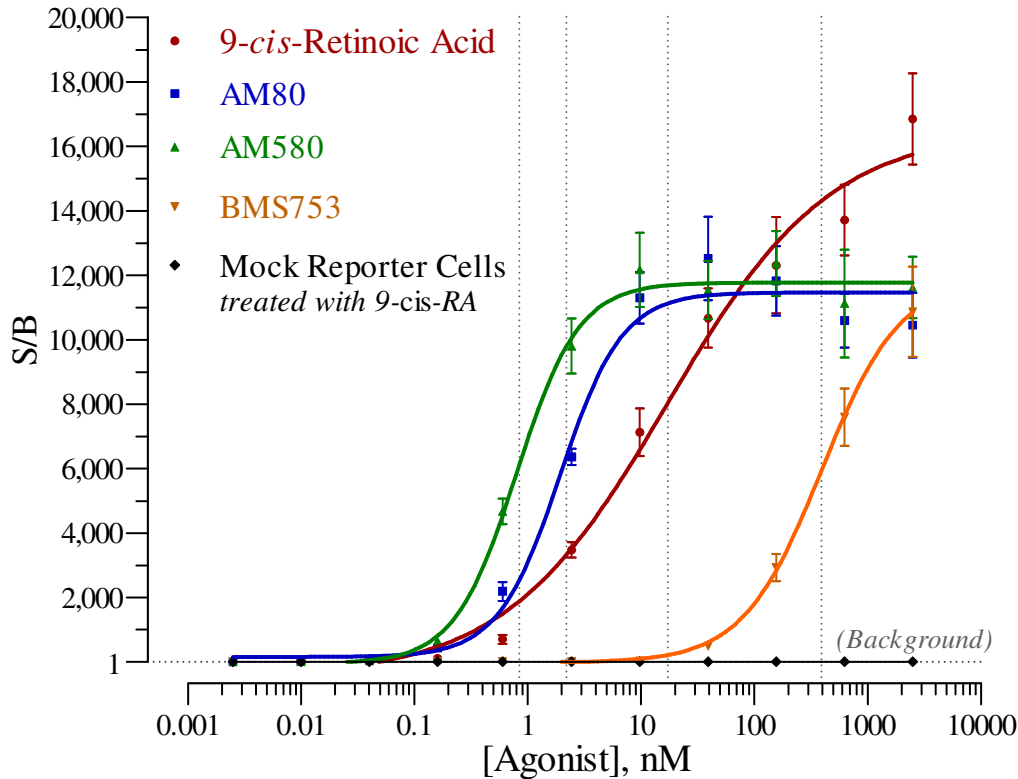


Figure 2a. Agonist dose-response analyses of the RAR α Assay.

Validation of the RAR α Assay was performed using manual dispensing and following the protocol described in this Technical Manual, using reference agonists 9-*cis*-Retinoic Acid (9-*cis*-RA; provided), AM80 (Tocris), AM580 (Tocris) and BMS753 (Tocris). In addition, to assess the level of background signal contributed by non-specific factors that may cause activation of the luciferase reporter gene, “Mock” reporter cells were specially prepared to contain only the luciferase reporter vector (mock reporter cells are not provided with assay kits). Final assay concentrations of agonist treatment media ranged between 2.5 μ M and 2.5 pM, and included a 'no-treatment' control ($n \geq 6$ / treatment; highest [DMSO] $\leq 0.025\%$ *f.c.*. APPENDIX 1 describes an abbreviated 8-point dilution scheme.) Mock Reporter Cells were identically treated with 9-*cis*-RA. Luminescence was quantified using a GloMax-Multi+ plate-reading luminometer (Promega Corp.). Average Relative Light Units (RLU) and their respective values of Standard Deviation (SD), Coefficient of Variation (CV), and Signal-to-Background (S/B) were determined for each treatment concentration. Z' values were calculated as described by Zhang, *et al.* (1999)¹. Non-linear regression analyses were performed and EC₅₀ values determined using GraphPad Prism software.

RESULTS: RAR α reporter cells treated with 2,500 nM 9-*cis*-RA yielded an average RLU value with CV=8.4%, S/B ~ 16,800, and a corresponding Z' = 0.75. Mock reporter cells treated with 9-*cis*-RA demonstrate no significant background luminescence ($\leq 0.006\%$ that of the reporter cells at EC_{Max}). Thus, luminescence results strictly through ligand-dependent activation of the human RAR α expressed in these reporter cells.

¹ 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.

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

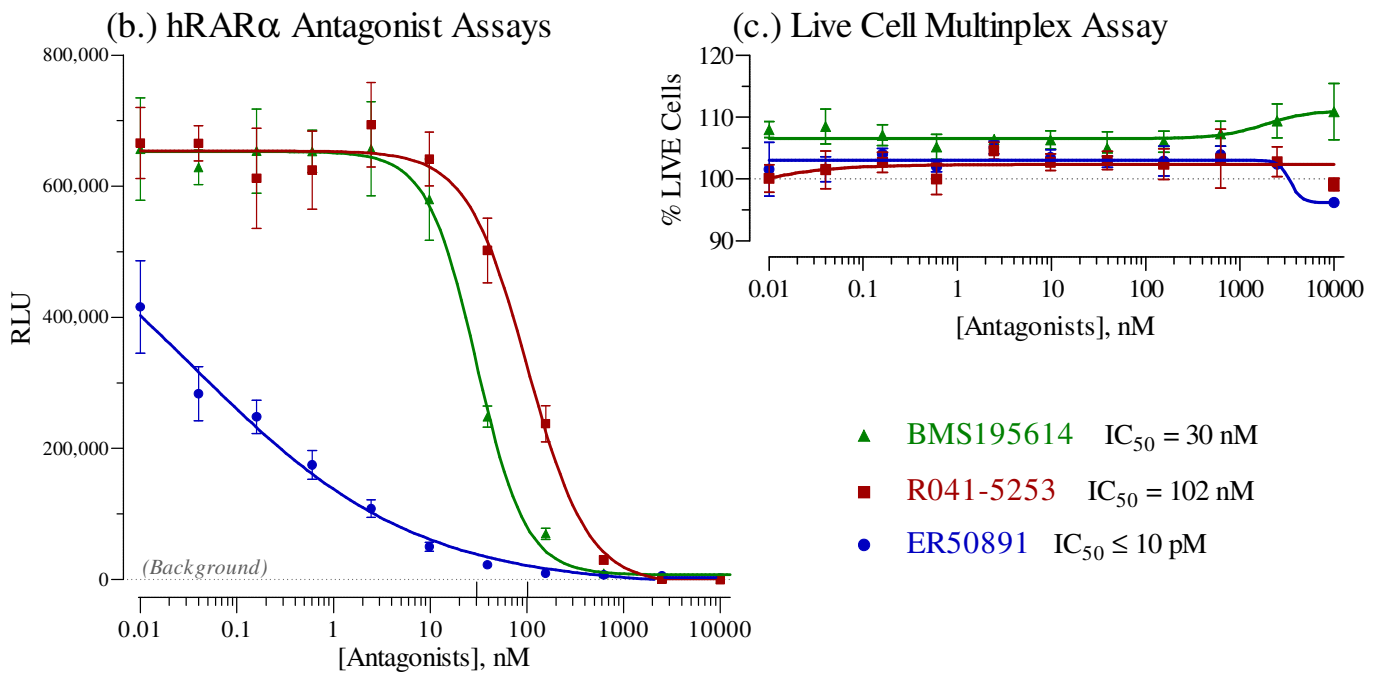


Figure 2b. Validation of RAR α antagonist dose-responses performed in combination with INDIGO's Live Cell Multiplex Assay.

RAR α antagonist assays were performed using BMS195614, R041-5253, and ER50891 (all from Tocris). To confirm that the observed drop in RLU values resulted from receptor inhibition, not induced cell death, the relative numbers of live cells in each assay well were determined at the end of the treatment period using INDIGO's Live Cell Multiplex (LCM) Assay (#LCM-01).

Final assay concentrations of the respective antagonists ranged between 10 μ M and 10 pM, including a 'no antagonist' control ($n \geq 6$ per treatment; highest [DMSO] $\leq 0.1\%$ *f.c.*). Each treatment also contained 15 nM (approximating EC₅₀) 9-*cis*-RA as challenge agonist. Assay plates were incubated for 23 hrs, then processed according to the LCM Assay protocol to quantify relative numbers of live cells per treatment condition. Plates were then further processed to quantify RAR α activity for each treatment condition.

Results: BMS195614, R041-5253, and ER50891 all caused dose-dependent reduction in RLU values. The LCM Assay reveals no significant variance in the numbers of live cells per assay well, up to the maximum treatment concentration of 10 μ M. Hence, the observed reduction in RLU values can be attributed to dose-dependent inhibition of RAR α activity, and *not* to induced cell death.

NOTE: RLU values will vary slightly between different production lots of reporter cells, and can vary *significantly* between different makes and models of luminometers.

II. Product Components & Storage Conditions

This Human RAR α Reporter Assay System 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.

The individual aliquots of Reporter Cells are provided as single-use reagents. 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.

<i><u>Kit Components</u></i>	<i><u>Amount</u></i>	<i><u>Storage Temp.</u></i>
▪ RAR α Reporter Cells	3 x 0.60 mL	-80°C
▪ Cell Recovery Medium (CRM)	1 x 10.5 mL	-20°C
▪ Compound Screening Medium (CSM)	1 x 35 mL	-20°C
▪ 9- <i>cis</i> -Retinoic Acid, 10 mM (in DMSO) (reference agonist for RAR α)	1 x 30 μ L	-20°C
▪ Detection Substrate	3 x 2.0 mL	-80°C
▪ Detection Buffer	3 x 2.0 mL	-80°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**
- cell culture-rated laminar flow hood.
 - 37°C, humidified 5% CO₂ 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.

▪ A word about Antagonist-mode assay setup ▪

Receptor inhibition assays expose the Reporter Cells to a constant, sub-maximal concentration (typically between EC₅₀ – EC₈₅) of a known agonist AND the test compound(s) to be evaluated for antagonist activity. This RAR α Reporter Assay System kit includes a 10 mM stock solution of **9-*cis*-Retinoic Acid**, an agonist of RAR α that may be used to setup antagonist-mode assays. 20 nM 9-*cis*-Retinoic Acid typically approximates EC₅₀ in this reporter assay. Hence, it presents a reasonable assay concentration of agonist to be used when screening test compounds for inhibitory 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. Note that, in *Step 6*, 100 μ l of treatment media is combined with 100 μ 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 proper aseptic technique.

- 1) Remove **Cell Recovery Medium (CRM)** and **Compound Screening Medium (CSM)** from freezer storage and thaw.
- **CRM** should be thawed and equilibrated to 37°C using a water bath. CRM pre-warmed to 37°C is required in *Step 3*.
 - **CSM** may be thawed in a 37°C water bath, but should then be allowed to equilibrate to room temperature.

- 2.) Prepare Test Compound(s) and Reference Compound stocks to be screened for *Agonist* or *Antagonist* activities.
- The final concentration of 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). Use **CSM** to prepare the appropriate dilution series. Plan dilution schemes carefully. This assay kit provides 35 ml of CSM.

This RAR α Reporter Assay System kit includes a 10 mM stock solution of the reference agonist **9-cis-Retinoic Acid**. The following 8-point treatment series, with concentrations presented in 4-fold decrements, provides a suitable dose-response: 2500, 625, 156, 39.1, 9.77, 2.44, 0.610, and 0.153 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, sanitize the outside with a 70% ethanol swab, then place it in the cell-culture hood.

Second, retrieve **Reporter Cells** from -80°C storage. Perform a *rapid thaw* of the frozen cells by transferring a 3.0 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 3 - 10 minutes. The resulting volume of cell suspension will be 3.6 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. 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.** Invert the tube of Reporter Cells several times to disperse cell aggregates and gain an homogenous cell suspension. Without delay, dispense 100 μ l of cell suspension into each well of the 96-well Assay Plate.

~ or ~

b. Antagonist-mode assays. Invert the tube of Reporter Cells several times to disperse any cell aggregates, and to gain an 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. 8). Dispense 100 μ l of cell suspension into each well of the 96-well 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 into a clear 96-well assay plate, treated +/- test compounds as desired, and incubated overnight in identical manner to those reporter cells contained in the white assay plate.

6.) Dispense 100 μ l of 2x-concentration treatment media (prepared as described in *Step 2*) into appropriate wells of the assay plate.

7.) Replace the plate's lid and transfer it into a 37°C, humidified 5% CO₂ incubator for 22 - 24 hours.

NOTE: Ensure a high-humidity ($\geq 90\%$) 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 -80°C 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 RAR α 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. 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.) Turn on the luminometer. Set the instrument to perform a single 5 second “plate shake” prior to reading the first assay well. Read time may be 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 the assay plate from the incubator. Remove the plate’s lid. 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 *via* a sweeping downward movement is NOT advised. 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 μ l per well of **LDR** to each well of the assay plate.
- 14.) 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.
- 15.) Between 5 - 90 minutes after adding LDR, place the assay plate in the luminometer and quantify luminescence.

V. Related Products

RARα Assay Products	
<i>Product No.</i>	<i>Product Descriptions</i>
IB02201-32	Human RAR α Reporter Assay System 3x 32 assays in 96-well format
IB02201	Human RAR α Reporter Assay System 1x 96-well format assay
IB02202	Human RAR α 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.	

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

Products commercialized by INDIGO Biosciences, Inc. are for RESEARCH PURPOSES ONLY – not for therapeutic or diagnostic use in humans. Other applications of this product may require licenses from others, including one or more of the institutions listed below.

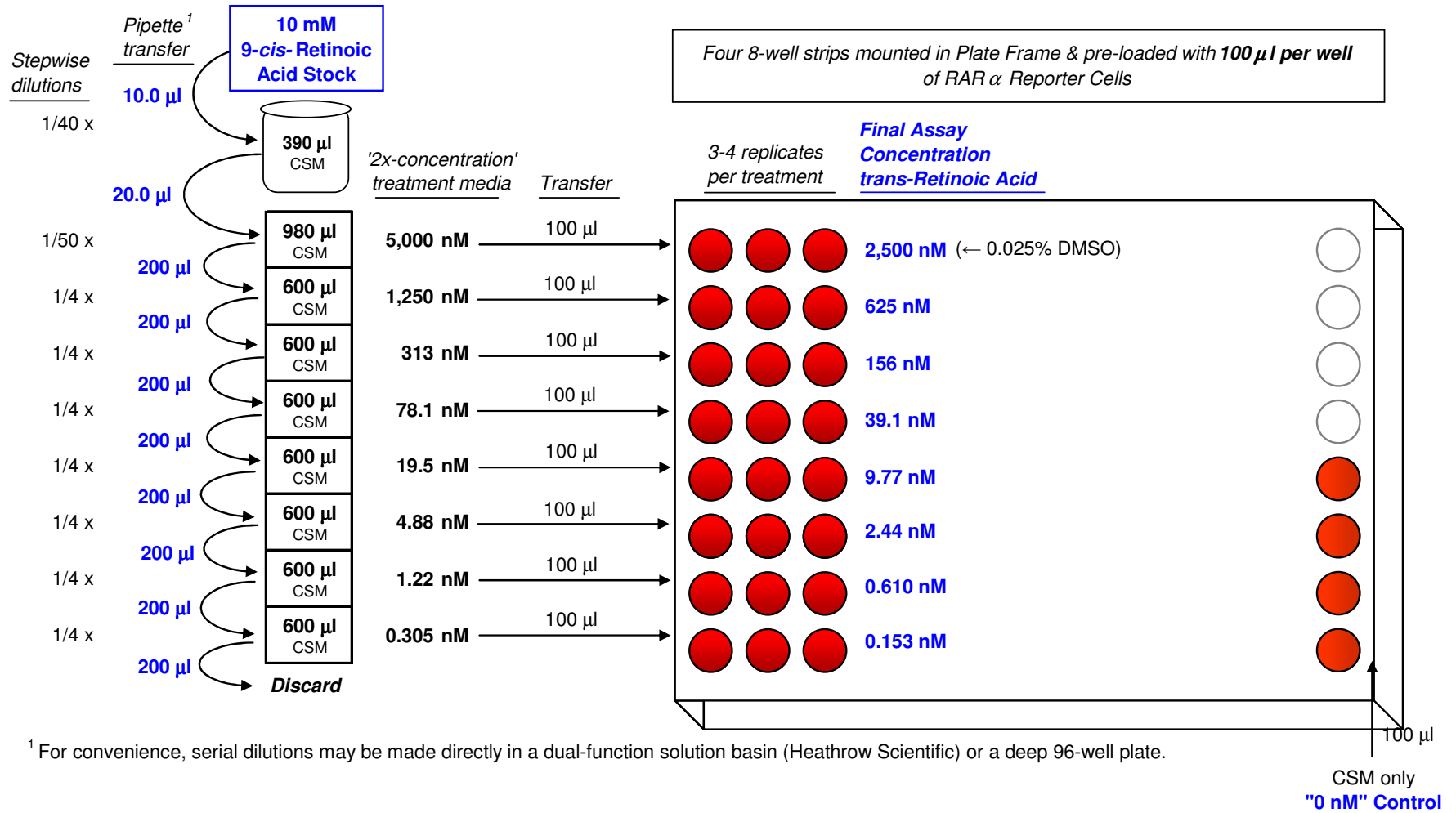
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APPENDIX 1

Example scheme for the serial dilution of 9-*cis*-Retinoic Acid reference agonist, and the setup of an RAR α dose-response assay.



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



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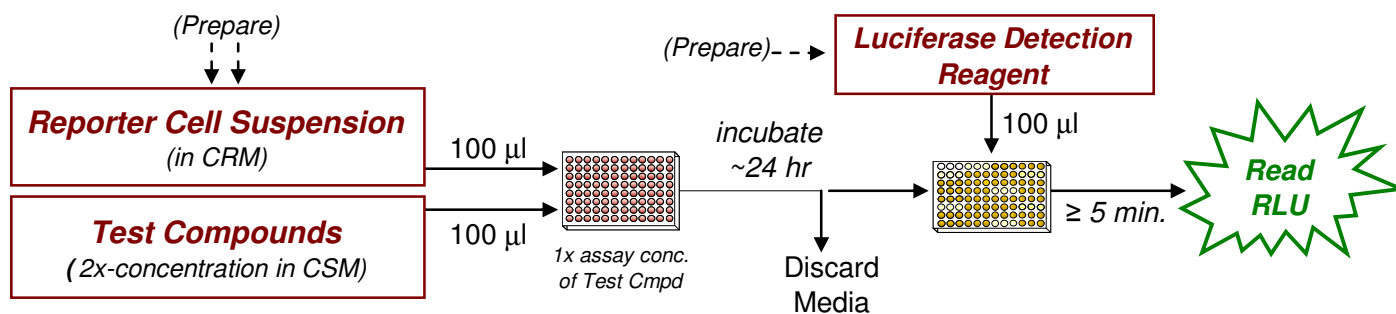
▪ Considerations for Automated Dispensing ▪

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.

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



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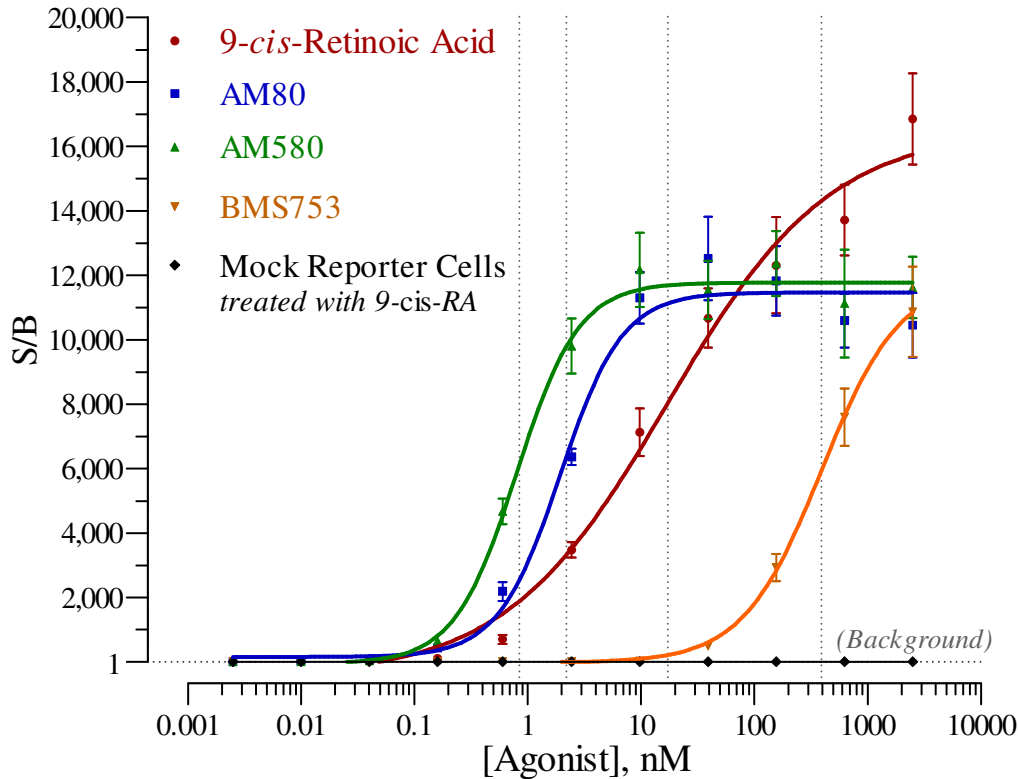


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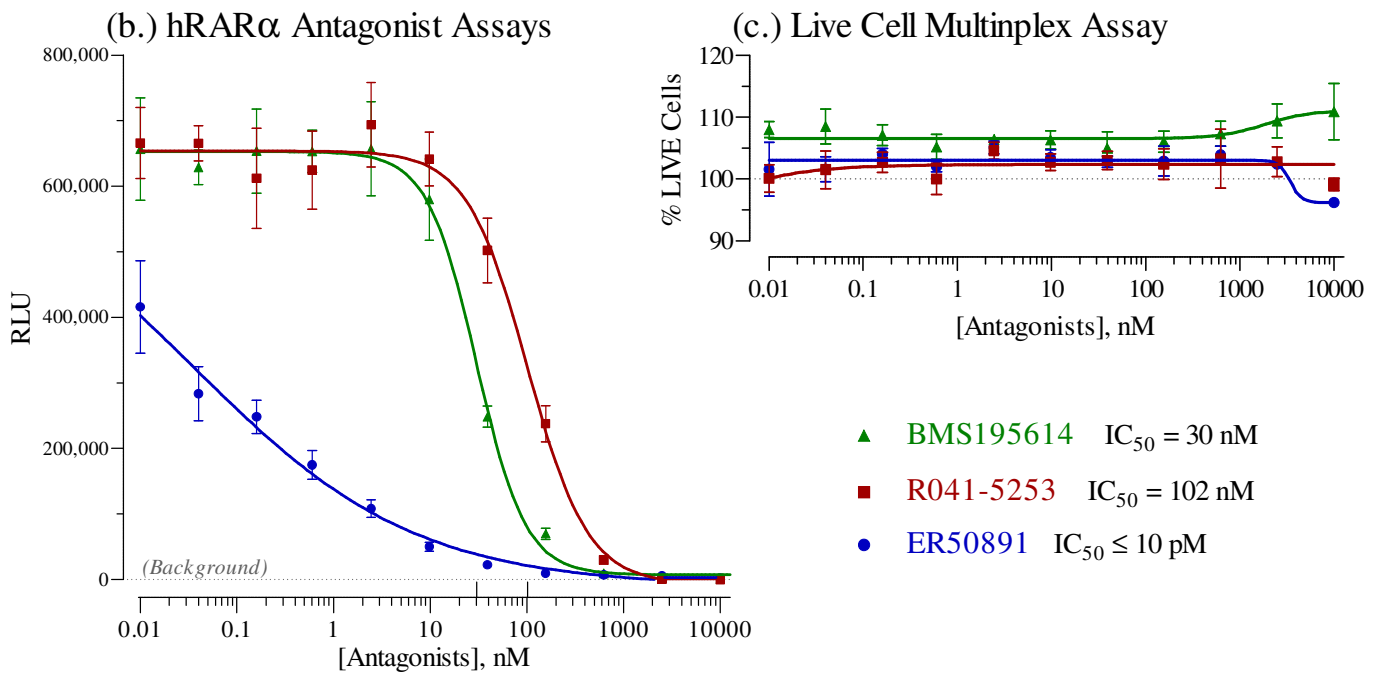


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II. Product Components & Storage Conditions

This Human RAR α Reporter Assay System contains materials to perform assays in a single 96-well assay plate.

The aliquot of RAR α 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><i>Kit Components</i></u>	<u><i>Amount</i></u>	<u><i>Storage Temp.</i></u>
▪ RAR α Reporter Cells	1 x 2.0 mL	-80°C
▪ Cell Recovery Medium (CRM)	1 x 10.5 mL	-20°C
▪ Compound Screening Medium (CSM)	1 x 35 mL	-20°C
▪ 9- <i>cis</i> -Retinoic Acid, 10 mM (in DMSO) (reference agonist for RAR α)	1 x 30 μ L	-20°C
▪ Detection Substrate	1 x 6.0 mL	-80°C
▪ Detection Buffer	1 x 6.0 mL	-80°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% CO₂ 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.

▪ A word about Antagonist-mode assay setup ▪

Receptor inhibition assays expose the Reporter Cells to a constant, sub-maximal concentration (typically between EC₅₀ – EC₈₅) of a known agonist AND the test compound(s) to be evaluated for antagonist activity. This RAR α Reporter Assay System kit includes a 10 mM stock solution of **9-*cis*-Retinoic Acid**, an agonist of RAR α that may be used to setup antagonist-mode assays. 20 nM 9-*cis*-Retinoic Acid typically approximates EC₅₀ in this reporter assay. Hence, it presents a reasonable assay concentration of agonist to be used when screening test compounds for inhibitory 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. Note that, in *Step 6*, 100 μ l of treatment media is combined with 100 μ 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 proper aseptic technique.

- 1) Remove **Cell Recovery Medium (CRM)** and **Compound Screening Medium (CSM)** from freezer storage and thaw.
- **CRM** should be thawed and equilibrated to 37°C using a water bath. CRM pre-warmed to 37°C is required in *Step 3*.
 - **CSM** may be thawed in a 37°C water bath, but should then be allowed to equilibrate to room temperature.

- 2.) Prepare Test Compound(s) and Reference Compound stocks to be screened for *Agonist* or *Antagonist* activities.
- The final concentration of 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). Use **CSM** to prepare the appropriate dilution series. Plan dilution schemes carefully. This assay kit provides 35 ml of CSM.

This RAR α Reporter Assay System kit includes a 10 mM stock solution of **9-cis-Retinoic Acid**, a reference agonist of RAR α . We find the following 8-point treatment series, with concentrations presented in 4-fold decrements, provides a suitable dose-response: 2500, 625, 156, 39.1, 9.77, 2.44, 0.610, and 0.153 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, sanitize the outside with a 70% ethanol swab, then place it in the cell-culture hood.

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. 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.** Invert the tube of Reporter Cells several times to disperse cell aggregates and gain an homogenous cell suspension. Without delay, dispense 100 μ l of cell suspension into each well of the 96-well Assay Plate.

~ or ~

b. Antagonist-mode assays. Invert the tube of Reporter Cells several times to disperse any cell aggregates, and to gain an 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 μ l of cell suspension into each well of the 96-well 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 into a clear 96-well assay plate, treated +/- test compounds as desired, and incubated overnight in identical manner to those reporter cells contained in the white assay plate.

6.) Dispense 100 μ l of 2x-concentration treatment media (prepared as described in *Step 2*) into appropriate wells of the assay plate.

7.) Replace the plate's lid and transfer it into a 37°C, humidified 5% CO₂ incubator for 22 - 24 hours.

NOTE: Ensure a high-humidity ($\geq 90\%$) 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 -80°C 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 RAR α 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. 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.) Turn on the luminometer. Set the instrument to perform a single 5 second “plate shake” prior to reading the first assay well. Read time may be 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, retrieve the assay plate from the incubator. Remove the plate’s lid and 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 μ l of **LDR** to each well of the assay plate.
- 14.) 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.
- 15.) Between 5 - 90 minutes after adding LDR, place the assay plate in the luminometer and quantify luminescence.

V. Related Products

RARα Assay Products	
<i>Product No.</i>	<i>Product Descriptions</i>
IB02201-32	Human RAR α Reporter Assay System 3x 32 assays in 96-well format
IB02201	Human RAR α Reporter Assay System 1x 96-well format assay
IB02202	Human RAR α 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.	

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

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APPENDIX 1

Example scheme for the serial dilution of 9-*cis*-Retinoic Acid reference agonist, and the setup of an RAR α dose-response assay.

