# human Serotonin 5-HT$_{1A}$ Receptor Cell Line

Product No.: ES-310-C

Lot No.: 1826798

## Material Provided

| | |
|---|---|
| Cells: | 2 x 1 mL frozen aliquot (ES-310-CV) |
| Format: | ~2.5 x $10^6$ cells /mL in freezing medium |

## Product Information

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|---|---|
| Cellular Background: | CHO-K1 |
| Cell Line Development: | Our proprietary bicistronic expression plasmid containing the sequence coding for the human Serotonin 5-HT$_{1A}$ receptor was transfected in CHO-K1 cells. Geneticin-resistant clones were obtained by limit dilution and compared for receptor expression levels using a radioligand binding assay. The clone with the highest receptor expression level was selected for characterization in binding and functional assays. |
| DNA Sequence: | Identical to coding sequence of GenBank M83181.1. with the exception of a silent mutation in codon # 117 (GTG becomes GTC, both coding for a Val). |
| Corresponding Protein Sequence: | Identical to GenBank NP_000515.2 |
| Receptor expression level ($B_{max}$): | Estimated to be 3.7 ± 2.3 pmol/mg protein, using [$^3$H] 8-OH-DPAT |
| $K_d$ for the above radioligand: | 0.85 ± 0.49 nM |
| Shipping Conditions: | Shipped on dry ice. Please ensure dry ice is still present in the package upon receipt or contact customer support. |
| Storage Conditions: | Store in liquid nitrogen (vapor phase) immediately upon receipt. |

## Quality Control

The $EC_{50}$ for a reference agonist was determined in a LANCE *Ultra* cAMP assay performed on an EnVision® instrument. A mycoplasma test was performed using MycoAlert® (Lonza) mycoplasma detection kit. We certify that these results meet our quality release criteria.

| | |
|---|---|
| 5-Carboxamidotriptamine (5-CT) ($EC_{50}$): | 0.74 nM |
| Stability: | Cells were kept in continuous culture for at least 60 days and showed no decrease of receptor expression level in a saturation binding assay (stable $B_{max}$ and $K_d$). |
| Mycoplasma: | This cell line tested negative for mycoplasma. |

## Assay Procedures

We have shown for many of our GPCR cell lines that freshly thawed cells respond with the same pharmacology as cultured cells. All of our products validated in this way are available as frozen ready-to-use cells in our catalogue. This demonstrates that cells can be prepared and frozen in advance of a screening campaign simplifying assay logistics.

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## Recommended Cell Culture Conditions (CHO-K1)

- The recommended media catalogue number and supplier reference information are listed in this Product Technical Data Sheet (last page). Media composition is specifically defined for each cell type and receptor expression selection. The use of incorrect media or component substitutions can lead to reduced cell viability, growth issues and/or altered receptor expression.
- Cells undergo major stress upon thawing, and need to adapt to their new environment which may initially affect cell adherence and growth rates. The initial recovery of the cells, and initial doubling time, will vary from laboratory to laboratory, reflecting differences in the origin of culture media and serum, and differences in methodology used within each laboratory.
- For the initial period of cell growth (i.e. until cells have reached Log-phase, typically 4-10 days), we strongly recommend removal of the antibiotics (G418, Zeocin™, Puromycin, Blasticidin, Hygromycin, Penicillin and Streptomycin) from the culture media. Immediately after thawing, cells may be more permeable to antibiotics, and a higher intracellular antibiotic concentration may result as a consequence. Antibiotics should be re-introduced when cells have recovered from the thawing stress.

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|---|---|
| Growth Medium: | Advanced DMEM/F12, 1% FBS dialyzed, 4 mM L-Glutamine, 0.4 mg/ml Geneticin (receptor expression selection). |
| Freezing Medium: | Advanced DMEM/F12, 1% FBS dialyzed, 4 mM L-Glutamine, with 10% DMSO, without selection agents. |

Thawing Cells: Using appropriate personal protective equipment, rapidly place the frozen aliquot in a 37°C water bath (do not submerge) and agitate until its content is thawed completely. Immediately remove from water bath, spray aliquot with 70% ethanol and wipe excess. Under aseptic conditions using a sterile pipette, transfer content to a sterile centrifuge tube containing 10 mL growth medium without antibiotics, pre-warmed at 37°C, and centrifuge (150 x g, 5 min). Discard supernatant using a sterile pipette. Resuspend cell pellet in 10 mL of pre-warmed growth medium without antibiotics by pipetting up and down to break up any clumps, and transfer to an appropriate culture flask (e.g. T-25, T-75 or T-175, see recommended seeding density below). Cells are cultured as a monolayer at 37°C in a humidified atmosphere with 5% $CO_2$.

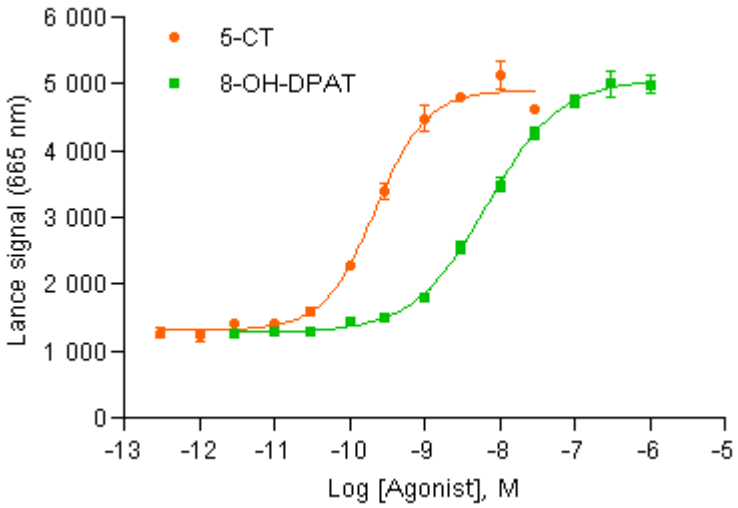
| | | |
|---|---|---|
| Recommended Seeding Density: | Thawing: | 15,000 – 33,000 cells/cm$^2$ |
| | Log-phase: | 11,000 – 15,000 cells/cm$^2$ |

Troubleshooting: Initial doubling time can vary between 18 and 96 hours (Average = 25 hours). If cells are still not adhering after 48 hours or grow very slowly, we recommend maintaining the cells in culture and not replacing the media before 5-6 days (cells secrete factors that can help with adherence and growth). If confluence is still <50% after 5-6 days, it is recommended that you replace the media with fresh media (without antibiotics). Do not passage the cells until they reach 80-90% confluence (Log-phase). If cells have not recovered after 10-12 days, please contact our Technical Support.

Culture Protocol: Under aseptic conditions, cells are grown to 80% confluence (Log-phase) and trypsinized (0.05% trypsin / 0.5 mM EDTA in calcium and magnesium-free PBS). See recommended seeding density for Log-phase above.

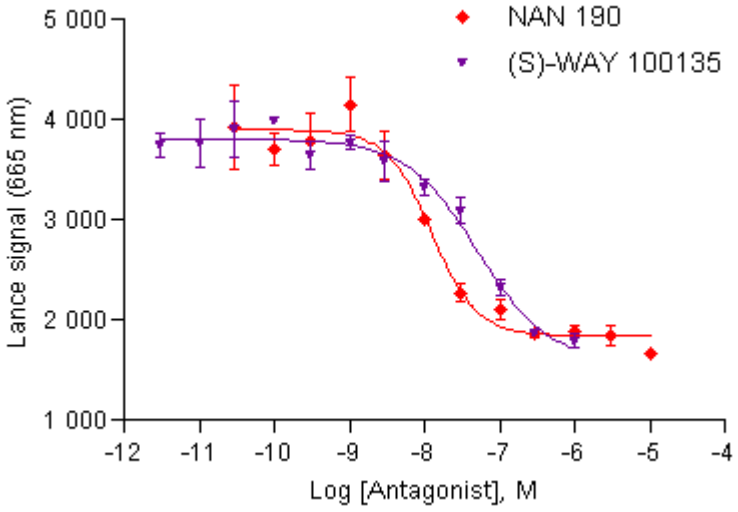
Banking Protocol: Cells are grown to 70-80% confluence (Log-phase). Under aseptic conditions, remove medium and rinse the flask with an appropriate volume of calcium and magnesium-free PBS (example 10 mL for T-175). Trypsinize (0.05% trypsin/0.5 mM EDTA in calcium and magnesium-free PBS) to detach cells (example 5 mL for T-175), let stand 5-10 min at 37°C. Add fresh, room temperature growth medium (without antibiotics) to stop trypsinization and dilute EDTA (example 10 mL for T-175). Transfer cells to a sterile centrifuge tube and centrifuge (150 x g, 5 min). Discard supernatant using a sterile pipette. Resuspend cell pellet in ice-cold freezing medium by pipetting up and down to break up any clumps. Count cells and rapidly aliquot at the selected cell density (e.g. 2.5 x $10^6$ cells/mL) in sterile polypropylene cryovials. Use appropriate material to ensure slow cooling (about -1°C/min) until -70°C. Transfer vials into a liquid nitrogen tank (vapor phase) for storage.

Typical Product Data –LANCE® *Ultra* cAMP Assay




| Agonist | $EC_{50}$ (M) |
|---|---|
| 5-CT | $2.2 \times 10^{-10}$ |
| 8-OH-DPAT | $6.7 \times 10^{-9}$ |

Figure 1. Agonist Response in LANCE® *Ultra* cAMP assay
An agonist dose-response experiment was performed in 384-well format using 2500 cells/well. Frozen cells were thawed and incubated for 30-min with 10 µM Forskolin (FK) and the indicated agonist concentrations. Time-resolved fluorescence was measured on an EnVision® instrument. Data from a representative experiment are shown.




| Antagonist | $IC_{50}$ (M) |
|---|---|
| WAY100,135 | $1.3 \times 10^{-8}$ |
| NAN190 | $5.0 \times 10^{-8}$ |

Figure 2. Antagonist Response in LANCE® *Ultra* cAMP assay
An antagonist dose-response experiment was performed in 384-well format using 2500 cells/well. Frozen cells were thawed and incubated for 30-min in the presence of 10 µM Forskolin (FK), a final concentration of 0.7 nM 5-CT, (corresponding to the $EC_{80}$), and the indicated antagonist concentrations. Time-resolved fluorescence was measured on an EnVision® instrument. Data from a representative experiment are shown.

Typical Product Data –Radioligand Binding Assay (Filtration)

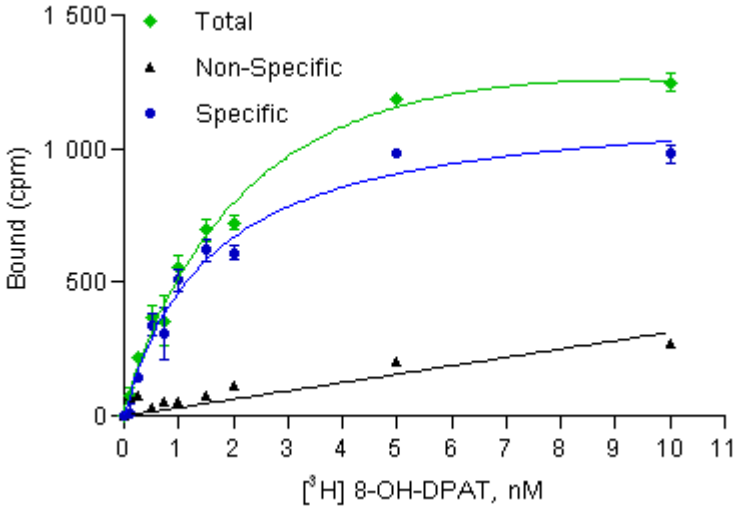
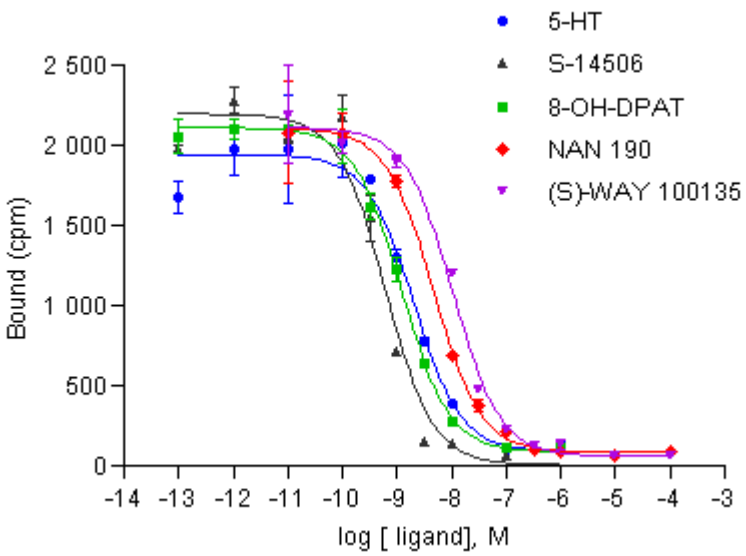


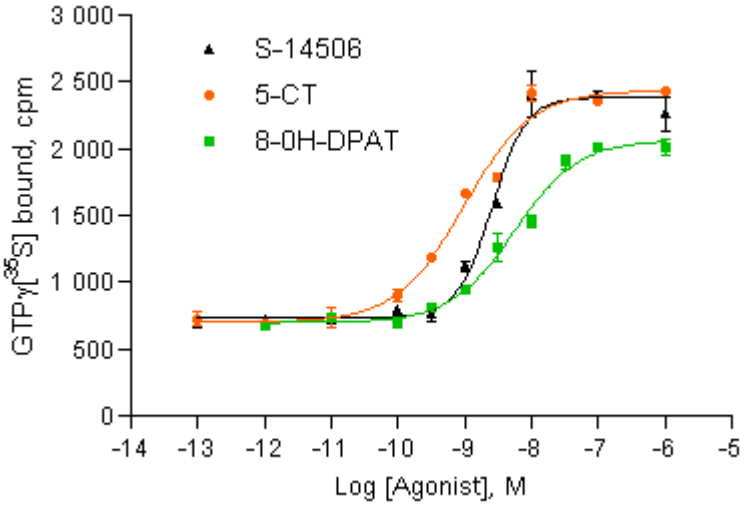

Figure 3: Saturation Binding Assay Curve (Filtration)
A saturation binding assay was performed in 96-well format using 2.5 µg membranes/well. Counts per minute (cpm) were measured on a TopCount® instrument. Data from a representative experiment are shown.




| Agonist / Antagonist | $IC_{50}$ (M) |
|---|---|
| 5-HT | $2.0 \times 10^{-9}$ |
| S-14506 | $6.1 \times 10^{-10}$ |
| 8-OH-DPAT | $1.2 \times 10^{-9}$ |
| NAN 190 | $4.6 \times 10^{-9}$ |
| (S)-WAY 100135 | $1.0 \times 10^{-8}$ |

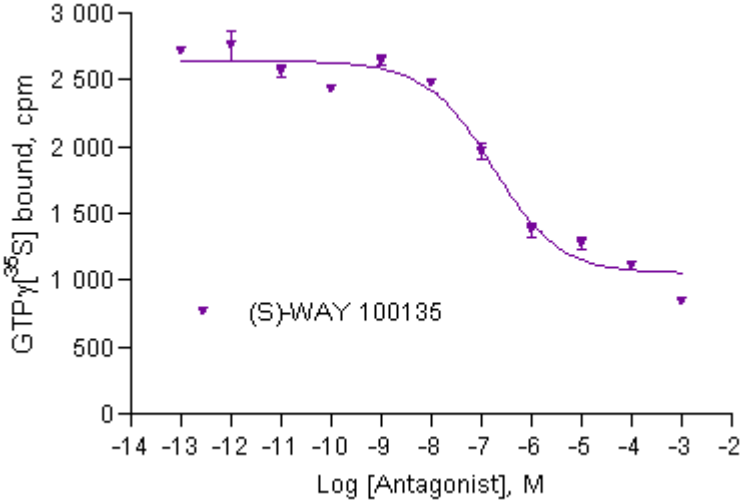
Figure 4: Competition Binding Assay Curve (Filtration)
A competition binding assay was performed in 96-well format using 2.5 µg membranes/well. Displacement of 1 nM [3H] 8-OH-DPAT was used. Counts per minute (cpm) were measured on a TopCount® instrument. Data from a representative experiment are shown.

Typical Product Data – GTPγS - SPA® Assay




| Agonist | $EC_{50}$ (M) |
|---|---|
| 5-CT | $9.7 \times 10^{-10}$ |
| 8-OH-DPAT | $5.5 \times 10^{-9}$ |
| S-14506 | $2.5 \times 10^{-9}$ |

Figure 5. Agonist Response in GTPγS - SPA® assay
An agonist dose-response scintillation proximity assay (SPA) was performed in 96-well format using 5 µg membranes/well. Counts per minute (cpm) were measured on a TopCount® instrument. Data from a representative experiment are shown.




| Antagonist | $IC_{50}$ (M) |
|---|---|
| (S)-WAY 100135 | $1.7 \times 10^{-7}$ |

Figure 6. Antagonist Response in GTPγS - SPA® assay
An antagonist dose-response scintillation proximity assay (SPA) was performed in 96-well format using 5 µg membranes/well. Counts per minute (cpm) were measured on a TopCount® instrument. Data from a representative experiment are shown.

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# LANCE® *Ultra* cAMP Assay Procedure

Stimulation Buffer: HBSS, 5 mM HEPES, 0.1 % Protease-free BSA, 0.5 mM IBMX, pH 7.4.

Cells/well: 2 500. For compounds not tested herein we recommend titrating the cells for optimal performance, i.e. 500-5 000 cells per assay point.

cAMP measurements were performed with the LANCE® *Ultra* cAMP 384 Kit (Revvity # TRF0262), according to the manufacturer instructions. Briefly:

Protocols for a 384-well white Optiplate (total assay volume of 20 µL):

| cAMP Standard curve | $G_s$ Agonist | $G_s$ Antagonist | $G_i$ Forskolin titration | $G_i$ Agonist | $G_i$ Antagonist |
|---|---|---|---|---|---|
| 5 µL cAMP Standard | 5 µL cell suspension | 5 µL cell suspension | 5 µL cell suspension | 5 µL cell suspension | 5 µL cell suspension |
| 5 µL Stimulation Buffer | 5 µL Agonist | 2.5 µL Agonist | 5 µL Forskolin | 2.5 µL Forskolin | 2.5 µL Forskolin/Agonist |
| - | - | 2.5 µL Antagonist | - | 2.5 µL Agonist | 2.5 µL Antagonist |
| Incubate 30 min at room temperature (optional step for cAMP Standard curve) | | | | | |
| 5 µL 4X Eu-cAMP Tracer Working Solution | | | | | |
| 5 µL 4X U*Light*-anti-cAMP Working Solution | | | | | |
| Incubate 1 h at room temperature | | | | | |
| Read on an EnVision® instrument. Remove microplate seal prior to reading | | | | | |

1. Cells in mid-log phase, grown in media without antibiotics for 18 hours prior to the experiment, were detached by gentle flushing with PBS-EDTA, recovered by centrifugation and resuspended in stimulation Assay Buffert the concentration of 6.0 x $10^5$ cells/mL.

2. Prepare the 4X Tracer Working Solution by making a 1/50 dilution of the Eu-cAMP stock solution in the cAMP Detection Buffer.

3. Prepare an U*Light*-anti-cAMP Intermediate Solution by making a 1/10 dilution of the U*Light*-anti-cAMP stock solution in cAMP Detection Buffer. Prepare the 4X U*Light*-anti-cAMP Working Solution by making a 1/30 dilution of the U*Light*-anti-cAMP intermediate solution in the cAMP Detection Buffer.

Notes:

For 96- and 1536-well formats, adjust proportionally the volume of each assay component in order to maintain the volume ratios for the 384-well format. Do not modify the Eu-cAMP and/or the U*Light*-anti-cAMP concentrations.

## Membrane Radioligand Binding Assay Procedure (Filtration)

*Note: The following are recommended assay conditions and may differ from the conditions used to generate the typical data shown in the above section.*

Assay Buffer: 50 mM Tris-HCl pH 7.4, 10 mM $MgSO_4$, 0.5 mM EDTA, 0.1% ascorbic acid

Wash Buffer: Tris-HCl 50 mM pH 7.4 (ice cold)

Radioligand: [$^3$H] LSD (Revvity # NET638)

Filters: Unifilter 96 GF/C (Revvity #6055690)

Membrane Binding Protocol:

Binding assays were performed in 550 µL total volume according to the following conditions. All dilutions are performed in assay buffer:

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|---|---|
| 1. Membrane dilution: | 2.5 µg of membranes per well, diluted in order to dispense 500 µL/well. Keep on ice. |
| 2. Assembly on ice (in 96 Deep well plate)<br><br>Saturation Binding: | • 25 µL of assay buffer or of unlabeled ligand (Metergoline, 10 µM final) for determination of non specific binding<br>• 25 µL of radioligand at increasing concentrations (see figure 3)<br>• 500 µL of diluted membranes |
| Competition Binding: | • 25 µL competitor ligand at increasing concentrations (see figure 4)<br>• 25 µL of radioligand (1 nM final)<br>• 500 µL of diluted membranes |
| 3. Incubation: | 60 min at 27°C. |
| 4. Filters preparation: | GF/C filters were presoaked in 0.3% PEI at room temperature for at least 30 min. |
| 5. Filtration: | Aspirate and wash 9 x 500 µL with ice cold wash buffer using a FilterMate Harvester. |
| 6. Counting: | Add 30 µL/well of MicroScint™-O (Revvity # 6013611), cover filter with a TopSeal-A PLUS (Revvity # 6050185) and read on a TopCount®. |

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# GTPγS – SPA® Assay Procedure

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| Assay Buffer: | 20 mM HEPES pH 7.4, 100 mM NaCl, 10 µg/ml saponin, 3 mM $MgCl_2$, |
| GDP concentration: | 3 µM GDP (final) |
| SPA Beads: | PVT-WGA (Revvity # RPNQ0001), 0.5 mg/well |
| Radioligand: | GTPγS, [$^{35}$S] - (Revvity # NEG030H) |
| Membranes: | 5 µg/well |
| Format: | 96-well |
| Final volume: | 100 µL/well |

GTPγS-SPA assays were performed in 100 µL total volume according to the following conditions. All dilutions are performed in assay buffer:

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|---|---|
| 1. Membrane Dilution: | 5 µg of membranes per well, diluted in order to dispense 20 µL/well. Keep on ice. |
| 2. GDP preparation: | Prepare a 5-fold concentrated GDP solution (i.e. 15 µM). |
| 3. GTPγS, [$^{35}$S] - dilution: | Dilute GTPγS, [$^{35}$S] - to give ~25.000 dpm/20µL |
| 4. Beads: | Dilute beads to 12.5 mg/mL (0.5 mg/20 µL) |
| 5. Assembly (in Optiplate™),<br>Agonist Assay: | • 20 µL of 5x GDP dilution<br>• 20 µL of 5x agonist dilutions at increasing concentrations<br>• 20 µL of diluted membranes |
| Antagonist Assay: | • 20 µL of 5x GDP dilution<br>• 20 µL of a 5x antagonist at increasing concentrations: 5x reference agonist dilution (to reach a final concentration corresponding to its $EC_{80}$)<br>• 20 µL of diluted membranes |
| 6. Pre-incubation: | Incubate for 15 min at room temperature (RT) |
| 7. Assemble (continued) | • 20 µL of the GTPγS, [$^{35}$S] - dilution<br>• 20 µL of the SPA Beads dilution |
| 8. Incubation: | • Cover plate with a TopSeal,<br>• Shake on an orbital shaker for 2 min,<br>• Incubate for 30 min at RT<br>• Centrifuge the plate for 10 min. at 2000 rpm,<br>• Incubate for 0h to 1h at RT |
| 9. Counting | Count for 1 min on a TopCount® |

## References


1. Kobilka B.K., Frielle T., Collins S., Yang-Feng T., Kobilka T.S., Francke U., Lefkowitz R.J. & Caron M.G. (1987) An intronless gene encoding a potential member of the family of receptors coupled to guanine nucleotide regulatory proteins. Nature 329:75-79.

2. Newman-Tancredi A., Wootton R. & Strange P.G. (1992) High-level stable expression of recombinant 5-HT1A 5-hydroxytryptamine receptors in Chinese hamster ovary cells. Biochem. J. 285:933-938.

3. Raymond J.R., Albers F.J. & Middleton J.P. (1992) Functional expression of human 5-HT1A receptors and differential coupling to second messengers in CHO cells. Naunyn-Schiedeberg's Archs Pharmac. 346:127-137.

4. Boess, F.G. and Martin, I.L. (1994). Molecular biology of 5-HT receptors. Neuropharmacology 33:275-317.

5. Xie D.-W., Deng Z.L., Ishigaki T., Nakamura Y., Suzuki Y., Miyasato K., Ohara K. & Ohara K. (1995) The gene encoding the 5-HT1A receptor is intact in mood disorders. Neuropsychopharmacology 12:263-268.

6. Newman-Tancredi A. (2010) The importance of 5-HT1A receptor agonism in antipsychotic drug action: rationale and perspectives. Curr Opin Investig Drugs

## Materials and Instrumentation

The following tables provide the references of compounds and reagents used or recommended for the characterization of the human Serotonin 5-$HT_{1A}$ receptor ValiScreen® cell line, as well as some advice on how to use these compounds:

Table 1. References of compounds used for functional characterization and binding assays

| Name | Provider | Cat no | Working Stock Solution |
|---|---|---|---|
| 5-Carboxamidotriptamine (5-CT) | Sigma | C117 | 10 mM in $dH_2O$ |
| 5-Hydroxytryptamine (5-HT) | Sigma | H-9523 | 10 mM in $dH_2O$ |
| 8-Hydroxy-DPAT (8-OH-DPAT) | Tocris | 0529 | 10 mM in $dH_2O$ |
| NAN 190 | Sigma | N3529 | 10 mM in DMSO |
| (S)-WAY 100135 | Tocris | 1253 | 10 mM in DMSO |
| S-14506 | Tocris | 1771 | 10 mM in DMSO |
| [$^3$H] 8-OH-DPAT | Revvity | NET929 | N/A |
| [$^3$H] LSD | Revvity | NET638 | N/A |

Table 2. References of cell culture media and assay buffers

| Name | Provider | Cat no |
|---|---|---|
| HAM's F-12 | Hyclone | SH30026.02 |
| DMEM | Hyclone | SH30022.02 |
| Advanced DMEM/F12 (serotonin receptors) | Invitrogen | 12634-010 |
| EMEM | BioWitthaker | 06-174G |
| EX-CELL DHFR$^-$ media (DHFR deficient cell lines) | Sigma | C8862 |
| FBS | Wisent | 80150 |
| FBS dialyzed | Wisent | 80950 |
| G418 (geneticin) | Wisent | 400-130-IG |
| Zeocin | Invitrogen | R25005 |
| Blasticidin | invitrogen | R210-01 |
| Puromycin | Wisent | 400-160-EM |
| Standard HBSS (with $CaCl_2$ and $MgCl_2$) | GIBCO | 14025 |
| HEPES | MP Biomedicals, LLC | 101926 |
| BSA, Protease-free | Sigma | A-3059 |
| PEI | Sigma | P3143 |
| Trypsin-EDTA | Hyclone | SH30236.02 |
| Sodium Pyruvate | GIBCO | 11360 |
| L-Glutamine | GIBCO | 25030 |
| NEAA (non-essential amino acids) | GIBCO | 11140 |
| Forskolin | Sigma | F6886 |



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