Melanocortin-4 Receptor Reporter Assay Kit

Item No. 600190

www.caymanchem.com
Customer Service 800.364.9897
Technical Support 888.526.5351
1180 E. Ellsworth Rd · Ann Arbor, MI · USA

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GENERAL INFORMATION

Materials Supplied

Kit will arrive packaged as a -20°C kit. For best results, remove components and store as stated below.

Item Number	Item	Quantity/Size	Storage
600191	Melanocortin-4 Receptor Reverse Transfection Strip Plate	1 plate	-20°C
600182	Melanocortin Assay α-MSH Positive Control	1 vial/10 µl	-20°C
600183	SEAP Substrate (Luminescence)	1 vial/15 ml	4°C
10011297	96-Well Solid Plate (black) with lid	3 plates	RT

If any of the items listed above are damaged or missing, please contact our Customer Service department at (800) 364-9897 or (734) 971-3335. We cannot accept any returns without prior authorization.

WARNING: THIS PRODUCT IS FOR RESEARCH ONLY - NOT FOR HUMAN OR VETERINARY DIAGNOSTIC OR THERAPEUTIC USE.

Safety Data

This material should be considered hazardous until further information becomes available. Do not ingest, inhale, get in eyes, on skin, or on clothing. Wash thoroughly after handling. Before use, the user must review the complete Safety Data Sheet, which has been sent *via* email to your institution.

Precautions

Please read these instructions carefully before beginning this assay.

If You Have Problems

Technical Service Contact Information

Phone: 888-526-5351 (USA and Canada only) or 734-975-3888

Fax: 734-971-3640

Email: techserv@caymanchem.com

In order for our staff to assist you quickly and efficiently, please be ready to supply the lot number of the kit (found on the outside of the box).

Storage and Stability

Remove the α-MSH Positive Control from the kit and store at -20°C (be careful to avoid repeated freeze/thaw cycles). Store the MC4R Reverse Transfection Strip Plate at -20°C. The SEAP Substrate should be stored at 4°C and will be stable for at least one year. The kit will perform as specified if used before the expiration date indicated on the outside of the box.

Materials Needed But Not Supplied

1. HEK293 or HEK293T cells; both cell lines can be obtained from ATCC
2. Culture medium used for the cells (DMEM)
3. Fetal Bovine Serum (FBS)
4. A plate reader capable of measuring luminescence
5. Adjustable pipettes and a repeating pipettor
6. An incubator set at 65°C
7. Penicillin-Streptomycin (100X) (Gibco 15140-122)

INTRODUCTION

Background

The melanocortins are a family of peptide hormones derived from proopiomelanocortin, which is synthesized primarily in the pituitary, but also in the central nervous system, skin, placenta, and other tissues. Through binding to five melanocortin receptors (MCRs), these hormones play diverse roles in physiological regulation. All the MCRs are members of the superfamily of G protein-coupled receptors (GPCRs) and are coupled to G_s. Thus, their activation stimulates the cAMP second messenger signal transduction pathway. Melanocortin-4 receptor (MC4R) has important roles in weight regulation, sexual function, and inflammation.[1,2] Mice deficient in MC4R have increased lipid deposition associated with elevated adiposity,[3] while mutations in MC4R in humans are associated with early onset or severe obesity.[4,5] Mice treated with a selective MC4R agonist have increased sexual function that is not observed in MC4R-null mice[6] and central injection of an MC4R antagonist impairs male sexual behavior.[7] Selective MC4R activation has been linked with the suppression of fever and reduced production of inflammatory mediators.[2] These results and others point to the need to identify novel agonists and antagonists for MC4R, both to further elucidate the function of this receptor and to selectively regulate different aspects of its function *in vivo*.

About This Assay

Cayman's Reverse Transfection Reporter Assays have overcome many of the disadvantages of other transfection approaches. In this method, a proprietary transfection complex containing DNA and an optimized mixture of lipids and proteins is evenly applied and processed on the culture surface of multi-well plates. Adherent cells, supplied by the user, are applied directly to the plate and allowed to grow in the coated wells. Using this method, the uptake of the DNA complex by the cell increases dramatically compared to solution-phase transfection, enhancing both the transfection efficiency and the co-transfection efficiency for multiple plasmids.

Cayman's Melanocortin-4 Receptor Reporter Assay Kit consists of a 96-well plate coated with a transfection complex containing DNA constructs for MC4R and a cAMP response element regulated Secreted Alkaline Phosphatase (SEAP) reporter (MC4R Reverse Transfection Strip Plate). Cells grown on the transfection complex will express MC4R at the cell surface. Binding of agonists to MC4R initiates a signal transduction cascade resulting in expression of SEAP which is secreted into the cell culture media. Aliquots of media are removed at timed intervals, beginning at approximately six hours, and SEAP activity is measured following addition of a luminescence-based alkaline phosphatases substrate provided in the kit. The kit is simple to use and can be easily adapted to high throughput screening for therapeutic compounds regulating the activation of MC4R. A MC4R agonist, α-melanocyte-stimulating hormone (α-MSH), is included in the kit for use as a positive control. The kit provides sufficient reagent to measure SEAP activity at three time points, using the black plates included.

ASSAY PROTOCOL

Plate Set Up

There is no specific pattern for using the wells on the plate. A typical experimental plate will include wells with cells treated with α-MSH provided in the kit (positive control), wells with cells treated with experimental compounds, and wells of untreated cells. We recommend that each treatment be performed at least in triplicate. If you are running a test compound curve to determine an EC_{50} value, several serial dilutions of the test compound should be included in the assay. The kit contains enough α-MSH to run a control dose-response curve as well. Record the contents of each well on the template sheet provided on page 17.

Addition of Cells to the Reverse Transfection Plate

IMPORTANT

Before starting the experiment, dilute Penicillin-Streptomycin (100X, Gibco 15140-122) 1:100 in culture medium used for your cells. This will be the culture medium for your experiment

1. Remove the MC4R Reverse Transfection Strip Plate (Item No. 600191) from the freezer and allow to equilibrate to room temperature. Clean the bag with 70% alcohol before opening the bag. Place the plate in the hood and remove from the bag.

   NOTE: If you are not using the whole plate at one time for your experiment, remove the number of strips needed, put the remaining strips back in the bag, and store in a desiccator, ***protected from UV light****, at room temperature for up to a week. Alternatively, you can vacuum seal the bag and store the remaining strips at -20°C for up to two months.*

2. Seed each well of the plate at a density of 50,000-100,000 cells/well in 200 µl of culture medium containing 10% FBS. Place the plate in a 37°C incubator with 5% CO_2 and incubate overnight or up to 24 hours.

Cell Stimulation

1. After 16-24 hours of incubation, aspirate the culture media from each well.
2. Add 100 µl of culture media containing 0.5% FBS to each well.
3. Prepare test compounds at 2X the desired final concentration in serum-free media and pipette 100 µl to the assigned wells. Wells containing untreated cells receive 100 µl of serum-free media only. For positive controls using the provided α-MSH, dilute the Melanocortin Assay α-MSH Positive Control (Item No. 600182) 1:500 in the serum-free culture media and add 100 µl to corresponding wells. At this concentration, α-MSH induces a 5-15 fold increase in SEAP activity, depending on the cell type and stimulation time used.

Performing the SEAP Assay

Pipetting Hints

- Use different tips to pipette each reagent.
- Before pipetting each reagent, equilibrate the pipette tip in that reagent (*i.e.*, slowly fill the tip and gently expel the contents, repeat several times).
- Do not expose the pipette tip to the reagent(s) already in the well.

Before performing the assay, remove the SEAP Substrate (Luminescence) (Item No. 600183) from refrigerator and allow to equilibrate to room temperature.

1. After 6-24 hours of stimulation with test compounds, transfer the plate from the incubator to a culture hood.
2. In the culture hood, remove 10 µl of culture media from each well to a corresponding well of a 96-Well Solid Plate (black) with lid (Item No. 10011297). Cover the plate with the lid.
3. Inactivate endogenous alkaline phosphatase by heating the samples at 65°C for 30 minutes. The SEAP expressed in this assay is stable under these conditions.
4. Remove the plate from the 65°C incubator and allow to equilibrate to room temperature.
5. Add 50 µl of substrate to each well, shake briefly, and incubate the plate at room temperature for two minutes.
6. Read the plate with a plate reader capable of detecting a chemiluminescence signal.

   NOTE: The plate should be read immediately after two minutes of incubation. When multiple plates are processed at the same time, the addition of substrate and reading of the plate should be done plate by plate in order to allow equal time from addition of substrate to the time the plate is read..

ANALYSIS

Calculations

Determination of EC_{50}

The term half maximal effective concentration (EC_{50}) refers to the concentration of a drug which induces a response halfway between the baseline and maximum after some specific exposure time. The dose-response curve of a typical agonist follows a sigmoidal curve with a bottom plateau (untreated cells) and a top plateau (drug saturation). See Figure 1, on page 13, for α-MSH curve.

For each compound, normalize the RLU results to run from 0% (no drug added) to 100% (saturating dose) by using the following formula:

$$\% \text{ Response at X Concentration} = \left[\frac{(\text{RLU at X Concentration}) - (\text{RLU of untreated cells})}{\text{Maximal RLU (saturation)} - (\text{RLU of untreated cells})} \right] \times 100$$

Graph % response *versus* log (drug concentration). In the resulting sigmodial dose-response curve, find the best-fit value for the $\log EC_{50}$ (the concentration that gives a 50% response; the middle of the curve).

NOTE: This kit could be used to characterize antagonists by co-incubation of the experimental compound with a fixed dose of α-MSH such as 3-10 nM.

Performance Characteristics

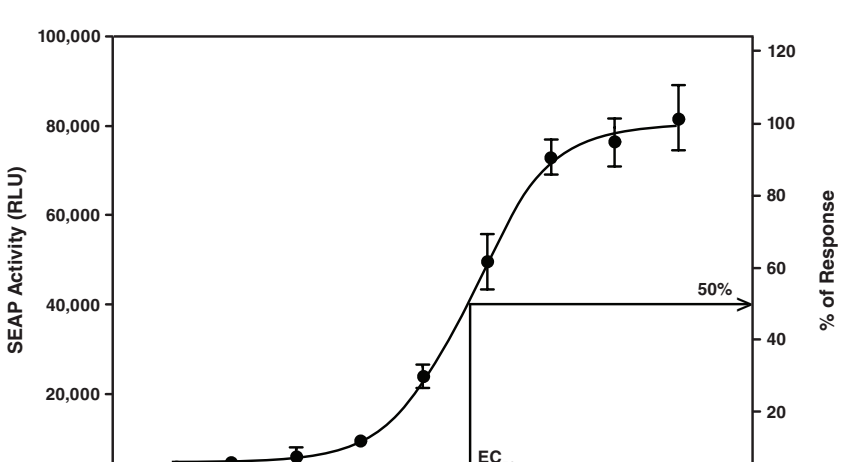

Figure 1. SEAP activity in HEK293 cells transiently transfected with MC4R in response to α-MSH stimulation. HEK293 cells were plated in a MC4R Reverse Transfection Strip Plate at a density of 80,000 cells/well and incubated overnight. The next day, cells were treated with different doses of α-MSH as indicated above. After 24 hours of stimulation, 10 µl of culture media was remove from each well and the SEAP activity from each sample was measured according to the protocol described on page 11. The calculated EC_{50} from the fitted curve is 2.57 nM.

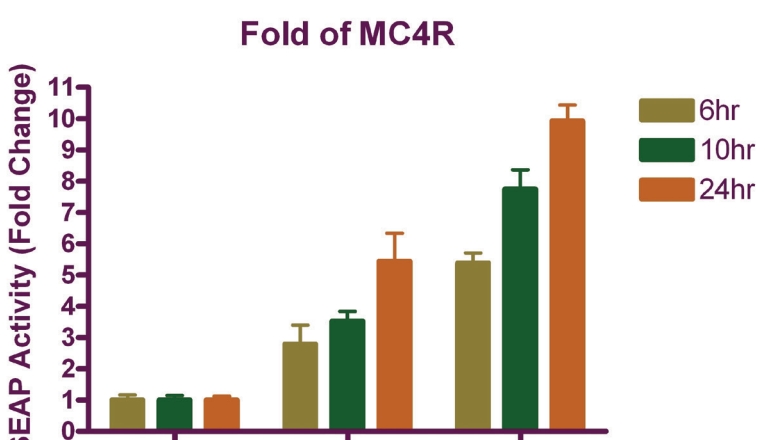

Figure 2. Time-dependent activation of MC4R by α-MSH

RESOURCES

Troubleshooting

Problem	Possible Causes	Recommended Solutions
Erratic values; dispersion of duplicates	A. Poor pipetting/technique B. Bubble in assay well(s)	A. Be careful not to splash the contents of the wells B. Carefully tap the side of the plate with your finger to remove bubbles
Erratic response curve of compound treatments	Unequal number of cells in each well	Make sure each well contains the same number of cells
High reading in all wells	Cell density is too high	Plate cells more sparsely
No signal	A. Contamination B. Layer lost	A. Keep plate in sterile environment B. Gently aspirate medium; do not disturb cell layer

References

1. Wikberg, J.E.S. and Mutulis, F. Targeting melanocortin receptors: An approach to treat weight disorders and sexual dysfunction. *Nature Reviews Drug Discovery* **7**, 307-323 (2008).
2. Lasaga, M., Debeljuk, L., Durand, D., *et al.* Role of a-melanocyte stimulating hormone and melanocortin 4 receptor in brain inflammation. *Peptides* **29**, 1825-1835 (2008).
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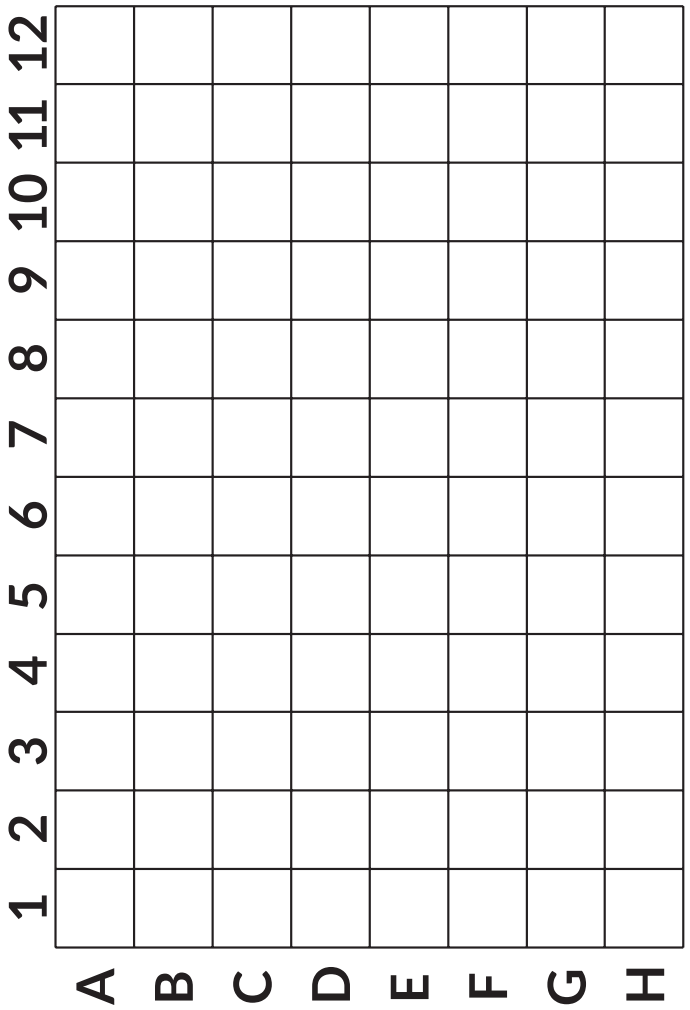
4. MacKenzie, R.G. Obesity-associated mutations in the human melanocortin-4 receptor gene. *Peptides* **27**, 395-403 (2006).
5. Govaerts, C., Srinivasan, S., Shapiro, A., *et al.* Obesity-associated mutations in the melanocortin 4 receptor provide novel insights into its function. *Peptides* **26**, 1909-1919 (2005).
6. Van der Ploeg, L.H.T., Martin, W.J., Howard, A.D., *et al.* A role for the melanocortin 4 receptor in sexual function. *Proc. Natl. Acad. Sci. USA* **99(17)**, 11381-11386 (2002).
7. Caquineau, C., Leng, G., Guan, X.M.M., *et al.* Effects of a-melanocyte-stimulating hormone on magnocellular oxytocin neurones and their activation at intromission in male rats. *Journal of Neuroendocrinology* **18**, 685-691 (2006).



NOTES

Warranty and Limitation of Remedy

Buyer agrees to purchase the material subject to Cayman's Terms and Conditions. Complete Terms and Conditions including Warranty and Limitation of Liability information can be found on our website.