Description

The PDE2A Assay Kit is a fluorescence polarization (FP), homogeneous, 384-well assay kit designed for the screening and profiling of PDE2A (Phosphodiesterase 2A) inhibitors. This assay takes advantage of a specific fluorescent phosphate-binding nanoparticle. The kit contains enough purified recombinant PDE2A, fluorescent probe, PDE assay buffer, Binding Agent, and diluent for 400 reactions.

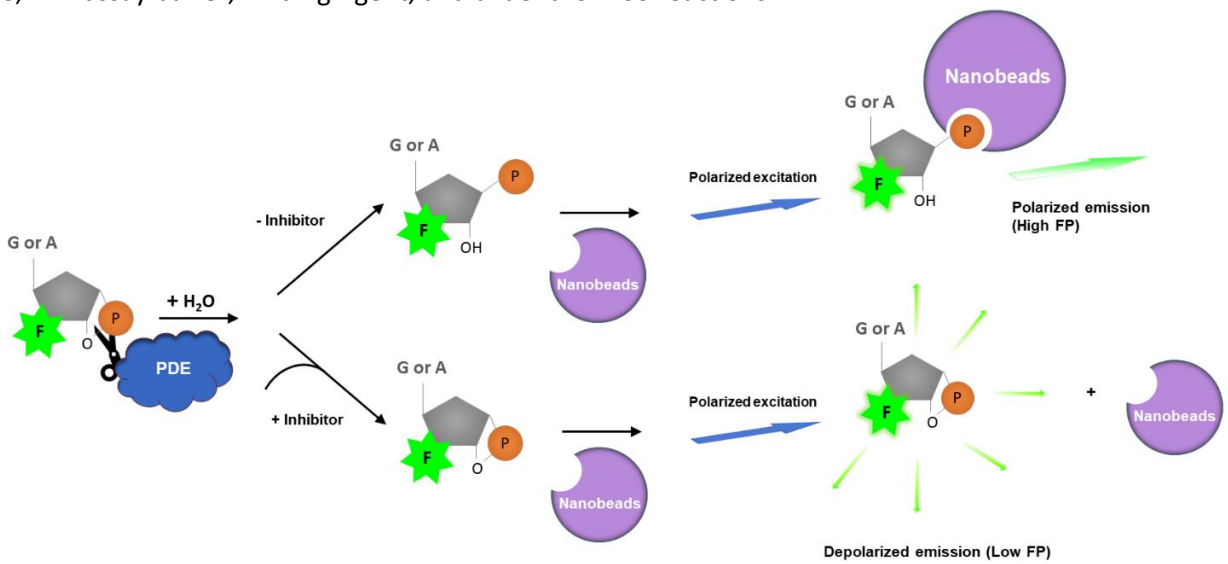


Figure 1: Illustration of the PDE2A Assay Kit principle.

The assay uses a fluorescein-labeled cyclic adenosine monophosphate (cAMP-FAM for PDE2A), in which the phosphate group is engaged within the cyclic nucleotide. This is a very small molecule that rotates fast (low FP). PDE2A catalyzes the hydrolysis of the phosphodiester bond in the cyclic nucleotide and frees the phosphate group. In a second step the free phosphate group is recognized by a specific phosphate-binding nanobead (Binding Agent) leading to the formation of a large complex, with restricted movement (high FP). FP is proportional to PDE2A activity.

This assay requires a fluorescent microplate reader capable of measuring fluorescence polarization (FP) and equipped with the required parts to read the FP signal. For more information FP technology, visit our Tech Note: FP, assay principles and applications.

Note: As of September 2024, this protocol has been re-optimized for performance.

Background

Phosphodiesterases (PDEs) play an important role in the dynamic regulation of the second messengers cAMP (cyclic adenosine monophosphate) and cGMP (cyclic guanosine monophosphate) signaling, by hydrolyzing them. The PDE superfamily is composed of 11 families, with PDE4, 7 and 8 being cAMP-specific hydrolases, and thus regulating positive and negative responses to it. Human PDE2A has multiple biological functions, in a cell-specific context. It is involved in mitochondrial morphology and removal, apoptosis and mouse liver development and hematopoiesis. Additionally, it has been linked to cancer progression, as in colorectal cancer, melanoma, glioma and hepatocellular carcinoma (HCC). PDE2 plays a role in the PDE2/cAMP/PKA (protein kinase A) axis, with increased calcium uptake leading to higher activity of PDE2, and a decrease in the levels of TFAM (mitochondrial transcriptional factor A) being phosphorylated. TFAM is closely linked to colorectal cancer (CRC), one of the most common cancers. Its various functions make it a highly relevant target for the treatment of many disorders, and the use of PDE2A inhibitors will continue to open new therapeutic avenues.

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Applications

Study enzyme kinetics and screen small molecule inhibitors for drug discovery in high throughput screening (HTS) applications.

Supplied Materials

Catalog #	Name	Amount	Storage
60020-KC1	PDE2A, GST-Th-Tag*	>1 µg	-80°C
60200-KC1.2	FAM-Cyclic-3', 5'-AMP**	2 x 1.2 nmoles**	-80°C
60393	PDE Assay Buffer (Incomplete)	25 ml	-20°C
60390-KC250	PDE Binding Agent	250 µl	4°C
60391-KC25	Binding Agent Diluent (cAMP)	25 ml	4°C
82735-KC200	0.5 M DTT	200 µl	-20°C
79685	Low binding, black 384-well plate	1	Room Temp.

** The concentration of protein is lot-specific and will be indicated on the tube containing the protein.*
*** FAM-Cyclic-3', 5'-AMP is provided as a powder. Each vial will need to be resuspended in 1200 µl of Complete PDE Assay Buffer before use.*

Materials Required but Not Supplied

- Adjustable micropipettor and sterile tips
- Rotating or rocker platform
- Fluorescent microplate reader capable of measuring fluorescence polarization (λex=470 (5 nm bandwidth) and detection at λem=528 (10 nm bandwidth)

Stability

This assay kit will perform optimally for up to **6 months** from date of receipt when the materials are stored as directed.

Safety

This product is for research purposes only and not for human or therapeutic use. This product should be considered hazardous and is harmful by inhalation, in contact with skin, eyes, clothing, and if swallowed. If contact occurs, wash thoroughly.

Contraindications

- The final concentration of DMSO in the assay should not exceed 1%.
- Compounds that are fluorescent may interfere with the results, depending on their spectral excitation and emission properties.
- It is recommended that the compound alone is tested to determine any potential interference of the compound on the assay results.

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Assay Protocol

- All samples should be run in duplicate while controls should be performed in quadruplicate.
- The assay should include "Blank", "Reference Control" (minimum FP), "Positive Control" (maximum FP), and "Test Inhibitor" conditions.
- It is recommended all controls are run side by side as they may be necessary for result calculation.
- We recommend using BAY-60-7550 (#27215) as an internal control for the assay. If not running a dose response curve for the control inhibitor, run at 0.1X, 1X and 10X the IC_{50} value shown in the validation data below.
- We recommend maintaining the diluted protein on ice during use.
- For detailed information on protein handling please refer to Protein FAQs (bpsbioscience.com).
- For instructions on how to prepare reagent dilutions please refer to Serial Dilution Protocol (bpsbioscience.com).

1. Prepare Complete PDE Assay Buffer by adding 20 µl of 0.5M DTT to 10 ml of PDE Assay Buffer (Incomplete).

2. Thaw **PDE2A** on ice. Briefly spin the tube containing the enzyme to recover its full content.

3. Dilute PDE2A with Complete PDE Assay Buffer to 150-200 pg/µl (15 µl/well), by performing a serial dilution. For instructions on how to prepare reagent dilutions please refer to Serial Dilution Protocol (bpsbioscience.com).

4. Add 15 µl of diluted PDE2A to the "Positive Control" and Test Inhibitor" wells.

5. Add 20 µl of Complete PDE Assay Buffer to the "Blank" wells.

6. Add 15 µl of Complete PDE Assay Buffer to the "Reference Control" wells.

7. Prepare the Test Inhibitor (5 µl/well): for a titration prepare serial dilutions at concentrations 5-fold higher than the desired final concentrations. The final volume of the reaction is 25 µl.

   7.1 If the Test Inhibitor is water-soluble, prepare serial dilutions 5-fold more concentrated than the desired final concentrations in Complete PDE Assay Buffer.

   For the positive and negative controls, use Complete PDE Assay Buffer as Diluent Solution.

   OR

   7.2 If the Test inhibitor is soluble in DMSO, prepare the inhibitor in 100% DMSO at a concentration 100-fold higher than the highest desired concentration, then dilute the inhibitor 20-fold in Complete PDE Assay Buffer to prepare the highest concentration of the 5-fold intermediate dilutions. The concentration of DMSO is now 5%.

   Use 5% DMSO in Complete PDE Assay Buffer (vol/vol) for the serial dilution to keep the concentration of DMSO constant.

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For positive and negative controls, prepare 5% DMSO in Complete PDE Assay Buffer (vol/vol) so that all wells contain the same amount of DMSO (Diluent Solution).

Note: The final concentration of DMSO should not exceed 1%.

8. Add 5 µl of the inhibitor serial dilution to the "Test Inhibitor" wells.

9. Add 5 µl of the Diluent Solution to the "Blank", "Reference Control", and "Positive Control" wells.

10. Resuspend one vial of FAM-Cyclic-3', 5'-AMP in 1200 µl of Complete PDE Assay Buffer to make a 1.0 µM solution.

11. Initiate the reaction by adding 5 µl of FAM-Cyclic-3',5'-AMP (1.0 µM) to each well designated for the "Reference Control", "Positive Control", and "Test Inhibitor".

12. Incubate at Room Temperature (RT) for 1 hour.

Component	Blank	Reference Control	Positive Control	Test Inhibitor
FAM-Cyclic-3', 5'-AMP	-	5 µl	5 µl	5 µl
Complete PDE Assay Buffer	20 µl	15 µl	-	-
Test Inhibitor	-	-	-	5 µl
Diluent Solution	5 µl	5 µl	5 µl	-
Diluted PDE2A (150-200 pg/µl)	-	-	15 µl	15 µl
Total	**25 µl**	**25 µl**	**25 µl**	**25 µl**

13. Gently mix the tube containing the **Binding Agent** and dilute 100-fold with **cAMP Binding Agent Diluent** (50 µl/well).
14. Add 50 µl of diluted Binding Agent to each well.

15. Incubate at RT for 30 minutes with gentle agitation (*Note: The signal is stable from 20 to 60 minutes*).

16. Read FP in a fluorescence plate reader capable of measuring fluorescence polarization (λex = 470 (5 nm bandwidth); λem = 528 (10 nm bandwidth)) **and set to FP**.

17. Subtract the "Blank" value from all other values.

Calculating Results

Fluorescence polarization is a measure of the amount of molecular rotation that takes place in the time between excitation and emission of the fluorescence probe. It can be determined from the measurements of perpendicular ($I_\perp$) and parallel ($I_{||}$) fluorescence intensity values emitted by the probe relative to the direction of the polarized excitation light (Figure 2).

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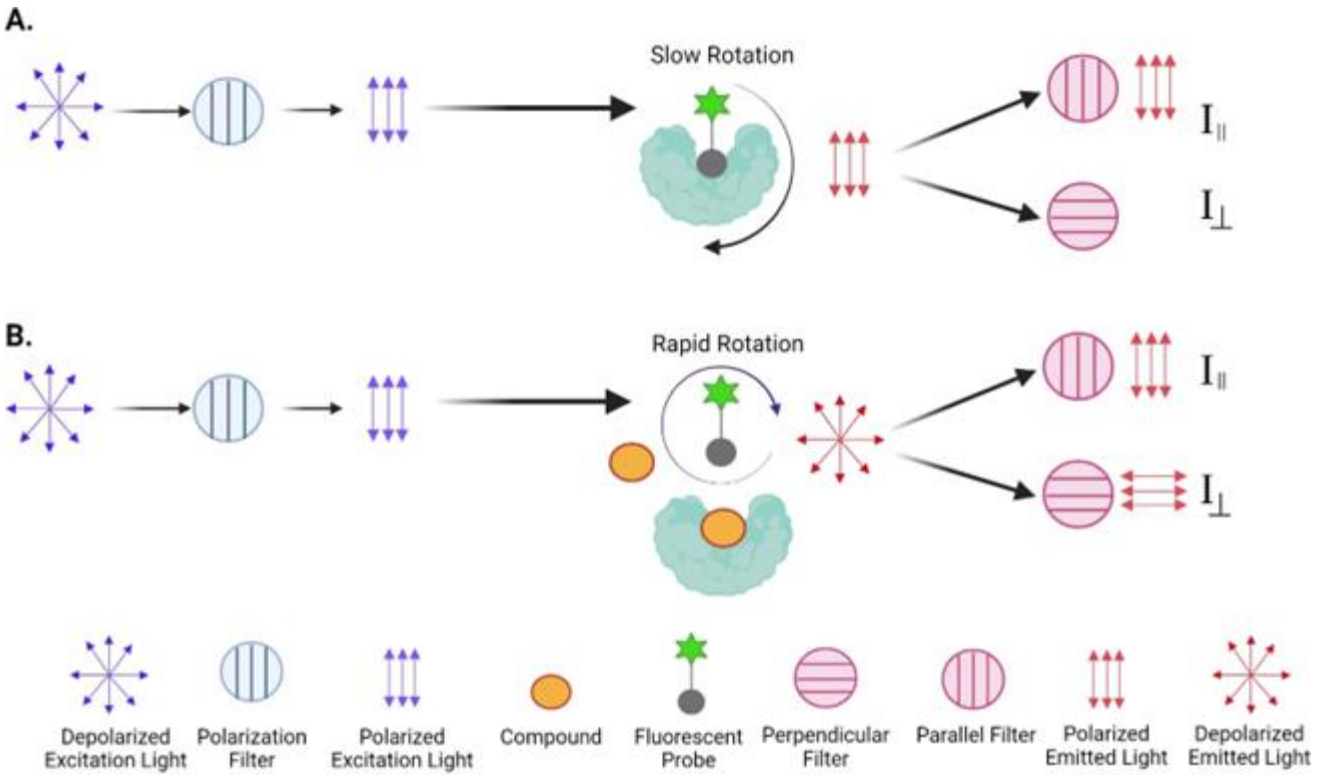


Figure 2: Fluorescence polarization principle.
A. When the fluorescently labeled probe binds to a protein it creates a complex of a large molecular weight that has a slow rotation ability. In this state the probe has a reduced rotational diffusion so when it is excited by polarized light, it still emits highly polarized light with a degree of polarization that is inversely proportional to the rate of molecular rotation.
B. In the presence of a compound that has affinity for the protein, the fluorescent probe remains in solution and can rotate rapidly. Unbound probe has a high rotational diffusion so when it is excited by the polarized light it emits light in orientations that can be detected by both the perpendicular and parallel filters.

Polarization is defined as the difference between the emission intensities of parallel fluorescence ($I_{||}$) and perpendicular fluorescence ($I_{\perp}$), divided by the total fluorescence emission intensity. The polarization value (P) being a ratio of light intensities, is a dimensionless number, often expressed in milli P units where 1 P unit = 1000 mP units. To calculate P one has to take into consideration that light is not transmitted equally well through both parallel and perpendicular channels and therefore a correction must be made. This correction factor is called the "G Factor" (G) and it is specific to the instrument used. mP can thus be calculated using the following formula:

$$mP = \left(\frac{I_{II} - G(I_{\perp})}{I_{II} + G(I_{\perp})}\right) x\ 1000$$

Modern instruments usually have the G factor pre-calculated and can automatically calculate fluorescence polarization for your experiments. If you need to determine, set up or calculate the G factor please refer to your instrument manual (the instrument manual should contain information about how to establish the G-factor) or check our FAQ section (FAQs (bpsbioscience.com).

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For accurate calculations it is necessary to provide the correct plate schematic when setting up your instrument, with defined positions for the "Blank" and "Reference" (also known as Substrate Control) wells, and to ensure that the emission intensities from the "Blank" wells are subtracted from all other wells prior to further data analysis.

We encourage you to analyze raw data and if appropriate to exclude those "Blank" or "Reference" wells that show aberrant readouts prior to mP determination.

The % of Activity can be calculated as follows:

$$\%\ of\ Activity = \frac{(mP\ value\ from\ Test\ Inhibitor - mP\ value\ from\ Reference\ Control)}{(mP\ value\ from\ Positive\ Control - mP\ value\ from\ Reference\ Control)} x\ 100$$

Example of Assay Results

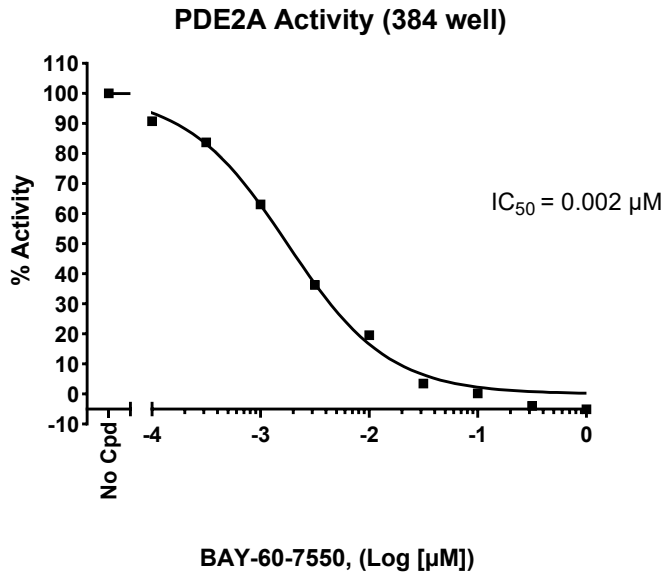


Figure 3: Inhibition of PDE2A by BAY-60-7550.
PDE2A was incubated with increasing concentrations of BAY-60-7550 (#27215) in the presence of 200 nM FAM-Cyclic-3', 5'-AMP substrate. Fluorescence Polarization was measured using a Tecan M1000 fluorescent microplate reader. Results are expressed in % activity, in which FP in the absence of inhibitor (positive control) is set to 100%.

Data shown is representative.

Troubleshooting Guide
Visit bpsbioscience.com/assay-kits-faq for detailed troubleshooting instructions. For lot-specific information and all other questions, please visit https://bpsbioscience.com/contact.

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References

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Gomez L., *et al.*, 2017 *J. Med. Chem.* 60(5):2037-2051.
Zhao Y., et al., 2021 *Front. Oncol. 11*: doi.org/10.3389/fonc.2021.663778.

Related Products

Products	*Catalog #*	*Size*
PDE2A Assay Kit	60321	384 reactions
Mouse PDE2A Assay Kit	79648	96 reactions
PDE2A (Rat), His-GST-Tags Recombinant	60022	5 µg
PDE2A V2 (Mouse), GST-Tag Recombinant	60018	5 µg
PDE2A V4 (Mouse), GST-Tag Recombinant	60019	5 µg
PDE2A, FLAG-Tag Recombinant	60021	5 µg

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