

# Cellular calcineurin activity assay Kit

**Cat. No.** Kit-0134    **Lot. No.** (See product label)

## SPECIFICATION

### Product Overview

**Description**

The Calcineurin Cellular Activity Assay Kit is a complete colorimetric assay kit for measuring cellular calcineurin (PP2B) phosphatase activity. It employs a convenient 96-well microtiter-plate format with all reagents necessary for measuring calcineurin (PP2B) phosphatase activity in tissue/cellular extracts PLUS, human recombinant calcineurin5 is included as a positive control! The RII phosphopeptide substrate, supplied with this kit, is the most efficient and outstanding peptide substrate known for calcineurin. The detection of free-phosphate released is based on the classic Malachite green assay and offers the following advantages: Nonradioactive; convenient 1-step detection; excellent sensitivity.

**Stability**

Store all components except the microtiter plate at -70°C for the highest stability. The calcineurin enzyme component must be handled particularly carefully in order to retain maximal enzymatic activity. Thaw it quickly in a RT water bath or by rubbing between fingers, then immediately store on an ice bath. The remaining unused enzyme should be quickly refrozen by placing at -70°C. To minimize the number of freeze/thaw cycles, aliquot the calcineurin into separate tubes and store at -70°C.

**Storage**                      at -80°C

**Size**                              96 wells

**Kit Components**

1. Calcineurin enzyme (human, recombinant)  
FORM: 50 mM Tris, pH 7.5, 100 mM NaCl, 6 mM MgCl<sub>2</sub>, 5 mM DTT, 0.025% NP-40,

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0.5 mM CaCl<sub>2</sub>.

1 U=1 pmol/min at 30°C.

STORAGE: -70°C; AVOID FREEZE/THAW CYCLES!

QUANTITY: 500 U

2. Calmodulin (human, recombinant)

FORM: 25 μg in dH<sub>2</sub>O

STORAGE: -70°C

QUANTITY: 100 μg

3. Substrate (R11 phosphopeptide, sequence Asp-LeuAsp-Val-Pro-Ile-Pro-Gly-Arg-Phe-Asp-Arg-Arg-Val-pSer-Val-Ala-Ala-Glu; MW=2192.0)

FORM: 1.5 mg net peptide/vial

STORAGE: -20°C

QUANTITY: 1 x 1.5 mg

4. 2x assay buffer

FORM: 100 mM Tris, pH 7.5, 200 mM NaCl, 12 mM MgCl<sub>2</sub>, 1mM DTT, 0.05% NP-40, 1 mM CaCl<sub>2</sub>

STORAGE: -70°C

QUANTITY: 20 mL

5. 2x EGTA Buffer

FORM: 100 mM Tris, pH 7.5, 20 mM EGTA, 200 mM NaCl, 12 mM MgCl<sub>2</sub>, 1 mM DTT, 0.05% NP-40

STORAGE: -70°C

QUANTITY: 1 mL

6. Lysis Buffer

FORM: 50 mM Tris, pH 7.5, 0.1 mM EDTA, 0.1 mM EGTA, 1 mM DTT, 0.2% NP-40

STORAGE: -70°C

QUANTITY: 1 X 40 mL

7. Protease inhibitor cocktail

FORM: Solid tablet

STORAGE: 4°C

QUANTITY: 2 tablets  
 8. Biomol Green Reagent  
 FORM: Liquid in screw-cap plastic bottle.  
 STORAGE: 4°C  
 QUANTITY: 20 mL  
 9. Phosphate standard  
 FORM: 80  $\mu$ M in dH<sub>2</sub>O  
 STORAGE: -70°C  
 QUANTITY: 0.5 mL  
 10. Okadaic acid  
 HARMFUL! AVOID ALL FORMS OF CONTACT.  
 FORM: 5  $\mu$ M in 2X Assay Buffer  
 STORAGE: -70°C.  
 QUANTITY: 325  $\mu$   
 11. Desalting column and resin  
 FORM: 5 mL polypropylene disposable column and P6 DG desalting resin  
 STORAGE: RT. After rehydration store at 4°C.  
 QUANTITY: 1 column and 1 g of resin  
 12. ½-Volume microplate  
 2 clear, 96-well  
 STORAGE: Room temperature

**Materials Required  
but Not Supplied**

Microplate reader capable of measuring A<sub>620</sub> to  $\geq 3$ -decimal accuracy.  
 Centrifuge capable of 100k x g RCF.  
 Swing bucket centrifuge capable of 800 x g RCF.  
 Pipetman capable of pipetting 5-100  $\mu$  accurately.  
 Multi-channel Pipetman capable of pipetting 100  $\mu$  (optional).  
 Ice bucket to keep reagents cold until use.  
 16 g needle/syringe  
 TBS buffer, 100 mL (20 mM Tris, pH 7.2, 150 mM NaCl)

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|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                         | <p>15 and 50 mL conical centrifuge tubes</p> <p>Biological test material (e.g.: tissue, cells)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Technical Notes</b>  | <p>NOTE ON HANDLING: Hold all samples on ice bath until use, unless otherwise noted.</p> <p>PRECAUTIONS: The BIOMOL GREEN reagent is a highly sensitive phosphate detection solution. Free phosphate present on labware and in reagent solutions will greatly increase the background absorbance of the assay. This is detected visually as a change in color from yellow to green. Detergents used to clean labware may contain high levels of phosphate. Use caution by either rinsing labware with dH<sub>2</sub>O or employ unused plasticware. Do not use phosphate buffered saline (PBS) for any tissue/cell rinses - use TBS (Tris buffered saline)!</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Detection method</b> | Colorimetric                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Preparation</b>      | <p><b>PREPARATION OF TISSUE/CELL EXTRACTS</b></p> <p>To prepare a tissue/cell extract for calcineurin activity assay:</p> <p>Calcineurin activity is highly dependent on the experimental conditions and the cell/tissue source. Therefore, the amount of material required for an assay should be determined empirically by the user. Typically, between 0.5-5 g of total protein or 5,000 and 50,000 cells per assay will provide sufficient signal for detection.</p> <p>NOTE ON BIOLOGICAL SAMPLE MATERIAL: The following procedures have been tested for rat and mouse brain tissue. Other tissue or cell culture samples employed may require adjustment to this protocol for satisfactory results.</p> <ol style="list-style-type: none"> <li>1. Add protease inhibitor tablets to lysis buffer immediately before use (1 tablet/10 mL buffer). Vortex.</li> <li>2. Obtain tissue, if fresh, excise quickly.</li> <li>3. Rinse tissue quickly in ice-cold TBS and shake-off/blot excess wetness.</li> <li>4. Weigh the tissue in centrifuge tube.</li> <li>5. Add lysis buffer with protease inhibitors to tissue. Use 0.33-0.5 mL per gram of</li> </ol> |

tissue.

6. Loosely break up cells by passing them through a 16 g needle. Avoid air bubbles.
7. Optional: Sediment at 100-200k x g in centrifuge at 4°C for 45 min. Save supernatant=HSS (high-speed supernatant). Please note that this step will sediment the nucleus and any associated nuclear calcineurin.
8. Freeze immediately at -70°C.

#### REMOVAL OF FREE PHOSPHATE FROM EXTRACTS

To desalt tissue samples by gel filtration:

NOTE: This procedure is intended to remove excess phosphate and nucleotides (which are slowly hydrolyzed to release free phosphate in the presence of the BIOMOL GREEN reagent) in the high speed supernatant (HSS) extract.

1. Rehydrate Desalting Column Resin in a 50 mL conical tube by adding 20 mL of phosphate free dH<sub>2</sub>O and vortexing briefly. Allow to set for 4 hours at RT or overnight at 4°C.
2. Decant the dH<sub>2</sub>O carefully, then add fresh dH<sub>2</sub>O at a 1:1 ratio to the rehydrated resin (~10 mL).
3. Add rehydrated resin to the Chromatography Column to obtain a 5 mL settled-bed volume (~5.5 cm bed height). Remove tip from column and allow dH<sub>2</sub>O to drain by gravity.
4. Equilibrate column by adding 8 mL of lysis buffer (without protease inhibitors) and allow to drain by gravity.
5. Place column in a 15 mL centrifuge tube. Centrifuge at 800 x g for 3 min at 4°C to displace column buffer. Discard flow-through buffer.
6. Place column in a clean 15 mL centrifuge tube.
7. Add up to 350 µL HSS sample, from above, to column.
8. Centrifuge at 800 x g for 3 min. Save extract flow-through. This is the desalted cell lysate material to be tested for calcineurin activity, below.
9. Freeze sample immediately at -70°C.

NOTE: The desalting column resin can be reused. Between samples, the column

should be rinsed with 4-5 volumes of phosphate free water, and then re-equilibrated with lysis buffer (return to step 4 in the protocol) before using the next sample. At least 4 or 5 samples may be used before efficiency drops.

TIP: The effective removal of phosphate/nucleotides from the extract should be tested qualitatively by adding 100  $\mu$  BIOMOL GREEN reagent to 1  $\mu$  extract, and a separate sample of 1  $\mu$  dH<sub>2</sub>O. If no phosphate/nucleotides are present, both samples should remain yellow in color over a time period of 30 min at RT. The development of a visible green color indicates phosphate contamination, which must be eliminated from the samples before proceeding further!

## Assay Protocol

### CaN Assays:

D.A. Fruman et al. Methods: A Companion to Meth. Enzymol. 1996 9 146

1. Subtract the "Background" phosphate released from each sample except the "Positive control".

2. Plot a graph use either OD<sub>620nm</sub> or phosphate released for the Y-axis.

3. Determine the contribution of calcineurin:

eq. 1 CaN (PP2B) = Total - EGTA buffer or

eq. 2 CaN (PP2B) = OA - (OA + EGTA)

Eq. 1 is a conventional method to report CaN activity. However, the user must determine the most appropriate analysis for their specific experimental goal.

### BIOMOL GREEN PHOSPHATASE ASSAY

To prepare reagents for the assay:

1. Thaw all kit components and hold on ice bath, except BIOMOL GREEN reagent at RT.

2. Dilute calmodulin 1/50 in 2X assay buffer to required quantity (25  $\mu$  are required per assay well). For example, add 20  $\mu$  to 980  $\mu$  2X assay buffer.

3. Reconstitute substrate (R11 phosphopeptide) with dH<sub>2</sub>O to 0.75 mM (1.64 mg/mL): Add 915  $\mu$  dH<sub>2</sub>O per 1.5 mg vial (10  $\mu$  are needed per assay well).

To prepare phosphate standard curve sample wells:

1. Prepare 1 mL of 1X assay buffer (dilute 500  $\mu$  of 2X assay buffer with 500  $\mu$  of dH<sub>2</sub>O)
2. Perform 1:1 serial dilutions of phosphate standard and an assay buffer blank. Concentrations of 40, 20, 10, 5, 2.5, 1.25 and 0.625  $\mu$ M correspond to 2, 1, 0.5, 0.25, 0.125, 0.063 and 0.031 nmol PO<sub>4</sub>:
  - a) Add 50  $\mu$  of assay buffer to wells A1, and A2 (2 nmol PO<sub>4</sub> standards)
  - b) Add 50  $\mu$  of 1X assay buffer (prepared in step 1 above) to wells B1-H1 and wells B2-H2. (remaining standard concentrations)
  - c) Add 50  $\mu$  of 80  $\mu$ M phosphate standard to wells A1 and A2 of assay plate. Mix thoroughly by pipetting up and down several times.
  - d) Remove 50  $\mu$  from well A1 and add it to well B1. Mix thoroughly by pipetting up and down several times.
  - e) Remove 50  $\mu$  from well B1 and add it to well C1.
  - f) Mix thoroughly and repeat for wells D1-G1. At well G1, remove 50  $\mu$  and discard. DO NOT PROCEED TO WELL H1 (assay buffer blank). Final volume=50  $\mu$ .
  - g) Repeat serial dilution for the wells in column 2 (standard curve duplicates)

To prepare calcineurin activity assay sample wells:

Background (no substrate): {Control for background phosphate/interfering substances}

1. Add 20  $\mu$  dH<sub>2</sub>O to appropriate wells.
2. Add 25  $\mu$  2X assay buffer with calmodulin to each well.

Total phosphatase activity wells: {Total phosphatase activity in the extract }

1. Add 10  $\mu$  dH<sub>2</sub>O to each well.
2. Add 25  $\mu$  2X assay buffer with calmodulin to each well.

EGTA buffer (Ca<sup>2+</sup>/CaM free): {Total activity in the absence of active PP2B (calcineurin)}

1. Add 10  $\mu$  dH<sub>2</sub>O to each well.
2. Add 25  $\mu$  2X EGTA buffer to each well.

OA (okadaic acid): {Total activity in the absence of active PP1 & PP2A}

1. Add 5  $\mu$  dH<sub>2</sub>O to each well.
2. Add 25  $\mu$  2X assay buffer with calmodulin to each well.
- 2+. Add 5  $\mu$  okadaic acid (5  $\mu$ M)

OA + EGTA: {Total activity in the absence of active PP1, PP2A & PP2B}

1. Add 5  $\mu$  dH<sub>2</sub>O to each well.
2. Add 25  $\mu$  2X EGTA buffer to each well.
- 2+. Add 5  $\mu$  okadaic acid (5  $\mu$ M)

Positive control (calcineurin enzyme): {Purified CaN enzyme positive control}

1. Add 10  $\mu$  dH<sub>2</sub>O to each well.
2. Add 25  $\mu$  2X assay buffer with calmodulin to each well.

Add phosphopeptide substrate:

3. Add 10  $\mu$  phosphopeptide substrate to each well of the calcineurin samples except the "Background" control. DO NOT ADD SUBSTRATE TO THE PHOSPHATE STANDARD CURVE SAMPLES!
4. Equilibrate microtiter plate to reaction temperature (e.g.: 30°C) for 10 min.

To initiate calcineurin assay:

5. Add 5  $\mu$  sample extract or diluted calcineurin (dilute to 8 U/ $\mu$  prior to use) to appropriate wells. For sample extract wells, it may be necessary to dilute the HSS tissue extract (e.g.: 1/5-1/10 in lysis buffer). For calcineurin "Positive control" add 5  $\mu$  (40 U/well).
6. Incubate plate at reaction temperature for desired duration (e.g.: 30 min@30°C).

To terminate reactions:

7. After incubating wells for desired duration, terminate reactions by adding 100  $\mu$  BIOMOL GREEN reagent to ALL samples including the phosphate standard curve.
8. Allow color to develop 20-30 minutes, making sure all wells spend approximately the same time with the reagent before reading on microplate reader.
9. Read OD620nm on microplate reader.
10. Perform data analysis (see below).

NOTE: Retain microplate for future use of unused wells!

#### Phosphate (PO<sub>4</sub>) Standard Curve

1. Plot standard curve data as OD620nm versus nmol PO<sub>4</sub>.
2. Obtain a line-fit to the data using an appropriate routine.
3. Use the slope and Y-intercept to calculate amount of phosphate released for the experimental data (see below).

NOTE: For highest accuracy, a standard curve must be performed for each new set of assay data. This will normalize for variations in free phosphate in samples, time of incubation with the BIOMOL GREEN reagent, and other experimental factors.

#### Analysis

##### Conversion of OD620nm to Amount Phosphate Released

1. Convert OD620nm data into the amount of phosphate released using the standard curve line-fit data, from above:

Phosphate released = (OD620nm – Yint)/slope

EXAMPLE:

Std curve slope=0.3 OD620nm/nmol phosphate

Std curve Yint=0.001 OD620nm

Sample OD=0.4

Phosphate released=(0.4-0.001)/0.3 = 1.33 nmol

## GENE INFORMATION

#### Synonyms

Cellular calcineurin activity assay Kit; Cellular calcineurin assay Kit; calcineurin

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