



# Rabbit (polyclonal) Anti-Ribosomal Protein S6 [pSpS<sup>235/236</sup>] Phosphospecific Antibody, Unconjugated

## PRODUCT ANALYSIS SHEET

<b>Catalog Number:</b>	44-922G (10 mini-blot size)
<b>Lot Number:</b>	See product label
<b>Volume:</b>	100 $\mu$ L
<b>Form of Antibody:</b>	Rabbit polyclonal immunoglobulin in Dulbecco's phosphate buffered saline (without Mg <sup>2+</sup> and Ca <sup>2+</sup> ), pH 7.3 (+/- 0.1), 50% glycerol, with 1.0 mg/mL BSA (IgG, protease free) as a carrier.
<b>Preservative:</b>	0.05% sodium azide (Caution: sodium azide is a poisonous and hazardous substance. Handle with care and dispose of properly.)
<b>Purification:</b>	Purified from rabbit serum by sequential epitope-specific chromatography. The antibody has been negatively preadsorbed using a non-phosphopeptide corresponding to the site of phosphorylation to remove antibody that is reactive with non-phosphorylated RPS6. The final product is generated by affinity chromatography using a RPS6-derived peptide that is phosphorylated at serines 235 and 236.
<b>Immunogen:</b>	The antiserum was produced against a chemically synthesized phosphopeptide derived from the region of human RPS6 that contains serines 235 and 236. The sequence is conserved in mouse and rat.
<b>Target Summary:</b>	40S ribosomal protein S6 (also known as RPS6) is a ~31 kDa substrate of p70 S6 kinase (p70S6K) and a major component of translational machinery involved in protein synthesis, cell growth, proliferation, and metabolism. Phosphorylation of RPS6 is rapamycin and wortmannin-sensitive as its activation is mediated by mTOR and PI3K pathways. Ribosomal protein S6 undergoes phosphorylation on multiple serines in the carboxyl terminal region in the order 236→235→240→244→247, due to the positions of these amino acid residues on the $\alpha$ -helix. Hyperphosphorylation of ribosomal protein S6 stimulates protein synthesis that mediates progression through the cell cycle.
<b>Reactivity:</b>	Human RPS6. Human and rat RPS6 (100% homologous) have not been tested, but are expected to react. This antibody does not cross react with RPS6 phosphorylated on serines 244 and 247.
<b>Applications:</b>	The antibody has been used for Western blotting applications.
<b>Suggested Working Dilutions:</b>	For Western blotting applications, we recommend using the antibody at a 1:1000 dilution. The optimal antibody concentration should be determined empirically for each specific application.
<b>Storage:</b>	Store at $-20^{\circ}\text{C}$ . We recommend a brief centrifugation before opening to settle vial contents. Then, apportion into working aliquots and store at $-20^{\circ}\text{C}$ . For shipment or short-term storage (up to one week), $2-8^{\circ}\text{C}$ is sufficient.
<b>Expiration Date:</b>	Expires one year from date of receipt when stored as instructed.
<b>Positive Control Used:</b>	HeLa +/- TNF- $\alpha$ or anisomycin.

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**Related Products:****Antibodies:**

Ribosomal Protein S6 [pSpS<sup>244/247</sup>], Cat. # 44-923G  
 p70S6K [pT<sup>229</sup>], Cat. # 44-918  
 Anti-Akt/PKB pan, Cat. # 44-609G  
 Akt/PKB [pT<sup>308</sup>], Cat. # 44-602G  
 Akt/PKB [pS<sup>473</sup>], Cat. # 44-622G  
 PKR [pT<sup>451</sup>], Cat. # 44-668G  
 eIF2 $\alpha$  [pS<sup>52</sup>], Cat.# 44-728G  
 eIF4G [pS<sup>1108</sup>], Cat. # 44-526  
 Src [pY<sup>418</sup>], Cat. # 44-660G  
 ERK1&2 [pTpY<sup>185/187</sup>], Cat. # 44-680G  
 PTEN [pS<sup>370</sup>], Cat. # 44-1060G  
 PTEN [pSpTpS<sup>380/382/385</sup>], Cat. # 44-1066G  
**Peptide:** Ribosomal Protein S6 [pSpS<sup>235/236</sup>] control peptides, Cat. # 04-922Z

**References:**

Pende, M., et al. (2004) S6K1(-)/S6K2(-) mice exhibit perinatal lethality and rapamycin-sensitive 5'-terminal oligopyrimidine mRNA translation and reveal a mitogen-activated protein kinase-dependent S6 kinase pathway. *Mol. Cell. Biol.* 24(8):3112-3124.

Mourani, P.M., et al. (2004) Unique, highly proliferative growth phenotype expressed by embryonic and neointimal smooth muscle cells is driven by constitutive Akt, mTOR, and p70S6K signaling and is actively repressed by PTEN. *Circulation* 109(10):1299-1306.

Lekmine, F., et al. (2004) Interferon-gamma engages the p70 S6 kinase to regulate phosphorylation of the 40S S6 ribosomal protein. *Exp. Cell. Res.* 295(1):173-182.

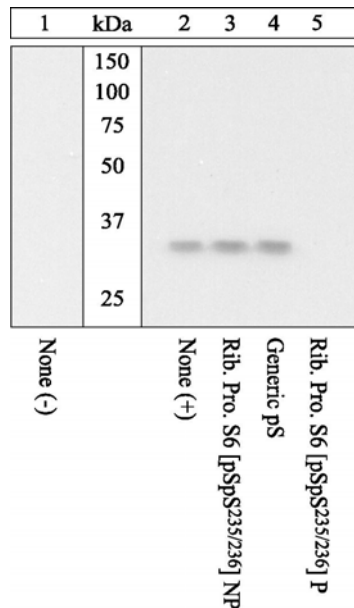
Tuhackova, Z., et al. (2004) IL2-dependent phosphorylation of 40S ribosomal protein S6 is controlled by PI-3K/mTOR signalling in CTLL2 cells. *Int. J. Mol. Med.* 13(4):601-605.

Ly, C., et al. (2003) Bcr-Abl kinase modulates the translation regulators ribosomal protein S6 and 4E-BP1 in chronic myelogenous leukemia cells via the mammalian target of rapamycin. *Cancer Res.* 63(18):5716-5722.

Shah, O.J., et al. (2003) Mitotic regulation of ribosomal S6 kinase 1 involves Ser/Thr, Pro phosphorylation of consensus and non-consensus sites by Cdc2. *J. Biol. Chem.* 278(18):16433-16442.

Stewart, M.J. and G. Thomas (1994) Mitogenesis and protein synthesis: a role for ribosomal protein S6 phosphorylation? *Bioessays.* 16(11):809-815. Review.

Ferrari, S., et al. (1991) Mitogen-activated 70K S6 kinase. Identification of in vitro 40S ribosomal S6 phosphorylation sites. *J. Biol. Chem.* 266(33):22770-22775.

**Peptide Competition**

Lysates prepared from HeLa cells left untreated (1) or treated with anisomycin (2-5) were resolved by SDS-PAGE on a 14% polyacrylamide gel and transferred to PVDF. Membranes were blocked with a 5% BSA-TBST buffer for one hour at room temperature, and incubated with ribosomal protein S6 [pSpS<sup>235/236</sup>] antibody for two hours at room temperature in a 3% BSA-TBST buffer, following prior incubation with: no peptide (1, 2), the non-phosphopeptide corresponding to the immunogen (3), a generic phosphoserine-containing peptide (4), or, the phosphopeptide immunogen (5). After washing, membranes were incubated with goat F(ab')<sub>2</sub> anti-rabbit IgG HRP conjugate (Cat. # ALI4404) and bands were detected using the Pierce SuperSignal™ method.

The data show that only the peptide corresponding to ribosomal protein S6 [pSpS<sup>235/236</sup>] blocks the signal, verifying the specificity of the antibody.

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## Western Blotting Procedure

1. Lyse approximately  $10^7$  cells in 0.5 mL of ice cold Cell Lysis Buffer (formulation provided below). This buffer, a modified RIPA buffer, is suitable for recovery of most proteins, including membrane receptors, cytoskeletal-associated proteins, and soluble proteins. This cell lysis buffer formulation is available as a separate product which requires supplementation with protease inhibitors immediately prior to use (Cat. # FNN0011). Other cell lysis buffer formulations, such as Laemmli sample buffer and Triton-X 100 buffer, are also compatible with this procedure. Additional optimization of the cell stimulation protocol and cell lysis procedure may be required for each specific application.
2. Remove the cellular debris by centrifuging the lysates at 14,000 x g for 10 minutes. Alternatively, lysates may be ultracentrifuged at 100,000 x g for 30 minutes for greater clarification.
3. Carefully decant the clarified cell lysates into clean tubes and determine the protein concentration using a suitable method, such as the Bradford assay. Polypropylene tubes are recommended for storing cell lysates.
4. React an aliquot of the lysate with an equal volume of 2x Laemmli Sample Buffer (125 mM Tris, pH 6.8, 10% glycerol, 10% SDS, 0.006% bromophenol blue, and 130 mM dithiothreitol [DTT]) and boil the mixture for 90 seconds at 100°C.
5. Load 10-30  $\mu$ g of the cell lysate into the wells of an appropriate single percentage or gradient minigel and resolve the proteins by SDS-PAGE.
6. In preparation for the Western transfer, cut a piece of PVDF membrane slightly larger than the gel. Soak the membrane in methanol for 1 minute, then rinse with ddH<sub>2</sub>O for 5 minutes. Alternatively, nitrocellulose may be used.
7. Soak the PVDF membrane, 2 pieces of Whatman paper, and Western apparatus sponges in transfer buffer (formulation provided below) for 2 minutes.
8. Assemble the gel and membrane into the sandwich apparatus.
9. Transfer the proteins at 140 mA for 60-90 minutes at room temperature.
10. Following the transfer, rinse the membrane with Tris buffered saline for 2 minutes.
11. Block the membrane with blocking buffer (formulation provided below) for one hour at room temperature or overnight at 4°C.
12. Incubate the blocked blot with primary antibody at a 1:1000 dilution in Tris buffered saline supplemented with 3% BSA and 0.1% Tween 20 for one hour at room temperature or overnight at 4°C.
13. Wash the blot with several changes of Tris buffered saline supplemented with 0.1% Tween 20.
14. Detect the antibody band using an appropriate secondary antibody, such as goat F(ab')<sub>2</sub> anti-rabbit IgG alkaline phosphatase conjugate (Cat. # ALI4405) or goat F(ab')<sub>2</sub> anti-rabbit IgG horseradish peroxidase conjugate (Cat. # ALI4404) in conjunction with your chemiluminescence reagents and instrumentation.

### Cell Lysis Buffer

#### Formulation:

10 mM Tris, pH 7.4  
100 mM NaCl  
1 mM EDTA  
1 mM EGTA  
1 mM NaF  
20 mM Na<sub>4</sub>P<sub>2</sub>O<sub>7</sub>  
2 mM Na<sub>3</sub>VO<sub>4</sub>  
0.1% SDS  
0.5% sodium deoxycholate  
1% Triton-X 100  
10% glycerol  
1 mM PMSF (made from a  
0.3 M stock in DMSO)  
or 1 mM AEBSF (water  
soluble version of PMSF)  
60  $\mu$ g/mL aprotinin  
10  $\mu$ g/mL leupeptin  
1  $\mu$ g/mL pepstatin  
(alternatively, protease inhibitor cocktail  
such as Sigma Cat. # P2714 may be used)

### Transfer Buffer

#### Formulation:

2.4 gm Tris base  
14.2 gm glycine  
200 mL methanol  
Q.S. to 1 liter, then add  
1 mL 10% SDS.  
Cool to 4°C prior to use.

### Tris Buffered Saline

#### Formulation:

20 mM Tris-HCl, pH 7.4  
0.9% NaCl

### Blocking Buffer

#### Formulation:

100 mL Tris buffered saline  
5 gm BSA  
0.1 mL Tween 20

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## Peptide Competition Experiment

Invitrogen's Phosphorylation Site Specific Antibodies (PSSAs) have been developed to enable the specific and sensitive detection of phosphorylation of particular amino acid residues in target proteins, while circumventing the need for protein purification, phosphopeptide mapping or handling radioactivity. The specificity of a PSSA in each experimental system can be confirmed through peptide competition. In this technique, aliquots of antibody are pre-incubated with peptide containing the sequence of the phosphopeptide immunogen used to raise the PSSA and the corresponding non-phosphopeptide. Following preincubation with the peptide, each antibody preparation is then used as a probe in antibody-based detection methods, such as Western blotting, immunocytochemistry, flow cytometry, or ELISA. With a PSSA specific for the phosphorylated target protein, pre-incubation with an excess of peptide containing the sequence of the phosphopeptide immunogen will block all antigen binding sites, while pre-incubation with the corresponding non-phosphopeptide will not affect the antibody.

Invitrogen has developed a line of control peptides specifically for use in peptide competition experiments with our PSSAs. These peptides, available as separate Invitrogen catalog items, are provided in pairs which contain the sequences of the phosphopeptide immunogen and the corresponding non-phosphopeptide.

In performing the Peptide Competition Experiment, it is important to note that the optimal dilutions of both antibody and peptide should be determined empirically for each specific application. The optimal dilution of antibody in these procedures is below saturating, as determined by previous experiments in your system. If an optimal antibody dilution has not been determined in your system, please refer to the Suggested Working Dilution on the antibody Product Analysis Sheet for guidance on an appropriate starting dilution. The optimal dilution of peptide used in these procedures will depend on the overall affinity or avidity of the antibody, as well as the quantity of the target antigen. A 50-150 fold molar excess of peptide to antibody is found to be effective for most peptide competition experiments.

In the example presented below, the PSSA is used as a dilution of 1:1000 and the peptides are used at a concentration of 333 nM. The total volume of the phosphopeptide and non-phosphopeptide-pre-incubated antibody preparations is 2 mL, sufficient for probing Western blot strips, as well as for use in other antibody-based detection methods. Under these conditions, the molar excess of peptide to antibody is  $\geq 50$ .

### Procedure:

1. Prepare three *identical test samples*, such as identical PVDF or nitrocellulose strips to which the protein of interest has been transferred. The test samples should be blocked using a blocking buffer, such as Tris buffered saline supplemented with 0.1% Tween 20, and either 5% BSA or 5% non-fat dried milk.
2. Prepare 6.5 mL of *working antibody stock solution* (1:1000 in this example) by adding 6.5  $\mu$ L of antibody stock solution to 6.5 mL of buffer containing blocking protein, such as TBS supplemented with 0.1% Tween 20, and either 3% BSA or 3% non-fat dried milk.
3. Apportion the unused PSSA into working aliquots and store at  $-20^{\circ}\text{C}$  for future use (the stock PSSA contains 50% glycerol and will not freeze at this temperature).
4. Allow the *lyophilized control peptides* to reach room temperature, ideally under desiccation.
5. Reconstitute each of the control peptides (supplied at 0.1 mg/vial) to a concentration of 66.7  $\mu\text{M}$  with nanopure water. For a peptide with a molecular mass of 1500 (stated on the peptide Product Analysis Sheet), reconstitution with 1 mL water yields a solution with a concentration of 66.7  $\mu\text{M}$ .
6. Apportion the unused reconstituted peptide solutions into working aliquots and store at  $-20^{\circ}\text{C}$  for future use.
7. Label 3 test tubes as follows:
  - tube 1: water only no peptide control
  - tube 2: phosphopeptide
  - tube 3: non-phosphopeptide
8. Into each tube, pipette the following components
  - tube 1: 2 mL diluted PSSA solution plus 10  $\mu\text{L}$  nanopure water
  - tube 2: 2 mL diluted PSSA solution plus 10  $\mu\text{L}$  phosphopeptide
  - tube 3: 2 mL diluted PSSA solution plus 10  $\mu\text{L}$  non-phosphopeptide
9. Incubate the three tubes for 30 minutes at room temperature with gentle rocking. During this incubation, the peptides have the chance to bind to the combining site of the antibody.
10. At the end of the incubation step, transfer the contents of each of the three tubes to clean reaction vessels containing one of the three identical test samples.

### For Western blotting strips:

- Incubate the strips with the pre-incubated antibody preparations for 1 hour at room temperature or overnight at  $4^{\circ}\text{C}$ .
- Wash each strip four times, five minutes each, to remove unbound antibody.
- Transfer each strip to a new solution containing a labeled secondary antibody [e.g., goat F(ab')<sub>2</sub> anti-rabbit IgG alkaline phosphatase conjugate (Cat. # ALI4405) or goat F(ab')<sub>2</sub> anti-rabbit IgG horseradish peroxidase conjugate (Cat. # ALI4404)].
- Remove unbound secondary antibody by thorough washing, and develop the signal using your chemiluminescent reagents and instrumentation.

The signals obtained with antibody incubated with the "Water Only, No Peptide Control" (Tube 1), represents the maximum signal in the assay. This signal should be eliminated by pre-incubation with the "Phosphopeptide" (Tube 2), while pre-incubation with the "Non-Phosphopeptide" (Tube 3) should not impact the signal. If the "Phosphopeptide" only partially eliminates the signal, repeat the procedure using twice the volume of water or peptide solutions listed in Step 8. If partial competition is seen following pre-incubation with the "Non-Phosphopeptide", repeat the procedure using half the volumes of water or peptide solutions listed in Step 8.

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