

# [Regulating the regulator: phosphorylation of pkc θ in t cells](https://assignbuster.com/regulating-the-regulator-phosphorylation-of-pkc-in-t-cells/)

[](https://assignbuster.com/)[Health & Medicine](https://assignbuster.com/essay-subjects/health-n-medicine/)

A commentary on

Barouch-Bentov, R., Lemmens, E. E., Hu, J., Janssen, E. M., Droin, N. M., Song, J., Schoenberger, S. P., and Altman, A. (2005). Protein kinase C-theta is an early survival factor required for differentiation of effector CD8+ T cells. *J. Immunol.* 175, 5126–5134.

Freeley, M., Kelleher, D., and Long, A. (2011). Regulation of protein kinase C function by phosphorylation on conserved and non-conserved sites. *Cell. Signal* . 23, 753–762.

Garaude, J., Kaminski, S., Charni, S., Aguilo, J. I., Jacquet, C., Plays, M., Hernandez, J., Rodriguez, F., Hipskind, R. A., Anel, A., and Villalba, M. (2008). Impaired anti-leukemic immune response in PKCtheta-deficient mice. *Mol. Immunol.* 45, 3463–3469.

Gruber, T., Hermann-Kleiter, N., Hinterleitner, R., Fresser, F., Schneider, R., Gastl, G., Penninger, J. M., and Baier, G. (2009). PKC-theta modulates the strength of T cell responses by targeting Cbl-b for ubiquitination and degradation. *Sci. Signal.* 2, ra30.

Hayashi, K., and Altman, A. (2007). Protein kinase C theta (PKCtheta): a key player in T cell life and death. *Pharmacol. Res.* 55, 537–544.

Kingeter, L. M., and Schaefer, B. C. (2008). Loss of protein kinase C theta, Bcl10, or Malt1 selectively impairs proliferation and NF-kappa B activation in the CD4+ T cell subset. *J. Immunol.* 181, 6244–6254.

Letschka, T., Kollmann, V., Pfeifhofer-Obermair, C., Lutz-Nicoladoni, C., Obermair, G. J., Fresser, F., Leitges, M., Hermann-Kleiter, N., Kaminski, S., and Baier, G. (2008). PKC-theta selectively controls the adhesion-stimulating molecule Rap1. *Blood* 112, 4617–4627.

Marsland, B. J., and Kopf, M. (2008). T-cell fate and function: PKC-theta and beyond. *Trends Immunol.* 29, 179–185.

Nika, K., Charvet, C., Williams, S., Tautz, L., Bruckner, S., Rahmouni, S., Bottini, N., Schoenberger, S. P., Baier, G., Altman, A., and Mustelin, T. (2006). Lipid raft targeting of hematopoietic protein tyrosine phosphatase by protein kinase C theta-mediated phosphorylation. *Mol. Cell. Biol.* 26, 1806–1816.

Quann, E. J., Liu, X., Altan-Bonnet, G., and Huse, M. (2011). A cascade of protein kinase C isozymes promotes cytoskeletal polarization in T cells. *Nat. Immunol.* 12, 647–654.

Saibil, S. D., Jones, R. G., Deenick, E. K., Liadis, N., Elford, A. R., Vainberg, M. G., Baerg, H., Woodgett, J. R., Gerondakis, S., and Ohashi, P. S. (2007). CD4+ and CD8+ T cell survival is regulated differentially by protein kinase Ctheta, c-Rel, and protein kinase B. *J. Immunol.* 178, 2932–2939.

Sims, T. N., Soos, T. J., Xenias, H. S., Dubin-Thaler, B., Hofman, J. M., Waite, J. C., Cameron, T. O., Thomas, V. K., Varma, R., Wiggins, C. H., Sheetz, M. P., Littman, D. R., and Dustin, M. L. (2007). Opposing effects of PKCtheta and WASp on symmetry breaking and relocation of the immunological synapse. *Cell* 129, 773–785.

Sutcliffe, E. L., Bunting, K. L., He, Y. Q., Li, J., Phetsouphanh, C., Seddiki, N., Zafar, A., Hindmarsh, E. J., Parish, C. R., Kelleher, A. D., McInnes, R. L., Taya, T., Milburn, P. J., and Rao, S. (2011). Chromatin-associated protein kinase C-theta regulates an inducible gene expression program and microRNAs in human T lymphocytes. *Mol. Cell* 41, 704–719.

Tan, S. L., Zhao, J., Bi, C., Chen, X. C., Hepburn, D. L., Wang, J., Sedgwick, J. D., Chintalacharuvu, S. R., and Na, S. (2006). Resistance to experimental autoimmune encephalomyelitis and impaired IL-17 production in protein kinase C theta-deficient mice. *J. Immunol.* 176, 2872–2879.

von Essen, M., Nielsen, M. W., Bonefeld, C. M., Boding, L., Larsen, J. M., Leitges, M., Baier, G., Odum, N., and Geisler, C. (2006). Protein kinase C (PKC) alpha and PKC theta are the major PKC isotypes involved in TCR down-regulation. *J. Immunol.* 176, 7502–7510.

Wang, X., Chuang, H.-C., Li, J.-P., and Tan, T.-H. (2012). Regulation of PKC-θ function by phosphorylation in T cell receptor signaling. *Front. Immun.* 3: 197. doi: 10. 3389/fimmu. 2012. 00197

Zanin-Zhorov, A., Ding, Y., Kumari, S., Attur, M., Hippen, K. L., Brown, M., Blazar, B. R., Abramson, S. B., Lafaille, J. J., and Dustin, M. L. (2010). Protein kinase C-theta mediates negative feedback on regulatory T cell function. *Science* 328, 372–376.

Zanin-Zhorov, A., Dustin, M. L., and Blazar, B. R. (2011). PKC-theta function at the immunological synapse: prospects for therapeutic targeting. *Trends Immunol.* 32, 358–363.