# Quantitative multiplex analysis of immune checkpoint protein expression in circulation and in the tumor microenvironment

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Immune checkpoint inhibitors have been proven to be an effective method in improving antitumor immune response. Many immune checkpoint proteins are expressed as soluble forms in circulation and in the tumor and tumor micro environment. Here were port the development of bead-based Luminex® multiplex assays for the quantitative profiling of co-inhibitory and co-stimulating immune checkpoint proteins CTLA-4, PD-1, TIM-3, LAG-3, HVEM, GITRL, BTLA, CD27, CD28, CD40, GITR, PD-L1, CD80/B7-1, CD86/B7-2 and ICOS (Cat.No.HCKPMAG-11K, which also includes an anti-tumor immuneregulator,TLR-2).

In order to explore the use of soluble immune checkpoint proteins as putative cancer biomarkers, we used these multiplex assays to measure checkpoint protein levels in serum samples from breast cancer patients, colon cancer patients, and a corresponding set of normal serum samples.