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**Cancer Immunology and Immunotherapy:**

Cancer is one of the most common life-threatening diseases, particularly in developed countries, and causes more than one third of all human deaths every year. Surgical therapy, chemotherapy, radiation therapy and the combination of them are general standard treatments, although their effects for advanced and metastatic cancers are still far from satisfactory. As a fourth treatment option, immunotherapy has been under investigation. The greatest merit of immunotherapy is its specificity, compared to non-specific standard treatments that cause various severe side effects. However, recent clinical trials of immunotherapy are turning out to be less effective than we expected, or else somewhat effective but with severe autoimmune reactions. One of the most important issues impeding cancer immunotherapy is the recruitment of the immune suppressor cells by cancer cells in the cancer microenvironment. These immune suppressors, represented by regulatory T cells (Treg) and myeloid-derived suppressor cells (MDSCs), efficiently attenuate the activity of cytotoxic T lymphocytes (CTLs) activities against cancer. The CTL is the most effective, most powerful, and largest unit to execute anti-cancer immune responses. In mouse and human studies, it has been shown that the accumulation of Tregs or MDSCs at the cancer site or in peripheral blood correlates with a poor prognosis. Many of the ongoing or near-future trials of cancer immunotherapy, such as LAK (lymphokine-activated killer cell) therapy, DC (dendritic cell) therapy, monoclonal antibody therapy, and cancer vaccines using cancer cells or antigen peptides, are focused on the elevation of effector cell function and activity. Even though CTL activity is elevated, if immune suppressors exist in the cancer microenvironment, it is very difficult for CTLs to reach cancer cells and destroy them. Therefore, understanding the mechanism of immune suppressor recruitment by cancer cells holds great promise for the development of effective future immunotherapies.

Our research goal is to investigate novel mechanisms of anti-cancer immune responses and discover immediate translational potential for new cancer immunotherapies. Our main research focus consists of two parts. One is to analyze the role of costimulatory molecules which provide costimulation and coinhibition for cancer immunosurveillance, T cell mediated cancer rejection and cancer induced host immune tolerance. The other focus is to evaluate cancer induced immune suppression mediated by immune suppressor cells such as regulatory T cells and myeloid-derived suppressor cells. For a future strategy of immunotherapy, to enhance immune response against cancer and to deplete immune suppressor factors from cancer microenvironment should be combined. We will focus our research on colorectal cancer and ovarian cancer.