Molecular diversity of macrophages in allergic reaction: Comparison between the allergenic modes—T_H1- and T_H2-derived immune conditions

MozhdehBagheri, YuPeng Dong, Masao Ono

Department of Pathology, Tohoku University Graduate School of Medicine,
2-1 Seiryo, Aoba-ku, Sendai, Miyagi 980-8575 Japan.

Macrophages participate in many normal processes such as apoptosis, necrosis, homeostasis, and adaptive and innate immunity; however, when over activated or defective, they contribute to diseases, including macrophage activation syndrome (MAS), diabetes, human immunodeficiency virus (HIV) infection, atherosclerosis, and cancer. In general, changes in the number of macrophages, parallel to changes in the functional activity, lead to different disease. While identifying macrophages by specific markers is clinically important, recognition and utilization of macrophage-specific markers are in the initial stages of research. Classically activated macrophages, stimulated by the combination of IFN-γ and TNF, exhibit enhanced microbicidal and tumoricidal abilities and secrete high levels of pro-inflammatory cytokines. Unlike classically activated macrophages, wound-healing macrophages respond to IL-4 and other signals released during injury.

On the basis of previous study, we used enzyme-linked immunosorbent assay (ELISA) to determine interleukin-10 (IL-10) and tumor necrosis factor-alpha (TNF-α) levels in cell supernatants, after activation of macrophages by the addition of different concentrations of lipopolysaccharides (LPS). The ELISA results revealed that after macrophage stimulation with LPS, the level of IL-10 produced by Alum-induced macrophages was higher than the level of IL-10 produced by CFA-induced macrophages in 0.01 μg/ml LPS. In contrast, the level of TNF-α produced by CFA-induced macrophages was higher than the level of TNF-α produced by Alum-induced macrophages in 0.1 μg/ml LPS ($p < 0.05$). Finally, DNA microarrays were employed to confirm previous results and to find new markers by analyzing the total mRNAs of macrophages. The DNA microarray results suggest immunoglobin-like type 2 receptor alpha

(*Pilra*) (Table 2) as a new marker for M1 macrophages and macrophage galactose*N*-acetylgalactosamine-specific lectin 2 (*Mgl2*) as a marker for M2 macrophages.

Keywords: Th1, Th2, macrophage, M1, M2, biomarkers, allergic reaction