The ultimate goal of modern regenerative biology and medicine is to achieve tissue/organ regeneration. The immune system has been reported as an important modulator of regeneration in multiple regenerative models (such as planarians, axolotl, hair and liver of mammals) [1-3], therefore, immune system is termed the “main switch” of tissue/organ regeneration. Deer antlers are the unique mammalian appendages capable of annual full regeneration. Although the regulatory mechanisms of immune system in other regeneration model have been extensively studied, there is no report thus far specifically regard to the role of immune system in antler regeneration. We infer here that immune system also plays a key role in antler regeneration based on the results of our two experiments.

(1) Previous studies demonstrated that antler regeneration is a stem cell-based process, and antler stem cells are located in pedicle periosteum (PP) [4-5]. Macroscopic and histological studies revealed that distal PP is intimately bound with the enveloping skin, while the proximal PP is only loosely attached [6]. The distal PP has been referred to as the “potentiated PP” as this is a step ahead toward antler regeneration, while the proximal PP as the “dormant PP” [7]. Analysis of those two types of PP tissue using transcriptome, proteome and MicroRNA [8], we found that a large number of immune related factors and signaling pathways were enriched in the potentiated PP, from which antler regeneration takes place.

(2) When the PP cells were co-cultured with immune cells, we found that the PP cells attracted immune cells by secreting chemokines; in turn, the proliferation, migration and apoptosis of the PP cells were regulated by immune cells. Furthermore, PP cells significantly inhibited the proliferation of activated lymphocytes.

We believe that the immune system plays a critical role in antler regeneration, although the cellular mediators and immune-pathways involved have not been revealed. Therefore, antler biology would be a fruitful field for studying the relationship between immune system and mammalian organ regeneration.

References