

During the past decades several spectacular findings have been made in the field of immunology. Elucidating the functions of the antigen presenting cells (APCs) belong to the most important. Dendritic cells (DCs) represent a specific group of APCs with a unique ability to initiate primary immune responses. Despite the fact that, in vivo, they are very rare and difficult to isolate, DCs came very fast into the focus of scientific interests. Development of novel laboratory techniques facilitated a robust expansion of their research. With time it has been proven that DCs play a pivotal role in initiation, maintenance and control of the immune responses. The extraordinary features of DCs were soon investigated in human clinical trials, where DCs have been particularly used as vectors for vaccination protocols, especially in the treatment of tumors. However, DCs capability to polarize the outcome of immune response and the potential to induce or suppress immunity under specific circumstances led to the idea that they might be also used in the treatment of autoimmune and allergic diseases or in transplantation medicine as well.

There is a need to stress that most of the knowledge has been obtained from the in vitro generated DCs, but advanced technological methods bring us the opportunity to study DCs directly in vivo. Multiparametric flow cytometry, two-photon microscopy, confocal microscopy and others shed some light on the DCs in vivo identification, quantification, in vivo trafficking and complex systemic interactions. Data acquired by in vivo monitoring reflect normal and various pathological conditions and they might be used as prospective diagnostic tools in medicine.