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Transcription factor Foxo1 is essential for IL-9 induction in T helper cells

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Abstract

Interleukin 9 (IL-9)-producing helper T (Th9) cells have a crucial function in allergic inflammation, autoimmunity, immunity to extracellular pathogens and anti-tumor immune responses. In addition to Th9, Th2, Th17 and Foxp3$^+$ regulatory T (Treg) cells produce IL-9. A transcription factor that is critical for IL-9 induction in Th2, Th9 and Th17 cells has not been identified. Here we show that the forkhead family transcription factor Foxo1 is required for IL-9 induction in Th9 and Th17 cells. We further show that inhibition of AKT enhances IL-9 induction in Th9 cells while it reciprocally regulates IL-9 and IL-17 in Th17 cells via Foxo1. Mechanistically, Foxo1 binds and transactivates IL-9 and IRF4 promoters in Th9, Th17 and iTreg cells. Furthermore, loss of Foxo1 attenuates IL-9 in mouse and human Th9 and Th17 cells, and ameliorates allergic inflammation in asthma. Our findings thus identify that Foxo1 is essential for IL-9 induction in Th9 and Th17 cells.The transcription factor Foxo1 can control regulatory T cell and Th1 function. Here the authors show that Foxo1 is also critical for IL-9 production by Th9 cells and other IL-9-producing cells.

Figures

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Review

Liposomes and phytosomes: Nanocarrier systems and their applications for the delivery of phytoconstituents

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Highlights

- Phytochemicals can be used against microbial infections, cancers, and for wound healing.
- Nanocarriers can be internalized into the cells.

Abstract

Phytochemicals, such as terpenes, polyphenols, and tannins, have been used in history, for the treatment of illnesses and fever. Phytochemicals are easily available in nature, can be isolated easily, and can be used against microbial infections, cancers, and for wound healing. However, due to poor pharmacokinetics, therapeutic applications of phytochemicals are heavily affected. Novel methods have been developed, for carrying and delivering phytochemicals to the target sites in a sustained manner. Liposomes and phytosomes are useful for encapsulating and delivering both lipophilic and hydrophilic therapeutic agents in higher quantity, without being identified by the reticuloendothelial system (RES). Surface modification of these nanocarriers, with polyethylene glycol (PEG), polyacrylic acid (PAA), or poly-L-lactic acid (PLA), has improved the bioavailability and stability. Development of immunoliposomes and immunophytosomes, by conjugating monoclonal antibodies, fragments, or targeting moieties, has improved the active targeting of cancer cells. If conjugated with the cancer specific antibodies, such as anti-HER2, transferrin, and folate, liposomes and phytosomes are capable for identifying and attaching cancer cells more efficiently. Targeted