inducing T_{Reg} cells in recipients? The authors investigated this by collecting $CD4^+$ T cells from the spleens of mice that had been injected with antigen-pulsed BAY-treated DCs and transferring these T cells into primed recipient mice. Antigen-specific T-cell responses were suppressed in mice that received the $CD4^+$ T cells. This shows that T_{Reg} cells were induced in the mice that received the treated DCs and that these T cells could transfer tolerance to recipient primed mice (a concept known as infectious tolerance). Further experiments showed that these T_{Reg} cells produced interleukin-10 (IL-10) in an antigen-specific manner, and that production of this cytokine was responsible for the observed suppression.

These results show that RELB, by controlling DC maturation and expression of CD40, could be important for determining the response of T cells to DCs in lymphoid organs, resulting in either tolerance or immunity.

Jenny Buckland

References and links

ORIGINAL RESEARCH PAPER Martin, E. *et al.* Antigen-specific suppression of a primed immune response by dendritic cells mediated by regulatory T cells secreting interleukin-10. *Immunity* **18**, 155–167 (2003)

FURTHER READING Thompson, A. G. & Thomas, R. Induction of immune tolerance by dendritic cells: implications for preventative and therapeutic immunotherapy of autoimmune disease. *Immunol. Cell Biol.* **80**, 509–519 (2002)

WEB SITE

Ranjeny Thomas's lab: http://130.102.98.253/cicr/Research_groups/Immunobiology/DCBGroup/dendritic_cell_biology_group.htm

functions, or is the microbicidal activity of CCL28 a later adaptation, arising by convergent evolution? The evolutionary origin of the dual functionality of CCL28 remains an intriguing unresolved issue.

Jennifer Bell

References and links

ORIGINAL RESEARCH PAPER Hieshima, K. CCL28 has dual roles in mucosal immunity as a chemokine with broad-spectrum antimicrobial activity. *J. Immunol.* **170**, 1452–1461 (2003)

FURTHER READING Nakayaka, T. *et al.* Profile of chemokine receptor expression on human plasma cells accounts for their efficient recruitment to target tissues. *J. Immunol.* **170**, 1136–1140 (2003)

IN BRIEF

IMMUNE REGULATION

Malaria blood-stage suppression of liver-stage immunity by dendritic cells.

Ocaña-Morgner, C. *et al. J. Exp. Med.* **197**, 143–151 (2003)

Malaria infection is initiated when an infected mosquito injects sporozoites into a mammalian host. The sporozoites invade the liver, where development and replication lead to the production of merozoites, which can infect erythrocytes — the blood stage of the infection. Using a rodent malaria model, this study shows that the blood stage of the infection actively suppresses immune responses targeted at the liver stage of the disease. Irradiated sporozoites injected into mice induce a $CD8^+$ T-cell response, whereas non-irradiated sporozites do not. When equal numbers of irradiated and non-irradiated sporozoites are injected, a $CD8^+$ T-cell response does not develop, which indicates that the non-irradiated sporozoites are mediating a suppressive effect. This suppressive effect — inhibition of IFN-γ secretion by T cells — was found to be mediated by dendritic cells (DCs). Blood-stage parasites inhibit DC maturation, enhance IL-10 production and decrease IL-12 production, but the suppressive factor released by DCs has not been identified yet.

REGULATORY LYMPHOCYTES

Activation of human $CD4^+$ cells with CD3 and CD46 induces a T-regulatory cell 1 phenotype.

Kemper, C. *et al. Nature* **421**, 388–392 (2003)

T regulatory 1 (T_R1) cells are a type of regulatory $CD4^+$ T cell that produce IL-10 and can suppress the function of T helper cells, but the differentiation pathway of these cells remains unclear. Now, Claudia Kemper and colleagues show that complement regulatory protein — a transmembrane protein that inhibits complement activation on host cells — has a role in stimulating the development of T_R1 cells. Co-engagement of CD3 and CD46 in the presence of IL-2 induces a T_R1 phenotype of human $CD4^+$ T cells. Supernatant from these T_R1-cell cultures suppresses the proliferation of bystander cells, a process that is inhibited by neutralizing IL-10-specific antibody.

EVOLUTION

Urochordates and the origin of natural killer cells: identification of a CD94/NKR-P1-related receptor in blood cells of *Botryllus*.

Khalturin, K. *et al. Proc. Natl Acad. Sci. USA* **100**, 622–627 (2003)

Botryllus schlosseri is a colony-forming invertebrate chordate that can undergo transplantation reactions. When two colonies meet, they either fuse or develop a cytotoxic lesion at the point of contact. The authors screened for genes with levels of expression that were either up or downregulated after allorecognition between colonies. Of the 1,200 transcripts analysed, 50 were differentially regulated. One of these (*BsCD94-1*) was found to be a protein containing a C-type lectin domain, with homology to the natural killer (NK)-cell receptor CD94. CD94.1-expressing blood cells in *Botryllus* resemble granulocytes and might be ancestral NK cells.