Maternal immune response to helminth infection during pregnancy determines offspring susceptibility to allergic airway inflammation.

Schistosomiasis, a chronic helminth infection, elicits distinct immune responses within the host, ranging from an initial TH1 and subsequent TH2 phase to a regulatory state, and is associated with dampened allergic reactions within the host. We sought to evaluate whether non-transplacental helminth infection during pregnancy alters the offspring’s susceptibility to allergy. Ovalbumin-induced allergic airway inflammation was analyzed in offspring from Schistosoma mansoni-infected mothers mated during the TH1, TH2, or regulatory phase of infection. Embryos derived from in vitro fertilized oocytes of acutely infected females were transferred into uninfected foster mice to determine the role of placental environment. The fetomaternal unit was further characterized by helminth-specific immune responses and microarray analyses. Eventually, IFN-γ-deficient mice were infected to evaluate the role of this predominant cytokine on the offspring’s allergy phenotype. We demonstrate that offspring from schistosome-infected mothers that were mated in the TH1 and regulatory phases, but not the TH2 immune phase, are protected against the onset of allergic airway inflammation. Interestingly, these effects were associated with distinctly altered schistosome-specific cytokine and gene expression profiles within...
the fetomaternal interface. Furthermore, we identified that it is not the transfer of helminth antigens but rather maternally derived IFN-? during the acute phase of infection that is essential for the progeny's protective immune phenotype. Overall, we present a novel immune phase-dependent coherency between the maternal immune responses during schistosomiasis and the progeny's predisposition to allergy. Therefore, we propose to include helminth-mediated transmaternal immune modulation into the expanded hygiene hypothesis.