Chapter 15

SCHISTOSOMIASIS AND REDUCED RISK OF ATOPIC DISEASES: NEW INSIGHTS AND POSSIBLE MECHANISMS

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1. INTRODUCTION

Infections with parasitic helminths and allergy are immunologically characterised by a skewing of the cellular immune response towards dominance by T helper type 2 (Th2) cells. The most evident sign of this is IgE antibody specific to the parasite or environmental allergen concerned, accompanied by high levels of apparently non-specific IgE. This has led to the seemingly antithetical ideas that helminth infection may exacerbate allergic reactions by enhancing IgE responses, or counter them by competition between total IgE and parasite-specific IgE with IgE specific for environmental allergens for mast cell activation. This area is currently under intense investigation as much for what it might tell us about the dramatic increase in atopic responses that has occurred over recent decades as for understanding the development of T cell immune biases in the human immune response as a whole. Despite the fact that schistosomes are neither nematodes nor intestinal and thus outside the scope of this book, new findings on schistosomiasis have greatly informed the helminth/allergy debate, and how Th2 biases arise in the situation for which they are assumed to have evolved resistance to macroparasites. With this in mind, therefore, we discuss immune responses in individuals infected with schistosomes, and the suppressive effect such infections may have on allergic diseases. We will discuss how Th2-skewed schistosome infected individuals not only do not develop, but even appear to have a reduced risk of, developing allergic diseases. We argue that a strong immunoregulatory network that develops upon persistent antigenic stimulation that helminths provide might play an
important role in suppressing atopic reactions in individuals with chronic helminth infections.

2. THE ASSOCIATION BETWEEN PARASITES AND ALLERGY

It is a commonly held view that IgE and Th2 responses evolved to combat helminth infections. As allergic diseases are associated with the expression of Th2 immune responses, it is possible that these diseases are a negative consequence of an evolutionary benefit of an anti-helminth response. Allergic responses are induced, prolonged, and amplified by Th2 cells secreting IL-4, IL-5 and IL-13 (Robinson et al. 1992; Umetsu & DeKruyff, 1997, 1999). Inflammatory cells, particularly eosinophils, basophils and mast cells, which bind to specific IgE and respond to incoming environmental allergens, characterize the harmful responses in allergic diseases.

Although genetic factors must influence the development of atopy and allergic diseases, only environmental factors could explain the recent dramatic rise in these diseases. International studies have indicated that allergic diseases are increasing in industrialized countries (International Study of asthma and Allergies in Childhood, 1998). In addition, there are clear differences in the prevalence of allergies between rural and urban areas within one country (Yemaneberhan et al. 1997). To explain these observations, environmental factors associated with a more industrialized/urban living have been studied intensively. Possible candidates include the rise in air pollution, increased exposure to indoor allergens, changes in diet, and changed patterns of microbial exposure. An overview of literature covering such factors is given in Table 15.1.

Much attention has been paid to the association between the decline in infectious diseases, due to improved hygiene and successful vaccination programs, and the development of allergy. First evidence supporting this negative association has come from studies showing that allergic sensitization is more frequent in children from small families and is over represented among the first born (Strachan, 1989; Jarvis et al. 1997). This suggests that the frequent exchange of infections may have a protective effect. More recent studies have shown a negative association between the development of allergy and exposure to infectious diseases such as Hepatitis A (Matricardi et al. 1997), measles (Shaheen et al. 1996) and tuberculosis