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Editor

How Helminths Alter Immunity to Infection

 Springer

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Preface

Helminth infections occur globally and all individuals are at some point in their life likely to be exposed to these parasites. Humans have always hosted parasitic worm infections and there is clear evidence that number of important helminth parasites have co-evolved with us. As such helminth infections should be considered a meta-zoan faunal complement to our micro-flora/biome. However, important pathological consequences of infection are also common. In tropical and sub-tropical regions, where helminth infections are common, the pathological effects of infection are important public health problems.

Conversely, in regions where helminth exposure has declined (i.e. North America and Western Europe) a corresponding increase in a range auto-immune diseases has occurred. Interest into how the decline of these infections may be contributing to heightened prevalence of allergy and auto-immunity has increased significantly. Therapeutically both controlled live helminth infections and administration of specific helminth antigens are now being actively tested as a new avenue of treatment of a range autoimmune diseases. This clinical work is supported by a large and compelling body of basic and clinical data that supports the hypothesis that helminth infections are likely to be effective in treating conditions such as inflammatory bowel disease, multiple-sclerosis and asthma. Underlying this helminth elicited protection from auto-immunity is the induction of immune regulatory cell populations such as regulatory T cells and alternatively activated macrophages.

In tropical and sub-tropical areas where helminth infections are still endemic, the influence of infection on a host's health status is typically associated with being negative. This association is largely correct and is probably exacerbated by increasing concentrations of populations in informal urban settlements lacking adequate public health provisions and changes in land use. Pathological infections affect millions of individuals worldwide. Infections with *Schistosoma* spp directly cause significant morbidity and death (approx. 200,000 deaths/year). Hookworm infections (approx. 500,000,000) are an important cause of anaemia and filarial nematode infections are the cause of severe morbidity to thousands of people in endemic areas.

In addition to these direct effects helminth infection is also associated with changes in a hosts ability to control unrelated infections. Typically this is associated with the mutual antagonism that can be predicted to occur between the typically

TH2 immune response to a helminth infection and the TH1 responses associated with many bacterial, protozoal and viral infections. Here immunological dogma has demonstrated in a number of classic basic studies that a pre-existing TH2 immune environment will inhibit the induction of a TH1 immune response and *vice versa*. It is therefore considered that abrogated efficacy of vaccines against childhood infections and increased prevalence and severity of a range of bacterial infections may result from helminth endemicity. As will be appreciated from reading the contributions to this book helminth influence on unrelated infection is diverse, context dependent and incompletely understood.

In this book we aim to assimilate our current understanding as to how helminth infections can influence our ability to control unrelated infections and also how under-appreciated modes of exposure to infection and responses to infection could influence our immunity to both the parasite and other infections. We have selected what we consider to be 2 poorly understood yet important influences of a helminthes infection on a host. These are how infection directs antibody responses and how infection during pregnancy influences infant health and immunity. Secondly, we present important and comprehensive reviews on the current state of understanding as to how helminth infections influence major causes of infectious disease in helminth endemic areas. Here we address the influence on TB, HIV, malaria and also other important “neglected” bacterial infections such as cholera.

In putting this book together we aimed to identify areas where our current understanding of the state of research has not been adequately addressed by review. We feel the chapters presented here provide important insights into what we understand about certain aspects of helminth infections. Importantly we identify areas where our understanding is strikingly incomplete. For example we understand very little about how helminth induced antibodies interact with their target cells via Fc Receptors. Additionally the work here highlights the importance (as expressed by many other prominent researchers in the field) that we need to start appreciating the different helminth species specific effects as well as the commonalities in host immunity that occur between taxa. The chapter addressing how helminth infection influences HIV highlights the urgent need for researchers to incorporate the influence of helminth immunity into HIV studies.

Finally we found that topics we would like to have included could not be owing to an almost total lack of literature. A notable area being how helminth infection may influence immunity to fungal pathogens.

University of Cape Town

William Horsnell

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