Modulation of hematopoiesis by protozoal and helminth parasites

Kyle Cunningham[1] and Kingston Mills[2]

[1]University of Glasgow
[2]Academic Director Trinity Biomedical Sciences Institute TCD Research Theme Leader Immunology, Inflammation and Infection School of Biochemistry and Immunology Trinity Biomedical Sciences Institute Trinity College Dublin, Ireland

December 23, 2022

Abstract

During inflammation hematopoietic stem cells (HSCs) in the bone marrow (BM) and periphery rapidly expand and preferentially differentiate into myeloid cells that mediate innate immune responses. HSCs can be directed into quiescence or differentiation by sensing alterations to the hematopoietic niche, including cytokines, chemokines, and pathogen-derived products. Most studies attempting to identify the mechanisms of hematopoiesis have focused on bacterial and viral infections. From intracellular protozoan infections to large multicellular worms, parasites are a global health burden and represent major immunological challenges that remain poorly defined in the context of hematopoiesis. Immune responses to parasites vary drastically, and parasites have developed sophisticated immunomodulatory mechanisms that allow development of chronic infections. Recent advances in imaging, genomic sequencing and mouse models have shed new light on how parasites induce unique forms of emergency hematopoiesis. In addition, parasites can modify the hematopoiesis in the BM and periphery to improve their survival in the host. Parasites can also induce long-lasting modifications to HSCs, altering future immune responses to infection, inflammation or transplantation, a term sometimes referred to as central trained immunity. In this review, we highlight the current understanding of parasite-induced hematopoiesis and how parasites target this process to promote chronic infections.

Hosted file

`KC_KM_Parasites and Hematopoiesis Review_Text_Final.docx` available at https://authorea.com/users/569305/articles/614956-modulation-of-hematopoiesis-by-protozoal-and-helminth-parasites

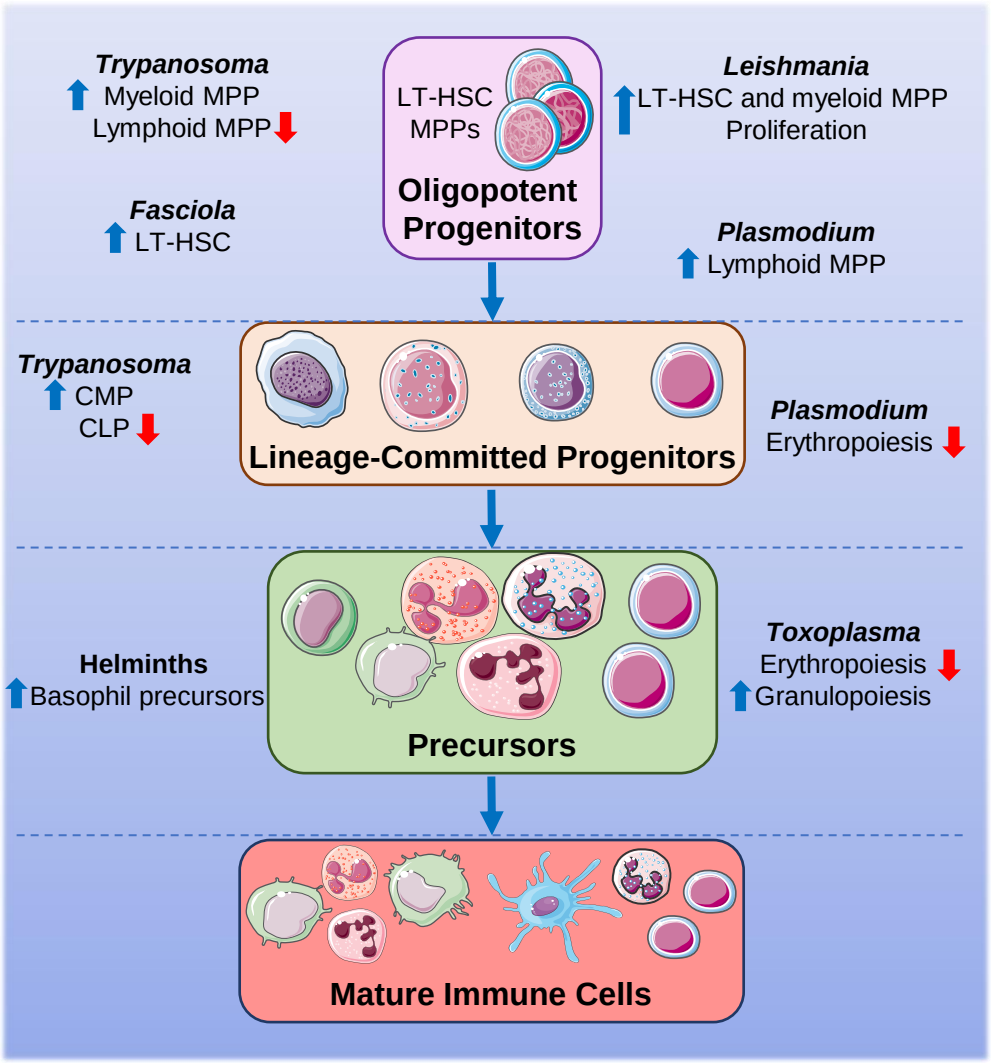
Trypanosoma
Myeloid MPP
Lymphoid MPP
LT-HSC
MPPs
Oligopotent Progenitors
Leishmania
LT-HSC and myeloid MPP
Proliferation
Fasciola
LT-HSC
Plasmodium
Lymphoid MPP
Trypanosoma
CMP
CLP
Lineage-Committed Progenitors
Plasmodium
Erythropoiesis
Helminths
Basophil precursors
Precursors
Toxoplasma
Erythropoiesis
Granulopoiesis
Mature Immune Cells

Fig 1

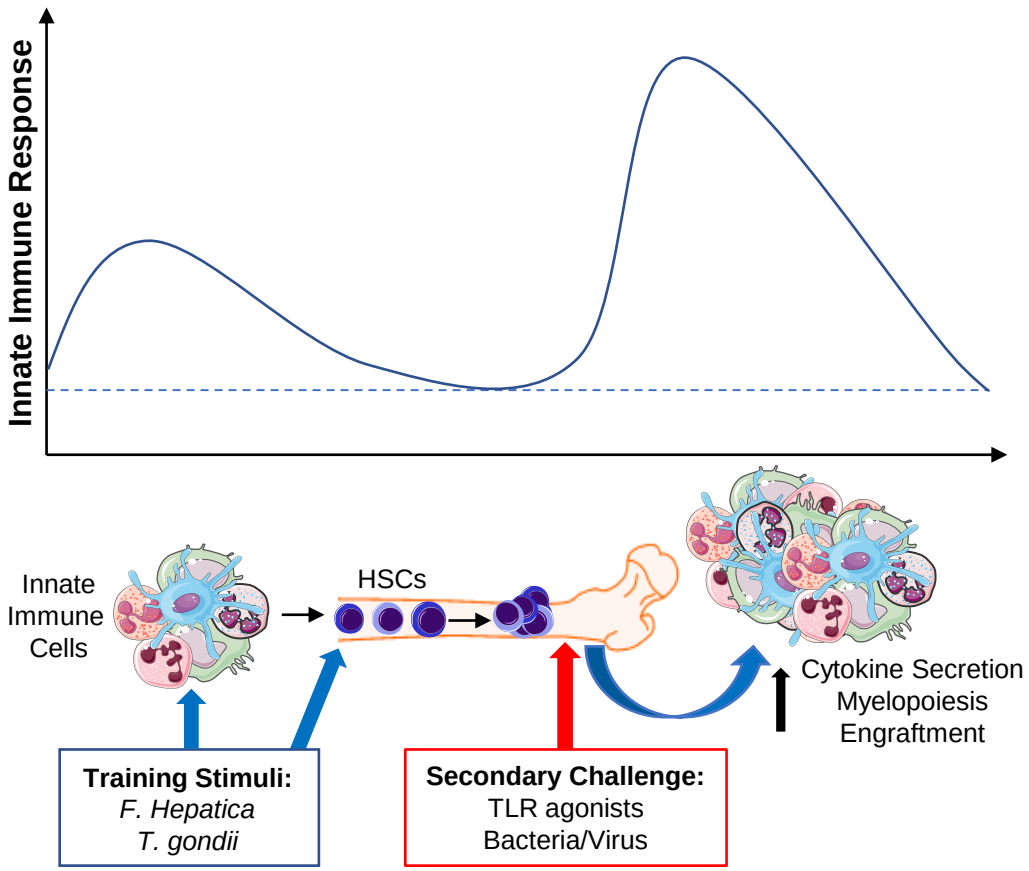
Innate Immune Response
Innate
Immune
Cells
HSCs
Cytokine Secretion
Myelopoiesis
Engraftment
Training Stimuli:
F. Hepatica
T. gondii
Secondary Challenge:
TLR agonists
Bacteria/Virus

Fig 2.