

## HELMINTHIC THERAPY READINGS

Below is a selection of articles that reflect some of the medical science pertaining to helminthic therapy.

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This list is not an exhaustive or comprehensive bibliography. It serves as a starting point for further exploration.

We recommend you search [PubMed](#) for additional information.

### **ANESTHESIA**

Boswell MV, Morgan PG, Sedensky MM. Interaction of GABA and volatile anesthetics in the nematode *Caenorhabditis elegans*. *FASEB J*. 1990 May;4(8):2506-10. PubMed PMID: [2335273](#).

### **ASTHMA**

Becker KG. Autism, asthma, inflammation, and the hygiene hypothesis. *Med Hypotheses*. 2007;69(4):731-40. Epub 2007 Apr 6. PubMed PMID: [17412520](#); PubMed Central PMCID: PMC2048743.

Feary JR, Venn AJ, Mortimer K, Brown AP, Hooi D, Falcone FH, Pritchard DI, Britton JR. Experimental hookworm infection: a randomized placebo-controlled trial in asthma. *Clin Exp Allergy*. 2010 Feb;40(2):299-306. Epub 2009 Dec 16. PubMed PMID: [20030661](#); PubMed Central PMCID: PMC2814083.

Mannie MD. Autoimmunity and asthma: The dirt on the hygiene hypothesis. *Self Nonself*. 2010 Apr;1(2):123-128. Epub 2010 Feb 15. PubMed PMID: [21487514](#); PubMed Central PMCID: PMC3065670.

Platts-Mills TA. Asthma severity and prevalence: an ongoing interaction between exposure, hygiene, and lifestyle. *PLoS Med*. 2005 Feb;2(2):e34. Epub 2005 Feb 22. Review. PubMed PMID: [15736993](#); PubMed Central PMCID: PMC549585.

### **ALLERGY AND IMMUNOLOGY**

Araújo MI, Hoppe BS, Medeiros M Jr, Carvalho EM. *Schistosoma mansoni*

infection modulates the immune response against allergic and auto-immune diseases. *Mem Inst Oswaldo Cruz.* 2004;99(5 Suppl 1):27-32. Epub 2004 Oct 13. Review. PubMed PMID: [15486631](#).

Bashir ME, Andersen P, Fuss IJ, Shi HN, Nagler-Anderson C. An enteric helminth infection protects against an allergic response to dietary antigen. *J Immunol.* 2002 Sep 15;169(6):3284-92. PubMed PMID: [12218148](#).

Borkow G, Leng Q, Weisman Z, Stein M, Galai N, Kalinkovich A, Bentwich Z. Chronic immune activation associated with intestinal helminth infections results in impaired signal transduction and anergy. *J Clin Invest.* 2000 Oct;106(8):1053-60. PubMed PMID: [11032865](#); PubMed Central PMCID: PMC314342.

Carvalho L, Sun J, Kane C, Marshall F, Krawczyk C, Pearce EJ. Review series on helminths, immune modulation and the hygiene hypothesis: mechanisms underlying helminth modulation of dendritic cell function. *Immunology.* 2009 Jan;126(1):28-34. Review. PubMed PMID: [19120496](#); PubMed Central PMCID: PMC2632707.

Doetze A, Satoguina J, Burchard G, Rau T, Löliger C, Fleischer B, Hoerauf A. Antigen-specific cellular hyporesponsiveness in a chronic human helminth infection is mediated by T(h)3/T(r)1-type cytokines IL-10 and transforming growth factor-beta but not by a T(h)1 to T(h)2 shift. *Int Immunol.* 2000 May;12(5):623-30. PubMed PMID: [10784608](#).

Erb KJ. Helminths, allergic disorders and IgE-mediated immune responses: where do we stand? *Eur J Immunol.* 2007 May;37(5):1170-3. Review. PubMed PMID: [17447233](#).

Elston DM. The hygiene hypothesis and atopy: bring back the parasites? *J Am Acad Dermatol.* 2006 Jan;54(1):172-9. Review. PubMed PMID: [16384780](#).

Fumagalli M, Pozzoli U, Cagliani R, Comi GP, Riva S, Clerici M, Bresolin N, Sironi M. Parasites represent a major selective force for interleukin genes and shape the genetic predisposition to autoimmune conditions. *J Exp Med.* 2009 Jun 8;206(6):1395-408. Epub 2009 May 25. PubMed PMID: [19468064](#); PubMed Central PMCID: PMC2715056.

Greer JB, O'Keefe SJ. Microbial induction of immunity, inflammation, and cancer. *Front Physiol.* 2011 Jan 26;1:168. PubMed PMID: [21423403](#); PubMed Central PMCID: PMC3059938.

Mangan NE, Fallon RE, Smith P, van Rooijen N, McKenzie AN, Fallon PG. Helminth infection protects mice from anaphylaxis via IL-10-producing B cells. *J Immunol.* 2004 Nov 15;173(10):6346-56. PubMed PMID: [15528374](#).

Osada Y, Kanazawa T. Parasitic helminths: new weapons against immunological disorders. *J Biomed Biotechnol*. 2010;2010:743758. Epub 2010 Feb 10. Review. PubMed PMID: [20169100](#); PubMed Central PMCID: PMC2821776.

Romagnani S. The increased prevalence of allergy and the hygiene hypothesis: missing immune deviation, reduced immune suppression, or both? *Immunology*. 2004 Jul;112(3):352-63. Review. PubMed PMID: [15196202](#); PubMed Central PMCID: PMC1782506.

Semic-Jusufagic A, Simpson A, Custovic A. Environmental exposures, genetic predisposition and allergic diseases: one size never fits all. *Allergy*. 2006 Apr;61(4):397-9. PubMed PMID: [16512799](#).

Taams LS, Palmer DB, Akbar AN, Robinson DS, Brown Z, Hawrylowicz CM. Regulatory T cells in human disease and their potential for therapeutic manipulation. *Immunology*. 2006 May;118(1):1-9. Review. PubMed PMID: [16630018](#); PubMed Central PMCID: PMC1782265.

## **AUTISM**

Ashwood P, Van de Water J. A review of autism and the immune response. *Clin Dev Immunol*. 2004 Jun;11(2):165-74. Review. PubMed PMID: [15330453](#); PubMed Central PMCID: PMC2270714.

Becker KG. Autism, asthma, inflammation, and the hygiene hypothesis. *Med Hypotheses*. 2007;69(4):731-40. Epub 2007 Apr 6. PubMed PMID: [17412520](#); PubMed Central PMCID: PMC2048743.

## **CANCER**

Greer JB, O'Keefe SJ. Microbial induction of immunity, inflammation, and cancer. *Front Physiol*. 2011 Jan 26;1:168. PubMed PMID: [21423403](#); PubMed Central PMCID: PMC3059938.

Lin CJ, Katongole-Mbidde E, Byekwaso T, Orem J, Rabkin CS, Mbulaiteye SM. Intestinal parasites in Kaposi sarcoma patients in Uganda: indication of shared risk factors or etiologic association. *Am J Trop Med Hyg*. 2008 Mar;78(3):409-12. PubMed PMID: [18337336](#).

## **CELIAC DISEASE**

Barton SH, Murray JA. Celiac disease and autoimmunity in the gut and elsewhere. *Gastroenterol Clin North Am*. 2008 Jun;37(2):411-28, vii. Review. PubMed PMID: [18499028](#); PubMed Central PMCID: PMC2730948.

Daveson AJ, Jones DM, Gaze S, McSorley H, Clouston A, Pascoe A, Cooke S, Speare R, Macdonald GA, Anderson R, McCarthy JS, Loukas A, Croese J. Effect of hookworm infection on wheat challenge in celiac disease--a randomised double-blinded placebo controlled trial. *PLoS One*. 2011 Mar 8;6(3):e17366. PubMed PMID: [21408161](#); PubMed Central PMCID: PMC3050888.

## **DIABETES**

Cooke A, Tonks P, Jones FM, O'Shea H, Hutchings P, Fulford AJ, Dunne DW. Infection with *Schistosoma mansoni* prevents insulin dependent diabetes mellitus in non-obese diabetic mice. *Parasite Immunol*. 1999 Apr;21(4):169-76. PubMed PMID: [10320614](#).

Musso G, Gambino R, Cassader M. Obesity, diabetes, and gut microbiota: the hygiene hypothesis expanded? *Diabetes Care*. 2010 Oct;33(10):2277-84. Review. PubMed PMID: [20876708](#); PubMed Central PMCID: PMC2945175.

## **HYGIENE**

Bloomfield SF, Stanwell-Smith R, Crevel RW, Pickup J. Too clean, or not too clean: the hygiene hypothesis and home hygiene. *Clin Exp Allergy*. 2006 Apr;36(4):402-25. Review. PubMed PMID: [16630145](#); PubMed Central PMCID: PMC1448690.

Gale EA. A missing link in the hygiene hypothesis? *Diabetologia*. 2002 Apr;45(4):588-94. Epub 2002 Mar 26. PubMed PMID: [12032638](#).

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Rook GA. Review series on helminths, immune modulation and the hygiene hypothesis: the broader implications of the hygiene hypothesis. *Immunology*. 2009 Jan;126(1):3-11. Review. PubMed PMID: [19120493](#); PubMed Central PMCID: PMC2632706.

von Mutius E. 99th Dahlem conference on infection, inflammation and chronic inflammatory disorders: farm lifestyles and the hygiene hypothesis. Clin Exp Immunol. 2010 Apr;160(1):130-5. PubMed PMID: [20415863](#); PubMed Central PMCID: PMC2841847.

## **INFLAMMATION**

Ewald PW. 99th Dahlem conference on infection, inflammation and chronic inflammatory disorders: symbionts and immunopathology in chronic diseases: insights from evolution. Clin Exp Immunol. 2010 Apr;160(1):27-34. PubMed PMID: [20415848](#); PubMed Central PMCID: PMC2841832.

Proudfoot L. Parasitic helminths tip the balance: potential anti-inflammatory therapies. Immunology. 2004 Dec;113(4):438-40. Review. PubMed PMID: [15554921](#); PubMed Central PMCID: PMC1782598.

Rook GA. 99th Dahlem conference on infection, inflammation and chronic inflammatory disorders: darwinian medicine and the 'hygiene' or 'old friends' hypothesis. Clin Exp Immunol. 2010 Apr;160(1):70-9. PubMed PMID: [20415854](#); PubMed Central PMCID: PMC2841838.

Zaccone P, Fehervari Z, Phillips JM, Dunne DW, Cooke A. Parasitic worms and inflammatory diseases. Parasite Immunol. 2006 Oct;28(10):515-23. Review. PubMed PMID: [16965287](#); PubMed Central PMCID: PMC1618732.

## **INFLAMMATORY BOWEL DISEASES**

Elliott DE, Urban JF JR, Argo CK, Weinstock JV. Does the failure to acquire helminthic parasites predispose to Crohn's disease? FASEB J. 2000 Sep;14(12):1848-55. PubMed PMID: [10973934](#).

Elliott DE, Li J, Blum A, Metwali A, Qadir K, Urban JF Jr, Weinstock JV. Exposure to schistosome eggs protects mice from TNBS-induced colitis. Am J Physiol Gastrointest Liver Physiol. 2003 Mar;284(3):G385-91. Epub 2002 Nov 13. PubMed PMID: [12431903](#).

Hunter MM, McKay DM. Review article: helminths as therapeutic agents for inflammatory bowel disease. Aliment Pharmacol Ther. 2004 Jan 15;19(2):167-77. Review. PubMed PMID: [14723608](#).

Lukas M, Bortlik M, Maratka Z. What is the origin of ulcerative colitis? Still more questions than answers. Postgrad Med J. 2006 Oct;82(972):620-5. Review. PubMed PMID: [17068271](#); PubMed Central PMCID: PMC2653902.

Niessner M, Volk BA. Altered Th1/Th2 cytokine profiles in the intestinal mucosa of patients with inflammatory bowel disease as assessed by quantitative reversed transcribed polymerase chain reaction (RT-PCR). Clin Exp Immunol. 1995 Sep;101(3):428-35. PubMed PMID: [7664489](#); PubMed Central PMCID: PMC1553229.

Radford-Smith GL. Will worms really cure Crohn's disease? Gut. 2005 Jan;54(1):6-8. Review. PubMed PMID: [15591496](#); PubMed Central PMCID: PMC1774348.

Summers RW, Elliott DE, Urban JF Jr, Thompson R, Weinstock JV. Trichuris suis therapy in Crohn's disease. Gut. 2005 Jan;54(1):87-90. PubMed PMID: [15591509](#); PubMed Central PMCID: PMC1774382.

Weinstock JV, Summers R, Elliott DE. Helminths and harmony. Gut. 2004 Jan;53(1):7-9. PubMed PMID: [14684567](#); PubMed Central PMCID: PMC1773927.

Weinstock JV, Elliott DE. Helminths and the IBD hygiene hypothesis. Inflamm Bowel Dis. 2009 Jan;15(1):128-33. Review. PubMed PMID: [18680198](#).

## **MULTIPLE SCLEROSIS**

Correale J, Farez M. Helminth antigens modulate immune responses in cells from multiple sclerosis patients through TLR2-dependent mechanisms. J Immunol. 2009 Nov 1;183(9):5999-6012. Epub 2009 Oct 7. PubMed PMID: [19812189](#).

La Flamme AC, Ruddenklau K, Bäckström BT. Schistosomiasis decreases central nervous system inflammation and alters the progression of experimental autoimmune encephalomyelitis. Infect Immun. 2003 Sep;71(9):4996-5004. PubMed PMID: [12933842](#); PubMed Central PMCID: PMC187318.

Sewell D, Qing Z, Reinke E, Elliot D, Weinstock J, Sandor M, Fabry Z. Immunomodulation of experimental autoimmune encephalomyelitis by helminth ova immunization. Int Immunol. 2003 Jan;15(1):59-69. PubMed PMID: [12502726](#).

## **NECATOR AMERICANUS**

Blount D, Hooi D, Feary J, Venn A, Telford G, Brown A, Britton J, Pritchard D. Immunologic profiles of persons recruited for a randomized, placebo-controlled clinical trial of hookworm infection. Am J Trop Med Hyg. 2009 Nov;81(5):911-6. PubMed PMID: [19861631](#).

Daveson AJ, Jones DM, Gaze S, McSorley H, Clouston A, Pascoe A, Cooke S, Speare R, Macdonald GA, Anderson R, McCarthy JS, Loukas A, Croese J. Effect of hookworm infection on wheat challenge in celiac disease--a randomised double-blinded placebo controlled trial. *PLoS One*. 2011 Mar 8;6(3):e17366. PubMed PMID: [21408161](#); PubMed Central PMCID: PMC3050888.

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Fujiwara RT, Cançado GG, Freitas PA, Santiago HC, Massara CL, Dos Santos Carvalho O, Corrêa-Oliveira R, Geiger SM, Bethony J. *Necator americanus* infection: a possible cause of altered dendritic cell differentiation and eosinophil profile in chronically infected individuals. *PLoS Negl Trop Dis*. 2009;3(3):e399. Epub 2009 Mar 24. PubMed PMID: [19308259](#); PubMed Central PMCID: PMC2654967.

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Wright V, Bickle Q. Immune responses following experimental human hookworm infection. *Clin Exp Immunol*. 2005 Nov;142(2):398-403. PubMed PMID: [16232230](#); PubMed Central PMCID: PMC1809522.

### **NECATOR AMERICANUS—PATHOGENICITY**

Brooker S, Bethony J, Hotez PJ. Human hookworm infection in the 21st century. *Adv Parasitol*. 2004;58:197-288. Review. PubMed PMID: [15603764](#); PubMed Central PMCID: PMC2268732.

van der Gaag R, Abdillahi H, Stilma JS, Vetter JC. Circulating antibodies against corneal epithelium and hookworm in patients with Mooren's ulcer from Sierra Leone. *Br J Ophthalmol*. 1983 Sep;67(9):623-8. PubMed PMID: [6882721](#); PubMed Central PMCID: PMC1040143.

### **TRICHURIS SUIS**

Hunter MM, McKay DM. Review article: helminths as therapeutic agents for inflammatory bowel disease. *Aliment Pharmacol Ther*. 2004 Jan 15;19(2):167-77.

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Summers RW, Elliott DE, Urban JF Jr, Thompson R, Weinstock JV. Trichuris suis therapy in Crohn's disease. Gut. 2005 Jan;54(1):87-90. PubMed PMID: [15591509](#); PubMed Central PMCID: PMC1774382.

Weinstock JV, Summers R, Elliott DE. Helminths and harmony. Gut. 2004 Jan;53(1):7-9. PubMed PMID: [14684567](#); PubMed Central PMCID: PMC1773927.

Weinstock JV, Elliott DE. Helminths and the IBD hygiene hypothesis. Inflamm Bowel Dis. 2009 Jan;15(1):128-33. Review. PubMed PMID: [18680198](#).

### **TRICURIS SUIS—PATHOGENICITY**

Van Kruiningen HJ, West AB. Iatrogenic Trichuris suis infection. Arch Pathol Lab Med. 2007 Feb;131(2):180. PubMed PMID: [17284099](#).