

They might sound gross, but intestinal worms can actually be good for you

by Dr. William Parker

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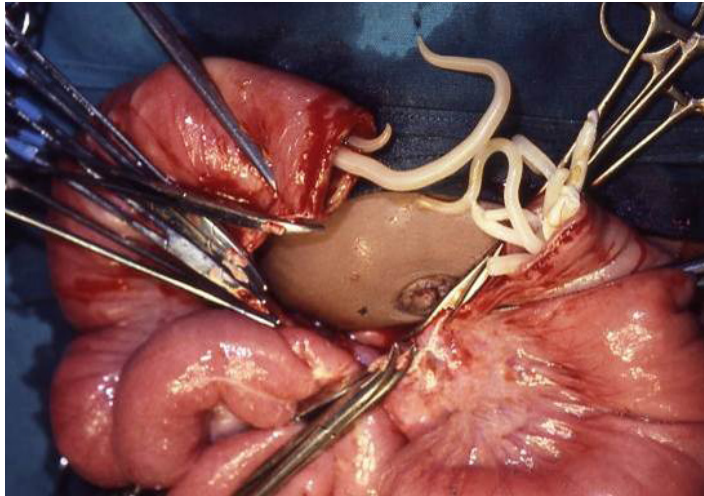
Intestinal worms have an incredibly bad reputation. The thought of them sneaking around inside our bodies and eating us from the inside is pretty unpleasant. But just 100 years ago, before toilets and running water were commonplace, everybody had regular exposure to intestinal worms. Thanks in part to modern plumbing, people in the industrialized world have now lost almost all of their worms, with the exception of occasional pinworms in some children.

Intestinal worms are properly called “helminths,” which most dictionaries will tell you are parasites. Exploiting their hosts, draining resources, sucking the life out of the body – that’s what parasites do, by definition. Indeed, many helminths, including the porcine tapeworm and the human hookworm, are known to cause disease and even death in the human population. Parasitic worms are still a big problem in some parts of the world.

But for decades, results coming out of lab after lab have shown that some kinds of helminths can be extremely beneficial to their host, and aren’t parasites at all.

These helpful helminths are mutualists, a type of organism that receives benefits from its host, and also provides benefits to the host.

For example, my lab, working with a Duke University colleague, Staci Bilbo, recently showed that the presence of helminths in pregnant rats protects the brains of the rat pups from inflammation. In other words, it seems that mom’s helminths can protect unborn babies. And that is just the tip of the iceberg for what these critters can do.



Tapeworms are used here to clear away gangrenous pieces of a bowel. The worms were cleared away before the tissue was reattached. Image credit: Sustainable Sanitation, Flickr, CC BY 2.0

Worms may help with allergies and multiple sclerosis¹

Having worms isn’t necessarily bad for you. The largest randomized trial ever performed in human history – involving two million children in India – looked at how helminths affect health in places where humans naturally have them. The study showed that mass treatment with an effective deworming drug did not increase body weight or survival. Shockingly, the helminths didn’t seem to be doing any harm, since getting rid of them didn’t improve health.

So that study seemed to show the absence of harm; could these helminths actively be doing good?

In the past, scientists thought that increases in inflammatory diseases such as hay fever and multiple sclerosis in industrialized societies were due to keeping our created environments too clean. Thus the name “hygiene hypothesis.”

However, the true problem for our health is the loss of biodiversity from our body’s own ecosystem, a condition called “biome depletion.”

Missing mutualistic helminths is a key factor in this, and is apparently a major contributing factor to a very large swath of disease, including allergies and autoimmune² conditions.

For instance, helminths have been found to protect laboratory animals from a wide range of allergies and autoimmune conditions. And recent findings suggest that many types of cancer can be reduced by helminths. The idea has been demonstrated by preventing colon cancer in rodents, and it is hoped that it will reduce the burden of cancer in humans by decreasing chronic inflammation, a condition that can give rise to cancer.

In controlled studies in humans, helminths were shown to halt the progression of relapsing remitting multiple sclerosis and effectively treat many individuals with inflammatory bowel disease without report of adverse side effects.

How do worms work with our immune system?

The idea that helminths can help us with a wide range of inflammatory diseases that plague modern society makes a lot of sense when considering the science behind how helminths interact with our immune system.

Helminths have been a part of the ecosystem of the body for so many millions of years that they have become an integral part of that system. Mutualistic helminths help regulate immune function, stimulating our body to build regulatory networks of immune cells that decrease

1. **multiple sclerosis** – a potentially disabling disease of the brain and spinal cord
2. **autoimmune** – of or relating to disease caused by antibodies or lymphocytes produced against substances naturally present in the body

general inflammation without hurting our immune system's ability to respond to danger. In addition, these helminths produce their own array of anti-inflammatory molecules and give our immune systems much needed exercise, all of which decreases inflammation.

And a recent study showed that the addition of helminths to laboratory rodents dramatically changed the balance of the gut ecosystem, shifting the bacteria in the gut toward a much healthier balance.

With these factors in mind, it would be hard to understand if missing our helminths did not cause health problems.

Therapeutic worms?

My laboratory began work a few years ago looking at the sociology³ of “helminthic therapy,” the use of helminths to treat disease. Working with Janet Wilson, a sociologist at the University of Central Arkansas, we found that thousands of people are using helminths to self-treat a vast array of inflammation-related conditions, from inflammatory bowel disease to hay fever to multiple sclerosis to migraine headaches.

At the moment, there is no helminth approved for medical use by the FDA⁴, and we found that people generally obtain their organisms from one of a few companies that sell expensive and often unregulated products, which can be risky.

Part of our study included a survey of helminth users, and most people filling out the survey reported that helminths treated their inflammatory conditions more effectively and with fewer side effects than did pharmaceuticals.

We also found that some “self-treaters” are the using a helminth called the rat tapeworm (*Hymenolepis diminuta*), which sounds truly disgusting. However, people are using this helminth because it is inexpensive and easy to produce, and may provide a very effective treatment for a range of inflammation-related

diseases, including migraine headaches and depression. People eat them and report that about 30 worms per month does the job, although the number varies

depending on the individual.

After being swallowed and passed into the small intestine, the tiny worms almost certainly hatch out of their jelly-like capsule that has protected them since they first hatched from an egg. At that point, they begin to interact with the immune system, reducing inflammation like any other helminth.

But then, with rare exceptions, they vanish mysteriously, never maturing into adults and producing eggs. Because rat tapeworms don't colonize our intestines the way that some other types of helminths do, an individual needs frequent exposure to have them in their bodies consistently.

The rat tapeworm has been used in the laboratory for decades and blocks experimentally induced colitis⁵ in mice more effectively than daily immunosuppression with steroids. In fact, this is the same helminth we use in my lab to protect the developing brains of rat pups from inflammation. But no researchers have ever studied using rat tapeworms on humans to treat disease.

Why aren't helminths catching on?

While work in labs and our own research on people self-treating with helminths is promising, the safety and effectiveness of helminths needs to be evaluated in more clinical trials. But perhaps the single greatest barrier to the widespread use of helminths as treatment in humans is the availability of an affordable and effective FDA-approved helminth to the medical community.

We have FDA-approved live maggots and leeches, both of which are extremely effective, but we have no effective and safe helminth approved for use.

Perhaps the horrible reputation of helminths has deterred us from taking helminths seriously as a treatment? But we can't let the ick factor intestinal worms may initially inspire hold us back from further research. Intense and systematic effort needs to be focused on the production of quality helminths.

We need to proceed with the domestication of helminths for the benefit of humankind.



When ingested, this tapeworm larva in the egg will hatch inside the digestive tract of its host.
Image credit: Sustainable Sanitation, Wikimedia Commons, CC BY 2.0

3. **sociology** – the study of how society functions

4. **FDA** – The Food and Drug Administration is a federal agency of the United States Department of Health and Human Services

5. **colitis** – inflammation of the lining of the colon

Deconstruct the Argument

On a separate sheet of paper, answer the following questions. To receive credit, you must write complete, thoughtful sentences.

1. Throughout the piece, Dr. William Parker uses **rhetorical questions** to move along his argument and build a conversational tone with the reader. He also drops **colloquial language** (ordinary, familiar words and phrases) into his academic argument to further engage the reader. Find and write a line that could be considered colloquial and explain how it contributes to his conversational tone.

2. What is the writer's purpose? In other words, what has motivated Parker to write this piece?

3. **Ethos** is a writer's ability to build credibility, establish himself as an expert, and/or convince the readers that he has their best interests at heart. How does Parker build ethos?

4. **Pathos** is an appeal to emotions (everything from humor to horror) in order to sway a reader. Find and write a line where Parker uses pathos.

5. **Logos** is the use of data/evidence to prove one's case. Find and write a line where Parker uses logos.

6. Does Parker rely more on pathos or logos to bolster his argument? Which do you find more effective? Why?

7. At different points in the article, Parker uses these words to describe the same thing: "intestinal worms," "rat tapeworms," "helminths," "mutualists," and "critters." Which of these word choices does he use most often? Why, do you suppose, he chose to mainly use that one?

8. Look closely at the passage about the "self-treaters." Find and write a line that an opponent to Parker's stance would view as a troubling gap in his argument.

9. If you could ask Parker a question about his information or position, what would you ask?



The head (scolex) of tapeworm *Taenia Solium*, an intestinal parasite, has hooks and suckers to attach to its host. Image credit: Centers for Disease Control and Prevention, U.S. Department of Health and Human Services, WikiMedia Commons, Public domain

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KEY

1. Throughout the piece, Dr. William Parker uses **rhetorical questions** to move along his argument and build a conversational tone with the reader. He also drops **colloquial language** (ordinary, familiar words and phrases) into his academic argument to further engage the reader. Find and write a line that could be considered colloquial and explain how it contributes to his conversational tone. *Students' answers will vary because there are numerous places in the essay where Parker uses such language. One example I think is especially effective is the use of the phrase, "ick factor," in the last paragraph. By acknowledging the reader's hesitancy to embrace intestinal worms as a medical treatment, he helps reassure the readers that he understands us and our reasonable concerns. This is a way to build ethos, as we believe he truly understands us and wants the best for us. The same effect is built when he uses the "which sounds truly disgusting" line as he discusses the "self-treaters."*

2. What is the writer's purpose? In other words, what has motivated Parker to write this piece? *Parker wants to change public opinion about the medical use of helminths. He also wants helminths to be approved by the FDA for medical research.*

3. **Ethos** is a writer's ability to build credibility, establish himself as an expert, and/or convince the readers that he has their best interests at heart. How does Parker build ethos? *Parker is a doctor and surgery professor at Duke University, a position that automatically gives him credibility with most readers. Some students may also say that the nature of Parker's work – medical research to reduce human suffering – makes them believe that his argument comes from a good place.*

4. **Pathos** is an appeal to emotions (everything from humor to horror) in order to sway a reader. Find and write a line where Parker uses pathos. *There are several lines students may choose, including the humorous bits from the opening paragraph or the tender line about the hope that the worms "will reduce the burden of cancer in humans..." I give credit for any reasonable choice.*

5. **Logos** is the use of data/evidence to prove one's case. Find and write a line where Parker uses logos. *There are several lines students may choose, including the randomized trial results on the children in India and Parker's own research results. I give credit for any reasonable choice.*

6. Does Parker rely more on pathos or logos to bolster his argument? Which do you find more effective? Why? *Parker's argument tilts toward logos, though he*

does use a fair amount of pathos to engage the reader. Students' answers will vary in terms of which rhetorical tool they prefer. I give credit for any reasonable answer.

7. At different points in the article, Parker uses these words to describe the same thing: "intestinal worms," "rat tapeworms," "helminths," "mutualists," and "critters." Which of these word choices does he use most often? Why, do you suppose, he chose to mainly use that one? *"Helminths" is used most often. Parker, a man of medicine, would prefer the scientific name of the worm. Also, the connotative qualities of words are important and "helminth" holds a neutral connotation for most readers, whereas "intestinal worms" is very negative. Interestingly, he limits his use of that negative phrase as he works to build a more positive image of the "critter."*

8. Look closely at the passage about the "self-treaters." Find and write a line that an opponent to Parker's stance would view as a troubling gap in his argument. *As he explains the rat tapeworm's activity in the small intestine, Parker writes, "But then, with rare exceptions, they vanish mysteriously, never maturing into adults and producing eggs." This is an alarming line, as it suggests that sometimes the tapeworms do mature into adults and lay eggs inside the host. Yikes! Although this may be rare, it certainly would be alarming to the unlucky individual. Also, he says in most cases the worms vanish "mysteriously." As a man of science, this explanation seems rather vague. The line is the weakest in the essay.*

9. If you could ask Parker a question about his information or position, what would you ask? *Students' answers will vary and credit should be given to any reasonable question. I would want to know if he personally has eaten the worms. Would he feed them to his own children if they had one of these inflammatory diseases?*

Deconstruct the Argument – Writing Assignment

Consider how Dr. William Parker uses:

- evidence, such as facts or examples, to support claims.
- reasoning to develop ideas and to connect claims and evidence.
- stylistic or persuasive elements, such as word choice or appeals to emotion, to add power to the ideas expressed.

Write an essay in which you explain how Parker builds his argument to persuade the reader that intestinal worms should be used to help humanity. In your essay, analyze how Parker uses one or more of the features listed above (or features of your own choice) to strengthen the logic and persuasiveness of his argument. Be sure that your analysis focuses on the most relevant features of the passage. Your essay should not explain whether you agree with Parker's claims, but rather explain how he builds an argument to persuade his audience.

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	READING	ANALYSIS	WRITING
ADVANCED	<ul style="list-style-type: none"> demonstrates thorough comprehension of the text. shows an understanding of the text's central idea/s and of most important details and how they connect. is free of errors of fact or interpretation of the text. makes skillful use of textual evidence (quotations, paraphrases, or both) to show a complete understanding of the text. 4	<ul style="list-style-type: none"> offers an insightful analysis of the text and demonstrates a sophisticated understanding of the analytical task. offers a thorough, well-considered evaluation of the author's use of evidence, reasoning, and/or stylistic and persuasive elements, and/or features of the student's own choosing. contains relevant, sufficient, and strategically chosen support for claims or points made. focuses consistently on those features of the text that are most relevant to addressing the task. 4	<ul style="list-style-type: none"> is cohesive and demonstrates a highly effective command of language. includes a precise central claim. includes a skillful introduction and conclusion. The response demonstrates a deliberate and highly effective progression of ideas both within paragraphs and throughout the essay. has a wide variety in sentence structures. The response demonstrates a consistent use of precise word choice. The response maintains a formal style and objective tone. shows a strong command of the conventions of standard written English and is free or virtually free of errors. 4
PROFICIENT	<ul style="list-style-type: none"> demonstrates effective comprehension of the text. shows an understanding of the text's central idea/s and important details. is free of substantive errors of fact and interpretation of text. makes appropriate use of textual evidence (quotations, paraphrases, or both) to show an understanding of the source text. 3	<ul style="list-style-type: none"> offers an effective analysis of the source text and demonstrates an understanding of the analytical task. competently evaluates the author's use of evidence, reasoning, and/or stylistic and persuasive elements, and/or features of the student's own choosing. contains relevant and sufficient support for claims or points made. focuses primarily on those features of the text that are most relevant to addressing the task. 3	<ul style="list-style-type: none"> is mostly cohesive and demonstrates effective use and control of language. includes a central claim or implicit controlling idea. includes an effective introduction and conclusion. The response demonstrates a clear progression of ideas both within paragraphs and throughout the essay. has variety in sentence structures. The response demonstrates some precise word choice. The response maintains a formal style and objective tone. shows a good control of the conventions of standard written English and is free of significant errors that detract from the quality of writing. 3
PARTIAL	<ul style="list-style-type: none"> demonstrates some comprehension of the text. shows an understanding of the text's central idea/s but not of important details. may contain errors of fact and/or interpretation of the text. makes limited and/or haphazard use of textual evidence (quotations, paraphrases, or both), showing only some understanding of the text. 2	<ul style="list-style-type: none"> offers limited analysis of the source text and demonstrates only partial understanding of the analytical task. identifies and attempts to describe the author's use of evidence, reasoning, and/or stylistic and persuasive elements, and/or features of the student's own choosing, but merely asserts rather than explains their importance, or one or more aspects of the response's analysis are unwarranted based on the text. contains little or no support for claims or points made. may lack a clear focus on those features of the text that are most relevant to addressing the task. 2	<ul style="list-style-type: none"> demonstrates little or no cohesion and limited skill in the use and control of language. may lack a clear central claim or controlling idea or may deviate from the claim or idea over the course of the response. may include an ineffective introduction and/or conclusion. The response may demonstrate some progression of ideas within paragraphs but not throughout the response. has limited variety in sentence structures; sentence structures may be repetitive. The response demonstrates general or vague word choice; word choice may be repetitive. The response may deviate noticeably from a formal style and objective tone. shows a limited control of the conventions of standard written English and contains errors that detract from the quality of writing and may impede understanding. 2
INADEQUATE	<ul style="list-style-type: none"> demonstrates little or no comprehension of the text. fails to show an understanding of the text's central idea/s, and may include only details without reference to central idea/s. may contain numerous errors of fact and/or interpretation of the text. makes little or no use of textual evidence (quotations, paraphrases, or both), showing little or no understanding of the text. 1	<ul style="list-style-type: none"> offers ineffective analysis of the source text and demonstrates little or no understanding of the analytic task. identifies without explanation some aspects of the author's use of evidence, reasoning, and/or stylistic and persuasive elements, and/or features of the student's choosing, or numerous aspects of the response's analysis are unwarranted based on the text. contains little or no support for claims or points made, or support is largely irrelevant. may not focus on features of the text that are relevant to addressing the task. offers no discernible analysis (e.g., is largely or exclusively summary). 1	<ul style="list-style-type: none"> demonstrates little or no cohesion and inadequate skill in the use and control of language. may lack a clear central claim or controlling idea. lacks a recognizable introduction and conclusion. The response does not have a discernible progression of ideas. lacks variety in sentence structures; sentence structures may be repetitive. The response demonstrates general and vague word choice; word choice may be poor or inaccurate. The response may lack a formal style and objective tone. shows a weak control of the conventions of standard written English and may contain numerous errors that undermine the quality of writing. 1

S.A.T. Essay Rubric

On an actual S.A.T. essay, students receive three separate scores, one each for Reading, Analysis, and Writing. A score, for example, might be 4-3-3, which would show Advanced Reading, Proficient Analysis, and Proficient Writing. Two readers evaluate each essay and their scores are added together, creating the final score which is reported as a number between 2-8 for each of the three categories.

This paper's score is: