Parasitic worms cause cancer—and could help cure it

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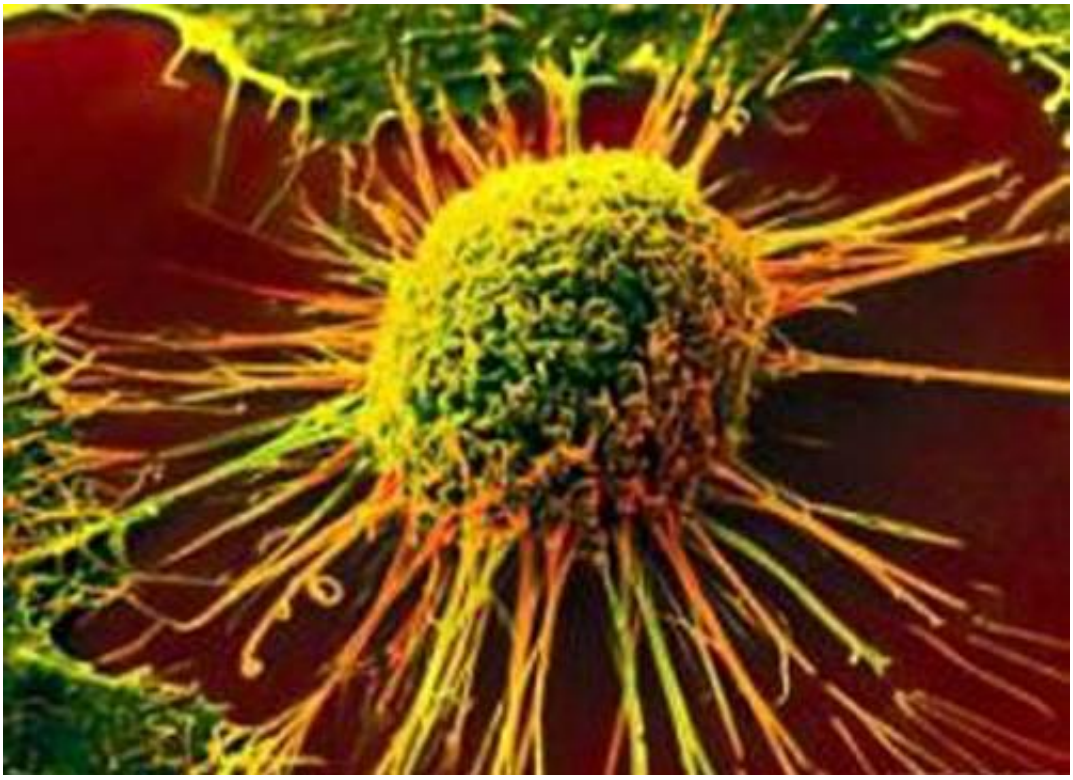

Billions worldwide are infected with tropical worms. Unsurprisingly, most of these people live in poor countries, kept poor by the effects of worm-related malnourishment.

What may surprise many is that worms also cause the majority of cases

of some cancers in these countries.

Published in *Frontiers in Medicine* as a special article collection on parasite-associated malignancy, new research aims to inform prevention and treatment—and perhaps even turn worms against cancer.

Worms cause cancer

Over a million worm species are classified as helminths. A single characteristic unites them: parasitism.

"Helminths take many forms, but all of them harm their host in some way. In humans, they can live in the intestinal tract, urinary tract or bloodstream, causing a variety of illness from malnutrition to organ failure" explains co-editor of the research Dr. Monica Botelho of Portugal's National Institute of Health.

In 2015 a more bizarre case of infection put helminths into the headlines: a man with HIV-AIDS died after his tapeworm contracted cancer and spread around his body. This remains the only such case ever recorded.

Meanwhile, scientists have known for decades that helminths can turn human cells into cancers.

"Three species of helminth are classified as class 1 carcinogens by the WHO," adds Botelho. "These are all designated trematodes—after the Latin name for the grisly feeding cavity with which they latch onto their host's insides."

Worm-related cancer is not just a fluke—it's three

Trematodes are known informally as 'flukes'. In this case however, they're anything but.

"In endemic regions—predominantly sub-saharan Africa and Southeast Asia—flukes are responsible for the majority of all bladder and liver cancer cases," says Dr. Joachim Richter, Associate Professor at Charité Berlin and co-editor with Botelho. "Cancers arise in sites of fluke infection including the bladder wall and the bile ducts of the liver."

But how does a worm cause cancer? According the research collection, their feeding—and breeding—habits might be to blame.

"Flukes constantly wound and re-wound their host as they latch on with their feeding cavity, burrow through organs, and deposit eggs in the bladder wall. This leads to chronic inflammation as the body tries endlessly to heal, meaning lots of cell division and so lots of opportunities for cancer-causing mutations to accumulate over years of infection."The flukes' toxic toilet habits then add insult to injury.

"Worms and their eggs also excrete proteins that exacerbate this chronic inflammation, further promoting cell division as well as the blood vessel growth required to feed it," adds Richter.

Hyper tapeworms protect hosts from cancer

Fluke infections and early stage cancers are often asymptomatic, so despite availability of anthelminthic drugs patients often present too late for curative treatment. Fortunately, flukes have an Achilles' heel: they require freshwater snails as a first host before infecting humans.

"Flukes have been successfully eliminated in Japan by economic development and the filling and drainage of snail habitats," says Richter. "Eradication efforts are underway in Thailand, which has the world's

highest rates of liver fluke infection and bile duct cancer—but some high-risk countries like Ethiopia lack a coordinated monitoring or prevention program for fluke-related cancer and need more help."

Beyond eradication efforts lies another twist in the bizarre world of worms and cancer: helminths as a cure for malignancy.

"Many parasites, including some helminths like the liver fluke Fasciola hepatica, inhibit cancer growth in vitro. Another of these—the ominously named 'hyper tapeworm' - is associated with a significantly lower rate of cancer in human hosts," reports Botelho.

"In fact, there is evidence that proteins produced by hyper tapeworms as well as F. hepatica not only kill cancer cells directly—but might also enhance their host's immune response to tumors."

"Even cancer-promoting fluke proteins might be repurposed as treatments for other conditions: for example, those that promote new blood vessel growth could help resolve chronic non-healing wounds in diabetics, tobacco users, and the elderly."

More information: Monica C. Botelho et al, Editorial: Parasites and Cancer, *Frontiers in Medicine* (2019). DOI: 10.3389/fmed.2019.00055

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