# Who’s really in charge here—you or your germs?

Maybe you’ve heard the expression, “It’s not your fault you’re fat.” Alternatively we may say of someone who’s having a bad day: “He’s just not himself.” Lawyers have even tried to sway murder juries with the “Twinkie Defense.”

What I’m about to share with you cuts to the heart of the age-old argument over free will versus determinism. To what extent are we captains of our fate, or are we commandeered by forces beyond our control?

Can aliens take over human bodies and subject them to their will? Science fiction movies have often explored the theme of mind control via a kind of parasitism. Extraterrestrial life-forms enter our bodies and take control of our brains,

subordinating our wills to theirs, opportunistically hitching a ride toward their nefarious goal of enslavement of the human race. (Cue spooky organ chords followed by sinister laughter!)

Mere fabrication? Think again.

Recently it was discovered that a cat-borne parasite, toxoplasmosis, increases the risk of mental diseases in humans. Even if it doesn't make people sick, its presence increases the risk for schizophrenia, depression and anxiety symptoms. It's transmitted to humans by careless handling of cat litter.

How does that square with the "alien mind control" scenario? Consider this: How does toxoplasmosis get into cats in the first place? Via mice that are the natural prey of cats.

But mice are wary creatures. At the first scent of cats, they retreat to their hiding places, making them tough to catch. If cats didn't capture and eat mice, toxoplasmosis would be at a dead end, a not very successful pathogen, relegated to the scrap heap of now-extinct species.

But toxoplasmosis has evolved to commandeer the brains of mice, making them easy targets. Mice infected with toxo undergo a behavioral switch. They become like zombie rodents, their cat-wariness turned off, and they stride blithely into cats' hunting grounds, get eaten, and enable the toxo to eventually hitch a ride into human hosts via mishandling of

cat poop.

Thus toxo finds a way to survive and thrive—it's just a matter of evolutionary adaptation. Whatever makes the mice bold makes humans slightly off-kilter mentally.

Let's take this one step further. We already know that the germs hitching a ride in our guts have an impact on mood and mental function. Probiotics have been shown to alleviate depression in experimental volunteers.

The term "microbiome-gut-brain axis" was coined by J.F. Cryan and S.M. Mahony at University College, Cork, Ireland to explain the link between bowel and behavior.

They note that germ-free mice—unnaturally bred to be without intestinal bacteria—are less timid than regular mice. Restoration of normal flora with probiotics normalized behavior.

Conversely, chronic stress can change the composition of intestinal bacteria. This could promote "leaky gut syndrome" resulting in systemic inflammation, a known risk factor for depression.

We now also know that lack of microbial diversity in the intestinal tract—often the result of overzealous antibiotic administration—is associated with a higher risk of breast cancer. This may be because normal healthy bacteria in the GI

tract are responsible for breaking down and eliminating excess estrogen. Surely it's not such a leap to infer that estrogen-dominant symptoms such as PMS, bloating or cravings are impacted by the composition of our microbiome.

But what evidence is there that the passengers in our intestines are commandeering us to perpetuate their survival, sometimes to our disadvantage?

I used to listen skeptically when patients told me: "I think my candida is back, my sugar cravings are off the wall!" "Sure," I thought to myself sometimes, "Easy to pin the blame on the candida, not your faltering willpower."

But new findings suggest that my patients may have been right: Is it far-fetched to think that an organism that requires sugar and refined carbohydrates to thrive may have "learned" via natural selection to exploit the appetite control centers of its hosts to ensure a steady supply of nutrients for its continued survival?

Now here's the clincher: A new article entitled *"Is eating behavior manipulated by the gastrointestinal microbiota? Evolutionary pressures and potential mechanisms"* suggests that "microbes in the GI tract are under selective pressure to increase their fitness, sometimes at the expense of host fitness." In other words, these primitive critters may be the bosses of us! After all, their cells outnumber ours 10 to one.

There are important practical implications here for our current epidemic of obesity. Studies show that intestinal microbes can determine whether we are fat or lean. Transferring fecal pellets from obese mice to germ-free mice makes the recipients fatten up. Conversely, probiotics have been shown to help experimental animals and humans lose weight. Could manipulating the intestinal flora by diet, pre- or probiotics, or even fecal transfers help us curb unhealthy eating?

We have a long way to go before commercial marketing of a diet pill based on patented probiotics that make us crave less or metabolize more efficiently. But the emerging science of the "microbiome-brain-gut axis" should make us more aware of how important it is to preserve and foster a healthy intestinal environment. Chronic stress, C-sections and lack of breast-feeding, a barrage of synthetic chemicals, antibiotics, acid blockers, sugary and refined foods are but a few of the many factors that mess up our modern GI tracts.

Rebalancing intestinal ecology is thus a primary goal of the integrative medicine we practice.