

Microbial Manipulators



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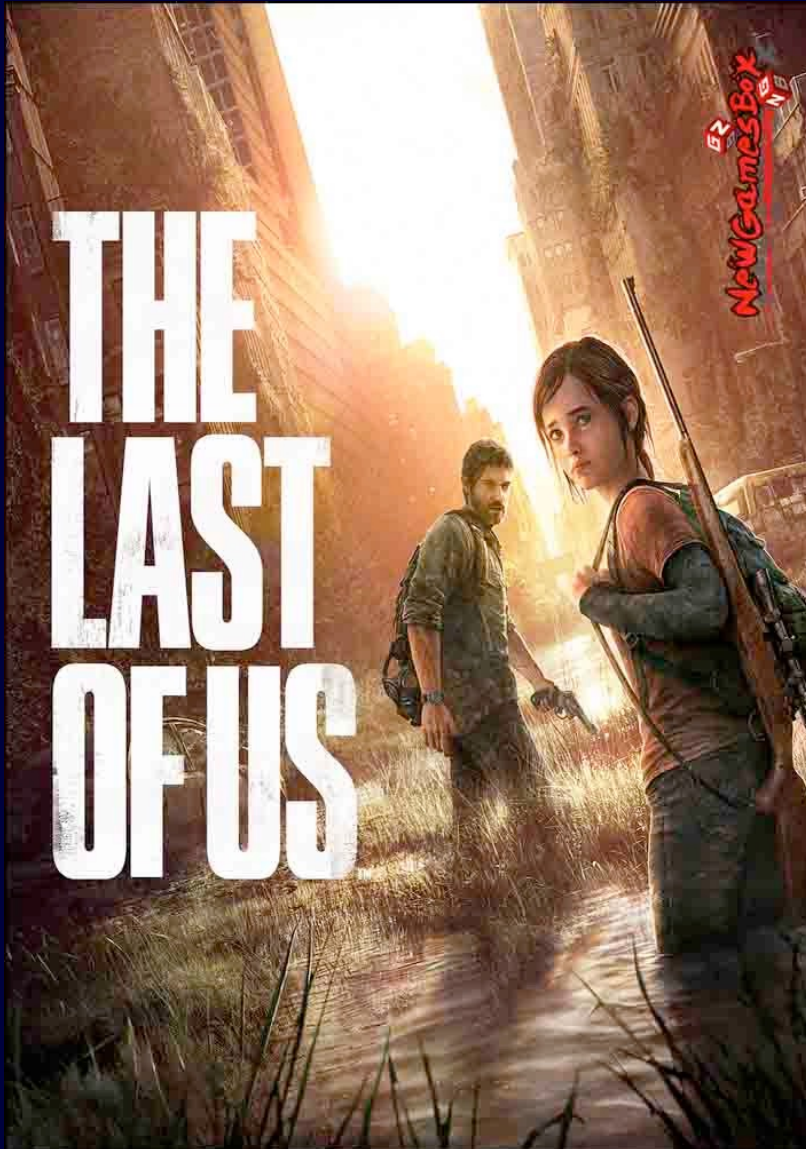
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From Science Fiction to Science Fact...

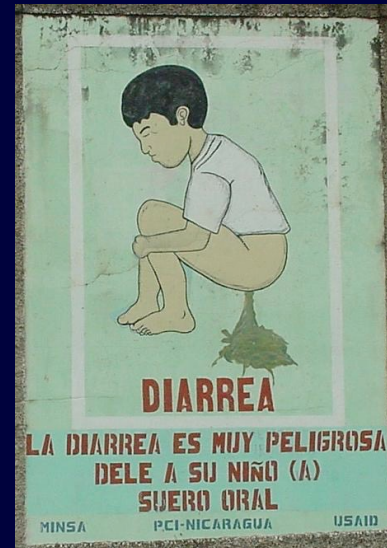
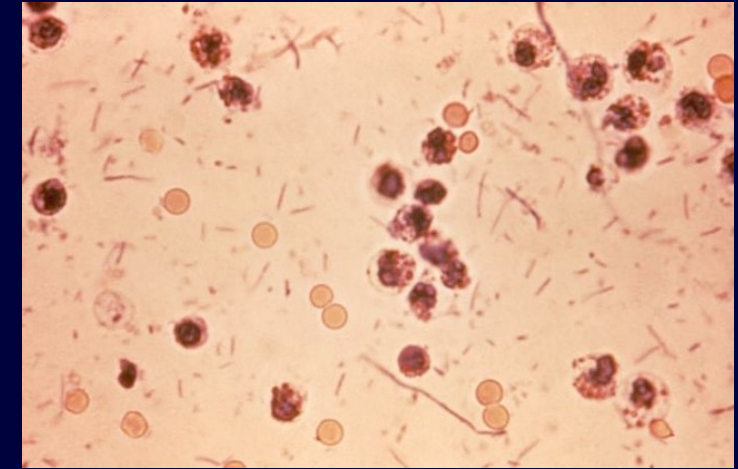


Bullet Ant (*Paraponera clavata*) with *Cordyceps* Fungus
Nicaragua, Rio San Juan
Refugio Bartola @ Rio San Juan/Rio Bartola
N10.973 W84.339
5-11.viii.2002
J.C. Abbott #1037

Public domain image by James Marchment
Produced as part of the Insects Unlocked Project
at the University of Texas at Austin



Manipulation is usually a lot simpler...

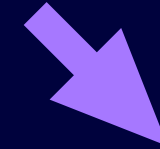
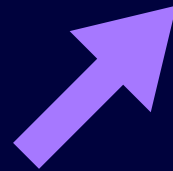




Behavioural manipulation is particularly common (and complex) in pathogens that need multiple hosts...



Plagiorhyncus cylindraceus (an Acanthocephalan)



Leucochloridium paradoxum



- Fluke (trematode) parasite
- Intermediate host is a snail (*Succinea*)
- Determinate host is a bird



Leucochloridium paradoxum



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Mind manipulation...



*But of course, no
microbe could ever
manipulate a
human...could it?*



Rabies

Infects all mammals, transmitted by bites and scratches.

- excessive salivation
- anxiety, paranoia and confusion
- unprovoked aggression

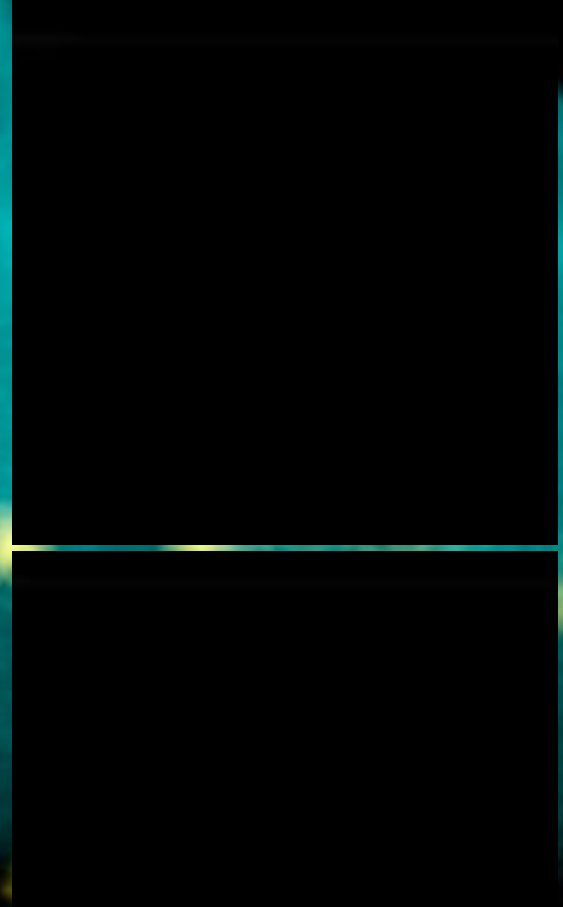
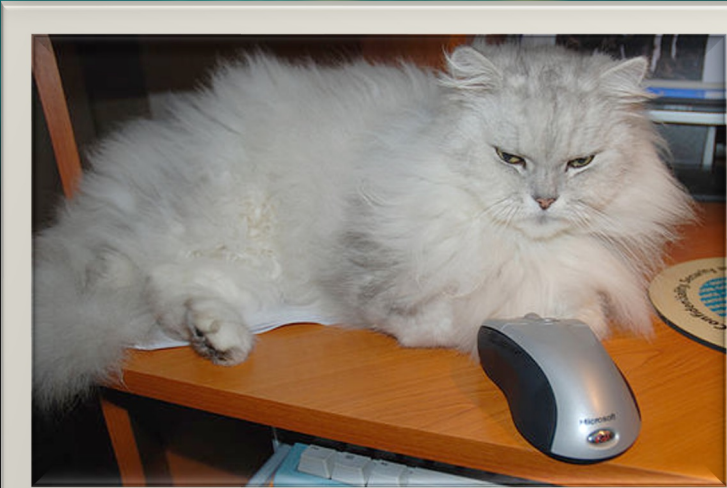


Toxoplasma gondii

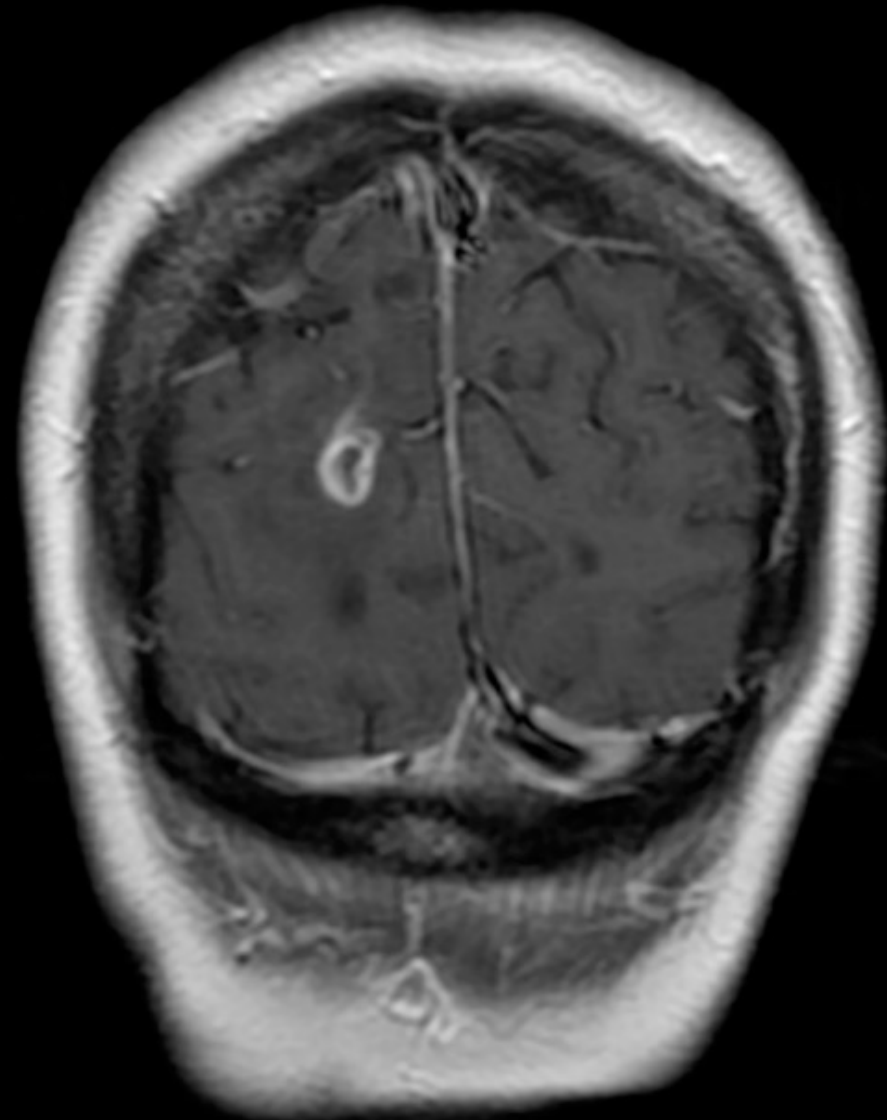
- *Toxoplasma gondii*, transmitted by undercooked food, water, or vertically (trans-placenta)
- Acute toxoplasmosis occurs in immunocompromised individuals or young infants
- Most cases are asymptomatic, with latent cysts in muscle or neural tissue



Toxoplasma gondii



- Humans are a dead-end host
- But behavioural manipulation still appears to occur:
 - Higher incidence of schizophrenia and paranoia in infected individuals (*Torrey, Emerging Inf. Disease, 2003*)
 - Higher incidence of infection in drivers who crash (*Flegr, BMC Inf Diseases, 2002*)



WELCOME

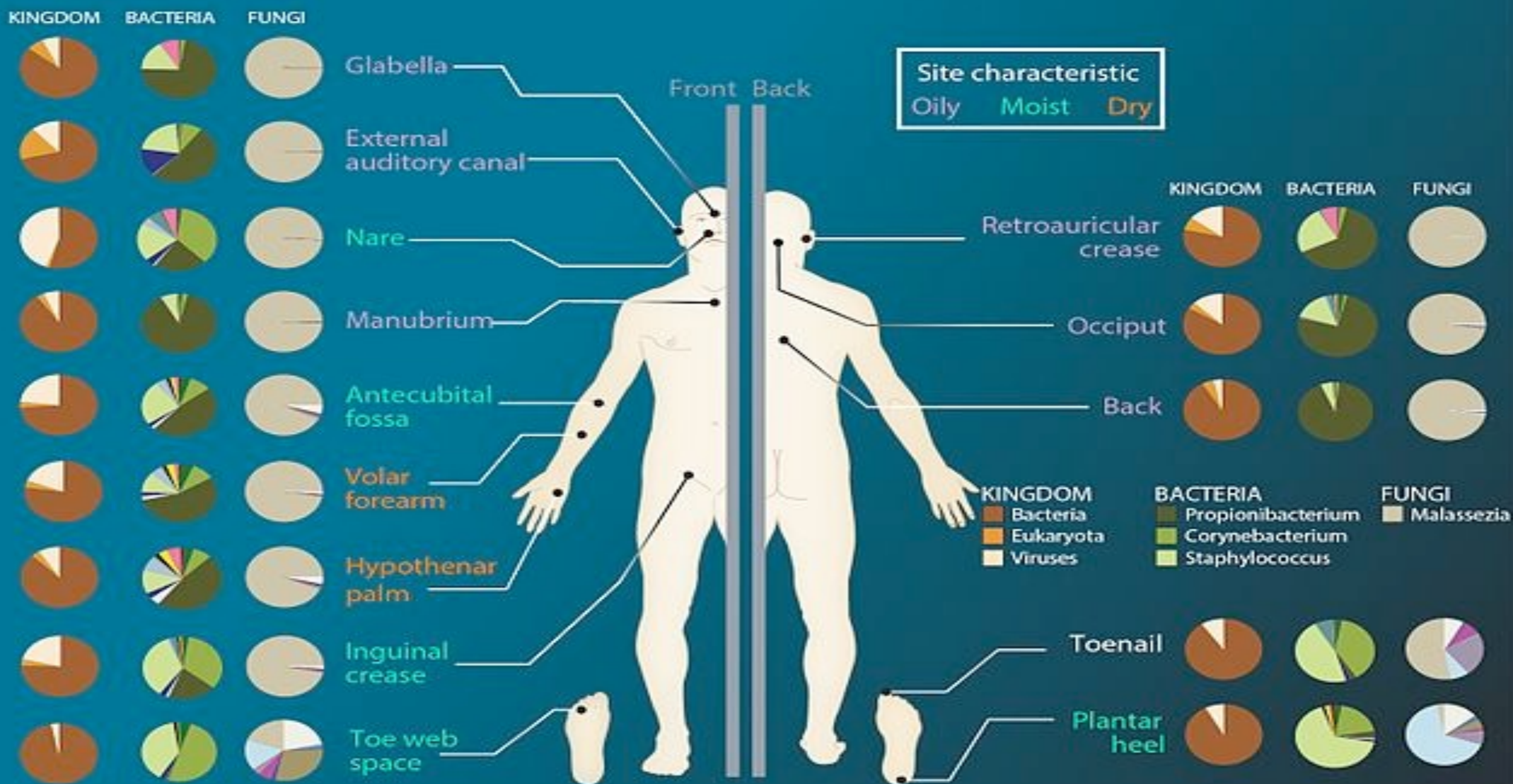
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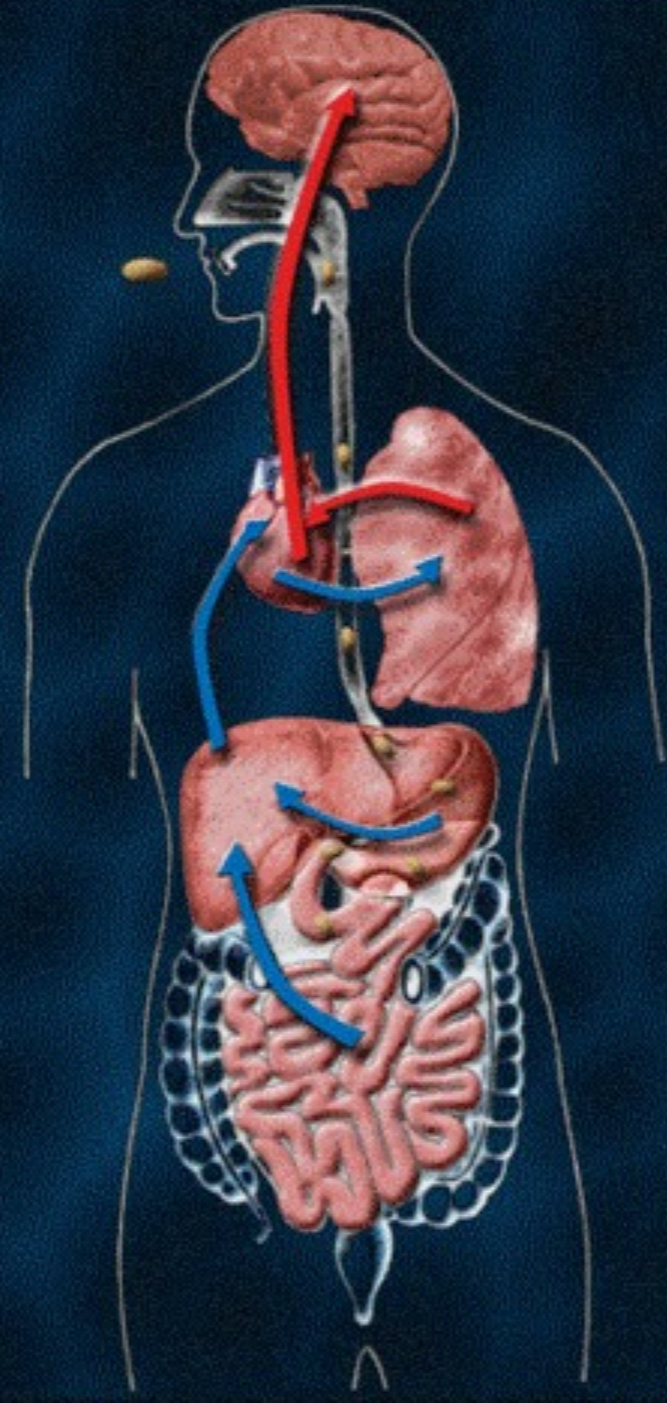


*So what else might be messing
with our minds?*





Trillions of individual
microbes, thousands
of species



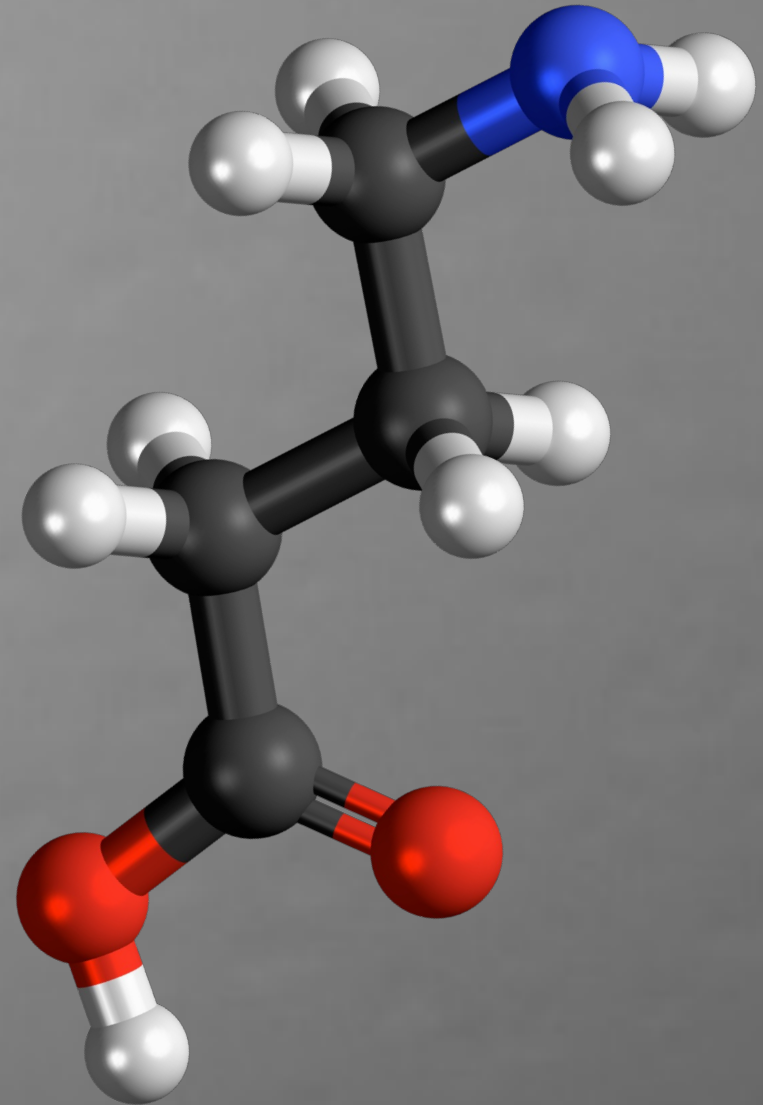
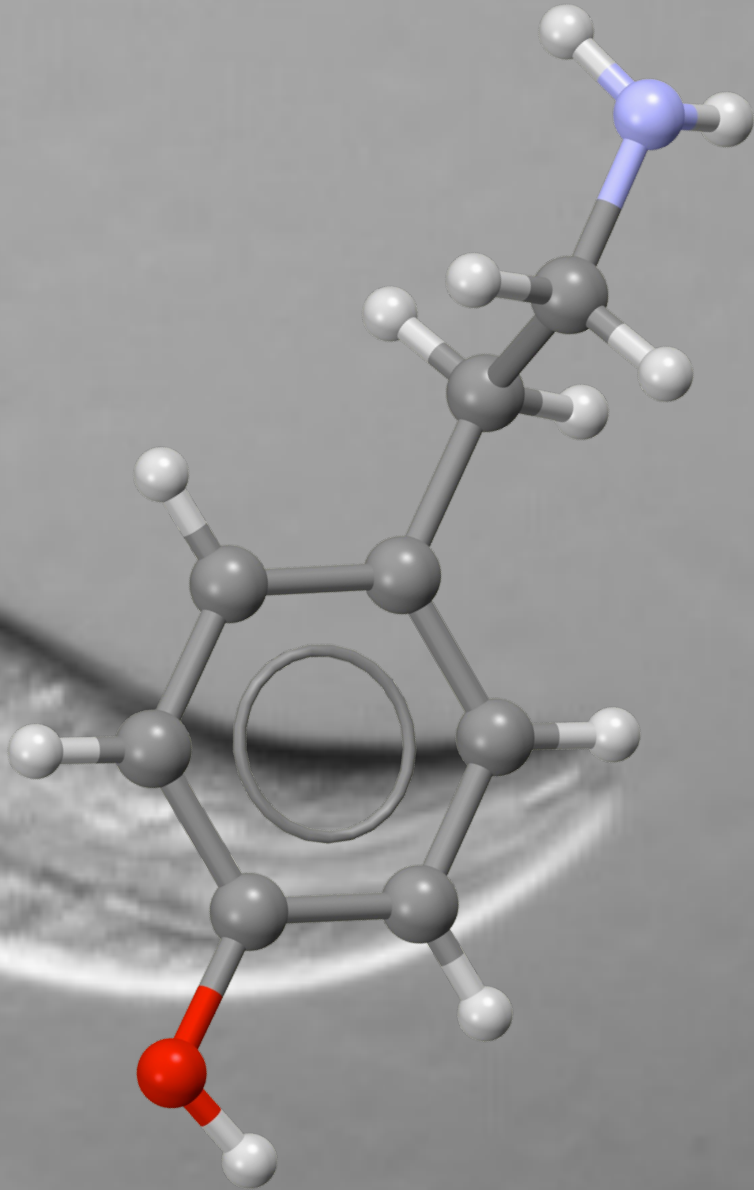
Might the residents of your gut affect the function of your brain?

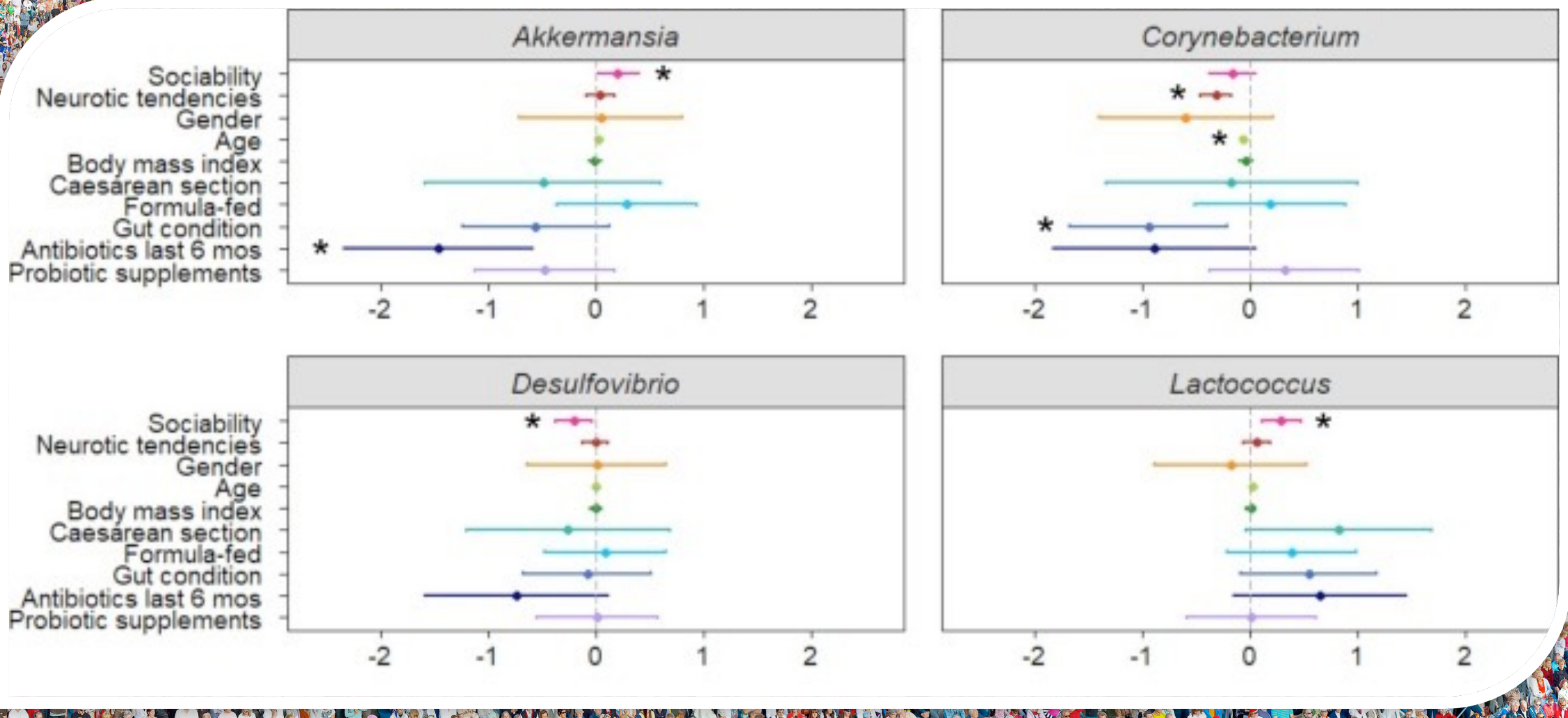






How might this work?







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