



BATTLE IN THE BELLY

The bacteria roiling in your child's gut are driving her immune system—and every day, scientists are figuring out more (and miraculous) ways to grab the controls to cure sick kids.

by **KATE ROCKWOOD** / photograph by **STEPHANIE RAUSSER** / illustrations by **GEO LAW**

CHRISTINA FUHRMAN knew in her heart that something was seriously wrong with her 22-month-old daughter, Pearl. The toddler was perpetually pale and tired, and her bowel movements, normally nothing out of the ordinary, were becoming the stuff of nightmares. “Every time I turned around, she’d be going—ten, 11, 12 times a day,” says Fuhrman.

Fuhrman’s fear peaked on Halloween as her daughter leaned against walls and begged to be carried as she trick-or-treated. Although Pearl had been to the pediatrician and was given standard stool tests that came back normal, her mother knew she needed to take action, and so she took Pearl straight to the E.R.

There, the toddler was diagnosed with clostridium difficile, commonly known as *C. diff*—a stubborn, potentially life-threatening gastrointestinal infection that upends the balance of the microbiome, the scientific word for the trillions of good and bad bacteria in the gut.

“Some people think of the microbiome as a second brain—a sensory organ that gathers information from the body and feeds info to the immune system,” says Thomas McDade, Ph.D., a biological anthropologist and professor at Northwestern University. Factors including how you delivered your baby (vaginally or via cesarean), your first feeding strategy (breast or bottle), where

you live, and your child’s diet and stress levels have been shown to impact how her microbiome is initially colonized and, in turn, how well her immune system works.

If your kid ingests only a few spores of the dangerous bacterium *C. diff*—which she can pick up just about anywhere—the thousands of good bacteria in her gut should compete with them for space. But sometimes, particularly after a child has taken antibiotics that can wipe out many of those good bacteria, *C. diff* can get a foothold. Once this happens, the infection can be tough to eradicate permanently, because even after treatment, a child’s microbiome remains off-kilter and susceptible to reinfection.



In fact, many kids in Pearl's situation spend a year or more in and out of the hospital, on and off different antibiotics.

But here's where Pearl's story takes a turn. When she relapsed, doctors at the Mayo Clinic in Rochester, Minnesota, decided to forgo the medicine merry-go-round and try a fecal transplant, a treatment available at only a handful of medical centers. They gave Pearl one more round of antibiotics and then collected a stool sample from her dad, mixed it with sterile saline water to create a bacteria-rich solution, and used a flexible tube to put that liquid directly into Pearl's digestive tract. In a matter of minutes, her gut was recolonized with healthy bacteria.

If your eyebrows are up near the sky, keep reading. This solution could help kids with lots of other tummy woes too.

The Power of Poop

Transplanting stool from a healthy person into the digestive tract of a sick one may seem far-fetched. But it works.

“My research found that about 90 of 100 pediatric patients got better, and some had been sick for more than a year before this treatment,” says Mark Bartlett, M.D., a pediatric gastroenterologist at the Mayo Clinic and one of Pearl's doctors. In fact, the physicians who conducted the first clinical trial of fecal transplant for *C. diff* in 2013 halted the study midway through because it was considered unethical to withhold such an effective treatment from the control group.

C. diff thrives on certain bile acids in the intestines, and the more of them it consumes, the more it spreads. But some good gut bacteria also eat bile acids, and when there are enough of those good guys, they monopolize the food supply and starve *C. diff* out. Pearl's fecal transplant brought those good bacteria into her gut, so that the spores of *C. diff* that were left couldn't multiply and survive.

Successes like hers have led doctors and scientists to ask: What other diseases and health problems could a microbiome makeover solve?

Healing the Gut—and Beyond

Approximately 100 to 200 of every 100,000 kids in the United States have a chronic inflammatory disorder of the GI tract, such as Crohn's disease or ulcerative colitis—diseases that can impact bone health, growth, and quality of life. And 6 percent of middle-school students have irritable bowel syndrome, which comes with chronically recurrent abdominal pain and irregular bowel movements. The causes of these GI issues—from bacteria to genetic luck—couldn't be more different. Yet all three illnesses have something in common: Altering a patient's microbiome can drastically improve symptoms.

In one study at Seattle Children's Hospital, pediatric patients with active Crohn's disease and ulcerative colitis ate a special diet (no grains, dairy, sugar, or processed foods) for 12 weeks with the goal of feeding the good bacteria in the gut and starving out the bad. By the end, eight of the ten patients were in remission. At Children's Hospital Colorado, doctors

are treating inflammatory bowel disease with a formula-only diet designed with a similar theory in mind. After three months, around 80 percent of pediatric patients are in remission.

Brett Finlay, Ph.D., a University of British Columbia microbiologist, found that four gut-bacteria strains were unusually low in Canadian children at increased risk for problematic asthma. When researchers introduced those bacteria into the intestines of young mice and then induced asthma, the mice didn't develop inflamed airways, showing that the bacteria may have preventive power.

So far, fecal transplant for *C. diff* is one of the more studied and most successful areas of microbiome treatment. Weeks after Pearl's fecal transplant, her parents sent her medical team a thank-you video. In it, the 2-year-old's face is flushed with life and her mom's dark circles are gone, replaced with a beaming grin. "To think that some kids battle *C. diff* for months, and this cured her?" Fuhrman says. "I couldn't be more grateful." ❌



HOW TO GROW A HEALTHY GUT

Early childhood is prime time for establishing a healthy microbiome. The more good critters that move in now, the more likely they'll crowd out or compete with bad bacteria your kid will encounter down the road. Start by making some adjustments to the food you serve. Gail Cresci, Ph.D., R.D., of the Cleveland Clinic, shares four ways to keep your little one's gut well fed.

1. Read Labels in the Dairy Case

Whether your child gobbles up Greek yogurt or slurps down smoothies doesn't matter much. Just make sure the yogurt has added strains of "live active cultures," aka probiotics, the living organisms created during the fermentation process that can take up residence in the GI tract and strengthen your kid's immune system.

2. Pick Cold Pickles

Fermented foods, like fermented pickles, sauerkraut, and beets, also contain probiotics. However, shelf-stable varieties often aren't produced through fermentation or are pasteurized, which kills the healthy bacteria. Hit up the refrigerator section of your grocery store instead.

3. Swap Cereal for Oatmeal

The friendly bacteria in your child's large intestine thrive on fermentable fiber (also known as prebiotic fiber), which can be found in unprocessed oats and barley.

4. Pack Cold Pasta for Lunch

When you boil and chill pasta, it increases the amount of resistant starch, a type of fiber that your body has difficulty digesting, so more of it makes its way to the good bacteria in your gut. Potatoes, lentils, chickpeas, and less-ripe bananas offer other ways to serve up this carb.