Fecal Transplants

Scientists and Doctors are starting to value the bowel flora and fecal transplant

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The Excrement Experiment

Treating disease with fecal transplants.

BY EMILY EAKIN

Some disease sufferers have benefitted from fecal transplantation, in which a healthy person’s stool is transferred to a sick person’s colon.

One morning last fall, Jon Ritter, an architectural historian living in Greenwich Village, woke to find an e-mail from a neighbor, who had an unusual request. “Hi Jon, This is Tom Gravel, from Apt. 4N,” the e-mail began. “I wanted to check in and see if you may be open to helping me with a health condition.” Gravel, a project manager for a land-conservation group, explained that he had Crohn’s disease, an autoimmune disorder that causes inflammation of the intestinal tract along with unpredictable, often incapacitating episodes of abdominal pain and bloody diarrhea. His doctor had prescribed a succession of increasingly powerful drugs, none of which had helped. But recently Gravel had experimented with a novel therapy that, though distasteful to
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contemplate, seemed to relieve his symptoms: fecal transplantation, in which stool from a healthy person is transferred to the colon of someone who is sick. He hoped to enlist Ritter as a stool donor.

“I realize this is really out there,” Gravel wrote. “But I think you and your family are the nicest people in our building, and I thought I might start with lucky you.”

Crohn’s disease affects as many as seven hundred thousand Americans, but, like other autoimmune disorders, it remains poorly understood and is considered incurable. (Autoimmune disorders are thought to arise when the immune system attacks healthy tissue, mistaking it for a threat.) The standard treatments for Crohn’s often don’t work, or work only temporarily, and many have serious side effects. When the disease cannot be managed by drugs, surgery to remove part of the colon is often the only option.

Gravel, who is thirty-nine, is slight and mild-mannered, with delicate features and floppy brown hair. He had endured nearly three years of debilitating symptoms, as well as a shifting regimen of enemas, suppositories, shots, supplements, and, for several months, intravenous infusions of Remicade, a potent immunosuppressant, at a cost of more than twelve thousand dollars each. “I would tell my wife in the morning, ‘I’m getting out my arsenal,’ ” Gravel told me.

Even so, blood tests continued to show high levels of inflammation. His daily life was governed by calculations of proximity to the nearest rest room. “I’d get nervous if I had to go to the bank,” he said. The checkout line at Whole Foods was an ordeal. By August, 2013, Gravel had stopped all his medications and was trying to manage his disease through a strict diet of broiled meat and fish and puréed vegetables. His mother showed him an article from the Times about a man who had been nearly bedridden by ulcerative colitis—a condition related to Crohn’s—and who had largely recovered after a month or so of fecal transplants. Gravel found a how-to book on Amazon and bought the recommended equipment: a blender, a rectal syringe, saline solution, surgical gloves, Tupperware containers. His wife agreed to be his donor. Doctors and patient-advocacy Web sites stress that donors should be screened for transmissible diseases, but Gravel and his wife decided to skip this step. “She’d been healthy as long as I’d known her,” he told me.

His doctor was unable to offer advice, saying that too little was known about fecal transplants. Nor could he legally provide the procedure. The Food and Drug Administration regards fecal transplantation as an experimental treatment, and doctors must apply to the agency for permission before offering it to Crohn’s patients. Just as Gravel began to research the procedure, his wife received a diagnosis of breast cancer. They began daily transplants anyway, and soon he was feeling much better. But his wife was scheduled to have surgery, followed by chemotherapy. Gravel needed another donor, someone nearby. “I immediately thought of Jon,” he said.

A strapping forty-eight-year-old partial to organic food, Ritter exuded good health. “At first I was kind of shocked,” he told me. “Pretty quickly I realized I didn’t really have a
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problem with it. What he wanted was something I wasn’t using—that was going to waste.”

No one knows how many people have undergone fecal transplants—the official term is fecal microbiota transplantation, or FMT—but the number is thought to be at least ten thousand and climbing rapidly. New research suggests that the microbes in our guts—and, consequently, in our stool—may play a role in conditions ranging from autoimmune disorders to allergies and obesity, and reports of recoveries by patients who, with or without the help of doctors, have received these bacteria-rich infusions have spurred demand for the procedure. A year and a half ago, a few dozen physicians in the United States offered FMT. Today, hundreds do, and OpenBiome, a nonprofit stool bank founded last year by graduate students at M.I.T., ships more than fifty specimens each week to hospitals in thirty-six states. The Cleveland Clinic named fecal transplantation one of the top ten medical innovations for 2014, and biotech companies are competing to put stool-based therapies through clinical trials and onto the market. In medicine, at any rate, human excrement has become a precious commodity.

“Get outta here—I shot a man in Reno just to watch him die, too

Science writers love to cite the freakish fact that for every one of our cells we are hosts to ten microbial ones, and nowhere are there as many as in our digestive tracts, which house about a hundred trillion bacteria, fungi, viruses, and other tiny creatures. (As one gastroenterologist put it to me, with only mild exaggeration, “We’re ten per cent human and ninety per cent poo.”) Collectively, this invisible population is known as the gut microbiome, and lately it has become an object of intense scientific interest. “You can hardly mention a disease today where something hasn’t been looked at regarding the microbiota,” Lawrence Brandt, a gastroenterologist at Montefiore Medical Center, in the Bronx, who was among the first physicians in this country to perform fecal transplants, told me.
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For years, efforts to study the microbiome were stymied by the number of species involved and the difficulty of culturing finicky strains in the lab. But the advent of genetic-sequencing technology has made it possible to identify microbes by their DNA, spawning a frenzy of research, whose highlights, routinely catalogued in the popular press, can have an air of science fiction. (A recent headline in the Times: “HOW BACTERIA MAY CONTROL OUR BEHAVIOR.”) Much of the research is still preliminary, and a lot of it depends on stool, which by dry weight is roughly forty per cent microbes and remains our best proxy for the brimming universe within.

FMT, the chief medical application of microbiome research to date, is also at a rudimentary stage. The procedure has been proven to work only in the case of a single disease: a bacterial infection known as *Clostridium difficile*. The infection, which causes symptoms similar to Crohn’s, afflicts more than five hundred thousand people each year, killing fifteen thousand of them, almost all hospital patients who received antibiotics. Like a weed killer that slays not just the invading vine but, inadvertently, the entire garden, broad-spectrum antibiotics, which are prescribed prophylactically to patients undergoing surgery, can destroy gut flora, making it easier for *C. difficile* to take hold. Moreover, the standard treatment for the disease—vancomycin, itself an antibiotic—is often ineffective against drug-resistant, “hypervirulent” new strains.

Scattered case reports in the medical literature described *C. difficile* patients, some on their deathbeds, who received fecal transplants and recovered, often within hours. Then, in January, 2013, *The New England Journal of Medicine* published the results of the first randomized controlled trial involving FMT, comparing the therapy to treatment with vancomycin for patients with recurrent disease. The trial was ended early when doctors realized that it would be unethical to continue: fewer than a third of the patients given vancomycin recovered, compared with ninety-four per cent of those who underwent fecal transplants—the vast majority after a single treatment. A glowing editorial accompanying the article declared that the trial’s significance “goes far beyond the treatment of recurrent or severe *C. difficile*” and predicted a spate of research into the benefits of fecal transplants for other diseases.

“Nothing in health care works ninety per cent of the time,” Mark B. Smith, a microbiologist at M.I.T. who is a co-founder of OpenBiome, the stool bank, told me. Zain Kassam, a gastroenterologist who is OpenBiome’s chief medical officer, put it this way: “It’s the closest thing to a miracle I’ve seen in medicine.”

Smith and his colleagues are stool’s most enterprising pitchmen, displaying a zeal for the collection and distribution of human waste that, as much as any other single force, has helped to catapult FMT to the front lines of medical treatment. The inspiration for OpenBiome was a friend of Smith’s, an otherwise healthy man in his twenties who, in 2011, acquired *C. difficile* following gallbladder surgery. “He ended up on seven rounds of vancomycin over a year and half,” Smith told me. “He was very sick.” The man found a doctor who was open to the idea of performing a fecal transplant and waited six months while the doctor researched the procedure. Finally, unable to wait any longer, he gave himself a transplant using his roommate’s stool. “It worked for him,” Smith, who was then completing his Ph.D., said. “But the whole thing seemed very bizarre to me: why is it so hard to get a treatment that is very effective?”
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Even patients who received fecal transplants from doctors had to find a donor themselves and pay for screening tests. Moreover, there was little consensus about what pathogens to screen for or how to perform a transplant. Enemas, colonoscopes, nasogastric tubes, gelatine capsules—all had served as delivery methods. Some doctors were mixing random amounts of stool and saline solution in blenders. “It’s not sterile, it’s not completely safe,” Smith told me. “I thought, Gosh, we should just start a stool bank.” He persuaded a friend, who was about to enter business school at M.I.T., to join the project. “Eventually, we decided that the right model is the Red Cross, but for poop. It’s a medical commodity, and we’ll try to make it available in a safe and standardized way.”

Last spring, OpenBiome moved from a lab at M.I.T., where it had been storing stool in a borrowed freezer, to an office suite in Medford, a Boston suburb. In September, it sent out its thousandth stool treatment. At eight-thirty one morning last month, the office was already busy. In one room, a technician was preparing for the day’s stool donations by donning protective gear—a white coat, safety goggles, surgical gloves. A few feet away stood three industrial freezers, set to -80 degrees Celsius and stocked with small containers of stool, like so many bottles of chocolate milk. Smith, dressed in jeans and a blue-and-white plaid shirt, darted from room to room. “Who’s coming this morning?” he asked a colleague bent over a laptop. “Donor 29?” He poked his head into another room, where, near a cooler packed with dry ice, a whiteboard listed the destinations of a dozen shipments that had recently gone out. “We’ve added twenty-three hospitals this month!” he said approvingly.

Twenty-seven years old, with cornflower-blue eyes and a closely trimmed beard, Smith tends to speak in exclamations, punctuated by a pealing laugh. When, at ten after nine, the doorbell rang, he bounded to the door. In the hallway stood a stocky man in a faded baseball T-shirt cradling a blue plastic bag: Donor 29, a.k.a. Winnie the Poo. (All OpenBiome donors are given code names. A current staff favorite: Vladimir Pootin.) Smith gingerly received his package, still warm. (OpenBiome requires that no more than an hour elapse between defecation and delivery.) Like all of the organization’s donors to date, Donor 29, a bioengineer who works elsewhere in the building, was recruited by...
Smith and his staff. “They were at the gym one morning, at seven-fifteen,” the donor explained. “They had a table outside, and they were just so enthusiastic.”

In fact, OpenBiome’s screening process is extremely strict: fewer than twenty per cent of recruits pass the blood and stool tests. Use of antibiotics in the previous six months is cause for rejection, as is travel to the developing world and the presence in a stool test of pathogens like \( B.\ hominis \), a parasite that is found in up to ten per cent of healthy people. Approved donors are given blue Cool Whip-style containers and paid forty dollars a specimen. Size is important: an ample donation can provide up to ten treatments, and a monthly prize is awarded for “the most generous contribution.”

The technician, working under a sterile hood, weighed Donor 29’s container: a hundred and twenty-seven grams. (The record is five hundred and eight.) “Not his best work,” murmured Smith. Even so, the effort yielded five treatments. First, the technician transferred the stool to what looked like a large ziplock bag, divided down the middle by a fine mesh panel. Then she hung the bag inside a stainless-steel machine, about the size of a microwave, and flipped a switch. For two minutes, the bag was pummelled by metal paddles, leaving food particles on one side of the mesh and a homogenized slurry of microbes on the other. Using a long pipette, the technician distributed the slurry among five sterilized plastic bottles. Every so often, a faint odor wafted out from the hood, then dissipated.

The doorbell rang again. It was Donor 28 (Dumpledore) with a delivery, and, close on his heels, Donor 26 (Albutt Einstein), who mumbled apologetically that he had nothing to offer but promised to return in the afternoon. Smith nodded sympathetically.

It’s a safe bet that few other miracle cures have had to overcome such repellent associations. The first known account of fecal transplantation dates to a fourth-century Chinese handbook by the physician Ge Hong, who prescribed “yellow soup”—a fecal suspension—as a remedy for severe diarrhea. (Ge Hong also discusses his cure for malarial fevers: a formula containing artemisinin, an herbal extract, which, rediscovered in the nineteen-seventies, is now part of the standard treatment for the disease.)

In the United States, the first description of FMT appeared sixteen centuries later, in 1958, when Ben Eiseman, a surgeon at the V.A. Hospital in Denver, published four case reports in the journal *Surgery*. Stool was then widely assumed to be mainly a source of disease; there was little empirical support for the notion that bowel bacteria were important for health. Several of Eiseman’s patients had become deathly ill after the requisite preoperative course of antibiotics, however, and he concluded that the drugs were destroying normal gut flora. He sent a resident to collect stool specimens from a nearby maternity ward, reasoning that pregnant women were likely to be young and healthy and to have avoided antibiotics. The stool, transferred to Eiseman’s patients, saved their lives.

The year that Eiseman began performing fecal transplants, Stanley Falkow, who went on to renown as a microbiologist at Stanford, was working in a lab at a hospital in Newport, Rhode Island. A doctor on staff shared Eiseman’s belief that antibiotics were hard on gut
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microbes and instructed patients to bring a stool specimen when they were admitted for surgery. Falkow’s job was to prepare capsules of the patients’ stool for them to swallow after they’d been discharged, on the hunch that these would help to prevent postoperative infections. “I was all for it,” Falkow told me. “When we tried to culture the stool from patients who’d had antibiotics using conventional culture methods, you got no growth. Their stool doesn’t even smell. Very few stools can make that statement.”

A hospital administrator discovered what was going on and, as Falkow recalls it, confronted him, saying, “Is it true that you’ve been feeding the patients shit?” Falkow was fired on the spot. (He was reinstated when a doctor intervened on his behalf.) “It’s a repulsive thought,” Falkow says of fecal transplantation, “and people are still repulsed by it.”

For years, virtually the only proponent of FMT was Thomas Borody, a gastroenterologist in Sydney, Australia, who, in 1988, after reading Eiseman’s paper, decided to try a fecal transplant on a patient who had contracted an intestinal ailment in Fiji. The patient recovered, and Borody estimates that he has since performed the procedure five thousand times, including, with stool supplied by his father, on his mother, who suffered from crippling constipation. In addition to C. difficile patients, Borody says that he has successfully treated people with autoimmune disorders, including Crohn’s and multiple sclerosis.

In the case of C. difficile, the impact of a fecal transplant is straightforward: normal gut bacteria overwhelm and suppress the pathogen. In patients suffering from other conditions, the effects of FMT are harder to predict or to explain, and until rigorous trials are undertaken reports of spectacular recoveries are merely anecdotes, without scientific value. It’s known that Crohn’s patients have a gut microbiome that is less diverse than average and is lacking in key species of bacteria. But many also carry genetic mutations not found in healthy people. How such mutations interact with the immune system and gut microbes to cause disease is not fully understood.

Some of the most promising research is still at the animal stage. In a 2006 study, researchers at Washington University, in St. Louis, transferred gut microbes from mice carrying a mutation that caused them to be obese to mice lacking the mutation. The mice that received the transplants subsequently became obese themselves, despite eating the same amount of food as a group of mice that received transplants from lean donors. (Presumably the microbes in the obese mice were able to extract more energy from food than were the microbes in their lean counterparts.) The study was the first to show that a disease trait could be transmitted from one animal to another through the microbiome.

“A lot of people my age who are moving into the field of microbiome research were really moved by that paper,” Mark Smith, of OpenBiome, told me. “It’s one thing to show that there are a lot of bacteria in humans, and these bacteria are associated in some cases with disease and health. But in this case the researchers changed the
composition of a microbial community, and that totally changed the health of this animal. And that could potentially happen in humans.”

It’s possible that no Americans have gut microbiomes that are truly healthy. Evidence is mounting that over the course of human history the diversity of our microbes has diminished, and, in a recent paper, Erica and Justin Sonnenburg, microbiologists at Stanford, argue that the price of microbial-species loss may be an increase in chronic illness. Unlike our genes, which have remained relatively stable, our microbiome has undergone radical changes in response to shifts in our diet, our antibiotic use, and our increasingly sterile living environments, raising the possibility that “incompatibilities between the two could rapidly arise.” In particular, the Sonnenburgs stress the adverse effects of a standard Western diet, which is notoriously light on the plant fibre that serves as fuel for gut microbes. Less fuel means fewer types of microbes and fewer of the chemical by-products that microbes produce as they ferment our food. Research in mice suggests that those by-products help reduce inflammation and regulate the immune system. Noting that rates of so-called Western diseases—including heart disease and autoimmune disorders, all of which involve inflammation—are thought to be much lower in traditional societies, the Sonnenburgs write, “It is possible that the Western microbiota is actually dysbiotic and predisposes individuals to a variety of diseases.”

The first step to determining whether our ancestors’ guts were healthier than our own is to figure out what might have lived in them. Jeff Leach, an anthropologist who is collaborating with the Sonnenburgs, has spent much of the past year in Tanzania, conducting research among three hundred Hadza, one of Africa’s last remaining hunter-gatherer tribes. “We need to go to places where people don’t have ready access to antibiotics, where people still drink water from the same sources that zebra, giraffes, and elephants drink from, and who still live outside,” Leach told me. “There are a number of people like that, but only the Hadza still live in a place that gave rise to our genus, Homo.” Based on a preliminary analysis of the tribe’s stool, he said, “it looks like the Hadza have one of the most diverse gut ecosystems in the world of any population that’s been studied.” (A previous study led by Stephanie Schnorr, of the Max Planck Institute for Evolutionary Anthropology, found that the Hadza harbored bacterial species that had never been seen before and lacked others that in Western guts have been associated with good health.) Among the Hadza, Leach is known as Doctor Mavi—Swahili for “shit.” His own also gets collected and analyzed, in an effort to measure the impact of a Hadza life style on a Western gut. In September, Leach gave himself a fecal transplant, with the aid of a turkey baster and a bemused Hadza man, who served as his donor. Afterward, Leach marvelled, “I probably had the most diverse ecosystem of any white person in the world.”

When I spoke with him, he had been back in the United States for two days, “drinking tequila and eating hamburgers,” and generating stool samples. These might show whether the microbes that he acquired from his Hadza donor could survive a Western
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diet or, as he predicted, would die off. If the microbes fail to take up residency in his gut, he said, “then I’ve effectively re-created the last ten thousand years of human history.”

Leach has a daughter, now fourteen, who, as a toddler, was given a diagnosis of Type 1 diabetes, an autoimmune disease. His interest in gut microbes grew out of a desire to understand her condition. “Hadza kids are born in the dirt, play in the dirt, and they’re literally chewing on animal bones,” he said. “They’re covered in microbes, and it’s been that way for millions of years. Maybe because we’ve un-wilded our children, that might play a role in some of the diseases we see in them.”

In September, I visited a scientist in San Diego who has thought as much about the relationship between gut microbes and autoimmune disease as anyone: Larry Smarr, a computer scientist at U.C.S.D. who directs the California Institute for Telecommunications and Information Technology. Smarr has Crohn’s. More than ten years ago, in an effort to lose weight and get fit, and before he had experienced any symptoms, he began to record his every bite, step, and sleep wave. When he discovered that he could order blood and stool tests online, he started tracking those results, too—eight times a year. The Atlantic dubbed him “The Measured Man.” The BBC aired footage of him holding a ziplock full of frozen stool.

“Do you have any tooth-whitening vodka?”

Smarr’s enthusiasm for data predates his obsession with his health; in the early nineteen-eighties, he helped persuade the National Science Foundation to fund the first national network of supercomputers, a precursor to the Internet. But it was an inadvertent discovery in a stool analysis that led to his Crohn’s diagnosis and, eventually, to a new calling: as an evangelist for an impending medical revolution, “quantified health.” In the future, as Smarr sees it, doctors won’t have to rely on symptoms and guesswork, because they’ll have computer files detailing a patient’s genes and microbes. Stool is central to this vision, and Smarr is an expert on the stuff.

“As I came to realize, stool is the most information-rich material you have ever laid eyes on,” he told me. Smarr is sixty-six, tall and thin, with a comic’s range of facial expressions and talent for quips. We met in his fifth-floor office on campus, at a conference table overlooking a dusty eucalyptus grove. On his desk lay a small white
sculpture with spiny protrusions, like a piece of bleached coral. It was a scale model of a six-inch region of Smarr’s colon that is chronically inflamed by Crohn’s. “It’s the Rodney Dangerfield of organs and substances,” he said when I admired it.

By 2008, Smarr had lost twenty pounds and become a convert to the Zone diet, a regimen that emphasizes foods containing copious amounts of Omega-3 fatty acids, which are thought to fight inflammation. (Inflammation is a normal immune response to a toxin or irritation, but chronic inflammation is a risk factor for disease.) Smarr, eager to measure the fatty acids in his blood, found a Web site that offered such a test. The site also advertised stool analyses, and impulsively he added one to his order. “At that point, I had no idea that I was anything but healthy,” he recalled.

The stool test indicated that Smarr had twenty times the advisable level of lactoferrin, a marker of inflammation. Two years later, Smarr’s lactoferrin had climbed to a hundred and twenty-five times the advisable level. “If you ever got something like that back, you’d fall over in a faint,” he told me, his eyes wide. A search of the medical literature revealed that highly elevated lactoferrin was closely correlated with Crohn’s and ulcerative colitis. But Smarr’s gastroenterologist was skeptical: a colonoscopy had shown only a small area of inflammation. Besides, most patients are given the diagnosis as young adults, and, apart from a passing infection of the colon, Smarr had been largely free of symptoms. He found a new doctor, William Sandborn, a leading Crohn’s researcher who had just been recruited to U.C.S.D., and underwent a second colonoscopy. He received a diagnosis of late-onset Crohn’s.

The diagnosis was a relief, confirming Smarr’s data. Still, if Crohn’s had caused the inflammation, what had caused the Crohn’s? In 2008, he had sent a saliva sample to 23andme, the genetics testing company, and had a portion of his genome (the unique pattern of DNA in his body) sequenced. After his diagnosis, he typed “Crohn’s disease” into 23andme’s online database, which retrieved those snippets of his DNA associated with the illness. Smarr learned that he had DNA aberrations on a gene that several studies suggest may be a “master regulator” in Crohn’s, and which, by exacerbating the immune system’s inflammatory response, confers a greater than average risk for the disease.

The gene was a clue, but not everyone with a genetic predisposition gets the disease. New research pointed to the microbiome as a likely factor. So Smarr sent a stool specimen to the J. Craig Venter Institute, the genetics-research organization, where a colleague agreed to sequence his microbes—into two hundred million strings of DNA. In a typical Western gut, two phyla of bacteria are overwhelmingly dominant: Bacteroidetes and Firmicutes. Together, they comprise roughly ninety per cent of our microbes. Smarr’s gut was nearly devoid of Bacteroidetes—a finding consistent with other Crohn’s patients. Equally disconcerting, Smarr had abundant archaea, obscure microorganisms known for their ability to survive in harsh environments, such as the hot springs at Yellowstone National Park. “At my highest level of inflammation, I was twenty-per-cent archaea,” Smarr said. “I’ve probably got the world’s record.”
Ten per cent of his bacteria were *E. coli*, a species that in healthy people is found in minute amounts, typically representing less than one per cent of the microbiome. A researcher at Smarr’s lab consulted a database at the National Institutes of Health containing DNA sequences for all the *E. coli* strains that had been identified at the time—about eight hundred—and found a match for Smarr’s strain. Known as “adherent-invasive *E. coli*,” the strain is often found in the guts of Crohn’s patients, where it digs through the mucus lining the colon and latches on to the healthy cells beneath. (Smarr: “Very sci-fi!”)

Finally, he felt that he had solved much of the puzzle of his disease: “The immune system senses that there’s a strain of *E. coli* that’s pathogenic, so it fires up, and when the body fires up the immune system you have inflammation.” Sandborn, Smarr’s doctor, called this hypothesis “very plausible.” But, he cautioned, it’s not clear whether an abnormal microbiome causes the inflammation or whether it’s the other way around. Smarr doesn’t know what led the invasive *E. coli* to bloom in his gut. “The issue is, what do you do about it?” he told me. “How do I get my Bacteroidetes back? Given that the immune system is reacting badly to something in the microbiome, it’s sort of logical that if I could get the microbiome back to normal the immune system would calm down.”

Smarr had read about fecal transplants, and in 2011 he asked Sandborn about them. At the time, no doctor at U.C.S.D. offered the procedure. When Smarr developed uncomfortable Crohn’s symptoms, Sandborn prescribed drugs, which didn’t seem to help, and eventually Smarr stopped taking them. His symptoms abated—perhaps the drugs had done some good after all—and he has been in remission for nearly a year.

“*I wish they’d quit sending my financial statements*”

Sandborn now performs fecal transplants, and Smarr says that if his symptoms return he will consider having one. “If I knew I could get five or ten years of remission out of it, I’d do it.”

Among the desperately ill, FMT’s reputation as a wonder cure has outstripped the science supporting its use. The lure of a potential remedy that is widely available, inexpensive, and considered relatively low-risk has yielded an improvisational approach to treatment and a growing D.I.Y. transplant population. When Jon Ritter agreed to serve as a donor for Tom Gravel, the Greenwich Village Crohn’s patient, Gravel paid the
charges for the blood and stool screening that Ritter’s insurance didn’t cover. But these tests can cost hundreds of dollars, and many patients are circumventing the medical system altogether. On YouTube, FMT how-to videos have received thousands of views, and on Facebook there are private forums where people trade advice about the procedure. “There are a lot of people who are doing this at home,” Lawrence Brandt, of the Montefiore Medical Center, says. “Some of them are doing it under the instructions of their physicians. Some of them are doing it by reading the Internet.” One of his patients, ill with *C. difficile* and unable to find a donor, asked whether she could use her dog’s feces. (The answer was no.) Another placed an ad in her local paper; more than forty-five people responded. Instances of FMT going terribly wrong are hard to find, although there have been anecdotal reports of people developing bacterial and viral infections following the procedure.

Like Mark Smith, of OpenBiome, the F.D.A. watched the surging demand for fecal transplants with concern. In the early nineteen-eighties, at least twenty thousand people became infected with H.I.V. after receiving blood transfusions contaminated with the virus, because doctors didn’t know to screen for it. Could a similar, as yet unknown threat be lurking in a donor’s stool? In May, 2013, agency officials convened a public workshop on FMT in Bethesda, where they explained that the F.D.A. considers stool to be a drug. This wasn’t particularly surprising. The agency defines a drug as any material that is intended for “use in the diagnosis, cure, mitigation, treatment, or prevention of disease.” An exception has been written into law for body parts, including skin, bone, and cartilage, which are classified as tissue. But the statute excludes most human secretions from this category.

Substances labelled drugs are subject to a rigorous approval process. Pharmaceutical companies typically spend many years and millions of dollars researching and testing a drug before submitting it to the agency for approval. Until the F.D.A. approved a fecal-transplant therapy, the procedure would be considered experimental. In order to offer it to patients, doctors would need to file an investigational new-drug application, or I.N.D., and obtain the agency’s permission. “That hit the whole field like a ton of bricks,” Smith, who attended the workshop, told me. “There was this increasing momentum around fecal transplants, and all of a sudden the whole field hit the brakes.”

I.N.D.s are intended to capture every aspect of a prospective therapy in exacting detail. At the Bethesda workshop, one gastroenterologist said that it had taken her hundreds of hours to complete the paperwork. Many others lacked the resources and staff to devote to such a task. “What do we do with the fifteen thousand patients who are really desperate for something that works?” a doctor from the Mayo Clinic asked F.D.A. officials. “If your mother shows up with severe or recurrent *C. difficile*, are you going to not offer something that you know how to do safely, effectively, and say, ‘I can’t do it because the regulatory agencies in the United States have decided that this requires a special licensure’?”

At the time of the workshop, OpenBiome had not yet started its operation; the F.D.A.’s ruling implied that the organization’s plan to send stool across state lines to hospitals and clinics would be illegal. “They were planning to ship this stuff around the country,” Peter Safir, a lawyer at Covington & Burling, in Washington, D.C., who is an expert on
F.D.A. regulation and has advised OpenBiome, told me. “There’s really no way around the idea that once the F.D.A. says it’s a drug you either have to have approval, which no one’s going to get in the near term, or you set up some kind of system where there’s an I.N.D."

Six weeks later, in July, 2013, the F.D.A. declared an exception for doctors treating recurrent *C. difficile*: they would be allowed to perform fecal transplants without an I.N.D. In revising its position, the agency said that it would be exercising “enforcement discretion”—a temporary measure. As an F.D.A. spokeswoman later explained in an e-mail, the directive did not reflect a change of policy; it was intended as an acknowledgment that “there are often few or no other treatment options for these patients.” According to Safir, “What they mean is they’re not doing anything. They’re not going to go after a doctor and they’re not going to go after OpenBiome.”

“Ah, just the person I was looking for.”

That August, OpenBiome screened its first donor, and early that fall sent out its first stool treatment, to a clinic in California. In the past year, orders for OpenBiome’s stool have increased at a rate of about eighteen per cent a month. Its success has unnerved biotech companies that are developing stool-based enemas and capsules—or, as they’re known in the field, “crapsules”—for eventual sale on the commercial market.

“OpenBiome is selling an unapproved drug without any kind of F.D.A. clearance, so in my opinion they’re breaking the law,” Lee Jones, the C.E.O. of Rebiotix, a company in Minnesota that is developing an enema for the treatment of *C. difficile*, told me. “They may parade as a nonprofit, but what they’re doing is selling a product to be used on patients.”

When, in a year or two, Rebiotix submits its enema to the F.D.A. for approval, it will have spent tens of millions of dollars on research and trials—costs that are typically factored into a drug’s retail price. OpenBiome charges two hundred and fifty dollars for a treatment, which just covers its costs. “This is a highly unusual situation,” Peter Safir, the lawyer, said. “There’s no question that in the United States we want our drugs approved. We want the F.D.A. to say a product is safe, effective, and is manufactured according to good practices, and that costs a lot of money. But here you’ve got an almost identical competitor that is virtually giving it away, without F.D.A. approval.” Once a company like Rebiotix obtains approval to sell its stool therapy, he went on, it could pressure the F.D.A. to shut down OpenBiome.
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The agency may be moving in that direction. In March, it proposed a new guideline for fecal transplants: that the stool donor should be “known to either the patient or the treating licensed health care provider.” It wasn’t immediately obvious what the agency meant by “known,” and the guideline, which was circulated for public comments, has not yet been formally adopted. Clearly, though, doctors relying on OpenBiome, whose donors are anonymous, would be unable to meet such a requirement. (“The F.D.A. is now reviewing the comments received on this draft guidance document,” an agency spokeswoman said in an e-mail.)

In an editorial in Nature earlier this year, Smith and two co-authors argued that stool should be reclassified as a tissue. Unlike drugs, tissues are not subject to clinical trials or to F.D.A. approval; when someone gets a bone graft, its efficacy isn’t in doubt. As Safir put it, “A tissue doesn’t require clinical trials, because you’re just substituting it for what everyone knows it already does.” Tissues are still obliged to meet strict safety standards, and Smith and his co-authors proposed that a screening system like the one currently in place for blood, which is in a category of its own, could be adapted for stool. Classifying stool as a drug “threatens to restrict FMT mainly to companies with the resources to fund large clinical trials,” they wrote.

To amend the federal statute governing the regulation of body parts and substances would require an act of Congress, and Smith and his colleagues understand that this is unlikely to happen. “We’ve always had a view that OpenBiome might have to go away,” James Burgess, the stool bank’s executive director, told me. But he warned, “If the cost of FMT goes up by an order of magnitude, you’ll see a big jump in the D.I.Y. approach.”

Even if OpenBiome were to stop shipping stool to hospitals, it could presumably continue to operate as a resource for researchers. When I visited in October, there was a tray of shiny white capsules on Smith’s desk—“poop pills that we’ve been working on,” he explained. Doctors at Massachusetts General Hospital had just announced the results of a study showing that capsules were as effective as colonoscopes for treating C. difficile, and the field was abuzz with the news, since, as Smith pointed out, “everyone would rather swallow a pill.” He had hit on a way to improve on the doctors’ methods: lining capsules with cocoa butter, which is solid at room temperature, thus insuring that they won’t disintegrate prematurely—on the shelf or in someone’s mouth.

Such research requires patients. Not only are D.I.Y. fecal transplants likely to be less safe than procedures administered by doctors but each one also represents a case lost to science. Researchers are unlikely to study Tom Gravel, the Greenwich Village Crohn’s patient, who recently cut back his fecal transplants to one every two weeks. “In a way, it is like I am a different person,” he told me, recalling the symptoms and medications that once dominated his life. He believes that he has found an effective therapy, not a cure. “Provided Jon is still up for it, which he generously seems to be, I will continue the transplants indefinitely,” he said. “Crohn’s is a very persistent disease.” ♦
An unnamed Rhode Island patient underwent the fecal matter transplant in 2011 to cure a serious bacterial infection C. difficile, which can lead to diarrhea and potentially fatal inflammation of colon. A patient gained more than 40 pounds of weight over the 36 months post-transplant. Her doctors reported that she was not able to lose the gained weight with regular exercise or diet.

The scientists are concerned with a case of a normal-weight woman becoming obese following the fecal transplant. While the doctors cited the evidence of lean mice gaining weight following fecal microbes transplant from obese mice, they are still not sure of what caused the weight gain in a woman patient.
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A case report is published in the journal Open Forum Infectious Diseases and its authors are Dr. Neha Alang of Rhode Island’s Newport Hospital and Dr. Colleen Kelly of and the Warren Alpert Medical School of Brown University.

The authors have mentioned in a report that the present case warns the consideration of non-ideal donors for fecal microbiota transplant. They also recommended selecting non-overweight donors for such transplant.

Fecal transplants have recently been accepted to treat C. difficile infections, which occurs when the natural inhabitants of the gut are killed by the antibiotics, replacing the gut flora with C. difficile bacteria.

Fecal transplant is done by collecting healthy donor’s fecal matter and placing it in the intestine of the recipient. The reintroduction of the good bacteria is expected to restore the natural flora of the gut.

The published case report describes that the donor was the patient’s 16-year daughter, who was normal-weight at the time of transplant. However, she gained weight later, weighing 170 patients.

Dr. Kelly said in a statement that whether there was something in the fecal transplant or good bacteria have negative impact on patient’s metabolism.

A faecal microbiota transplantation (FMT) also known as a stool transplant is the process of transplantation of fecal bacteria from a healthy individual into a recipient. FMT involves restoration of the colonic microflora by introducing healthy bacterial flora through infusion of stool, e.g. by enema, orogastric tube or orally in the form of a capsule containing freeze dried material, obtained from a healthy donor. A limited number of studies have shown it to be an effective treatment for patients suffering from Clostridium difficile infection (CDI), which can range from diarrhea to pseudomembranous colitis. Due to an epidemic of CDI in North America and Europe, FMT has gained increasing prominence, with some experts calling for it to become first-line therapy for CDI. In 2013 a randomized, controlled trial of FMT from healthy donors showed it to be highly effective in treating recurrent C. difficile in adults, and more effective than vancomycin alone. FMT has been
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used experimentally to treat other gastrointestinal diseases, including colitis, constipation, irritable bowel syndrome, and neurological conditions such as multiple sclerosis and Parkinson's. In the United States, the Food and Drug Administration (FDA) has regulated human faeces as an experimental drug since 2013.

Definition

Fecal microbiota transplantation or FMT is the transfer of fecal material containing bacteria and natural antibacterials from a healthy individual into a diseased recipient. Previous terms for the procedure include fecal bacteriotherapy, fecal transfusion, fecal transplant, stool transplant, fecal enema, and human probiotic infusion (HPI). Because the procedure involves the complete restoration of the entire fecal microbiota, not just a single agent or combination of agents, these terms have now been replaced by the new term 'Fecal Microbiota Transplantation'.

Technique

A team of international gastroenterologists and infectious disease specialists have published formal standard practice guidelines for performing FMT which outline in detail the FMT procedure, including preparation of material, donor selection and screening, and FMT administration.

Donor selection

Preparing for the procedure requires careful selection and screening of the donor and excluding those who test positive for certain diseases as well as any donor carrying any pathogenic gastrointestinal infectious agent. Although a close relative is often the easiest donor to obtain and have tested, there is no reason to expect this to affect the success of the procedure as genetic similarities or differences do not appear to play a role. Indeed, in some situations a close relative may be an asymptomatic carrier of C. difficile, a disadvantage. Donors must be tested for a wide array of bacterial and parasitic infections. In more than 370 published reports there has been no reported infection transmission.

Specimen preparation

Approximately 200-300 grams of fecal material is recommended per treatment for optimum results. Fresh stools have been recommended to be used within six hours, however frozen stool samples can also be used without loss of efficacy. There is evidence that the relapse rate is 2 fold greater when water is used as opposed to saline as the dilution agent. There is also some evidence that using infusions of greater than 500 ml produces a higher success rate compared to infusions using less than 200 ml of prepared solution. Research is needed to determine whether certain mixing methods such as using an electric blender reduce the efficacy of treatment.
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via oxygenating the solution and killing obligate anaerobes. The fecal transplant material is then prepared and administered in a clinical environment to ensure that precautions are taken.

Administration

Numerous techniques have been published, and choice depends on suitability and ease. The procedure involves single to multiple infusions of bacterial fecal flora originating from a healthy donor by enema, through the colonoscope, or through a nasogastric or nasoduodenal tube. There does not appear to be any significant methodological difference in efficacy between the various routes. Repeat stool testing should be performed on patients to confirm eradication of CDI.

Autologous restoration of gastrointestinal flora

A modified form of fecal bacteriotherapy (Autologous Restoration of Gastrointestinal Flora - ARGF) was being developed as of 2009. An autologous fecal sample, provided by the patient before anticipated medical treatment with antibiotics, is stored in a refrigerator. Should the patient subsequently develop C. difficile infection the sample is extracted with saline and filtered. The filtrate is freeze-dried and the resulting solid enclosed in enteric-coated capsules. Administration of the capsules is hypothesised to restore the patient’s original colonic flora and combat C. difficile. However using one’s own original colonic flora which made them susceptible to the CDI infection in the first place obviously holds a foreseeable disadvantage. As such, it is likely that following treatment the patient will still remain susceptible to C. difficile colonisation. In comparison, the introduction of donor flora facilitates colonisation with a more robust, C. difficile-resistant flora.

Standardised filtrate

Researchers have also produced a standardised filtrate composed of viable fecal bacteria in a colourless, odourless form. The preparation has been shown to be as effective at restoring missing and deficient bacterial constituents as crude homogenised FMT.

Public stool bank in the United States

In 2012, a team of researchers from the Massachusetts Institute of Technology founded OpenBiome, the first public stool bank in the United States. OpenBiome provides clinicians with frozen, ready-to-administer stool samples for use in treating C. difficile, and supports clinical research into the use of faecal transfer for other indications.

Use by indication

In Clostridium difficile infection

Clostridium difficile infection (CDI) produces effects ranging from diarrhea to pseudomembranous colitis. Beginning in 2000, hypervirulent strains of C. difficile have emerged, which seem to be linked to commonly used broad acting antibiotics that are prescribed empirically. As of 2009 an
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estimated 3 million new acute *Clostridium difficile* infections were diagnosed in the US annually. Of these, a subgroup will go on to develop fulminant CDI which results in approximately 300 deaths per day or almost 110,000 deaths per year. This epidemic of CDI in North America and Europe, has made FMT increasingly attractive, with some experts calling for it to become first-line therapy for CDI.

The original cause of CDI is damage of the normal human flora and removal of protective *Bacteroidetes* and *Firmicutes* species. FMT restores the colonic microbiota to its natural state by replacing missing *Bacteroidetes* and *Firmicutes* species, eradicates *C. difficile* including its spores, and resolves clinical symptoms such as diarrhea, cramping, and urgency. Antibiotic resistance in CDI is an uncommon event- rather CDI relapses due to the presence of *C. difficile* spores. Anecdotal reports had shown FMT to be an effective treatment for patients with recurrent CDI. Most patients with CDI recover clinically and their CDI is eradicated after just one treatment.

A 2009 study found that fecal bacterio-therapy was an effective and simple procedure that was more cost-effective than continued antibiotic administration and reduced the incidence of antibiotic resistance.

In 2013, a randomized, controlled trial of FMT published in the New England Medical Journal in January 2013 reported a 94% cure rate of pseudomembranous colitis caused by *Clostridium difficile* in adults, compared to just 31% with Vancomycin alone. The study was stopped prematurely as it was considered unethical not to offer the FMT to all participants of the study due to the outstanding results.

once considered to be "last resort therapy" by some medical professionals due to its unusual nature and 'invasiveness' compared with antibiotics, perceived potential risk of infection transmission, and lack of Medicare coverage for donor stool, position statements by specialists in infectious diseases and other societies have been moving toward acceptance of FMT as standard therapy for relapsing CDI and also Medicare coverage in the United States.

It has now been recommended that endoscopic FMT be elevated to first-line treatment for patients with clinical deterioration and severe relapsing *C. difficile* infection. The earlier the infusion is initiated, the less likely the patient's condition will deteriorate, thereby preventing the higher mortality rate associated with severely affected patients. Fecal Microbiota Transplantation is being increasingly used in clinical practice and, since complications of FMT are rare, its use is likely to increase.
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In ulcerative colitis and other gastrointestinal conditions

While *C. difficile* is easily eradicated with a single FMT infusion, this generally appears to not be the case with ulcerative colitis. Published experience of ulcerative colitis treatment with FMT largely shows that multiple and recurrent infusions are required to achieve prolonged remission or ‘cure’. 

FMT has been used to treat other conditions, including colitis, constipation and irritable bowel syndrome.

In autoimmune and neurologic conditions

The therapeutic potential of FMT in non-gastroenterologic conditions, including autoimmune disorders, neurological conditions, obesity, metabolic syndrome and diabetes, Multiple Sclerosis and Parkinson's disease are now being explored. As of May 2008, studies had shown that FMT can have a positive effect on devastating neurological diseases such as Parkinson's disease. While Dr. Thomas Borody was experimenting with patients who were afflicted by both CDI and Parkinson's disease, he realized that after fecal therapy the symptoms of Parkinson's in his patients began to decrease; some to the point that the Parkinson's could not be detected by other neurologists. The hypothesis for future studies is that the fluctuation in the body's microbiome done by FMT can also be recreated by adding anti-*Clostridium difficile* antibodies to the patient's body a technique intended to be used in Borody's future case studies involving Parkinson's disease.

History

The concept of treating fecal diseases with fecal matter originated in China millennia ago. Fourth century Chinese medical literature mentions it to treat food poisoning and severe diarrhea. 1200 years later Li Shizhen used yellow soup aka golden syrup which contained fresh dry or fermented stool to treat abdominal diseases. 'Yellow soup' was made of fecal matter and water, which was drunk by the patient.

The consumption of "fresh, warm camel feces has been recommended by Bedouins as a remedy for bacterial dysentery; its efficacy probably attributable to the antimicrobial subtilisin produced by *Bacillus subtilis* was anecdotally confirmed by German soldiers of the Afrika Korps during World War II".

The first description of FMT was published in 1958 by Ben Eiseman and colleagues, a team of surgeons from Colorado, who treated four critically ill patients with fulminant pseudomembranous colitis (before *C. difficile* was the known cause) using fecal enemas, which resulted in a rapid return to health. Stool transplants, are about 90% effective in those with severe cases of *Clostridium difficile* colonization, in whom antibiotics have not worked.

Since that time various institutions have offered the treatment as a therapeutic option for a variety of conditions. At the Centre for Digestive Diseases in Sydney Australia, FMT has been offered as a
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treatment options for more than 20 years. In May 1988 the CDD treated the first idiopathic colitis patient with FMT which resulted in a durable clinical and histological cure. Since that time, a number of publications have reported the successful treatment of UC with FMT, with clinical trials now underway in this indication.

In animals

Elephants, hippos, koalas, and pandas are born with sterile intestines, and to digest vegetation need bacteria which they obtain by eating their mothers' feces, a practice termed coprophagia. Many other vegetarian mammals eat dung "because it's so hard to extract nourishment from their nutrient-poor diet".

In veterinary medicine fecal bacteriotherapy has been known as 'transfaunation' and is used to treat ruminating animals, like cows and sheep, by feeding rumen of a healthy animal to another individual of the same species in order to colonize its gastrointestinal tract with normal bacteria.

The Italian Renaissance anatomist Hieronymus Fabricius was familiar of transfaunation.

Theoretical basis

The hypothesis behind fecal bacterio-therapy rests on the concept of bacterial interference, i.e. using harmless bacteria to displace pathogenic organisms. In the case of CDI, the C.difficile pathogen is identifiable. However in the case of other conditions such as ulcerative colitis, no single 'culprit' has yet been identified.

In patients with relapsing CDI, the mechanism of action may be the restoration of missing components of the flora including Bacteroidetes and Firmicutes. The introduction of normal flora results in durable implantation of these components.

Another postulated mechanism entails the production of antimicrobial agents (Bacteriocins) by the introduced colonic flora to eradicate C. difficile. This may be a similar mechanism to that of Vancomycin which originates from soil bacteria, and Bacillus thuringiensis which has been proven to produce bacteriocins specific for C. difficile. The potential combination of replacing missing components and antimicrobial products manufactured by the incoming flora are likely to be the mechanisms curing CDI.

In the case of ulcerative colitis, it is likely that a shared infectious mechanism is at play, where the offending infective agent/s are still unknown. Given the response to FMT, it is scientifically plausible that an infection persists but cannot be identified.
Interest in FMT as measured by the number of clinical trials and scientific publications surged in 2012 and 2013. After the first rigorous, head-to-head study (randomized controlled trial) published January 2013 showed FMT was superior to antibiotics for patients with recurring *C. difficile*, the FDA announced in February 2013 to hold a public meeting entitled "Fecal Microbiota for Transplantation". At the meeting held on 2-3 May 2013 the FDA announced that it had been regulating human faeces as a drug. The American Gastroenterological Association (AGA), the American College of Gastroenterology (ACG), the American Society for Gastrointestinal Endoscopy (ASGE), the Infectious Disease Society of America (IDSA) and the North American Society for Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) sought clarification, and the FDA Center for Biologics Evaluation and Research (CBER) stated that FMT falls within the definition of a biological product as defined in the Public Health Service Act (42 U.S.C. § 262(i)) and the definition of a drug within the meaning of the Federal Food, Drug, and Cosmetic Act (FDCA; 21 U.S.C. § 321(g)). It argued since FMT is used to prevent, treat, or cure a disease or condition, and intended to affect the structure or any function of the body, "a product for such use" would require an Investigational New Drug application (IND; regulations at 21 C.F.R. 312).

In July 2013, the FDA issued an enforcement policy ("guidance") regarding the IND requirement for using FMT to treat *C. difficile* infection unresponsive to standard therapies (78 F.R. 42965, 18 July 2013).

In February 2014, a gastroenterologist, a biological engineering professor from Massachusetts Institute of Technology (MIT) and an MIT microbiology PhD candidate, with the latter 2 being co-founders of the stool bank OpenBiome recommended that "for medical use, human stool should be considered a tissue, not a drug". They the strict requirements to protect patients, limited access to care. If stool was treated as a tissue product or given its own classification like blood, it would "keep patients safe, ensure broad access and facilitate research".

In March 2014, the FDA issued a proposed update (called "draft guidance") that, when finalized, is intended to supersede the July 2013 enforcement policy for FMT to treat *C. difficile* infection unresponsive to standard therapies. It announced an interim discretionary enforcement period, if 1) informed consent is used, mentioning investigational aspect and risks 2) stool donor is known to either patient or physician and 3) if stool donor and stool are screened and tested "under the direction of the physician" (79 F.R. 10814, 26 February 2014).

Some doctors and patients have been worried that the proposal, if finalized, would shutter the handful of stool banks, which have sprung up, using anonymous donors and ship to providers hundreds of miles away.
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As of 2015 FMT for recurrent C. difficile infections can be done without mandatory donor and stool screening, whereas FMT for other indications cannot be performed without an IND.

“Fecal Transplant At Home – DIY Instructions”

DISCLAIMER:
These “Fecal Transplant At Home – DIY Instructions” are based on the experiences of one person, the anecdotal reports of others and questions most frequently asked by e-Patients. They are not medical advice. Please read the disclaimer and discuss your options with your doctor before doing fecal microbiota transplant (FMT). It is critical that your doctor test your donor before FMT. An outwardly healthy person could carry an asymptomatic parasite or blood borne illness that could wreak havoc in your fragile system.

Introduction
These instructions are for fecal transplant at home using an enema bag or bucket hung on a wall, which will maximise flow up the colon from the force of gravity. If you are in a hurry, syringes and enema bottles can also be used but do try to use the enema bag method as often as possible, for maximum effect. These are solo DIY instructions and do not require assistance from another person.

Shopping List
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- Enema bag or bucket. You can buy these products here and here and here and here and here and here.
- **A heavy duty adhesive hook**
- A cheap blender or zip lock bag
- Bristol Stool Chart
- Diagram of colon
- Kitchen strainer
- Kitchen funnel
- Distilled water
- Sea salt (optional)
- Silicon gloves if you are squeamish
- Separate dishwashing utensils or a dishwasher
- Personal lubricant or coconut oil
- A big-brown towel or bath
- Tissues
- Paper towels
- Plastic bag
- A large cushion (from a sofa is ideal)
- A timer
- **Imodium** (optional)

**Before the Big Day**

- Find and test your donor. The minimum tests should be as per the Infectious Diseases Society of America recommendations for Fecal Microbiota Transplant Donor Testing. See the FAQs for more testing options.
- Read the CDD Home Infusion Protocol for Donor & Recipient
- Read every Frequently Asked Question on this site. Don’t be lazy about this. You are putting someone’s poop up you, to make an informed decision you must research the possible risks as well as the possible benefits.
- Familiarise yourself with the Bristol Stool Chart so you know what healthy poop looks like (2, 3 or 4 on this chart).
- Familiarise yourself with the shape and position of your colon so that you understand the direction in which the FMT will flow.
- Decide if you are going to use anti-biotics / anti-microbials to kill off bad bugs before FMT. This is not mandatory, opinions differ.
- If you have IBD take whatever medication you know will control the inflammation.
- Purchase supplies.
- Decide where you will do your FMT – either in a bath or lying on a towel on the bathroom floor. Avoid doing it on a bed or sofa or in a carpeted area in case you have a spill.
- Hang a heavy duty adhesive hook on the wall at a height that will allow for the tube to reach your body without too much slack. Too high and the tube will not reach. Too low and you won’t get enough flow from gravity.
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- Decide if you are going to use distilled water or saline. Opinions differ which is better so you may have to experiment. Some have reported that saline has a laxative effect. Others have reported that saline is easier to hold in.
- Do a practice run with your enema bag using just distilled water.
- Go on a low fibre diet for 2 weeks.
- Stop anti-biotics/anti-microbials 24 hours before FMT
- If this is the first FMT in a series clear out the contents of your bowel 24 hours prior to FMT by fasting and using a laxative or water diet beforehand DO NOT DO THIS EVERY TIME AS IT WILL DISRUPT GROWTH OF THE NEW FLORA
- Do not eat anything for 24 hours before the first FMT other than fluids. A little fibre free fruit juice, honey in water, black coffee or tea is ok but not too much as these sugars can grow bad bacteria. Most clear fluids are okay except alcohol. Take medications as usual.
- Leave plastic food containers or zip lock bag with your donor for collection of sample
- If weather is cold leave a microwavable heat pack with your donor so that it can gently keep the sample warm while waiting to be collected.

On the Big Day

- Prepare your FMT area. Put enema bag, lubricant, tissues, paper towels, plastic bag, diagram of colon & timer within easy reach together with anything you need to be comfortable eg rug and pillow. The cushion should go underneath the towel so that it raises your rear end. This will use gravity to keep the FMT in.
- Assume you will have a spill and make sure paper towels and plastic bag are nearby to dispose of clean-up items. A bath is easier as you can wash the mess away.
- Take Imodium upon waking.
- Collect sample.
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- Do not use sample if it does not look healthy. Sample should look like 2, 3 or 4 on the Bristol Stool Chart.
- Keep sample at room temperature and use within 2 hours unless freezing.
- If you are going to freeze some sample, separate it into portions and put it in the freezer.
- Heat distilled water in microwave so that it is tepid (the temperature of a baby’s bottle). Too hot will kill the FMT and too cold will be uncomfortable for you to hold in.
- To make saline add ¼ tsp. sea salt to 1 cup distilled water. Do not use table salt with additives.
- Put sample in blender or zip lock bag and lightly mush/blend with water. If using a blender don’t overdo it as too much air will reduce the potency of the sample. Zip-lock bags require less clean up than blender-method and expose the microbiota to less turbulence, but the process is somewhat more revolting as you are closer to the poop and have to mush it by hand through the bag. Your choice.
- Add as much water as necessary to make the FMT the consistency of paint. Too thick will block the nozzle and too runny will be harder to hold in and reduce the potency of the FMT.
- Take care not to expose the sample to any more air or water than absolutely necessary as this will reduce its quality.
- Make sure enema nozzle switch is shut. VERY important or it will spurt everywhere!
- Pour FMT slurry into enema bag using kitchen strainer & funnel.
- Hang enema bag on hook.
- Prepare for entry with a little lubricant.
- Lie down on your left side making sure your rear is raised on the cushion.
- Lift up your right leg and slowly, gently insert enema nozzle. A little discomfort is normal but do not continue if it is painful. It can help to dilate the entry with a finger before insertion.
- Open the enema nozzle switch.
- Feel the FMT flowing. If it’s not flowing sit up, carefully holding the nozzle in place and shake the enema bag to get it flowing.
- Lie down and take a deep breath as the FMT flows in. Hold your butt tight. Congratulate yourself for having got this far. Think of all the good bugs that are going to repopulate your gut. Breathe.
- If you feel like you are going to expel the FMT then turn off the enema nozzle. You can put more in later.
- Refresh your memory by looking at the diagram of the colon.
- Lie on your left side for 10 minutes. Massage the FMT gently up your colon.
- Switch off the enema nozzle, then remove the nozzle and put it straight into the plastic bag. Wipe yourself if necessary.
- Lie on your stomach for 10 minutes.
- Lie on your back for 10 minutes. Massage the FMT gently across your colon.
- Lie on your right side for 10 minutes. Massage the FMT gently down your colon.
- If you are having trouble holding it in, don’t panic. It doesn’t matter if you lose a little. That’s what the big brown towel and paper towels are for. Try doing a little at a time, massaging, and then doing some more.
- Try and hold it in for at least 6 hours.
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- If you are using a re-useable enema bag, wash it and store it in a bucket of water with 1 lb / 500g of dissolved sea salt.

After the Big Day
- You will get into a routine with FMT. The first time is the hardest and like everything it gets easier with practice. Hopefully you won’t have to do it for too long.
- Only continue the Imodium if you are having trouble holding in the FMT.
- A high fibre diet will help grow your new microbiota, but don’t overdo it. If you have food intolerances don’t try anything that isn’t a known safe food, for at least 3 months after FMT and then only introduce slowly.
- If you suffer from food intolerances and react to the donor’s food, use less FMT or ask your donor to modify their diet. A little used frequently is better than a lot used occasionally.
- If FMT doesn’t work for you, try a different donor or investigate factors that might be disrupting growth of the new flora.

Frozen FMT Instructions
Frozen FMT allows you the flexibility that a donor doesn’t. But it is reported not to have the same ‘hit’ as fresh as the quality is compromised by freezing in home refrigerators. There are three ways to freeze FMT. When you do a fresh FMT you can pour some of the slurry into ice cubes and keep them to use as needed. Add a few drops of liquid glycerol to preserve it, not too much as it is a laxative.
However to maximize the potency of the FMT it is best to freeze the sample without adding water. The more interference (air and water) the more the potency is compromised. To do this, you distribute the sample into ice cubes or cupcake trays. Alternately freeze it whole and break it up later by putting it into two plastic bags and hitting it with a hammer.
The amount of frozen FMT you use will depend on how much you have and when you will next see your donor. There are no hard and fast rules. Considering that pro-biotics come in tiny capsules you really don’t need much FMT to make a difference, especially if you are doing it regularly.
To defrost FMT put it in a cup of warm distilled water/saline and keep stirring until it’s dissolved. If you find this too revolting then put it in the blender. The water should be warm enough so that the end mix will be tepid, a comfortable temperature to have inside you, but not so hot that the good bacteria are killed. If the mix is too cold once defrosted, simply add a little warm water. Once it’s defrosted strain the mix into an enema bag as per above instructions. Where possible, always do FMT when your bowel has been emptied.
We don’t yet know how long frozen stool can be kept. One person has used it after 10 months without adverse effects. Open Biome states that although further research has yet to be done “microbiological culturing experience suggests that samples may be stored for up to 6 months at -20°C without a significant loss of viability”.
Is it really worth having your gut bacteria tested?

Lauren Davis

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How much can you learn about your health from a dab of poop or a swab from your skin or mouth? With various scientific researchers offering to test your microbiome for a fee, it’s natural to be curious about the trillions of microbes living in your body. But is it worthwhile to get tested yourself, and what can current tests really tell you about your own health?

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The Human Microbiome Project is an incredibly exciting collection of research, one that may someday yield highly personalized medical treatments and teach us about the impact of various microbial ecosystems on specific aspects of human health. Currently, there are research organizations that offer microbial testing kits, such as uBiome and the American Gut Project. You buy a kit, send in your sample (your gut bacteria can be tested, but so can the bacteria from other parts of your body, including your mouth and skin), receive your microbiome data, and then compare yourself to other people who have had their microbiomes tested.

It's a neat idea, and with research exploring the relationship between the microbiome and everything from intestinal disorders to mental health, a very enticing one. What if understanding the makeup of the various microbes in our bodies could help diagnose ailments we didn't even know we had? What if it could predict diseases we're at risk of developing down the line?

In a lot of ways, these tests resemble those home genetic testing kits, where you send in a swab and receive information about your personal genetic makeup. But those tests have not been without controversy. Just this past December, genetic testing company 23andMe agreed to comply with FDA demands that the company stop making health claims related to customer's genetic data. That means that, while customers can still receive their raw genetic data from 23andMe, the company can no longer claim that you may be predisposed to a particular disease or have a specific response to a particular drug. There is still a gap between identifying specific genes and understanding how to apply them to our health.

So what about microbiome testing? What can it tell us about what's going on inside our bodies? And what, if anything, can it tell us about our health now or in the future?

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Why You Can't Take Your Microbiome Test to Your Doctor

While researchers have already made great strides in examining the human microbiome, researchers note that we are still just five or six years into studying the microbiome. "We are gathering incredibly detailed, rich data about the microbiome," says Lita Proctor, Program Director of the National Institute of Health's Human Microbiome Project, "but the reason, I presume, that most people want to have their microbiome tested is that they want to learn whether they're considered healthy, whether they have some impending disease or condition that's on the horizon or if they can do anything to modify their microbiome, increase its robustness and so on. You're motivated to want to improve your health or to cure some condition or disease that you may have. And that's tricky. It's tricky for a lot of reasons."
"We're not sure what 'composition' means in the makeup of the microbiome," she notes. For example, some research groups believe that humans have different microbiome "types," similar to blood types, called enterotypes. However, other groups, including the HMP, have not been able to replicate those enterotypes. "On the other hand," she concedes, "I think the HMP acknowledges that this is still very early days. As we gather more data, we might start to see people fall out into different groups tied to their environment, to their diet, and genetics, and so on."

Joseph Petrosino, Director of the Alkek Center for Metagenomics and Microbiome Research at the Baylor College of Medicine, adds that while some studies have found correlations between certain microbial signatures and conditions like obesity, type 2 diabetes, and irritable bowel disease, it is too early to know whether those microbial signatures are part of the cause or part of the effect of those conditions. He does note that, when looking at the data from their own microbiome tests, individuals might look for a diverse microbiome or high levels of microbial generalities associated with health. But even then, he cautions, it's difficult to say that a certain microbiome makeup identifies a person as healthy. He explains, "In the Human Microbiome Project, they found in a very small cohort of individuals that even the taxa that people thought to be associated with health, the Bacteroides genus, you could be at a status of health that we call 'no overt signs of disease,' you could have five percent of your microbiome comprised of this taxa or you could have 95 percent, or anywhere in between. So it was very hard to associate a taxa with being particularly healthy."

There is also the problem of the breadth of the human microbiome studies so far. Proctor points out that, while some countries are working on national-scale human microbe studies, most microbe studies thus far have been performed primarily on white Westerners, which limits our understanding of how environment and genetics interact with the microbiome. Also, your microbiome isn't a static ecosystem; it changes throughout your life in ways we are still investigating.

It's natural for people to want to see what's going with their microbes and to want to find ways to control their own health. "I've had my microbiome sequenced," says Petrosino. "It's interesting to know what's inside of you. And you wonder, 'Hey, is that probiotic I'm taking showing up anywhere?' But if you're interested in the test for the sole purpose of manipulating your microbiome or predicting your future, you may want to wait. "For the 'worried well' looking at their microbiome data and thinking, 'I'm hosed,' or 'I'm looking pretty good,' it's a little bit premature for that," Petrosino says.
Researchers studying the human microbiome are excited by the public interest in the microbiome, but in some cases a little bit of knowledge misapplied can be a dangerous thing. Proctor points to a curious case regarding fecal transplants. In some instances, people with debilitating gut diseases, such as ulcerative colitis, have received enema infusions of stool from healthy donors and apparently recovered from their illness. However, Proctor adds, "We have no idea what the microbiological or biochemical properties that are contributing to that recovery from ulcerative colitis."

Some lay people have taken this idea of fecal transplants and run with it, performing their own fecal transplants at home. That's right, folks are finding donors to provide them with stool, making stool smoothies, and then giving themselves stool enemas without medical supervision. (Proctor notes that this is a bit bizarre for a culture where people smear hand sanitizer over the handles of their shopping carts.) And they are doing this in attempt to "treat" conditions that there is no scientific evidence can be treated with fecal transplants, such as obesity. Plus, they may be unknowingly exposing themselves to harmful pathogens. Proctor says, "We're seeing the application of knowledge about the microbiome being applied so rapidly and without careful study that I, as a scientist, have a fear that some people may go, 'Oh yeah, we know enough about the microbiome to be able to conduct these kinds of activities.' I'm fearful that there could be some unintended consequences."

She also cautions that people should not be looking to the human microbiome as the be-all end-all of human health. We should be thinking of the microbiome as another organ, she says, another thing to look for in human health. She also notes that it's not a good idea to think of the microbiome as somehow separate from the rest of the human body. When you treat the microbiome, you're treating the rest of the body as well.

_A recent Henry Ford Hospital study has shown the effectiveness of an unconventional therapy in..._ [Read more](#)

**Why You Should Consider Getting Tested Anyway**

So you can't use your microbiome to predict health or recommend medical treatments at this point. Does that mean you shouldn't get yours tested? Assuming you're not going to run off and give yourself a stool enema, there are actually some very good reasons to have your microbiome tested if you have the money to spend on it.
For one thing, these tests can really tell you what microbes are inside of you, even if they can't tell you exactly what that means. "That's just human curiosity," notes Proctor. "That's worth doing."

More significantly, though, having your microbiome tested by one of these companies is a way to participate in and fund research into the microbiome. Proctor points out that these testing companies are operated by trained scientists who are analyzing the data and publishing peer-reviewed papers based on their findings. These papers, she notes, have the same currency as research funded in any other way, and the true test of the research is in the peer-review process.

Petrosino agrees, adding that there is value in an individual contributing their data to a much larger study, "What is going on is that you're contributing your sample to a much larger cohort of individuals who then can be studied as a whole. And perhaps your sample, if you happen to have a condition, be it celiac disease or whatnot, will lead to a better understanding of the full breadth of the impact of that condition on the microbiome."

Even if you can't derive any clinical meaning from your individual test in the short term, sending your sample to one of these companies is a way to participate in a larger scientific research project, one that could have an enormous impact on our understanding of the human body. "There's probably limited information you can get by yourself for a study like this," says Petrosino, "but in the end, you're contributing to science—and perhaps to [the understanding of] a condition that you may or may not have."

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Microbiologists have a new way to tell whose sh-t is dirtying the waters. A survey of sewage across the United States shows that every city has a distinct microbial character that can reveal signs of health, such as how obese its residents tend to be. Dozens of the microbes identified in the survey are common throughout the United States, and could provide better ways to tell whether bacterial pollution comes from humans.

The human gut is filled with microbes that are proving ever more important to health and disease. To understand the diversity of these bacteria—collectively called the gut microbiome—and how their numbers and types vary through time, microbiologists have isolated and sequenced DNA from stool samples of hundreds of individuals. But Mitchell Sogin, a molecular evolutionist at the Marine Biological Laboratory in Woods Hole, Massachusetts, and Sandra McLellan, a microbiologist at the University of Wisconsin, Milwaukee, wanted to take a much broader view and study the microbiomes of entire human communities. In addition, they were looking for a better indicator of human fecal pollution.
Fecal Transplants

To do that, they needed to figure out how to assess the microbiomes of large numbers of people at once. They recruited wastewater treatment plant operators from 71 U.S. cites to collect more than 200 samples of incoming sewage. They then sequenced DNA in the samples and determined its origin. About 15% of the isolated sewage DNA belonged to microbes found in humans, Sogin and McLellan’s team reported online last week in *mBio*. Many of the rest are microbes that live in sewer pipes. Using a technique developed by Sogin and his colleagues, which can more precisely determine which bacteria are present in a large sample of feces, the researchers identified about 60 types of bacteria that were common to people in all of the cities. Because they seem to be found wherever humans are, these 60 may be a more reliable way to determine if human feces are contaminating a waterway, McLellan says.

But the abundance of these and less common bacteria varied from place to place. This variation in the “sewer-wide” microbiomes reflected the variation seen among surveys of microbiomes of individual people. Each city had “a unique signature,” McLelland explains.

Those differences offer hints about the health of cities’ residents. Fat people tend to have a different microbiome from that of lean people, for example. By analyzing the microbes in each city’s sewage, the researchers could tell which had an obesity problem, Sogin says. Denver and Key West, Florida, microbes reflected a leaner population than those from Salina, Kansas, and Memphis, Tennessee, for example. The researchers have not tested whether sewage microbiomes can indicate other health conditions.

“What appeals to me [about this work] is the scale and the novelty,” says Gary Huffnagle, a microbiologist at the University of Michigan Medical Center in Ann Arbor who was not involved with the work. “It’s got the potential to open up a new way to look at large-scale populations for epidemiological analyses.”

Although analyzing the microbiomes of a city’s population as a whole can obscure important individual differences, it also reveals patterns evident only on a broad scale, Huffnagle notes. Besides, it’s much easier to collect poop from sewers than by collecting stool samples from individuals. “We can actually study human beings without all the paperwork.”
Fecal Transplants

SUGAR FED BAD BACTERIA IN THE GUT CAN TAKE OVER YOUR BRAIN LIKE AN ALIEN PRESENCE

http://www.downloads.imune.net/medicalbooks/Bad%20Bowel%20Bacteria%20can%20take%20control%20of%20your%20Brain.pdf
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Bad Bacteria Develops from Anti-Biotics, SINthetic Chemicals, Processed Carbohydrates, Sugar
Fecal Transplants

THE BAD BACTERIA IN YOUR GUT IS USING YOUR BODY AS A RESTAURANT

Artificial Sweeteners Feed the Bad Bacteria
Fecal Transplants

Bad Bacteria
Take over the Brain and
Makes you Crave Foods that Feed The Bad Bacteria

AN INNER BATTLE BETWEEN YOUR GOOD BACTERIA AND YOUR BAD BACTERIA
Fecal Transplants
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Destroys Good Bacteria

1. Antibiotics
2. Chlorinated water
3. Coffee, tea (black pekoe), and soda
4. Sugar
5. Stress
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