

## Brains On (APM) | Brains On! Flush! Where does our poo and pee go? 01GHAFJ3WQ3950CDTYG70VSXFW

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**RAYHAN:** You're listening to *Brains On*.

**ALIA:** Where we're serious about being curious.

**KID:** *Brains On* is supported in part by a grant from the National Science Foundation.

[TOILET FLUSH]

**RAYHAN:** Hey, Alia. Is the girls' bathroom like super normal one too?

**ALIA:** Yeah, it was totally simple just like a regular public bathroom. Oh, there's Molly.

**MOLLY BLOOM:** Hey, are you guys ready? Do you need anything else before we head to the studio?

**RAYHAN:** We're all set. Molly, I'm kind of surprised that the bathrooms here are so normal.

**MOLLY BLOOM:** Yeah, it's just a bathroom.

**ALIA:** Yeah. But I mean, you have a hidden taco farm, a talking elevator, at least two labs dedicated to slinkys.

**MOLLY BLOOM:** It's important research.

**ALIA:** What if the tile could change colors? Ooh, ooh, or the toilet spread a puff of lavender oil with every flush?

**RAYHAN:** You got a sparkly soap [GASP] or a talking toilet or both! Ooh, and the mirrors can add filters to your face. The cat is [MEOW].

**ALIA:** And the hand dryers sing opera while they blow. (SINGING) La la.

**MOLLY BLOOM:** [LAUGH] Those are interesting ideas. We have been thinking about some renovations around here. But right now, we need to get this taping started.

**ALIA:** To the studio!

[MUSIC PLAYING]

**MOLLY BLOOM:** You are listening to *Brains On* from American Public Media. I'm Molly Bloom. And today, my co-hosts are brother and sister, Rayhan and Alia from Baton Rouge, Louisiana. Welcome.

**RAYHAN:** Hi.

**ALIA:** Hi.

**MOLLY BLOOM:** This episode was inspired by a common question we've heard from a lot of *Brains On* listeners.

[MUSIC PLAYING]

**MAE SIMMONS:** My name is Mae Simmons. I'm from Stamford, Connecticut. And I want to know where my waste goes after I flush it down the toilet.

**TUCKER:** Hi, my name is Tucker.

**SAM:** And my name is Sam.

**TUCKER:** We're from Saint Louis, Missouri.

**SAM:** Our question is, what happens to poop once it goes down the toilet?

**JACK:** I'm Jack from Warrenton, Virginia. I would like to know where the water goes when you flush the toilet.

**KHADAR:** My name is Khadar from Fremont, California. And what happens after I flush the toilet?

[MUSIC PLAYING]

**MOLLY BLOOM:** So a little heads up right now. This episode is about toilets, sewers, and everything that goes on in them.

**ALIA:** So keep that in mind if you're a bit squeamish.

**RAYHAN:** Or about to eat lunch.

**MOLLY BLOOM:** Right. Toilet talk isn't for everyone, but it is for us. In fact, Alia, you asked us about this. What made you curious about toilets?

**ALIA:** I was curious about toilets whenever I flush them.

**MOLLY BLOOM:** If you could design your dream toilet, what would it be like?

**ALIA:** Mine would be more entertaining. And it could be like scented whenever you flush it so that you have a nice bathroom that smells.

**MOLLY BLOOM:** That sounds very lovely. Rayhan, what would yours be like?

**RAYHAN:** Mine would actually, it'd be like the same toilet except afterwards, you got-- afterwards, there's going to be a miniature clock. And the bird pops out. And then you're done.

**MOLLY BLOOM:** Wait. So did you say a clock, like a bird, like a cuckoo clock?

**RAYHAN:** Ah-huh.

**MOLLY BLOOM:** A cuckoo clock on the toilet, why not? So we're going to help you answer those questions today. But I know you guys did some of your own research, right? You got really into some YouTube channel. What is it called?

**RAYHAN:** Take it from a Turd.

**ALIA:** She's-- well, she's a "PooTuber."

**MOLLY BLOOM:** A YouTuber that's a poo? Is that possible?

**RAYHAN:** It's hard to explain. Here, we'll show you.

[MUSIC PLAYING]

**TAYLOR:** Hey, everyone. Taylor the turd here. [CHUCKLE] I know, I know. It's taken me a long time to get this video out. And it's not because poops can't talk. Obvs, we can because I'm talking right now. It's also not because of constipation. It's-- well, it's because it's a subject that's hard to talk about. You guys know.

[TOILET FLUSH]

The flush.

[SUSPENSE MUSIC]

What actually happens when you get flushed? In this video, I'm showing you my flush. I got a friend to help me explain what I and you can expect.

**ELLEN  
EVERAGE:** Hi, I'm Ellen Everage. And I'm a wastewater and environmental engineer. So that means that I make sure your wastewater gets cleaned before it goes into the environment. Sometimes, I consider myself a turd herder.

[WHIP]

[COW MOO]

**TAYLOR:** I know. Is a turd herder really a friend of the turds? Turd nation, Ellen is on our side. And she knows all about the flush.

[SCREAM]

And water systems, the whole shebang. So while I sit up my you got to GoPro, Ellen, what should I expect once I hit the toilet bowl?

**ELLEN  
EVERAGE:** All right. So you're in the toilet. You're going in the whirlwind down the bull. That water dropping by gravity swirls you out of that toilet bowl and down the pipe.

**TAYLOR:** OK, not going to lie. I'm nervous. But I think I'm all set. Here I-- [FLUSH] go!

[MUSIC PLAYING]

So it's kind of like a water slide. You're going down the pipe. And you take some turns, and you meet up with the water that's coming from the shower. And you meet up with the water from the laundry and the sink and all other water in that house. So you're all floating together.

So many new friends! Little food particles, some pee pals, and poo pals.

**FRIEND 1:** Hi.

**FRIEND 2:** Hello.

**FRIEND 3:** Hey.

**TAYLOR:** And lots and lots of water.

[WATER BURBLING]

And now, I'm in a bigger pipe outside the house. I can really wiggle around in here. I thought I'd be in a small pipe like forever. What's the speed limit on this thing, Ellen?

**ELLEN  
EVERAGE:** Well, you're moving a little bit faster than like the lazy river at a water park. But you're not moving too much faster than that. You don't want to drop to the bottom of the pipe and get stuck there. So the flow moves a little bit faster to keep you in the water and moving along.

**TAYLOR:** Nope, definitely do not want to get stuck. But this is a nice ride, a poo cruise. So while I float along, what's at the end of the sewer line?

**ELLEN  
EVERAGE:** There's quite a lot that awaits you at a treatment plant.

**TAYLOR:** I think I learned about the water treatment plant at poo school, where wastewater goes through a bunch of filters and tanks and machines to get clean. Are we going to get separated by like ones and twos?

**ELLEN  
EVERAGE:** You're not necessarily a number two completely anymore. You've broken up a bit as you went through that pipeline.

**TAYLOR:** Oh, I see. So the wastewater treatment plant will filter and clean all my little bits out of the water. After that, what's going to happen to me?

**ELLEN  
EVERAGE:** It's kind of like you're going through a transformation. You're going to get a second, like an afterlife almost. Because once you're broken down and you become what's called a bio solid, you can then be used for another purpose.

So for instance, you can be used as fertilizer or compost. So sometimes, they'll take this bio solid and put it on farming land. Or you might be used to cover up landfills to minimize odor. You might be burned and made into energy.

**TAYLOR:** Hmm. I kind of get it.

**ELLEN  
EVERAGE:** For the treatment plant, one of the surprises that might come up is that there's going to be little microorganisms eating you. But it's not necessarily something to fear.

**TAYLOR:** OK. I might need some time to process that. But it sounds like I'll be in the sewer for a few miles first, breaking into smaller and smaller bits. Are there any other places that little tiny turdlets could ever end up besides the treatment plant?

**ELLEN  
EVERAGE:** Sometimes, they're combined sewer systems. You meet up not just with the water that's coming out of households and buildings, but you also get put in with rainwater that gets collected. And that can make it a bit crowded in the pipeline. And so one thing that could happen there is you have an overflow.

So you might actually wash out of the sewer and into a river or the ocean or somewhere else. And that can be a problem because then you'll never make it to the treatment plant.

**TAYLOR:** Oh. I'm glad I'm going the most common route, to the treatment plant, not to the ocean or a stream. What about tips for your friends at home who might be preparing for the flush?

**ELLEN  
EVERAGE:** When you're getting flushed, make sure there's no other like wet wipes or garbage or other dangerous things in the toilet that don't decompose because that could cause problems for you and for the whole treatment system.

**TAYLOR:** I've seen how small some of those pipes are. We don't want to clog them up. Any other words of advice?

**ELLEN  
EVERAGE:** Honestly, I think each turd can do it. You don't need a lot of preparation. You kind of get floated along and taken through the process.

**TAYLOR:** OK. Thanks so much, Ellen. Turds, that's it for my flush. See you guys in the comments. Remember to like and subscribe. And if you want to donate, visit my "Pootreon" page. Supporters get an extra video each month. Catch you next Tuesday for a new Take it from a Turd Pootube. Next time, I'll take you inside the wastewater treatment plant.

[MUSIC PLAYING]

**RAYHAN:** Taylor is the best PooTuber out there.

**ALIA:** Definitely. Should we watch another video, maybe the one from that series called Colons, where she shows like where the magic happens?

**MOLLY BLOOM:** Um, one PooTube video is probably good for today. But before the rest of this episode gets flushed away, let's pause and take a moment for something very important. It's time for the mystery sound. Here it is.

[MUSIC PLAYING]

**KID:** (QUIETLY) Mystery Sound.

[GRINDING]

**MOLLY BLOOM:** What are your guesses? Let's start with you, Rayhan.

**RAYHAN:** Well, I'm guessing it's from the water treatment plant.

**MOLLY BLOOM:** Mm.

**RAYHAN:** It's in the water treatment plant because you hear all that noise, right? And there's water, right?

**MOLLY BLOOM:** Yes. So you thought it was from the water treatment plant. Very good guess. And Alia, what do you think?

**ALIA:** I think it could be from one of those travel cards where it has a toilet, a TV, a bed, and all that stuff. And I think that it was driving. Well, you heard someone flush.

**MOLLY BLOOM:** Whoa. That is a very complex guess. I like it. Well, we are going to be back with the answer a little later in the show.

[MUSIC PLAYING]

We love reading all the amazing ideas and questions you send our way at [brainson.org/contact](http://brainson.org/contact).

**RAYHAN:** Like this one.

**CARTER:** Hello. My name is Carter from Toronto, Canada. Can we control our dreams?

**MOLLY BLOOM:** You can find an answer to that on the *Moment of Um* podcast. It's a daily dose of facts every weekday. And you can get it wherever you listen to *Brains On*. And while you're at [brainson.org/contact](http://brainson.org/contact), you can also send us your questions, drawings, mystery sounds, and high fives. We love to hear from you.

And everyone who contacts us gets added to the Brain's Honor Roll, which you can hear at the end of the show.

**ALIA:** So keep listening.

You're listening to *Brains On*. I'm Alia.

**RAYHAN:** I'm Rayhan.

**MOLLY BLOOM:** And I'm Molly. Now, before we continue our sewer exploration, let's go back to that mystery sound again. Here it is one more time.

[GRINDING]

[WATER DRIPPING]

So any new guesses after hearing it again? Alia, let's start with you.

**ALIA:** I think that it could be a wave or a tsunami.

**MOLLY BLOOM:** Oh, very good. And Rayhan, what do you think?

**ALIA:** I think-- no. I have no other guesses.

**MOLLY BLOOM:** That is totally OK. Here is the answer.

**ANDREW:** Hi, my name is Andrew. That was the sound of a washing machine. If I close my eyes and think about it, this sound reminds me of an airplane engine.

**ALIA:** Oh.

**RAYHAN:** Oh, yeah. I should have known.

**ALIA:** It is an everyday device.

**MOLLY BLOOM:** Yeah. I mean, it's something we've all heard. But you guys were close. You heard some water, some flushing, some water treatments. So you were on the right track. Just like when we flush the toilet, the water from our dishwashers, washing machines, sinks, and bathtubs goes into the sewer too.

And to tell us more about the stuff people are flushing and sending down the drain is *Brains On* producer Marc Sanchez.

**MARC**  
**SANCHEZ:** Hi, Alia. Hi, Rayhan.

**ALIA:** Hi, Marc.

**RAYHAN:** Hi.

**MARC SANCHEZ:** So far, we've been following what happens to waste after it's been flushed. It's a whole process, right? But can you think of things that people might flush that maybe they aren't supposed to?

**ALIA:** Wipes?

**RAYHAN:** I know one.

**MARC SANCHEZ:** What's that?

**RAYHAN:** Oil.

**MARC SANCHEZ:** Oil. Indeed. Wipes and oil are a big part of the problem I'm about to tell you about. What comes to mind when I say the word "fatberg?" Have you guys ever heard of that word?

**RAYHAN:** No.

**ALIA:** No.

**MARC SANCHEZ:** Well, it actually has a lot to do with those oils and wipes that you were talking about. The word "fatberg" is a combination of the words fat and iceberg. And that's pretty much what it is, a big hard chunk of fats, oils, and grease clogging up sewer pipes.

**NARRATOR:** The Whitechapel fatberg in East London, 130-ton monster.

**SUBJECT 1:** It's about 64 meters long, we think, which is the equivalent of about six double-decker buses.

**SUBJECT 2:** Now, a giant fatberg as big as a Boeing 747 has been discovered, blocking a sewer in a seaside town.

**SUBJECT 3:** Well, other monstrous blockages have turned up in Leicester Square and Shepherd's Bush.

**SUBJECT 4:** I've smelt it first hand. It's one of the biggest ones we found, a congealed concrete-like mass of all the stuff that people flushed down their toilet and flushed down their sinks.

**MARC SANCHEZ:** So how do you two think that something can get the size of two football fields? How do you think that grows in the sewers of the world?

**ALIA:** It gets clogged up from fat.

**MARC SANCHEZ:** Yeah?

**RAYHAN:** Yeah. But then, some of the poo and pee can just push it out, right?

**MARC SANCHEZ:** Well, that would be nice. But unfortunately, poo and pee are not powerful enough to push a fatberg out of the sewer. According to Joel Ducoste, who researches fatbergs at North Carolina State University, these giant chunks of fat have the same consistency as something that we use everyday.

**JOEL DUCOSTE:** What we've learned over the years is that it is formed from a chemical reaction, very similar to what people have used to wash their bodies to making soaps.

**MARC SANCHEZ:** So a fatberg is essentially like a giant bar of soap, except it smells much, much worse. The chemical reaction Joel talked about is called saponification. And that happens when broken-down fats, oils, and grease mix with calcium.

This calcium leaks into the sewer from cracks in the pipes and from us. Part of what comes out of us and goes down the toilet is calcium. Do you guys know how oils and grease get into the sewers?

**RAYHAN:** By humans.

**MARC SANCHEZ:** Yeah. The majority of fats, oils, and grease comes from restaurants. Have you guys ever seen French fries being cooked in those baskets?

**ALIA:** Yeah.

**RAYHAN:** Yes.

**MARC SANCHEZ:** All those baskets and the other plates and pots and pans in a restaurant, those all need to be cleaned of their grease. Restaurants are supposed to use these things called interceptors that trap the grease from going down their drains. But sometimes, for one reason or another, that just doesn't happen.

So fats, oils, and grease get into the sewer and combine with the calcium that's there. And saponification begins. Think about all the stuff that might be down there. Ooh, but don't think too hard. The fatberg essentially gobbles it all up and grows and grows until it fills the pipes.

So all those flushable wipes, all the stuff that people drop down the drain gathers in that fat, oil, and grease, and starts to harden. And what do you think happens when the pipes get clogged?

**ALIA:** Then the other stuff cannot get in.

**MARC SANCHEZ:** Mm-hmm.

**RAYHAN:** They expand and expand and expand.

**MARC SANCHEZ:** And when other stuff can't go in those pipes, where do you think it goes?

**RAYHAN:** It goes nowhere.

**MARC SANCHEZ:** Well, it has to go somewhere. And that means it comes shooting backwards through the pipes, which means it goes into houses, and it goes into the streets, and it goes into all the places that we never wanted to go to.

And in the US, our average sewer pipes are around 2-feet wide, so maybe you could stuff like a backpack in there. And if we start to get a blockage in one of our pipes, workers go down and spray one end of the fatberg with a big high-powered stream of water. And on the other end of the fatberg, they suck it up with a big vacuum.

England is a different story. Some of the sewers in England are big enough for a grown up to stand up in. So think about the sheer size of a fatberg that can grow in that kind of space. That's where we start getting these big, massive, blue whale-sized fatbergs. And in that case, high-powered water jets and vacuums are not going to be enough.

Sewer workers, called flushers, go down into these drains and hack away at the fatberg with pickaxes and shovels, chipping away at the fatberg one disgusting chunk at a time.

There is one silver lining to this fatberg story. Scientists have figured out a way to convert this saponifide fat into biodiesel fuel. One of the biggest fatbergs in history, it was called the Whitechapel fatberg, that one got broken down into enough fuel for 350 London buses. So there is a bit of a big fat happy ending.

**ALIA:** Thanks, Marc.

**MARC** You bet.

**SANCHEZ:**

**RAYHAN:** Bye.

**MARC** Bye.

**SANCHEZ:**

[MUSIC PLAYING]

**MOLLY BLOOM:** Marc talked about those sewer systems in England that are big enough to stand up in. There are some sewers in London that have been around since the 1800s. They are about 150 years old.

**ALIA:** The first sewer systems in the US--

**RAYHAN:** Which were in Chicago and Brooklyn.

**ALIA:** --those were built around the same time.

**MOLLY BLOOM:** But these were not the first sewer systems.

**RAYHAN:** The sanitation systems can be found throughout the ancient world.

**ALIA:** The Mayans had pressurized water and indoor plumbing.

**RAYHAN:** Ancient Greeks and Romans also had the sewer system and plumbing.

**ALIA:** As did ancient China, Mesopotamia, and Persia.

**MOLLY BLOOM:** But one of the earliest examples of a citywide urban sanitation system can be found in the Indus Valley civilization.

**JENNIFER** Hello, my name is Jennifer Bates. And I'm an archeologist.

**BATES:**

**MOLLY BLOOM:** Jennifer studies the Indus Valley civilization which dates back 5,000 years.

**JENNIFER BATES:** It covered what today is now modern Pakistan and Northern India. So it's a huge civilization. So the Indus is really exciting in terms of its sanitation. It was a society that was very, very interested in keeping everything really clean.

**MOLLY BLOOM:** They were around during the same period as ancient Egyptians and Mesopotamians.

**ALIA:** This era is called the Bronze Age.

**MOLLY BLOOM:** It's called that because it's when people first started using tools made out of bronze, which is a mixture of two kinds of metals, copper and tin.

**ALIA:** But what sets the Indus Valley civilization apart was how big it was.

**RAYHAN:** It stretches over a large geographic area. And there is some pretty big cities that have been excavated by archeologists.

**MOLLY BLOOM:** The two biggest, being Harappa and Mohenjo-daro. And these places had amazing city designs, what we call urban planning. And a lot of it had to do with their water system and how they cleaned that water or sanitized it. Here's Jennifer again.

**JENNIFER BATES:** We've got a big bath, so their public baths. And there's also private baths. Almost all the houses seem to have some kind of water control. And they're all linked up by drainage systems made of precisely laid bricks. They're all lined up, so there's no gap between them.

And that all links together to create a system of public water movement and also to remove public waste. So there are houses have their own toilets. And these link into the drains that move waste out of the cities and into other areas. So it's a really clever system.

**MOLLY BLOOM:** These sewer systems can be found at the big research sites in the Indus Valley. And a really cool example can be found in Lothal, which is one of the Indus Valley sites found in India.

**JENNIFER BATES:** And it's got this series of drop steps so that it controls how the sewage moves through the city and make sure it automatically cleans itself. It's a really clever system. It's a huge engineering feat. And it basically ensures that all the waste moves through the city in a controlled manner.

It also was designed to separate out solids and liquids so that they could move the liquids out into the estuary and collect the solids and remove those safely.

**ALIA:** Many ancient civilizations had sanitation systems.

**MOLLY BLOOM:** But what makes the Indus Valley system unique is that it reached everyone in these cities.

**JENNIFER BATES:** Every house seems to have some kind of water control, sewage system. Every single house seems to be-- in the cities-- at least seems to be involved in some kind of sewage system for making sure everything is kept clean. And that's amazing.

**MOLLY BLOOM:** So even though we understand a good deal about how this sewer system worked, a lot about the Indus Valley civilization remain a mystery. We're not sure if all of these cities and towns are part of one big community or if they were separate but similar.

Right now, Jennifer is studying fossilized plants to better understand what they ate and how they farmed. But it is clear that this civilization farmed, engaged in trade, and made beautiful art and jewelry, games, and toys, and a really cool sewer system.

[MUSIC PLAYING]

We've talked a lot about sewers. But you know what we haven't talked a lot about?

**RAYHAN:** Hot air balloons?

**ALIA:** Argyle socks?

**RAYHAN:** *Lion King*?

**ALIA:** Winter Olympic sports.

**MOLLY BLOOM:** OK, yes, those. But more on point, we haven't talked much about toilets.

**RAYHAN:** Oh, yeah. The important part of all this.

**ALIA:** It all starts with a toilet, a toilet and a dream.

**MOLLY BLOOM:** Indeed. You may think toilets are all pretty much the same. There's a seat, a lid, something to flush with, but you'd be wrong.

**RAYHAN:** There are lots of different types of toilets all over the world.

**ALIA:** In fact, there's a hot new tech startup to help you find the potty of your dreams.

[MUSIC PLAYING]

**SAGE:** Hi, I'm Sage, the founder of New Loo and You, the dating site for your derriere. Our patented secret algorithm uses AI, machine learning, quantum computing, superfoods, the gig economy, and CrossFit training to find you the perfect toilet.

[FLUSH]

Let's meet some happy users, like Mika.

**MIKA:** Thanks to New Loo and You, I met the bidet. And my life is at least 76% better. The bidet is a French invention, and it looks like a low sink. You use it to wash your business after you make potty. Have you ever seen one?

The bidet is commonly found in Europe, the Middle East, and parts of Asia. Now, it's commonly found in my heart too. Joining New Loo and You is easy. You just fill out a 2,000-question survey, send us a hair sample, tell us the names of all your past pets, take the SAT twice, and create an interpretive dance based on the last thing you ate. Our technology will do the rest.

[FLUSH]

**DEVAN:** New Loo and You paired me with a squat toilet and boy, am I into it.

**SAGE:** Devan's squat toilet is essentially a porcelain bowl or pan on the floor that has a hole in it. As the name implies, you just squat over it and do your thing. They're common all over Asia, Africa, and the Middle East.

**DEVAN:** I love it. It's easy to use, simple design, and great for my quads. It's like leg day every time I go.

**SAGE:** Many scientists think squatting might make it easier for a person to go number two. We also pair people with fancy Japanese toilets that play music, have heated seats, and can spray your nethers with water for a fresh feeling after a pit stop.

If you're more of the rugged type, we might set you up with a kind of toilet they use in Antarctica.

**LANE:** It's called the poop bucket, and we're happy together.

**SAGE:** Lane is a researcher exploring Antarctica. It's cold, snowy, and pristine there. And Lane and the other scientists want to keep it that way. So instead of going to the bathroom willy nilly, they pee in bottles and poop in buckets.

**LANE:** That's right. Then we bring the buckets of poo back with us, and they're eventually sent to the mainland for disposal.

**SAGE:** What a green way to go.

**LANE:** My poop bucket completes me.

[WHOOSHING]

[FLUSH]

**SAGE:** Find your bum's better half by joining New Loo and You today. And use the promo code *Brains On* for a 3% discount. Happy bathrooming.

[MUSIC PLAYING]

**RAYHAN:** Well, there's so many types of toilets.

**ALIA:** And some of them, like the poo bucket in Antarctica, aren't even connected to sewers.

**MOLLY BLOOM:** Yep. The Antarctica poo bucket is sewer free. That's very handy for places like Antarctica where it would be hard to build a sewer. But you still have to carry the buckets back to the mainland to treat the waste inside. There are other off-grid toilets that process their poo on site.

**ALIA:** Like a toilet and a mini-wastewater treatment plant in one.

**MOLLY BLOOM:** Exactly. Places like national parks and forests often have composting toilets. Those are potties with their own supply of microbes, which are bacteria and fungi that help break down waste. And our producer Menaka Wilhelm looked into another kind of off-grid toilet. It uses power from the sun to recycle its water.

**MENAKA WILHELM:** We're talking next level dookie disposal. I took a toilet field trip to Caltech, a University in Pasadena, and met someone who's helping build this all-in-one toilet. His name is Hugo Leandri.

**HUGO LEANDRI:** Hello, my name is Hugo. I'm a French engineer at Caltech.

**MENAKA** Hugo is working on a toilet to keep drinking water healthy in places that don't have water treatment plants. So  
**WILHELM:** the toilet has its own equipment to treat poop and pee. You know the rectangular boxes that you see on the backs of big trucks?

The toilet and the treatment equipment fit in a smaller version of one of those. And there's one of these boxes with the toilet and the treatment equipment in a parking lot in the middle of campus at Caltech.

**HUGO LEANDRI:** Restroom open so you can get in there and then contribute to the project.

**MENAKA** And do people use it?

**WILHELM:**

**HUGO LEANDRI:** Yes, they do.

**MENAKA** The toilet part is a pretty normal potty situation, a white porcelain toilet and a urinal on the wall. But whenever  
**WILHELM:** anyone flushes, they're number ones and number twos flow into a pipe that leads to a mini-wastewater treatment plant behind the bathroom wall.

It gets its power from a solar panel on the bathroom roof. And on the wastewater treatment side of things, it's a little smelly.

**HUGO LEANDRI:** So the smell that you smell here, this is ammonia. It's in the urine. There is a lot of ammonia in urine. Yeah, it's a strong smell that you can find in a fertilizer.

**MENAKA** The smell is from the waste tank. The toilet's flushes go there until the water is treated. But all that water  
**WILHELM:** eventually gets clean.

**HUGO LEANDRI:** So the water will bring it first. And then we put that in the tank. That is the clean tank. And when people come and use the toilet, we use this water to flush the toilet. And the mix of the clean and the dirty water goes to our reactor, which is basically this big box.

**MENAKA** This big box is clear. It looks a little like a fish tank. It uses electricity to clean the dirty water. And there are  
**WILHELM:** sensors in the computer that watch how it's doing. As the electricity cleans the water, the sensors tell the computer things like--

**HUGO LEANDRI:** Hey, water is still yellow, when water is brownish.

**MENAKA** The water gets clearer and clearer as the electricity kills the germs in the water.

**WILHELM:**

**HUGO LEANDRI:** And once the water gets treated in the reactor with electricity for about 24 hours, the water is safe and clean. So we put them back into the clean tank. And then you can start over again.

**MENAKA** Pretty cool, huh?

**WILHELM:**

**ALIA:** Super cool.

[MUSIC PLAYING]

**MOLLY BLOOM:** In lots of places when you flush the toilet, it heads into a sewer with a bunch of other water, from laundry and restaurants.

**RAYHAN:** Flushing only pee, poo, and toilet paper helps to keep that sewer flowing.

**MOLLY BLOOM:** Fats, oils, and grease should never go down the drain.

**ALIA:** There are lots of different ways to clean the water from toilets. Some places have wastewater treatment plants, but there are other systems too. That's it for this episode of *Brains On*.

**MOLLY BLOOM:** *Brains On* is produced by Marc Sanchez, Sanden Totten, and me, Molly Bloom. Menaka Wilhelm is our most esteemed fellow. We had production help from Jackie Kim, Caroline Champlin, and Christina Lopez, and engineering help from John Miller, Bill Baverstock, Adam Voss, and Corey Schreppel.

Many thanks to Nasreen Paptani, Rosie Dupont, Cameron Petrie, Chrissy Pease, Lauren Dee, Curtis, Gilbert, and Justin Levy.

My heart is full of love as I prepare to read this list of names. It's the Brain's Honor Roll. These are the talented listeners who send us their incredible ideas, questions, mystery sounds, and drawings.

[LISTING HONOR ROLL]

[MUSIC PLAYING]

**ALIA AND  
RAYHAN:** Thanks for listening.