The Pop Ups. Stay seated. Three, two, one, ignition. Get ready for an adventure of magnificent proportion.

The Pop Ups. (Singing.) I don't know what you've been told, but we're in a golden age - so many discoveries that are jumping off the page. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world. Wow in the world.

The Pop Ups. With Guy and Mindy. We're on our way, Houston.

Mindy Thomas. (Groaning.) Morning, Guy Raz.

Guy Raz. Are you OK, Mindy?

Mindy. Yeah, I'll be fine. So what are you doing out here? A little medical research?

Guy. Medical research? No, Mindy, I'm just doing some light gardening. Look. Look here. Everything is in bloom. Hey, wait a minute. Why did you think I was doing medical research?

Mindy. Well, I was just reading this new scientific study that says that the next medical breakthrough could be found in the dirt beneath our feet.

Guy. The dirt beneath our feet? You mean like this stuff?

Mindy. Yep. Living inside that handful of dirt or millions tiny, microscopic lifeforms called bacteria.

Guy. Ah, yes. Of course. Bacteria. Bacteria are those tiny, little organisms that live almost everywhere on planet Earth...

Mindy. Yep.

Guy. From our oceans to the soil, even in our own guts.

Mindy. What? Hold the phone, Guy Raz.

Guy. Huh?

Mindy. There's bacteria in my guts?

Guy. Almost twenty-nine trillion in you alone, Mindy.

Mindy. Twenty-nine trillion?

Guy. And another twenty-nine trillion live inside of me and everyone else and so on.

Mindy. Whoa.

Guy. Bacteria comes in all shapes and sizes, too. Sometimes, they're helpful.

Mindy. Oh, yeah, like how bacteria can help turn milk into yogurt.

Guy. Right. Or some of the bacteria in our guts that help keep us healthy.

Mindy. That's nice of them.

Guy. But there are some bacteria that are bad for us. And these kinds of bacteria often infect us with diseases and can make us sick. But since the 1940s, we've been using a special type of medicine called antibiotics to help us fight off these nasty bacterial bugs.

Mindy. Right, antibiotics. That's what this new research is about.

Guy. Oh, really?

Mindy. Really. But first, I think we need a crash course in antibiotics. And, Guy Raz, this crash course in antibiotics will give me the opportunity I've been waiting for to try out my new home theater system.

Guy. Home theater system?

Mindy. Oh, yeah. Reggie helped me set it up last weekend - five point one surround sound, 4K display. There's even a machine that shoots popcorn right into your mouth.

Guy. That's a real timesaver.

Mindy. You're telling me. Come on. Let's go.

Guy. OK.

Mindy. Here we are. Oh, hey, before we start, you want a snack for the movie?

Guy. Movie? Wait a minute. What does a movie have to do with antibiotics?

Mindy. Oh, it came with the system.

Guy. What did?

Mindy. The entire history of antibiotics.

Guy. Right.

Mindy. OK. Just going to boot up the old projector here.

(Soundbite of music.)

Mindy. (Through speaker.) The year is 1928. And Dr. Alexander Fleming, a famous bacterialogamist.

Guy. Huh?

Mindy. (Through speaker.) No. A famous bacterialalalogist.

Guy. What the...Are you trying to say bacteriologist?

Mindy. (Through speaker.) Guy Raz, I had it that time.

Guy. But you did mean a bacteriologist - right? - a scientist who studies bacteria.

Mindy. (Through speaker.) Yeah, that's what I was trying to say.

Unknown Audience Member. Who cares? Start the movie.

Guy. Who was that?

Mindy. (Through speaker.) Sorry. OK. Back to the film. When Alexander returned home from his summer vacation, he discovered that a mold called Penicillium notatum had contaminated - or poisoned - all of his petri dishes.

Alexander Fleming. Oh, no. My petri dishes.

Guy. And, Mindy, petri dishes are those little disks of plastic or glass that scientists put bacteria and other things on so they can look at them under the microscope.

Mindy. You got it, Guy Raz. (Through speaker.) And when he put one of these moldy petri dishes under the microscope, he noticed that the Penicillium mold had completely stopped the growth of the bacteria that he already had on that petri dish.

Guy. And what type of bacteria was that, Mindy?

Mindy. (Through speaker.) It was a bacteria called...

Alexander Fleming. Staphylococci.

Guy. Ah! Staphylococci? Mindy, isn't that a deadly disease?

Mindy. Well, technically, it's a big family of bacteria, Guy Raz. And just like in most families, there are some members that are totally fine but others - well, let's just say they're the kinds that can be a little cuckoo for Coco Puffs, if you know what I mean.

Guy. You mean like your Aunt Mojo?

Mindy. Yeah.

Guy. Oh boy!

Mindy. But you're right. They can sometimes turn deadly, especially before Alexander Fleming's discovery.

Guy. I can imagine because before the discovery of antibiotics, things as simple as a paper cut or a scraped knee could be deadly because open wounds could let infectious bacteria like...

Alexander Fleming. Staphylococci.

Guy. Exactly.

Mindy. Which is why Alexander Fleming's discovery was such a huge deal.

Guy. So what happened next?

Mindy. (Through speaker.) Well, he spent the next few months just toiling away, creating more and more of this Penicillium mold.

Alexander Fleming. Toil, toil, toil, toil, toil, toil, toil, toil.

Mindy. And eventually, he discovered that this mold could be used to create medicine that can not only stop staphylococci but all sorts of other infectious bacterial diseases, as well.

Guy. Creating the world's first antibiotic medicine.

Alexander Fleming. I call it penicillin.

(Soundbite of crowd aweing.)

Guy. Fascinating.

Mindy. But that's not the end of the story.

Guy. It isn't?

Mindy. Not even close. Now let me just find the fast forward button here. We need to stop at around 1941. There.

(Soundbite of tape fast forwarding.)

Howard Florey. Right this way, sir.

Albert Alexander. Right-o. Very good.

Guy. Huh. Who's that, Mindy?

Mindy. (Through speaker.) Oh, that Guy Raz, is Dr. Howard Florey. He's just showing Mr. Albert Alexander into his lab.

Guy. Oh, Albert Alexander. I know him. He's the first person who was ever treated with antibiotics.

Mindy. (Through speaker.) You know it. He got pricked by a rose thorn in his garden. And then his cut got infected with Staphylococci.

Guy. The bacteria from Fleming's lab.

Mindy. (Through speaker.) Yeah. And even though Alexander Fleming had been able to combat small, microscopic doses of Staphylococci in his lab, to treat a whole person - that would take all lot more mold. Turns out you need two thousand liters or five hundred and twenty-eight gallons of mold just to get enough penicillin to treat one person.

Guy. Five hundred and twenty-eight gallons, Mindy? That's, like, three hot tubs' worth of mold.

Mindy. (Through speaker.) Yep. And all for just one guy.

Guy. Or gal.

Mindy. (Through speaker.) So obviously, they had to find a better way to make this much penicillin.

Guy. Obviously.

Mindy. (Through speaker.) And that better way came in the form of a cantaloupe.

Guy. A cantaloupe?

Mindy. (Through speaker.) Yep. And for this, we're going to need to fast forward again to 1941.

(Sound bite of tape fast forwarding and high heels stepping.)

Guy. Hey, who's that walking into Florey's lab now?

Mindy. (Through speaker.) Oh, that's his laboratory assistant Mary Hunt. And look. She's just returned from the market with a cantaloupe.

Mary Hunt. I got that cantaloupe you asked for, sir.

Howard Florey. Ah, just in time for brunch.

Mindy. (Through speaker.) And growing on that cantaloupe is a very special kind of mold.

Guy. More mold?

Mindy. (Through speaker.) More mold, Guy Raz! But the fungus found in this mold produced two hundred times as much penicillin as that fungus Alexander Fleming discovered.

Guy. Wow. That's a lot of mold.

Mindy. (Through speaker.) And that's not even the best part. With a little bit of tinkering...

Howard Florey. Tinker, tinker, tinker, tinker, tinker...

Mindy. (Through speaker.) They were able to make this fungus produce one thousand times as much penicillin as Alexander Fleming's original discovery.

Guy. So that means they were now able to make enough of it to treat people?

Mindy. (Through speaker.) Exactoritos, Guy Raz. And as they say, the rest is antibiotic history.

Guy. So, Mindy, as much as I enjoyed the movie, I still don't understand what any of this has to do with my gardening.

Mindy. Oh, right. So as much as these antibiotics have helped us keep these nasty bacterial bugs away...

Guy. Yeah.

Mindy. Well, these bugs have basically spent the last eighty years getting smarter and learning new ways to fight back.

Guy. The bacterial bugs are trying to fight the antibiotics?

Mindy. Oh, yeah. And the smartest bugs - or at least the bugs that are winning the battle - are called superbugs. And they are what scientists call antibiotic-resistant.

Guy. Antibiotic-resistant?

Mindy. Yeah, which is basically just a fancy way of saying that antibiotic medicine doesn't always work against these bacterial infections anymore. But have no fear, Guy Raz. Superhero scientists to the rescue!

Guy. Phew.

Mindy. These super scientists, men and women, are on the case, searching high and low for new antibiotics to fight these new superbugs.

Guy. Huh. Well, where are they searching?

Mindy. Well, you know that dirt in your backyard?

Guy. Scientists are looking for the next big antibiotic in the dirt in my backyard?

Mindy. Well, I mean, not just the dirt in your backyard but dirt everywhere.

Guy. Wait a minute.

Mindy. You know what? Let's head back out to your backyard, and I'll show you. Plus, I think hear the cleaning crew is about to come in.

Guy. Yup. Looks like it's time to get out of here.

(Soundbite of door shutting.)

Guy. Ah, back in my beautiful, pristine, well-kept...

Mindy. Antibiotic farm!

Guy. Well, I was going to say horticultural display, but...

Mindy. But nothing, Guy Raz. You are currently standing on a potential gold mine of medical wonders. And like I said earlier, there are trillions of bacteria living inside this dirt. In fact, in just one ounce of dirt, there can be as many as eight point five million different bacteria.

Guy. Wow - eight point five million. That's like the entire population of New York City living in this tiny morsel of dirt.

Mindy. And guess what?

Guy. What, Mindy?

Mindy. Those bacteria are at war.

(Soundbite of weapons clashing.)

Guy. War?

Mindy. That's right. Every day, underneath our feet, millions of bacteria are clashing in epic, microbial battles.

Microbe. Ahhh!

Mindy. And each of these microbes uses a different type of microbial weapon to fight the others.

Guy. Oh, yikes.

Mindy. And some of these bacteria are the ones that spread infectious diseases and make us sick.

Guy. Huh. And so I'm guessing that these scientists are studying how these warring bacteria defeat each other, so they can try to use that same technique in hospitals, right?

Mindy. Right. These superhero scientists are trying to take the weapons that the good bacteria is using against the bad, infectious bacteria...

Guy. Wow.

Mindy. And then use these weapons to defend ourselves the next time the bad bacteria decides to infect a human.

Guy. Huh. So how do they do it?

Mindy. Well, after inspecting soil samples sent in from other scientists from all over the world, the team was able to extract - or take out - ten thousand new microbial weapons that could potentially be used to fight superbugs.

Guy. But, you know, in the meantime, there's a much more effective and potentially cheaper way to combat antibiotic resistance.

Mindy. Really? How?

Guy. Well, it may seem like a pretty simple thing, Mindy, but washing your hands is actually the best way to stop these bacterial infections in their tracks. In fact, researchers at the University of Southampton in the United Kingdom recently conducted a huge survey where they divided twenty thousand people into two groups.

Mindy. Uh huh.

Guy. And one group was told to go to a website that encouraged them to wash their hands.

Mindy. OK.

Guy. And that website would remind the people in that group about the benefits of washing hands and the dangers of not washing your hands.

Mindy. Huh. And so what happened?

Guy. Well, three years later, the researchers went back to that group and compared them with another group that never saw the website at all.

Mindy. So what did these researchers find?

Guy. Well, they found that the group that was reminded to wash its hands - the people in that group didn't get sick as often as the people in the other group that weren't washing their hands.

Mindy. Like less cold, flu and all those other infections we get?

Guy. Exactly.

Mindy. So what you're saying is that our hands are like a highway that infections use to travel, and hand-washing with soap is the big roadblock we need?

Guy. Spoken like a true member of the hand-washing society.

Mindy. So there's something that all of us can do to help defeat these nasty superbugs? So there’s something that all of us can do to defeat these nasty superbugs?

Guy. That's right. I even put it into a song!

Mindy. Man, now there's a song?

Guy. And here we go. All right. Here we go. (Singing.) Put your right hand in and wash it around. Get some soap in your left hand and go to town.

Mindy. All right. Yeah. This is the kind of hand-washing I could get into. Whoo!

Guy. (Singing.) Put your right hand in and wash it all around. Get some soap in your left hand and go to town.

Mindy. Guy Raz, you show that bacteria who's boss.