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Chapter 1 : Cell Lab: Mystery Microbes | Science Museum of Minnesota

bacteria Simple, single-celled organisms that inhabit most environments on Earth. biosphere All living things, and the environments they inhabit. ecosystem The interdependent web of organisms â€" ranging from tiny microbes to plants and large animals â€" that inhabit any place.

December 17, iStock You may think of your body as home to only one organism: But you actually host trillions of microbes, mainly bacteria, fungi and viruses, comprising their own individual microbiomesâ€"ecosystemsâ€"too small to be seen with the naked eye. Before you rush off to take a shower, consider that these living colonies in your body work in synergy with you to keep you healthy. Studying them can reveal imbalances in health, and offer avenues of treatment for a wide range of physical and mental health problems. Your microbiome is so unique to you, it could one day replace the fingerprint ID. Here are 10 mysteries revealed about the human microbiome. Bacterial cells are so prolific in our bodies, that they outnumber our human cells 10 to 1. A recent study done at George Washington University found a notable difference in the throat microbiomes of schizophrenics as compared to healthy controls. Several studies have tested the effects of bacteria lactobacillus and bifidobacterium on mice and humans. In one study , mice fed these bacteria showed less anxiety or despair measured by how willing mice are to rescue themselves when dropped into jars of water , which the researchers compared to how mice behaved when given the anti-depressant drug Prozac. In another study , mice treated with the probiotics performed better on cognitive tests, including navigating mazes, and object recognition tests. And in the biggest known human study , a group of 25 healthy women ate yogurt with live bacteria every day for four weeks. Researchers are still trying to pinpoint how these good bacteria improve the mood; theories include activating compounds like serotonin, stimulating the vagus nerve , which releases the natural calming agent acetylcholine, and simply sending calming signals to the immune and nervous systems. Researchers hope that one day common psychiatric disorders could be treated with probiotics as well as drugs. The exterior surface of human skin is home to as many as strains of bacteria. These microbes are intricately linked to your immune system, helping you defend against invading pathogens. Other research suggests that reduced interaction with the natural world is also responsible for a rise in allergies. So go for a hike, and get dirty. According to a study done by the University of Cambridge, as many as of the genes in your human genome are bacteria genes that have used a process known as horizontal gene transfer to "jump" into human DNA over the course of our evolution. Though you have approximately the same number of bacteria on each of your hands, research done at George Washington University has found that the colonies are different from hand to hand, suggesting that your dominant hand, with which you are likely to do more things, comes in contact with a different set of bacteria than the other hand. Men always take heat for being dirtier than women, but it might be true, in a way. At the very least, the bacteria Corynebacteriumâ€"usually found in the armpit and responsible for the pungent odorâ€"prefers male chemistry. But Enterobacteriales is percent more abundant on women, and Lactobacillaceae primarily found in the mouth and the vagina is percent more abundant. In general, the palms of women were found to have greater bacterial diversity than the palms of men. Some explanations for this diversity may have to do with the slightly different Ph balance between male and female skin, differences in sweat and sebum oil production, and the frequency of moisturizer or cosmetics use. There are more than strains of bacteria that call your "inny" home, with as many as of those not previously identified by science until the Belly Button Biodiversity Project analyzed them. And in case you were wondering, "outies" are the same. For years, science considered the uterus of a pregnant woman a sterile environment, but new research published in Science Translational Medicine revealed that placentas have a unique microbiome that is different from any other part of the body though most similar to the microbiome of the mouth. Understanding this particular microbiome may also help researchers learn more to treat in-utero infections and preterm births.

Chapter 2 : Bacteria are all around us â€" and thatâ€™s okay | Science News for Students

Topics: Bacteria, ï»¿he Mysteries of Udolpho by Ann Radcliffe is a Gothic romance that presents supernatural phenomenon which is later explained by natural causes.

Most people assume unfairly that these germs are all dangerous. Studying these poorly understood microbes could better reveal how they function as the "invisible backbone of life. Orphan went to college at the University of California, Santa Barbara in the early s. There she discovered something that changed the way she thought about the oceans â€" and life on Earth. Another student showed her a small vial of seawater. It was just plain old water. Then the other student added a fluorescent chemical to the water and shined ultraviolet light on it. The tube lit up as millions of tiny bacteria began to glow. Just moments earlier, the microbes had been invisible. We knew almost nothing about them. As a geobiologist at Caltech in Pasadena, Calif. On a research vessel, Victoria Orphan holds a tube of sediment retrieved from the seafloor. The orange material is a large mat of bacteria. Researchers collected the bugs from a crack in the ocean floor near California. Victoria Orphan Bacteria play central roles in many ecosystems. These include the oceans, soil and atmosphere. Bacteria make it possible for all other life on Earth to exist. The methane eaters Some bacteria eat really weird things. Scientists have found bacteria that eat rocks, sewage â€" even nuclear waste. Orphan studies a type of bacteria that live on the sea floor and gobble up methane. CO2 and other greenhouse gases Methane is a greenhouse gas. Like carbon dioxide and some other greenhouse gases, it enters the air when people burn oil, gas and coal. There are also natural sources of methane, such as natural gas, rice production and cow manure. Greenhouse gases trap heat in the atmosphere. Methane can seep out of the Earth on the sea floor. Certain of those bacteria dine on methane. That allows the oceans to trap a huge amount of the gas. Finding single-celled organisms on the vast sea floor can be a challenge. Through the window of a submarine, she looks for clusters of clams and giant tube worms. These organisms signal that invisible marine bacteria live there, too. Wherever those methane-eaters live, they create new molecules as they dine. Other organisms use those new molecules as food. An entire food web springs up on the ocean floor. Orphan and her team have found methane-eating bacteria along cracks on the sea floor, where this gas is seeping out. These cracks often happen where two tectonic plates bump into each other. Some bacteria, they learned, can eat methane only by partnering with other single-celled organisms called archaea Ar-KEE-uh. That important detail could help scientists better predict how much methane is escaping into the air, says Orphan. Biddle studies bacteria that live in deep ocean trenches. The Mariana Trench is the deepest place on the planet. Jennifer Biddle and colleagues discovered new clues about the bacteria that survive here. They are incredibly hard to reach. Challenger Deep wins the record for the deepest-known spot on the planet. At the bottom of the Mariana Trench, in the western Pacific, Challenger Deep sits some 11 kilometers more than 7 miles below the ocean surface. The Mariana Trench is one of the toughest places for life to survive. Zero sunlight reaches it. Its temperatures are frigid. Little surprise, then, that most of the locals are microscopic. They have adapted its extreme conditions. Biddle and other scientists teamed up with deep-ocean explorers to send a submarine to Challenger Deep. James Cameron piloted the vessel. The vessel also brought back sediment from the bottom of the trench. Biddle and the other scientists screened that sediment for DNA. They were scouting for genes of familiar bacteria. They turned up evidence of some known as Parcubacteria. Back then, they found some in groundwater and dirt from a few places on land. Here, on the trench floor, the microbes were breathing nitrogen, not oxygen as they did on land. And that makes sense. They had adapted to nitrogen since their home had little access to oxygen. The more places we find such little-known bacteria, says Biddle, the more we can learn about what they do for their ecosystems. Story continues below video. In , film director James Cameron traveled to the deepest place in the ocean: There he collected water and sediment samples for scientists to study. World Science Festival From bread to biofuels Even the bacteria in our kitchens and compost heaps interest scientists. Sourdough bread gets its unique tart flavor when a mix of bacteria munches on the sugars in bread flour. Those bacteria make carbon dioxide, acids and other flavorful compounds. But to function, sourdough bacteria need their friends. And he suspected he could use the lessons of sourdough to make better

biofuels. These plant-based fuels can power cars or trucks. For ideas about how to make Earth-friendly fuels, microbiologist Steve Singer studies bacteria living on garbage. These sugars can then be turned into fuels such as ethanol a type of alcohol. These are molecules that jump-start or speed up chemical reactions. The enzymes currently used to make biofuels are expensive. He turned his search for them to the compost pile. There, bacterial communities were hard at work breaking down rotting fruits and veggies. Singer took a small sample of the compost back to his lab. There, he let bacteria from the compost grow in a beaker. Later, he collected enzymes that these bacteria made and tested them on other plant bits. The enzymes broke down the plants into sugars. Just as the sourdough bacteria need their friends to function, Singer discovered that these microbes produced the useful enzymes only when they were part of robust communities of different compost bacteria. Singer is now scaling up his project. His team is growing bacteria in huge vats called bioreactors. After he makes lots of the new enzymes, he can test whether they work better than existing ones for converting plant wastes into fuels. Meta microbes Singer is studying his new enzymes without knowing which bacteria are making them. Bacteria are invisible to the unaided eye. Even with a microscope, telling two species apart can be hard. Key to this sleuthing: All organisms shed a little DNA throughout their environment. She studies bacteria at the Netherlands Institute of Ecology in Wageningen. Swab your kitchen counter and you might find human DNA from you and your parents. There might be some plant DNA from the veggies you just cut up and from a fungus or two. There might even be some dog or cat DNA if you have a pet. More than 1, scientists are working together to catalogue all the bacteria on the planet. Their project is called the Earth Microbiome Project. Earth Microbiome Project Scientists can use these genetic fingerprints to discover new bacteria, notes Ramirez. Think of it as a DNA soup. All the molecules used to build the genes of different organisms are jumbled together. Scientists use computers to untangle the mess. Like a sieve, computer programs filter the soup. They look for familiar patterns known as genetic sequences.

Chapter 3 : Mystery microbes of the sea | Science News for Students

The researchers hypothesize that microbes within the mountain introduce carbon and nutrients to the ecosystem, which enables microbial life on the surface of the chimneys.

Print Algae are currently turning parts of the Greenland ice sheet pinkish-red and contribute more than a little to the melting of one of the biggest frozen bodies of water in the world. Hidden microbes turn the ice pink around the world. Benning, GFZ In order for them to form visible blooms and increase the melting of the snow and ice, they just need the right conditions, which at a minimum involve basic nutrients and melting. Right now, the availability of liquid water from snow and ice becomes higher, favoring the growth of snow and ice algae. This is an increasing problem in the Arctic, Alpine, and Himalayan glaciers. Blooms of red snow and brown ice are turning up in Antarctica, too. Martyn Tranter is a polar biogeochemist at the University of Bristol in the U. The microscopic algae turning the ice pink around the globe. Stefanie Lutz, GFZ One of those drivers, he believes, is the darkening caused by the algal blooms that quilt the snow-strewn Greenland ice every summer. These ice algae are photosynthetic organisms that produce biological sunscreen molecules to protect them from the sun, which in the Arctic in summer stays above the horizon up to 24 hours a day. The darker surface lowers its ability to reflect the sunlight back into space, and that results in more light absorbed and more melting. As algae spreads over larger areas of the ice sheet, the effect will be compounded, leading to even more melting. A recent study found that algal blooms can contribute as much as 13 percent more ice melt over a season. Pink ice and snow on Petermann Island, Antarctica. The Greenland ice sheet is the biggest piece of ice in the Northern Hemisphere. Each year, it loses billion tons of ice, adding a fraction of an inch to global sea levels. The amount of melting is speeding up year by year, and if the entire ice sheet melted, it would add 20 feet to sea levels. The availability of liquid water from snow and ice becomes higher, favoring the growth of snow and ice algae. Benning, GFZ Scientists are worried that if it melts more quickly its effects will be felt in coastal areas from New York to Shanghai to Miami, as well as in low-lying areas like Bangladesh and Indonesia. In this movie the snow is more looking like black: So far, the blooms have not been taken into account as a contributing factor to Arctic ice melting at an unprecedented rate. Just beneath the ice surface there are red algae that turn the ice pinkish. Are probably some other things that we are not aware of yetâ€¦.

Chapter 4 : Mystery bacteria linked to 18 deaths in Wisconsin - CBS News

Synthetic microorganisms allow scientists to study ancient evolutionary mysteries Scientists use the tools of synthetic biology to engineer organisms similar to those.

Contact Privacy Cookie Policy Terms of Use Diving Deep to Reveal the Microbial Mysteries of Lost City An expedition sets out this week to explore a field of hydrothermal vents in the deep Atlantic, one of the most extreme ecosystems on the planet The remotely operated vehicle Hercules explores the hydrothermal vents of Lost City during a expedition. Deborah Kelley By Anna Kusmer smithsonian. Hundreds of white spires jut into the dark ocean, spanning the area of a city block and towering between 30 and feet tall. Hot alkaline fluids filled with hydrogen gas spew from the tops of these natural towers into the waters just east of the Mid-Atlantic Ridge. What looks like a long-abandoned metropolis is, in fact, teeming with microscopic life. The trillions of microbial residents of Lost City, perched on top of the Atlantis Massif, have become a fascination for scientists. Tomorrow, September 8, a group of 22 researchers, microbiologists, geologists and oceanographers, will travel to Lost City for the first time in years. This group of scientists wants to know how the microbes of Lost City make their living, what they eat and breathe, and how they survive in the extreme temperatures and pressures of the deep ocean. Discovered in , Lost City is one of only a few known places like it on the planet. Unlike more common types of hydrothermal vents, such as black smokers and methane seeps , Lost City is not fueled by volcanic activity. Carbonate chimneys of Lost City imaged during a expedition to the hydrothermal vent system. The chimneys also release methane, an organic molecule which is a rich source of energy for many types of life. According to team co-lead Susan Lang, a geochemist at the University of South Carolina, solving this mystery is one of the primary missions of the expedition. The expedition scientists plan to collect water streaming out of the chimneys to capture microbes that live deep within the Atlantis Massif. The researchers hypothesize that microbes within the mountain introduce carbon and nutrients to the ecosystem, which enables microbial life on the surface of the chimneys. Because the ingredients are relatively simple rock and seawater , and the environment is oxygen-free, microbes within the Atlantis could be a window to extraterrestrial lifeforms. Some of the collected water will be stored in freezers for future research, while some will be analyzed on the spot to measure chemical composition as well as microbe and virus populations. Over the next years, genetic testing of the seawater samples will illuminate what kinds of microbes live in this extreme environment and how they manage to survive. There are also scientists who believe that Lost City, or a place like it, may be where life started on Earth. Small pores in the walls of Lost City chimneys, combined with basic as opposed to acidic seawater and an unlimited energy source in the hydrogen gas, could provide the Goldilocks conditions needed for spontaneous life. The hydrogen gas and other molecules mixing together in the pores may create a pre-cursor to a cell, known as a proto-cell. A scanning electron microscope image reveals the gauzy biofilms made of microbes on and within Lost City chimneys. The deep ocean is as much a frontier for scientists as deep space. Mineral resources, like nickel, cobalt, silver and gold, have piqued the interest of mining companies, who are increasingly investing in future deep-sea exploitation. But now, the required technologies are here, and the International Seabed Authority the United Nations agency that gives permission for mining in international waters gives out permits for mining exploration every year. One such permit, issued in August , gave Poland the right to exploit the area of seafloor where Lost City is located. A "beehive" structure in Lost City. Courtesy of Deborah Kelley, University of Washington Some marine scientists say that mining the seafloor before we understand its basic biology could be a recipe for disaster. Levin says that when Poland received the rights to mine the area around Lost City, it raised a red flag for deep sea microbiologists. Every time scientists go to the bottom of the ocean, new species are discovered.

Chapter 5 : Unlocking the Mysteries of the Microbes | The Scientific Method

Group Roles. Project Manager â€¢ Only team member that is allowed to ask the teacher questions. â€¢ Only member of the team that will report out/ answer questions.

Mystery microbes of the sea What gobbles up millions of tons of poisonous ammonia each year, making the water safe for fish? Douglas Fox Sep 26, â€” But Santoro kept one important item close as she drove across the country. It was a plastic cooler. Four square bottles sat inside, each wrapped in tinfoil. The seawater that sloshed around in them contained millions of mysterious microbes. Santoro had scooped up the waterborne microbes a year earlier while cruising the Pacific Ocean. They were in the water that she sampled as part of the research for her Ph. The two-week cruise had been her first time at sea. And she had worked nonstop, hardly sleeping. Once back home, Santoro shoved the four bottles of seawater into her refrigerator, behind the milk. Then she collapsed and took a nap. And those bottles remained in the fridge, untouched, until Santoro finally drove across country the next year. She treated each bottle with great care. Every night, for instance, they stayed in her hotel room as she slept along with several delicate orchid plants that she had coaxed into blooming. Santoro believed that the answer lay with special microbes, called archaea ar KEE ah. Biologists find archaea a true curiosity. The two better known branches are bacteria and eukaryotes u KARE ee oatz. That last branch includes animals, plants and fungi. But archaea have remained mysterious. Very little is known about them. Yet if Santoro was right, these mysterious archaea did a huge job â€” mopping up a waste that would otherwise poison large ocean species. As they rot, they give off a stinky gas called ammonia NH3. The same chemical is a familiar problem to anyone who keeps pet fish. For 50 years, biologists have puzzled over what might be removing it. They assumed microbes must play a role. After all, the oceans contain millions of different types. Yet only a few of them would eat ammonia. Santoro was among those hunting for the helpful mystery microbe. She believed that some unknown archaea species must gobble up ammonia as quickly as it forms. And it must convert that ammonia into other chemicals. These same archaea, Santoro reasoned, might even lie at the center of a second mystery â€” the source of huge quantities of a gas called nitrous oxide N2O. Entering the atmosphere, it acts as a potent greenhouse gas. Gram for gram, nitrous oxide absorbs more sunlight â€” and heats the atmosphere much more strongly â€” than does carbon dioxide. No one knew what life-form was behind all of this nitrous oxide. All biologists knew was that this gas carried a strange chemical signature. Just as with the ammonia-gobbling microbe, whatever organism was producing nitrous oxide also was unknown to science. Santoro believed that an unknown type of archaea was behind both mysteries. It was gobbling up ammonia and belching out vast amounts of nitrous oxide. Despite the mystery surrounding it, this microbe might be one of the most common life-forms on Earth. Yet for many years, biologists could not study it. They simply could not get it to grow in the lab. Hard to grow Suppose you have an unknown seed. You can find out what type it is by sticking it in soil, watering it and waiting to see what type of plant sprouts. For a long time, biologists identified mystery microbes in much the same way. Once they had enough of the microbe, they could identify its genes. Or they could do experiments to see what it eats and how it lives. Growing microbes is a lot like growing orchids or other tricky houseplants, observes Santoro, who now works at the University of Maryland Center for Environmental Science in Cambridge. You have to try various temperatures and menu options. Those bottles of seawater that Santoro collected might have contained a million different types of microbes. But 99 out of every had never been grown in a lab before. It also prevents researchers from understanding how microbes shape the environment. Say you want to study a common ecosystem. Maybe it is the web of plants, animals and other organisms that inhabit deserts of the American West. You can recognize which species are most common simply by camping out on a hilltop. You might figure out pretty quickly that in many places both tortoises and rabbits are quite common. If you do some experiments, you might learn how each survives the desert. Rabbits grow and multiply quickly. Tortoises grow slowly, but they need very little water and food. So tortoise numbers change slowly throughout good years and bad. Cultivating tortoises Studying communities of ocean microbes, as Santoro does, is far more challenging. The very act of looking at a microbial ecosystem by growing it in the lab can change it. And

no scientist can predict how it will change. Conditions in a glass bottle are almost always different from those in the real ocean. This is one reason that lab researchers sometimes overlook the microbes that are most common in nature. Scientists who sought to find out what was eating ammonia in the ocean faced this problem. Ammonia-munching microbes were probably very common â€" but they grew very slowly. Santoro solved that problem by accident. After putting her water bottles in the refrigerator in , she forgot about them. So they never got any more food. Vast swaths of the ocean are like a desert, with very little food. By the time she finally opened the bottles in February , the microbes had gone a year and a half without food. They must have been starving! But that was just what her tortoises needed. Only the slow-growing tortoises remained. These were mainly archaea. At first glance, archaea resemble bacteria. They are about the same size. They often have the same ball and rod shapes as bacteria when seen under a microscope. But archaea are entirely different organisms. Santoro grew her surviving tortoise microbes for another year. During that time, she fed them tiny amounts of ammonia â€" but none of the chemicals on which most other microbes depend. And slowly, her ammonia-munching archaea grew. As they dined on ammonia, they burped up small amounts of nitrous oxide gas as a waste product. By mid, Santoro had enough of her archaea to do an experiment. As they grew, she siphoned off the nitrous oxide for her tests. Santoro was hoping to solve the mystery of what was making nitrous oxide in the ocean. Chemical fingerprint Nitrous oxide bubbling out of the ocean has an unusual chemical signature. Santoro wanted to see if her archaea made nitrous oxide with a matching chemical signature. It would hint that they were the source of the gas. Atoms of some elements, such as the nitrogen and oxygen that make up nitrous oxide, come in so-called light and heavy forms. They define its characteristic signature. Have you ever cracked open an egg and found two yolks, instead of just one? Atoms are kind of like that. A few atoms have one or two extra neutrons a type of atomic building block at their center. Nitrous oxide that leaves the ocean has a very specific signature: But in nitrous oxide from the ocean, these heavy atoms are more common. This odd signature provides a clue about what might be burping up the gas. Other scientists had already grown ocean bacteria that eat can ammonia and make nitrous oxide.

Chapter 6 : Scientists scramble to trace source of blood infection in Wisconsin - www.nxgvision.com

According to a NASA press release, scientists on the ISS successfully sequenced the genomes of mystery microbes found inside the space www.nxgvision.com microbes were found earlier last year clinging to various surfaces inside the space station.

Chapter 7 : Diving Deep to Reveal the Microbial Mysteries of Lost City | Science | Smithsonian

NASA astronauts successfully sequenced the DNA of microbes found aboard the International Space Station, marking the first time unknown organisms were sequenced and identified entirely in space.

Chapter 8 : Mysterious microbes turn polar ice pink all around the world - Strange Sounds

But you actually host trillions of microbes, mainly bacteria, fungi and viruses, comprising their own individual microbiomesâ€"ecosystemsâ€"too small to be seen with the naked eye.

Chapter 9 : Elizabethkingia outbreak spreads; source still a mystery - CNN

Cheesemaking is an art, but it's also science. Like other fermented foods such as sourdough, kombucha, and kimchi, cheese is the product of bacteria and yeast, plus mold. Cheese is mostly.