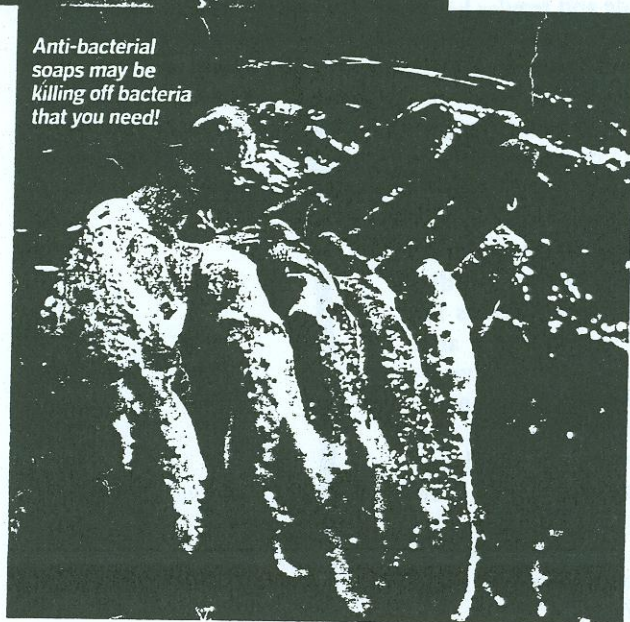


are you too clean?

Anti-bacterial soaps may be killing off bacteria that you need!



Those household anti-bacterials may be doing more harm than good.
By Jenna McCarthy

cause a modest reduction in bacteria, but these are not necessarily the harmful ones," says Michael Doyle, Ph.D., director of the Center for Food Safety and Quality Enhancement at the University of Georgia in Griffin. "What many consumers don't realize is that there are thousands of strains of *E. coli*, for instance, that are actually good for us." In addition, Doyle explains that when we kill off beneficial bacteria, we create an environment where stronger strains — the ones likely to cause disease — grow and multiply.

"Relying on anti-microbial products also gives you a false sense of security," says Stuart Levy, M.D., director of the Center for Adaptation Genetics and Drug Resistance at Tufts University in Boston. When you buy an "anti-bacterial" cutting board or sponge, for example, the implication is that these products are somehow bacteria-repellent, so you don't have to follow standard hygienic practices. Unfortunately, that's not the case.

Overcleanliness is not next to godliness

As ironic as it may sound, the urge to oversanitize can be the most harmful to infants. "Our immune systems have evolved over millions of years of exposure to bacteria," explains Levy. "If a baby never comes into contact with germs, his immune system doesn't learn how to respond. Several studies in Europe have found that the over-

whelming majority of children with asthma, allergies and hay fever come from overly hygienic homes." Certainly, no one is suggesting you abandon common sense and begin living in squalor. The message the experts hope to

If you're tempted to trade in your usual soap or cleaning spray for a new-and-improved anti-bacterial model, you may want to reconsider. Experts have evidence that by killing off only the weakest bacteria, these products may be promoting the growth of stronger, drug-resistant strains. This means that someday, when you need an antibiotic most, it may not work. What's more, the proliferation of anti-bacterial-impregnated products, including things like toys and highchair trays, may be contributing to the alarming rise in breathing difficulties — allergies and asthma — especially among children.

"Most anti-microbial products have been shown to

they keep going, and going... anti-microbial chemicals can leave long-lasting residues that keep contributing to potential antibiotic resistance even when levels of the germ killers drop.

Anti-microbial products give you a false sense of security: You may neglect other hygienic practices.

convey is that you can safely sterilize your home without the fanatical use of harsh chemical disinfectants. Levy recommends switching to noncommercial cleansers such as alcohol, hydrogen peroxide and regular household bleach (although "soap and water is generally fine," he insists).

A happy, healthy middle ground

Not all scientists completely agree. "A lot more research needs to be done," Doyle says. "I don't believe we need to avoid anti-bacterial products entirely. For example, studies have shown that the kitchen is the dirtiest room in the house, so anywhere food-borne illnesses thrive — counters, cutting boards, utensils, sinks — should be cleaned with hot, soapy water, then sanitized." This is especially important if they've been in contact with uncooked meat, chicken, fish or eggs. Adds Doyle, "The key is to rotate your cleansers frequently so that bacteria can't develop an immunity."

Doyle also believes that scientists are on the brink of coming up with better solutions. In the meantime, the secret to safe sudsing isn't what's in your soap, but whether or not you're using it effectively. You should wash your hands with soap and water before handling food and after gardening, changing diapers or using the bathroom. ("It sounds obvious, but not everyone does it," Levy says). But while studies have shown that the average hand-washing lasts a scant four seconds, to thoroughly disinfect your dukes you should be spending about 20 seconds doing it — approximately as long as it takes to sing the "Happy Birthday" song. ■

Jenna McCarthy is a free-lance writer in Santa Barbara, Calif.

PERSONAL HEALTH | Jane E. Brody

Babies Know: A Little Dirt Is Good for You

Ask mothers why babies are constantly picking things up from the floor or ground and putting them in their mouths, and chances are they'll say that it's instinctive — that that's how babies explore the world. But why the mouth, when sight, hearing, touch and even scent are far better at identifying things?

When my young sons were exploring the streets of Brooklyn, I couldn't help but wonder how good crushed rock or dried dog droppings could taste when delicious mashed potatoes were routinely rejected.

Since all instinctive behaviors have an evolutionary advantage or they would not have been retained for millions of years, chances are that this one too has helped us survive as a species. And, indeed, accumulating evidence strongly suggests that eating dirt is good for you.

In studies of what is called the hygiene hypothesis, researchers are concluding that organisms like the millions of bacteria, viruses and especially worms that enter the body along with "dirt" spur the development of a healthy immune system. Several continuing studies suggest that worms may help to redirect an immune system that has gone awry and resulted in autoimmune disorders, allergies and asthma.

These studies, along with epidemiological observations, seem to explain why immune system disorders like multiple sclerosis, Type 1 diabetes, inflammatory bowel disease, asthma and allergies have risen significantly in the United States and other developed countries.

Training the Immune System

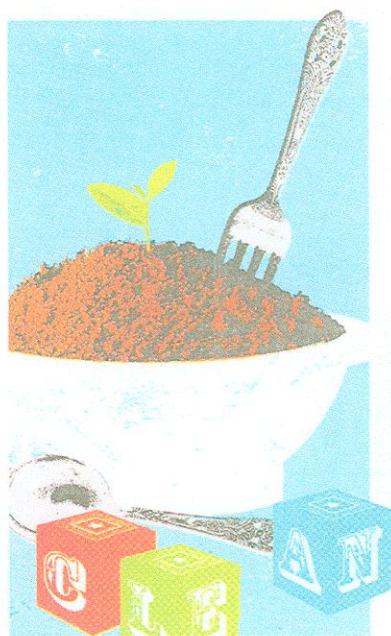
"What a child is doing when he puts things in his mouth is allowing his immune response to explore his environment," Mary Ruebush, a microbiology and immunology instructor, wrote in her new book, "Why Dirt Is Good" (Kaplan). "Not only does this allow for 'practice' of immune responses, which will be necessary for protection, but it also plays a critical role in teaching the immature immune response what is best ignored."

One leading researcher, Dr. Joel V. Weinstock, the director of gastroenterology and hepatology at Tufts Medical Center in Boston, said in an interview that the immune system at birth "is like an unprogrammed computer. It needs instruction."

He said that public health measures like cleaning up contaminated water and food have saved the lives of countless children, but they "also eliminated exposure to many organisms that are probably good for us."

"Children raised in an ultraclean environment," he added, "are not being exposed to organisms that help them develop appropriate immune regulatory circuits."

Studies he has conducted with Dr. David Elliott, a gastroenterologist and immunologist at the University of Iowa, indicate that intestinal worms, which have been all but



GREG NEILL

eliminated in developed countries, are "likely to be the biggest player" in regulating the immune system to respond appropriately, Dr. Elliott said in an interview. He added that bacterial and viral infections seem to influence the immune system in the same way, but not as forcefully.

Most worms are harmless, especially in well-nourished people, Dr. Weinstock said. "There are very few diseases that people get from worms," he said. "Humans have adapted to the presence of most of them."

Worms for Health

In studies in mice, Dr. Weinstock and Dr. Elliott have used worms to both prevent and reverse autoimmune disease. Dr. Elliott said that in Argentina, researchers found that patients with multiple sclerosis who were infected with the human whipworm had milder cases and fewer flare-ups of their disease over a period of four and a half years. At the University of Wisconsin, Madison, Dr. John Fleming, a neurologist, is testing whether the pig whipworm can temper the effects of multiple sclerosis.

In Gambia, the eradication of worms in some villages led to children's having increased skin reactions to allergens, Dr. Elliott said. And pig whipworms, which reside only briefly in the human intestinal tract, have had "good effects" in treating the inflammatory bowel diseases, Crohn's disease and ulcerative colitis, he said.

How may worms affect the immune system? Dr. Elliott explained that immune regulation is now known to be more complex than scientists thought when the hygiene hypoth-

esis was first introduced by a British epidemiologist, David P. Strachan, in 1989. Dr. Strachan noted an association between large family size and reduced rates of asthma and allergies. Immunologists now recognize a four-point response system of helper T cells: Th 1, Th 2, Th 17 and regulatory T cells. Th 1 inhibits Th 2 and Th 17; Th 2 inhibits Th 1 and Th 17; and regulatory T cells inhibit all three, Dr. Elliott said.

"A lot of inflammatory diseases — multiple sclerosis, Crohn's disease, ulcerative colitis and asthma — are due to the activity of Th 17," he explained. "If you infect mice with worms, Th 17 drops dramatically, and the activity of regulatory T cells is augmented."

In answer to the question, "Are we too clean?" Dr. Elliott said: "Dirtiness comes with a price. But cleanliness comes with a price, too. We're not proposing a return to the germ-filled environment of the 1850s. But if we properly understand how organisms in the environment protect us, maybe we can give a vaccine or mimic their effects with some innocuous stimulus."

Wash in Moderation

Dr. Ruebush, the "Why Dirt Is Good" author, does not suggest a return to filth, either. But she correctly points out that bacteria are everywhere: on us, in us and all around us. Most of these micro-organisms cause no problem, and many, like the ones that normally live in the digestive tract and produce life-sustaining nutrients, are essential to good health.

"The typical human probably harbors some 90 trillion microbes," she wrote. "The very fact that you have so many microbes of so many different kinds is what keeps you healthy most of the time."

Dr. Ruebush deplores the current fetish for the hundreds of antibacterial products that convey a false sense of security and may actually foster the development of antibiotic-resistant, disease-causing bacteria. Plain soap and water are all that are needed to become clean, she noted.

"I certainly recommend washing your hands after using the bathroom, before eating, after changing a diaper, before and after handling food," and whenever they're visibly soiled, she wrote. When no running water is available and cleaning hands is essential, she suggests an alcohol-based hand sanitizer.

Dr. Weinstock goes even further. "Children should be allowed to go barefoot in the dirt, play in the dirt, and not have to wash their hands when they come in to eat," he said. He and Dr. Elliott pointed out that children who grow up on farms and are frequently exposed to worms and other organisms from farm animals are much less likely to develop allergies and autoimmune diseases.

Also helpful, he said, is to "let kids have two dogs and a cat," which will expose them to intestinal worms that can promote a healthy immune system.

PERSONAL HEALTH | Jane E. Brody

Mosquito Thrives; So Does Dengue Fever

On a recent visit to Cambodia, outside a children's hospital a block from my hotel, I saw a large red-and-white sign that warned of a severe epidemic of dengue hemorrhagic fever. Years ago, the disease killed our tour guide's 5-year-old brother.

My tripmates and I managed to escape even the milder form of this mosquito-borne viral infection — we all slept in an air-conditioned hotel and each day applied insect repellent with 30 percent DEET on our exposed skin. But I have since learned that I could have been infected on several previous trips abroad and even in parts of the United States.

Dengue (pronounced DEN-gee) fever has increased rapidly in tropical and subtropical areas worldwide in recent years, thanks to factors both natural and manmade.

Among the countries that have experienced recent epidemics are Cambodia, Costa Rica, India, Indonesia, Malaysia, the Philippines, Singapore, Thailand and Vietnam. In the Western Hemisphere, outbreaks have also occurred in some Caribbean islands, Cuba, northern Mexico, Nicaragua, Panama, Puerto Rico and Venezuela.

This year, dengue fever has ravaged Rio de Janeiro, infecting more than 75,000 people in Brazil's Rio state, including Diego Hypólito, a world champion gymnast and gold-medal favorite in the Beijing Olympics this summer. More than 80 people in Rio have died from dengue.

Though most North Americans who receive a diagnosis of dengue fever were infected while traveling to countries where the disease is endemic, including Mexico, it has also struck residents of Hawaii and Texas who had not left American shores. And last summer a related mosquito-borne disease, chikungunya, afflicted more than 100 residents of a village in Italy, Castiglione di Cervia.

The disease is not contagious; rather, it is passed from person to person through the bite of a virus-carrying mosquito.

Epidemiologists say that global warming is allowing the tiger mosquito, *Aedes albopictus*, a vector of both chikungunya and dengue fever, to survive in areas that were once too cold for it. This mosquito now thrives across southern Europe and even in France and Switzerland. All it takes is one infected traveler to bring the dengue virus home, where the bite of a resident tiger mosquito could transmit it to others.

The primary vector for dengue fever is *Aedes aegypti*, a daytime biter that is especially active during the early morning and late afternoon. (Unlike the *Anopheles* mosquito, which transmits malaria, it is not active at night.)

While dengue fever is not as serious a threat as malaria, which afflicts up to 500 million people and kills one million each year, both diseases have flourished since DDT, the pesticide that controlled mosquitoes more effectively and inexpensively than



ANDY MARTIN

any other, fell out of favor in the 1960s. Uncontrolled urbanization and its accompanying population growth, along with inadequate water management systems, have also played a role in the spread of dengue fever.

The Virus and Its Effects

Dengue fever is caused by any of four variants of a flavivirus, DEN-1, DEN-2, DEN-3 and DEN-4. Other flaviviruses cause West Nile, yellow fever and Japanese encephalitis. While infection by one of the dengue variants confers lifetime immunity to it, a person can still be infected by any of the other three.

The evidence strongly indicates that it is the second infection (though not the third and fourth) that can lead to a far more serious form, dengue hemorrhagic fever, in which the capillaries leak fluid. If not treated soon enough, the hemorrhagic form can result in a life-threatening loss of blood volume and death from dengue shock syndrome.

There is no vaccine for dengue fever and unlikely to be one anytime soon. In 2003, the Bill and Melinda Gates Foundation pledged \$55 million over six years to foster the development of a vaccine for dengue fever and stop its global spread. Vaccine trials are under way in several tropical areas, but approval of an effective vaccine is not expected for perhaps a decade.

The bite of an infected mosquito is followed by an incubation period of 3 to 14 days, most commonly 4 to 7 days, before symptoms might appear.

Many people experience only mild flu-like

symptoms, or none at all. In others, the characteristic symptoms of dengue fever are the sudden onset of high fever, a severe headache in the front of the head and excruciating pains in the joints and muscles — leading to its colloquial name of break-bone fever.

The fever typically resolves in three to five days, but in 1 percent of patients the disease progresses to the hemorrhagic form. Even if a first infection causes no or few symptoms, a second infection can increase the risk of the hemorrhagic form.

Since none of the known antiviral drugs are effective, treatment is symptomatic. Acetaminophen is given to reduce fever and pain. But all aspirin-like drugs, including ibuprofen, must be avoided because they can cause bleeding and make matters worse. As with other viral diseases, children with dengue fever who are given aspirin can develop Reye syndrome.

Patients should rest and drink lots of fluids. In most cases, symptoms resolve in a week or two. The disease is likely to have progressed to its more dangerous form if fever is followed by a low body temperature, severe abdominal pain, prolonged vomiting and mental changes like confusion, irritability and lethargy. Immediate hospitalization and intravenous fluids are then essential. Full recovery to a normal energy level can take months.

Prevention

Based on studies of military and relief workers, the Centers for Disease Control and Prevention estimates the risk to those who visit a dengue-endemic area as one illness per 1,000 travelers. This is likely to be an overestimate for ordinary travelers, most of whom stay only a few days in air-conditioned hotels with well-kept grounds.

Though many trips to Brazil this year were canceled during the epidemic in Rio, travelers do not need to avoid dengue-endemic areas if they are willing to take precautions to avoid mosquito bites.

The disease control agency recommends staying in well-screened or air-conditioned areas whenever possible (not a realistic option for sightseers and adventure travelers like me); wearing clothing that covers the entire body, including long sleeves and pants with tight cuffs; and covering exposed skin with insect repellent containing DEET at a concentration of 20 percent or 30 percent, applied three times a day. Though neither I nor my tripmates could tolerate full-body attire during Cambodia's humid, 90-plus-degree days, we all doused ourselves daily with repellent.

In very sunny places, sunscreen should be applied first, followed by the repellent. It also helps to spray clothing with a repellent.

Since the mosquito breeds in small amounts of fresh water, eliminating standing water in places like flower pots and old tires can reduce exposure to this dengue carrier.



START HERE

★ A BIKE TRIP THRU AFRICA

And for me, even after it.

Two weeks after I arrived home, I was stricken with a vicious fever of 104°, alternately sweating and freezing, and feeling what I could only describe as “pain in every molecule.” My doctor sent me to the Tropical and Infectious Diseases department at the Toronto General Hospital, and my wife Jackie dropped me off there, to spend four hours in their waiting area, delirious most of the time, shivering in my winter coat. I occasionally dozed off into hallucinatory, febrile dreams, between staggering off into the vast labyrinth of the hospital to submit bodily fluids to hidden laboratories. By that time, late in 1992, AIDS had long been a full-blown epidemic, and its victims were also treated in the Infectious Diseases department (though sadly, there *was* no real treatment then), and I sat in my feverish nightmare state watching cadaverous, doomed shadows come and go.

I had first suggested to the nurse that I might have caught malaria, and she agreed that seemed likely. The chief specialist of the department must have overheard her, for sometime during that phantasmagoric day, I heard a stern voice scolding her for daring to hand out a diagnosis. When I finally saw the specialist myself, he said I should come back the following day for the malaria test results.

The fever continued through that night, with bed-soaking sweats alternating with uncontrollable shivering, and I was back the next morning, sitting in the hard plastic chairs in my winter clothes, still delirious, hardly aware of time or place. The malaria test was negative, and I was sent to various labs around the hospital to have my bodily fluids analyzed some more, this time for the various strains of hepatitis. On the third day of my delirium, the chief specialist called me into his office and said they had tested me for the usual tropical diseases of malaria, yellow fever, hepatitis, typhoid, and cholera, but I didn't have any of those. When I asked what I *did* have, he said that people sometimes returned from Africa with mysterious fevers that were *never* identified. They either went away on their own, or, he smiled, “you die.”

And with those uncomfortable words, he sent me home.

That night the fever broke, I felt it clearly. Although my symptoms remained the same, I just *knew* it was over. I was soon feeling fine again,

and forgot all about the

“Fever,” as I had christened it

Several months later, I was at a residential studio, an old farmhouse in a rural area just outside Toronto, working with the band on what would become our *Counterparts* album. I began having some strange new symptoms: large, itchy red welts appearing on my arms and legs, sometimes in prominent egg-sized bumps, and I felt constantly tired, unwell, and generally allergic, with irregularities of color and frequency in the “plumbing” as well. Also, I seemed to have developed asthma for the first time in my life, and my doctor prescribed one of those ventilators. That alleviated the symptoms, but not the condition, and one cold winter day I was out in the park with our dog, Nicky, and suddenly I couldn’t breathe. Trying not to panic, drawing in slow, steady breaths, I walked slowly and carefully back home, back to the ventilator, and from then on I never went anywhere without it.

As the symptoms piled up and gradually worsened, I began to worry a little, but tended to put it down to the stress of working on the new record. I had suffered from strange stress-related symptoms before, from heart arrhythmia to toothaches to anxiety attacks, so I knew how insidious stress could be.

Along with working on lyrics and drum parts for the Rush album, I was also transcribing my notes and tapes from the Mali-Senegal-Gambia trip, and I paused when I encountered the quote from Schopenhauer I had recorded in the Gambia, “Every great pain, whether physical or spiritual, declares what we deserve; for it could not come to us if we did not deserve it” — not to forget my automatic editorial comment at the time (“~~There is a~~ ~~problem~~”). Wanting to know more about a so-called philosopher who could write such an evil thought, I walked out to the bookshelf in the living room of the old farmhouse, to an old set of encyclopedias. I pulled out the appropriate volume, and as I paged through looking for Schopenhauer, I came across an entry for “schistosomiasis,” and thought, “Hmm, I’ve heard of that.”

I read the description of the disease, and its symptoms: “skin rashes,

asthmatic episodes, malaise, urinary infection,” and suddenly the thunder rolled, the lightning flashed, and the penny dropped: “Ohmygod! — I *have* this!”

Other phrases leaped off the page and into my brain, “severe morbidity and mortality,” “chronic ill health,” “ultimately fatal,” and I immediately called the Tropical and Infectious Diseases department at the Toronto hospital, asking to speak to the big-shot doctor.

“Did you test me for schisto?”

“Hmm, let me check your file . . . Well, no, but I don’t think you have *that*.”

I don’t know why he felt so sure, as the World Health Organization listed schistosomiasis as the “second most prevalent tropical disease after malaria,” but I told him, “I am coming in tomorrow, and you are going to test me for it.”

Sure enough, that’s what I had picked up in my ill-advised float in the Bani River, a water-borne parasite that passed through the skin and into the bloodstream, spreading its infectious eggs through the internal organs, especially the liver (I flashed back to the doctor looking at my test results and remarking that my liver function was reduced, then giving me an accusatory look (“Any idea why *that* should be?,”) as if it were somehow my fault. He knew I was a musician, and perhaps presumed I was by definition a raging alcoholic).

Fortunately, though the disease was considered “ultimately fatal,” there was a cure, but it didn’t sound pleasant. Until the ’70s, the remedy had been a dose of *arsenic*, described as “nearly as dangerous as the disease.” The trick was to prescribe a dose strong enough to kill the schisto flukes, but not the host. The modern remedy was still a poison, but apparently more controllable, and consisted of about eight large capsules to be taken at once. And the doctor warned me, “Don’t plan anything for the day you take them — you won’t be feeling very well.”

And I was deathly ill for a couple of days, a rerun of the “Fever,” then the symptoms seemed to fade away. A few weeks later, I returned to the Tropical and Infectious Diseases department to be tested.

The doctor pronounced me cured, and when I remarked what a strange ordeal it had all been, he looked at me with his usual self-satisfied expression and said something I could hardly believe: "Well, at least we were able to catch it."

We?

I just looked at him for a beat, then said, "*We?* We didn't 'catch' anything! Remember, you told me I would either get better or *die*, then sent me *home*. It was pure luck that, four months later, I happened to look up Schopenhauer in the encyclopedia!"

He just gave me a withering look, and I shook my head, turned and walked out of his office, carrying away a newly diminished respect for him and his profession.

However, I had learned that even a bad philosopher could save your life.

TRAVELING MUSIC

The Soundtrack to My Life and Times

neil peart



How One Person Can Fuel an Epidemic

American Society for Microbiology

As SARS turns up around the world, scientists worry that some patients may be particularly efficient at spreading it.

By DONALD G. McNEIL Jr.
and LAWRENCE K. ALTMAN

A child in China so infectious that he is nicknamed "the poison emperor." A Chinese doctor who infects 12 fellow guests in his Hong Kong hotel, who then fly to Singapore, Vietnam and Canada. An elderly Canadian woman who infects three generations of her family.

Watching as the mysterious illness called severe acute respiratory syndrome hopped around the world and exploded in new outbreaks, epidemiologists began to ask themselves an unsettling question: is it

carried by "superspreaders"?

The notion that some people are hyper-infective, spewing germs out like teakettles while others simmer quietly like stew pots, has been around for at least a century, ever since Typhoid Mary became notorious in 1907 [Page 6].

For some diseases, including tuberculosis, smallpox and staphylococcus infections, superspreaders definitely exist. They have been variously called "superinfectors," "supershedders" and even "cloud cases" for the mist of invisible droplets trailing them.

But while there are anecdotal case studies of individuals behind some outbreaks, there is little concentrated research in the

field. "There hasn't been enough time, thinking and probing" to hazard more than a guess as to why superspreaders are responsible for so much of the spread of SARS, said Dr. Donald A. Henderson, the epidemiologist who led the global eradication of smallpox.

Dr. Joshua Lederberg, emeritus professor of microbiology at Rockefeller University and a Nobel laureate in medicine, said there were many hypotheses — for instance, that superspreaders are partly resistant to the disease they spread. But he added, "It's epidemiological conjecture."

As several experts pointed out, it is hard

Continued on Page 6

How Just One Person Can Fuel a Deadly Epidemic

Continued From First Science Page

to describe how a disease spreads when its cause has not even been nailed down; in the case of SARS, a coronavirus is still just a prime suspect. Moreover, no one knows the answers to basic questions about disease transmission — why, for example, AIDS is transmitted by blood but not by coughing, while tuberculosis is usually the opposite.

Several SARS patients have infected more than 30 people, according to the World Health Organization. The biggest reported superspreader is a 26-year-old airport worker admitted to Prince of Wales Hospital in Hong Kong in early March. He infected 112 people, including every doctor and nurse who treated him.

Doctors suspect the cause was a jet nebulizer that sprayed medicated mist deep into his phlegm-filled lungs four times a day for seven days. The mist expanded his lungs and was itself exhaled.

"You put someone with a viral infection in their lungs on a nebulizer — well, yeah, you're going to spread the disease," said Dr. Susan C. Baker, a professor of microbiology at Loyola University of Chicago. "The air that goes in has to come out."

That, experts said, is a good example of a leading theory about superspreaders — that their infective powers are not genetic, but are due simply to unhappy coincidences. They have shedding sores in the throat that make their coughs extra deadly. They have no symptoms and feel well enough to go out. They have an occupation like flight attendant, doctor or prostitute that involves close contact with many strangers. Or they get sick while in a group of people with low resistance.

In many outbreaks, said Dr. Jack M. Gwaltney Jr., an expert in the common cold at the University of Virginia, children are the spreaders.

Referring to a well-known study of a cold outbreak at the Eagle Heights Apartments in Madison, Wis., and to an early theory that the outbreak of more than 300 SARS cases in the Amoy Gardens apartment complex in Hong Kong was spread by cockroaches, he said: "Don't blame the cockroaches. In Wisconsin, it wasn't the cockroaches, it was the kids."

But neither children nor cockroaches are suspects at Amoy Gardens now. The leading theory is that leaking sewage contaminated sidewalk puddles. Residents walked through them, then took off their shoes and picked up the disease by touching their faces or eating with-

out washing their hands. Many viruses are shed in feces, famously including polio, which can spread to diaper-changing parents.

Whoever put SARS in the Amoy Gardens sewage pipes — and one regular visitor was a dialysis patient at the Prince of Wales Hospital while the airport worker was on the nebulizer — would be a superspreader, with the help of rusty pipes.

Some people become superspreaders because they contact many others in the hours before symptoms develop. A famous case of the superspreading of smallpox was described in 1913: a man who took two trains across England, and was said to have infected nearly 100 people en route. No one in his compart-

ment noticed any rash on his face.

Another theory is that some people have more contagious strains. Flu viruses mutating between animals and humans can become more or less infectious, said Dr. Megan Murray, a professor of epidemiology at the Harvard School of Public Health. The Norwalk virus, found on cruise ships, is highly infectious.

But in tuberculosis outbreaks, for example, what matters is not the strain but whether the carrier has a throat infection or, more commonly, lung cavities. The oxygenated bacteria grow faster, "so they cough up huge amounts," said Dr. James Plorde, an infectious disease expert with the University of Washington.

A famous tuberculosis super-

spreader, described in *The New England Journal of Medicine* in November 1999, was a 9-year-old boy in rural North Dakota, an immigrant from the Marshall Islands, who in 1997 and 1998 infected his family and 56 schoolmates. The boy had deep cavities in his lungs, while his twin brother, who was two inches taller and 11 pounds heavier, had a mild case and was not infectious.

Some populations are genetically more susceptible, so the first carrier to get it often becomes a superspreader. For example, Dr. Plorde said, "people of European descent handle TB much better than American Indians — presumably because their genetic stock survived more epidemics of TB."

Also, a second infection can turn someone with a mild primary illness into a superspreader.

In 1996, the journal *Annals of Internal Medicine* described an experiment conducted after an outbreak of antibiotic-resistant staphylococcus in a hospital's surgical intensive-care unit. Of 64 people tested, one medical student was found to have staph germs in his nose that matched those infecting eight patients. He had a mild cold during the week the patients were infected, he said.

Since he was healthy again, his dispersal of staph germs was tested, and was unremarkable. Then, with his permission, he was given another cold. Three days later, his sneezes were tested, and he was spraying out 40 times as much bacteria.

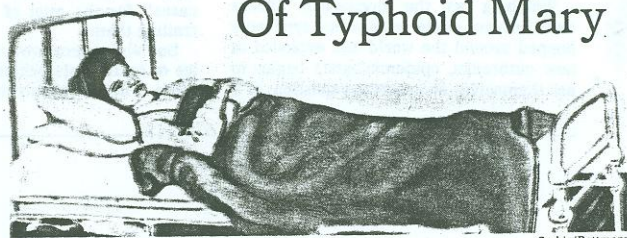
Secondary infections are thought to be part of the rapid spread of AIDS in Africa. The virus spreads much more rapidly in populations where untreated genital sores are common.

Gaetan Dugas, the gay airline attendant blamed for much of the early spread of AIDS in North America who was dubbed Patient Zero in Randy Shilts's book "And the Band Played On," would be considered a superspreader like Typhoid Mary because he willfully infected others. The book says he even taunted some men he had slept with by pointing to the sores on his arm and saying, "gay cancer — maybe you'll get it."

Mary Mallon, or Typhoid Mary, infected as many people as she did because she never got sick enough to stop working, and she refused to quit her chosen occupation: cook.

"If she'd been an epidemiologist or a reporter," observed Dr. James Curran, dean of Emory University's school of public health, "she wouldn't have been Typhoid Mary."

The Deadly Trails Of Typhoid Mary



Corbis/Bettmann

Mary Mallon, known as Typhoid Mary, in quarantine on an island in the East River, where she spent the last 23 years of her life. She died in 1938.

By DONALD G. McNEIL Jr.

History's most famous superspreader was Typhoid Mary, born Mary Mallon in Ireland in 1869 and a cook for wealthy New York families.

She was initially caught in 1906 when a sanitary engineer was hired to investigate six cases of typhoid fever in a banker's summer household in Oyster Bay, on Long Island.

He found that typhoid had struck seven of the last eight families Mary Mallon worked for.

The engineer confronted her in her next employer's kitchen and asked for blood, urine and stool samples; she swore she had never been sick and advanced on him with a carving fork. He called in the New York City health department; she threatened its doctor.

Finally, it took five police officers and a chase over backyard fences to subdue her and get her to a hospital. High levels of *Salmonella typhosa*

bacilli were found in a stool sample. She was quarantined in a cottage on the Riverside Hospital grounds on an island in the East River.

Her case — an apparently healthy woman held without a trial — became a cause célèbre. She sued for release, submitting to weekly stool tests; a private laboratory hired for her produced regular negative results as the city lab produced positive ones. She lost, but in 1910 a new health commissioner freed her on the promise that she would never again work as a cook.

Instead, she changed her name and disappeared. In 1915, after an outbreak of 25 cases in the Sloane Memorial Maternity Hospital, she was found working there as a cook under the name Mrs. Brown.

Quarantined again, she remained on the island for 23 years, though she did have human contact working in the hospital laboratory. She had a stroke in 1932, shortly after the discovery of penicillin, which would have cured her, and died in 1938.

SOUTHWEST

ARIZONA: JAILED FOR A TUBERCULOSIS VIOLATION A man was jailed for failing to take his tuberculosis medication after officials said he was a serious health risk. The man, James R. Pearson, 49, remained at the Pima County Jail on a tuberculosis violation, more than two weeks after the county health department petitioned to have him taken into custody. "He is now being held in isolation," said Deputy Dawn Hanke, a sheriff's department spokeswoman. "The court will decide when he will be released." Mr. Pearson is taking his medication while in custody, the authorities said. (AP)

The sudden appearance of an epidemic typically inspires rapt attention, panic and action. Once the crisis subsides, public attention wanes although the threat of contagion continues, especially among the world's poor.

Compare our response to severe acute respiratory syndrome, or SARS, with the more familiar germs that plague us daily. Compare it to the dangers of smoking or getting in a car and heading out on the road. Every life is precious, but when you look at the numbers, SARS just isn't as formidable a threat as we've made it out to be. Its death rate is far lower than that for AIDS or malaria; coronaviruses, like the one believed to cause SARS, tend to be most active in the winter and early spring.

In addition to taking the steps necessary to keep SARS at bay—watching out for new cases and isolating people who are contagious to others—we would do well to channel our energies into something more lasting: a permanent, integrated and accountable global public health system for the surveillance and prevention of the microbes that are certain to emerge in the future. Right now, worldwide accounting of disease is incomplete at best, hampered in large measure by sketchy reporting from developing countries. These gaps slowed our containment of SARS and allowed rumor to spread more rapidly than reliable information. When the facts are few, it's easy for fear to fill the vacuum.

Howard Markel, professor of pediatrics and communicable diseases at the University of Michigan, is author of the forthcoming "When Germs Travel."

THE EPIDEMIC SCORECARD

By Howard Markel and Stephen Doyle

Estimates of disease incidence and mortality are from the World Health Organization

2 MILLION DEATHS A YEAR
8 MILLION NEW CASES A YEAR, AND CLIMBING

ONE THIRD OF THE WORLD'S POPULATION IS INFECTED WITH

Tuberculosis

IN THE last hour, more than 200 people have died of tuberculosis

EACH YEAR 1 PERCENT of the WORLD BECOMES INFECTED with the TB GERM

INFECTIOUS DROPLETS TRANSMITTED BY
* BREATHING * COUGHING *
* SNEEZING * EVEN SPEAKING *

TO BE EFFECTIVE, TB DRUGS MUST BE TAKEN FOR SIX TO EIGHT MONTHS

DRUG-RESISTANT STRAINS ARE INCURABLE (AND MULTIPLYING)

MORE THAN 100 DEATHS AN HOUR

BORNE BY MOSQUITOES

Medicines exist to fight many strains of the malaria parasite, but public health workers are concerned about drug-resistant forms of the disease.

Prevention (mosquito control) is the most effective.

MALARIA

1 MILLION DEATHS A YEAR
300-500 MILLION NEW CASES A YEAR

1 MILLION DEATHS A YEAR / 10-30 MILLION NEW CASES A YEAR

HEPATITIS B VIRUS

puts you at high risk for cirrhosis, liver cancer, liver failure and death

TRANSMITTED VIA
• Mother to child at birth
• Unsafe injections or transfusions
• Sexual contact

No effective treatment.
Vaccine can block chronic infection, but its high cost prevents its widespread distribution in poor nations.

DIARRHEAL DISEASES

(cholera, shigella, dysentery, typhoid, E. coli and others)

1.9 MILLION DEATHS A YEAR
mostly infants and young children
2.7 BILLION NEW CASES A YEAR

Within the last hour, 200 people have died of these diseases

Transmitted by contaminated food or water

1.5 billion people do not have ready access to clean water

AIDS

3.1 MILLION DEATHS A YEAR
5.5 MILLION NEW CASES A YEAR
42 MILLION PEOPLE ARE H.I.V.-POSITIVE

IN THE LAST HOUR, MORE THAN 300 PEOPLE HAVE DIED OF AIDS

And...

Cardiovascular disease (heart attack and stroke) deaths: 17 million a year
Tobacco-related deaths: 3.5 million a year
Motor vehicle fatalities: 1.26 million a year

Measles

NEARLY 900,000 DEATHS A YEAR
30 MILLION NEW CASES A YEAR

ENTIRELY PREVENTABLE WITH A VACCINE THAT COSTS 26 CENTS AND HAS BEEN AVAILABLE SINCE 1963

mosquito-borne

Dengue Fever

24,000 DEATHS A YEAR
20 MILLION NEW CASES A YEAR

INFLUENZA

250,000 DEATHS A YEAR
3-5 million new cases a year

Entire world affected

YELLOW FEVER

30,000 DEATHS A YEAR
200,000 NEW CASES A YEAR

SARS

353 DEATHS out of 5,462 cases in 180 days