Three Sources of Antibiotics That Threaten Human Health

By Dr. Mercola
Antibiotic resistance is a serious threat facing all of us today, and there’s plenty of blame to go around. Overall, modern science, especially veterinary medicine, has done a miserable job when it comes to predicting the outcome of its actions.

According to Dr. Cyril Gay,¹ the senior national program leader at the United States Department of Agriculture’s (USDA) Agricultural Research Service: "The loss of antibiotics due to antimicrobial resistance is potentially one of the most important challenges the medical and animal-health communities will face in the 21st century."

Antibiotic resistance has also been declared "an increasingly serious threat to global public health that requires action across all government sectors and society" by the World Health Organization (WHO).²

Antibiotic overuse is rampant. Inappropriate use and negligent disposal of antibiotics is also a major part of the problem. Three of the primary sources of antibiotics entering the environment, the human food chain, and the human body are:

- Medicine
- Agriculture (both livestock and produce)
- Pharmaceutical processing plants dumping drugs into wastewater

Antibiotics are a foundational component of modern medicine, without which many of our current treatment modalities and medical procedures become exceedingly dangerous.

Due to overuse, bacteria are becoming increasingly resistant to these drugs, and even "simple" infections like urinary tract infections can become lethal. It’s also exceedingly costly.

What farmers are saving on the front end by using antibiotics instead of costlier alternatives, Americans pay for on the back end, via exorbitant health care costs. As noted by Scientific American:³

"[R]esearchers estimate that antibiotic resistance causes Americans upwards of $20 billion in additional healthcare costs every year stemming from the treatment of otherwise preventable infections."

Antibiotics in Agriculture

In the US, animals raised in confined animal feeding operations (CAFOs) are routinely fed low doses of antibiotics to make them grow fatter, faster, and to prevent disease associated with crowded and unsanitary living conditions.
This appears to be one of the primary driving factors when it comes to the development of antibiotic-resistant bacteria. According to CDC statistics, two million Americans are infected with antibiotic-resistant bacteria each year, and at least 23,000 of them die as a result of those infections.

A recent report commissioned by the British government, estimates that by the year 2050, drug-resistant disease cause more than 10 million deaths and cost the global economy $100 trillion!

Even the US Food and Drug Administration (FDA) acknowledges that antibiotic-resistant disease can be spread via ingestion or contact with contaminated foods. Despite this knowledge, the FDA has opted not to ban the use of antibiotics in agriculture.

Last year, the agency issued updated guidance on agricultural antibiotics, recommending that pharmaceutical companies voluntarily relabel certain antibiotics, reserving them for use in sick animals only, with a prescription from a licensed veterinarian. Aside from the fact that they're leaving it up to pharmaceutical companies to be the heralds of change—a change that will reduce the drug companies' income, there are other glaring loopholes. As noted by Scientific American: "Some worry that the FDA's action doesn't go far enough, given that farmers will still be able to administer antibiotics to their livestock for disease prevention. The fact that more and more livestock operations are switching over to Animal Feeding Operations (AFOs) whereby animals are confined in crowded enclosures (instead of allowed to graze at pasture) means that antibiotics will play an increasingly important role in disease prevention."

**US Meat Production Uses More Antibiotics Than Ever**

The US uses nearly 30 million pounds of antibiotics each year to raise food animals. This accounts for about 80 percent of all antibiotics used in the US. Moreover, according to the most recent FDA report, antibiotic usage INCREASED by 16 percent between 2009 and 2012, and nearly 70 percent of the antibiotics used are considered "medically important" for humans.

A 2013 paper by the Center for Science in the Public Interest (CSPI) titled "Antibiotic Resistance in Foodborne Pathogens," report that between 1973 and 2011, there were 55 antibiotic-resistant foodborne outbreaks in the US. More than half of these outbreaks involved pathogens resistant to five or more antibiotics! In my view, these are highly compelling reason to switch to organic, grass-fed (pastured) varieties, as growth promoting drugs such as antibiotics are not permitted in organic farming.
Antibiotic Resistance Promoted via Drug Manufacturing Process

Forbes Magazine\textsuperscript{14} recently featured an article on the topic of antibiotic resistance, noting that the drug manufacturing process itself may also be a major contributor to drug resistant bacteria in the environment. During the drug manufacturing process, significant quantities of antibiotics are flushed out into wastewater, which then find its way into rivers, drinking water, and agricultural crop lands. Many drug companies have located their manufacturing facilities in countries where production costs are low, such as China and India.

According to Forbes:
"Patancheru, near Hyderabad, India, has a treatment plant that receives wastewater from 90 pharmaceutical companies which discharge 400,000 gallons daily.\textsuperscript{15} This effluent from manufacturing is combined with domestic wastewater. In India, only 24 percent of domestic waste undergoes treatment.
Researchers from Sweden have studied the area around Hyderabad for a number of years, publishing a series of reports since 2007.\textsuperscript{16} They found a number of drugs contaminating the water, some in concentrations higher in the water than in patients' blood. The worst was pollutant was ciprofloxacin, with concentrations up to 31 mg/L and in only one day totaling "44 kg, which is equivalent to Sweden's entire consumption over 5 days, or, expressed in another manner, sufficient to treat everyone in a city with 44,000 inhabitants."

These researchers also found that the effluent was toxic to many organisms, and that it promoted resistance genes.\textsuperscript{17} Almost two percent of DNA samples from downstream sites sampled had resistance genes.\textsuperscript{18}[Emphasis mine]
Aside from direct ingestion, contaminated wastewater also finds its way onto crop fields via irrigation and sludge (biosolids) used as fertilizer. In this way, drug resistant genes are spread throughout the environment. The spread is by no means contained in any way. According to a 2008 CDC report,\textsuperscript{19} E.coli bacteria resistant to multiple drugs have even been found in the Arctic; brought there by migrating birds... How can we even begin to address these issues?
As noted by Forbes:
"Clearly, this will require a multi-pronged approach. Besides the need to control agricultural misuse, a major area that requires urgent attention is the need for improved sanitation globally..."

We also need better regulation of industrial waste and strengthening and enforcement of whatever environmental protections are available. Amy Pruden, Joikim Larsson, et. al. have an excellent overview\textsuperscript{20} of management options, ranging from wastewater and biosolid treatment, to limiting agricultural and aquacultural use, and the use of alternatives to antibiotics. One thing individuals can do is to educate about safe drug disposal..."
Researchers to Determine Role of Farm Practices in Rise of Superbugs

The farm industry has long denied or downplayed its role in drug-resistant disease, but scientists are now inching closer to determining exactly how the livestock industry's misuse of antibiotics contributes to human disease. As reported by Reuters:

"Researchers at Colorado State University are rolling out a series of projects to track antibiotic-resistant bacteria in the livestock industry, in an attempt to determine whether farm practices are fueling the rise of "superbugs." Using a $2.25 million grant from the US Department of Agriculture, the scientists will focus on the DNA of these bacteria to help identify and trace back where such organisms become drug-resistant. 'We're trying to answer the question, 'Are agricultural production systems truly affecting human health by increasing antimicrobial resistance?'' said veterinarian Paul Morley, a professor of epidemiology and infection control at Colorado State University, Fort Collins."

A recent Frontline News documentary also investigated the role of large scale meat production as a primary breeding ground of drug-resistant bacteria. According to their investigation, meat may be a source of potentially lethal infections—not simply because you're eating antibiotics and therefore building resistance, but also because the meat may be tainted with drug-resistant bacteria that can cause acute disease if the meat is improperly handled or undercooked. Previous research has suggested you have a 50/50 chance of buying meat tainted with drug-resistant bacteria when shopping at your local grocery store.

One example given is drug-resistant urinary infections, which are on the rise. If the antibiotics fail to wipe out the bacteria, the infection can progress to your kidneys, which allows the bacteria access to your blood. The result is sepsis, which kills 40,000 Americans each year. Using state of the art genome sequencing, researchers have compared E.coli samples found on supermarket meat with E.coli samples collected from patients with drug-resistant urinary tract infections, genetically linking more than 100 urinary tract infections to tainted supermarket meat products.

Why Were Warnings Not Heeded Decades Ago?

As reported by The Atlantic, we had foreknowledge that using antibiotics for growth promotion in animals was a bad idea, but industry interests won over concern for human and environmental welfare:

"Dr. Stuart B. Levy... author of the book The Antibiotic Paradox: How the Misuse of Antibiotics Destroys Their Curative Powers... has been warning about this impending disaster for nearly 40 years, a couple of decades after farmers discovered that putting small amounts of antibiotics in the animals' feed resulted in increased growth. Even back then, a study led by Levy found that chickens developed resistance to the antibiotic tetracycline at a rapid pace–within a week, the animals had resistant bacteria in their gut.

Months later, the stubborn bugs had spread to untreated chickens and even the farmers. And it didn't stop there: Those resistant bacteria also became resistant to other antibiotics that the chickens hadn't even consumed. 'Antibiotics used anywhere creates
antibiotic resistance, and that resistance doesn't stay in that environment,' Levy says. And resistance is transferrable among bacteria of different types."

**Antibiotics Also Contribute to Obesity**

While antibiotic-resistant disease is perhaps the most acute danger of antibiotic overuse, it also has more insidious and hard to prove consequences on human health. We now know that antibiotics alter the microbiome—the microbial composition in your gut—which can result in obesity and any number of other health problems. It's also worth recalling that antibiotics are used in livestock to promote weight gain.

As previously stated by the Ontario Ministry of Agriculture and Food: "Continuous, low-dose administration of an antibiotic can increase the rate and efficiency of weight gain in healthy livestock. The presence of antibiotics likely changes the composition of the gut flora to favor growth. Debate is ongoing as to how gut flora are changed; change may simply be a reduction in numbers, a change in species composition or a combination of the two... Some antibiotics may also enhance feed consumption and growth by stimulating metabolic processes within the animal."

If low dose antibiotics make animals fatter, why would we assume the effect on humans would be any different? A recent paper in the *New England Journal of Medicine,* authored by Dr. Tine Jess, MD discusses the scientific evidence linking antibiotics and obesity. For example, mice exposed to subtherapeutic doses of antibiotics early in life suffered "lasting effects on body composition owing to alteration of the intestinal microbiota." Studies suggest there may be a critical window of time, right before and after birth, when exposure to antibiotics can cause long-term alterations in body composition.

According to Dr. Jess:

"Male mice whose mothers were treated with penicillin before the birth of the pups and throughout the weaning process had a markedly altered body composition in adulthood, with increased total mass and fat mass, increased ectopic fat deposition, increased hepatic expression of genes involved in adipogenesis, decreased bone mineral content, and increased bone area.

By contrast, the body composition of adult male mice who had received penicillin after weaning and of female mice who had received penicillin at either phase of development (just before birth or after weaning) was more similar to that of controls. The results suggest that even transient changes to the microbiota caused by limited exposure to low-dose penicillin during a specific time window during development may have a sex-specific long-term effect on body composition."
Your Gut Bacteria and Your Waistline Go Hand-in-Hand

One 2011 study\textsuperscript{27} shed light on the mechanisms by which antibiotics can promote obesity. It found that 18 months after antibiotics are used to eradicate \textit{H. pylori} bacteria, there is a:

- Six-fold increase in the release of ghrelin (the "hunger hormone") after a meal
- 20 percent increase in leptin levels (leptin is a hormone produced by fat tissue)
- 5 percent increase in body mass index (BMI)

Levels of ghrelin should ordinarily \textit{fall} after a meal to signal your brain that you're full and ready to stop eating; an increase would therefore essentially tell your brain to continue eating, leading to weight gain. Further, the increase in leptin levels is concerning because overexposure to high levels of the hormone can lead to leptin resistance, which means your body is unable to properly hear leptin's signals. The way your body stores fat is a highly regulated process that is controlled, primarily, by leptin. If you gain excess weight, the additional fat produces extra leptin that should alert your brain that your body is storing too much fat and needs to burn off the excess. To do this, signals are sent to your brain to stop being hungry and to stop eating. When you become leptin-resistant, your body can no longer hear these messages -- so it remains hungry and stores more fat. You can also easily become leptin resistant by eating the typical American diet full of refined sugar (particularly processed fructose), refined grains, and processed foods—which, like antibiotics, will upset the balance of bacteria in your gut. Multiple studies have shown that obese people have different intestinal bacteria than slim people, and that altering the microbial balance in your gut can influence your weight. Such research includes but is not limited to the following:

Research by Dr. Martin Blaser found that mice fed antibiotics (in dosages similar to those given to children for throat or ear infections) had significant increases in body fat despite their diets remaining unchanged.\textsuperscript{28}

One 2011 study\textsuperscript{29} showed that rats given lactic acid bacteria while in utero through adulthood put on significantly less weight than other rats eating the same high-calorie diet. They also had lower levels of minor inflammation, which has been associated with obesity.

Babies with high numbers of \textit{Bifidobacteria} and low numbers of \textit{Staphylococcus aureus} – which may cause low-grade inflammation in your body, contributing to obesity – appeared to be protected from excess weight gain in a 2008 study.\textsuperscript{30} This may be one reason why breast-fed babies have a lower risk of obesity, as \textit{Bifidobacteria} flourish in the guts of breast-fed babies.
Two studies found that obese individuals had about 20 percent more of a family of bacteria known as *Firmicutes*, and almost 90 percent less of a bacteria called *Bacteroidetes* than lean people. *Firmicutes* help your body to extract calories from complex sugars and deposit those calories in fat. When these microbes were transplanted into normal-weight mice, those mice started to gain twice as much fat.

In 2010, researchers found that obese people were able to reduce their abdominal fat by nearly five percent, and their subcutaneous fat by over three percent, just by drinking a probiotic-rich fermented milk beverage for 12 weeks.

Probiotics (good bacteria) have been found to benefit metabolic syndrome, which often goes hand-in-hand with obesity.

Probiotics may also be beneficial in helping women lose weight after childbirth when taken from the first trimester through breastfeeding.

**Essential Oils Might Be the New Antibiotics**

Fortunately, some farmers and scientists have started investigating various plant extracts, hoping to find alternatives to antibiotic drugs. Essential oils have antimicrobial, antibacterial, and antifungal properties, rendering them useful in various areas of food production. A recent article in The Atlantic discusses the experimental use of essential oils to combat disease and pests. Mounting research also suggests they may be potent enough to address diseases like cancer.

According to The Atlantic:

"Numerous recent studies—including several done by the USDA—have shown great promise in using essential oils as an alternative to antibiotics in livestock. One of their studies, published in October 2014 in the journal Poultry Science, found that chickens who consumed feed with added oregano oil had a 59 percent lower mortality rate due to ascites, a common infection in poultry, than untreated chickens. Other research, from a 2011 issue of BMC Proceedings, showed that adding a combination of plant extracts—from oregano, cinnamon, and chili peppers—actually changed the gene expression of treated chickens, resulting in weight gain as well as protection against an injected intestinal infection. A 2010 study from Poultry Science produced similar findings with the use of extracts from turmeric, chili pepper, and shiitake mushrooms."
Scientists have also compared the effectiveness of antibiotics versus various essential oils. Rosemary and oregano oil, for example, resulted in the same growth rate in chickens as the antibiotic avilamycin. The oils were effective against pathogenic bacteria as well. Essential oil blends have also been found effective against salmonella in chickens. According to Dr. Charles Hofacre, a professor at the University of Georgia’s College of Veterinary Medicine, "There is some strong evidence that [essential oils] are functioning by both an antibacterial action in the intestine and also some have an effect to stimulate the intestinal cells ability to recover from disease more quickly–either by local immunity or helping keep the intestinal cells themselves healthier.”

In humans, a combination of thyme and clove essentials oils was found to be as effective against bacterial vaginosis as standard antibiotic treatments. Researchers have also successfully treated staph infection with tea tree oil vapors. An added boon: Essential oils appear to be less likely to cause resistance, for the fact that they contain hundreds of different chemical compounds, which makes bacterial adaptation more difficult.

**Healthy Gut Bacteria Cannot Coexist with Antibiotics**

Antibiotics can save your life if you develop a serious bacterial infection, but it's important that you resist the urge to ask your physician for a prescription for every infection you come down with, especially viral infections such as the common cold and influenza. Antibiotics are useless against viral infections. Remember that whenever you use an antibiotic, or if you're frequently eating treated animal foods, you're:

a. Decimating your microbiome, which will need time and proper diet and/or a probiotic supplement to restore rebalance. An unbalanced microbiome can contribute to both obesity and disease

b. Increasing your susceptibility to developing infections with resistance to that antibiotic -- and you can become the carrier of this resistant bug and even spread it to others

It's quite clear that the foods you eat are a major source of chronic low-dose exposure to antibiotics, so to protect your gut bacteria you need to buy antibiotic-free, organically raised meat and, yes, even produce. Conventionally farmed vegetables are often grown in fertilizer derived from factory-farmed animal waste and sewage sludge, which is yet another source of antibiotic-resistant bacteria.

My bottom-line recommendation is to take decisive action for yourself and your own family, and seek out trusted sources of food that do not use antibiotic pesticides and/or antibiotic growth promoters. Your best bet for finding healthy food is to connect with a local farmer that raises animals according to organic standards, allowing them to roam freely on pasture. Some grocery chains also offer 100% grass-fed meats these days. In the US, the following organizations can help you locate farm-fresh foods:
Weston Price Foundation has local chapters in most states, and many of them are connected with buying clubs in which you can easily purchase organic foods, including grass-fed raw dairy products like milk and butter.

Local Harvest -- This Web site will help you find farmers' markets, family farms, and other sources of sustainably grown food in your area where you can buy produce, grass-fed meats, and many other goodies.

Farmers' Markets -- A national listing of farmers' markets.

Eat Well Guide: Wholesome Food from Healthy Animals -- The Eat Well Guide is a free online directory of sustainably raised meat, poultry, dairy, and eggs from farms, stores, restaurants, inns, and hotels, and online outlets in the United States and Canada.

Community Involved in Sustaining Agriculture (CISA) -- CISA is dedicated to sustaining agriculture and promoting the products of small farms.

FoodRoutes -- The FoodRoutes "Find Good Food" map can help you connect with local farmers to find the freshest, tastiest food possible. On their interactive map, you can find a listing for local farmers, CSAs, and markets near you.