Antibiotic Factsheet Primary source material: Lemonick, Micheal D. (1994) The killers all around: new viruses and drug-resistant bacteria are reversing human victories over infectious disease. ©1994 Time Inc. Supplemental material from Brody, Jane New York Times. (Late Edition (East Coast)). New York, N.Y.: Jun 20, 2000, Brain, Marshall " How the immune system works" http://ibs.howstuffworks.com ©1998-2004 HSM, Inc

Before penicillin and other antibiotics were developed in the 1940s, there were few effective treatments for bacterial infections such as typhoid, gangrene, tuberculosis, or syphilis: either the immune system fought them off or the patient died. Antibiotics have been so effective that these "wonder drugs" represent a major revolution in the improvement of health care. *Antibiotics are natural chemicals extracted from a variety of harmless bacterial and fungal species.* They work by *interrupting the cellular processes* of a pathogen. For instance, many antibiotics interrupt the machinery inside bacterial cells that build the cell wall. Because human cells do not contain this machinery they are unaffected. Different antibiotics work on different parts of bacterial machinery, so each one is more or less effective on specific types of bacteria. *Because a virus is not alive, antibiotics have no effect on them.* Antibiotics work on bacteria, fungi, and parasites (Brain 2004).

Antibiotic Resistance Antibiotics lose effectiveness over time because bacterial populations can *evolve*. New traits arise in a species due to random mutations in the DNA. Usually a trait will be either useless or debilitating, but once in a while it will confer a survival advantage, allowing the individual to live longer and bear more offspring. When you take antibiotics you will kill the vast majority of the bacteria. But one or two may contain a mutation that allows it to withstand the effects of the treatment. This bacterium will then *reproduce and its offspring will come to dominate the population in the body because it has a survival advantage.* Eventually this new strain is infecting everyone and the old antibiotic is no longer effective. This is called antibiotic resistance. *It is important to note that you can contract an antibiotic-resistant strain of bacteria, and die from this infection, even if you personally have never taken an antibiotic in your life.* Just a year or two after penicillin went into widespread use, the first resistant strain of *Staphlococcus sp.* appeared. *By now nearly every disease organism known to medicine has become resistant to at least one antibiotic, and several are* resistant *to more than one.* Staph, strep, and tuberculosis infections have become deadly again.

Why is it that antibiotic resistance can happen so quickly? 1) Life cycle: Bacteria reproduce asexually by simple cell division, *and a new generation comes along as often as every 20 minutes.* That speeds up the evolutionary process considerably. 2) Ecology**: Antibiotics *wipe out harmless bacteria* in your body. The resistant microbes that would ordinarily have to fight other species for space and nourishment suddenly find the way clear to multiply and become dominant. 3) H**uman behaviors**: *not taking the full course or demanding antibiotics for viral infections* weeds out the weaker, susceptible bacteria and promotes the growth of stronger, more resistant bacteria. 4) Economics: farmers mix low doses of antibiotics into cattle feed to make the animals grow larger. Bacteria in the cattle become resistant to the drugs, and when people drink milk or eat meat, this *resistance may be transferred* to human bacteria (Lemonick 1994). Even more pervasive are the more than 700 *"antibacterial" products now crowding the marketplace which leave a false sense of security* while sparing the bacteria that are strong enough to survive and multiply (Brody 2000). 5) Genetics: perhaps most importantly, bacteria often** *swap bits of DNA with other bacteria:* **this versatility *means bacteria can acquire useful traits without having to wait for mutations* in the immediate family. Thus, the mildly resistant but harmless bacteria we select for by using antibiotics can donate their resistant DNA to dangerous bacteria such as strep or staph.**