

in fact, developing resistance to the incredible quantities of antibiotics we are pouring into the ecosystem, and they are doing so in ways that show they are highly intelligent and adaptable.

HOW BACTERIA DEVELOP RESISTANCE

When we are born we are sterile; there are *no* bacteria on or in our bodies. Normally the first thing that happens after birth is that we are placed on our mother's stomach and we begin to nurse. At this moment our skin begins to be colonized with human-friendly bacteria from our mother's body, and our intestinal tract begins to be colonized from bacteria from our mother's milk.

Eventually, 1 to 2 pounds ($\frac{1}{2}$ to 1 kg) of our mature body weight will be the billions of bacteria that live in healthy symbiosis in and on our bodies. Many of these bacteria produce essential nutrients that we could not live without. Even more striking, researchers are discovering that many of these friendly bacteria actually fight off more dangerous bacteria in order to keep us healthy. Babies removed from their mothers before this healthy colonization can take place (usually in hospitals) are often colonized with bacteria that are anything but friendly to human beings. Eventually, there are literally billions of bacteria on and in our bodies at any one time. Most of these bacteria are friendly to us; a few are not. These unfriendly or pathogenic bacteria usually remain in small numbers and, in general, do us no harm.

But when we become ill, the ecological balance in our body is disturbed, and some of the friendly bacteria are displaced enough to allow pathogenic bacteria to gain a toehold. As our body tries to throw off the infection we show classic symptoms of disease, such as fever, chills, vomiting, or diarrhea. In some cases we then go to a doctor and are given

antibiotics to kill the disease organisms. However, there is not just one kind of that particular disease bacterium in our bodies; there are many, a few of which are naturally immune or resistant to antibiotics. Generally, these few resistant bacteria are in competition with their nonresistant cousins (and all the other helpful bacteria) for living space in

Antibiotic usage has stimulated evolutionary changes that are unparalleled in recorded biologic history.

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