

And not only do the bacteria, those naturally immune and those mutating, survive the antibiotics, many also seem to get stronger so that the diseases they cause are more severe and generate greater mortality than those they produced before. We have been, in fact, creating what *The New York Times* is now calling bacterial superbugs. But as incredible as this capacity for literally engineering responses to antibiotics and passing it on to their offspring is, bacteria do something else that makes them even more amazing and dangerous. They communicate intelligently with each other. It has taken scientists a long time to discover this. We were raised to believe that bacteria are pretty dumb, but it is turning out that the other life-forms with which we share this planet are much smarter than we gave them credit for. And bacteria are turning out to be very smart indeed.

### *Communicating Resistance*

Bacteria are single-cell organisms containing, among other things, special loops of their DNA called plasmids. Whenever two bacteria meet — and they do not have to be the same kind of bacteria — they position themselves alongside each other and exchange information. Bacteria, in fact, possess a kind of biological Internet, and these information exchanges occur with great frequency. Unfortunately for us, one of the types of information they exchange is antibiotic resistance.

During an information exchange, a resistant bacterium extrudes a filament of itself, a plasmid, to the nonresistant bacterium, which opens a door in its cell wall. Within the filament is a copy of a portion of the resistant bacterium's DNA. Specifically, it contains the encoded information on resistance to one or more antibiotics. This DNA copy is now a part of the new bacterium; it is now resistant to all the antibiotics the first bacterium was resistant to. It can pass this resistance on to its offspring or to any other bacteria it meets. This communicated resistance can be a natural immunity, information on how to disable or destroy a particular antibiotic or antibiotics, or information on how to prevent the antibiotic from having an effect. And bacteria that have never been known to communicate — gram-negative and gram-positive bacteria, aerobic and nonaerobic bacteria, for instance — have seemingly learned the art. Bacteria are in fact intelligently communicating to each other