Useful Bacteria

By Robert S. Boyd, INQUIRER WASHINGTON BUREAU

WASHINGTON — The time has come to put in a good word for bacteria, which have been getting a bad rap lately. These invisible bugs - the oldest and simplest living creatures - are blamed, properly, for everything from children's ear infections to leprosy and the plague. But now, thanks to the increasing pace of discoveries in biology and genetics, scientists are finding lots of useful jobs for bacteria to do. So small that 3 million could line up along a yardstick, microorganisms are being put to work mining gold, cleaning up toxic wastes, protecting crops, removing stains and manufacturing drugs, fuels and biodegradable diapers.

What would happen if there were no bacteria?

* Without bacteria in their stomachs, cows couldn't change grass into milk and steak.
* Without bacteria, there would be no oil or gas, no cheese or yogurt, no pickles or sauerkraut.
* Without bacteria to recycle dead animals and plants, scientists say life on Earth would cease within a few weeks.
* For most of us, the word bacteria raises specters of plague, cholera, tuberculosis, leprosy, diphtheria and other dreaded ills, a Nobel Prize- winning biologist, Christian de Duve, wrote in a new book on the origin of life.

However, disease-causing microbes are only a small minority among a wide diversity of harmless or useful forms, which occupy almost every possible kind of habitat, from the balmy shelter of the human gut to the brine of drying seas and the boiling waters of volcanic springs.

Relatively crude, one-celled blobs of matter, lacking a proper nucleus, bacteria consist of bits of DNA and protoplasm encased in rubbery shells. The complete DNA, or genetic code, of a single bacterium - one that causes ear infections - was deciphered for the first time in the past decade. Bacteria were formed almost 4 billion years ago, when the Earth was barely half a billion years old. They had the planet to themselves for the next 2 billion years and are the common ancestor of all plants and animals alive today. Even now, bacteria make up half the living matter in the world, and new variants form constantly. "We don't know what 98 percent of these microorganisms are," said Julius Jackson, director of the Division of Molecular and Cellular Biosciences at the National Science Foundation. "We don't know what they can do."

Here are some of the helpful tasks bacteria perform:

* CLEANUP CREW. Waste-gobbling bacteria feed happily on chemicals polluting the soil or water. They break down toxic compounds, such as pesticides and PCBs, leaving water, carbon dioxide and other harmless products. They make possible flushless toilets for vacation homes and campsites. They turned smelly sewage of Palm Beach County, Fla., into odorless compost. They wiped oil off Alaskan beaches after the Exxon Valdez disaster. They scrubbed the bilges of the Queen Mary in Long Beach harbor.
* FACTORY WORKERS. Mixed with chemicals in huge vats, bacteria help manufacture biodegradable plastic cups, shampoo bottles and diaper liners. They turn wood fibers into threads thinner and stronger than spider silk. They make thin films out of cellulose to cover burns. They are getting into the energy business - producing ethanol from corn and trees, removing sulfur from coal and crude oil, splitting water into hydrogen and oxygen.
* FARM HANDS. For most of this century, farmers have been adding bacteria known as rhizobia to fields of legumes - such as peas, beans, alfalfa and clover - because of the microbes' ability to take nitrogen out of the air and ''fix" it to the roots of the plants. "No life on Earth would exist without nitrogen fixation," Jackson said. Bacteria that fix nitrogen increase crop yields and replace environmentally harmful fertilizers.
* MINERS. They don't wear hard hats, but some kinds of bacteria are busy mining gold, uranium and copper. These microbes feast on sulfur and iron compounds that prevent the recovery of precious minerals from low-grade ores. The ore is crushed, a bacterial soup is added, and eventually the gold is extracted.
* HEALTH WORKERS. As well as causing disease, microbes are major suppliers of drugs to treat sickness. E. coli bacteria are notorious for their role in sometimes fatal intestinal infections. But E. coli also serve as factories to make insulin, a life-saving medicine for diabetics. The streptomyces bacteria churn out streptomycin, aureomycin, actinomycin and other antibiotics of the mycin family.

Advanced Microbiology Name

Useful Bacteria Date/Hour

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