antibiotics (see box below). Comparison figures for the United States are hard to come by, but probably no more than 10% of pneumococci are penicillin-resistant, except in rare outbreaks.

In another resistance area—multi-drug resistant tuberculosis—Europe seems to be faring much better than the United States—at least for now. In some areas of the United States, especially large cities, isolates of *M. tuberculosis* that are resistant to both isoniazid and rifampicin, the two major drugs for treating TB, are becoming common. For example, almost 20% of the isolates tested in New York City in 1992 were resistant to both drugs, according to data compiled by the World Health Organization. But isolates resistant to two or more drugs are still rare in England and Wales, constituting only 0.6% of all isolates made there between 1982 and 1991. Says Tony Jenkins, microbiologist at the Mycobacterium Reference Unit of the Cardiff Regional Public Health Labor Laboratory: "Without wishing to sound blasé, I can't see drug-resistant tuberculosis as being a threat in England and Wales at the moment."

He attributes the success in controlling the problem here to the ongoing tuberculosis control program, which includes tracing the contacts of infected individuals and well-trained physicians who continue to have a good understanding of how to treat the disease. "We were fortunate in that, unlike the United States, we did not dismantle our TB services. And we don't have the same inner-city problems on the same scale as in some cities in the U.S., where high levels of drug abuse, alcohol problems, and homelessness lead people not to take their drugs or to take them inadequately. These are the breeding grounds for drug resistance." Indeed, the importance of public health measures in controlling tuberculosis is underscored by recent findings that the number of new cases in New York City dropped last year by 15%, the first major decrease there since the late 1970s. A major factor in the decline, according to city health officials, was their stepped-up efforts to identify patients and ensure that they take their medicine.

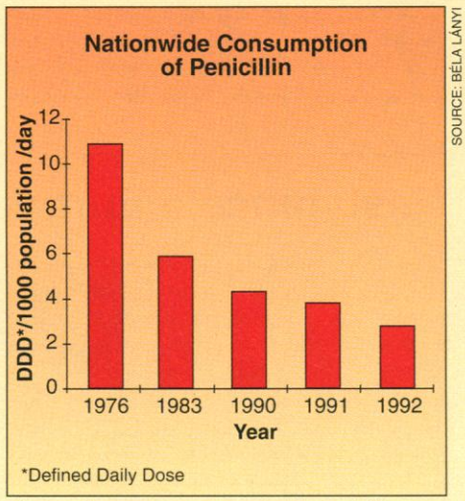
Rates of multi-drug resistant tuberculosis are similarly low in France, where only 0.5% of isolates were resistant to both isoniazid

Hungary Sees an Improvement in Penicillin Resistance

Childbirth is a gamble with death. Dental surgery, potentially disabling. Even a facial boil can end in a trip to the morgue. Such is the forecast of the postantibiotic era, an era in which antibiotics are powerless against the new drug-resistant strains of bacteria.

Sound fanciful? Maybe not: Take a look at what was happening in Hungary in the 1980s. At the time, the country was highly dependent on penicillin for treating infections. So when bacteria such as pneumococcus, a frequent cause of ear and sinus infections in children, became resistant to the antibiotic, Hungarian physicians all too often saw these simple infections turn into life-threatening pneumonia, or, in rare instances, even meningitis.

But Hungary provides a ray of hope as well as a preview of medicine without effective antibiotics. In a surprise turnabout, by 1992 the levels of penicillin-resistant pneumococcus infections had fallen from a high of 50% to 34%. Still not good—for comparison, although there is little surveillance data, in the United States the incidence of penicillin-resistant pneumococcus is thought rarely to exceed 5%—but a shift in the right direction nonetheless.



SOURCE: BÉLA LÁNYI

Down, down, down. Faced with penicillin-resistant pneumococcus, Hungary's penicillin use fell.

The decrease may have been partly caused by what Anna Marton, a microbiologist at the Heim Pál Children's Hospital in Budapest, describes as a "sharp reduction" in penicillin use as Hungarian physicians became aware of the resistance problem and switched to other antibiotics, thereby relieving the selective pressure that drove the development of the penicillin-resistant strains. And that, says Stuart Levy of Tufts University School of Medicine, who in 1981 cofounded an international organization, the Alliance for the Prudent Use of Antibiotics, is "very exciting. It offers hope that the more careful use of antibiotics can turn the tide. We've seen it before in hospitals, but we've never seen it across a country. If we can get it down to 5 or 10%, we're in great shape." Levy cautions, however, that the link between falling penicillin use and the reduction in resistance to the antibiotic must be confirmed.

The eventual discovery of the changing fortunes of penicillin depended, in part, on Hungary's remarkably sophisticated surveillance system for antibiotic resistance. Since 1974, the country's National Institute of Public Health in Budapest has collated data on bacterial resistance to upwards of 20 different drugs from 23 microbiological laboratories in all 19 counties. "Hungary has a beautiful surveillance system. It's really unique," says Alexander Tomasz of Rockefeller University, an expert on antibiotic resistance.

Yet the surveillance data, which has been published annually for the past 20 years, did little to avert the crisis in penicillin resistance. Indeed, says Marton, during the 1980s, Hungarians used even more penicillin—and more antibiotics generally—per capita than people from Spain, a country that is infamous for its high antibiotic consumption. Consumption was high, says Béla Lányi of the National Institute of Hygiene, who set up the nationwide surveillance system, because penicillin was cheap and patients demanded it.

But by the late-1980s physicians began to change their prescribing practices because of what was happening in the clinic. By that time, says Marton, "penicillin was useless" against most common sinus and ear infections. A simple sinus infection in a child, for example, would develop into a very long and painful illness.

To avoid more such clinical failures Hungary's pediatricians are now relying more heavily on other antibiotics such as the non-*beta*-lactam antibiotics, a trend that might be behind the recent decline in penicillin resistance. And to prevent the new antibiotics' clinical effectiveness going the same way as penicillin's, organizations like Hungary's Society of Infectious Diseases and the Society of Chemotherapy are attempting to educate physicians about the perils of overusing antibiotics.

Lányi predicts that the drive to prevent the misuse of the new antibiotics should be more successful than the drive to stop penicillin abuse. "The new antibiotics are more expensive," he explains.

–Rachel Nowak