Can dental fillings create drug resistance?

Numerous reports have proclaimed the safety of "silver" tooth fillings, which are made from a mix of silver, tin, copper, zinc, and mercury. Yet questions about the safety of this type of dental amalgam persist. A controversial new study now suggests that the mercury-laden fillings may play a role in the spread of drug-resistant bacteria.

For years, microbiologist Anne O. Summers had noticed that many people have a large number of intestinal bacteria resistant to the poisonous effects of mercury, a metal that is liquid at room temperature. Dental amalgam is, of course, a solid material.

However, the mercury in that amalgam can vaporize when people chew their food or brush their teeth. The end result is that mercury gets into saliva and is swallowed. Summers, who works at the University of Georgia in Athens, wondered if the mercury released by dental fillings somehow conferred drug resistance on certain bacteria.

To find out, Summers and her colleagues took a look at 356 people who had not taken antibiotics within the previous two weeks. The team examined fecal samples that contain bacteria that live in the human intestine. The team discovered a high prevalence of mercury-resistant intestinal bugs in those samples. These same microbes also shrugged off the killing effects of several antibiotics.

That finding spurred another experiment, this one with six adult monkeys. To do the primate study, the U.S. group teamed up with Canadian researchers Murray J. Vimy and Fritz L. Lorscheider at the University of Calgary in Alberta. Vimy and Lorscheider have published extensively on the health effects of silver dental amalgam.

The researchers first obtained a baseline count of the bacteria living in each monkey's mouth and intestinal tract. Later, the team put the monkeys to sleep with a general anesthetic, then drilled each primate's teeth and packed them with silver dental amalgam.

Within two weeks, the team found a "statistically significant" increase in the number of mercury-resistant mouth and intestinal bacteria. More important, nearly all the mercury-impervious strains also proved resistant to several common antibiotics, including ampicillin.

The researchers then took four of the six monkeys and removed the silver fillings, replacing them with another type of dental amalgam that did not contain mercury. In some bacterial colonies, the proportion of mercury- and antibiotic-resistant bacteria dropped off during the next two months. The U.S. and Canadian researchers report their data in the April ANTIMICROBIAL AGENTS AND CHEMOTHERAPY.

The genes that allow bacteria to fight off mercury's toxic effects lie on the same stretch of DNA as the genes that confer resistance to antibiotics, Summers notes. She believes that once a microbe gets exposed to mercury, it is primed to resist antibiotic therapy as well.

Summers says mercury-containing fillings may be responsible in part for what many believe is an increase in bacterial drug resistance. Antibiotics are still the physician's main weapon in the fight against many infections, she says.

"There's more than reasonable doubt about the safety of this material," Vimy adds.

The American Dental Association (ADA) disagrees. The data in the new paper fail to support the conclusion that humans may suffer antibiotic resistance due to the mercury in their dental fillings, asserts Terence E. Donovan, a researcher at the University of Southern California in Los Angeles. Donovan, speaking for the ADA, says Summers and her co-workers present no proof that mercury-based amalgam contributes to drug-resistant infections in humans.

"From the public's point of view, silver amalgam is the safest material we can use," he adds. —*K.A. Fackelmann*

Taxol-making fungus found

Thirty years ago, scientists discovered a fungus that produced a complicated growth-stimulating compound also made by its host plant. So plant biologist Gary Strobel from Montana State University in Bozeman decided to look for a yew-tree fungus that might make the promising anticancer compound taxol.

Montana State organic chemist Andrea Stierle and her husband, Donald Stierle, collected bark from 25 Pacific yews found in 20 places in Montana. The researchers grew fungi from the bark and extracted and analyzed the compounds each fungus produced.

Of 200 organisms surveyed, one, which they named *Taxomyces andreanae,* makes taxol and a related molecule in small amounts, they report in the April 9 SCIENCE.

This fungus comes from the pinkish inner bark of a yew found in an old-growth cedar forest, says Strobel. Its taxol kills cancer cells just as the yew's taxol does, he adds. He is confident that genetic manipulation and culturing techniques can increase the yield significantly.

More important, the discovery may prompt more scientists to consider fungi in their search for useful compounds, he adds. □

Prospecting for seeping, buried oil wells

What do you do when you can see the effects of crude oil spilling from buried wells but haven't a clue as to their locations? That's the dilemma Charles K. Eger faced last year, when he was named coordinator for the cleanup of unmapped, abandoned wells in the Boyd's Creek region of south central Kentucky.

A geologist in the Environmental Protection Agency's Atlanta office, Eger tackled the problem with geophysical tools he had previously reserved for hunting buried toxic wastes, such as drums of pesticides. The approach paid off with the discovery of four long-forgotten wells, he reported in Tampa, Fla., last week at the 1993 International Oil Spill Conference. Surface accumulations of leaking oil — such as a 100-yard-long, 10-yard-wide crude-oil pool atop Houchins' Spring — helped pinpoint four more wells. Eger's team has since plugged them all.

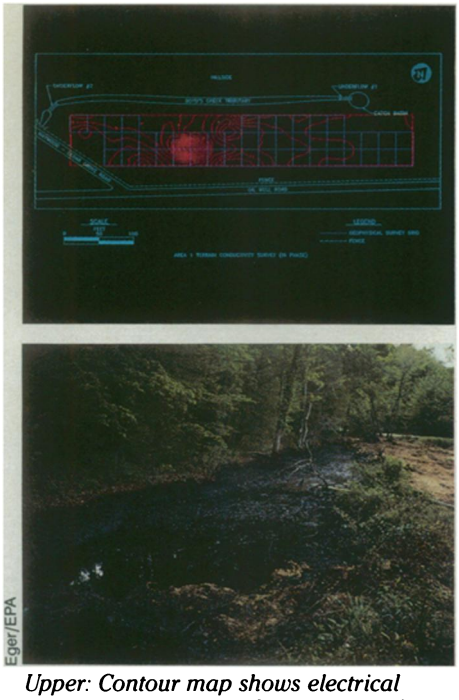
The group surveyed a 6-acre meadow at regular intervals, scouting for spots that responded "anomalously" to three types of geophysical probes. They fed data from each assay into a computer program that mapped the contours of areas responding similarly to measures of soil conductivity, magnetic-field values, or the ground's ability to transmit low-frequency radio waves. The soil-conductivity and magnetic-field maps both proved useful in identifying "odd" areas warranting additional analysis — and sometimes excavation.

Eger/EPA

Oil is still bubbling up this wood-cased well, discovered under 2 feet of soil.

Drilling at Boyd's Creek, the birthplace of Kentucky's oil industry, commenced in the early 1860s. Within a few years, wildcatters began abandoning the less-productive wells without plugging their still-flowing streams of crude. Unscrupulous drillers are still abandoning unplugged wells, Eger notes.

Eger tapped the new Oil Pollution Act (OPA) for money to plug 27 abandoned wells last year in Kentucky. Because OPA was written in the wake of the *Exxon Valdez* spill — and with marine contam-



Eger/EPA

Upper: Contour map shows electrical conductivity anomaly (circular patch) that marked a well. Lower: River of oil covers Houchins' Spring in July 1992. EPA temporarily pumped the spring dry to find and plug a perhaps 60-year-old well.

ination in mind — securing this money for terrestrial leaks initially proved challenging, he says.

According to Eger, however, the potential threat to humans is "infinitely higher" from inland oil spills than from offshore ones. He notes, for instance, that "oil contains some of the worst carcinogens known. And in groundwater wells adjacent to oil wells, levels found are typically two to three times the drinking-water standard for those chemicals."

Not only do an estimated 150,000 unmapped and abandoned oil wells exist within Kentucky, he reports, but it's likely a large number of similar sites also litter states drilled during the oil industry's initial boom — especially Pennsylvania, West Virginia, Tennessee, parts of southern Illinois and Indiana, and probably Michigan.

Eger's cleanup efforts highlight a largely unrecognized problem, the prevalence and importance of terrestrial spills, says James H. Parker, president of Industrial Marine Service, Inc., in Norfolk, Va. Parker, whose firm primarily cleans oil spills in water environments, notes that inland spills are becoming a fast-growing part of his business.

Increasingly, such pollution managers are turning to geophysical soil probes, notes Jay Rodstein, formerly with EPA and now with the National Oceanic and Atmospheric Administration in East Lansing, Mich. He recalls using such probes in 1985 to hunt buried and abandoned coal-tar pits. — *J. Raloff*

Images hint at comet reservoir, breakup

If detecting one large object at the outskirts of the solar system provides supporting evidence for a proposed — but never observed — reservoir of comets, do two such objects offer convincing proof? Comet hunter David Jewitt of the University of Hawaii in Honolulu is betting they will.

For the second time in seven months, he and Jane X. Luu of the University of California, Berkeley, have imaged a body that lies beyond the orbit of Neptune. The researchers suggest that the object, one of the most distant ever detected in the solar system, belongs to a primordial storehouse of comets that astronomers have long theorized should exist. Known as the Kuiper belt, this ring-shaped storehouse would serve as home base for short-period comets, which visit the inner solar system at least once every 200 years.

The mysterious body, known as 1993 FW, lies too far away — and researchers have made too few measurements — to determine whether it is indeed a comet, Jewitt says. But 1993 FW appears to measure about 250 kilometers across and lies roughly 42 times as far from the sun as Earth does, he adds. That distance, notes Jewitt, corresponds to the inner reaches of the proposed Kuiper belt. He and Luu reported their work in a March 29 circular of the International Astronomical Union.

Jewitt says the new finding, coming on the heels of his team's earlier one (SN: 9/26/92, p.196), indicates that Kuiper belt objects are "waiting to be found. . . . We are surrounded by a ring [of comets], but we didn't know it."

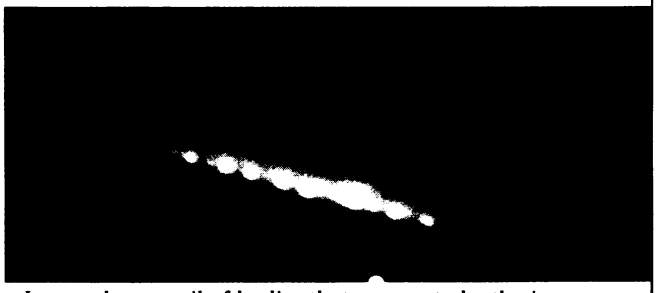
He and Luu observed 1993 FW with the University of Hawaii's 2.2-meter telescope atop Mauna Kea. Scanning the same tiny patch of sky examined in their earlier work, they spotted a faint, slow-moving object late last month.

The slow speed indicates that 1993 FW lies relatively far out in the solar system, says Jewitt. But he adds that many more measurements are needed to determine if it has the circular orbit required of a Kuiper belt resident. If 1993 FW instead has a highly elliptical orbit, it might eventually reach the inner solar system and could not be a current resident of the reservoir, he notes. Jewitt says that studies of the previously detected object, 1992 QB1, have now revealed that it indeed has a nearly circular orbit.

Brian G. Marsden of the Smithsonian Astrophysical Observatory in Cambridge, Mass., says he looks forward to the eventual detection of a Kuiper belt object caught in the act of leaving the belt. "If nothing ever leaves the belt, what good is it?" asks Marsden. After all, he notes, a key reason for believing in this reservoir is that its existence can explain how a seemingly endless supply of short-period comets frequents the inner solar system.

Comets also take center stage in another dramatic finding. Astronomers have detected a group of at least 18 glowing objects, lined up like pearls on a string, that may be the fragments of a single comet that broke apart sometime last year.

A trio of scientists using the 0.46-meter telescope atop Mt. Palomar, near Escondido, Calif., battled unfavorable weather conditions in late March to make the discovery. Caroline S. Shoemaker and Eugene M. Shoemaker of the U.S. Geological Survey in Flagstaff, Ariz., and amateur astronomer David H. Levy of Tucson, Ariz., reported the find in a March 26 circular of the International Astronomical Union.



Luu and Jewitt

Image shows trail of bodies that appear to be the icy fragments of a comet.

The trail of fuzzy, comet-like objects appears to lie near Jupiter, and Marsden says the breakup could have come about if a large comet passed too close to the giant planet — possibly last July, according to his orbital calculations. Jupiter's gravitational tug might have caused the parent to shatter, and the freshly exposed ice layers of each fragment would glint brightly in sunlight, he says.

Jewitt, who along with Luu has identified 18 fragments so far, says he favors another explanation. He suggests that the fragments arose because a parent comet was spinning so rapidly that gravity could no longer keep it intact. Jewitt adds that astronomers have documented few cometary breakups and that none has been well studied. Closely tracking the recently found fragments, he says, could shed new light on why comets sometimes split apart.

— *R. Cowen*