

says, should turn out biodegradable plastics with up to 50 percent starch at costs comparable to currently available plastics containing only 6 percent starch.

While potentially more expensive, graft-copolymer technology such as that used at Purdue offers better custom-tailoring of desired features. That's why Gould expects this technology ultimately to yield the biodegradable competitors to purely petrochemical plastics. In fact, ARS has already begun developing its own graft-copolymer plastics. One of them has the unique ability to shrink-wrap objects at room temperature, provided the humidity is high enough.

**O**ne nagging concern of the biodegradable-research community has been whether degradation products of these new plastics will themselves present an environmental hazard.

Preliminary data now suggest the answer is no.

In a six-month study, chemist Michael S. Tempesta at the University of Missouri in Columbia exposed polyethylene films — with or without 6 percent starch — to conditions simulating a landfill, a compost heap, an anaerobic waste-treatment plant and surface litter. His "surprising" data, also described at last month's meeting, show "the starch is removed from the polyethylene under all environments," he says. Its microbial breakdown and removal was quickest in the oxygen-free waste-treatment sludges and slowest in air.

"Even more surprising, the polyethylene degraded to smaller molecules," he reports. Particularly under the anaerobic conditions, where decomposition was greatest, up to 15 percent of the 1,200-carbon-long molecules gradually de-  
graded into natural, nontoxic 25-carbon

waxes — like those that form naturally on apples, Tempesta notes.

To optimize plastic breakdown, Gould is identifying the most efficient decay microbes, because plastic-wastes managers will likely have to seed their landfills with decay-fostering organisms, much as backyard gardeners today add soil bacteria and fungi to compost their garden wastes.

Unfortunately, Gould says, today's landfills "are designed by law to be areas where degradation does not occur." Moisture, essential for microbial decay, is the bane of landfill managers; it threatens to leach buried toxic substances into the environment. But if one designs landfills properly, Narayan believes, moisture can be managed to limit toxic-materials migration and foster microbial degradation. It requires a new vision, he says, in which landfills are no longer tombs but renewable compost heaps. □

*Continued from p.281*

In the early 1970s, Robert Fox, a now-deceased archaeologist who lived in the Philippines, studied the stone tools and concluded they were used for simple types of scraping or sawing, such as breaking open nuts or extracting the edible pith from slender palms.

Anthropologist Gerald Berreman of the University of California, Berkeley, a critic of Tasaday research, sides with Carneiro's analysis. "These tools are clearly fakes," he asserts.

In addition, Berreman says, observers at the Tasaday caves have found no floor middens — the anthropological term for the inevitable mounds of garbage at human occupation sites. While he argues that this suggests the tribe has been fabricated, researchers who visited the site, such as Molony, maintain that further fieldwork would undoubtedly locate middens.

Berreman views the Tasaday as rain-forest clock punchers, reporting for work as primitive hunter-gatherers in the morning and sneaking back to their home villages at night after journalists and researchers had left by helicopter.

**B**oth critics and defenders of the Tasaday wonder how the tribe survived, given its population of only 26 individuals in 1972.

"It would be impossible for a group of that size to sustain its population, unless it were able to obtain spouses from neighboring tribes," Headland says. Demographers generally concur that a group requires at least 400 members to continue reproducing new generations as large as the old one, he notes.

All the scientists who originally visited the Tasaday agree the tribe would have disappeared without some kind of con-

tact with outsiders, Molony says. Perhaps an illness, introduced through brief encounters with people from other tribes, devastated the original population. In 1972, Molony points out, the Tasaday spoke of a plague that killed many of their people a few generations back.

In addition, Nance says, the Tasaday initially spoke of two neighboring bands of rain-forest people with whom they intermarried — the Tasafeng and the Sanduka. Investigators have located neither band.

Questions about the tribe's size, tools and middens do not alter Nance's opinion that "there is no good evidence that the Tasaday are not real."

Nance says he has visited the Tasaday five times in the last few years and knows of several expeditions to the mountain caves turned back by gunmen in the area. The Philippines' political situation remains volatile, Nance notes, with Marxist guerrillas, disaffected soldiers from the Marcos regime and armed tribal groups all operating out of the Mindanao rain forest.

"I don't see how scientific work can go on in that atmosphere," he says.

Nance maintains that political pressures fuel the hoax charges. If the Philippine government comes to regard the Tasaday as impostors, the tribe will be stripped of its land preserve, opening the rain forest up to logging companies and other groups desperate for land amid a burgeoning population crunch on the islands.

For now, the land is off limits to loggers and the "gentle Tasaday" continue to fuel a rancorous scientific debate. "The session at the anthropological meeting this November should bring together the major insights on the Tasaday," remarks Johnston. "But I doubt it will resolve the issue." □

*Letters continued from p.275*

### **Kelheim: A prehistoric Pittsburgh?**

In "Iron and Industry: Ancient Links" (SN: 3/18/89, p.170), I think Blair is closer to the track. Kelheim, like early Pittsburgh, was an iron center — but for fabrication and shipping. The early iron business in the Pittsburgh area was slash and burn. A furnace was built, ore and lime dug, charcoal made and the lot turned into iron. When it became unprofitable to haul in the charcoal, you abandoned the furnace, moved on to another place with lots of trees nearby and put up another smelter.

When coal/coke smelting and steam transport became the rule, Pittsburgh became "steel town" — smelting and working could profitably be done all in one spot. In the Kelheim area, one should look for furnaces in the middle of nowhere (but with ore, lime and trees all about), then roads or paths for bringing in charcoal and taking the iron to a river for shipping. Deep-green slag in streams is a good indicator of an upstream smelter, at least in western Pennsylvania.

*James O. Porter  
Mars, Pa.*

### **Diver's defect**

Either your reporter or the researchers studying decompression sickness ("Heart defect may lie behind 'bends,'" SN: 3/25/89, p.188) are being overly conservative in hypothesis formation. The key facts in the article are that patent foramen ovale, a heart defect, occurs more frequently among divers (37 percent) than among the general population (5 percent) and that a high percentage (61 percent) of divers with the most serious decompression symptoms have the defect. The main conclusion is that the defect may explain many cases of the bends.

What I think needs further investigation is the origin of the defect, which is implied to be congenital ("left over from early development in the womb") in all cases. It would be more plausible to explain the defect among only 5 percent of the divers (as among the general population) as a congenital abnormality, and among the remaining 32 percent by the activity of diving itself.

*Denis F. Harney  
Seattle, Wash.*