

vironmental impact of pumping the water out of the well. Although Dorfman and crew will be monitoring air, thermal and noise pollution, in addition to microseismic activity, their only real environmental concern is land subsidence. While subsidence of land is known to occur when water is withdrawn from very shallow depths, the effect of pumping water from much deeper depths, such as from the Gulf Coast aquifer, is not yet known. To monitor possible subsidence, highly sensitive tiltmeters have been installed at the well site. "If a cockroach walks across the location, I'll know about it," Dorfman says.

The environmental and water-utiliza-

tion investigations, along with legal and institutional studies, will continue over the next two years. By 1986, Dorfman hopes to begin small-scale commercial production of gas from the basin, generating about 1 trillion cubic feet annually by the year 2000 (the United States now uses 19 trillion cubic feet per year). Dorfman expects little more than these small-scale geothermal developments as long as conventional sources of gas and oil continue to provide the best return on investment. Although he sees an "increased interest" in geothermal development, "accelerated activity" in the field is still "down the road." □

The quest for a catastrophe

The sudden extinction about 65 million years ago of half to three-quarters of the living species on earth, as evidenced by microfossils in sediment samples from the boundary between the Cretaceous and Tertiary periods, has intrigued researchers for many years. Last year, the University of California's Walter Alvarez and colleagues reported on samples from Italy and Denmark that contained excesses of the element iridium typical of extraterrestrial materials, inferring that such anomalies might have been due to a huge meteorite striking the earth. Dust from such an impact, they reported (SN: 1/12/80, p. 22), might have lingered in the atmosphere for several years, shutting off sunlight effectively enough to inhibit photosynthesis and cause the extinctions. Other scientists have subsequently found similar iridium anomalies in Spain (which also showed an excess of osmium) and New Zealand (SN: 6/14/80, p. 381).

Now a researcher has taken another look at samples from the Cretaceous-Tertiary boundary period in Denmark, measured concentrations of nearly all the noble metals (iridium, osmium, gold, platinum, nickel, cobalt, palladium, rhenium and ruthenium) and compared them with samples from meteorites—representing high, "cosmic" abundances—and from typical, "terrestrial" basalts from the Columbia River. And according to R. Ganapathy of the J. T. Baker Chemical Co.

in Phillipsburg, N.J., the likelihood that the boundary samples are of extraterrestrial origin looks greater than ever. Not only did all of the elements on the list show up in the boundary samples at levels well above those normally seen in terrestrial materials, he reports in the Aug. 22 SCIENCE, but the pattern of their abundances generally matches the extraterrestrial one. (The boundary samples have lower absolute abundances than do the meteorite samples, but Ganapathy points out that the impact would have tossed up a lot of terrestrial material that would later mix with the resettling meteorite debris. The clay in the boundary samples, he says, now contains about 7 to 8 percent meteorite material.)

How big a meteorite might have been involved? The "part-meteoritic" boundary clay containing the noble metals studied by Ganapathy was in a layer about 2 centimeters thick. If the meteorite material was carried around by the atmosphere long enough to have been evenly distributed over the globe at that rate, the scientist says, the impacting object would have been 11 kilometers in diameter and weighed 2.5 trillion tons. (An alternate source of the "extraterrestrial" material—a nearby supernova—was discounted previously by Alvarez on the basis of plutonium 244 and iridium 191:193 data. Osmium 184:190 ratios, reports Ganapathy, support the same conclusion.) □

Noble-metal abundances in two clay samples from the Cretaceous-Tertiary boundary in Denmark, compared with abundances from a meteorite and from a terrestrial basalt.

Element	Sample 4 (207.8 mg)	Sample 5 (243.4 mg)	C1 chondrites (4)	Columbia River Basalt (5)
Ir (ppb)	47 ± 9	55 ± 6	514	0.0011 to 0.012
Os (ppb)	40 ± 1	49 ± 2	480	≤ 0.01
Au (ppb)	8.8 ± 0.2	12.3 ± 0.2	152	0.35 to 1.33
Pt (ppb)	24 ± 5	17 ± 6	900	
Ni (ppm)	310 ± 45	322 ± 35	10,300	7.3 to 13
Co (ppm)	38 ± 1	46 ± 1	483	28 to 38
Pd (ppb)	45 ± 8	53 ± 8	460	≤ 0.03
Re (ppb)	35 ± 1	59 ± 1	35	0.64 to 1.06
Ru (ppb)*	37 ± 28, 39		690	

R. Ganapathy/Science

*Ruthenium was determined only in sample 1

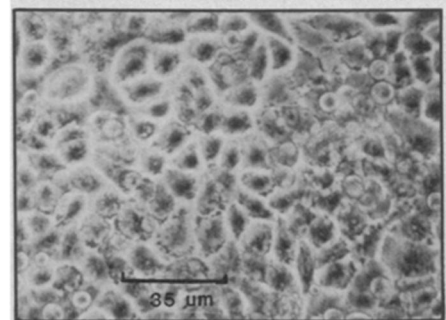
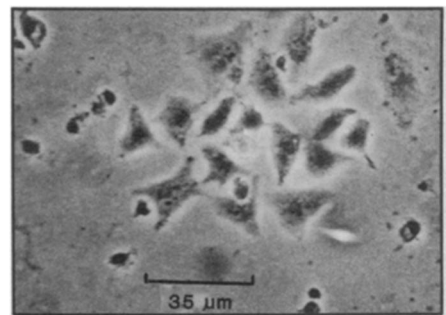
Ozone: Pollutant Slows cancer growth

Ozone as an air pollutant causes major problems for persons with diminished lung function and it causes respiratory difficulties and discomfort in healthy persons. In the laboratory it causes problems for cancer cells. Ozone selectively inhibits the growth of cancer cells in culture, say five St. Louis researchers from governmental agencies and the Washington University School of Medicine.

The team, admittedly surprised by their discovery that cancer cells are more sensitive to ozone than are normal cells, made their finding while looking for a cell culture with which they could measure the harmful effects of pollutants. Using a chamber to hold cells in an ozone-suffused controlled atmosphere, they tested breast, lung, epithelial and uterine cancer cells and normal lung cells.

The growth rate of cancer cells, they found, was inhibited at a rate dependent on the ozone concentration, independent of the type of cancer. At 0.3 parts per million (ppm) of ozone, cancer cells reproduced at 60 percent of the rate of normal lung cells in the chamber; at 0.5 ppm, the rate of growth was 40 percent. When the researchers upped the ozone concentration to 0.8 ppm, cancer cell growth was inhibited 90 percent, and normal growth was inhibited less than 50 percent. "Evidently," they conclude, "cancer cells are less able to compensate for the oxidative burden of ozone than normal cells."

One possible mechanism, they suggest in the Aug. 22 SCIENCE, is that ozone affects glutathione molecules, which neutralize oxidizing chemicals by donating hydrogen atoms. As glutathione is used



Lung cancer cells show ozone effect (top).

up, the cell regenerates it. Cancer cells, the researchers suggest, may be less efficient at regenerating glutathione than are normal cells.

They also tested 14-generation-old cells in ozone, and found structural damage at 0.5 ppm, suggesting that "aging increases the sensitivity of normal lung cells to ozone," possibly accelerating processes similar to those that cause cellular damage. □

Italians offer breathing substitute

The main reason we breathe, says Theodor Kolobow of the National Institutes of Health, is not to provide the body with vast quantities of oxygen but to remove high concentrations of carbon dioxide from the blood. Using that concept, he and 11 Italian researchers headed by L. Gattinoni at the Istituto di Anestesiologia e Rianimazione in Milan have successfully treated six cases of acute respiratory failure, using a modification of a procedure already judged by U.S. researchers to have been a failure.

The original technique involved placing patients with acute respiratory failure on mechanical ventilators and bypassing their blood to an artificial lung that removed carbon dioxide and added oxygen. In 42 patients at nine medical centers, researchers found "neither a significantly increased respiratory recovery nor a greater long-term survival" than in 48 patients treated with conventional mechanical respiration.

The major difference between the original technique and the Italian modification is the hook-up to the gas-exchanger. The Americans removed venous blood, routed it through the artificial lung, and returned it to an artery. The Italians have been taking and replacing blood from veins. This modification makes carbon dioxide removal easier, and allows a lower mechanical respiratory rate.

During the procedure, patients' natural breathing is stopped with curare and an artificial respirator gently sends air into the lungs one to three times per minute. The procedure is used for a few days until the patients' lungs are judged adequate to resume functioning.

Kolobow says the modified technique, which allows lungs to "rest," may change the 90 percent mortality rate of lung failure to 90 percent survival, but U.S. researchers are doubtful.

Michael Snider of the Massachusetts General Hospital, one of the researchers who evaluated the original procedure, says, "The idea of resting the lung is an attractive idea, but it is as yet unproven in animal models or clinically."

"Some conditions are self-limiting," he says. "The only difference may be in the selection of patients." □

An energy bank for developing nations

More for the world's poor. That's the topic of a 92-page energy report prepared by the World Bank and issued this week.

This year developing nations will spend almost \$50 billion for imported oil. By 1990 that figure could more than double even if those nations average a seven percent annual growth in the rate of energy production. How to stem the developing world's reliance on imported energy and its growing need for energy-assistance funds is the report's theme.

Up to 30 percent of the developing world's predicted energy tab could be eliminated by 1990 by maximizing both conservation and energy production from sources such as oil, gas, coal, hydropower and wood, the report says. And it outlines ways for saving 15 percent of the energy needed by those nations without sacrificing their economic growth during the coming decade.

Many of the bank's suggestions invoke economic policy considerations, such as pricing energy to reflect its replacement costs or taxing energy products to encourage conservation and a switching of fuels. It also earmarks "efficient import substitution through expansion of domestic production of energy" as a principal

task for developing nations over the next 10 years.

Altogether it sets a mammoth task for the largely strategy-shy developing world. Where nations will acquire the expertise to adapt, develop or import skills and technology to accomplish these aims was a dominant theme in discussions at the United Nations Conference on Science and Technology for Development a year ago (SN: 8/18/79, p. 126). Since no flurry of concrete answers emerged from those discussions, it is left to speculation how oil-importing developing countries would use the \$450 billion that the World Bank pegs as necessary for expansion of their domestic energy programs throughout the next 10 years.

Perhaps most significant, however, is the report's role as a vehicle to float the idea of creating a special affiliate of the World Bank to handle just energy. Already the largest source of public assistance for developing energy resources, the bank has committed \$4.5 billion to such projects since 1978. And it has broached the idea of offering \$25 billion in loans over the next five years through its proposed energy affiliate to encourage domestic energy production in developing nations. □

A hypothalamic hormone in the retina

Tucked away in the dark recesses of the human skull is a cluster of cells known as the hypothalamus. Hormones released by these cells influence the release of hormones from the brain's pituitary gland, which in turn influence the release of hormones throughout the body. Hypothalamic hormones can thus be called the executive hormones of the brain and body.

But hypothalamic hormones do more than act as executive hormones. They have been found not only in the hypothalamus but in other areas of the brain and body, and they have been found to perform duties unrelated to their hormonal roles. And now one hypothalamic hormone — thyrotropin-releasing hormone (TRH) — appears to be involved in vision, say Enio Martino and colleagues of the University of Chicago in the July PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

TRH was first found to play a role in the regulation of pituitary thyrotropin secretion and, in turn, in the regulation of thyroid hormone secretion in the body. During the 1970s it became apparent that TRH is involved in elevation of mood, excitation of behavior, stimulation of muscle activity and inhibition of the electrical activity of some neurons. TRH was also found in other areas of the central nervous system, and in the placenta, skin, pancreas and retina. It was this latter discovery, plus the finding that levels of TRH are highest in the retina during the day and lowest dur-

ing the night, that prompted Martino and co-workers to compare the developmental pattern of retinal TRH with that of TRH in other organs and to investigate the effects of dark and light on this developmental pattern.

The researchers raised rat pups in either normal light-dark conditions or in total darkness, then measured the TRH in their hypothalami, retinæ and pancreas. They found that under normal light-dark conditions the levels of TRH in these three organs did not develop in the same manner, suggesting organ independence in the regulatory control of TRH accumulation and possibly synthesis. Hypothalamic and retinal concentrations increased from birth to 23 and 30 days of age, respectively, accompanied by a marked decline in pancreatic TRH over the same period. However, while pups raised in the dark showed a normal developmental pattern for hypothalamic and pancreatic TRH, this was not the case for retinal TRH: No TRH whatsoever could be detected in the retinæ of rats raised in darkness.

These findings, Martino and his team conclude, suggest that TRH development in the retina is independent of that in other organs and is totally dependent on light exposure for development. These findings, taken together with what is already known about TRH, suggest that TRH plays a crucial role in retinal functioning, perhaps as a neurotransmitter. □