all incidence declined between 1947 and 1970, it has increased between 5 and 10 percent since 1970. The ACS specifically cautions that the increase does not represent an epidemic. Lawrence Garfinkel, ACS vice president for epidemiological studies, says that despite potential flaws, the NCI evidence is the best around. "You have to be patient and give it time in order to decide if this is a real trend or an artifact," he says.

Just how reliable are the NCI data? Epidemiologists would probably agree that the ideal study of trends in cancer incidence would consist of annual national surveys, which would also be prohibitively expensive, or—barring this—annual surveys of perfectly comparable populations that are representative of the United States. The surveys on which the Pollack and Horm data depend, and which NCI funds at the rate of $10 million a year, are a far cry from this ideal.

There is only indirect evidence that the populations surveyed are representative of the total U.S. population. Each survey encompassed 10 percent of the total population, but underrepresented rural dwellers and overrepresented Chinese and Japanese Americans, Indians, and Polynesians. An industry critic complains that it overrepresents shipbuilders, who are vulnerable to asbestosis; Harris of CEQ, on the other hand, complains that it underrepresents the industrial Northeast.

Perhaps more important in the statistical sense is that the survey groups varied considerably from year to year on a nonrandom basis, as cities and regions decided to drop out or were persuaded to join. The survey population in 1976 had only four geographical regions (out of 11) in common with the survey population in 1969.§ NCI made efforts to ensure continuing regional participation beginning in 1973, but it could not resist the temptation to add new groups until 1976.

Authors Pollack and Horm attempt to prove that the total populations are comparable from year to year. But their methodology has been attacked by other epidemiologists including Kenneth Rothman at Harvard, and Robert Morgan at *SRI International* in Palo Alto. Rothman, who prepared his critique at the request of the Shell Oil Company, says that the authors' comparisons of the total populations are flawed, leading to an inadvertent doubling of the estimated cancer rate increase. Morgan, who prepared his critique at the request of the American Industrial Health Council, an organization of chemical firms, says that these and other flaws "produce a trend estimate that must be considered unreliable and possibly deceptive." Schneiderman characterizes Rothman's comments as "thoughtful," but insists that the populations are indeed comparable from year to year. Clearly, NCI's case would be stronger if the regions (and the demographic characteristics of each region) had remained constant.

Even if one accepts the data as valid, there are several factors other than exposure to chemicals that might account for the cancer rate increase. Several critics of the NCI data raise the possibility that methods of detecting cancer improved enough from 1969 to 1976 to account for a portion of the increase in reported cases. "Case finding is improving, expecially among the old and the black, and this biases such trends upwards," says Richard Peto, a statistician at Oxford University. Peto favors mortality as an indicator of cancer trends, and only among middle-aged white populations—to compensate for changes in cancer reporting and therapy. In this group, he suggests, mortality rates are not significantly increasing.

Horm and Schneiderman counter that disease reporting among all age groups has been good in the United States for some time, and that incidence rates are therefore a reliable indicator of trends. Possible exceptions are cancer of the pancreas and of the breast; increased detection of the latter was sparked in the early 1970's by the publicity surrounding the surgery of Betty Ford and Happy Rockefeller, and incidence rates went up shortly thereafter. Cancer incidence among blacks was deliberately excluded from the NCI data because of detection improvements.

Abe Lilienfeld, an epidemiologist at Johns Hopkins University, suggests another potential explanation for the cancer rate increase. During the 1970's, he

> If the statistics cannot relate cause and effect, they can certainly add to the rhetoric.

§Atlanta, Detroit, Iowa, and San Francisco.

(Continued on page 1002)

French Doctors Claim Shah Had Wrong Treatment

The French doctors who had long been treating the late Shah of Iran for cancer believe that their patient did not receive the correct treatment when he was brought from Mexico to the United States last year.

The French doctors, Paul Milliez and Jean Bernard, visited the Shah in Mexico in October 1979 and advised that his spleen, which was considerably enlarged, should be removed, and that he should have an operation for his gallstones. Everything was ready for both operations at a Mexican hospital, according to a report in *Le Monde* (29 July), when the Shah was taken to New York. Here he was treated for gallstones. "Despite the specific and urgent recommendations of the French doctors, the removal of the spleen was not undertaken at that time, and the chemotherapy modified by the Americans, was in no way suitable to his condition," says *Le Monde*.

The Shah left New York for Panama, then Cairo, where his spleen was finally removed, by DeBakey of Houston, on 28 March 1980. But it was too late. The Shah's condition continued to deteriorate. His immune system, weakened by the chemotherapy, was unable to fight off infections, and on 27 June he died.

Aquarian Candidate Quizzed by Laureates

A group of Nobel laureates has a question for Ronald Reagan: Do you really believe in astrology?

The five Nobelists confess themselves to be "gravely disturbed" at a recent newspaper report which states that Reagan follows the daily zodiacal advice for his sign—Aquarius—in the horoscope column of Carroll Righter, and that he pays attention to the predictions of clairvoyant Jeane Dixon.

In a 12 August letter to the Republican candidate, the Federation of American Scientists on behalf of the five worried laureates asks for a clarification of Reagan's views.

"As scientists we know of no basis for the belief in astrology . . . that you

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are quoted as holding. . . . We would welcome any information you could send us that would dispel the notion that your presidential decision-making would be biased by these or other superstitions," says the FAS letter.

FAS director Jeremy Stone reports in the federation's current newsletter that Jeane Dixon told him she considers Reagan a friend and writes to him periodically. Reagan responds from time to time, Dixon says, but she would not expect him to consult her when he was President.

The Reagan-Bush campaign headquarters takes a calm view of the candidate's astrological interests. "Mr. Reagan has a casual interest in astrology, nothing heavy. He simply, like most people, checks the astrology in the paper," says deputy press secretary Joe Holmes.

Holmes denies that Reagan believes in astrology. Why then does he bother to check his horoscope? "He certainly doesn't check it every day," the governor's press secretary explains.

France, Iraq, and the Bomb

On 12 July a young woman named Marie-Claude Magal, apparently drunk, got into a quarrel with a man driving a car down the Boulevard Saint-Germain in Paris. He slapped her; she fell to the ground and was hit and killed instantly by a passing car.

Miss Magal was the only witness to a murder committed a month earlier. Yahia El Meshad, an Egyptian physicist, was found dead in his Paris hotel room on 14 June, having been killed with a sharp object.

Meshad's purpose in Paris was to check the quality of the enriched uranium being supplied by France to Iraq as part of a 1.45-billion-franc ($363-million) contract to provide a nuclear research center.

Israel has strenuously opposed the contract, arguing that the transfer of both nuclear know-how and nuclear materials will enable Iraq to build atomic weapons. Israeli objections may not have been limited to words. An Israeli radio report 3 days after the murder stated that El Meshad was one of the few Arab scientists with authority in nuclear energy, and that his death "will delay by at least two years the completion of the atomic weapon planned by Iraq."

An earlier violent setback to the French-Iraqi research program occurred on 6 April 1979. Saboteurs broke into the factory at Seyne-sur-Mer where the two research reactors intended for Iraq were under construction, and damaged both severely with explosive devices.

The Israelis' conviction that the Iraqis intend to derive nuclear weapons from their research reactor may be based on more than theoretical grounds: Israel is widely believed to have developed her own nuclear weapons from the research reactor constructed for her by the French at Dimona.

There are several disquieting features about the French-Iraqi agreement. Despite public assurances that all is well, the French government seems to have had qualms about the pact, at least to the extent of trying to persuade Iraq to accept a form of nuclear fuel unsuitable for bombs in place of enriched uranium. Iraq refused to alter the terms.

Not only is Iraq France's second largest oil supplier, but France hopes to sell Iraq a 700-megawatt commercial nuclear reactor. The agreement to supply Iraq with a nuclear research center was made in the wake of the 1973 oil crisis. The contract calls for two research reactors of which the larger, known as Osiris, is fueled by 93 percent enriched uranium, supplied by France's military enrichment plant at Pierrelatte. France has undertaken to supply four charges of fuel for the reactor, making a total of 70 kilograms of enriched uranium. This is reported to be sufficient to make about four nuclear weapons.

The nuclear research center, located at Tuvait, near Baghdad, will train some 600 nuclear engineers and technicians. Under a contract signed in February 1978 with Italy, Iraq is also obtaining four laboratories, one of which, known as a "hot cell," is reportedly capable of extracting and fabricating small quantities of plutonium from the spent fuel of the reactor.

The French government, finding it cannot apparently alter the terms of the agreement, has reacted with heat to accusations made by the Israelis and others. "The French government is astonished," declared a statement put out by the Quai d'Orsay on 31 July, "at the fantastical assertions and accusations that have recently been spread about." Iraq, the statement pointed out, has signed the non-proliferation treaty and has placed itself under the controls of the International Atomic Energy Agency. "The modalities of delivery of the uranium correspond to the unique needs of the research reactor supplied, they are scheduled to that end and they are surrounded by all necessary precautions," the statement added. The government's assurances would perhaps carry even more conviction if the terms of the French-Iraqi agreement of 18 November 1975 had ever been made public.

Iraq has reacted to international criticism by insisting all the more that the agreement be executed as planned. At a press conference held in Baghdad on 20 July, Iraqi strongman Saddam Hussein sarcastically observed that several years ago "Zionist circles in Europe derided the Arabs who, they said, were an uncivilized and backward people, good only for riding camels in the desert. See how today these same circles say without batting an eyelid that Iraq is on the point of producing an atomic bomb."

The Carter Administration, which has made nonproliferation a central feature of its foreign policy, is not happy about the deal but can do little to prevent it. Issues such as what will happen to the spent fuel from the reactor, whether Iraq will be able to reprocess it and extract the plutonium, are open questions, since apparently France has not informed the American government of the precise terms of the agreement.

The United States has no obvious means of stopping the deal. Embargoing sales of enriched uranium, as suggested by the *Washington Post* on 8 August, would accomplish little beyond infuriating the French, who have just built a $6-billion enrichment plant to insulate themselves from this very kind of pressure.

Lest Foggy Bottom should be mulling over any such move, the Quai d'Orsay has helpfully compiled a list of 78 imported research reactors around the world, almost all of them fueled by enriched uranium, and almost all of American manufacture.

Nicholas Wade