Cancer in Nickel-Processing Workers in New Caledonia

It appears to us that the hypothesis advanced by Langer et al. (1) is very weak and unsubstantiated when brought under close scrutiny.

1) The study by Lessard et al. (2) referred to in (1) does not present conclusive evidence with respect to the toxicity of nickel. As Maheux et al. point out (3), "this study [Lessard et al.] is by no means the final evidence that nickel (ore) dust is carcinogenic for human beings." Numerous criticisms can be made of this work, most of which were raised by the authors themselves. These include the following points: (i) There is no distinction made between primary and secondary cancers. (ii) A comparison is made between the incidence of lung cancer in New Caledonia and that in the rest of the world, which is based on data from the period 1970 to 1974 for New Caledonia and 1960 to 1964 for the rest of the world. It is known that the risk of mortality from lung cancer has risen over the years in developed countries. Between the period 1960 to 1964 and the period 1970 to 1974, the increase in the incidence was sufficient to place the European population of New Caledonia on the same level as the European population of New Zealand (where there is no nickel mining industry). (iii) The control group that was used is not representative of the population of New Caledonia and must therefore be considered with extreme caution. This group was selected from among hospital laboratory outpatients. As Maheux et al. admitted (3), "Some consequences of this, like a significant different mean age between the case group (58 years) and the comparison group (46 years) is of critical importance, even though the statistical method employed permitted to control for age." Furthermore, the proportion of smokers among the nickel workers in the control group (90 percent) is very different from what appears in our medical records (56 percent). (iv) Specificity with respect to nickel as the causative factor is missing.

2) The incidence of lung cancer in New Caledonia has remained practically unchanged over the past 10 years, although there was a considerable increase in medical monitoring and an increase in the level of nickel production from 1945 to 1975, and despite the fact that the incidence of lung cancer has increased significantly throughout the world (4).

3) The numbers of nasal sinus cancers, the incidence of which has been reported to be as much as 600 times higher in nickel workers according to epidemiological surveys related to "nickel smokers," have been very small thus far in New Caledonia, although nickel has been mined and smelted on the island for a century.

4) Only three cases of pleural mesothelioma were recorded in New Caledonia between 1970 and 1980 (5, 6), and none of these among smelter workers. In our opinion, it is not possible to conclude one way or the other about the normality or abnormality of mesothelioma occurrences in New Caledonia. If, in fact, the inhalation of asbestos fibers had been an important factor in New Caledonia, a large number of cases of asbestosis should have been observed. The results of a complete standard detection program carried out in June and July 1980 on all personnel at a mining center on the island showed no significant anomalies that could result from exposure to asbestos, notably no pleural plate, pleural thickening, or pulmonary fibrosis (5).

5) Ores mined in New Caledonia result from the transformation by surficial weathering of ultrabasic rocks which are more or less serpentinitized. These ores correspond to soft material which surrounds hard cores of fresh rock. When serpentinitized, the fresh rock contains two magnesium silicates, lizardite and chrysotile, which is fibrous. In the course of weathering, the chrysotile disappears. The newly formed magnesium silicates are predominantly a nickeliferous lizardite (plane sheets) (7). As a result, the fines, the part of the ore liable to produce inhalable dust, contain only small, in fact very small, amounts of chrysotile (a few hundred parts per million). Thus, the amount of fibers inhaled by nickel workers is much lower than the minimum amount established by French law and also lower than the amount currently urged as a standard (less than 0.5 fiber per cubic centimeter).

Our investigations do not lead us to support the thesis of Langer et al. or to suspect that the nickeliferous substances (whether associated with chrysotile or not) that are handled in New Caledonia are responsible for most of the

References and Notes

4. They were designated to reproduce by isolation in unequal groups as sexual maturity approached.
5. At the end of the 9 months for which data were reported, the population size was approximately 120, including about 20 juveniles, most of which were removed at a later date.
7. "Pseudomedal" and "pseudofemale" behaviors have been described for heterosexual zebra finches by D. Morris (8) and Behaviour 8, 46 (1955). I have not previously observed homosexual pairing in zebra finches, although they do occur in low frequency in other monogamous avian species (pigeons [Columbia livia], personal observation; M. Levi, The Pigeon [Levi, Sumter, 1974], and gulls [Larus spp.], J. P. Ryder, Proceedings Colonial Waterbird Group 1976, p. 138; and P. L. Somppi, Auk 96, 1 (1979).)
9. Individual recognition is commonly effected by banding birds with unique color combinations. However, in this study there were at least ten birds of each color type in the aviary at any one time.
11. The below average clutch size is consistent with the suggestion (1) that sex-ratio manipulation occurs postzygotically (and probably after hatching). Unpublished data (N. Burley) indicate that preferences displayed in experiments are sex-specific. For example, males given choices among males wearing red, males wearing green, or males with red and green bands show very different responses than females choosing among such males.
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cases of lung cancer that have been observed among people in contact with these substances.

We believe, however, that the problem of lung cancer is of sufficient concern that dust emissions and the attendant hazards of all dust emissions require careful scrutiny. Société Métallurgique Le Nickel-SLN has created a special department to deal with this problem.

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References and Notes
4. This statement comes from a comparison of information contained in (3) with data from the Bureau of Statistics for Oncology Data of New Caledonia, which was established in 1977. In (3) the number of cases per year is given as follows: 1977, 7; 1971, 12; 1972, 21; 1973, 26; and 1974, 26. Data from the New Caledonian Bureau of Statistics is as follows: 1977, 16 to 17; 1978, 34; and 1979, 23.
9. 15 May 1981; revised 13 July 1981

Five years ago, the International Metallworkers’ Federation sought our assistance. They were concerned that members of their union at a nickel smelter in Noumea, New Caledonia, were experiencing an unusual frequency of lung cancer. Their apprehension was based in large measure on reports that excess lung and sinus cancers had occurred in workers in other nickel smelters in many industrialized countries, including Great Britain, Canada, Germany, Norway, and the U.S.S.R. (1). Although nickel mines, and later a smelter, had been in operation in New Caledonia for approximately a century, no health data had been reported (2).

The first health data from New Caledonia in 1978 indicated an increased incidence of lung cancer (3). Meininger et al. question this epidemiological report. We will leave its defense to the investigators except to note that any discussion of cancer rates in South Pacific populations is replete with statistical difficulties of case management, ascertainment, reporting, and recording (4). The essential question is whether the nickel workers have a significantly greater incidence of cancer than their compatriots not so exposed. Studies that might shed light on this question have not been carried out. This is unfortunate, since, if there is no increased incidence of cancer in workers at the smelter in New Caledonia, as Meininger and his colleagues propose, it would be very important to study this anomaly in order to clarify why there is an increased incidence of cancer in workers at other similar nickel smelters.

It was against this background that we began investigating the New Caledonia situation. We are seeking etiological factors since studies on similar smelters had suggested that no single factor could account for the occurrence of all “nickel-associated cancers” (especially lung cancer). In a careful analysis of the question, E. Mastromatteo, medical director of the International Nickel Company, noted that some investigators had observed that cancer incidence was correlated best with the overall dustiness in a smelter (5). There have also been reports from metal recovery operations elsewhere, in which the host rock itself, being mined for specific commercial metals, also contained hazardous minerals, for example, crystalline silica (quartz) in gold mining and fibrous rock-forming silicates in iron-ore mining (6). That a similar situation might exist for nickel ores on New Caledonia was possible, especially since the saprolitic ores worked there included serpentine minerals, from which chrysotile asbestos fibers could be liberated.

With our colleagues in the Department of Mineral Sciences at the American Museum of Natural History, we examined Noumean nickel ores in the museum’s collection as well as other specimens brought directly from New Caledonia. We detected the presence of submicroscopic chrysotile asbestos (7). Indeed, reports by the geologists of Société Métallurgique Le Nickel-SLN had already noted this (8). Our calculations, based on a limited number of available samples, show a gradation of from 80 to 0.3 percent chrysotile in one of the ore minerals, garnierite, and in several processed ores.

Thus, there is ample potential for exposure to chrysotile asbestos among the New Caledonia nickel workers. If these workers are exposed to chrysotile asbestos, lung cancer may be an important disease among them, as it is among other chrysotile-exposed populations throughout the world (9). We do not consider this a “weak” hypothesis at all: it originated from documented identification of the presence of chrysotile asbestos in the ores and is supported by studies that show chrysotile to be an agent that in many other circumstances produces precisely the cancer of concern (10). On the contrary; if chrysotile asbestos was not associated with lung cancer here, this would attract much more attention.

The occurrence of cases of pleural mesothelioma in New Caledonia is of particular interest (11). This neoplasm, rare in the general population, is considered a marker for previous exposure to asbestos. In a series of 110 consecutive cases that they personally observed, Cochrane and Webster found asbestos exposure implicated in 109 (12). The association is so strong that, where there is occupational exposure to asbestos, mesothelioma is likely to occur with increased frequency.

We are pleased to read that Société Métallurgique Le Nickel-SLN has now set up a special department to deal with health hazards and dust emissions at their facility.

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References and Notes
1. A summary of this data base, over the early and mid-20th century, appears in E. Mastromatteo, J. Occup. Med. 9, 127 (1967). The Welsh, Norwegian, German, and Canadian experiences are developed historically. The citation for the Russian report is an abstract. For the refinery at Clydach, Wales, the site for which most data are reported, there was a fivefold excess lung cancer attack rate and a 150-fold excess nasal cancer attack rate [R. Doll, Br. J. Ind. Med. 15, 217 (1958); J. G. Morgan, ibid., p. 224].
2. The lack of health information from the New Caledonia refinery may have been attributable to limited medical surveillance. We have been informed that workers are referred elsewhere for diagnostic workup of chest diseases because of a lack of medical expertise on the island. Therefore, it is reasonable to expect that the diagnosis of mesothelioma, primary lung cancer, and nasal cancer was underreported.
4. Each criticism of Meininger et al. may be answered with plausible counterarguments. For example: (i) Although primary and metastatic lung cancers were not differentiated in this study, neither were other cancers considered, which may have been metastatic from the lung (for example, brain tumors). (ii) The rise in the world incidence of lung cancer during the decade preceding the New Caledonia study, against which the island rates were compared, is a difficulty of the analysis. What is significant in (3) is the higher rates of lung cancer observed among the New Caledonia population compared to those of other South and Central Pacific countries, with the same data base used in each case. (iii) The control group used by Lessard et
Cancer in nickel-processing workers in New Caledonia
J. Meininger, P. Raffinot and G. Troly

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