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EDITORIAL

The air we breathe

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Twenty-four centuries ago Hippocrates suggested that the air around us might affect our health. Although at that time there did not exist a pertinent concept of the influence of air quality on the prevention or pathogenesis of respiratory diseases, the notion seems quite modern even today. Galen's views on the act of breathing and processing of the inspired air appear even more modern and appropriate. He related air quality, its temperature and dust level to patients symptoms. Apart from these historical notes the quality of air has long been unquestioned. Until very recently fresh air has been the major element in the treatment of patients with lung diseases, particularly when Koch's finding of the infectious nature of tuberculosis became accepted. A prerequisite for hospitals dealing with lung diseases in the absence of any other rational, successful remedy, has therefore been their location within areas of unpolluted air. Apart from the risks of infection physicians working in these hospitals also enjoyed breathing fresh clean air. Most industrialized work-places at the turn of the century, however, exposed workers to a variety of adverse health effects.

Nowadays major newspapers publish actual figures on SO_2, NO_2, or ozone with respect to the upper limits of allowed environmental concentrations. Already back in the 16th century Georgius Agricola (Georg Bauer), a Saxon by birth born two years after Columbus rediscovered America, described the deleterious effects of dust inhalation in the Silesia Mountains as well as the Carpathian mines. He reported the fate of a woman who had married seven husbands, all of whom had died because of respiratory illnesses due to workplace exposure.

Apart from these descriptions of occupational lung disease the literature on air quality shows that major work only started in 1886. It was Lehmann who laid down the basis for defining health-based upper limit concentrations to some common toxicants [1]. He performed field studies as well as animal experiments under controlled conditions. He has been given credit for introducing a quantitative approach to occupational hygiene. From 1919 onwards Flury and Zernik developed a theoretical concept of the concentration-effect relationships of some pulmonary irritants and for certain types of systemically active noxious gases. By 1938 they had proposed some 100 exposure limits for gases, vapours and suspended particles [2]. The concept of Flury and Zernik included the notion that there was an adverse effect following the exposure to inhalant toxicants. This reflected the fact that modern life with its workplaces no longer guaranteed fresh air. Air quality, therefore, was recognized to be responsible for adverse respiratory health effects.

Adverse respiratory health effects as medically significant physiological or pathological changes have since been defined and evidenced by one or more of the following [3]: interference with normal activity of the affected person; episodic respiratory illness; incapacitating illness; permanent respiratory injury; and/or progressive respiratory dysfunction. According to these criteria not all physiological changes due to poor air quality are necessarily adverse, and the detection of a point on a dose-response curve that separates a medically significant from a medically insignificant effect may be very difficult. There is, accordingly, a wide spectrum of biological responses to pollutant exposure due to both respiratory organ burden as well as specific host factors. Adverse respiratory health effects may be as mild as suffering from odours, eye, nose or throat irritations with little interference to normal activity, or as serious as increased frequency of symptomatic asthmatic attacks, increased incidence of cancer, or increased mortality. Depending on individual host factors a given respiratory organ burden may thus go undetected for quite a long time, or may cause medical attention immediately due to hyperreactivity of the airways.

Interaction of exposure to man-made or natural pollutants with inhalational cigarette smoking may be negative or positive in either preventing or aggravating disease processes. The positive interaction of asbestos and smoking is well recognized. The negative relation between smoking and extrinsic allergic alveolitis on one hand and the positive relation in occupational asthma due to chemical compounds on the other has only recently been established [4, 5]. Epidemiological work on the influence of occupation and smoking habits have clearly shown that subjective symptoms are very important signs of the interaction of the respiratory system and its pollution burden. Therefore, it has been hypothesized that acute exposure and related symptoms may be meaningful indicators of the long-term effect of exposure.

Today many people breathe air originating from air-conditioning systems with a potential for new health problems. Apart from the ill-defined "sick building syndrome", descriptions of infectious diseases, extrinsic allergic alveolitis, and asthma relate more directly to the disease processes. These diagnoses clearly demonstrate the impact of air quality on the well-being of modern man. Patients with pathological or suppressed host defences are especially dependent on good air quality in rooms and devices like ventilators to avoid nosocomial airborne disease.

The detrimental effect of air pollution can clearly be appreciated by the incidence of "Waldsterben" in Europe. Acid rain is the major cause of this devastating disease. Acid rain is the result of the presence of sufficient amounts of SO_2 and NO_2 under photochemical influence. Automobile internal combustion has been identified as a major cause of NO_2 production. Governments have taken legal actions to reduce the NO_2 concentration by using unleaded fuel and catalysis technology. It remains to be determined whether these measures will be sufficient and whether the predictions in terms of air quality improvement are correct.

Reducing the NO_2 and SO_2 output, however, is only one aspect, and it needs to be stressed that air pollution is just one consequence of the fact that our civilization needs, or at least uses, ever increasing amounts of energy. Instead of using 1600–8000 Calories per day on his own to tackle life, Man in developed countries is using a thousand and more times that amount, there by producing excess amounts of CO_2 and thermal energy apart from pollutants. The world energy demand per year uses up more than 100,000 yrs of collected solar energy in terms of coal, oil or gas. These two factors – increased CO_2 production and thermal energy – plus the effect of other trace gases like methane and halogenated hydrocarbons are believed to have profound effects on our climate [6, 7]. The ozone hole is but one example, and it is predicted that unless a reduction in the velocity of increase in CO_2 production is achieved, measurable increases in temperature will result in profound changes of our living conditions [8]. Desert zones will move northwards whereas an increase in sea level will flood other parts. The UN Environment Programme warns that one-third of the entire land surface of the world is now in danger. As one commentator said, the world must act fast, before the very foundations of our civilization crumble in the sand.

By what measures can air pollution be curbed and climatic changes be prevented? Both seem to be mainly consequences of combustion of coal, oil and gas, which are all unrenewable resources that will be used up very quickly. A turn towards alternative forms of energy seems the only answer. So far, mainly nuclear power has been used. Nobody, however, will propose after the Chernobyl accident that this globe should have 10,000 nuclear power plants. Therefore, the only answer seems to be a technology that uses photovoltaic energy plus electrolysis of water to have two carrier systems – hydrogen pipelines plus electric power lines – as a form of energy that is clean and available in abundance. Experts predict that the 21st century will be the century of solar hydrogen and that solar energy will achieve what nuclear energy failed to do in the twentieth [9].

As Crofton has said with regard to the responsibility of chest physicians for the tobacco pandemic, we should not only be busying ourselves with trying to mitigate the tragedies of poor air quality in patients, but we should devote a major effort to pointing to the roots and improve the awareness of the dangers for mankind in general.

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