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Chulabhorn Research Institute

INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND INDUSTRIAL TOXICOLOGY (ICEIT)

CRI's ICEIT has been designated as a
"UNEP Centre of Excellence for Environmental and Industrial Toxicology".

INTERNATIONAL CONFERENCE ON BIOTECHNOLOGY RESEARCH AND APPLICATIONS FOR SUSTAINABLE DEVELOPMENT (BRASD)

August 7–10, 1995

The Conference, organized as one of the education and training activities of the Chulabhorn Research Institute under the International Program on Environmental and Industrial Toxicology (IPEIT), was presided over by Her Royal Highness Princess Chulabhorn.

The four day conference program attracted over 450 delegates from academia and research establishments, government agencies and the private industrial sector from 20 countries, providing an international forum for the exchange of ideas and the sharing of research experience in one of the most rapidly advancing areas of scientific and technological development.

The scientific program of the Conference covered a wide range of areas including:

- Agricultural Biotechnology
- Environmental Biotechnology
- Microbial Biotechnology
- New Technologies and Bioprocesses
- Medical Technologies
- Food Microbiology and Food Technologies

and featured a keynote lecture, 20 plenary lectures, 14 scientific sessions and poster presentations. In total, there were 80 oral presentations and 100 poster presentations.

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Interviews with BRASD Participants

The CRI conference on Biotechnology Research and Applications for Sustainable Development, organized in the program of the Institute's International Center for Environmental and Industrial Toxicology (ICEIT), attracted researchers from some 20 countries worldwide

The Editor took this opportunity to talk with some of the distinguished speakers who presented papers in the scientific program of the conference. Firstly, I asked Dr. John Mattick, Director of the Centre for Molecular and Cellular Biology at the University of Queensland, Australia, what, in his view, had been the main achievements of the conference:

Dr. Mattick: *I think the main achievements of the conference have been in two areas. Firstly it has provided an excellent opportunity to hear about new developments in science, and secondly it has provided the opportunity to renew connections and linkages with colleagues, particularly with those based in Bangkok. One of the most important aspects of this type of meeting is that scientists working in related areas can get together and talk face to face about new projects and ways of working together. Often people are too busy at home to come to this kind of meeting, but one reason I came is that the scientific program looked so good, and I knew it would attract good people. Scientific research has become increasingly international and so it is very important to have this kind of opportunity. The present workshop has been perfect from this point of view.*

Editor: I then asked Dr. Mattick for his opinion on exciting developments in biotechnology that had been presented at the conference.

Dr. Mattick: *To see the wonderful potential use of microorganisms, to address environmental problems; the use of microbial pathways defined by genetics & microbiology to break down toxic chemicals and to deal with waste treatment. In fact one of the most exciting developments in biotechnology internationally is the use of microorganisms in waste treatment. Also, genuine genetic engineering, taking existing genes and modifying them for producing compounds or processes of economic value. It's just been wonderful to see the maturity of the field. The progress is on a broad front; but whereas 5 or 10 years ago people were talking about what might be possible, we are now seeing real examples of what can be done.*

Editor: Next, I turned to the question of Dr. Mattick's own research at the Centre for Molecular and Cellular Biology at the University of Queensland, and asked him about his own immediate concerns and interests with regard to biotechnology and its applications.

Dr. Mattick: *My main concern is to generate as much knowledge as quickly as possible. I have a strong view that people who are working on particular applied projects in biology are wasting their time because they don't know enough about the systems they are working in. This is largely because of short term political and economic pressures; and it applies as much in Australia or America as it does in Thailand. For example, people are trying to solve problems with technology when their knowledge basis is not good enough. So my own concern is to generate as much information as I can about the systems that I am interested in. I'm mainly interested in bacterial pathogenesis and also the genetic control of human development. Every time I clone a sequence of new gene, I learn something new. Every time we do this we have a better idea of how a system works and therefore of what products and processes may be possible. So the future belongs to those who generate information; and I think the next 5-10 years are critical and that the countries and the researchers who go after new information will be those who will profit most in the long term. Information is power, and the people who generate information will own the future.*

Editor: I next talked with Dr. Waclaw Szybalski of the McArdle Laboratory of Cancer Research of the University of Wisconsin, who at the conference presented a paper on Novel Methods for Rapid Sequence of Large Genomes. The paper described the development of a new "top-down" procedure for preparing contiguous 50-100-Kb fragments without conventional cloning.

I asked Dr. Szybalski what had been, in his opinion, the most exciting development in biotechnology discussed during the conference.

Dr. Szybalski: *It such an enormous field that it is very difficult to isolate any one development that is more exciting than another. But there was one particularly interesting subject presented here at the workshop by Thai researchers about making hybrid plants that produce properties that normal fruit do not have.*

It's very important to remember that biotechnology is a very old

science, going back at least 20,000 years, when people were developing agricultural plants to feed themselves, and later fermentation and preservation of food was all part of biotechnology. What is happening at the moment is an accelerated pace of knowledge but not the creation of a new field of knowledge. What we have now is development in 3 main areas. One is drugs to treat disease, another is new foodstuffs to alleviate hunger and the third is new approaches to cleaning up the environment thus creating sustained biotechnology. Bacteria, if they are properly designed, are wonderful at doing this.

To these three, I would also add new diagnostic tools. What I am working on in Wisconsin is trying to speed up the sequencing of the human genome because that will be one of the most important diagnostic tools. Once we fully understand the sequencing of DNA then we shall be in a position to understand susceptibility to diseases and many other things. It's very difficult to repair something if you do not have a blueprint, and DNA sequencing provides just that blueprint which will show what is wrong and how to correct or repair it. And future developments in medicine will be along these lines, producing better diagnostic tools, more efficient ways of producing more healthy food.

Editor: I next asked Dr. Meinhart Zenk of the University of Munich and presenter of a paper on Heavy Metal Detoxification in Higher Plants, for his views on the achievements of the conference:

Dr. Zenk: *The workshop has provided a very good overview of developments in biotechnology both internationally and here in Thailand. I am most impressed by the developments in gene technology that have been made. In the past I have not been exposed to oxidative stress and this is one of the areas that I really learned a lot about here. The level of research that is being carried out is most impressive.*

In Germany we have a Green Party which is backed up by Green Peace and these movements are, in my opinion, hindering progress in biotechnology because they are too worried about negative effects that biotechnology might have on the environment and on society. I completely disagree with this view. The press takes up horror stories which are scientifically not true. But these are elements that we always have to take into account.

Editor: Asked about his work at the University of Munich, Dr. Zenk replied:

Dr. Zenk: *My group in Munich is engaged in two main areas of research. Firstly, alkaloids which are pharmaceutically important alkaline compounds formed in higher plants. We want to produce plants which produce either new alkaloids or more of the known alcoloids. Secondly, heavy metal resistance in higher plants. This will increase our understanding of how heavy metals are inactivated in higher plants – leading to a process which is known as bioremediation. This means that we can remove heavy metal from contaminated soil with certain plants that are genetically modified to have a higher capacity to remove the metal in normal plants.*

This would give back to agriculture large areas where the soil is currently contaminated by industrial pollution in the form of heavy metals. We can genetically engineer tobacco plants that contain less cadmium to cut down on risks of lung cancer which some people believe to be caused by the inhaling of cadmium.

Editor: Finally I spoke with Dr. A.M. Chakrabarty of the Department of Microbiology and Immunology at the College of Medicine at the University of Illinois. I asked Dr. Chakrabarty what had been the most significant developments in biotechnology in the United States in recent years.

Dr. Chakrabarty: *In the United States developments in biotechnology have been quite extensive with most of the advances being made in medical biotechnology. A lot of work is going on in enhancing production of antibiotics and other drugs. But now, molecular plant biology is beginning to take off. New types of agricultural products are being introduced into the market and I believe that during the next 5-10 years there will be a significant number of new types of fruit and vegetables.*

The slowest moving area is environmental and industrial biotechnology. There are certain regulatory issues that have hampered progress, but I am pleased to say that these are now being addressed and I am sure that in the next 10-20 years we shall see significant advances in environmental biotechnology. Indeed, it is my personal belief that, in the long run, this area will prove even more important than medical biotechnology. I predict that there will be major innovations in the way we deal with problems of toxic chemicals in the near future.

Editor: When I asked Dr. Chakrabarty for his views on the overall achievements of the conference, he was most positive.

Dr. Chakrabarty: *We discussed different areas of plant biotechnology, medical biotechnology and environmental biotechnology, what their present status is and what future developments might be. This, I think, will be useful to students and researchers here in Thailand so that they can decide what directions to take and in what areas to concentrate research. Bringing into focus these major developments has been the main success and accomplishment of the conference.*

Editor: Dr. Chakrabarty's view was shared by all the other participants I spoke with. They agreed that as a forum both for information exchange and as a training workshop the conference had been outstandingly successful.

The Carcinogenesis Bioassay in Perspective

In a recent review article on the application of carcinogenesis bioassay in identifying human cancer hazard, the authors① point out that carcinogenesis bioassays have been criticized for identifying "too many rodent carcinogens" and for not predicting carcinogenic hazards to humans, largely because of purported differences in exposures and lack of discrimination due to high-dose effects. Long-term bioassays are designed to expose rodents to chemicals or environmental mixtures that cause only minimal toxic effects. The highest dose selected for these studies has been termed the "maximum tolerated dose" (MTD), when, in fact, it actually represents a minimally toxic exposure dose. Since nearly half the chemicals tested by the National Cancer Institute (NCI) and the National Toxicology Program (NTP) elicited a positive response in the rodent bioassays, some researchers have postulated that carcinogenesis in these studies results from cell killing and increased cell division (mitogenesis). However, no obvious correlation between toxicity and carcinogenicity exists. Mitogenesis is certainly crucial to the carcinogenic process, but the conclusion that the majority of positive carcinogenesis responses results from cell killing and mitogenesis requires a more critical evaluation.

Most of the chemicals selected for the NCI/NTP rodent bioassay program were suspect carcinogens. Thus, not surprisingly, many of these chemicals (two-thirds) did induce carcinogenic responses in well-controlled, 2-year rodent carcinogen bioassays. More criteria are used to predict the carcinogenic potential of chemicals since the inception of the bioassay program, as more information on mechanisms of carcinogenesis has become available. These criteria include 1) positive or suggestive evidence from epidemiological studies or previous experimental studies in animals, 2) potential to act as an electrophilic agent or to be metabolized to an electrophilic species, 3) potential to be metabolized to active free radical species, and 4) known biological activity, such as genotoxicity. Other information useful for assessing potential carcinogenicity includes data on levels and duration of exposure to the chemical, potential for bioaccumulation, mechanism of carcinogenic activity, species differences, and genetic susceptibility.

Some chemicals were selected for carcinogenicity testing based primarily on estimates of human exposures, without prior suspicion of carcinogenecity. Estimates of exposure were based on 1) production volume; 2) use pattern (e.g., is the chemical an intermediate or end product, is it used in an open or closed system, is it used in occupational settings or by certain subgroups of the general population); 3) environmental pollutants such as pesticides; 4) potential to enter the food chain; 5) physical properties (e.g., vapor pressure and partition coefficients) that are relevant to the route of human exposure; 6) potential for bioaccumulation; and 7) worker and consumer exposure databases. This subset of chemicals represents a more randomly selected group of substances to ascertain more accurately the percentage of chemicals that are carcinogenic to rodents, assess whether testing chemicals at minimally toxic exposure levels generally results in carcinogenic responses, and predict the proportion of chemicals that may pose a carcinogenic risk to humans.

In their study the authors divided chemicals tested for carcinogenicity into two categories: those selected on the basis of being suspect carcinogens and those selected on the basis of exposure/production volume.

Two thirds of the suspect carcinogens exhibited carcinogenic activity, whereas the majority (nearly 80%) of the high-volume chemicals were not carcinogenic, even when tested at relatively high exposures. On the basis of their analyses, the authors predict that less than 5-10% of the 75,000 chemicals in commercial use might be reasonably anticipated to be carcinogenic to humans.

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① Victor A. Fung, National Toxicology Program, National Institutes of Health.

J. Carl Barrett and James Huff, National of Environmental Health Sciences.

Source: Environmental Health Perspectives, Vol. 103, No. 7-8, July/August 1995.

MEASURING ENVIRONMENTAL TOBACCO SMOKE

A workshop organized by the Institute of Occupational Health of the Chinese Academy of Preventive Medicine in May 1995 brought together experts from major cities across China as well as environmental specialists from USA and UK to discuss a contentious aspect of air pollution – the generation of environmental tobacco smoke or ETS.

Environmental tobacco smoke is a combination of sidestream smoke produced at the burning end of cigarette and exhaled mainstream smoke. This mixture is aged and diluted by ambient air and is of variable composition depending on different types of cigarette, coagulation of particulates, ambient temperature and relative humidity among other factors.

During the ageing some of the nicotine, which is initially associated with the particulate phase, vapourises; the particles decrease in size and the nitric oxide oxidises to nitrogen dioxide. Almost 4000 compounds have been identified in tobacco smoke, most of which are also found in the smoke from other burning plant materials. Differences in the smoke from plant material are determined more by the temperature, humidity and oxygen supply than by the plant material being burned.

It is important to quantify ETS exposure and uptake in humans in order to conduct set target exposure levels for animal studies and for risk assessment and human studies. Measurement of ETS concentration requires a marker unique for tobacco smoke and present in sufficient quantity in the smoke to be detected in ambient air even at very low smoking rates. Its decay rate would need to be slow and independent of other variables such as temperature, humidity, furnishings and fabrics. Although no such ideal marker exists, nicotine has been widely used as a marker for ETS in past studies. Physiological fluid analysis is the approach most commonly used to assess human exposure to ETS. Carbon monoxide has also been used as a marker but CO is not specific to ETS and there are often other major sources of CO in the environment. Thus, nicotine and its metabolite, cotinine, in plasma, urine, saliva and hair are now the most widely used markers for exposure to ETS. Although cotinine is not the main metabolite of nicotine in man, urinary cotintine, because it is non invasive, has become the most popular method of measuring human exposure to ETS.

Source: Summary workshop report. G. Leslie. Center for Environmental Control and Waste Management. Imperial College, London.

Risk and Revisionism in Arsenic Cancer Risk Assessment

A recent article on arsenic cancer risk assessment presents aspects of the existing controversy on assessment for environmental oral exposures to inorganic carcinogenic arsenic.

Oral exposures of nonoccupational populations to environmental inorganic arsenic are associated with skin and internal cancers as well as with various noncarcinogenic effects.

Cancer risk assessments have been based largely on epidemiological studies of a large population in Taiwan that suffered exposure to inorganic arsenic in well water.

This population makes up the principal epidemiological data base for cancer risk assessment of ingested inorganic arsenic by such regulatory agencies as the US Environmental Protection Agency (EPA). Criticisms of the use of this data for assessing risks outside Taiwan have been expressed on various grounds, particularly in thelight of recent findings of increased incidence of internal cancers (of the bladder, kidney, liver and lung) in the exposed Taiwanese, in addition to already observed skin cancer.

Such criticisms collectively posit a revisionist view that: (1) cancer incidence among the affected Taiwanese population was amplified by a number of host and environmental factors not applicable elsewhere, (2) the cancer dose-response curve may not be linear at the lower exposures, elsewhere, and (3) there is a toxicokinetic and metabolic threshold to cancer risk that was exceeded in the Taiwanese population.

It may be contested, however, that the identification of alleged problems with the Taiwanese data represents flawed reasoning.

Arguments have been made that levels of carcinogenic arsenic in diet can be significant and must be taken into account, rather than using drinking water arsenic alone. However, the quantitative role of dietary inorganic arsenic in generation of a cancer slope factor (CSF) is far from established and may not even be significant, given the overall uncertainty and variability in the cancer risk characterizations reported for inorganic arsenic. There are questions about the form of arsenic in foodstuffs and their relative carcinogenic potency, questions about how dietary arsenic intakes would affect CSF values, and the matter of a likely modest effect of added arsenic ingested from foods prepared with arsenic-contaminated water.

Arguments have been made that there have been underestimates of water intake by arsenic-exposed Taiwanese in the past and that EPA's current use of an intake volume of 4.5 L/day, a value over twice that of the generic figure of 2 L/day, is appropriate. However, that higher volume selection appears to be quite arbitrary, given what we know about fluid intakes in various human populations. It should be noted that any argument for a high daily intake volume of water in the Taiwanese is no more well grounded than is use of a generic/default value of 2 L/day used by EPA in many of its other risk assessments.

Arguments have been advanced that carcinogenic risk from inorganic arsenic is quantitatively linked to biomethylation/detoxification of inorganic arsenic in humans and that the exposed Taiwanese were in the reduced methylation/detoxification portion of the dose curve. However, some of the arguments advanced to show reduced biomethylation with increasing arsenic intake are not credible. Ongoing studies attempting to quantify this relationship and define a threshold for methylation efficiency have produced a mixed picture. In one study of Nevada residents ingesting arsenic-laced well water at a high average concentration, the fractional distribution of urinary arsenic among forms did not vary compared to lower total arsenic intakes. In other studies, the relative proportion of inorganic arsenic compared to the two combined methylated forms or to total arsenic does not appear to define a clean dose-response relationship or a threshold for methylating efficiency.

One of the more common arguments against use of Taiwanese data in risk assessment is rooted in the claim of alleged nutritional deficiencies in the Taiwanese, with implications for the efficiency of arsenic biomethylation relative to, say, North American populations. However, a report of nutrient intakes among the exposed Taiwanese[1] indicates that the nutritional status of the exposed Taiwanese, particularly in terms of nutrients associated with single carbon (methyl) metabolism, was sufficient to accommodate the body stores of methyl groups needed for arsenic biomethylation. At the highest arsenic level reported, the biomethylation process requires only a percent or so of reported total daily methyl intake, hardly a convincing methyl deficiency situation. A second difficulty with the nutrition argument is a demographic, socioeconomic one; i.e., the assumption that all North American populations exposed to arsenic are composed only of individuals whose nutritional status is superior to that of the arsenic-exposed Taiwanese. Where has this been quantitatively demonstrated? In the absence of data to the contrary, if individuals in the Taiwan endemic zone were at added risk for arsenic effects by virtue of poor nutritional status, then individuals anywhere with this risk factor are of concern, including exposed subjects in northern Mexico and some areas in the United States.

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[1] Engel RR, Receveur O. Arsenic ingestion and internal cancers: a review. Am J Epidemiology 138:896-897 (1993).

Source: Risk and Revisionism in Arsenic Cancer Risk Assessment. P. Mushak and A.F. Crocetti, Environmental Health Perspectives, Vol. 103, No. 7-8, July-August 1995.

The Impact of Ozone on Air Pollution

Unlike the four other main air pollutants – carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulates – for which the US Environmental Protection Agency (EPA) has established national ambient air quality standards (NAAQS), ozone is not directly emitted into the air from automobiles, power plants, or industrial facilities. Rather, it is a photochemical pollutant, created when sunlight catalyzes chemical reactions with other pollutants. Hot temperatures and stagnant air provide conditons conducive to the formating of ozone; thus in most of the United States and in Europe, the effects are most noticeable in summer. Recent US hospital admissions data have helped clarify the relationship between ozone and health effects. Studies have shown a very strong link between summertime ozone levels and increased respiratory hospital admissions.

Ozone is a powerful irritant to the respiratory tract. It constricts the air passages, making breathing difficult, particularly in young children and the elderly, and people with asthma, chronic bronchitis, or emphysema. Ozone has also been described as a powerful cellular poison that interferes with the ability of the lung to defend itself against other offending agents. It affects alveolar macrophages, which act as scavenger cells in the lung, engulfing harmful bacteria, and by interfering with this process, ozone makes the lung more susceptible to infection.

Studies suggest that pulmonary function changes caused by exposure to an episode of relatively high ozone (0.5 ppm) during a low-ozone season are more severe than when these same levels occur during a high-ozone pollution season. The attenuation of effects after repeated exposures is demonstrated by data from studies of five-day exposures according to the EPA's criteria document, which noted that the pulmonary function changes are typically greatest on the second day of a five-day exposure but return to control levels by the fifth day of exposure.

However, attenuation of some of the effects reverses when exposure ceases, and cell damage continues while the attenuation process is underway. Moreover, attenuation may alter the normal distribution fo ozone within the lung, allowing more ozone to reach sensitive regions, possibly affecting normal lung defenses. A recent animal study conducted by the U.S. National Toxicology Program in collaboration with the Health Effects Institute (HEI) suggests that rats develop a tolerance to long-term (eight hours/day) ozone exposures. In the study, healthy, sedentary rats were exposed to three different concentrations of ozone (0.12 ppm, 0.5 ppm, 1.0 ppm) for 5 days a week, 6 hours a day, for 20 months. Results indicated the rats experienced relatively few health effects in the lung and other parts of the respiratory system, with the exception of the nose, where inflammation occurred at exposures of 0.5 ppm and 1.0 ppm.

At these exposures, structural and biochemical changes were found in certain regions of the lung, especially the centriacinar region at the beginning of the air exchange system. Data on the effects of 0.12 ppm ozone were inconclusive. Ozone causes damage and death of epithelial cells, accompanied by inflammation at the end of the airway, which interferes with the body's ability to carry particles out of the lung. These effects were apparent in the rats exposed for 20 months under the HEI study, but the effects were similar to those exhibited by rats in other studies that were exposed for 90 days, suggesting that past a certain point, additional exposure may not produce additional harm.

In comparing the results of rat studies to human effects, the committee said that the effects experienced by rats were not similar to the more serious human pulmonary fibrosis, or scarring of lung tissue, but instead resembled bronchiolitis, or inflammation of the bronchioles, the small branches that extend from the bronchial tree, a condition that produces limited or no functional impacts.

HEI researchers believe more work is needed to determine whether animals develop tolerance to ozone by examining lung function at various intervals of exposure. Evidence demonstrates that lung function is impaired after exposure to ozone, but it is as yet unclear whether a week after exposure lung function is permanently impaired. Moreover, there is a need to understand more about the effects of ozone in combination with other pollutants as in real world air pollution which is extremely difficult to replicate in a laboratory.

Source: Environmental Health Perspectives, Vo.. 103, Number 7-8 July-August 1995.

Air Pollution: Butenes and Smog

Recent studies of smog levels in Mexico City have revealed that one of the main contributing factors of the smog that reaches dangerous levels on average 80 hours in any one month in this metropolitan area is caused in the main not by vehicle exhaust gases but unburned liquid petroleum gas, or LPG, used for cooking and heating in most homes.

Mexican LPG is only fifty per cent propane, the remainder being a mixture of butane and butenes, the latter being highly efficient at forming ozone, the main component of smog. The problem of air pollution in Mexico City is exacerbated by the fact that there appears to be a very high leakage rate of LPG used in the home, and researchers estimate that one third of the city's smog could result from this source. Residents of Mexico City use LPG in individual tanks rather than by drawing it from a main distribution system; thus finding the source of leaks is extremely difficult. It has been estimated that more than a million homes use LPG. Mexico City is not the only urban area with this problem. Studies of smog in several cities in eastern Europe have revealed high levels of propane, butane and butenes in the air. Although many developed countries do not have high levels of butane or butenes in their LPG, thus alleviating some of the concern over ozone formation, substantial leaks could occur anywhere, creating an environmental hazard.

Source: Scientific American, July 1995.

Studies of the effects of air pollution in Bangkok

Bangkok, a city of over 6 million inhabitants, has serious air pollution problems arising from chronic traffic congestion and largely unzoned industrial development. Incomplete combustion of coal, natural gas, and other carbon-contatining compounds, emits carbon monoxide (CO) at concentrations as high as 6%. Thus, in Bangkok, production of CO from fuels accounts for greater quantities of pollutants than all other sources combined.

Recent studies carried out by researchers at Ramathibodi Hospital have measured the effects of air pollution in particularly vulnerable groups in the urban population: bus drivers, traffic policemen, and young children who live in areas of high levels of air pollution.

A study carried out in 1994[1] examined the increasing carbon monoxide blood levels of Bangkok bus drivers.

Thirty-one bus drivers were examined prior to their daily work. Data collected included age, sex, years of work as bus drivers, smoking history, previous illnesses and present symptoms. Work blood was drawn for measurement of COHb before the work shift and this was compared with a sample of blood obtained after a 6 hour shift. The whole blood was placed in a tube with EDTA and analysed by microdiffusion technique in a Conway cell. The coefficient of variation for this method is ±5.2%

The ages of the 31 bus drivers included in this study ranged from 25 years to 58 years, and all were male. Their period of engagement as bus drivers ranged from 0.5 to 13 years, giving a mean of 8 years.

The COHb level before a shift was 2.19±2.5% (range 0-7.18). After a 6 hour shift it was 5.26±2.52% (range 0-10.4). The increased COHb level in drivers after a 6 hour shift is significant and may well reflect the COHb level of other workers in the urban area. Chronic exposure at these levels is considered harmful to health. Previous epidemiological studies indicate that persons with underlying disease, especially chronic obstructive pulmonary disease (COPD), are more sensitive to the adverse effects of air pollution than other subjects. Moreover, air pollution and cigarette smoking have synergistic adverse health effects. Sedentary, healthy subjects would be expected to have COHb levels of less than 1.8%. Acute CO poisoning, with blood COHb levels over 30%, results in secondary hypoxic damage to the heart and brain. Chronically elevated levels of COHb have been shown to impair cognitive formation and judgment.

It should be noted that this study addressed a single pollutant. Most environmental pollution involves multiple agents. It is quite likely that the subjects in the study also suffer daily exposures to other gaseous and particulate pollutants. Long-term studies of street workers in urban areas with congested traffic are needed to determine the extent of damage they might be suffering.

A related study first published in March 1995[2] took pulmonary function testings of a group of one hundred and seventy four traffic policemen working in the Bangkok metropolitan area. Lung function tests were performed via vitalograph and the American Thoracic Society's predictive values x 0.85 were used as reference.

The study showed the pulmonary functions of 44 policemen to be abnormal (25.3%). Restrictive lung functions occurred in 30 subjects (17.2%), small airway obstruction in 11 (6.3%) and large airway obstruction in 3 (1.7%). The study postulates that chronic exposure to complex pollutants in urban workers may cause chronic as well as active inflammation and lead to focal epithelial proliferation and metaplasia and fibrosis in the proximal alveolar region.

Earlier studies have examined the effect of environmental pollution on the lung health of Thai children aged under 5 years,[3] and on school students in schools located in areas of high air pollution.[4]

Children depend on the environment for their health and well being, the city being the nurturing environment in which they grow and form their behavioral patterns. Thailand has experienced rapid industrialization and urbanization in the past 15 years. In metropolitan areas, environmental pollution has become a major health problem.

A research study conducted in 1989 by C. Pulket and colleagues on domestic air pollution in Bangkok and child survival revealed a significant tendency that the quality of air may be a direct cause of Acute Respiratory Infection (ARI).

Attention has recently been focussed on the potential health effects of passive smoking. The weight of evidence now indicates that it is harmful. Children are the most vulnerable sufferers of air pollution as well as often being passive smokers in their domestic environment.

Other studies in Thailand conducted in 1985 and 1986 by the BOSTID ARI group revealed more frequent occurrence of ARI in children aged less than 5 years in families where cigarette smoking occurred. (K. Vathanophas et al.). The risk factors for development of pneumonia compared with the group for bronchitis was increased, though not statistically significant (S. Suwanjutha et al.).

A two year study of ARI in children under five years in the Din-Daeng (central Bangkok) community showed that smoking among family members was significantly correlated with severe ARI cases (Darmawan 1989).

A pulmonary function study and health evaluation was carried out on 452 students (male 45.6% and female 54.4%) between 6 and 15 years of age in schools located near highways, from November 1993 to April 1994. Pulmonary function was studied using a computerized spirometer (Autospiro AS-500) and Mini Wright peak flow meter. The results showed prevalence of allergic rhinitis and bronchial asthma of 24.9 and 7.0% respectively. When values of pulmonary function in this study were compared with students 10 years earlier, higher vital capacity (VC) values were found than in the past. This may be due to improvements in nutritional status and exercise. Forced expiratory volume in one second (FEV1.0) and peak expiratory flow rate (PEFR), which indicates major airway obstruction, were lower than in the past in boys but unchanged in girls. Mid-maximal expiratory flow rate (MMEFR) values, which indicate small airway obstruction, were lower than in the past for both sexes. This lower rate may be due to air pollution which irritates the airways.

Further exploration and well-designed studies specific to respiratory health status related to exposure to both indoor and outdoor air pollution are

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COURSE ON EXPERIMENTAL AND CLINICAL NEUROTOXICOLOGY

at Department of Nutrition Sciences
University of Oporto, Portugal
May 27-31, 1996

Under the auspices of University of Oporto, IPCS, WHO, EC.

This course will cover the whole field of Neurotoxicology and include classifications of neurotoxic substances, mechanisms and pathophysiology of neurotoxicity, clinical and functional diagnosis of neurotoxic diseases (including toxicological, electrophysiological and neuro behavioural tests), and epidemiology of neurotoxic diseases.

Faculty:

H. H. Schaumburg, MD
Albert Einstein College of Medicine
New York – USA

P. S. Spencer, Ph.D.
Center for Research on Occupational and Environmental Toxicology
Portland – USA

M. Lotti, MD
Institute of Occupational Medicine – University of Padua – Italy

Registration fees:
Before 31st. Marh 96 – US$ 300
From 1st April to 26th May – US$ 400
27th May – US$ 500

(cheque made payable to "Curso de Ciencias da Nutrição/ICFT). You can also register by fax: 351-2-5504143. (Your fax registration will be considered valid only after receipt of the registration fee.)

Fellowships:
20 fellowships covering registration are available for scientists under the age of 35.

Registration and further information:
Dr. Ana Paula Augusto
Curso Ciências an Nutriçao
University of Oporto

Rua Dr. Roberto Frias
4200 Oporto Portugal
Fax: 351-2-5504143

INTERNATIONAL CONFERENCE

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In her opening address on the first day of the Conference, Her Royal Highness Princess Chulabhorn President of the Chulabhorn Research Institute and Chairman of the Organizing Committee of the Conference, emphasized the need for close cooperation among scientists to ensure that applications of new research findings lead to sustainable development, a cleaner environment and an improvement in the quality of life. Her Royal Highness cited the field of biotechnology as an excellent example of multidisciplinary research in which cooperation was the key to success.

Dr. Skorn Mongkolsuk, Secretary General of the Organizing Committee, reported the objectives of the conference as being, "to bring together scientists, government officials and personnel involved in the research and application of biotechnology to exchange ideas, to share research experience and to learn of recent advances in the areas of agriculture, environmental and medical biotechnology from the experts."

In his keynote lecture, Professor Marc van Montagu, Head of Laboratory in the Laboratory of Genetics of the University of Ghent, Belgium, emphasized the progress that has been made in improving plants through genetic engineering. However, it is not only for agriculture but also for the chemical and pharmaceutical industry that transgenic plants will become important. It is now more than 10 years since transgenic plants became available. The first constructs of importance for agriculture were plants carrying an additional single gene conferring insect or virus resistance or a gene conferring tolerance towards a herbicide. More recently, more sophisticated constructions have been made. A most elegant example is the engineering of restorable nuclear male-sterile plants. For all species tested, it has been found that the transgenic plants, engineered for male sterility, are an excellent starting material for breeding high yielding hybrid cultivars. These constructs were made thanks to outstanding fundamental research on another development.

Studies of the effects of air pollution in Bangkok

(Continued from page 7)

being carried out through cooperation and collaboration among government personnel and non-governmental agencies in order to find the solution to prevent further environmental hazards to health, especially the respiratory health status of Thai children.

① Sawang Saenghirunvattana. Increasing Carbonmonoxide Blood Levels in Bangkok Bus Drivers, Environment International, Vol. 21, No. 1. pp. 81-84, 1995

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