IITR

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Indian Institute of Toxicology Research, Lucknow
(Formerly: Industrial Toxicology Research Centre, Lucknow)

IITR FOUNDATION DAY

Indian Institute of Toxicology Research (IITR) celebrated its 43rd Foundation Day on November 4, 2008. Dr Ashwani Kumar, Acting Director, IITR welcomed the guests, Dr PS Chauhan, Chairman, Research Council, IITR and Ex-Head, Department of Genetics, BARC, Mumbai and Dr Mone Zaidi, Prof. of Medicine and Physiology, Mount Sinai School of Medicine , NY, USA. Dr Ashwani Kumar presented the annual report of the institute. He informed the august gathering that it was an eventful year for the institute as its name was changed from 'Industrial Toxicology Research Centre' to 'Indian Institute of Toxicology Research'. The name change reflects that the core activity remains research in 'Toxicology ', but the scope of work has now expanded from 'Industrial Toxicology' to toxicology in all areas. This would require a substantial upgradation of both ideas and resources. Some significant highlights of the research activities during the period were presented, which are:

Inaugural ceremony of 43rd Foundation Day

- Three tested pesticides, dichlorvos, pedimethalian, and cypermethrin, have DNA damaging potential in mammalian cells. These should, therefore, be used with caution.
- Oral administration of low doses of lindane to pregnant rats from gestation day 5-21 produced a dose-dependent increase in xenobiotic metabolizing cytochrome P450s, both in the brain and liver of the offspring. Interestingly the increase in mRNA expression of these P-450s was found to persist up to adulthood, suggesting that the exposure to low doses of lindane administered to the pregnant mothers might program the brain and liver of the offspring to permanently overexpress the xenobiotic metabolizing P450s. Further, these rats were more sensitive to exposures now and showed higher toxicity. The results suggest that exposure to pollutants during pregnancy can have long imprints in new born even though the later might not be exposed.
- Gene-environment interactions play an important role in the development of cancers. Patients carrying the variant genotype combinations of cytochrome P-450 and glutathione transferases were found to have 2-4 fold higher risk for lung cancer. The risk was further increased by cigarette smoking, tobacco chewing or alcohol consumption.
- Spices Board of India formulated a mandatory testing program for the detection of Sudan dyes in all consignments of chilli, exported from India. The loose chilli powder samples were tested for the presence of Sudan dyes, out of 800 non-branded samples 66% were found to contain these dyes. However, these dyes were not detected in the branded samples.
- Several studies were carried out to elucidate the strategies for mitigation of food based toxicants. For example, consumption of mustard oil, which is contaminated with argemone oil, leads to a clinical condition called Epidemic Dropsy (ED). Studies revealed that the patients from Lucknow showed faster recovery in comparison to patients from Patna. This was possibly because Lucknow patients were treated with an antioxidant therapy by á-tocopherol. This therapy may, therefore, be beneficial to dropsy patients and needs detailed clinical trials.
- In All India Network projects on "Monitoring of pesticide residues in food commodities" at national level, 225 samples of vegetables, 45 samples of fruits, 36 samples of wheat and rice, 9 samples each of milk and butter and 3 samples of ground water were analyzed for the presence of 14 organochlorines, 7 pyrethroids and 13 organophosphate pesticides. While most of the samples had pesticide residues below their 'Mean Residue Levels' (MRL) some samples i.e. 25 vegetables, 6 fruits, 1 milk and 2 cereal

On the dais (L-R) Dr DK Saxena, Dr Mone Zaidi, Dr PS Chauhan and Dr Ashwani Kumar

samples showed presence of some organochlorine pesticide residues that were above their MRL values. None of the butter and water samples, however, were found contaminated with these residues.

While delivering the presidential address, Dr PS Chauhan said that IITR has made a very good progress both in the area of basic as well as applied research, addressing the issues of public health, environment and industry as well as food including novel foods. He lauded the achievements of IITR scientists with publications appearing on the cover page of high impact factor journals. He further mentioned that IITR has forayed into the area of nano science which is an area which will surpass all other areas of technology including biotechnology in terms of product development and will find application in the pharmaceutical, aviation, transport and nuclear fields.

On this occasion the report on "Environmental status of Lucknow city" (post monsoon) survey was released. The salient features of this report are:

The survey was conducted separately at commercial, residential and industrial areas of the city and it was found that the pollution levels at these sites were higher than the permissible limit. Day time noise pollution level in residential, commercial and industrial areas was found to be in the range 65.5 to 71.1 dB, 70.7 to 77 decibel and 73.7 to 77.5 decibel respectively. The permissible limits are 55, 65, 75 decibel respectively. The night time noise pollution too was found higher. Noise pollution levels were found in the range of 54.6 to 65.7, 56.8 to 71.9 and 62.9 to 66.3 decibels in residential, commercial and industrial areas. The permissible limits are 45, 55 and 70 decibel respectively. There was an increase in the level of Suspended Particulate Matter (SPM). Suspended Particulate Matter in Indira Nagar was recorded

Lighter moments during IITR Foundation Day celebrations

PROF SH ZAIDI ORATION

and drug targets toward personalizing medicine, have together impacted profoundly on our understanding of the genesis of human disease, as well as molecular mechanisms underlying adverse drug effects. He further said that his group has for over 20 years utilized the vertebrate skeleton as a paradigm, and osteoporosis as a prevalent public health hazard worldwide, to study common molecular mechanisms to a therapeutic advantage. His group has discovered that postmenopausal osteoporosis, which causes over 2 million fractures in the United States alone, is not solely due to lowered estrogen levels. Thus, the understanding the human genome and how gene expression is regulated together have created unprecedented opportunities for the physicians, who can now unravel clinical mysteries in the laboratory and then translate the research findings to the benefit of patients.

While delivering the presidential address, Dr PS Chauhan said that it was a special occasion to pay regard and homage to founder Director, Prof. SH Zaidi, whose vision and foresightedness led to establishment of IITR. He described Prof. Mone Zaidi as "a worthy son of an illustrious father". He further said that Prof. Mone Zaidi, in his lecture, has elegantly brought out how translational research in the post genomic era is underlining the complexity of life processes and trying to understand its pathophysiology to provide better health care and control for an array of diseases in the skeletal paradigm.

WHO/TDR training workshop on "Train the GLP-Trainer"

The WHO/TDR GLP-Network Regional Coordination (Asia), established at the Indian Institute of Toxicology Research (IITR), Lucknow, held a training workshop on "Train the GLP Trainer" from October 13-17, 2008 at Hotel Clark's Awadh, Lucknow. This workshop was a follow-up of the previous workshops on GLP principles held at Bangalore in October 2007 and Mumbai in August 2008. This workshop was comprised of two components; 1. Train the GLP Trainer, 2. Fresh Trainers train the trainees. Sixteen prospective "Trainers" were selected from our previous batches of trainees while twenty fresh trainees were be selected from the fresh nominations/applicants from various government R&D organizations, universities, medical departments, and

CONFERENCE/WORKSHOPS

private industry, CROs, etc. The highlight of this training workshop were Dr. Andrew Walubo, Prof. of Pharmacology, Free University, South Africa, participating as faculty and Dr. Hasenah Ali and Ms. Fadhilah Hasbulah, Bureau of Pharmaceutics, Government of Malaysia, participating as trainees.

The objective for the GLP workshop was to encourage production of high quality data from pre-clinical studies through training of GLP concepts. WHO/TDR Network of GLP-trainers was started in 2006 to propagate GLP training in disease endemic countries (DECs). The training targets R&D scientists/researchers who are involved in the area of pre-clinical development in order to introduce them to the concepts of GLP and help implementing these concepts in the safety studies. The training follows the WHO/TDR GLP training materials that are based on international Organization for Economic Co-operation and Development (OECD) GLP Principles. Topics, such as resources, preparation of study plan and SOPs, characterization of test item and test systems, documentation and reporting of results and quality assurance, were discussed in the training sessions of five days for the Trainers and three days for the Trainees. Additionally, workshops on preparation and analysis of study plan and SOPs, case studies and self assessment of the understanding of OECD principles of GLP were held to provide hands-on experience to these important aspects of GLP principles for their implementation in individual's laboratories. It is hoped that this workshop will lead to improved understanding of the role of pre-clinical studies in product development, the requirement of GLP as a quality management system and the basis for mutual recognition of pre-clinical data.

The expected benefit of such workshops is to make available a cadre of trained human resource and to empower the best talents to become GLP-trainers so that the knowledge spreads through multiple sources that will facilitate implementation of GLP-principles at the governmental as well as private organizations conducting non-clinical safety studies for their own products or for the sponsors for regulatory submissions and asserting their credibility as GLP compliant laboratory for global acceptance of their data and reports.

Current Advances in Biological Research

A one day symposium on Current Advances in Biological Research was organized at Indian Institute of Toxicology Research on November 5, 2008. This was to mark the end of celebration of IITR Foundation Day 2008. Event was organized for educating, updating and encouraging vibrant minds on subjects that led to award of Nobel Prizes in last two years. Scientists at IITR, Drs Y Shukla, D Parmar, AB Pant, Sanjaya Yadav and Er. AH Khan, were the speakers.

Dr CM Gupta Ex-Director CDRI and Distinguished Biotechnologist, DBT inaugurated the Symposium. After introduction of the Symposium by Dr Ashwani Kumar, Acting Director, IITR and the inaugural address by Chief Guest, lectures entitled “Potent and specific genetic interference by double stranded RNA in *Caenorhabditis elegans”*, “Molecular Basis of Eukaryotic transcription”, “Principles for introducing specific gene modifications in mice by the use of embryonic stem cells”, “Selective blockade of microRNA processing by Lin28 RNA silencing”, and “Man-made climate change and counteracting measures” were held. Symposium ended with a vote of thanks by Dr Sushil Kumar, Scientist IITR.

Alexander Hollaender Workshop on Genetic Toxicology

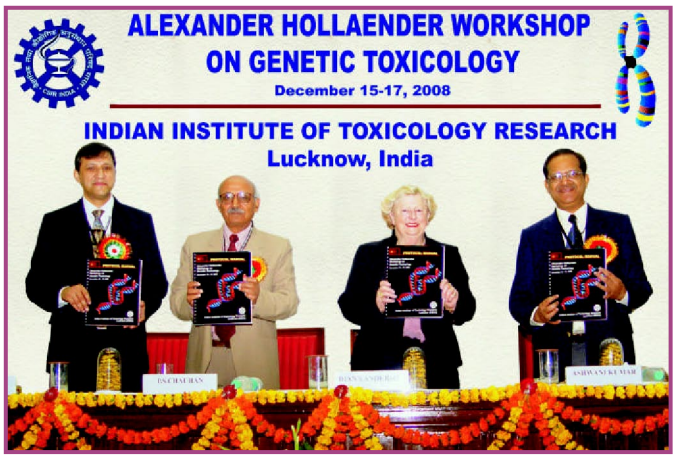
A three day "Alexander Hollander Workshop on Genetic Toxicology" was organized at the Indian Institute of Toxicology Research (IITR) from December 15-17, 2008. Prof. Alexander Hollaender, also known as the Father of Radiation Biology was the Director of Biology Division in Oak Ridge, USA (1946-63) and was the first to point out nucleic acids as the genetic material and that cells have repair mechanisms. He was also, Founder of the Environmental Mutagen Society, USA. Alexander Hollaender courses (AHC) are organized in his memory to promote scientific exchange between USA and developing countries in the area of environmental mutagenesis. 13 such courses have already been organized in different countries where environmental mutagenesis and health issues are of major concern. The first AHC was held in Mexico City, Mexico from 14-17 November 1993 and was considered a landmark event in the area of genetic toxicology to facilitate the development of trained human resource in this important field. The 14th AHC was the first to be held in India. It was jointly organized by the Indian Institute of Chemical Biology, Kolkatta and the Indian Institute of Toxicology Research, Lucknow. The lecture course was held at Kolkatta while the lab workshop was held at the Indian Institute of Toxicology Research, Lucknow from December 15–17, 2008. The workshop brought together experts working in the field of genetic toxicology from India as well as abroad. The goal of the workshop was to impart hands on training to researchers on different techniques used in genetic toxicology. Eleven participants from pharmaceutical industry, drug discovery laboratory, research institutions and universities took part in this workshop. During the inaugural session Dr Ashwani Kumar, Acting Director IITR, highlighted the scientific contributions of Alexander Hollaender and welcomed all the participants. The workshop was inaugurated by Prof. Diana Anderson, Established Chair, University of Bradford, U.K. During her inaugural speech she stressed the importance of such workshops, especially with respect to creating trained manpower in the area of genetic toxicology in India. Prof. Anderson also released the “Protocol Manual” at this occasion. Dr PS Chauhan, Chairman, Research Council, IITR, while addressing the gathering, lauded the effort of IITR

in holding the prestigious Alexander Hollaender Workshop for the young scientists and researchers in India. He emphasized that such workshops shall not only fulfill the dream of Prof. Hollaender but also help the Indian scientists and research students to learn different techniques in genetic toxicology and their implementation to understand the mechanism of DNA damage. He also shared his scientific experience and told about the history of genetic toxicology. Prof. Alok Dhawan, Co-Director of the workshop in his speech thanked Dr David DeMarini, Prof. William Au and all those who helped in organizing the workshop at IITR.

After the inauguration, the first lecture was delivered by Dr Nicole Weiland from Switzerland on Ames test. She discussed the conventional *Salmonella* Ames test as well as a microplate format. The mutagenicity of compound in the new liquid microplate format was measured by adding a pH indicator medium to the treated bacteria, which show a change in colour after 48 hour incubation. All the participants got an opportunity to conduct the Ames test on their own.

The other lectures were on : the micronucleus (MN) assay; the role of Biomarkers in Cancer; Chromosomal Aberration test and its role in regulatory toxicology; the *in vivo* and *in vitro* Comet assay; application of the Comet assay especially sperm Comet assay and the significance of mitochondrial DNA in toxicological studies.

The Chief Guest of the Valedictory session was Prof. Hasan Mukhtar, University of Wisconsin, USA. Dr Ashwani Kumar, Prof. Alok Dhawan, Dr Mukul Das, Dr Rishi Shankar, Dr SK Rath were also present. Dr Ashwani Kumar thanked the committee for organizing a laboratory workshop in the important area of genetic toxicology. Prof. Hasan Mukhtar also shared his experience and emphasized the importance of such workshops in creating trained human resource in genetic toxicology. He then distributed the certificates of participation. Prof. Alok Dhawan thanked all the faculty members as well as the participants for their cooperation in



Release of the "Protocol Manual"

making this workshop a success. He also expressed his gratitude to International Association of Environmental Mutagen Societies (IAEMS) for the support and assured the participants that more such workshops shall be organized in future.

1. Multipronged evaluation of genotoxicity in Indian petrol-pump workers

[Pandey AK, Bajpayee M, Parmar D, Kumar R, Rastogi SK, Mathur N,Thorning P, de Matas M, Shao Q, Anderson D, Dhawan A. Environmental and Molecular Mutagenesis,2008; 49: 695-707].

Petrol (gasoline) contains a number of toxicants. This study used human biomonitoring to evaluate the genotoxic effects of exposure to benzene in petrol fumes in 100 Indian petrol-pump workers (PPWs) and an equal number of controls. The study was corroborated *with in silico* assessments of the Comet assay results from the human biomonitoring study. An *in vitro* study in human lymphocytes was also

Demonstration of the *in vivo* MN assay in progress

Demonstration of Ames Test

Internal Seminars

Date	Topic	Speaker
17th October, 2008	Functional observational battery: a tool for neurobehavioral studies.	Dr Pramod Kumar
7th Nov., 2008	Lindane may modulate the female reproductive development through the interaction with ER- *in-vivo* and *in vitro* approach	Upasana Kapoor
14th Nov., 2008	Distinct MAPK signaling pathway up-regulation and caspase- mediated p21 cleavage establishes the fate of U937 cells exposed to 3-hydroxyandrographolide: differentiation versus apoptosis	Meenakshi Tewari
14th Nov., 2008	Endocrine-disrupting properties of widely used azole fungicides	*in vitro* Shipra Bhardwaj
28th Nov., 2008	Phosphorylation and dephosphorylation of tyrosine 141 regulate stability and degradati of INrf2: a novel mechanism in Nrf2 activation.	Monika Gupta
28th Nov., 2008	Transcription-coupled and DNA damage breaks are mediated via the nucleotide excision repair (NER) pathway	Poonam Singh
5th Dec., 2008	Comparative proteomics analysis of human gastric cancer	Jasmine George
5th Dec., 2008	Nanoparticle-mediated cellular response is size-dependent.	Vyoms Sharma
19th Dec., 2008	The Nalp3 inflammasome is essential for the development of silicosis	Mohd. Javed Akhtar
26th Dec., 2008	Control of acute, chronic, and constitutive hyperammonemia by wild-type and genetically engineered *Lactobacillus plantarum* in rodents.	Sapna Sharma

RESEARCH HIGHLIGHTS OF IITR

conducted to understand the genotoxicity of benzene and its metabolites. In a subset of the population studied, higher blood benzene levels were detected in the PPWs (n= 539; P < 0.01) than the controls (n= 518), and 100–250 ppb benzene was also detected in air samples from the petrol pumps. PPWs had higher levels of DNA damage than the controls (P < 0.01). In addition, the micronucleus assay was performed on lymphocytes from a subset of the subjects, and the micronucleus frequency for PPWs was significantly higher (n= 539; 14.73 ± 9.92%) than the controls (n= 518; 7.54 ± 3.00%). Human lymphocytes were treated *in vitro* with benzene and several of its metabolites and assayed for DNA damage with the Comet assay. Benzene and its metabolites produced significant (P < 0.05) levels of DNA damage at and above concentrations of 10 µM. The metabolite, p-benzoquinone, produced the greatest amount of DNA damage, followed by hydroquinone > benzene > catechol > 1,2,4-benzenetriol > muconic acid. This study demonstrates that, using sensitive techniques, it is possible to detect human health risks at an early stage when intervention is possible.

2. *Bacopa monnieri* modulates antioxidant responses in brain and kidney of diabetic rats.

[Kapoor R, Srivastava S, Kakkar P. Environ Toxicol Pharmacol, 2009; 27: 62-69].

Role of oxidative stress has been reported in various diabetic complications including neuropathy, nephropathy and cardiopathy. This study was undertaken to evaluate the protective effect of *B. monnieri,* a medicinal plant, on tissue antioxidant defense system and lipid peroxidative status in streptozotocin induced diabetic rats. Extract of *B. monnieri* was administered orally, once a day for 15 days (at doses 50, 125, 250 mg/kg b.wt.) to diabetic rats. Activity of antioxidant enzymes (SOD, Catalase, and GPx), levels of GSH and lipid peroxidation were estimated in kidney, cerebrum, cerebellum and midbrain of diabetic rats and compared to reference

drug, Glibenclamide. Administration of plant extract to diabetic rats showed significant reversal of disturbed antioxidant status and peroxidative damage. Significant increase in SOD, CAT, GPx activity & levels of GSH was observed in extract treated diabetic rats. The present study indicates that extract of *Bacopa monnieri* modulates antioxidant activity, and enhances the defense against ROS generated damage in diabetic rats.

3. **Glycyrrhizic acid modulates t-BHP induced apoptosis in primary rat hepatocytes**

[Tripathi M, Singh BK, Kakkar P. Food Chem Toxicol. 2009 Feb; 47(2): 339-47].

Glycyrrhizic acid (GA) is the main bioactive ingredient of licorice (*Glycyrrhiza glabra*). The object of this study was to evaluate the protective effects of GA on tert-butyl hydroperoxide (t-BHP) induced oxidative injury leading to apoptosis in cultured primary rat hepatocytes. Throughout the study silymarin was used as positive control. Molecular mechanisms involved in apoptotic pathways induced in hepatocytes by t-BHP at 250μM were explored in detail. DNA fragmentation, activation of caspases and cytochrome c release were demonstrated. In addition, changes in the mitochondrial membrane potential and ROS generation were detected confirming involvement of mitochondrial pathway. Pre-treatment with GA (4μg) protected the hepatocytes against t-BHP induced oxidative injury and the results were comparable to the pre-treatment with positive control, i.e. silymarin. The protective potential against cell death was achieved mainly by preventing intracellular GSH depletion, decrease in ROS formation as well as inhibition of mitochondrial membrane depolarization. GA was found to modulate critical end points of oxidative stress induced apoptosis and could be beneficial against liver diseases where oxidative stress is known to play a crucial role.

4. **Chemometrics assisted spectrophotometric determination of pyridine in water and wastewater**

[Singh KP, Basant N, Malik A, Singh VK, Mohan D. Anal Chim Acta. 2008 Dec 7; 630(1): 10-8].

The paper reports a direct method for the determination of pyridine in water and wastewater samples based on ultraviolet spectrophotometric measurements using multivariate calibration modeling techniques. Parallel factor analysis (PARAFAC) and multi-way partial least squares (N-PLS) regression methods were employed for the decomposition of spectra and quantification of pyridine. The study was carried out in the pH range of 1.0-12 and concentration range of 0.67-51.7 μg/mL of pyridine. Both the three-way PARAFAC and tri-PLS1 models successfully predicted the concentration of pyridine in synthetic (spiked) river water and field wastewater samples. The mean recovery obtained from PARAFAC regression model were 97.39% for the spiked and

significantly reduced the augmented nitrite content, iNOS expression and MPO activity to control level in MB and PQ exposed animals. Although the augmented LPO was also reduced significantly in L-NAME and AG treated rat PMNs, the level was still higher as compared with controls. Alterations induced in SOD and GST activities were not affected by NOS inhibitors. The results thus suggest that MB and/or PQ induce iNOS-mediated nitric oxide production, which in turn increases MPO activity and lipid peroxidation, thereby oxidative stress.

8. **Bactericidal effects of adsorbent on *Escherichia coli* for use in disinfection of drinking water**

[Dubey, SP, G, K, Pathak, S P. Toxicol Environmen Chem, 2008 Nov; 90 (6) 1141-1146)]

A synergistic action of silver (Ag) and groundnut husk carbon was shown, which markedly enhanced inactivation of *Escherichia coli*. The purpose of this study was to assess the feasibility of using a silver-impregnated groundnut husk carbon adsorbent (AdSG) for drinking water disinfection and evaluate % disinfection of *E. coli*. The results showed that contact of bacterial cells with AdSG resulted in a transfer of Ag ion to the cell, as evidenced by bactericidal activity. It is also possible that Ag produced generation of reactive oxygen species in the cell that led to bactericidal activity of the adsorbent. Data indicated that AdSG was effective as a bactericidal agent and may prove to be economically beneficial in drinking water disinfection.

AEB Honour

Dr Krishna Gopal, Scientist, Indian Institute of Toxicology Research, Lucknow was conferred life time achievement award (a memento and citation) in the field of "Resource Management and Environmental Toxicology". Dr T Ramasami, Secretary, Department of Science and Technology, Government of India bestowed him the award at Hamdard University, New Delhi on November 20, 2008 during the inaugural session of 28th Annual session of Academy of Environmental Biology.

NASI TOXICOLOGY AWARD

Prof. Alok Dhawan, Scientist, Indian Institute of Toxicology Research, Lucknow has been awarded the prestigious **"Lecture Award in the field of Toxicology"** by The National Academy of Sciences, India (NASI) for the year 2008. The award carries a Gold Medal, Citation and Rs. 10,000/- cash prize and was given in recognition of his outstanding contributions in the field of toxicology. Prof. Dhawan is the youngest recipient of this Award. He delivered the Award Lecture on "Multipronged approach in toxicology: A new paradigm" during the Annual meeting of the Society of Toxicology (India) held at Ludhiana. The Gold Medal was presented by Prof. P.K. Seth, General Secretary, NASI and the Citation by Dr V. K. Taneja, Vice Chancellor, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana during the Annual meeting of the Society of Toxicology (India) on October 16, 2008.

Dr Kausar Mahmood Ansari, Scientist attended the Workshop-cum-course on "Detection techniques for mycotoxins and toxigenic fungi in food chain" in Bari, Italy from September 29 to Octber 3, 2008.

Dr Vinay Khanna, Scientist visited Grahamstown, South Africa from October 4 - 12, 2008 for giving a talk at the SA Pharmacology and Neuroscience 2008 and to visit Department of Pharmacology, University of South Africa.

HONOURS AND AWARDS

Dr Krishna Gopal receiving the award from Dr T Ramasami

Prof. Alok Dhawan receiving the Award from Dr V.K. Taneja, also seen are Dr Hardayal Singh and Prof. P.K. Seth.

ASSIGNMENT ABROAD

SUPERANNUATIONS

Dr Jai Raj Behari Scientist	Gr IV(5)	31-10-2008
Shri Devta Din	Grl (4)	31-12-2008

CURRENT TOPIC

Footprints of IITR in Toxicology

Anvita Shaw and Farhat N. Jaffery

Introduction

Indian Institute of Toxicology Research, formerly known as Industrial Toxicology Research Centre. Has been in service of the society since inception in 1 9 6 5through generating data on the toxicogenic potential of chemicals of interest to the country such as pesticides, heavy metals, dyes and food colours; developing test systems for evaluating the safety of chemicals, helping regulatory agencies in monitoring environmental pollutants and advising them in prescribing and fixing safe limits in finished products, including food materials.

A cursory glance on the literature of toxicology reveals that the subject has undergone a dimensional change in the last decade. The major thrust being a the multidisciplinary frontier of t o x i c o l o g y both investigative and regulatory toxicology. From essentially a data generating process on the gross effects, mainly for regulatory purposes, toxicology research here is firmly rooted in mechanistic studies focused on the understanding of toxicological endpoints (involving proteomics, genomics and bioinformatics approaches towards development of biomarkers), an approach that allows greater confidence in the subsequent risk assessments. The research concentrates on assessing the toxicities and risks associated with specific products for example, drugs, cosmetics, or foods and the introduction of new techniques for risk assessment. Research within the Institute capitalizes on scientific knowledge in the areas of biochemistry, chemistry, microbiology, cellular and molecular biology, immunology, and biotechnology. It is supported by sound technical skills and the availability of s t a t e - o f - t h e - a r t equipments, collaborations and funding.

IITR, during its journey of more than four decades, has expanded its activities in diverse areas of toxicology—dyes & food adulterant toxicology, ecotoxicology, developmental toxicology, neurotoxicology, phototoxicology, immuno-toxicology, toxicogenomics, environmental carcinogenesis, nanotoxicology, to mention a few. The Institute remains at the forefront in addressing human health and environmental problems of the country.

In assessing research performance, emphasis is not only laid on social impact but on the quality of research and its impact on advancement of knowledge [1] which is traditionally evaluated on the basis of the number of peer reviewed publications in impact factor (IF) journals. In India, bibliometric studies have already been carried out [1] of several areas viz. medical research, fisheries, and agricultural research; however toxicology research remains to be analyzed. An attempt has therefore been made here to analyze IITR's work in terms of publications available on ISI's Web of Science [2].

Methodology

The Web of Science data base is available from 1 9 8 7 and covers IF journals only, hence this analysis includes publications from 1 9 8 7 u p2 0 0 7, that is, of last 20 years. IITR published 1 5 2 p9 apers during this period. Out of these, 87% were research papers, 2.8% were review articles, and 5% were conference/symposium abstracts. This 20 year data was analyzed using following parameters: y e a r - , subject-, journal-, and citation-wise distribution of publications. Further, citations of these publications were analyzed by considering different parameters like country, institution, journal and year.

Discussion

Year-wise analysis: This analysis of IITR publications was performed on the basis of time period (Table 1) Year 2006 seems to be the most productive year w i t h 2 1 papers followed by 1 0 3 papers in 1 9 9 7. The least number of publications appeared in 1 9 9 with only 33 papers.

Subject-wise analysis: On performing subject wise analysis it was observed that out of a total of 1 5 2 p9 apers during the period of study, 'toxicology' accounted for maximum number of papers (664), that is 43.4%, this was followed by 'environmental science' (443) at 28.9%, then 'pharmacology' and 'biochemistry' 11% each; 'environmental/ occupational health' and 'neurosciences' accounted for 8% and 5% each respectively; publications in other toxicology related subjects were less than 4% (Table.2).

Journal-wise analysis: During the study period, IITR papers were published in 328 journals. It was not possible to include the entire list, only those journals with 11 or more papers during the period of study are shown in decreasing order in Table.3. Bulletin of Environmental Contamination and Toxicology finds the top slot with 11 3 papers, i.e. 7% of total publications, followed by Toxicology Letters with 62 papers (4%); Human and Experimental Toxicology, Journal of Applied Toxicology, Journal of Environmental Biology, Journal of Neurochemistry, and Veterinary and Human Toxicology have more than 2.5% papers in each. It is known that journals of toxicology/ environmental sciences have lower IF compared to pure sciences nevertheless, IITR has 9 contributions in journals with IF>5 viz. Carcinogenesis and Environmental Health Perspectives.

Citation-wise analysis: Citation analysis carried out y e a r - w a s based on the most cited IITR papers in different countries/journals. An analysis performed with the help of Essential Science Indicators [2] places India on the 1 7 t p o s ition with respect to maximum cited papers in the field of pharmacology and toxicology during 1 9 9 6 - 2 0 0 6

(Table 4). During this period there have been 4,328 papers from India with IITR contributing 729 papers. Indian publications had 19,401 citations with 4.48 citations per paper whereas IITR attracted 4463 citations with 6.12 per paper which could be considered above average. Nevertheless, excluding self-citations, IITR papers have a total of 3,158 citations and all studies were based on this figure only.

An analysis of country distributions of IITR papers citations (Table 5) revealed that USA had cited maximum number of times (1467) followed by India (902), Japan(334), Germany (285) and Peoples Republic of China (301). As depicted in Table 7, US EPA has cited IITR work the most during the period of study.

When publications were analyzed in terms of journals citing IITR work, then, Toxicology topped the list followed by Bulletin of Environmental Contamination and Toxicology, Toxicology Letters, Environmental Health Perspective and Chemosphere. It is observed that mostly all the journals appearing in the field of toxicology have cited IITR's work (Table 7). Year-wise distribution of IITR's citations showed an expected decreasing trend with the year 2007 having maximum citations (Table 8). A list of ten most cited publications of the Institute are also presented as Table 10.

Conclusion

This study is an appraisal of toxicological research at IITR and is indicative of the research trends during the last two decades. This is an initial study but further comparative studies related to toxicology research being done throughout the country are required so as to assess the status of IITR in the area. Publications in high IF journals are limited in the area of toxicology and environmental sciences however, with expansion in activities of the Institute in this multidisciplinary field of toxicology, the number of publications in high IF journals are bound to increase.

References

1. Arunachalam, S. (1997) How relevant is medical

Table 1 : Number of IITR Publication/Year

Publication Year	Record Count
2006	113
1990	103
2007	93
1988	92
1991	92
1987	90
1989	90
2005	86
2003	81
2004	80
2002	77
1992	74
2001	70
2000	57
1999	56
1993	55
1994	55
1995	45
1996	44
1998	38
1997	33

Table 2: Subject wise classification of IITR Publications (1529)

Subject Category	Record Count	% of 1529
TOXICOLOGY	664	43.43
ENVIRONMENTAL SCIENCES	443	28.97
PHARMACOLOGY & PHARMACY	174	11.38
BIOCHEMISTRY & MOLECULAR BIOLOGY	169	11.05
PUBLIC, ENVIRONMENTAL & OCCUPATIONAL HEALTH	127	8.31
NEUROSCIENCES	79	5.17
FOOD SCIENCE & TECHNOLOGY	54	3.53
BIOTECHNOLOGY & APPLIED MICROBIOLOGY	52	3.40
ONCOLOGY	52	3.40
IMMUNOLOGY	47	3.07
VETERINARY SCIENCES	45	2.94
CELL BIOLOGY	42	2.75
CHEMISTRY, MULTIDISCIPLINARY	42	2.76
ENGINEERING, ENVIRONMENTAL	42	2.75
MULTIDISCIPLINARY SCIENCES	39	2.55
GENETICS & HEREDITY	37	2.42
BIOPHYSICS	36	2.35
MEDICINE, RESEARCH & EXPERIMENTAL	34	2.22
WATER RESOURCES	30	1.96
BIOLOGY	27	1.76
CHEMISTRY, ANALYTICAL	23	1.50
ENDOCRINOLOGY & METABOLISM	23	1.50

Table 3: Journal wise Classification of IITR Publication(1529)

Journal Impact	Number of Papers	% of total 1529
BULLETIN OF ENVIRONMENTAL CONT AMINATION AND TOXICOLOGY 0.505	113	7.39
TOXICOLOGY LETTERS 2.784	62	4.05
HUMAN & EXPERIMENTAL TOXICOLOGY 1.122	41	2.68
JOURNAL OF APPLIED TOXICOLOGY 1.625	41	2.68
JOURNAL OF ENVIRONMENTAL BIOLOGY 0.197	40	2.62
JOURNAL OF NEUROCHEMISTRY 4.260	39	2.55
VETERINARY AND HUMAN TOXICOLOGY 0.660	39	2.55
FOOD AND CHEMICAL TOXICOLOGY 2.393	34	2.22
BIOMEDICAL AND ENVIRONMENTAL SCIENCES --	30	1.96
ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY 2.00	26	1.70
INDIAN JOURNAL OF EXPERIMENTAL BIOLOGY --	24	1.57
JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH (PART A) 2.154	22	1.49
INDUSTRIAL HEALTH 0.911	21	1.34
MOLECULAR AND CELLULAR BIOCHEMISTRY 1.625	21	1.34
TOXICOLOGY 2.685	21	1.37
CANCER LETTERS 3.049	20	1.31
ENVIRONMENTAL MONITORING AND ASSESSMENT 0.793	19	1.24
CHEMOSPHERE 2.442	18	1.12
IMMUNOPHARMACOLOGY AND IMMUNOTOXICOLOGY 0.654	18	1.12
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS 2.855	16	1.05
DRUG AND CHEMICAL TOXICOLOGY 1.239	15	0.98
WATER AIR AND SOIL POLLUTION 1.205	15	0.98
TOXICOLOGICAL AND ENVIRONMENTAL CHEMISTRY --	14	0.91
ARCHIVES OF TOXICOLOGY 1.787	13	0.85
CURRENT SCIENCE 0.737	13	0.85
JOURNAL OF SCIENTIFIC & INDUSTRIAL RESEARCH 0.178	13	0.85
PHARMACOLOGY & TOXICOLOGY (now name changed to Basic & Clinical Pharmacology & Toxicology) 1.788	13	0.85
ENVIRONMENTAL AND MOLECULAR MUTAGENESIS 2.653	12	0.78
ENVIRONMENTAL RESEARCH 2.556	12	0.78
JOURNAL OF TOXICOLOGY ϾUTANEOUS AND OCULAR TOXICOLOGY 0.407	12	0.78
LIFE SCIENCES 2.389	12	0.78
ARCHIVES OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY 1.419	11	0.72
BIOLOGICAL TRACE ELEMENT RESEARCH 0.868	11	0.72

Table 4: Countries that cited IITR publications during 1996 2006

RANK	COUNTRY	PAPERS	CITATIONS	CITATIONS PER PAPER
1	USA	47,593	628,701	13.21
2	ENGLAND	11,222	155,467	13.85
3	JAPAN	20,106	153,397	7.63
4	GERMANY	11,979	120,738	10.08
5	FRANCE	8,444	90,464	10.71
6	ITALY	7,715	73,722	9.56
7	CANADA	5,976	70,651	11.82
8	NETHERLANDS	3,805	43,839	11.52
9	SWITZERLAND	2,803	42,515	15.17
10	SWEDEN	3,264	42,374	12.98
11	AUSTRALIA	3,541	36,992	10.45
12	SPAIN	4,455	33,579	7.54
13	BELGIUM	2,386	26,704	11.19
14	SCOTLAND	1,531	25,198	16.46
15	SOUTH KOREA	4,644	23,195	4.99
16	PEOPLES R CHINA	5,562	21,541	3.87
17	**INDIA**	**4,328**	**19,400**	**4.48**
18	NEW ZEALAND	1,267	18,635	14.71
19	TAIWAN	2,659	16,720	6.29
20	BRAZIL	2,894	16,464	5.69

SOURCE: *Essential Science Indicators*, January 1996 October 31, 2006.; http://in eites.com/countries/top20pha.html

Table 5: Countries Citing IITR Work (5841 = number of times IITR work cited)

Country	No. of Citation	% of 5841
USA	1467	25.11
INDIA	902	15.44
JAPAN	334	5.72
PEOPLES R CHINA	301	5.15
GERMANY	285	4.88
CANADA	255	4.36
TURKEY	244	4.17
ENGLAND	243	4.16
ITALY	230	3.94
FRANCE	223	3.82
SPAIN	213	3.64
BRAZIL	142	2.43
SOUTH KOREA	135	2.31
POLAND	123	2.10
TAIWAN	117	2.00
AUSTRALIA	91	1.54
SWEDEN	81	1.38
NETHERLANDS	78	1.33
MEXICO	68	1.16
EGYPT	67	1.14
GREECE	66	1.13
CZECH REPUBLIC	60	1.03
BELGIUM	54	0.92
SCOTLAND	54	0.92
SLOVAKIA	53	0.91
DENMARK	48	0.82
PORTUGAL	48	0.82
HUNGARY	46	0.78
NORWAY	46	0.78
SWITZERLAND	46	0.78
FINLAND	42	0.72
ISRAEL	42	0.72
ARGENTINA	37	0.63
AUSTRIA	34	0.58
THAILAND	31	0.53
RUSSIA	30	0.51
PAKISTAN	29	0.49
NIGERIA	28	0.48
CHILE	26	0.44
SOUTH AFRICA	26	0.44
SAUDI ARABIA	24	0.41
IRAN	22	0.37
SINGAPORE	21	0.34
CROATIA	20	0.34

Table 6: Institutions citing IITR Work (5841=number of times IITR work cited)

Institution Name	No.	% of 5841
US EPA	64	1.09
UNIV TEXAS	54	0.92
CHINESE ACAD SCI	49	0.83
DEF RES & DEV ESTAB	45	0.77
NCI	43	0.73
UNIV MADRAS	41	0.70
HARVARD UNIV	40	0.68
UNIV N CAROLINA	33	0.56
UNIV SAO PAULO	30	0.51
INDIAN INST TECHNOL	29	0.49
BOSE INST	28	0.47
CENT DRUG RES INST	28	0.47
POSTGRAD INST MED EDUC & RES	28	0.47
JOHNS HOPKINS UNIV	27	0.46
NIEHS	27	0.46
UNIV CALIF DAVIS	25	0.42
UNIV DUSSELDORF	24	0.41
UNIV FED SANTA MARIA	24	0.41

CSIC	23	0.39
UNIV DELHI	23	0.39
UNIV SASKATCHEWAN	23	0.39
UNIV WASHINGTON	23	0.39
ZHEJIANG UNIV	23	0.39
ANKARA UNIV	22	0.37
CORNELL UNIV	22	0.37
KAROLINSKA INST	22	0.37
NATL BOT RES INST	22	0.37
UNIV CALIF BERKELEY	22	0.37
BANARAS HINDU UNIV	21	0.35
HLTH CANADA	21	0.35
MCGILL UNIV	21	0.35
N CAROLINA STATE UNIV	21	0.35
NATL TAIWAN UNIV	21	0.35
PANJAB UNIV	21	0.35
PEKING UNIV	21	0.35
RUTGERS STATE UNIV	21	0.35
SEOUL NATL UNIV	21	0.35
UNIV HEIDELBERG	21	0.35
CNR	20	0.34
CNRS	20	0.34
NIOSH	20	0.34
UNIV FLORIDA	20	0.34
UNIV MONTREAL	20	0.34
UNIV TURIN	20	0.34
UNIV VERMONT	20	0.34

Table 7: Journals that cited IITR Papers (5841=number of times IITR work cited)

Title	No.	% of 5841
TOXICOLOGY	117	2.00
BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY	85	1.45
JOURNAL OF HAZARDOUS MATERIALS	84	1.43
TOXICOLOGY LETTERS	73	1.24
ENVIRONMENTAL HEALTH PERSPECTIVES	70	1.19
CHEMOSPHERE	69	1.18
TOXICOLOGY AND APPLIED PHARMACOLOGY	64	1.09
ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY	63	1.07
BIOLOGICAL TRACE ELEMENT RESEARCH	52	0.89
FOOD AND CHEMICAL TOXICOLOGY	49	0.83
ARCHIVES OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY	46	0.78
MUTATION RESEARCH GENETIC TOXICOLOGY AND ENVIRONMENTAL MUTAGENESIS	46	0.78
ENVIRONMENTAL TOXICOLOGY AND CHEMISTRY	45	0.77
SCIENCE OF THE TOTAL ENVIRONMENT	44	0.75
ARCHIVES OF TOXICOLOGY	41	0.70
JOURNAL OF APPLIED TOXICOLOGY	41	0.70
AQUATIC TOXICOLOGY	40	0.68
ENVIRONMENTAL TOXICOLOGY AND PHARMACOLOGY	40	0.68
HUMAN & EXPERIMENTAL TOXICOLOGY	40	0.68
REPRODUCTIVE TOXICOLOGY	39	0.66
TOXICOLOGICAL SCIENCES	36	0.61
FREE RADICAL BIOLOGY AND MEDICINE	35	0.59
JOURNAL OF COLLOID AND INTERFACE SCIENCE	35	0.59
JOURNAL OF ENVIRONMENTAL BIOLOGY	35	0.59
LIFE SCIENCES	34	0.58
NEUROTOXICOLOGY	33	0.56
ENVIRONMENTAL RESEARCH	31	0.53
ENVIRONMENTAL MONITORING AND ASSESSMENT	30	0.51
TOXICOLOGY IN VITRO	30	0.51
ENVIRONMENTAL POLLUTION	29	0.49
JOURNAL OF ETHNOPHARMACOLOGY	29	0.49
BIOCHEMICAL AND BIOPHYSICAL RESEARCH COMMUNICATIONS	28	0.47
BRAIN RESEARCH	26	0.44
JOURNAL OF AGRICULTURAL AND FOOD CHEMISTRY	26	0.44
WATER RESEARCH	26	0.44
BIOCHEMICAL PHARMACOLOGY	25	0.42

JOURNAL OF ENVIRONMENTAL SCIENCE AND HEALTH PART B PESTICIDES FOOD CONTAMINANTS AND AGRICULTURAL WASTES	25	0.42
MOLECULAR AND CELLULAR BIOCHEMISTRY	25	0.42
ANALYTICA CHIMICA ACTA	24	0.41
ENVIRONMENTAL SCIENCE & TECHNOLOGY	24	0.41
INHALATION TOXICOLOGY	24	0.41
MUTATION RESEARCH FUNDAMENTAL AND MOLECULAR MECHANISMS OF MUTAGENESIS	24	0.41
FRESENIUS ENVIRONMENTAL BULLETIN	22	0.37
PHARMACOLOGY & TOXICOLOGY	22	0.37
CHEMICAL RESEARCH IN TOXICOLOGY	21	0.35
CRITICAL REVIEWS IN TOXICOLOGY	21	0.35
JOURNAL OF NEUROCHEMISTRY	21	0.35
AMERICAN JOURNAL OF INDUSTRIAL MEDICINE	20	0.34
CHEMICO BIOLOGICAL INTERACTIONS	20	0.34

Table 8: Year wise Distribution of Citation (5841=number of times IITR work cited)

Year	Record no.	% of 5841
2007	910	15.57
2006	782	13.38
2005	665	11.38
2004	533	9.12
2003	419	7.17
2002	352	6.02
2001	328	5.61
1999	275	4.70
2000	268	4.58
1998	238	4.07
1997	192	3.28
1996	174	2.97
1995	152	2.60
1994	133	2.27
1993	126	2.15
1992	102	1.74
1991	80	1.36
1990	55	0.94
1989	29	0.49
2008	15	0.25
1988	12	0.20

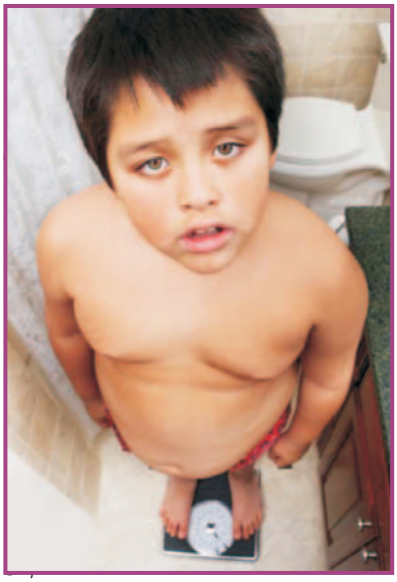
Table 9: Most Cited Papers

1. Hussain T, Shukla GS, Chandra SV. Effects of cadmium on superoxide and lipid peroxidation in rat liver and kidney: a comparative *in-vivo* and *in-vitro* studies. Pharmacology & Toxicology 60 (5): 355-MAY 1987 **(Times Cited: 120)**
2. Mohan D, Singh KP. Single- and multi-component adsorption of cadmium and zinc using activated carbon derived from bagasse - an agricultural waste. Water Research 36 (9): 2304-May 2002 **(Times Cited: 95)**
3. Kumar R, Agarwal AK, Seth PK. Free radical mediated neurotoxicity of 6-hydroxydopamine. Journal of Neurochemistry 64 (4): 1703-Apr 1995 **(Times Cited: 92)**
4. Athar M, Hasan SK, Srivastava RC. Evidence for the involvement of hydroxyl radicals in nickel mediated enhancement of lipid peroxidation: implications for nickel carcinogenesis. Biochemical and Biophysical Research Communications 147 (3): 1276-Sep 30 1987 **(Times Cited: 68)**
5. Shukla GS, Hussain T, Chandra SV Possible role of regional superoxide dismutase activity and lipid peroxide levels in cadmium neurotoxicity – *in-vivo* and *in-vitro* studies in growing rats. Life Sciences 41 (19): 2215-Nov 29 1987 **(Times Cited: 65)**
6. Rahman Q, Abidi P, Afaq F, et al. Glutathione redox system in oxidative lung injury. Critical Reviews in Toxicology 29 (6): 543-1999 **(Times Cited: 61)**
7. Gupta VK, Ali I, Suhas, et al. Equilibrium uptake and sorption dynamics for the removal of a basic dye (basic red) using low-cost adsorbents. Journal of Colloid and Interface Science 265 (2): 257-Sep 15 2003 **(Times Cited: 59)**
8. Raoul S, Berger M, Buchko GW, et al. H-1-, and N-15-nuclear magnetic resonance analysis and chemical features of the two main radical oxidation products of 2'-deoxyguanosine and 8-oxo-2'-deoxyguanosine nucleosides . Journal of the Chemical Society-Perkin Transactions 2 (8): 1371-Mar 31 1996 **(Times Cited: 54)**
9. Das M, Khanna SK Clinicoepidemiological, toxicological, and safety evaluation studies on argemone oil. Critical Reviews in Toxicology 27 (3) 1997 **(Times Cited: 48)**
10. Khangarot BS, Ray PK Investigation of correlation between physicochemical properties of metals and their toxicity to the water flea Daphnia-magna Ecotoxicology and Environmental Safety 18 (2): 109-Oct 1989 **(Times Cited: 47)**

RESEARCH DIGEST

Childhood BMI Rises with Prenatal Exposure to Hexachlorobenzene

[Environmental Health Perspectives Volume 116, Number 12, December 2008]



Child obesity may begin with prenatal exposures

A prospective study published in the October 2008 issue of *Acta Paediatrica* has found an association between prenatal exposure to hexachlorobenzene (HCB) with overweight/obesity in childhood.

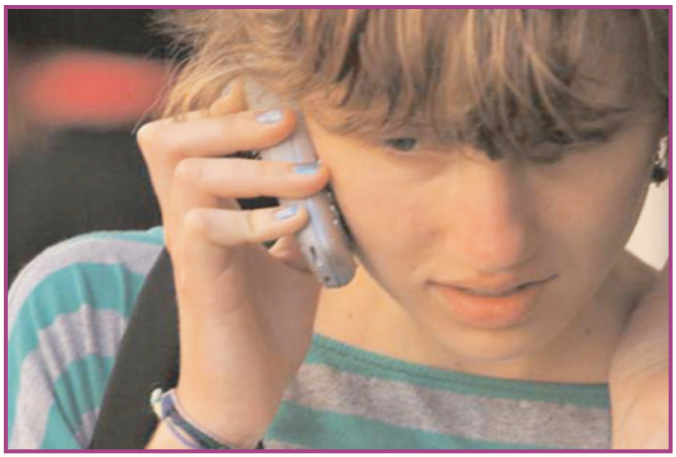
HCB is one of many organochlorine compounds restricted or banned by the Stockholm Convention on Persistent Organic Pollutants, which was signed in 2001. The compound was widely used, starting in 1933 to kill fungi on crop seeds and in some manufacturing processes. Its commercial use in the United States ceased in 1965. HCB bioaccumulates in fat and breaks down slowly.

In 1997, the research group began recruiting expectant mothers on the Spanish Mediterranean island of Minorca. They measured HCBs, PCBs, pesticide DDT, and its metabolite DDE in umbilical cord blood of 405 children. The children's height and weight was measured at birth and at age 6.5 years. Analysis showed that each doubling in cord blood HCB levels was associated with a weight increase of 1.1 kg (2.5 lb), but the children's height did not differ significantly. The relative risk of being overweight was statistically significant 1.7 times higher per doubling in cord blood HCB level, and the relative risk for obesity was a non-significant 2.0 times higher. The association between HCB concentration and elevated BMI was independent of maternal socioeconomic status, weight, education, child's birth order or birth weight. There was no observed correlation between elevated BMI and PCBs, DDT, or DDE. "This study provides an important piece of evidence that obesity may be related not only to junk food and lack of exercise but also to halogenated compounds or endocrine disruptors," says Wilfried Karmaus, a professor of epidemiology at the University of South Carolina. In his study of Michigan women who ate large quantities of home-caught fish, maternal levels of DDE did correlate with BMI and weight in the women's adult children aged 20 to 50.

The author cautioned that the new study does not suggest that HCB, or indeed any other organochlorine, is the sole explanation for overweight and obesity. She says "It is important to keep in mind that a lot of factors are involved in the obesity epidemic". I think that the proportion of the ongoing obesity epidemic is minimal when it comes to HCB exposure. However, it is important to reduce prenatal exposure to toxicants like HCB to prevent health problems like overweight. It is not clear if the observed effects on body weight remain after the age of six years. Because most HCB exposure comes through diet, especially meat, "a mother can prevent exposure by paying attention to where the local pollution sources are located and avoid eating food which has been grown there," Smink says. "Pregnancy is a really important time for development," says Karmaus. "During pregnancy, you are exposed to [all the toxicants a mother has collected in twenty or thirty years." Prevention is key, he says, because "as a fetus you can't decide not to live under these conditions."

Strong Signal for Cell Phone Effects

[Environmental Health Perspectives Volume 116, Number 10, October 2008]



In July 2008 market research firm MultiMedia Intelligence reported that more than 16 million U.S. teens use cell phones.

With 3 billion cell phone users worldwide and more than 260 million in the United States alone—among them 46% of U.S. children aged 8–12, according to Nielsen Mobile figures released on 10 September 2008—human exposure to low-energy radiation in the 800–2,000 MHZ range is at an all-time high. The most recent attempt to systematically review the epidemiologic evidence for increased risk of brain tumors related to cell phone use indicates that repercussions from this global experiment are coming to light. In a meta-analysis published in the May 2008 issue of the *International Journal of Oncology*, Swedish researchers found significant associations between long-term cell phone use and brain tumor risk.

"We found that cell phone use is linked to gliomas [malignant brain tumors] and acoustic neuromas [benign tumors of the brain's auditory nerve] and are showing up after only ten years," says lead author Lennart Hardell, an oncologist and cancer epidemiologist at University Hospital in Örebro, Sweden. Specifically, for studies that included at least 10 years of exposure, there was a doubling in the risk of gliomas for ipsilateral (same-side but not contralateral (opposite) exposures to the head (as reflected by which hand the subject typically used to hold his/her cell phone). A 2.4-increased in risk was seen for acoustic neuromas due to ipsilateral exposures, whereas no increased risk occurred for meningiomas (tumors that occur in the membranes covering the brain and spinal cord).

Emerging evidence suggests that children may be more vulnerable to the potential carcinogenic effects of cell phones and other microwave-emitting technologies. "Concerns about children's potential vulnerability to RF [radio frequency fields] have been raised because of the potentially greater susceptibility of their developing nervous systems," says Leeka Kheifets, an epidemiology professor at the University of California, Los Angeles, and former Director of the Electric Power Research Institute EMF research program. "In addition, their brain tissue is more conductive, RF penetration is greater relative to head size, and they will have a longer lifetime of exposure [although the degree of risk for any carcinogen will be primarily determined by the exact timing and magnitude of exposure]."

The importance of a thinner skull and differing dielectric properties is confirmed by a study in the 7 June 2008 issue of *Physics in Medicine and Biology* showing that a child's brain absorbs up to twice as much RF as an adult brain. Children today will experience a longer period of exposure because they start using cell phones at an earlier age. According to Hardell; this might be important, because cumulative dose seems to have a strong influence on increased risk of brain tumors. Kheifets adds, however, that "data are lacking on effects of exposures on brain tumors in children . . . [and other] health effects need to be looked at as well."

The wireless industry takes a cautious view of the research. "The weight of the scientific evidence and the conclusions of a large number of expert scientific reviews show that wireless phones do not pose a health risk," says Joseph Farren, Assistant Vice President for Public Affairs with CTIA–The Wireless Association. "The industry supports continued research as technology continues to evolve, but wishes to stress the fact that there is a consensus among leading health organizations regarding published scientific research showing no reason for concern."

Hardell concedes that it is too soon to determine a safe limit for cell phone use. "Can we say that a ten-minute call is equal to ten one-minute calls?" he asks. "Until we answer such questions, we cannot establish a new limit or even state which parameters or units that help to define that limit. Nonetheless, since we do see an increased risk of brain tumors, it is necessary to apply the precautionary principle in this situation, especially for long-term exposures that are likely to affect children in particular." In practice, this might involve limiting children's use of cell phones and using speaker phones to minimize direct exposure to the head.

Stormy Outlook for Asthma

[Environmental Health Perspectives Volume 116, Number 10, October 2008]

Emergency room visits for asthma symptoms rise in the hours after thunderstorms

Conventional wisdom holds that rainy days aid asthmatics by washing away pollen pollutants that trigger attacks. But a new study shows that in some cases just the opposite is true—in a report published in the July 2008 issue of *Thorax*, the number of people seeking help at emergency rooms for asthma attacks routinely increased within hours of thunderstorms striking.

Since the 1980s, studies in Canada, Europe, and Australia have documented spikes in asthma cases after thunderstorms. The new study "confirms the association between thunderstorms and outbreaks of asthma in the largest database to date," says Christine A. Rogers, an Assistant Professor of Environmental Health Science at the University of Massachusetts, Amherst.

In the current study, a team of climatologists and epidemiologists from two Georgia universities evaluated data from 10 million emergency room visits to 41 Atlanta hospitals over the period from 1993 to 2004. Of 215,832 asthma emergency room visits, they found that 24,350 took place on the day following a thunderstorm, which worked out to about 3% more visits on days after thunderstorms than on other days.

Although a 3% rise may seem small, it could have a significant public health impact for areas with populations in millions, says study leader Andrew Grundstein, a climatologist at the University of Georgia, Athens.

A more detailed analysis using sophisticated tools such as Doppler radar to identify key elements of

thunderstorms and meteorological factors that may impact asthma, such as rainfall rates, strength of downdraft winds, and lightning. "Down the road, we may be able to develop a forecast system to warn people who are especially vulnerable to keep them out of emergency rooms," Grundstein says.

The Irritation from House Dust: DEHP Heightens Inflammatory Response in Allergy Sufferers

Environmental Health Perspectives Volume 11 6Number 11 , November 2008

Past research has suggested that d i (2 - e t h y l h e x y l) phthalate (DEHP), a commonly used plasticizer, contributes to asthma symptoms in children [EHP 11 6 : 9 8 (2 0 0 8)] and to dermatitis caused by dust mite allergens in mice [EHP 11 4 : 1 2 6 6 (2 0 0 6)]. Both the prevalence of allergic diseases and environmental exposure to phthalates have increased dramatically in the past several decades, but few studies have examined how people's mucosal airways respond to inhaled DEHP. A new study reveals that exposure to DEHP in house dust altered the response of nasal mucosa in allergic people but not in n o n - a l l e r g i c p e o p l e [E H P 11 6 : 1 4 8 7 D e u t s c h l e t a l .] .

DEHP is found in polyvinyl chloride pipes, flooring, food containers, and other household products. Oral intake is the main route of exposure, but inhalation offers an alternative route. DEHP vaporizes from consumer products directly into the home and attaches to inhalable airborne dust particles.

हिन्दी सप्ताह

प्लास्टिक एक, समस्या अनेक

उत्तम कुमार शुक्ल एवं डॉ० वी०पी० शर्मा
भारतीय विषविज्ञान अनुसंधान संस्थान
80, महात्मा गांधी मार्ग, लखनऊ

आज के मौजूदा परिवेश में प्लास्टिक समाज का अभिन्न अंग बन गया है। प्लास्टिक का प्रयोग पेकेजिंग घरेलू, आटोमोबाइल्स, कृषि, इलैक्ट्रिक और इलेक्ट्रॉनिक उत्पाद स्वासयि सुरक्षा उत्पाद में हो रहा है। भारत में प्लास्टिक की खपत 400 टन प्रति वर्ष (1998) से 4 मिलियन टन (2001) व 2007 तक 705 मिलियन प्रति वर्ष हो गया है। प्रतिवर्ष प्लास्टिक की खपत 3.8 किग्रा प्रतिवर्ष है जो बढ़ती ही जा रहीं है। 50 प्रतिशत से भी अधिक प्लास्टिक का खपत पैकेजिंग के लिए होता है। पैकेजिंग डत्पाद प्लास्टिक की थैली, पान मसाला के सैचेट्स, सीमेंट बैग, कप, थर्माकोल इत्यादि है। प्लास्टिक की खपत बढ़ने के साथ ही इसका अनियोजित निस्तारण पर्यावरण को क्षति पंहुचा रहा है बल्कि मानव स्वास्थ्य को भी बुरी तरह प्रभावित कर रहा है। अनियोजित कूड़ा निस्तारण, प्लास्टिक को जल निकाय पार्को, बगीचों, रेलवे ट्रैक इत्यादि में फेंक देने की आदत एक गंभीर समस्या को जन्म दे रहा है। औद्योगिकीकरण के युग में आधुनिकता के साथ ही अपशिष्ट पदार्थ की मात्रा भी बढ़ रही है जैव विघटन रहित होने के वजह से जिसका निस्तारण एक गंभीर समस्या है।

प्लास्टिक और पर्यावरण समस्या

भारत जैसे विकासशील देश के लिए प्लास्टिक अपशिष्ट गंभीर समस्या है। प्लास्टिक एक उच्च अणुभार युक्त कार्बनिक पदार्थ होता है जो मोनोमर इकाइयों से मिलकर बना होता है। यह जल में अविलेय होता है। प्लास्टिक जैव विघटन रहित होने की वजह से वर्षों तक भूमि और जल निकायों यथा नदी, नालों, तालाबो में पड़े रहते है और जल को प्रदूषित करने के साथ ही जल निकासी में बाधा उत्पन्न करते है। प्लास्टिक में मौजूद हानिकारक पदार्थ प्लास्टिक से भूमि में अंतरित हो जाते है और भूमि की उर्वरा शक्ति को प्रभावित करते प्लास्टिक के दहन से कार्बन मोने आक्साइड और कार्ब्न डाई आक्साइड जैसी हानिकारक गैस निकलती है जो वायुमंडल को प्रदूषित करती है। पी०वी०सी० प्लास्टिक के दहन से क्लोरीन गैस निकलती है जो डाईआक्सिन नामक विषैली गैस को जन्म देती है। डाईआक्सिन से जनद विकार, कैंसर, ल्युकिमिया आदि बीमारिया उत्पन्न होने की संभावना रहती है। मानकों के अनुसार बनी एवं जांच की गयी प्लास्टिक का उपयोग करना उचित होता है।

प्लास्टिक और स्वास्थ्य समस्या

प्लास्टिक के मुख्य संघटक प्लास्टिसाइजर, स्टैबिलाइजर, मोनोमर और कलरैन्ट्स है। प्लास्टिक के रासायनिक संघटक यथा मोनोमर जैसे वायनिल क्लोराइड, एक्रिलामाइड, स्टाईरीन प्लास्टिसाइजर जैसे लैट एस्टर, स्टैबिलाइजर जैसे आर्गेनोटीन्स, कलरैन्ट्स अकार्बनिक तत्व जैसे लेड, बेरियम, क्रोमियम, निकिल आदि स्वास्थ्य के लिए हानिकारक होते है। ये पदार्थ प्लास्टिक से संग्रहित खाद्य पदार्थ में अंतरित हो जाता है, यह प्रक्रिया लीचिंग कहलाती है। हॉस्पिटल में ऐसे मरीजो में जिनमें रीनल डायलिसिस और रक्त अंतरण के लिए प्लास्टिक की नली प्रयोग की गई है, के रक्त में डाई (2-इथाइल हेक्सिल) थैलेट की मौजूदगी पायी गई है। थैलेट प्लास्टिसाइजर का इस्तेमाल बच्चों के खिलौनों जैसे टीथ रिंग, बेबी बोतल में प्रयोग होने वाले निपल्स में प्लास्टिक को मुलायम बनने के लिए होता है। थैलेट बच्चों के लार द्वारा शरीर के अन्दर पहुँच जाता है और बीमारी का कारण हो सकता है। सन् 1997 में अमेरिका, जापान, यूरोपीय यूनियन सहित लगभग 20 देशों ने थैलेट प्लास्टिसाइजर को बच्चों के खिलौनों में प्रयोग पर रोक लगा दी है। भारत में भी थैलेट एवं अन्य विषैले पदार्थों के सम्बन्ध में महत्वपूर्ण जानकारी उपलब्ध है और सावधानी बरतने के लिए राय दी जाती है।

प्लास्टिक में मोजूद विष और उनका प्रभाव

प्लास्टिक	विषैले पदार्थों की संभावना	स्वास्थ्य पर प्रभाव
पी०वी०सी०	लेड, कैडमियम, थैलेट, क्लोरो, पैराफिन्स, आर्गेनोक्लोरीन जैसे डाईआक्सिन, वायनिल क्लोराइड	कैंसर, गर्भपात, मानसिक विकलांगता
पॉली स्टाइरीन	बेंजीन, स्टाइरीन, 1,3-व्युटाडाईन	जनद विषाक्तता

प्लास्टिक अपशिष्ट का प्रबंधीकरण

नगरीय अपशिष्ट में प्लास्टिक की प्रतिशतता 3 से 4 प्रतिशत होती है। लेकिन आयतन के हिसाब से यह 25 से 30 प्रतिशत तक होता है। प्लास्टिक का जैव अपघटित न होना एक गंभीर समस्या है नगरीय ठोस अपशिष्ट (प्रबंधन और हस्तलन) नियम 2000 के अनुसार कूड़े के निस्तारण से पूर्व जैव अपघटित और जैव अपघटन रहित वस्तुओं को अलग-अलग करना अनिवार्य है। लेकिन इस नियम का युक्तिसंगत पालन नहीं किया जा रहा है। सन् 2006 में जैव अपघटन रहित अपशिष्ट प्रबंधन एक्ट पारित किया गया जिसका मुख्य उद्देश्य जैव अपघटन रहित अपशिष्ट के बेहतर प्रबंधन के लिए पुनः चक्रीकरण, पुनरप्रयोग और न्यूनीकरण की नीति को प्रोत्साहित करना है।

पुनः चक्रण

प्लास्टिक उत्पाद जो पाली इथिलीन, पाली स्टाईरीन, पालीप्रोपाईलीन से बना होता है पुनः चक्रित हो सकता है। पुनः चक्रण की प्रक्रिया में प्लास्टिक की प्लास्टीसिटी कम हो जाती है। अतः प्लास्टिक का पुनः चक्रण 5-6 बार तक ही हो सकता है। ऐसे प्लास्टिक जो दो या अधिक प्लास्टिक का मिश्रण होता है जैसे पी०ई० (पालीा इथिलीन) और एलयूमिनियम इनका पुनः चक्रीकरण नहीं हो सकता है, अतः इनका निस्तारण सामान्य अवशिष्ट के साथ कर दिया जाता है। थार्मोसेटिंग प्लास्टिक जैसे बैकेलाईट, नायलॉन, मेलामिन को पुनः प्रयोग में नहीं लाया जा सकता है अतः इन्हें साधारण कूड़े के साथ निस्तारित कर देते है।

पी०वी०सी० प्लास्टिक के पुनः चक्रीकरण में एक पुमुख समस्या है पी०वी०सी० में मौजूद क्लोरीन। प्लास्टिक को खुले में या इनेसनरेटर में जलाए जाने पर हानिकारक डाईआक्सिन गैस बनाता है। प्लास्टिक को गढ्ढो में निस्तारित करने पर पी०वी०सी० में मौजूद रसायन भूमि में अंतरित हो जाते है और पृथ्वी की उर्वरा शक्ति को नुकसान पहुँचाते है लगभग 84 प्रतिशत पी०वी०सी० प्लास्टिक का उपयोग पाइप और निर्माण सामग्री में होता है। पुनः चक्रित प्लास्टिक से बने थैली और डिब्बे, खाद्य पदार्थ के भण्डारण, प्रदाय और पैकेजिंग के लिए प्रयोग में लाना स्वास्थ्य के लिए सुरक्षित नहीं होता है।

पुनः प्रयोग

प्लास्टिक की खाली बोतलों और कंटेनरों को दैनिक आवश्यकता की वस्तुओं को संग्रहित करने के लिए प्रयोग किया जा सकता है। यह तरीका अपना कर प्लास्टिक के अनियंत्रित प्रयोग को रोका जा सकता है।

न्यूनीकरण

प्लास्टिक हमारी सुविाा के लिए है, लेकिन इसका अनियंत्रित उपयोग और अनियोजित निस्तारण गंभीर समस्या का कारण बन रहा है। प्लास्टिक की जगह हूट और कपड़े के बैग का इस्तेमाल किया जा सकता है। प्लास्टिक का कम से कम प्रयोग पर्यावरण और स्वास्थ्य समस्या को कम कर सकता है।

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