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IITR CELEBRATED 44TH FOUNDATION DAY



Dr KC Gupta welcoming the guests on the occasion of Prof. SH Zaidi oration

Indian Institute of Toxicology Research (IITR), celebrated its Foundation Day on November 4, 2009. The celebrations began with 13th Prof. SH Zaidi Oratorion in the morning at IITR Auditorium. Dr D Kar Chowdhuri, Convener of IITR Foundation day organising committee, gave the genesis of Prof. SH Zaidi Oratorion and mentioned that the oration is being held every year to honour Prof. Zaidi, the founder Director of IITR. Dr KC Gupta, Director, IITR welcomed the guests on the dais, Dr Ch Mohan Rao, Scientist, Centre for Cellular and Molecular Biology (CCMB), Hyderabad, Dr CM Gupta, DBT Distinguished Research Professor, Central Drug Research Institute (CDRI), Lucknow, distinguished guests and scientists in the audience including members of IITR family. He also introduced Dr Ch Mohan Rao to the audience.

Dr Ch Mohan Rao delivered the oration entitled "Small Heat Shock Proteins in Health and Disease". He said that molecular chaperones help proteins to maintain their structure and assembly and failure to do so can lead to diseases. These sHsps are critical for several cellular functions. Investigations on these proteins in the context of pathology using biophysical to molecular biological, cell biological approaches, revealed their role in cell cycle, apoptosis, cytoskeletal dynamics and differentiation. He described a mutation in sHsp-B4 (alpha A-crystallin), reported from India, that is associated with pre-senile cataracts. Unlike the wild type protein, this mutant protein is vulnerable to environmental factors such as heavy metal ions, providing an example of how environmental factors could augment phenotype in certain genetically predisposed conditions.



Dr Ch Mohan Rao delivering the Zaidi oration

In his presidential address, Dr CM Gupta appreciated the importance of small heat shock proteins in pathology, including malaria. He further said that Prof. Zaidi was the first from Central Drug Research Institute to receive the Shanti Swaroop Bhatnagar prize, and it is a great tribute to Prof. Zaidi to have the oration by a scientist who is using integrative approach towards therapeutics. Subsequently, Dr D Kar Chowdhuri proposed the vote of thanks.



A view of audience

In the evening, the 44th Foundation Day function was held in the IITR lawns. Dr KC Gupta welcomed the dignitaries and guests. While presenting the annual report of the Institute for the year 2008-09, Dr KC Gupta, who took over as the Director of Indian Institute of Toxicology Research in March 2009, said that the rechristening of

Industrial Toxicology Research Centre as Indian Institute of Toxicology Research has broadened the scope and purview of this institute to explore R&D activities in toxicology in every sphere; to meet global challenges as well as the need of the country. Besides several in house R&D programmes, a number of grant-in-aid, industry sponsored consultancy research and societal programmes were also undertaken during this period. He said that institutional R & D output is reflected by 130 research papers with an average impact factor of 2.08 and 4 chapters in books. The institute has filed 1 national patent and has been granted 3 national and 2 international patents. Further, he also mentioned that the exponential growth of nanotechnology warrants safety as well as toxicological evaluation of nanomaterials and that IITR has initiated steps in this direction.



Inauguration of Foundation Day function with lighting of the lamp

Certain research activities of the institute that were highlighted:

- 1) Interactions of nature and nurture are crucial in the development of cancers and other diseases. Patients carrying genotype of combinations of Cytochrome P450 1A1 (CYP1A1) were found to have higher risk of head and neck squamous cell carcinoma. In another type of cancer like squamous cell esophageal cancer, Exon 3 of Tyr113His genotype was found to be associated with higher risk. CYP1B1 wild type (Val¹⁵⁸ Val) in combination with catechol-O-methyl transferase heterozygous (Leu⁴³²Val) was associated with protection against breast cancer in pre-menopausal women. Further, combination of variant genotype of CYP2E1 with GABAG2 or null genotype of GSTM1 increased the risk of alcoholic cirrhosis when compared to non-alcoholic cirrhotic patients.
- 2) PCR based methods were developed to detect the presence of vegetative insecticidal protein (VIP) gene in GM food. Further, HPTLC based method was developed for simultaneous screening of water and fat soluble dyes such as Metanil yellow, Sudan dyes, Curcumin in a large number of samples of turmeric, chilli and various mixed curry powders. A Randomly Amplified Polymorphic DNA (RAPD) based method was established to identify the genotype of a particular medicinal plant in the herbal formulations. Using this, a dry medicinal plant, *Desmodium gangeticum* was characterized to resolve the problem of adulteration. A rapid and specific molecular beacon probe-based real-time PCR assay was developed for detection of vanA gene in surface waters and aquatic macrophyte and this could be used for detection of vancomycin-resistant enterococci (VRE) in surface waters and for identification of non-point sources of pollution.
- 3) Caffeine and nicotine were found to protect 1-methyl 4-phenyl 1,2,3,6-tetrahydropyridine (MPTP) induced neurodegenerative changes in mouse by modulating CYP1A2 and CYP2D22 respectively.
- 4) Studies on ZnO nanoparticles being used worldwide in different dermatological preparations, showed their genotoxic potential and induction of oxidative stress in human epidermal cells, implicating cautious approach for their use. This study was highlighted in Safety for Environmental Policy document of European Commission.
- 5) Groundwater quality in Ghaziabad region was assessed for various chemical contaminants during the pre- and post-monsoon seasons. The groundwater aquifers were contaminated more with anthropogenic contaminants in the industrial region as compared to other areas of the town.
- 6) A multi-way partial least square model for the prediction of effluent quality of the sewage treatment plant was developed. The model predicted BOD and COD levels in treated effluents, which were

close to the measured values. The model can be used for the performance evaluation of the sewage treatment plant

- 7) Post-monsoon monitoring of ambient air quality and noise levels of Lucknow showed that levels of RSPM and SPM were less than or comparable to those during the last year. SO_2 and NO_x levels were lower than the prescribed standard limits. However, noise levels were above the permissible limits during day and night.



Dr Ch Mohan Rao delivering the Foundation Day address

Dr Mohan Rao released the Annual Report of IITR and in his foundation day address, he said that the future is going to be of nanotechnology and GM food. Therefore, IITR should pursue the R&D in the areas of nanotoxicology and safety evaluation of GM food. Further, he stated that IITR should conduct more programmes for children on science to arouse their curiosity.

Later, the certificate of appreciation was given to the following administrative staff for their meritorious service: Mr. BK Jha, PA to Director, Mr. BK Mishra, Finance & Accounts Officer and Mr. Umesh Chandra Srivastava, Driver.

Dr CM Gupta released the Environmental Status Report of Lucknow and in his presidential address said that IITR is fully equipped in terms of technology and scientific expertise and should focus on futuristic areas such as nanotoxicology, long-term safety evaluation of GM food and climate change.

Assessment of Environmental Status of Lucknow City(Post-monsoon, 2009).

Urbanization of Lucknow city is happening at a very fast pace as the city is growing in stature as well as in geographical area and it is almost in the same league as metropolitans now. As per 2001 census, total population of Lucknow city is 22.45 lakhs. Also, vehicular population of Lucknow has increased manifold, there has been an increase of 8.34% in number of vehicles since last year as per March, 2009 data. Due to this development, qualitative and quantitative deterioration of environmental components in terms of ambient air quality has been observed in Lucknow as well as other cities.

Environmental Monitoring Section of Indian Institute of Toxicology Research, Lucknow initiated random survey of air pollution and noise measurement in Lucknow city in May 1997 and has been doing it since then. This year, post monsoon study of ambient air quality of Lucknow city was done during September-October at 10 locations (4 residential, 5 commercial and 1 industrial area) for air pollutants i.e. SPM, RSPM, SO_2 , NO_x . Day and night time noise levels were also monitored at above locations and in Talkatora industrial area during this period.

The average concentrations of RSPM and SPM were in the range of 132.3 to 177.0 and 263.2 to 337.8 $\mu\text{g}/\text{m}^3$ respectively in residential areas; in range of 169.3 to 204.0 and 304.5 to 397.7 $\mu\text{g}/\text{m}^3$ in commercial area (Amausi) and 165.7 and 304.7 $\mu\text{g}/\text{m}^3$ in industrial area. All the values of RSPM were above the prescribed National Ambient Air Quality Standard (NAAQS) [Residential: 100 $\mu\text{g}/\text{m}^3$, Industrial: 150 $\mu\text{g}/\text{m}^3$]. SPM levels in Residential and commercial areas were above prescribed standards but within limits in Industrial area [Residential: 200 $\mu\text{g}/\text{m}^3$, Industrial: 500 $\mu\text{g}/\text{m}^3$]. However, RSPM and SPM levels were less than or comparable to corresponding concentrations during last year. This may be due to erratic rainfall this year which might have washed away the pollutants.

The concentration of SO_2 and NO_x was found to be lesser than previous years in all the residential and commercial areas and also lesser than prescribed standard limits [Residential: 80 $\mu\text{g}/\text{m}^3$ Industrial: 120 $\mu\text{g}/\text{m}^3$].

The noise survey revealed higher noise pollution during day and night time in residential and commercial

areas, which were above the permissible limits of 55 & 65 dB (A) for day time and 45 and 55 dB (A) at night time respectively.

It is suggested that more use of CNG vehicles be deployed to bring down air pollutants at the same time environmental fairs need to be organized at school, college and municipality level to generate interest and increase awareness among masses. Also, extensive plantation should be done along the roads, in and around the public gardens. This will not only help in reducing air pollutants but will also lower the noise levels by absorption. Dr DK Saxena, Senior Scientist and Chairman of the Organizing Committee proposed the vote of thanks



IITR Annual Report was released on the occasion

IITR RESEARCH HIGHLIGHTS

Polymorphism in cytochrome P4501A1 is significantly associated with head and neck cancer risk

[Singh AP, Shah PP, Ruwali M, Mathur N, Pant MC, Parmar D. *Cancer Invest.* 2009 Oct; 27(8):869-76]

A case control study was undertaken to investigate the association of polymorphisms in cytochrome P4501A1 (CYP1A1) with squamous cell carcinoma of head and neck (HNSCC) in North Indian population. The variant genotypes of CYP1A1*2A and CYP1A1*2C were found to be over represented in cases when compared to controls. The HNSCC risk also increased several folds in cases with combination of variant genotypes of CYP1A1*2A or CYP1A1*2C with null genotype of glutathione-S-transferase M1 (GSTM1), a phase II enzyme, particularly in cases who were tobacco users (smokers and tobacco chewers), demonstrating the role of gene-gene and gene-environment interactions in the development of HNSCC.

Death receptors: targets for cancer therapy

[Mahmood Z, Shukla Y. *Exp Cell Res.* 2009 Dec 21. (Epub ahead of print)]

Apoptosis is the cell's intrinsic program to death, which plays an important role in physiologic growth control and homeostasis. Apoptosis can be triggered by death receptors (DRs), without any adverse effects. DRs are the members of tumor necrosis factor (TNF) receptor super family, known to be involved in apoptosis signaling, independent of p53 tumor-suppressor gene. Selective

triggering of DR-mediated apoptosis in cancer cells is a novel approach in cancer therapy. So far, the best characterized DRs are CD95 (Fas/Apo1), TNF-related apoptosis-inducing ligand receptor (TRAILR) and tumor necrosis factor receptor (TNFR). Among these, TRAILR is emerging as most promising agent for cancer therapy, because it induces apoptosis in a variety of tumor and transformed cells without any toxicity to normal cells. TRAIL treatment in combination with chemotherapy or radiotherapy enhances TRAIL sensitivity or reverses TRAIL resistance by regulating downstream effectors. This review covers the current knowledge about the DRs, summarizes main signaling in DRs and also summarizes the preclinical approaches of these DRs in cancer therapy.

Interaction of drug metabolizing cytochrome P450 2D6 poor metabolizers with cytochrome P450 2C9 and 2C19 genotypes modify the susceptibility to head and neck cancer and treatment response

[Yadav SS, Ruwali M, Pant MC, Shukla P, Singh RL, Parmar D. *Mutat Res.* 2010 Feb 3;684(1-2):49-55. Epub 2009 Nov 30]

The present case-control study attempted to investigate the association of poor metabolizer (PM) genotypes of cytochrome P450 2D6 (CYP2D6*4 and CYP2D6*10) with squamous cell carcinoma of head and neck (HNSCC) and treatment response in patients receiving chemotherapy or combination of chemo- and radiotherapy. Cases with the PM genotypes of CYP2D6 displayed a significantly

increased risk for HNSCC as compared to wild type genotypes. The risk was found to further increase in cases (up to 4.8) carrying combination of PM genotypes of CYP2D6, CYP2C9 (CYP2C9*2) or CYP2C19 (CYP2C19*2), suggesting that synergism amongst the PM genotypes of drug metabolizing CYPs leads to impairment in the detoxification of the tobacco carcinogens. A small increase in the risk in tobacco (chewers or smokers) or alcohol users in cases with CYP2D6*4 allele while no change or even a small decrease in risk in cases with CYP2D6*10 allele when compared to non-tobacco or alcohol users have suggested that CYP2D6 genotypes alone do not appear to interact significantly with environmental risk factors in modifying the susceptibility to HNSCC. Furthermore, most of the cases carrying PM genotypes of CYP2D6 did not respond to the treatment. Moreover, higher prevalence of non-responders among cases carrying combination of CYP2D6*4 or CYP2D6*4, CYP2C9*2 and CYP2C19*2 have demonstrated that interaction of PM genotypes may not only significantly modify the susceptibility to HNSCC but also the treatment response.

Polycyclic aromatic hydrocarbon metabolizing cytochrome P450s in freshly prepared uncultured rat blood lymphocytes

[Saurabh K, Sharma A, Yadav S, Parmar D. *Biochem Pharmacol.* 2009 Nov 29. (Epub ahead of print)]

In an attempt to develop blood lymphocyte cytochrome P450 expression profile as a surrogate to monitor tissue enzyme, the present study aimed to identify the expression and regulation of polycyclic aromatic hydrocarbons (PAHs) responsive CYPs in freshly prepared rat blood lymphocytes. Semi-quantitative and RT-PCR studies demonstrated constitutive and inducible mRNA expression of CYP1A1, 1A2, 1B1 isoenzymes and the associated transcription factors, aryl hydrocarbon receptor (AhR) and AhR translocator (ARNT) in blood lymphocytes. Absolute quantification using RT-PCR revealed several fold lower basal expression of CYP1A1, 1A2 and 1B1 in lymphocytes when compared to the liver. However, significant increase in the mRNA expression of these isoenzymes as well as AhR and ARNT in lymphocytes following pretreatment with 3-methylcholanthrene (MC) have demonstrated that responsiveness is retained in the blood lymphocytes, though the magnitude of increase is several fold lower when compared to liver. This increase in the mRNA expression

was found to be associated with an increase in the protein expression of CYP1A1 and 1A2 in blood lymphocytes. Further, CYPs expressed in blood lymphocytes catalysed the O-dealkylation of 7-ethoxy- and 7-methoxyresorufins (ER or MR), though the reactivity was several fold lower in lymphocytes when compared to the liver enzyme. Our data providing quantitative evidence for similarities in the regulation of PAH-regulated CYP in uncultured and non-mitogen stimulated blood lymphocytes with the liver enzyme has led us to suggest that blood lymphocytes could be used as a surrogate to monitor tissue expression of CYPs.

Pyrogallol-mediated toxicity and natural antioxidants: triumphs and pitfalls of preclinical findings and their translational limitations

[Upadhyay G, Gupta SP, Prakash O, Singh MP. *Chem Biol Interact.* 2010 Feb 12;183(3):333-40. Epub 2009 Dec 3]

Pyrogallol, a potent anti-psoriatic drug, produces toxicity due to its ability to generate free radicals, besides its beneficial effects. Oxidative stress is implicated in pyrogallol-mediated toxicity in general and hepatotoxicity in particular. Naturally occurring antioxidants including, resveratrol and silymarin have been proposed as potential supplements to counteract pyrogallol-mediated toxicity, without reducing its efficacy. Due to increase in the popularity of natural antioxidants in combating pyrogallol-mediated toxicity, a literature-based survey was performed to assess their role in experimental studies and possible implications in real life situations. Although preclinical studies revealed the boons of naturally occurring antioxidants in attenuating/abolishing the undesirable effects of pyrogallol exposure, limited studies have been conducted to evaluate their role in clinics. In this review, an update on the recent development in assessing the potential of natural antioxidants in pyrogallol-mediated toxicity in preclinical interventions, triumphs and pitfalls of such investigations, their translational challenges and future possibilities are discussed.

Indoor exposure to respirable particulate matter and particulate-phase PAHs in rural homes in North India

[Ansari FA, Khan AH, Patel DK, Siddiqui H, Sharma S, Ashquin M, Ahmad I. *Environ Monit Assess.* 2009 Nov 26. (Epub ahead of print)]

In order to evaluate the exposure of the northern India rural population to polyaromatic hydrocarbon (PAH) inhalation,

indoor pollution was assessed by collecting and analyzing the respirable particulate matter PM(2.5) and PM(10) in several homes of the village Bhithauli near Lucknow, UP. The home selection was determined by a survey. Given the nature of biomass used for cooking, homes were divided into two groups, one using all kinds of biomass and the second type using plant materials only. Indoor mean concentrations of PM(2.5) and associated PAHs during cooking ranged from 1.19 +/- 0.29 to 2.38 +/- 0.35 and 6.21 +/- 1.54 to 12.43 +/- 1.15 mug/m(3), respectively. Similarly, PM(10) and total PAHs were in the range of 3.95 +/- 1.21 to 8.81 +/- 0.78 and 7.75 +/- 1.42 to 15.77 +/- 1.05 mug/m(3), respectively. The pollutant levels during cooking were significantly higher compared to the noncooking period. The study confirmed that indoor pollution depends on the kind of biomass fuel used for cooking.

Co-expression of p53 and Bcl-2 proteins in human papillomavirus-induced premalignant lesions of the uterine cervix: correlation with progression to malignancy

[Singh M, Srivastava S, Singh U, Mathur N, Shukla Y. *Tumour Biol.* 2009;30(5-6):276-85. (Epub 2009 Nov 20)]

To analyze aberrant expression of the apoptotic protein p53 and the anti-apoptotic protein Bcl-2 in premalignant lesions of the uterine cervix induced by human papillomavirus (HPV) infection and its significance for early diagnosis of cervical cancer. Cytological adequate smears (n = 382) from various grades of squamous intraepithelial lesions (SILs; n = 142), 'atypical squamous cells of unknown significance' (ASCUS; n = 128) and normal tissue (n = 112) were investigated immunocytochemically for aberrant expression of p53 and Bcl-2 proteins using the streptavidin-biotin-peroxidase method; HPV status was analyzed in cervical smears using general and type-specific primers. HPV-DNA of any type was detected in 25.7% (98/382) of cases. HPV16 was seen in 58.2% (57/98), HPV18 in 20.4% (20/98) and other HPV types in 21.4% (21/98). Abnormal nuclear expression of p53 protein and cytoplasmic expression of Bcl-2 protein were noted in cervical dysplasia and an association with the presence of HPV16/HPV18 was noted. The intensity of immunoreactivity for p53 and Bcl-2 proteins varied between different cytological grades of cervical smears. Follow-up data revealed that cases with high-risk HPV and co-induced expression of apoptosis-regulatory proteins presented a trend to progressive disease. The detection of both p53 and Bcl-

2 proteins in cervical smears can be used as independent diagnostic marker for early-stage HPV-associated cervical cancer.

Inhibitory effects of tea polyphenols by targeting cyclooxygenase-2 through regulation of nuclear factor kappa B, Akt and p53 in rat mammary tumors

[Roy P, George J, Srivastava S, Tyagi S, Shukla Y. *Invest New Drugs.* 2009 Nov 20. (Epub ahead of print)]

Breast cancer has become the second leading cause of cancer-related deaths worldwide. The control of this disease can be achieved through chemoprevention, which refers to the consumption of synthetic or naturally occurring agents to block, reverse, or delay the process of tumor development. Tea (*Camellia sinensis*), the most widely consumed beverage, has shown promises in the field of cancer chemoprevention. Inhibition of tumorigenesis by green or black tea polyphenols has been demonstrated in various *in vitro* and *in vivo* models. Here, we examined the inhibitory effect of green tea polyphenol (GTP) and black tea polyphenol (BTP) on the development of mammary tumors-induced by 7, 12-dimethylbenz (a) anthracene (DMBA) in female, Wistar rats. 13% and 33% of animals developed tumors in GTP and BTP supplemented groups, respectively. Both GTP and BTP are effective in significantly inhibiting the cumulative number of mammary tumors (by ~92% and 77%, respectively) and in reducing their growth. Mechanistically, we investigated the effects of GTP and BTP on the components of cell signaling pathways, connecting biomolecules involved in cancer development. GTP and BTP supplementation as a sole source of drinking solution leads to scavenging of reactive oxygen species (ROS) (by ~72% and 69%, respectively) by inhibiting cyclooxygenase-2 (Cox-2) and inactivation of phosphorylated forms of nuclear factor-kappa B (NF-kappaB) and Akt. Altogether, the study suggests that both cultivars of tea, i.e. green and black, have anti-tumorigenic potential against DMBA-induced mammary tumorigenesis in Wistar rats. Further studies such as large and long term cohort studies and clinical trials are warranted.

Occurrence of phthalic acid esters in Gomti river sediment, India

[Srivastava A, Sharma VP, Tripathi R, Kumar R, Patel DK, Mathur PK. *Environ Monit Assess.* 2009 Nov 4. (Epub ahead of print)]

Phthalic acid esters (PAEs) are well-known ubiquitous environmental pollutants and used as plasticizers for the manufacturing of plastic products. During this exploratory study, an attempt has been made to determine the concentration and distribution of five prominent PAEs, viz. di-methyl phthalate (DMP), di-ethyl phthalate (DEP), di-butyl phthalate (DBP), di-(2-ethylhexyl) phthalate (DEHP), and di-octyl phthalate (DOP) in the sediment samples of Gomti River collected from 30 different locations. Identification and quantification of PAEs were performed by high-performance liquid chromatography. The mean concentration values of DMP, DEP, DBP, DEHP, and DOP were found as 10.54, 4.57, 10.41, 31.61, and 5.16 mug/kg, respectively. Limit of detection and limit of quantification for each PAE were also calculated and found in the ranges of 0.09-0.55 and 0.28-1.67 mug/kg. DEHP was the most frequently detected PAE (present in 93.3% samples); however, DOP was found only in 36.7% samples.

Homology modeling and docking studies of *Comamonas testosteroni* B-356 biphenyl-2,3-dioxygenase involved in degradation of polychlorinated biphenyls

[Baig MS, Manickam N. Int J Biol Macromol. 2010 Jan 1;46(1):47-53. Epub 2009 Oct 30]

Biphenyl dioxygenase is a microbial enzyme which catalyzes the stereospecific dioxygenation of aromatic rings of biphenyl congeners leading to their degradation. Hence, it has attracted the attention of researchers due to its ability to oxidize chlorinated biphenyls, which are one of the serious environmental contaminants. In the present study, the three-dimensional model of alpha-subunit of biphenyl dioxygenase (BphA) from *Comamonas testosteroni* B-356 has been constructed. The resulting model was further validated and used for docking studies with a class of chlorinated biphenyls such as biphenyl, 3,3'-dichlorobiphenyl and 4,4'-dichlorobiphenyl. The kinetic parameters of these biphenyl compounds were well matched with the docking results in terms of conformational and distance constraints. The binding properties of these biphenyl compounds along with identification of critical active site residues could be used for further site-directed mutagenesis experiments in order to identify their role in activity and substrate specificity, ultimately leading to improved mutants for degradation of these toxic compounds.

Adverse health effects due to arsenic exposure: modification by dietary supplementation of jaggery in mice

[Singh N, Kumar D, Lal K, Raisuddin S, Sahu AP. Toxicol Appl Pharmacol. 2010 Feb 1;242(3):247-55. Epub 2009 Oct 27]

Populations of villages of eastern India and Bangladesh and many other parts of the world are exposed to arsenic mainly through drinking water. Due to non-availability of safe drinking water they are compelled to depend on arsenic-contaminated water. Generally, poverty level is high in those areas and situation is compounded by the lack of proper nutrition. The hypothesis that the deleterious health effects of arsenic can be prevented by modification of dietary factors with the availability of an affordable and indigenous functional food jaggery (sugarcane juice) has been tested in the present study. Jaggery contains polyphenols, vitamin C, carotene and other biologically active components. Arsenic as sodium-m-arsenite at low (0.05 ppm) and high (5 ppm) doses was orally administered to Swiss male albino mice, alone and in combination with jaggery feeding (250 mg/mice), consecutively for 180 days. The serum levels of total antioxidant, glutathione peroxidase and glutathione reductase were substantially reduced in arsenic-exposed groups, while supplementation of jaggery enhanced their levels in combined treatment groups. The serum levels of interleukin-1beta, interleukin-6 and TNF-alpha were significantly increased in arsenic-exposed groups, while in the arsenic-exposed and jaggery supplemented groups their levels were normal. The comet assay in bone marrow cells showed the genotoxic effects of arsenic, whereas combination with jaggery feeding lessened the DNA damage. Histopathologically, the lung of arsenic-exposed mice showed the necrosis and degenerative changes in bronchiolar epithelium with emphysema and thickening of alveolar septa which was effectively antagonized by jaggery feeding. These results demonstrate that jaggery, a natural functional food, effectively antagonizes many of the adverse effects of arsenic.

Activation of inflammatory response and apoptosis of polymorphonuclear leukocytes in patients with argemone oil poisoning

[Babu CK, Ansari KM, Mehrotra S, Patel S, Dikshit M, Das M. Chem Biol Interact. 2010 Jan 5;183(1):154-64]

In the present study, the role of ROS and RNS in activation of inflammatory response and associated molecular events during apoptosis of polymorphonuclear leucocytes (PMNs) in patients from an outbreak of argemone oil (AO) poisoning leading to epidemic dropsy in Lucknow, India was undertaken. It was observed that generation of superoxide radical, nitrite formation and phagocytosis (103-429%) were significantly increased in PMNs of dropsy patients. Furthermore, activities of superoxide dismutase and glutathione peroxidase (GPx) (47-79%) were found to be increased while that of catalase and glutathione reductase (GR) (56-57%) were decreased. Lipid and protein oxidation, nitrotyrosine formation and 8-hydroxydeoxyguanosine (8-OHdG) excretion were significantly enhanced with concomitant depletion of GSH levels (67%) in dropsy patients. In addition, significant elevation of IL-6, IL-8 and TNF-alpha (68-406%) in plasma was observed. Apoptosis was enhanced (1.5 folds) with increased (2.0-3.6 folds) caspases 3, 8 and 9 activities along with DNA fragmentation (119%). The results suggest that generation of ROS and RNS along with enhancement of secretion of inflammatory mediators leading to DNA damage followed by apoptosis may have an effect on immune system, which in turn may be responsible for histopathological changes in target organs of dropsy patients.

Phenotype of hepatic xenobiotic metabolizing enzymes and CYP450 isoforms of sanguinarine treated rats: effect of P450 inducers on its toxicity

[Eruvaram NR, Das M. Toxicol Mech Methods. 2009 Oct;19(8):510-7]

Catalytic and immunochemical activities of cytochrome P450 (CYP) isoforms were investigated in argemone alkaloid, sanguinarine (SAN) intoxicated rats, pre-treated with different CYP inducers. SAN treated control (CON) and ethanol (ET), 3-methylcholanthrene (MC) or dexamethasone (DEX) pre-exposed rats, resulted in 48, 64, 47 and 33% decrease in CYP content. SAN exposure to CON, and DEX, MC or ET pre-treated animals caused a decrease (22-37%) in glutathione-S-transferase (GST) activity, however, quinone reductase (QR) activity decreased (26-45%) in the MC pre-exposed group. Similarly, western-blot analysis of hepatic CYP1A1 and CYP1A2 showed a decrease (27-37%) in MC pre-treated SAN exposed animals. Further, a decrease in mortality in the SAN+MC (25%) group compared to SAN treated animals was also observed. The results suggest that inhibition of CYP 1A1, 1A2, 2D1, 2E1, 3A1, and Phase II enzymes by SAN augments its toxicity, whereas attenuation of SAN toxicity by MC may be due to removal of parent compound/metabolites from the body.

HONOURS AND AWARDS



Ms. Madhulika Tripathi, SRF, receiving gold medal for best poster presentation during 29th Annual Conference of Society of Toxicology held at National Institute of Nutrition, Hyderabad from November 4-7, 2009.

RESEARCH DIGEST

A Clash of Old and New Scientific Concepts in Toxicity, with Important Implications for Public Health

[Environmental Health Perspectives, November 2009, Volume 117, Number 11, 1652-55]

A core assumption of current toxicologic procedures used to establish health standards for chemical exposures is that testing the safety of chemicals at high doses can be used to predict the effects of low-dose exposures, such as those common in the general population. This assumption is based on the precept that "the dose makes the poison": higher doses will cause greater effects. Authors challenge the validity of assuming that high-dose testing can be used to predict low-dose effects for contaminants that behave like hormones. The review data from endocrinology and toxicology that falsify this assumption and summarize current mechanistic understanding of how low doses can lead to effects unpredictable from high-dose experiments. Falsification of this assumption raises profound issues for regulatory toxicology. Many exposure standards are based on this assumption. Rejecting the assumption will require that these standards be reevaluated and that procedures employed to set health standards be changed. The consequences of these changes may be significant for public health because of the range of health conditions now plausibly linked to exposure to endocrine-disrupting contaminants. Authors recommend that procedures to establish acceptable exposure levels for endocrine-disrupting compounds incorporate the inability for high-dose tests to predict low-dose results. Setting acceptable levels of exposure must include testing for health consequences at prevalent levels of human exposure, not extrapolations from the effects observed in high-dose experiments. Scientists trained in endocrinology must be engaged systematically in standard setting for endocrine-disrupting compounds.

Chocolate Cake: The New Heroin ?

[ScienceNOW Daily News 9 November 2009]

If you're constantly starting new diets, then breaking them, you may have more in common with a drug addict than you know. A new study suggests that yo-yo dieters experience the same stressful pangs of withdrawal when they go on a diet that addicts experience when they go cold turkey.

The idea that bad food can be addictive is not new. But

previous studies have tended to focus on the positive reinforcement side of the equation--for example, the pleasurable "rush" you get from eating chocolate cake. "This is just part of the story," says Pietro Cottone, a neuroscientist at Boston University and a co-author of the new study, which was conducted at The Scripps Research Institute in La Jolla, California. The brain also has a negative reinforcement system that causes anxiety and stress during withdrawal. Rather than doing drugs for the rush, he says, addicts do drugs to relieve the stress associated with withdrawal. Dieters often follow the same pattern of abstinence and relapse as drug addicts, so Cottone and his colleagues wanted to see whether the same brain circuitry might be involved.

The researchers gave one group of rats unlimited access to regular rat food for 5 days, followed by 2 days of sugary, chocolate-flavored rat chow. ("They like it a lot," says Cottone.) The team repeated this cycle for 7 weeks and compared the rats' food intake and behavior with that of a control group of rats that had access only to standard chow. The control rats ate roughly the same amount of food every day, but the rats in the experimental group did not: When the junk food arrived, they pigged out. By the fifth week, the experimental rats were eating roughly 20% more food when they had access to chocolate chow than rats in the control group ate. And when it was replaced with normal food, they ate less normal food, approximately 30% less by week 5. As the study progressed, the effect became stronger. What's more, the rats going through chocolate-chow withdrawal spent less time in the exposed parts of a specially designed maze, a measure of increased anxiety. When the chocolate chow was returned, the anxiety disappeared.

The researchers suspected that the anxiety was the result of corticotropin-releasing factor (CRF), a hormone involved in the brain's stress response. Previous studies have shown that this molecule plays a role in drug and alcohol withdrawal. Indeed, when the researchers gave the rats a drug to block their CRF receptors, the animals ate less chocolate chow and more normal chow. They also experienced less withdrawal-associated anxiety. Further experiments revealed that the rats expressed five times more CRF during their withdrawal periods than during their binge periods. This is the first time the CRF system has been implicated in food addiction, offering a potential drug target, the team reports in the Proceedings of the National Academy of Sciences.

Drugs to block CRF receptors in the brain are currently being developed.

"This is a brilliant study," says Markus Heilig, a psychiatrist at the National Institute on Alcohol Abuse and Alcoholism in Bethesda, Maryland, who has studied the role of CRF in alcohol addiction. "[Intermittent] dieting is not a good idea, this would seem to indicate." In fact, Heilig says, the study suggests that long-term serial dieting may be driving the biology of the brain into a state in which an individual will experience increased cravings for junk food. Whether you're talking about alcohol, drugs, or even junk food, he says, the more times you relapse, the more stress you feel during withdrawal, and the harder it is to stay on the wagon. "That is the vicious circle," says Heilig.

Lead Exposure and Behavior among Young Children in Chennai, India

[*Environ Health Perspect* 117:1607-1611. doi:10.1289/ehp.0900625]

Blood lead levels have decreased in Indian children since the phaseout of leaded gasoline in 2001, but levels continue to exceed acceptable limits in many areas. Effects of lead on IQ (intelligence quotient) scores are well established, but few studies have assessed effects on specific domains of behavior and cognition. Roy et al. conducted a cross-sectional study of 756 children 3-7 years of age in Chennai, India, to evaluate relations between blood lead levels and anxiety, social problems, inattention, hyperactivity, attention-deficit/hyperactivity disorder (ADHD), and executive function, which were assessed based on the Conners' Teacher Rating Scales-39, the Conners' ADHD/Diagnostic and Statistical Manual for Mental Disorders, 4th Edition Scales (CADS), and the Behavior Rating Inventory of Executive Function. The mean blood lead level in the study population was 11.4 µg/dL (range, 2.6-40.5 µg/dL), with more than half of the children having levels > 10 µg/dL. The authors report that blood lead level was associated with higher anxiety, social problems, ADHD, and deficits in executive function, and conclude that executive function and attention are particularly vulnerable to adverse neurobehavioral effects of lead.

How Aircraft Emissions Contribute to Warming: Aviation Contributes up to one-fifth of Warming in Some Areas of the Arctic.

[*Nature* 21 December 2009 (doi:10.1038/news.2009.1157)]

The first analysis of emissions from commercial airline flights shows that they are responsible for 4-8% of surface global warming since surface air temperature records began in



Aircraft emissions could be having a dramatic effect on the warming of the Arctic.

1850 - equivalent to a temperature increase of 0.03-0.06 °C overall. The analysis, by atmospheric scientists at Stanford University in Palo Alto, California, also shows that in the Arctic, aircraft vapour trails produced 15-20% of warming. The results of this analysis are likely to be studied widely as nations attempt to address the impact of commercial aviation on global warming. There are around 35 million commercial airline flights every year. Studies have been conducted in Europe, with airlines coming under increased pressure as European Union leaders consider levying a carbon tax on aircraft emissions. But little research has been conducted on the topic in the United States.

Previous studies have only estimated the impacts of commercial aviation, but this is the first use of actual emissions data - from 2004 and 2006 - to calculate warming from such flights, says Mark Jacobson, a Stanford engineer who presented the analysis on 17 December at the American Geophysical Union's annual meeting in San Francisco, California. For the latest study, Jacobson and his team developed a model for aircraft emissions that accounts for atmospheric composition, cloudiness and the physical properties of emissions, particularly of black carbon - a major part of soot. In his presentation, Jacobson explained how the model was applied to a nine-year simulation covering 2004 to 2013, after breaking up flight routes into 300-kilometre-square grids for analysis. The model was able to calculate the characteristics of vapour trails based on the actual particulate size of emissions and their evolution over time.

Many previous studies have assumed that the impact of aircraft emissions was the same everywhere. But the new analysis reveals that aircraft emissions increased the fraction of cirrus clouds where vapour trails were most abundant, and actually decreased the cirrus fraction in several locations

by increasing the temperatures in the lower atmosphere, reducing the relative humidity in such locations. If black-carbon emissions from aircraft could be reduced 20-fold, warming would be halted and a slight cooling would occur from plane-created vapour trails, Jacobson says. David Fahey, of the Earth System Research Laboratory in Boulder, Colorado - part of the National Oceanic and Atmospheric Administration - says that studies such as Jacobson's are important to fill the gaps in aircraft-emissions data following the nation's previously "muddled" research course.

Mother's Cancer Can pass on to Fetus

[ScienceNOW Daily News 13 October 2009]



A startling case in Japan has confirmed that pregnant women with cancer can pass the disease to their fetus. These transmissions, normally blocked by the placenta, are rare, so the work likely won't change how doctors screen or care for pregnant women. But scientists say the case could help illuminate how cancer foils the body's immune system. In early 2007, a 28-year-old Japanese woman gave birth to a girl. Thirty-six days later, the mother was hospitalized with vaginal bleeding, which became uncontrollable. Doctors diagnosed leukemia, and she soon died. The baby developed normally until age 11 months, when a huge tumor appeared in her cheek. A biopsy determined the cancer was not sarcoma--a cancer of certain connective tissues--but a leukemic tumor somehow trapped in the child's cheek.

The doctors alerted cell biologist Mel Greaves of the Institute of Cancer Research in Sutton Surrey, United Kingdom, who studies transmissible cancers. Scientists had suspected mother-to-fetus cancer in other cases with strong

circumstantial evidence (especially with leukemia and melanoma, which both metastasize readily). But no one had done genetic tests to prove the cancer had grown from a single source and wasn't just an unfortunate coincidence.

In their investigation, Greaves and colleagues discovered incipient cancer cells in routine blood samples taken from the child at birth, strongly suggesting that the transmission happened in utero. They also examined a DNA sequence unique in each case of leukemia, the BCR-ABL1 sequence. It was identical in mother and daughter. Finally, tests showed the child's cancer cells were almost all maternal cells, with no genetic material from the father. This indicated that the transmission path was mother to fetus, not the reverse. Greaves and colleagues also determined how cancer survived inside the fetus, whose immune system should have destroyed the mother's cells. They found that the cancer cells were missing a large region from a stretch of the sixth human chromosome known as 6p, which produces surface markers that immune cells latch on to. In short, Greaves says, "the cancer succeeded because it was immunologically invisible."

Knowing the molecular details of how the cells evaded detection will help scientists probe how other cancers slip by our immune system, says Howard Weinstein, a pediatric cancer specialist at Massachusetts General Hospital in Boston. Despite the findings, mothers shouldn't panic, says Greaves. With only a few dozen cases of mother-fetus cancer transmission reported since the first, in 1866, the risk for pregnant women is minimal, he says. And transferring advanced cancer to infants is not necessarily fatal--the Japanese girl was successfully treated and is still alive. But Greaves says his team's work questions the assumption that the placenta provides a wholly effective barrier between mothers and fetuses. "I'm more inclined to think that maybe cells get by in modest numbers all the time," he says. "You can learn a lot from very odd cases in medicine."

Oseltamivir Carboxylate, the Active Metabolite of Oseltamivir Phosphate (Tamiflu), Detected in Sewage Discharge and River Water in Japan.

[Environ Health Perspect 118:103-107. doi:10.1289/ehp.0900930]

Oseltamivir phosphate (OP; Tamiflu) has been used to treat and prevent H1N1 influenza. OP is primarily excreted in urine as oseltamivir carboxylate (OC), the active form of the drug, and OC may be subsequently released into the environment via sewage treatment plant (STP) wastewater. Ghosh et al. used solid-phase extraction followed by liquid chromatography-tandem mass spectrometry to measure OC in sewage discharge and river water samples collected near Kyoto City, Japan, during the 2008-2009 flu season.

The authors report that OC concentrations were highest during the peak of the flu season, with the highest concentration (293.3 ng/L) in discharge water from a conventional activated sludge-based STP. OC concentrations in STP wastewater might be high enough to promote the emergence of drug-resistant influenza strains in exposed waterfowl, but discharge sample concentrations varied depending on the type of sewage treatment method used, with a substantially lower peak concentration (37.9 ng/L) measured in discharge from an STP that used ozonation as a tertiary treatment. The authors recommend additional research to determine effective sewage treatment methods to limit environmental discharges of OC.

Soils Give Clean Look at Past Carbon Dioxide

It Could Take Less of the Greenhouse Gas to Reach a Particular Level of Warming.

[Nature 30 December 2009. doi:10.1038/news.2009.1168]



Atmospheric carbon dioxide levels may have been lower in warm eras of the Earth's distant past than once believed. The finding raises concern that carbon dioxide levels from fossil fuel burning may, in the near future, be closer to those associated with ancient hothouse climates. More immediately, the work brings one line of palaeoclimate evidence - that deduced from ancient soils - into agreement with other techniques for studying past climate. "It makes a major revision to one of the most popular methods for reconstructing palaeo-CO₂," says Dana Royer, a palaeobotanist at Wesleyan University in Middletown, Connecticut, who was not involved in the work. "This increases our confidence that we have a decent understanding of palaeo-CO₂ patterns."

In a paper in the Proceedings of the National Academy of Sciences, Dan Breecker, a soil chemist from the University of Texas, Austin, and colleagues report studying modern soils from Saskatchewan to New Mexico, to determine the conditions under which the mineral calcite forms. Calcite occurs in limestone and can be produced by the action of carbon dioxide in arid soils. Scientists trying to puzzle out

ancient climate conditions often use it as an indicator of amount of carbon dioxide in the atmosphere. Previous studies had concluded that calcite formation indicates atmospheric carbon dioxide levels as high as 3,000 to 4,000 parts per million. The new study, however, lowers the calcite-formation threshold in soil to about 1,000 parts per million. Breecker's team reached the conclusion by studying the outgassing of carbon dioxide from modern soils during times when calcite minerals are forming. "You can just put a box on top of the soil and let it fill up with carbon dioxide," he says. "The rate at which the concentration increases gives you the flux into the atmosphere." That information, in turn, can be used to determine the conditions under which calcite forms.

The team then looked at what the new estimates of calcite formation would mean for fossil soils from warmer eras over the past 450 million years. "We plugged in our new conditions and out come new atmospheric carbon dioxide concentrations that are decreased by as much as four times," Breecker says. The new result, he says, brings carbon dioxide calculated from fossil soils into line with results obtained from other methods, such as measuring the spacing of pores on fossil leaves. Estimates based on these other techniques have generally produced lower carbon dioxide concentrations than those derived from carbonate levels in fossil soils, Breecker says. But the higher levels derived from soil carbonates were thought to be more accurate, especially from eras when atmospheric carbon dioxide was high.

Atmospheric carbon dioxide levels are rising today, and the new finding suggests that climate might be considerably more sensitive to changes in carbon dioxide than previously thought. "This may have implications for near-future climate change," Royer says. Breecker cautions that fossil soils reflect the Earth's adjustment to long-term climate changes, on scales of millions of years, rather than the more rapid, and possibly shorter-lived, changes likely to result from fossil-fuel burning. But, he notes, his study still indicates that the difference in carbon dioxide levels between ice ages and hothouse climates is less than previously believed.

Effect of Early Life Exposure to Air Pollution on Development ? of Childhood Asthma.

[Environ Health Perspect 118:284-290. doi:10.1289/ehp.0900916]

Air pollution has been consistently associated with asthma symptoms, but relatively few studies have evaluated early life exposures and asthma onset. Clark et al. conducted a nested population-based case control study of childhood asthma diagnosed up to 3-4 years of age among children born in southwestern British Columbia in 1999 and 2000, including 3,482 eligible cases (with a history of

hospitalization or at least two asthma diagnoses) and 17,410 age- and sex-matched controls. Administrative and health care data were used to identify eligible children and obtain information on residential histories and potential confounders. Air pollution exposures during pregnancy and the first year of life [specifically, to carbon monoxide, nitric oxide, nitrogen dioxide, particulate matter $\leq 10 \mu\text{m}$ (PM10) and $\leq 2.5 \mu\text{m}$ (PM2.5) in aerodynamic diameter, ozone, sulfur dioxide, black carbon, woodsmoke, and proximity to major roads and industrial point sources] were estimated using regulatory monitoring data and land use regression models adjusted for temporal variation. Early life exposures to CO, NO, NO₂, PM10, SO₂, black carbon, and industrial point sources were positively associated with asthma, with the strongest associations noted for traffic-related pollutants. The authors conclude that results support effects of early exposure to air pollutants on the development of childhood asthma.

Melting Glaciers Release Frozen Toxicants.

[*Environ Health Perspect* 117:A538-A538. doi:10.1289/ehp.117-a538]

The melting of glacial ice that formed in the middle of the twentieth century may be a source of a cocktail of persistent, bioaccumulative toxic substances that can threaten human health and the environment, according to a study by Christian Bogdal, a postdoctoral research fellow at the Swiss Federal Institute of Technology, Zürich, and colleagues in the 1 November 2009 issue of *Environmental Science & Technology*. Their findings, along with those of a handful of other studies, suggest the release of toxics once bound within glaciers may be a little-recognized consequence of ongoing climate change.

The Swiss team analyzed sediment samples taken from Lake Oberaar, a glacier-fed lake in central Switzerland. They measured sediment levels of several pollutants that would have entered the lake over the period 1953-2006 and compared the measurements with those from three lower-altitude Swiss lakes that aren't glacier fed. The substances analyzed included 17 dioxins and furans, 18 polychlorinated biphenyls (PCBs), 10 synthetic musk compounds, DDT and two of its transformation products (DDE and DDD), 4 additional organochlorine pesticides (hexachlorobenzene, hexachlorocyclohexane, dieldrin, and heptachlor epoxide) and their transformation products, and polychlorinated naphthalenes.

The Lake Oberaar and lower-altitude samples reflected a generally consistent pattern of increased influx of the compounds into the lakes from the 1950s through a peak in the 1960s-1970s, followed by a decrease to relatively low levels in the 1980s and 1990s. The exception was musk

compounds, whose sediment influx was fairly steady from the 1950s to the mid-1990s. These patterns parallel the widespread increase in production and use of these substances from the 1950s through the 1970s, and the subsequent decline (except in the case of musk compounds) as concerns about toxic effects often resulted in restrictions or bans on use. These patterns also mesh with the premise that the primary source of the sediment toxics to that point was deposition of airborne pollutants generated in urban, industrial, and agricultural areas.

Beginning in the late 1990s, however, the influx of all the compounds into Lake Oberaar-but not the lower-altitude lakes-increased moderately to sharply. In some cases, the new peak influxes were 2-5 times higher than the 1960s-1970s peaks. These increases coincide with a total reduction in Alpine glacier volume of about 12% between 1999 and 2008, according to a report by Daniel Farinotti and colleagues in the August 2009 issue of *Global and Planetary Change*. About one-quarter of that reduction occurred following the unusually hot summer of 2003.

Bogdal and colleagues hypothesize that the sources of the later contaminant influxes they observed likely were not distant, because production and use of these chemicals had decreased substantially. Instead, they conclude the glacial meltwater was the source. Studies they are conducting at Lake Oberaar and elsewhere support this hypothesis, says Bogdal.

The evidence to date suggests the release of these and other persistent toxics, such as lead and mercury, may be a concern for many glaciated settings. Among areas of potential concern, say Bogdal and other experts in this field, are locations in the Arctic region, Antarctica, the Alps, the Himalayas, and the Caucasus, Andes, Rocky, Cascade, and Sierra Nevada mountain ranges. "Melting of glaciers is releasing a huge amount of water containing dangerous contaminants used in the past," says Roberta Bettinetti, an assistant professor of freshwater ecology at Italy's University of Insubria. "Now these pollutants can contaminate great basins even at low altitudes where water is used for drinking and fishing purposes."

In the October 2008 issue of *Chemosphere*, Bettinetti and colleagues reported on their study of the toxic effects of melting glaciers on biota of two southern Alpine lakes. They found that the amount of DDT and its metabolites released by melting glacial ice increased the concentrations in lake mussels and fish above the threshold considered safe for human consumption. Silvana Galassi, a professor of ecology at the University of Milan and coauthor of that report, recommends implementation of monitoring to identify areas where mitigation, such as limiting fish consumption or avoiding disturbance of sediments, may be warranted.

राजभाषा वैज्ञानिक संगोष्ठी

भारतीय विष विज्ञान अनुसंधान संस्थान में 4 दिसम्बर, 2009 को “पर्यावरण प्रदूषण एवं स्वास्थ्य : भावी चुनौतियाँ एवं संभावित उपाय” विषय पर राजभाषा वैज्ञानिक संगोष्ठी का आयोजन किया गया। इस अवसर पर माननीय प्रो. भूमित्र देव, कुलपति, मंगलायत विश्वविद्यालय, अलीगढ़ मुख्य अतिथि थे। डॉ. अश्वनी कुमार ने समारोह की अध्यक्षता की। समारोह के उद्घाटन के पश्चात विभिन्न वैज्ञानिक व्याख्यानों का आयोजन हुआ। पहला व्याख्यान प्रो. उदय मोहन छ.सा.म. चिकित्सा विश्वविद्यालय का हुआ उन्होंने “पर्यावरण प्रदूषण और स्वास्थ्य : भावी चुनौतियाँ एवं संभावित उपाय” विषय पर अपना व्याख्यान दिया तत्पश्चात् डॉ. आलोक कालरा, केन्द्रीय औषधीय एवं सगंध पौधा संस्थान लखनऊ ने “जैविक निवेशों के विकास द्वारा कृषि में रासायनिक प्रदूषण के बचाव एवं स्वस्थ वातावरण की रक्षा” विषय पर शोध पत्र प्रस्तुत किया। इसी प्रकार डॉ. नीरज सिन्हा, वैज्ञानिक, केन्द्रीय औषधि

अनुसंधान संस्थान ने “हमारा पर्यावरण एवं गर्भस्थ शिशुओं पर उनका प्रभाव, “डॉ. आर.डी. त्रिपाठी, वैज्ञानिक एन वी.आर. आई. ने “आर्सेनिक प्रदूषित क्षेत्र एवं सुरक्षित मानव सेवन हेतु धान की उन्नत किस्म का विकास, डॉ. एस.एम. त्रिपाठी, वैज्ञानिक, बीरबल साहनी पुरा वनस्पति विज्ञान संस्थान ने पृथ्वी के पुरा-पर्यावरण का इतिहास डॉ. डी.के. सक्सेना, वैज्ञानिक भा.वि.अ.सं. ने “मानव शुक्राणु पर पर्यावरणीय प्रदूषकों का प्रभाव, डॉ. दीपक चन्द्रा बायोकेमिस्ट्री विभाग, लखनऊ विश्वविद्यालय ने “कार्बोफ्यूरोन का प्रतिरोधकता विलोपन प्रभाव एवं निवारण” डॉ. डी.कार. चौधरी वैज्ञानिक, भा.वि.अ.सं. ने “पर्यावरण के स्वास्थ्य पर प्रभाव के अध्ययन हेतु प्रयोगशाला जन्तुओं के विकल्प एवं डॉ. एन. मणिकम ने जैव प्रौद्योगिकी संसाधनों द्वारा विषैले रासायनिक प्रदूषकों का उपचारिकण विषय पर व्याख्यान दिया।



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