CRI/ICEIT NEWSLETTER
VOL. 30 NO. 1 – January 2020
ISSN 0858-2793
BANGKOK, THAILAND

Chulabhorn Research Institute

INTERNATIONAL CENTRE FOR ENVIRONMENTAL AND INDUSTRIAL TOXICOLOGY (ICEIT)

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

CRI Collaborates with the Vietnamese Institutes to Organize a Training Course on Environmental Toxicology

in Ho Chi Minh City, Vietnam from December 2 - 5, 2019

The Chulabhorn Research Institute (CRI) led a team of international faculty to conduct in-country training on "Environmental Toxicology", in collaboration with the National Institute of Occupational and Environmental Health and (NIOEH) in Hanoi and Ho Chi Minh Institute of Public Health (IPH), Vietnam, from December 2-5, 2019 in Ho Chi Minh City, Vietnam.

The CRI teaching team, which included Professor Herman Autrup from Aarhus University, Denmark, Professor Leonard Ritter from the University of Guelph, Canada, and Professor Martin van den Berg from Utrecht University, the Netherlands, as well as a technical team from CRI consisting of Professor Mathuros Ruchirawat, CRI Vice President for Research and Academic Affairs, Dr. Jutamaad Satayavivad, CRI Associate Vice-president for Scientific Affairs, Dr. Panida Navasumrit and Dr. Daam Settachan, research scientists from CRI's Laboratory of Environmental Toxicology, has vast experience with providing training for participants within the SEA region.

Training has previously been conducted in Bhutan, Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Sri Lanka, as well as several previous occasions in Vietnam. The training course was conducted as part of CRI's ongoing role as the WHO-designated regional centre for training in chemical safety.

This in-country training course was designed to provide participants with a background of the major groups of toxic substances encountered by man and animals through food and the environment, and also through exposure at the workplace. The course focused on the chemistry, fate and distribution in the environment, mechanisms of their action, toxic manifestation in living organisms, as well as toxic syndrome in human beings.

(Continued on page 2)

CRI Collaborates with the Vietnamese Institutes to Organize a Training Course on Environmental Toxicology in Ho Chi Minh City, Vietnam from December 2 - 5, 2019

(Continued from page 1)

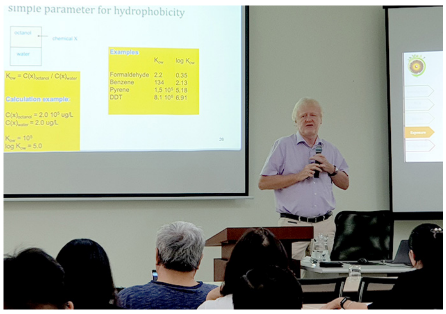
The course was attended by 53 participants from various health-related governmental agencies, as well as academic institutions, e.g. Department of Preventive Medicine; Department of Worker Health Protection; various centers for disease control; the Ho Chi Minh Institute of Public Health; the Ministry of Health, Nutrition and Indigenous Medicine; Hue College of Medicine and Pharmacy; Pasteur Institute in Ho Chi Minh City; Saigon University; and the University of Medicine and Pharmacy at Ho Chi Minh City.

Participants attended the lectures in 6 sessions: (1) Exposure to Chemical Hazards, (2) Pesticides, (3) Air Pollution, (4) Ecotoxicology, (5) Industrial Chemicals and Hazardous Waste, and (6) Toxicants in Food and Environmental Carcinogens.

The course also introduced a module on Hazard Assessment, as well as one on a case study of a chemical incident, through the Electronic Distance Learning Tool (eDLT) on Risk Assessment and Risk Management of Chemicals, which was developed by CRI in collaboration with WHO IPCS, the University of Ottawa (Canada), Utrecht University (the Netherlands), and the WHO Collaborating Center for Chemical Incidents (Cardiff, Wales).

The eDLT is an interactive, web-based, self-learning tool that is administered through a Learning Management System and hosted through a website at http://www.chemDLT.com, where interested persons can find more information about how to access and use it.

As part of the capacity building programme, CRI regularly conducts in-country training in developing countries in the Asia-Pacific region in the areas of chemical safety, environmental health, toxicology, and human health and environmental risk assessment in response to requests made from the respective country, either directly through an agency/institution with existing collaborations with CRI, or through an international organization such as the WHO, e.g. through the respective regional office at SEARO or WPRO.



For more information on CRI's capacity building programme, including a calendar of training events, please visit http://www.cri.or.th/en/envtox/default.htm.

Toxicity Trends in E-Waste: A Comparative Analysis of Metals in Discarded Mobile Phones

Electrical and electronic equipments tend to evolve very quickly. This is especially true in the case of mobile phones, which enjoy ever-wider distribution and ever-increasing demands. With a lifespan of typically less than 2-3 years, mobile phones have now become significant generators of e-waste worldwide.

Between 50-80% of the mass of a mobile phone consists of a printed circuit boards and a liquid crystal display screen.

The chemical composition of these circuit boards and display screens includes precious metals (e.g. silver and palladium), rare minerals (e.g. coltan) and so-called conflict minerals such as tin, tungsten and gold. They also contain a variety of potentially hazardous substances, including toxic metals such as arsenic, beryllium, cadmium, lead, antimony, nickel, and organic chemicals (e.g. halogenated flame retardants), which could potentially threaten human life and damage the environment if improperly managed.

The most important approaches to sustainably managing this kind of waste focused on dismantling, recycling, and covering material resources recovery. However, industrial-scale implementation is still a challenge because there is little economic incentive for processing such components.

The present study collected and analyzed the material composition of relevant discarded phones and smartphones manufactured between 2001 and 2015. After being manually dismantled, these devices, excluding batteries and cover case, were found to contain concentrations of 19 toxic chemicals among their component parts.

The trends in potential human health impacts and in the ecotoxicity of waste generated in the form of discarded mobile phones were investigated through quantitative life cycle impact assessment methods (using USEtox model) and regulatory total threshold limit concentrations.

USEtox is a life cycle initiative model based on scientific consensus among international researchers. It was developed under the guidance of the United Nations Environment Program (UNEP) and the Society for Environmental Toxicology and Chemistry (SETAC).

This model was used to characterize the potential impact on human toxicology and ecotoxicology of toxic chemicals in discarded products. The output of USEtox modeling include human toxicity criteria related to outcomes, such as the incidence of cancers and non-cancer diseases associated with toxic emission concentrations and multi-media exposure assessments, and ecotoxicity.

The results from the USEtox model show an increase in the relative mass of toxic materials over the 15-year period.

While no statistically significant change was found in the use of toxic components in basic phones, from 2006 to 2015 the content of toxic materials in smartphones increased notably.

Nickel was the most significant carcinogen in mobile phones, but the toxic presence of lead and beryllium was also disturbing. Silver, zinc and copper contents were associated with non-cancer health risks. Copper components dominate the ecotoxicity risks in mobile phones.

The results of this research reveal that adverse human health impacts and environmental contagions are potentially associated with discarded cell phones. It is also clear that the mass of toxic metals content has increased in the past decade, especially in smartphones as compared to basic phones, despite the pace of technological innovation in mobile phone design and manufacture.

As a result, workers and the general population who are directly exposed to the dismantled products, especially in the informal recycling sector in developing countries, are at high risk of various serious health impacts.

The current approaches to handling this particular wastes in a sustainable way includes metals recovery (especially precious metals) by dismantling and recycling. At present, however, there are very few options for minimizing the risks involved or for ensuring safe management of these toxic metals.

Thus, the findings of this research support the urgent call for national and international regulation of cellphone waste and the development of effective management strategies that prevent human exposure and environmental pollution.

Overall, these results highlight the increasing importance of monitoring trends in the use of materials for electronic product manufacturing and in electronic-waste management processes in order to prevent human and environmental exposure to toxic components.

According to various international reports, the possession of smartphones worldwide is going to increase in the coming years. This suggests a great potential increase in the number of older mobile phones being discarded on mass.

The trend of increasing demand for smartphones and the toxic metals embodied in such devices will pose a serious danger to the environment and to human health unless discarded units are properly collected and recycled.

These results should prompt the producers of smartphones and the relevant decision makers (such as designers, recyclers, and government agencies) around the world to reduce the use of toxic metals and to put forward effective prevention and control measures for products approaching their expiration date. Plans are needed for recovering precious metals, specifically in developing countries where collection and recycling rates are very low.

The approaching tide of obsolete mobile phones provides a huge potentials for secondary or urban harvesting of the significant amounts of precious metals (gold, silver, palladium, and platinum) and other valuable base metals (Cu, Al, Fe, Ni) contained in discarded units.

Finally, increases in the amount of toxic metals (lead, beryllium, arsenic, mercury) being used in smartphones manufacture should be of special concern if the environment and human health are to be effectively safe guarded.

Source: Journal of Hazardous Materials, Vol. 380, Article 120898, December 2019.

Thyroid Hormone Levels Associated with Exposure to Polybrominated Biphenyls and Polychlorinated Biphenyls

Increased exposures to endocrine-disrupting compounds (EDCs) have been associated with the development of cancer, reproductive problems, and hormone dysfunction.

In 1973, millions of Michigan residents were exposed to polybrominated biphenyl (PBB), a brominated flame retardant and an EDC, when a factory accident caused it to be added to the food supply.

In the aftermath, the people who were believed to have the highest direct exposure, people living on or obtaining food from quarantined farms and the Michigan Chemical Company's workers and their families, were recruited to investigate the long-term health effects of PBB exposure.

People exposed to PBB *in utero* or as children have been shown to have an increased risk of endocrine-related health conditions, and may experience unique problems compared to those exposed as adults.

PBBs and polychlorinated biphenyls (PCBs) may disrupt thyroid hormone signaling and lead to thyroid disease, given the structural similarities between these EDCs and thyroid hormones.

Thyroid disease can cause issues with metabolism and weight, fertility, and attentiveness, while subclinical thyroid function may lead to issues with fertility, fetal development, and increased risk of cardiovascular disease.

The present study extended previous work by examining the relationship between the age of exposure and thyroid function in a large group of individuals exposed to PBBs.

The associations between serum measures of thyroid function [total thyroxine (T_4), total triiodothyronine (T_3), free T_4, free T_3, thyroid stimulating hormone (TSH), and free T_3: free T_4 ratio] and serum PBB and PCB levels were tested in a cross-sectional analysis of 715 participants.

Because PBB exposure (unlike PCB exposure) in this cohort occurred within a single, unique time-point, the researchers could estimate the participants' age when exposed to PBB, and test whether their age at exposure to PBB and their current PBB levels are predictors of thyroid function.

Many of the health effects associated with PBBs and the factory fire were found in those who were exposed as children, aged 16 years or younger at the time of the incident. Their case studies allowed researchers to try to determine whether the association between PBB exposure and thyroid function differs for people who were exposed before or after the age of 16.

The results showed that higher PBB levels impacted many thyroid hormone measures, including higher free T_3, lower free T_4, and higher free T_3: free T_4 ratios. Higher PCB levels were associated with higher free T_4, and higher free T_3: free T_4 ratios.

Among the people who were under the age of 16, greater PBB exposure was associated with higher thyroid T_3 and free T_3, lower free T_4 and higher free T_3: free T_4 ratios. However, no significant associations were found among those tested who were older than 16 at the time of the factory fire.

This study did find that higher, current PBB and PCB levels were associated with thyroid hormone levels. It corroborated previous studies that found increased risk of thyroid disease in women exposed to PBBs and PCBs.

Because the cohort of people in the Michigan study was exposed during a narrow time frame, their case studies helped researchers pinpoint the association between higher PBB and thyroid hormone measures in people who were exposed to PBBs before puberty.

The finding suggests, however, that they may still be at risk for metabolic and endocrine-related conditions, even 40 years after they were first exposed, and that people who are exposed at a young age may be more vulnerable to the endocrine-disrupting effects of PBBs.

Source: Environmental Health, Vol. 18, Article 75, December 2019.

Toxicity Assessment Due to Prenatal and Lactational Exposure to Lead, Cadmium and Mercury Mixtures

Lead (Pb), cadmium (Cd), and mercury (Hg) are heavy metals that can cause strong biological effects. Since they degrade very slowly and persist in the environment, long-term, low-level exposure is an on-going concern.

Although their toxicity has been widely studied, these elements do not exist alone in the environment. They are detected in the air, water, dust and soil, entering the human body and impacting human health through a variety of pathways.

In some cases, these heavy metals have been detected simultaneously in blood, serum, and urine samples from the general human population. However, information regarding the toxicity of low-level exposure to Pb, Cd, and Hg mixtures is still limited.

Current studies regarding these heavy metal mixtures are inconclusive. The combined effects of any two or all three of these metals has rarely been investigated. Therefore, there is a need to clarify the health impacts of low-level combined exposure.

Previous research focused on the interaction of these three elements at low concentrations *in vitro.* Combined Pb + Cd + Hg co-exposure induced a synergistic toxic effect that was more serious than contamination by any of them individually or even with combinations of two metals, when they were below no observed adverse effect levels. However, the health impacts of Pb + Cd + Hg co-exposure *in vivo* were unclear and need to be further studied.

The present study evaluates early effects of low dose exposure to Pb, Cd, and Hg mixtures on the brain, heart, liver, kidney, and testicle in rats.

(Continued on page 5)

Bisphenol A and Bisphenol S Exposures During Pregnancy and Gestational Age: A Longitudinal Study in China

Bisphenol A (BPA) and its substitute bisphenol S (BPS) are endocrine-disrupting chemicals metabolized rapidly in the human body.

The toxic effects of BPA, especially on susceptible pregnant women and vulnerable fetuses have been increasingly investigated and recognized, resulting in it being banned in the USA, Canada, and many European countries.

BPA exposure in late pregnancy has been associated with preterm birth, but the association of trimester BPA and BPS exposures with gestational age have rarely been studied.

BPS, a major alternative chemical of BPA, has been extensively used in the manufacture of consumer products. However, current knowledge on the health impact of BPS is limited.

A previous study found weak positive associations between BPS exposure at delivery and pregnancy duration. BPS has a relatively short half-life (< 7 hours) and is rapidly metabolized in humans. Repeated measurements of BPS levels across pregnancy are needed to explore the effects of BPS exposure as pregnancy progresses.

A prenatal cohort study was conducted in Wuhan, China to measure longitudinally maternal urinary BPA and BPS concentrations in the 1st, 2nd, and 3rd trimester during pregnancy in order to better understand their association with gestational age and preterm birth.

The results showed that maternal exposure to BPA during pregnancy was associated with decreased gestation and increased risk of preterm birth. By contrast, BPS exposure was related neither to pregnancy duration nor to preterm birth.

The levels of BPA and BPS in urine varied during different trimesters throughout pregnancy. This may be attributed to the rapid metabolism of BPA and BPS.

This study first reported the variation of BPS across pregnancy, but the results showed that BPA exposure levels were much higher.

Due to its greater resistance to heat and sunlight, BPS used to be regarded as a "safe" alternative to BPA. However, since BPS is structurally similar to BPA and also has endocrine disrupting properties, the potential effects of gestational exposure to BPS on fetal growth remains a concern.

Research focusing on the toxicity of BPA has provided some mechanistic evidence which may well explain the detrimental connection between prenatal BPA exposure and preterm birth.

One potential mechanism is the role of BPA on placental function and fetal development. Some studies have already shown that exposure to environmental concentrations of BPA may not only increase placental cell apoptosis but also may disrupt normal placental development, resulting in adverse pregnancy outcomes, such as prematurity.

In this study, the analyses demonstrated a negatively significant association of BPA with pregnancy duration throughout pregnancy. However, a positive tendency of association was found between BPS and gestational length during late pregnancy.

The different exposure levels of BPA and BPS during pregnancy may also contribute to the discrepancies in results related to gestational age and preterm birth.

There is increasing evidence regarding the reproductive and developmental toxicity of BPS due to its extensive utilization in recent years. More attention should be paid to the potential adverse health effects of BPS exposure.

Source: Chemosphere, Vol. 237, Article 124426, December 2019.

Toxicity Assessment Due to Prenatal and Lactational Exposure to Lead, Cadmium and Mercury Mixtures

(Continued from page 4)

Pregnant rats were exposed to various concentrations of heavy metal mixtures (MM) in drinking water and during gestation and lactation. The impacts on offspring were measured at postnatal day 23.

The results revealed that Pb, Cd, and Hg co-exposure in rats induced damage to multiple organs, including brain, liver, kidney, and testicle. Impairments were observed in a dose-response manner, using concentrations based on human environmental exposure levels.

In the brain, significant increases were detected in oxidative stress, intracellular free calcium, and cell apoptosis. Further neurobehavioral testing revealed that MM exposure caused dose-dependent impairments in learning and memory as well as sensory perception.

MM exposure also disrupted synapse remodeling, which may be associated with pathways involved in dendritic spine growth, maintenance, and elimination.

This is the first report that evaluates the potential early effects of exposure to Pb, Cd, and Hg mixtures in rats that are relevant to human environmental exposure levels, especially for neurobehavioral impairments and related mechanisms.

These findings provide a basis for further study on toxic mechanisms of heavy metal pollutants to improve health risk assessments. They also support the need for research regarding low-level exposure to toxic metals to improve public health and safety.

Due to uncertainty in the extrapolation of data from animals to humans, these findings need to be confirmed in further population-based studies.

Source: Environment International, Vol. 133, Article 105192, December 2019.

Ambient Air Pollution is Associated with Pediatric Pneumonia: Study in an Urban Area

Pneumonia, an inflammatory lung condition, is the leading cause of death in children, accounting for approximately 1.3 million deaths among children aged < 5 years in 2010-2011.

Many epidemiological studies have reported that short-term variations in ambient air pollution are related to poor health outcomes, such as respiratory diseases, cardiovascular diseases, and mortality. Particulate matter (PM), nitrogen dioxide (NO_2), and ozone (O_3) are reportedly related to hospital admissions for pneumonia.

The health effects of air pollutants seemed to have regional and seasonal variations. The regional heterogeneity between the estimated effect of PM on hospitalization and mortality has been reported in several previous multi-city studies.

These seasonal and regional variations might be explained by certain community characteristics, for instance, air conditioning, population density, the proportion of elderly residents, and effect modification by ambient temperature.

To date, only a few studies have examined the association of air pollution with emergency department (ED) visits for pediatric pneumonia, with inconsistent results.

The present study collected data of pediatric patients, over a 7-year period in South Taiwan, who presented at the ED from a tertiary academic medical center due to pneumonia. Using a case-crossover design, the data were analyzed with respect to weather and air pollution parameters.

The study aimed to evaluate correlation between increase in short-term exposure to air pollutants and events of pediatric pneumonia and to evaluate the potential triggering effects of $PM_{2.5}$, especially in individuals with pre-existing disease.

The results found that $PM_{2.5}$ and NO_2 possibly play important roles in pediatric pneumonia events in Kaohsiung, Taiwan.

Of all pollutant exposures included in the analysis, the odds of pediatric pneumonia following $PM_{2.5}$ exposure was greater in older children (aged ≥4 years) and children were more susceptible to NO_2 during warm days (≥26.5 °C).

This study was conducted in an industrial city having a tropical monsoon climate; the mixture of air pollutants and seasonal effects may be different in other regions. Factors such as personal protective equipment use and time spent outdoors may affect personal exposure. Moreover, individual susceptibility might vary due to ethnic differences.

Thus, further studies should be conducted in more regions with larger samples and include seasonal constituent analysis.

Source: Environmental Health, Vol. 18, Article 77, December 2019.

Long-term Effects of Chromium on Morphological and Immunological Parameters of Wistar Rats

Hexavalent chromium [Cr (VI)] raises high concern because of its wide industrial application and reported toxicity. Cr (VI) when orally introduced into an organism, , is reduced to Cr (III), giving rise to the free radicals which are mainly implicated in Cr (VI) induced toxicity.

Characterized as carcinogenic to humans (Group I) by the International Agency for Research on Cancer (IARC, 2012), Cr (VI) has been restricted for use in commercial products in the European Union under Regulation (EC) 1907/2006.

The normal oxidation state of chromium in biological tissues is Cr (III). In this form, it is an essential mineral believed to be a component of the glucose tolerance factor and to play a role in the carbohydrate metabolism involved in cardiovascular risk and the metabolic syndrome. The toxicity of hexavalent chromium is closely associated with its oxidation state. When administered orally, hexavalent compounds are about 10-100 times more toxic than the trivalent ones. .

The effects of Cr (VI) on the immune system involve morphological and functional damage to organs such as the thymus, spleen lymph nodes, and bone marrow. Immunologically active tissues can serve as toxicity biomarkers when there are early reactions of the immune system following exposure to organic or inorganic chemicals.

The most commonly investigated morphological endpoint of the immune system is the determination of morpho-functional alterations in lymphoid tissue after long-term exposure to different toxicants of organic and inorganic origin.

The present study aimed to perform a comprehensive *in vivo* assessment of the chronic effects of Cr (VI) on morphological, immunological and oxidative stress parameters in Wistar rats' spleen and lymph nodes.

Long-term (135 days) oral exposure of Wistar rats to chromium in the form of $K_2Cr_2O_7$ (exposed group ~ 20 mg/kg/day) led to a decrease in thymus mass and in the number of thymocytes. There were also structural and functional changes in particular, lymphoreticular hyperplasia and plasmocytic macrophage transformation, in the lymph nodes and spleen.

Reductions in thymus weight and is the thymocyte population observed throughout the experiment following exposure to Cr (VI) could be attributed to

(Continued on page 7)

Health at a Glance 2019

Health at a Glance compares key indicators for population health and health system performance across OECD members, candidates and partner countries.

The book highlights how countries differ in terms of the health status and health-seeking behaviour of their citizens; access to and quality of health care; and the resources available for health.

Analysis is based on the latest comparable data across 80 indicators, with data coming from official national statistics, unless otherwise stated.

In addition to indicator-by-indicator analysis, an overview chapter summarises the comparative performance of countries and major trends, including how health spending is associated with staffing, access, quality and health outcomes.

This edition also includes a special focus on patient-reported outcomes and experiences, with a thematic chapter on measuring what matters most in people-centred health systems.

- Gains in longevity are stalling; chronic diseases and mental illness affect more and more people.
- Excessive smoking and drinking as well as obesity continue to undermine quality of life and contribute to premature deaths.
- Barriers to access persist, among the poor and, increasingly among the middle classes as well.
- Quality of care is improving in terms of safety and effectiveness, but more attention should be given to patient reported outcomes and experiences
- Countries spend a lot on health, but they do not always allocate as effectively as they could

The Organisation for Economic Co-Operation and Development (OECD) is a unique forum where governments work together to address the economic, social and environmental challenges of globalisation. The OECD is also at the forefront of efforts to understand and to help governments respond to new developments and concerns, such as corporate governance, the information economy and the challenges of ageing population. The Organisation provides a setting where governments can compare policy experiences, seek answers to common problems, identify good practice and work to coordinate domestic and international policies.

The OECD member countries are: Australia, Austria, Belgium, Canada, Chile, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Latvia, Lithuania, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. The European Union takes part in the work of the OECD.

Source: OECD Publishing, Paris. Health at a Glance 2019: OECD Indicators, https://doi.org/10.1787/4dd50c09-en. November 2019.

Long-term Effects of Chromium on Morphological and Immunological Parameters of Wistar Rats

(Continued from page 6)

the redistribution of thymocytes due to lymphocyte pool replenishment in peripheral blood and peripheral lymphoid organs.

Programmed cell death increased in both thymocytes and splenocytes and decreased in lymphocytes in the T-zones of spleen and lymph nodes. Moreover, Cr (VI) administration decreased the number of myeloid cells and neutrophils while the number of lymphoid and erythroid cells in bone marrow increased.

Cr (VI) immune system effects seem to be related to oxidative stress induction. This is depicted by the increased levels of diene conjugates and malondialdehyde in the spleen and liver and by the decreased activity of catalase and superoxide dismutase in the rats' erythrocytes.

In addition, exposure to Cr (VI) decreased copper, nickel and iron concentrations in blood and liver, while Cr levels in blood, spleen and liver increased, as expected.

Collectively, Cr (VI) exposure leads to the activation of free radical oxidation processes and to an imbalance in micronutrients, which could contribute to the development of the changes in immunological and biochemical factors that were observed.

Chromium capacity to activate free radical oxidation processes is an essential factor in Cr-induced cytotoxicity. Cells in the organs of immunogenesis are depleted and immunological suppression develops.

Changes observed in the series of immunological parameters studied provide essential new knowledge which can support the development of new approaches for the prevention of adverse effects due to Cr exposure.

Source: Food and Chemical Toxicology, Vol. 133, Article 110748, November 2019.

CALENDAR OF EVENTS

International Training Courses at Chulabhorn Research Institute Schedule for 2020

	Training Course	Date	Duration	Closing Date
1	Environmental Toxicology	April - May 2020	1 week	January 31, 2020
2	Environmental and Health Risk Assessment and Management of Toxic Chemicals	November - December 2020	2 weeks	To be announced

Course Coordinator: *Khunying* Mathuros Ruchirawat, Ph.D.

Course Description:

1. Environmental Toxicology (April - May 2020)

The course provides students and participants with a background of the major groups of toxic substances encountered by man and animals through food and the environment, and also through exposure at the workplace. These toxicants include mycotoxins, naturally occurring plant and animal toxins, toxic substances in air, water and soil, N-nitroso compounds, solvents, plastics, pesticides and pollutants. The course focuses on the chemistry, fate and distribution in the environment, mechanisms of their action, toxic manifestation in living organisms, as well as toxic syndrome in human beings.

Requirement: Participants should have some basic knowledge of chemistry and the biological/biomedical sciences.

2. Environmental and Health Risk Assessment and Management of Toxic Chemicals (November 2020)

The course is an integration of science and policy, covering the fundamental basis of environmental and health risk assessment and management, from identification of hazard, assessment methods, the mode of action and human relevance framework, the inherent uncertainties in each step, the relationship between risk assessment and risk management, and the need for open, transparent and participatory acceptance procedures and credible communication methods. Emphasis is placed on human health risk assessment, although the principles of ecological risk assessment will also be covered. The course teaches the practical application of risk assessment methods to various problems, e.g. hazardous waste site release, through the use of case studies relevant to problems faced in developing countries, and describes the policy context in which decisions to manage environmental health risks are made. Teaching and learning aids such as electronic distance learning tools and IPCS risk assessment toolkit will be introduced.

Requirement: Participants should have jobs/responsibilities related to assessment of risk from the use of chemicals.

Fellowships: A limited number of fellowships are available that will cover roundtrip airfare, accommodation (on site) and meals, training materials, and health insurance.

Contact: Chulabhorn Research Institute (CRI)
54 Kamphaeng Phet 6 Rd.,
Lak Si, Bangkok 10210, Thailand
Tel: +66 2 553 8535
Fax: +66 2 553 8536
E-mail: envtox@cri.or.th

More information and application:
Please visit - http://www.cri.or.th/en/ac_actcalendar.php

The ICEIT NEWSLETTER is published quarterly by the International Centre for Environmental and Industrial Toxicology of the Chulabhorn Research Institute. It is intended to be a source of information to create awareness of the problems caused by chemicals. However, the contents and views expressed in this newsletter do not necessarily represent the policies of ICEIT.

Correspondence should be addressed to:

ICEIT NEWSLETTER
Chulabhorn Research Institute
Office of Academic Affairs
54 Kamphaeng Phet 6 Road
Lak Si, Bangkok 10210, Thailand
Tel: +66 2 553 8535
Fax: +66 2 553 8536
CRI Homepage: <http://www.cri.or.th>

For back issues of our newsletter, please visit:

http://www.cri.or.th/en/envtox/et_newsletter.htm