

Annual Report



2005 - 2006

Center for Integrative Toxicology

MICHIGAN STATE  
UNIVERSITY

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**THE MICHIGAN STATE UNIVERSITY  
CENTER FOR INTEGRATIVE TOXICOLOGY**

**2005-2006 ANNUAL REPORT**

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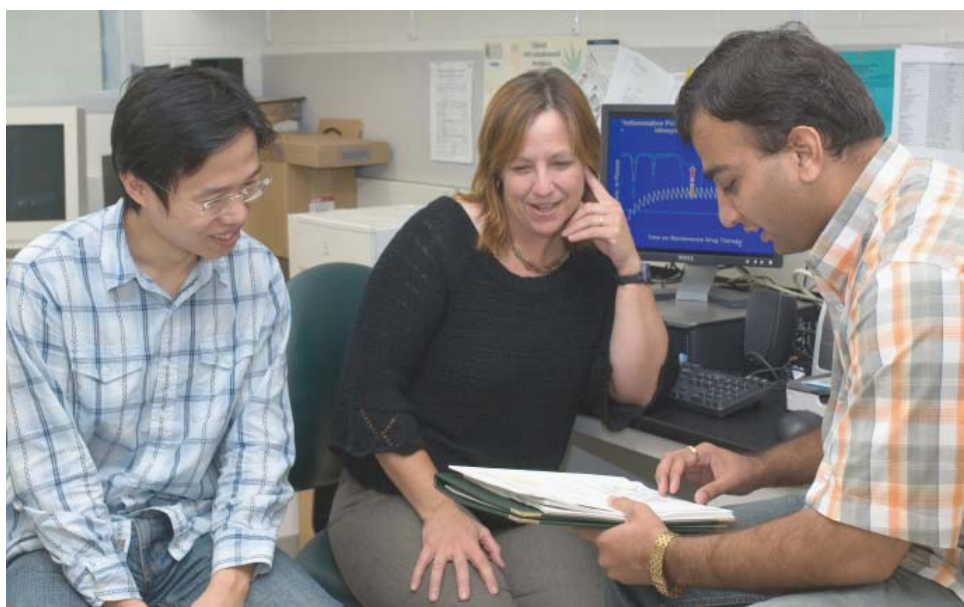
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## DIRECTOR'S MESSAGE

“The strength of the toxicology program is reflected in part by the successes of our Center, but more importantly by the accomplishments of the faculty and students affiliated with the CIT.”

Toxicology continues to thrive at Michigan State University. This has been an exciting, as well as highly productive year for the Center for Integrative Toxicology as evidenced by a long list of accomplishments by its trainees and affiliated faculty, including recognition through awards, research funding and University support.

In May, the CIT faculty successfully competed for a \$16 million award for an additional five years of funding

from the National Institute of Environmental Health Sciences to conduct toxicology research as part of an ongoing program through the Superfund Basic Research Program. The MSU Superfund Program is now in its fifth competitive renewal and 17th year of continuous funding, bringing the total amount of funding to \$52 million. The continuation of this program is a clear recognition of MSU's strength in the area of environmental toxicology and remediation engineering (see page 18).

The Center's faculty continue to be highly active in the Society of Toxicology. MSU has been repeatedly recognized for toxicology leadership by the SOT. The CIT has the unique distinction of having four current or former affiliated faculty members, plus two former students who have served as President of the Society of Toxicology (see picture on page 5), most recently Dr. Kendall Wallace SOT President 2005-2006 and MSU Ph.D. graduate 1979.

The CIT hosted a well-attended MSU Alumni Reception at the 2006 SOT Annual Meeting, providing an opportunity for current and former faculty and trainees to meet and network. MSU toxicologists were highly visible throughout the meeting with over 50 abstracts presented and eight awards received by MSU faculty and students (see page 4).

A chronic respiratory disease research initiative was also undertaken

this year. CIT affiliated faculty along with other MSU colleagues are spearheading new collaborative research focussed on the role of environmental factors in chronic respiratory disease. The group received one of ten intramural grants from MSU's Fund for the Enhancement of Academic Quality to expand collaborations in this important research area.

The CIT also undertook a curriculum review for the biomedically focused toxicology track of the Environmental and Integrative Toxicological Sciences (EITS) graduate training program. Revisions to the curriculum have been made to prepare trainees better for careers in toxicological sciences in the twenty first century. The EITS graduate program currently has 40 trainees and has graduated over 150 Ph.D. students to date.

The CIT was active in bringing toxicology scholars and professionals to campus for seminars. Six seminars were sponsored or co-sponsored during the year (see page 3). This is just one of the ways in which the CIT maximizes the impact of resources while partnering with other units on campus. Likewise, the CIT has been assisting affiliated departments by providing funding for first year graduate students interested in toxicological sciences. By doing so, we believe that we can enhance the recruitment and quality of trainees in the biomedical sciences campuswide.

The strength of the toxicology program is reflected most importantly by the accomplishments of the faculty and students affiliated with the CIT. The faculty had an extremely productive year with over 150 articles published in peer-reviewed journals (see pages 5-14). In addition, over 23 million dollars in contracts and grants were secured in the 2005-2006 academic year (see pages 15-18).

In short, toxicology continues to be a nationally and internationally recognized strength at MSU, and the CIT continues to provide a focal point for those efforts.

*Norb Kaminski*  
CIT Director



# HIGHLIGHTS

## Toxicology Seminars Sponsored

From new toxicological approaches being utilized in drug discovery to the use of toxicology in the safety assessment of genetically modified crops, the Center for Integrative Toxicology's seminar speakers highlighted the changing role of toxicology.

- Dorr G. Dearborn, Ph.D., M.D., Director, Mary Ann Swetland Center for Environmental Health, presented "Black Mold *Stachybotrys* and Pulmonary Hemorrhage: Infants, Rat Pups and Biomarkers"; co-sponsored with the MSU Respiratory Research Initiative and the Department of Pathobiology and Diagnostic Investigation.
- Dale Morris, Senior Director, Worldwide Safety Sciences at Pfizer, Inc., spoke about the types of toxicities and mechanistic approaches to enhance the safety profile of drug candidates.
- Donald Robertson, Ph.D., Pfizer Global R & D, presented "Metabonomics: State of the Science"; co-sponsored with the Department of Pharmacology and Toxicology.
- Richard Calabrese, Ph.D., University of Massachusetts, presented "The Case for Hormesis as the Most Fundamental Dose Response Relations"; also co-sponsored with Pharm./Tox.
- Brian Delaney, Ph.D., DABT, Senior Research Scientist, Pioneer Hi-Bred International, Inc., gave an overview of the toxicological safety assessment of genetically modified crops; co-sponsored with the National Center for Food Safety and Toxicology.
- David Jacobson-Kram, Ph.D., Associate Director, Pharmacology and Toxicology, Office of New Drugs, Center for Drug Evaluation and Research, U.S. Food and Drug Administration, spoke about safety and toxicology studies in drug development.



## Annual Research Evening

MSU-CIT hosted the annual research evening for faculty, current and prospective students for the Environmental and Integrative Toxicological Sciences training program. Over 40 attended. Three trainees presented their research.

- Darrell Boverhof, then a postdoctoral trainee working with Timothy Zacharewski, Biochemistry and Molecular Biology, presented "Comparative Toxicogenomic Analysis of the Hepatotoxic Effects of TCDD in Sprague Dawley Rats and C57BL/6 Mice". Boverhof is now employed at Dow Chemical Company.
- Rita Seston, a doctoral trainee with John Giesy, Zoology, presented "Assessment of PCDFs and PCDDs in the Tittabawassee River basin."
- Gautham Rao, then a predoctoral trainee with CIT Director Norb Kaminski, presented "Elevation of Calcium by Delta-9-THC in T cells". Rao completed his doctorate and is currently pursuing postdoctoral training in immunology at Yale University.

## Toxicology Taught in Thailand

CIT Director, Norb Kaminski, taught in a two-week advanced graduate level short course entitled "Environmental Immunotoxicology and Reproductive Toxicology: A Deeper Look into the Science of Toxicology" at the Chulabhorn Research Institute, Bangkok, Thailand. In addition to graduate trainees from the Chulabhorn Research Institute, trainees from neighboring Asian Institute of Technology and Mahidol University in Bangkok were enrolled.

## Society of Toxicology Awards

**M**SU researchers in the Center for Integrative Toxicology received a number of prestigious honors at the 45th Annual Meeting of the Society of Toxicology held March 5-9, 2006 in San Diego, California.

In recognition of unique research to predict idiosyncratic reactions to pharmaceutical drugs, Robert Roth, a professor of pharmacology and toxicology, was the SOT 2006 recipient of the AstraZeneca Traveling Lectureship Award. As a result, Roth delivered presentations and met with colleagues and collaborators at pharmaceutical companies and universities in the United Kingdom, Germany, and Austria. Xiaomin Deng, a MSU-CIT postdoctoral trainee with Roth, received the Merck Travel Award from the SOT Toxicologic and Experimental Pathology Specialty Section. Theresa Eagle, an undergraduate biochemistry major working with Roth and Patricia Ganey, professor of pharmacology and toxicology, received a Pfizer Undergraduate Travel award.

Zahidul Islam, a research assistant professor in the lab of James Pestka, professor of food science and human nutrition, received the Best Abstract Award for 2006 from the Occupational and Public Health Specialty Section. Heekyong Bae, Eleni Beli, and Yuhui Shi, all food science graduate students enrolled in the EITS program and working with Pestka, were selected to receive travel awards to present their research at the meeting.

Darrell Boverhof, former graduate student and postdoctoral trainee in professor Tim Zacharewski's lab and now employed at Dow Chemical Company, received a first place research award from the Molecular Biology Specialty Section.

Jennifer Phillips, a second year biochemistry and molecular biology graduate student enrolled in the EITS program and working with Jay Goodman, professor of pharmacology and toxicology, received a second place award from the Carcinogenesis Specialty Section.

## Society of Toxicology Leadership

**T**he CIT has the unique distinction of having four current or former affiliated faculty members plus two students who have been President of the Society of Toxicology. Five of these individuals are pictured here at the MSU reception sponsored by the CIT during the SOT 2006 Annual Meeting held in March. They are, along with the dates of their Presidency and CIT-affiliation, from left to right: Jay Goodman, 1999-2000, CIT-affiliated faculty member; Ken Wallace, current President, 2005-2006, former doctoral trainee with Jerry Hook; Jerry Hook, 1987-1988, founding director of the MSU Center for Environmental Toxicology (now the CIT); Jim Gibson, 1988-1989, former faculty member; and Jim Bus, 1996-1997, completed Ph.D. with Jim Gibson. Regretfully, Perry Gehring, 1980-1981, former faculty member, is deceased.



## PUBLICATIONS

The CIT faculty published over 150 articles in over 80 peer-reviewed journals. These publications not only report on research that was conducted on the MSU campus, but also on collaborative research being conducted by MSU faculty and trainees worldwide.

The following list details those publications included in PubMed, the on-line service of the U.S. National Library of Medicine. To access abstracts, and in many cases full text, of these articles go to <http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?DB=pubmed>.

### American Journal of Industrial Medicine

- Asthma Death After Spraying Polyurethane Truck Bedliner. Chester DA, Hanna EA, Pickelman BG, Rosenman KD. *Am J Ind Med.* 2005 Jul;48(1):78-84.
- Hypersensitivity Pneumonitis Due to Metal Working Fluids: Sporadic or Under Reported? Gupta A, Rosenman KD. *Am J Ind Med.* 2006 Jun;49(6):423-33.
- Ulcerative Colitis Reactivation After Mercury Vapor Inhalation. Cummings CE, Rosenman KD. *Am J Ind Med.* 2006 Jun;49(6):499-502.

### American Journal of Veterinary Research

- Use of Simulation Modeling to Estimate Herd-Level Sensitivity, Specificity, and Predictive Values of Diagnostic Tests for Detection of Tuberculosis in Cattle. Norby B, Bartlett PC, Grooms DL, Kaneene JB, Bruning-Fann CS. *Am J Vet Res.* 2005 Jul;66(7):1285-91.

- Evaluation of historical Factors Influencing the Occurrence and Distribution of Mycobacterium Bovis Infection Among Wildlife in Michigan. Miller R, Kaneene JB. *Am J Vet Res.* 2006 Apr;67(4):604-15.

### Animal Genetics

- The B-cell CLL lymphoma 2 (BCL2) Gene Maps to Equine Chromosome 8q22. Klukowska-Rotzler J, Bugno M, Slota E, Robinson NE, Piumi F, Guerin G, Dolf G, Gerber V. *Anim Genet.* 2005 Dec;36(6):517-9.

### Animal Reproduction Science

- Effects of Extender, Incubation Temperature, and Added Seminal Plasma on Capacitation of Cryopreserved, Thawed Boar Sperm as Determined by Chlorotetracycline Staining. Vadin ML, Kirkwood RN, Specher DJ, Chou K. *Anim. Reprod. Sci.* 2005 Dec;90(3-4):347-54.

### Analytical Biochemistry

- Study of Primary Amines for Nucleophilic Cleavage of Cyanylated Cystinyl Proteins In Disulfide Mass Mapping Methodology. Gallegos-Perez JL, Rangel-Ordonez L, Bowman SR, Ngowe CO, Watson JT. *Anal Biochem.* 2005 Nov 15;346(2):311-9.

### Analytical Chemistry

- Chlorinated Phenol Analysis Using Off-Line Solid-Phase Extraction and Capillary Electrophoresis Coupled with Amperometric Detection and a Boron-Doped Diamond Microelectrode. Muna GW, Quaiseroba-Mocko V, Swain GM. *Anal Chem.* 2005 Oct 15;77(20):6542-8.
- Detection of Phosphopeptides Using Fe(III)-Nitrilotriacetate Complexes Immobilized on a MALDI Plate. Dunn JD, Watson JT, Bruening ML. *Anal Chem.* 2006 Mar 1;78(5):1574-80.

### Applied and Environmental Microbiology

- Genetic and Genomic Insights into the Role of Benzoate-Catabolic Pathway Redundancy in Burkholderia xenovorans LB400. Deneff VJ, Klappenbach JA, Patrauchan MA, Florizone C, Rodrigues JL, Tsoi, TV, Verstraete W, Eltis LD, Tiedje JM. *Applied and Environmental Microbiology*, January 2006, p. 585-595, Vol. 72, No. 1.





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Degradation of Aroclor 1242 Dechlorination Products in Sediments by *Burkholderia xenovorans* LB400(ohb) and *Rhodococcus* sp. Strain RHA1(fcb). Rodrigues JL, Kachel CA, Aiello MR, Quensen JF, Maltseva OV, Tsoi TV, Tiedje JM. *Appl Environ Microbiol*. 2006 Apr;72(4):2476-82.

### Aquatic Toxicology

Atrazine Concentrations, Gonadal Gross Morphology and Histology in Ranid Frogs Collected in Michigan Agricultural Areas. Murphy MB, Hecker M, Coady KK, Tompsett AR, Jones PD, Du Preez LH, Everson GJ, Solomon KR, Carr JA, Smith EE, Kendall RJ, Van Der Kraak G, Giesy JP. *Aquat Toxicol*. 2006 Mar 10;76(3-4):230-45.

Plasma Steroid Hormone Concentrations, Aromatase Activities and GSI in Ranid Frogs Collected From Agricultural And Non-Agricultural Sites In Michigan (USA). Murphy MB, Hecker M, Coady KK, Tompsett AR, Higley EB, Jones PD, Du Preez LH, Solomon KR Carr JA, Smith EE, Kendall RJ, Vn Der Kraak G, Giesy JP. *Aquat Toxicol*. 2006 May 1;77(2):153-66.

### Archives of Environmental Contamination and Toxicology

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Pharmacokinetics and Acute Lethality of Perfluorooctanesulfonate (PFOS) to Juvenile Mallard and Northern Bobwhite. Newsted JL, Beach SA, Gallagher SP, Giesy JP; *Arch Environ Contam Toxicol*. 2006 Apr;50(3):411-20.

Assessment of Effects in Mink Caused by Consumption of Carp Collected from the Saginaw River, Michigan, USA. Bursian SJ, Beckett KJ, Yamimi B, Martin PA, Kannan K, Shields KL, Mohr FC. *Arch Environ Contam Toxicol*. 2006 May;50(4):614-23.

### Astrobiology

Bacterial Community in Ancient Siberian Permafrost as Characterized by Culture and Culture-Independent Methods. Vishnivetskaya TA, Petrova MA, Urbance J, Ponder M, Moyer CL, Gillchinsky DA, Tiedje JM. *Astrobiology*. 2006 Jun;6(3):400-14.

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Activation of the Aryl Hydrocarbon Receptor by Berberine in Hepg2 and H4IIE Cells: Biphasic Effect on CYP1A1. Vrzal R, Zdarilova A, Ulrichova J, Blaha L, Giesy JP, Dvorak Z. *Biochem Pharmacol*. 2005 Sep 15;70(6):925-36.

### BioMed Central Clinical Pathology

Protection of Early Phase Hepatic Ischemia-Reperfusion Injury by Cholinergic Agonists. Crockett ET, Galligan JJ, Uhal BD, Harkema J, Roth R, Pandya K. *BMC Clin Pathol*. 2006 Feb 15;6(1):3.

### BioMed Central Genomics

In vivo - In Vitro Toxicogenomic Comparison of TCDD-Elicited Gene Expression in Hepa1c1c7 Mouse Hepatoma Cells and C57BL/6 Hepatic Tissue. Dere E, Boverhof DR, Burgoon LD, Zacharewski TR. *BMC Genomics*. 2006 Apr 12;7(1):80.

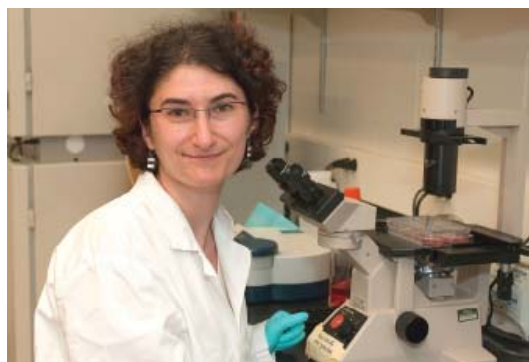
### Biomedicine & Pharmacotherapy

The Role of Stem Cells and Gap Junctions as Targets for Cancer Chemoprevention and Chemotherapy. Trosko JE. *Biomed Pharmacother*. 2005 Oct;59 Suppl 2:S326-31. Review.

### Birth Defects Research. Part B, Developmental and Reproductive Toxicology

NTP-CERHR Expert Panel Report on the Reproductive and Developmental Toxicity of Acrylamide. Manson J, Brabec MJ, Buelke-Sam J, Carlson GP, Chapin RE, Favor JB, Fischer LJ, Hattis D, Lees PS, Perreault-Darney S, Rutledge J, Smith TJ, Tice RR, Working P. *Birth Defects Res B Dev Reprod Toxicol*. 2005 Feb;74(1):17-113.

Erratum: NTP-CERHR Expert Panel Report on the Reproductive and Developmental Toxicity of Styrene. *Birth Defects Research (Part B)* 77:110-193, 2006. Luderer U, Collins TF, Daston GP, Fischer LJ, Gray RH, Mirer FE, Olshan AF, Setzer RW, Treinen KA, Vermeulen R. *Birth Defects Res B Dev Reprod Toxicol*. 2006 Jun;77(3):250.



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### Cancer Immunology, Immunotherapy : CII

Interferon-Gamma Renders Tumors that Express Low Levels of Her-2/Neu Sensitive to Cytotoxic T Cells. Kaplan BL, Norell H, Callender GG, Ohlum T, Kiessling R, Nishimura MI. *Cancer Immunol. Immunother.* 2006 Jun;55(6):653-62.

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Trapping of Arsenite by Mercaptopropyl-Functionalized Mesoporous Silica with a Wormhole Framework. McKimmy E, Dulebohn J, Shah J, Pinnavaia TJ. *Chem Commun (Camb).* 2005 Aug 7;(29):3697-9.

### Chemosphere

Receptor-Mediated In Vitro Bioassay For Characterization of Ah-R-Active Compounds and Activities in Sediment From Korea. Yoo H, Khim JS, Giesey JP. *Chemosphere.* 2006 Mar;62(8):1261-71.

Effects of PCBs and MeSO(2)-PCBs on Adrenocortical Steroidogenesis in H295R Human Adrenocortical Carcinoma Cells. Xu Y, Yu RM, Zhang X, Murphy MB, Giesey JP, Lam MH, Lam PK, Wu RS, Yu H. *Chemosphere.* 2006 May;63(5):772-84.

AhR-active Compounds in Sediments of the Haihe and Dagu Rivers, China. Song M, Jiang Q, Xu H, Liu H, Lam PK, O'toole DK, Zhang Q, Giesey JP. *Chemosphere.* 2006 May;63(7):1222-30.

### Clinics in Perinatology

The Descriptive Epidemiology of Cerebral Palsy. Paneth N, Hong T, Korzeniewski S. *Clin Perinatol.* 2006 Jun;33(2):251-267.

Comparative Biochemistry and Physiology. Part B, Biochemistry & Molecular Biology

Development and Optimization of a Q-RT PCR Method to Quantify CYP19 mRNA Expression in Testis of Male Adult *Xenopus Laevis*: Comparisons with Aromatase Enzyme Activity. Park JW, Hecker M, Murphy MB, Jones PD, Solomon KR, Van Der Kraak G, Carr JA, Smith EE, du Preez L, Kendall RJ, Giesey JP. *Comp Biochem Physiol B Biochem Mol Biol.* 2006 May;144(1):18-28.

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Adult stem cell theory of the multi-stage, multi-mechanism theory of carcinogenesis: role of inflammation on the promotion of initiated stem cells. Trosko JE, Tai MH. *Contrib Microbiol.* 2006;13:45-65.

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### Current Pharmaceutical Design

Hematopoietic Colony Stimulating Factors in Cardiovascular and Pulmonary Remodeling: Promoters or Inhibitors? Parrissis J, Filippatos G, Adamopoulos S, Li X, Kremastinos DT, Uhal BD. *Curr Pharm Des.* 2006;12(21):2689-99. Review.

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MafA Expression and Insulin Promoter Activity are Induced by Nicotinamide and Related Compounds in INS-1 Pancreatic {beta}-Cells. Ye DZ, Tai MH, Linning KD, Szabo C, Olson LK. *Diabetes.* 2006 Mar;55(3):742-50.

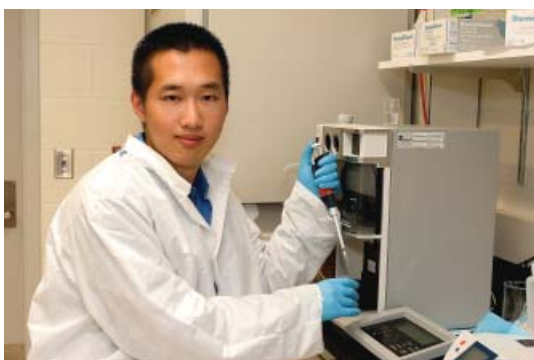
### Developmental Medicine and Child Neurology

Proposed Definition and Classification of Cerebral Palsy, April 2005. Bax M, Goldstein M, Rosenbaum P, Leviton A, Paneth N, Dan B, Jacobsson B, Damiano D; Executive Committee for the Definition of Cerebral Palsy. *Dev Med Child Neurol.* 2005 Aug;47(8):571-6.

### Ecotoxicology and Environmental Safety

Instrumental and bioanalytical measures of dioxin-like and estrogenic compounds and activities associated with sediment from the Korean coast. Koh CH, Khim JS, Villeneuve DL, Kannan K, Johnson BG, Giesey JP. *Ecotoxicol Environ Saf.* 2005 Jul;61(3):366-79.

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Effects of Nonequilibrium on Velocity and Plate Height in Reactive Capillary Electrophoresis; Newman CI, McGuffin VL. *Electrophoresis*. 2005 Nov;26(21):4016-25.

Capillary Electrophoresis for Thermodynamic and Kinetic Studies of Peptidyl-Proline Isomerization by the Theoretical Plate Height Model. Newman CI, McGuffin VL. *Electrophoresis*. 2006 Feb;27(3):542-52.

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Integrated Human-Animal Disease Surveillance. Mauer WA, Kaneene JB. *Emerg Infect Dis*. 2005 Sep;11(9):1490-1.

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Activation of the Stress Axis And Neurochemical Alterations in Specific Brain Areas by Concentrated Ambient Particle Exposure with Concomitant Allergic Airway Disease. Sirivelu MP, MohanKumar SM, Wagner JG, Harkema JR, Mohankumar PS. *Environ Health Perspect*. 2006 Jun;114(6):870-4.

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MX, a By-product of Water Chlorination, Lacks in vivo Genotoxicity in gpt Delta Mice but Inhibits Gap Junctional Intercellular Communication in Rat WB Cells. Niskikawa A, Sai K, Okazaki K, Son HY, Kanki K, Nakamima M, Kinase N, Nohma T, Trosko JE, Inoue T, Hirose M. *Environ Mol Mutagen*. 2006 Jan;47(1):48-55.

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Human Health Risk Assessment of Organochlorines Associated with Fish Consumption in a Coastal City in China. Jiang QT, Lee TK, Chen K, Wong HL, Zheng JS, Giesy JP, Lo KK, Yamashita N, Lam PK. *Environ Pollut*. 2005 Jul;136(1):155-65.

### Environmental Research

Mink as a Sentinel Species in Environmental Health. Basu N, Scheuhammer AM, Bursian SJ, Elliott J, Rouvinen-Watt K, Chan HM. *Environ Res*. 2006 May 20.

### Environmental Science and Pollution Research International

Distribution of PCDDs and PCDFs in Soils Collected from the Denver Front Range--Principal Components Analysis of Diffuse Dioxin Sources. Jones PD, Newsted JL, Henningsen G, Slocomb J, Giesy JP. *Environ Sci Pollut Res Int*. 2005 Jul;12(4):189-98.

### Environmental Science & Technology

Spatial and Temporal Distribution of Polycyclic Aromatic Hydrocarbons in Sediments from Michigan Inland Lakes. Kannan K, Johnson-Reseno B, Yohn SS, Giesy JP, Long DT. *Environ Sci Technol*. 2005 Jul 1;39(13):4700-6.

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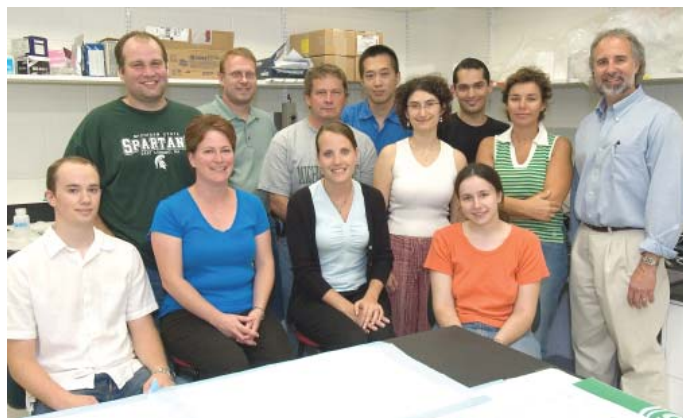
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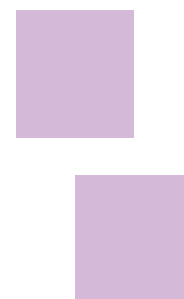
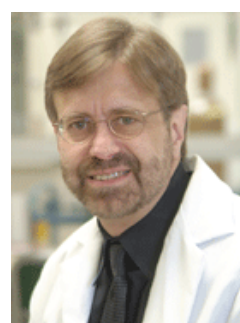
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## FUNDING

**M**SU-CIT-affiliated faculty finished the fiscal year with over 23 million dollars in research contracts and grants accepted by the MSU Board of Trustees.

These awards largely came from the National Institutes of Health (NIH) and the Public Health Service (PHS), as well as other federal and state government agencies, corporations, and universities. The majority of the awards represent just one year in a multi-year funding cycle, supporting leading-edge toxicology research.

The competitive renewal of a five-year \$16 million Superfund Basic Research Grant (SBRG) from the National Institute of Environmental Health Sciences (NIEHS) tops the list. (see page 18).

The continuation of the previous SBRG to the CIT also was accepted during this fiscal year totalling \$2,751,719 from the NIEHS. It was one of the largest single grant amounts accepted by the MSU Board during 2005.

The following list of the other grants includes the principal investigator (PI), the PI's primary department, co-PIs, amount, title, and agency.

**Bursian, Steven J.;** Animal Science: \$16,974 for "Petroleum Oil-Induced Adrenal Hypertrophy in Mink: Effects of Stress, Gender, and Oil Composition on Adrenal Function" from the University of California-Davis; \$20,000 for "Research on Nutrition, Toxicology, Behavior and Management of Mink" from the Mink Farmers Research Foundation I; and \$60,173 for "Kinetic Evaluation of Exposure to TCDFs in Mink" from Entrix Inc.

**Boyd, Stephen A.;** Crop and Soil Sciences; Rugh, Clayton L.; and Teppen, Brian J.: \$99,550 for "Geochemical Controls on Bioavailability and Toxicity of Nitroaromatics During Phytoremediation (TSE03-N)" from the National Science Foundation.

**Ewart, Susan L.;** Large Animal Clinical Sciences; and Karmaus, Wilfried J: \$343,236 and \$392,629 for "Genetic and Epidemiologic Cohort Study of Asthma and Allergy" from the NIH/PHS.

**Fischer, Lawrence J.;** CIT Director Emeritus; and Hootman, Seth R.: \$120,000 for "ENKA: Mechanistic Studies on AZD5455-Mediated Pancreatitis" from AstraZeneca.

**Ganey, Patricia E.;** Pharmacology and Toxicology; and Roth, Robert A.: \$195,228 for "Inflammation/Drug Interaction: Towards Validation of an Animal Model for Idiosyncratic Drug Induced Liver Injury" from Pfizer Inc.; and Ganey, Roth, and Zacharewski, Timothy: \$377,500 for "Gene Expression in Drug-Inflammation Models as Predictive of Idiosyncratic ADRS" from the NIH/PHS.

**Giesy, John P.;** Zoology: \$14,051 for "Development of an Assay Using the H295r Cell Line to Identify Chemical Modulators of Steroidogenesis and Aromatase Activity" from Entrix, Inc.

**Goodman, Jay I.;** Pharmacology and Toxicology: \$100,000 for "Altered DNA Methylations in Carcinogenesis" from the RJ Reynolds Tobacco Company.

**Harkema, Jack R.;** Pathobiology and Diagnostic Investigation; and Wagner, James G.: \$14,950 for "Nasal Injury in Infant Monkeys Exposed to Ozone (Project 3 of Program Project – Postlethwait, PI)" from the University of Alabama, and \$125,427 for "Cardiopulmonary Toxicity Induced By Particulate Matter: Inhalation Toxicology Studies Using A Mobile Particle Concentra" from the Electric Power Research Institute; and Harkema: \$62,000 for "Histopathology and Morphometric Determination of Endothelial and Epithelial Cell Proliferation in the Nasal and Pulmonary" from the American Chemical Council; \$4,895 for "downtown Ia; november 2004" from the University of California; and \$1,658 for "The Fungal Sinusitis Project" from the University of Michigan.

**Hashsham, Syed Anwar;** Civil and Environmental Engineering; Tiedje, James M.; and Cole, James R.: \$468,111 for "Flexible Biochip for Highly Parallel Microbial Detection" from the NIH.

**Hollingworth, Robert M.;** Entomology; Miyazaki, Satoru; Jiang, Wayne; and Chen, Zhongxiao: \$1,354,300 for "NC Region IR-4 Leader Lab Program to Clear Pest Control Agents for Minor Uses" from the US Department of Agriculture; Hollingworth



and Miyazaki: \$10,000 for "Herbicides for Minor Use Food Crops" from the Agricultural Research Service, USDA; Hollingworth and Miyazaki: \$190,100 for "A National Agricultural Program: Clearance of Chemicals and Biologics for Minor or Special Uses/Pesticides" from Rutgers University; and Hollingworth and Miyazaki: \$237,200 for "IR-4 Fungicide/Herbicide/Insecticide and Field Efficacy Studies" from Rutgers University.

**Jacobs, Lee W.;** Crop and Soil Sciences: \$10,020 for "Ag Expo Demo Site" from the Michigan Department of Environmental Quality.

**Kaminski, Norbert E.;** Center for Integrative Toxicology: \$3,075,889 for "Environmental; Microbial; and Mamalian Biomolecular Responses to AHR Ligands" from National Institute of Environmental Health Sciences (NIEHS); \$2,751,719 for "Health Hazards from Groundwater Contamination" from the NIEHS; \$314,400 for "Impairment of B Cell Differentiation by TCDD" from the NIEHS; \$328,742 for "IL-2 Suppression by Endocannabinoid Activation of PPAR  $\gamma$ " from the National Institute on Drug Abuse; \$255,478 for "CB1/CB2 Dependent and Independent T Cell Modulation" from the National Institutes of Health (NIH); and \$28,437 for "Regulation of Calcium by Delta-9-Tetrahydrocannabinol" from the NIH.

**Kaneene, John B.;** Diagnostic Center for Population and Animal Health; Fitzgerald, Scott D.; Bolin, Steven R.; Griffore, Robert J.; Phenice, Lillian: \$328,726 for "Bovine Tuberculosis: Epidemiology, Diagnosis, and Pathogenesis" from the ES-USDA; Kaneene and Mauer, Whitney Allyson: \$290,000 for "Michigan Stride System to Report Integrated Diseases Events: Phase IV" from the Michigan Department of Community Health; Kaneene, Grooms, Daniel L.; Bolin, Carole Ann; Bolin Steven R.; and Wolf, Christopher A.: \$123,819 for "Michigan Johnes Disease Control Program" from the USDA.

**Karmaus, Wilfried J.;** Epidemiology; and Chou, Karen: \$220,961 for "Organochlorines and Sex Steroids in Two Michigan Cohorts" from the Agency for Toxic Substances and Disease Regulation-PHS.

**LaPres, John J.;** Biochemistry and Molecular Biology: \$279,960 for "Hypoxia and an Epigenetic Mechanism for Toxicity" from the NIH.

**Linz, John E.;** Food Science and Human Nutrition; and Mansfield, Linda S.: \$228,111 for "Natural Transformation of Campylobacter Jejuni in Chickens: Impact on Food Safety" from the ES-USDA; and Linz: \$208,031 for "Iaflatoxin B1 Biosynthesis in Aspergillus Parasiticus" from the ES-USDA.

**Long, David T.;** Geological Sciences; and Giesy, John P.: \$140,909 for "A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters: Sediments" from the Michigan Department of Environmental Quality.

**Maher, Veronica M.;** College of Osteopathic Medicine Research and Advanced Study Programs, and McCormick, J. Justin: \$347,588 for "Error Prone Vs. Error Free DNA Replication

in Human Cells" from the NIH.

**Paneth, Nigel;** Epidemiology; and Davies, Herbert O.: \$399,011 for "Training Program in Perinatal Epidemiology" from the NIH; Paneth: \$102,450 for "Molecular Antecedents of Brain Damage in Preterm Infants" from the Children's Hospital of Boston; \$45,976 for "Developing a Communication Classification System of Cerebral Palsy" from the NIH.

**Pestka, James J.;** Food Science and Human Nutrition: \$335,805 for "Mechanisms of Trichothecene Toxicity" from the NIH/PHS; \$253,719 for "Dietary Lipids and Experimental IGA Nephropathy" from the NIH; \$93,710 for "Human Susceptibility to Trichothecenes" from the USDA; \$92,594 for "Human Susceptibility to Trichothecene Mycotoxins" from the Agricultural Research Service-USDA; and \$23,000 for "Efficacy of Healthreat Formulas in Remediation of Black Mold-Contaminated Buildings" from Spectrum Enterprises LLC.



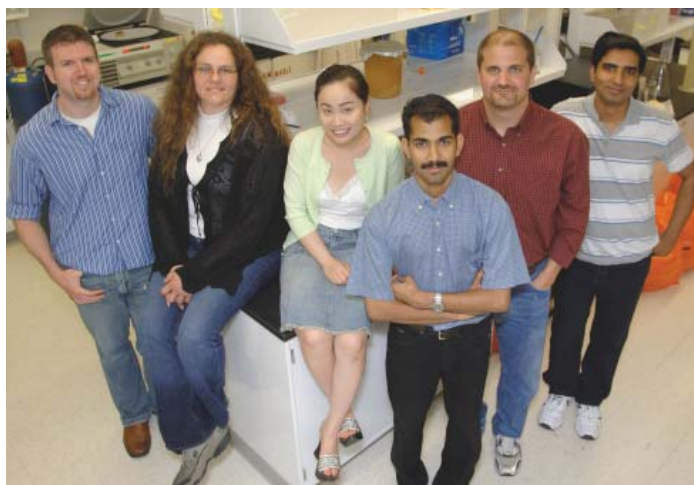
**Pinnavaia, Thomas J.;** Chemistry; Tepe, Jetze P. M.; and LaPres, John J.: \$239,200 for "New Methods in Phosphoproteomics" from the NIH; Pinnavaia: \$38,000 for "Synthetic Silicates for the Production of High Performance Aerospace Nanocomposites" from NASA; \$45,000 for "Clay Nanoparticle Reinforcement of Aerospace Polymers" from NASA; and \$60,000 for General Research from the Dupont De Nemours El Company.

**Robinson, N. Edward;** Large Animal Clinical Sciences; and Holcombe, Susan J.: \$151,248 for "Environmental Particulates and Airway Mucus in Racehorses" from the Grayson-Jockey Club Research Foundation, Inc.

**Rosenman, Kenneth D.;** Medicine: \$680,242 for "Enhanced Program in Occupational Injury and Illness Surveillance" from the Center for Disease Control; \$311,500 for "Michigan Sensor Project" from Michigan Consumer and Industry Services (MCIS); \$298,557 for "Genetic Exposure Interaction in Beryllium Disease" from the NIH; \$140,000 for "Farm Related Asthma" from the Ohio State University; \$87,252 for "State-Wide Asthma Mortality Review" from the Michigan Department of Commu-

nity Health (MDCH); \$21,440 for "ABLES" from the Centers for Disease Control-PHS; \$22,744 for "ABLES" from Michigan Labor and Economic Growth; \$36,717 for "Work-Related Asthma Education Project" from the MDCH; \$412,447 for "Fatality Assessment and Control Evaluation (FACE)" from the MCIS; and \$10,800 for "Fatality Assessment and Control Evaluation (FACE)" from the Michigan Farm Bureau.

**Roth, Robert A.;** Pharmacology and Toxicology: \$305,176 for "Multidisciplinary Training in Environmental Toxicology"; Roth; Ganey, Patricia E; and LaPres John J.: \$267,520 for "Neutrophils and Hepatotoxicity" from the NIH; Roth and Ganey: \$231,726 for "Inflammation and Drug Idiosyncrasy" from the NIH; Roth and Tukov, Frances Fonyuy: \$38,500 for "Development of an in Vitro Model for Studying Drug-Induced Idiosyncratic Liver Injury from the Society of Toxicology.



**Sikarskie, James G.;** Small Animal Clinical Sciences: \$330,210 for "Bald Eagle Biosentinel Monitoring of Inland Watersheds and Great Lakes Shorelines" from the Michigan Department of Environmental Quality (MDEQ); and \$61,000 for "Herring Gull Biosentinel Monitoring of Great Lakes Breeding Areas" from the MDEQ.

**Swain, Greg M.;** Chemistry: \$193,695 for "Sympathetic Neural Control Mechanisms in Hypertension" from the NIH/PHS; \$130,000 for "Metal/Diamond Composit Thin-Film Electrodes, New Carbon Supported Catalytic Electrodes" from the US Department of Energy; \$109,011 for "Advanced Diamond Electrodes for Electrochemical-Based Monitoring of Spacecraft Water" from NASA; and \$10,000 for "Expansion to ONR Award

N000140310995 – Advanced Analytical Methods for Water Quality Monitoring" from the US Office of Naval Research, USDN.

**Tiedje, James M.;** Center for Microbial Ecology; March, Terence L.; Kim, Sang-Hoon; Broderick Joan B; Dewitt, David Lee; and Phinney Brett: \$754,250 for "Exploring the Genome and Proteome of *Desulfitobacterium Hafniense* DCB2 for IT Protein Complexes Involved in Metal Reduct" from the US Department of Energy (USDE); Tiedje, Cole, James R.; and Garrity, George: \$150,000 for "The Ribosomal Database Project: Automation, Integration and Education" from the National Science Foundation (NSA); Tiedje, Cole, and Garrity: \$323,709 for "The Ribosomal Database Project: Automation, Integration and Education" from the USDE; Tiedje, Cole, and Klappenbach, Joel: \$380,517 for "Integrated Analysis of Protein Complexes and Regulatory Networks Involved in Anaerobic Energy Metabolism of *Shewanella O*" from the USDE; Tiedje: \$231,946 for "Molecular Approaches to Understanding C and N Dynamics in Marine Sediments and Their Role in Global Carbon Cycling" from the USDE; Tiedje and Marsh: \$75,000 for "Towards Understanding Population Dynamics of Metal and Radionuclide Reducers at Field Remediation Sites: from the USDE; and Tiedje and Konstantinidis, Konstantinos: \$117,345 for "Genomic Approaches to Advance the Species Definition of Prokaryotes" from the NSA; Tiedje and Konstantinidis: \$22,371 for "Assessment of the *Burkholderia* Microarray for Use with Other BCC Strains" from the Cystic Fibrosis Foundation.

**Uhal, Bruce D.;** Physiology: \$243,396 for "Control of Type II Pneumocyte Proliferation" from the NIH/PHS and \$2,673 for "Minority Supplement to Control of Type II Pneumocyte Proliferation" from the NIH.

**Voice, Thomas C.;** Institute of International Health; and Long, David T.: \$200,000 for "Training and Research in Environmental Health – the Balkans" from Fogarty International Center-NIH/PHS; Voice; Civil and Environmental Engineering; Voice and Riley, Kirk S.: \$92,500 for "Technical Outreach/Midwest Hazardous Substance Research Center" from Purdue University; and Voice, Tarabara, V.V.; and Bruening, Merlin L.: \$460,751 for "USA-Ukraine-France-Russia Partnership New Generation Synthetic Membranes: Nanotechnology for Drinking Water Safety" from the National Science Foundation.

**Wagner, James G.;** Pathobiology and Diagnostic Investigation; Harkema, Jack R.: \$288,800 for "Preclinical Evaluation of CAM Therapies for Asthma (Project 2)" from the University of North Carolina.

**Zacharewski, Timothy;** Biochemistry and Molecular Biology; \$355,063 for "AH Receptor Mediated Ligand Toxicity" from the NIH/PHS; \$206,918 for "Systematic Assessment of the 2;3;7;8;-Tetrachlorodibenzofuran (TCDF) Toxic Equivalency Factor" and \$40,000 for "General Research in the Area of Toxicogenomics", both from Dow Chemical Company; Zacharewski and Harkema, Jack R.: \$617,117 for "Metabolic Assessment of Estrogenic Endocrine Disruptors" from the NIH; Zacharewski; Chang, Chia-Cheng; Chan, Christina; and Harkema, Jack: \$377,500 for "Human Stem Cells for Toxicity Screening" from the NIH.

## CIT Successfully Competes for \$16 million NIH Superfund Grant

In the Spring of 2006, the MSU-CIT received a five-year \$16 million award from the National Institutes of Health Superfund Basic Research Program as part of a successful competing renewal application for a program project grant. These funds will be used to assess the potential health risks associated with environmental contaminants and for developing novel environmental remediation strategies to clean up polluted sites worldwide. This grant renewal brings to more than \$52 million in research funding the center has received from the Superfund Basic Research Program since it was established nearly 20 years ago.

The current MSU program focuses on a subclass of chemicals belonging to the halogenated aromatic hydrocarbon family that bind and activate the aryl hydrocarbon receptor. Activation of the aryl hydrocarbon receptor in turn can result in the inappropriate regulation of a wide range of genes and modulation of numerous biological responses. These chemicals, which include chlorinated dibenzo-p-dioxins, dibenzofurans, biphenyls, and polycyclic aromatic hydrocarbons, are environmentally persistent, lipid soluble compounds that accumulate in the food chain and lead to human and wildlife exposure.

Much of the work will be directed toward defining specific aspects of environmental, microbial, and mammalian biomolecular responses to environmental contaminants that act as ligands for the aryl hydrocarbon receptor.

A highly integrated, multidisciplinary research program is underway consisting of seven research projects and five supporting core units. The research team of 27 investigators includes faculty at Michigan State University (20), CIIT Centers for Health Research (3), Rutgers, The State University of New Jersey (2), Purdue University (1), and the U.S. Environmental Protection Agency (1).

For more information on the MSU Superfund program go to <http://www.cit.msu.edu/Superfund/superfund.html>.



## AFFILIATES

### Faculty Affiliated with the Center:

**William D. Atchison**, Professor, Pharmacology and Toxicology

**Leslie D. Bourquin**, Associate Professor, Food Science and Human Nutrition

**Stephen A. Boyd**, University Distinguished Professor, Crop and Soil Sciences

**Daniel A. Bronstein**, Professor of Community, Agriculture, Recreation and Resource Studies; Professor, Psychiatry

**Steven J. Bursian**, Professor, Animal Science

**Karen Chou**, Associate Professor, Animal Science

**Susan L. Ewart**, Associate Professor, Large Animal Clinical Sciences

**Patricia E. Ganey**, Professor of Pharmacology and Toxicology

**John P. Giesy**, Distinguished Professor of Zoology

**Jay I. Goodman**, Professor, Pharmacology and Toxicology

**Jack R. Harkema**, University Distinguished Professor, Pathobiology and Diagnostic Investigations

**Syed A. Hashsham**, Edwin Willits Associate Professor, Civil and Environmental Engineering; Adjunct Associate Professor, Crop and Soil Sciences and the Microbial Ecology Center

**Robert M. Hollingworth**, Professor, Entomology

**Lee W. Jacobs**, Professor, Crop and Soil Sciences

**Norbert E. Kaminski**, Director, Center for Integrative Toxicology; Professor, Pharmacology and Toxicology

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**Barbara Lee Faubert Kaplan**, Research Assistant Professor, Center for Integrative Toxicology

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**John E. Linz**, Professor, Food Science and Human Nutrition; and Microbiology and Molecular Genetics

**David T. Long**, Professor, Geological Sciences

**Jane F. Maddox**, Assistant Professor, Pharmacology and Toxicology

**Burra V. Madhukar**, Associate Professor, Pediatrics and Human Development

**Veronica M. Maher**, University Distinguished Professor, Microbiology and Molecular Genetics; Biochemistry and Molecular Biology

**Susan Masten**, Professor, Civil and Environmental Engineering

**J. Justin McCormick**, University Distinguished Professor, Microbiology and Molecular Genetics; Biochemistry and Molecular Biology

**Victoria L. McGuffin**, Professor, Chemistry

**Thomas P. Mullaney**, Professor, Pathobiology and Diagnostic Investigation

**Lawrence Karl Olson**, Associate Professor, Physiology

**Nigel Paneth**, Professor, Epidemiology and Pediatrics and Associate Dean of Research, College of Human Medicine

**James J. Pestka**, Professor, Food Science and Human Nutrition

**Thomas J. Pinnavaia**, University Distinguished Professor, Chemistry

**N. Edward Robinson**, Professor, Physiology and the Matilda R. Wilson Professor of Large Animal Clinical Sciences

**Kenneth Rosenman**, Professor, Medicine, and Chief of the Division of Occupational and Environmental Medicine

**Robert A. Roth**, Professor, Pharmacology and Toxicology; Graduate Program Director, Environmental and Integrative Toxicological Sciences, Center for Integrative Toxicology; Associate Director, National Food Safety and Toxicology Center

**Wilson K. Rumbleha**, Assistant Professor of Pathobiology and Diagnostic Investigation

**James G. Sikarskie**, Associate Professor of Small Animal Clinical Sciences

**Greg M. Swain**, Professor, Chemistry

**Brian J. Teppen**, Associate Professor, Crop and Soil Sciences

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**James E. Trosko**, Professor, Pediatrics and Human Development

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**Thomas C. Voice**, Professor, Civil and Environmental Engineering; Associate Director, Midwest Hazardous Substance Research Center

**James G. Wagner**, Assistant Professor, Pathobiology and Diagnostic Investigation

**Jack Throck Watson**, Professor, Chemistry; and Biochemistry and Molecular Biology

**Timothy R. Zacharewski**, Professor, Biochemistry and Molecular Biology

### Deans:

**Lonnie J. King**, College of Veterinary Medicine

**Jeffrey D. Armstrong**, College of Agriculture and Natural Resources

**Satish S. Upda**, College of Engineering

**Marsha Rappley**, College of Human Medicine

**William D. Stampel**, College of Osteopathic Medicine

**George E. Leroi**, College of Natural Science

**Marietta L. Baba**, College of Social Science

and **Steven G. Pueppke**, Director, Michigan Agricultural Experiment Station

### Academic Departments/Disciplinary Ph.D. programs:

*(participating in the CIT's Environmental and Integrative Toxicological Sciences graduate programs)*

Animal Science

Biochemistry and Molecular Genetics

Cell and Molecular Biology

Chemistry

Civil and Environmental Engineering

Comparative Medicine & Integrative Biology

Crop and Soil Science

Fisheries and Wildlife

Food Sciences/Human Nutrition

Forestry

Geological Sciences

Microbiology and Molecular Genetics

Pathobiology and Diagnostic Investigation

Pharmacology and Toxicology

Zoology

### CIT Staff:

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**Robert A. Roth, Ph.D.**, Graduate Program Director

**Carol Chvojka**, Financial Manager

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**Lois Furry, M.A.**, Editor

