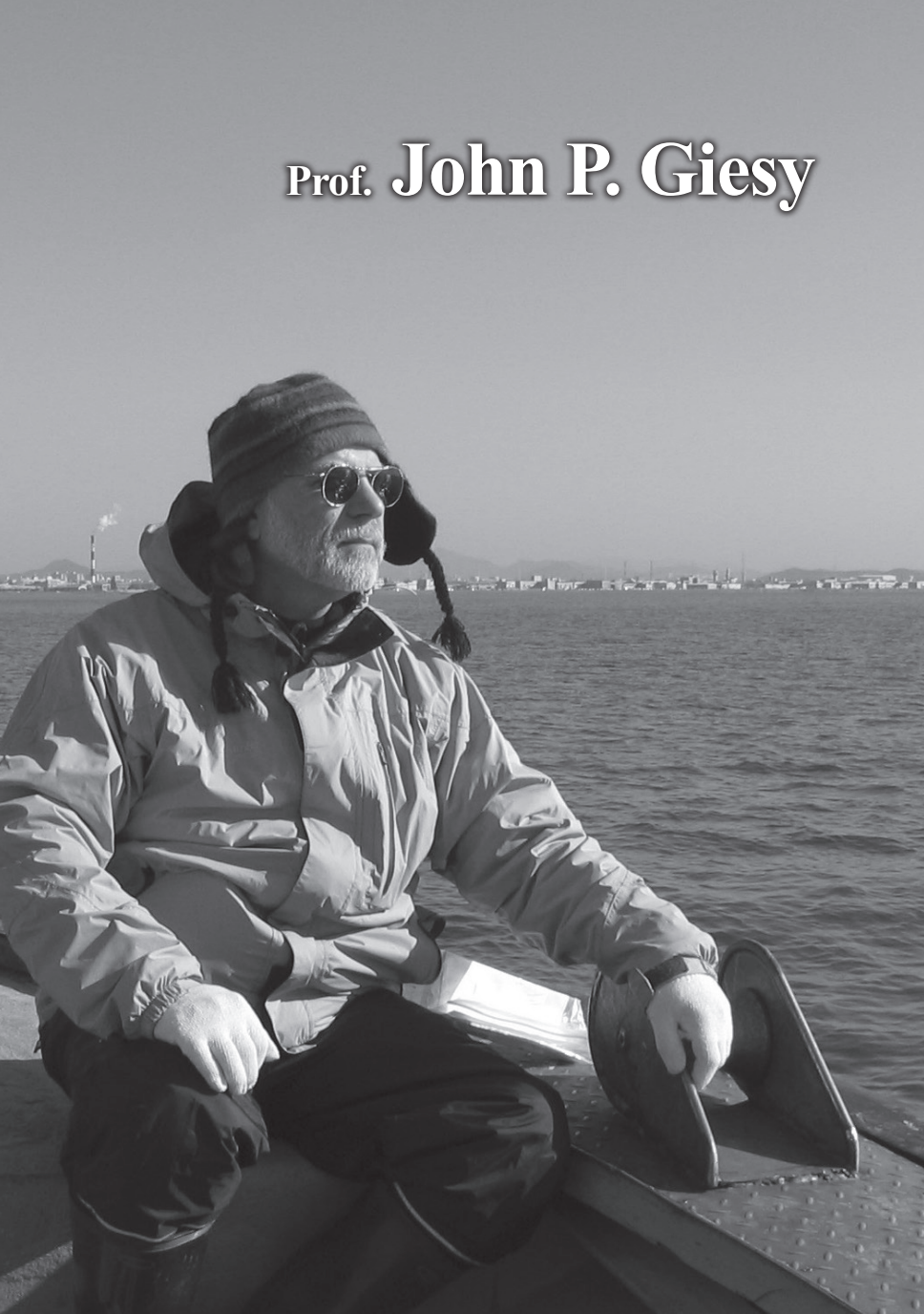
Prof. John P. Giesy



John P. Giesy

John P. Giesy is among the world's most innovative and influential environmental toxicologists. He has made tremendous contributions towards improving our environment through his exceptional scientific work and his commitment to promoting positive and tangible change in government policy and industry practices. Dr. Giesy's career achievements in research, knowledge transfer, and training HQP as well as the significance of his work for society and for industry are documented in full in his attached CV. Listed below are some highlights of his most important work that have had the most impact in Canada. Since immigrating to Canada in 2006, Dr. Giesy has had a profound impact on the field of environmental sciences in Canada and has been named the *No. 1 Environmental Scientist* in Canada by the *Globe and Mail*. Since 2006, he has published more than 490 peer-reviewed papers and based on his research 87 chemicals have been banned in Canada. He has been elected a fellow in Academy III of the Royal Society of Canada, and received some of Canada's most prestigious awards in environmental sciences.

Contributions to Knowledge

Dr. Giesy's research interests span broad aspects of environmental toxicology and chemistry. He has conducted research into the movement, bioaccumulation, and effects of toxic substances at different levels of biological organization, ranging from biochemical to ecosystem. Dr. Giesy has done extensive research in the areas of metal speciation, multispecies toxicity testing, biochemical indicators of stress in aquatic organisms, as well as fates and effects of PAHs, halogenated hydrocarbons, PCBs, perfluorinated chemicals (PFCs), and pesticides. Some of his most significant contributions are:

The discovery of PFCs in the environment. Dr. Giesy was the first person to identify perfluorinated chemicals (PFCs) as being widespread in the environment. Dr. Giesy's 2001 paper (Giesy and Kannan 2001) "Global distribution of perfluorooctane sulfonate (PFOS) in wildlife" *Env. Sci. Technol.* 35:1339-1342) essentially started the research on the environmental toxicology and fate of this important class of compounds. Until 2001 there was no evidence of bioaccumulation of perfluorooctane sulfonate (PFOS) or other PFCs in wildlife and work on humans had involved only total organic

fluorine measurements. At the time of this discovery PFOS was used in many products, including for the manufacture of microchips and stain repellents. Dr. Giesy was invited to prepare a cover, feature article on the subject for Environmental Science and Technology. (Giesy, J. P. and K. Kannan. 2002."Perfluorochemical Surfactants in the Environment". *Environ. Sci. Technol.* 36:146A-152A.) This paper became the 3rd most cited of the more than 47,000 papers ever published in ES&T, which is globally the premier journal in environmental science. Dr. Giesy has conducted extensive research on PFOS and other PFCs. He was the first to measure and describe: 1) binding of PFCs to proteins; 2) effects of PFOS on expression of genes in rats; 3) alterations in cell membrane properties and 4) effects on gap junctional intercellular communication; 5) explain the unexpected bioaccumulation potential and mechanisms of toxic action of PFCs; Conduct a global assessment of risks to humans and wildlife. The Giesy lab also led research on the avian toxicology of PFOS with studies on mallards and bobwhite. By applying molecular techniques, he worked out the critical mechanisms of toxic action and determined thresholds for effects on wildlife. By 2005 Giesy and colleagues had developed the first avian toxicity reference values for PFOS. This body of work, reported in 72 peer-reviewed papers, has been widely used by risk assessors in Canada, the US and Europe for ecological risk assessment of PFOS and other PFCs. Thirteen of these papers (the most of any scientist) are

also cited in the United Nations Environment Programme (UNEP) dossier (2007) supporting the global ban of PFOS-containing chemicals and products. Because of Dr. Giesy's discoveries, new fields of study have been opened and are now a major topic of discussion at many scientific conferences and regulatory attention by governments. Following Dr. Giesy's lead in toxicological studies, recent research has shown present-day health effects from PFCs in the general human populations that have resulted in major class-action law suits. Dr. Giesy's actions also had direct effects on assessments of these chemicals by US, Canadian, European and Japanese regulators. His research led to a global withdrawal of PFOS-containing chemicals by the manufacturer (2001) and eventual listing on the *Stockholm Convention on Persistent Organic Pollutants* (POPs) (2009) for global elimination. It is not an exaggeration to say that his research affected every living organism on the planet. Global concentrations were near thresholds for adverse effects and in some cases exceeded these thresholds. The dose-response relationship was very steep, which meant that there was little margin for error. Dr. Giesy developed alternatives to PFCs for industrial and commercial use so that the benefits of this class of chemicals was not lost. Moreover, his discovery had political and economic implications: Dr. Giesy reduced the risks to humans and wildlife while finding ways to continue to allow for products that use PFOS, such as microchips and textile and paper

coatings. Without his work the world would now be exposed to a critical contaminant or not be able to manufacture microchips.

Endocrine Disruptors. Dr. Giesy is a leader in the area of endocrine disrupting chemicals in the environment. Over the last decade, chemicals that bind with hormone receptors and alter the normal functioning of sex and thyroid hormones have become a significant public concern. The EPA tasked Dr. Giesy with developing, testing and validating a screening program for these chemicals without using animals. He was one of the first scientists to identify endocrine disrupting chemicals in the environment and is well known for his development of methods for the analysis of co-planar PCBs and the development of rapid, sensitive integrating bioassays to measure concentrations of complex mixtures of dioxin-like compounds. His group pioneered the methods for determining the toxicity of sediments that are still used today. In response to the EPA's request, and with funding from Western Economic Diversification Canada, Dr. Giesy developed the H295R steroidogenesis assay, which the US EPA now requires for screening chemicals and is approved by the Organisation for Economic Co-operation and Development (OECD) for screening regarding the endocrine disrupting effects of chemicals used in commerce. The assay replaces six previously used assays that required whole animal testing. This technique is rapid, sensitive, flexible, cost-effective and does not use any live animals. A patent

has been granted by the USA and patents are pending on 20 modifications of the H295R steroidogenesis assay. This discovery was recognized with the 2010 Award of Innovation from the University of Saskatchewan.

Birth defects and embryo-lethality in Great Lakes birds and salmon. In the 1970s and 1980s, populations of birds and some fishes in the North American Great Lakes declined precipitously. Dr. Giesy was the first to determine the cause of developmental deformities and embryo-lethality in colonial, fish-eating water birds and fishes. He developed new instrumental methods that allowed quantification of the co-planar PCBs (polychlorinated biphenyls) and also developed a bio-analytical technique (H4IIE-luc Assay) that measures total dioxin-like equivalents. By applying a combination of chemistry and molecular toxicology in both laboratory and field studies, Dr. Giesy was able to determine the mechanism of action and identify the cause of Great Lakes Embryo Mortality and Deformities (GLEMEDS). These results were presented in a cover feature article in *Environmental Science and Technology*, and he received the *Vollenweider Award* from Environment Canada for this work.

Photo-enhanced toxicity of polycyclic-aromatic hydrocarbons (PAHs) in aquatic systems. Dr. Giesy was the

first to describe the phenomenon of photo-enhanced toxicity of PAH in aquatic environments. He then worked out the mechanisms of this phenomenon and developed a quantitative structure activity model, which predicts toxicity of PAH in the presence of UV-A and UV-B light. This discovery has greatly influenced government regulations and, essentially, resulted in an entirely new area of science. Dr. Giesy's work in this area was identified as one of the top 25 most significant discoveries in the past 50 years at the 25th *International Symposium on Halogenated Environmental Organic Pollutants and POPs* held in Toronto in 2005. The discovery required detailed knowledge in environmental chemistry, quantum physics, mathematics and toxicology.

Wildlife Toxicology. A world leader in the area of wildlife toxicology and ecological risk assessment, Dr. Giesy has developed many of the tools and techniques used by governments all over the world to set environmental standards and conduct ecological risk assessments for birds, mammals and surface waters. Understanding effects of dioxin-like chemicals on fish and wildlife is critically important, and virtually all current environmental standards in this regard are based on the results of laboratory and field studies Dr. Giesy has conducted with numerous mammals and birds. He has been conducting studies into effects of contaminants on frogs and was part of a team that identified a new sub-species of the African

clawed frog, *Xenopus*. He is currently a global leader investigating potential effects of chemicals used in agriculture in bees.

Oil Sands Research. Dr. Giesy is a leader in both the analytical chemistry and assessment of toxicity of oil sands development and he is currently investigating the best way to monitor the environment for effects of oil sands development and treat wastes. He has recently focused his research on the effects of Oil Sands Process Water (OSPW) and processes to more efficiently extract bitumen and to remove toxicity from OSPW. To this point, his group has determined the cause of toxicity of OSPW and developed biomarkers for monitoring the environment for exposure of wildlife to the organic constituents of OPSW before it would lead to adverse effect on survival, growth and reproduction. He has developed a mathematical model that allows prediction within experimental error of the bioassays toxicity of mixtures containing an estimated 250,000 organic compounds. This breakthrough, which was thought to be an impossible challenge, will allow effective management of wastes. He has also developed methods to treat wastes so it can be released into the environment. In addition, Dr. Giesy is working with northern communities to examine their traditional, subsistence diets to determine contamination from oil sands development. This high quality work has significant social, political and economic implications for Canada was supported through an NSERC CRD with Syncrude, Ltd.

Training of HQP

Over the course of his distinguished career, Dr. Giesy has maintained an extraordinary level of success in training the next generation of environmental toxicologists. He maintains an international research and training program that, to date has seen Dr. Giesy supervise more than 800 individuals, ranging from undergraduates (>400), M.Sc. (42) and Ph.D. (84) students to technicians (200+), visiting students (86), visiting scientists (64) and post-doctoral fellows (66). Training of HQP is a central component of Dr. Giesy's research program. HQP development is supported through mentorship, fostering cooperation in a creative environment, and encouraging his students to be independent thinkers. Those who are trained by Dr. Giesy receive unparalleled opportunities to work alongside leaders in environmental toxicology, chemistry and related disciplines. The HQP trained by Dr. Giesy are highly sought after by leading institutions and corporations worldwide. For example, one of Dr. Giesy's former postdoctoral fellows, Dr. Gerald Ankley, is currently a highly-cited, award-winning research scientist at the US EPA. He is a recipient of the SETAC *Founder's Award*, the highest award given

globally for excellence in environmental research. Another former student, Dr. Shane A. Snyder, is currently Professor & Co-Director of Chemical and Environmental Engineering at the Arizona Laboratory for Emerging Contaminants (ALEC), University of Arizona. Dr. Snyder is considered the preeminent scientist globally concerning the safety of reused drinking water. In short, Dr. Giesy' students have excelled:

- 25 former students are currently professors or retired from academic positions. Several hold prestigious chair positions at major universities around the world, including Cambridge;
- several former students currently lead environmental divisions at major corporations, including Dow Chemical, Dow Agro, Dow Corning, Syngenta, Shell, 3M, Chevron, Monsanto and Exxon; 4 have gone on to be vice presidents of Fortune 500 companies;
- many former students and PDFs work for various government agencies around the world. One is the head of the contaminants branch of the US Geological Survey, while another has a similar position for the US Fish and Wildlife Service in the USA;
- 8 former students have been members of the SETAC's board of directors and one was elected president.

Significance and Impact

Dr. Giesy's contributions and impact on the Canadian and global research environment has been tremendous. He is a frequent adviser to industries and governments all over the world. An example of Dr. Giesy's impact can be illustrated by the example of his role in 3M's cessation of PFOS production. After making the initial discovery, he worked cooperatively with 3M to analyze thousands of samples which yielded overwhelming evidence of the widespread distribution of PFOS in the environment and wildlife. Dr. Giesy persuaded 3M to discontinue the manufacturing of PFOS. As a consequence, concentrations of PFOS in the environment have decreased 3-fold – a benefit to the global environment and to all of humanity.

In 2011, he was selected by the Federal Environment Minister (MOE) to chair the first ever Board of Review (BOR) to determine if volatile methyl cyclic siloxanes, a class of chemicals used in personal care products, should be permitted to be used in Canada. This was the first time a BOR allowed under provisions in the Canadian Environmental Protection Act was convened to review Environment Canada's risk assessment decisions on chemicals.

The MOE accepted Dr. Giesy's ruling so we can still have antiperspirants in Canada

In addition to his extraordinary scientific productivity, Dr. Giesy has had a major role in development of the science of environmental toxicology and chemistry through his roles in scientific societies and in journals. He served many roles at the Society of Environmental Toxicology and Chemistry (SETAC) including President in 1991. He also led the first efforts to take SETAC to the international level by helping to form the European chapter. He has received several SETAC awards including the Founder's Award, the society's highest scientific award. Dr. Giesy's international influence has also been enhanced through the many roles he has held in scientific societies and journals, as well as his advisory work with organizations such as the National Academy of Science (NAS), US National Institutes of Health (NIH), Environment Canada, US Environmental Protection Agency (USEPA), and the World Health Organization (WHO). He served two terms on the USEPA Science Advisory Board, which oversee all operations of the USEPA and two terms on the Board of Scientific Councilors, which oversees USEPA Office or Research and Development, both of which are congressionally mandated advisory bodies.

Dr. Giesy's research, for which he has received more than $100 million in funding over 40 years and $13.5 million in the last five years alone, have significantly influenced industry

practices and government policies related to the broad discipline of environmental toxicology. He conducts research of the highest caliber and publishes the results of those studies in the world's most reputable journals. He is one of the world's most highly-cited authors, with more than 45,000 citations of his work. According to the Web of Knowledge, he is in the top 0.001% of active authors in all fields, and his h-index of 103 (Google Scholar) reflects his position as one of the world's most influential environmental toxicologists. His i10 Index (number of papers cited more than 10 times) is 633. Dr. Giesy is also a highly sought after speaker; he has given more than 1,600 presentations and lectures including, plenary and keynote lectures to an array of academic, government, industrial and other stakeholder groups.

Dr. Giesy has been recognized for his work on numerous occasions. He was elected as a fellow of the Royal Society of Canada (RSC) (2010) and SETAC (2014) and was named Distinguished Visiting Professor at The University of Hong Kong. In 2009, he received the *Einstein Professor Award* from the Chinese Academy of Sciences and the *Vollenweider Award* for Aquatic Sciences from the National Water Research Institute of Canada in 1994. In 2013, he received the *Miroslav Romanowski* Medal from the RSC. It is seldom that one person has so much impact on science, economics, policy, and has affected so many people and the environment for the better through a body of scientific work. The work by Dr. Giesy

in the area of PFCs has had more impact than almost any other discovery in chemistry or environmental sciences during the past 15 years, but he did most of it without any fanfare. John Giesy is an extraordinarily productive scientist who has made seminal contributions to the life sciences in a wide range of areas of environmental toxicology and chemistry. His work has benefited society enormously by providing the scientific basis for assessing impacts of chemicals on humans and wildlife.