

## Still Curious: An Overview of John Casida's Contributions to Agrochemical Research<sup>†</sup>

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Professor John Casida's research accomplishments span nearly 60 years, from the dawn of the development of agrochemicals based on organic chemicals to the discovery of genetically modified organisms. Professor Casida's research has resulted in more than 800 peer-reviewed publications and 31 patents to date. The topics covered in the symposium held in his honor at the 239th National Meeting of the American Chemical Society in March 2010 clearly reflect his stature as a scientist whose research transcends specific disciplines to reach solutions that very often uncover new scientific challenges and novel areas of research.

A review of cited work in articles dealing with the chemistry and toxicology of agrochemicals almost invariably includes John Casida's contributions. Not only has his group published hundreds of papers, but, more importantly, these address the core areas of mode of action, toxicity, neurophysiology, resistance, synergism, synthesis, and environmental and metabolic transformation. Furthermore, his research has always exploited the newest techniques available as represented by his early recognition of useful tools such as radiotracers, NMR and mass spectrometry, the Ames assay, and, more recently, photoaffinity labeling and knockdown mice.

Professor Casida's enduring interest in the chemistry and metabolism of the organophosphate, carbamate, and pyrethroid insecticides, and, more recently, of the neonicotinoid and ryanoid classes, is well represented in the symposium. Several papers illustrate recent developments arising in great part from his seminal work on the mode of action at the receptor level of many classes of insecticides, particularly the nicotinic acetylcholine receptor, the GABA-gated chloride channel, and the ryanodine receptors.

### ■ APPROACH

John Casida modestly specified that curiosity is the driving force behind his research efforts. Knowing him as we do, we would have to add a few more traits that we feel are responsible for his incredibly prolific and creative output. These include an uncommon ability to focus on several apparently unrelated problems simultaneously while establishing previously unexpected connections and total dedication to his work. However,

he would not be respected as highly if loyalty to his colleagues and complete honesty had not always been top priorities.

### ■ BIOGRAPHY

John Casida earned his B.S. in Entomology (1951), M.S. in Biochemistry (1952), and Ph.D. in Entomology/Biochemistry (1954) from the University of Wisconsin (Madison). Upon graduation, Dr. Casida joined the faculty of his alma mater and rose through the ranks to professor. Professor Casida joined the faculty of the University of California (Berkeley) in 1964 as professor of Entomology and Toxicology and director of the Pesticide Chemistry and Toxicology Laboratory (renamed the Environmental Chemistry and Toxicology Laboratory in 1994). From 1996, Professor Casida has held the William Muriece Hoskins Chair in Chemical and Molecular Entomology, University of California, Berkeley.

### ■ SIGNIFICANT RESEARCH ACCOMPLISHMENTS

Among the many accomplishments of Professor Casida's laboratory, a partial list of significant accomplishments includes the following:

- Identification of the metabolic basis for selective toxicity and environmental fate of organophosphates, methylcarbamates and pyrethroids.

- Identification of mode of action of synergists as inhibitors of mixed-function oxidases.

- Identification of nicotinic acetylcholine receptor, the target of imidacloprid insecticides.

- Identification of NADH:ubiquinone oxidoreductase, the target of rotenone insecticide/pesticide.

- Identification of kynurenine formamidase inhibition as the target for organophosphate-induced avian teratogenesis.

- Identification of the calcium-activated calcium channel with the botanical insecticide ryanodine.

- Identification of protein phosphatase 2A as the target of cantharidin vesicant/endothall herbicide.

- Discovery of trioxabicyclooctanes and dithianes as potent insecticides.

<sup>†</sup> Part of the Symposium on Pesticide Toxicology in Honor of Professor John Casida. J.J. was a postdoctoral researcher with Dr. Casida 1986–1988. L.R. was a Professional Research Chemist and Co-Director of the Environmental Chemistry and Toxicology Center 1976–1987.

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Discovery of TBPS and EBOB as probes for the molecular architecture of the GABA-gated chloride channel.

Discovery of trio-cresyl phosphate bioactivation to a neurotoxicant, laying the background for understanding organophosphate-induced delayed neuropathy.

### ■ AWARDS/RECOGNITION

Professor Casida's accomplishments have been recognized by numerous awards including 1970 Guggenheim Fellowship; 1970 International Award for Research in Pesticide Chemistry (American Chemical Society); 1978 Spencer Award for Research in Agricultural and Food Chemistry (American Chemical Society); 1988 Distinguished Service Award for Research (USDA); 1989 J. E. Bussart Award and Fellow of the Entomological Society of America; 1991 National Academy of Sciences (U.S. A.) Member; 1992 Sterling B. Hendricks Memorial Lectureship (USDA); 1993 Wolf Foundation Prize in Agriculture; 1994 Founders Award (Society of Environmental Toxicology and Chemistry); 1995 Koro-Sho Prize (Pesticide Science Society of Japan); 1997 Honorary Member (Society of Toxicology); 1997 Honorary Doctor Degree and Third World Academy of Sciences Lectureship (University of Buenos Aires, Argentina); 1998 Faculty Research Lecturer (U. C. Berkeley); 1998 Royal Society of the United Kingdom, Fellow and Foreign Member; 2004 European Academy of Sciences, Member; 2005 Honorary Member (Pesticide Science Society of Japan); 2008 Career Achievement Award (College of Natural Resources, U. C. Berkeley); 2009 Distinguished Service Award (American College of Toxicology).

Sabbaticals involved several months of research spent at laboratories in England, France, Germany, Greece, Japan, Sweden, and Switzerland.

### ■ ALUMNI

A review of publications, patents, and awards fails to represent the breadth of Professor Casida's impact on the field of pesticide chemistry and toxicology. More than 230 students, postdocs, and research associates have worked in Professor Casida's laboratory. Most of these individuals continued to work as scientists in the fields of pesticide (and drug) discovery, metabolism, and environmental fate in academics, government, and industry. The symposium in honor of Professor Casida's 80th birthday and career accomplishments at the 2010 Spring National Meeting of the American Chemical Society presented an opportunity for Professor Casida's colleagues to reflect on the incredible accomplishments of the Environmental Chemistry and Toxicology Laboratory and the honor of being associated with Professor Casida.

John's wife, Kati Casida, has been instrumental in developing the bonds that exist among his alumni and maintains an extensive communication network appreciated by all of us.

A review of the papers presented here offers insight to those who were not able to attend this wonderful symposium. Enjoy.

### ■ AUTHOR INFORMATION

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