

REFERENCES

- Abdullah, A. R. (1986). Studies on the resolution and anti-esterase activity of selected saligenin cyclic phosphorus esters. PhD Thesis.
- Abdullah, A. R.; Lim, R. P. and Chapman, J. C. (1993). Inhibition and recovery of AChE in *Paratya australiensis* exposed to the OP insecticide chlorpyrifos. *Fresenius Environ. Bull.* 2: 752-757
- Abdullah, A. R.; Kumar, A. R. and Chapman, J. C. (1994). Inhibition of AChE in the Australian freshwater shrimp (*Paratya australiensis*) by profenofos. *Environ. Toxicol. and Chem.* 13(11): 1861-1866
- Abou-Donia, M. B. and Menzel, D.B (1967). Fish brain cholinesterase : Its inhibition by carbamates and automatic assay. *Comp. Biochem. Physiol.* 21: 99-108
- Aldridge, W. N and Reiner, E. (1972). Enzyme inhibitors as substrates. In : *Interactions of esterases with esters of organophosphorus and carbamic acids. Frontiers of Biology* vol. 26 A. Neuberger and E.L. Tatum (Eds.). North -Holland Publishing Co. Amsterdam. pp 37-52
- Andersson, T.; Pesonen, M. and Johansson, C. (1985). Differential induction of cytochrome P-450-dependent monooxygenase, epoxide hydrolase, glutathione transferase and UDP glucuronosyl transferase activities in the liver of the rainbow trout by β -naphthoflavone or clophen A50. *Biochem. Pharmacol.* 34(18): 3309-3314
- Andersson, T. and Forlin, L. (1992). Regulation of the cytochrome P-450 enzyme system in fish. *Aquatic toxicology* 24: 1-24

- Ansari, B. A. and Kumar, K. (1984). Malathion toxicity : *In vivo* inhibition of acetylcholinesterase in the fish *Brachydanio rerio* (Cyprinidae). *Toxicol. Lett.* 20: 283-287.
- Arinc, E. and Sen, A. (1994). Effects of *in vivo* benzo(a)pyrene treatment on liver microsomal mixed-function oxidase activities of gilthead seabream (*Sparus aurata*). *Comp. Biochem. Physiol.* 107C(3): 405-414
- Asian Development Bank (1987). In: *Handbook on the use of pesticides in the Asia-Pacific region*. pp 205-206
- Balint, T.; Szegletes, T.; Szegletes, Z.; Halasy, K. and Nemcsok, J. (1995). Biochemical and subcellular changes in carp exposed to the organophosphorous methidathion and the pyrethroid deltamethrin. *Aquatic toxicology* 33: 279-295.
- Barron, M. G.; Plakas, S. M. and Wilga P. C. (1991). Chlorpyrifos pharmacokinetics and metabolism following intravascular and dietary administration in channel catfish. *Toxicology and Applied Pharmacology* 108: 474-482
- Barron, M. G.; Plakas, S. M.; Wilga, P. C. and Ball, T. (1993). Absorption, tissue distribution and metabolism of chlorpyrifos in channel catfish following waterborne exposure. *Environmental Toxicology and Chemistry* 12: 1469-1476
- Bend, J.R and James M.O. (1978). Xenobiotic metabolism in marine and freshwater species. In : *Biochemical and biophysical perspectives in marine biology*, Vol. 4. Malins, D.C. and Sargent, J. A. (Eds.). Academic Press NY page 128-172

- Benke, G. M. and Murphy, S. D. (1974). Anticholinesterase action of methyl parathion, parathion and azinphosmethyl in mice and fish : Onset and recovery of inhibition. *Bull. Environ. Contam. Toxicol.* 12: 117-122
- Bloomquist, J. R. (1992). Intrinsic lethality of chloride channel-directed insecticides and convulsants in mammals. *Toxicol. Lett.* 60: 289-298
- Brodie, B. B.; Gillette, J. R. and La Du, B. N. (1958). Enzymatic metabolism of drugs and other foreign compounds. *Annu. Rev. Biochem.* 27: 427-453.
- Buhler, D. R. and Williams, D. E. (1988). The role of biotransformation in the toxicity of chemicals. *Aquatic Toxicology* 11: 19-28
- Buhler, D.R and Williams, D. E. (1987). Enzymes involved in the oxidative metabolism of PAHs by fish and other aquatic animals. In : *Metabolism of polycyclic aromatic hydrocarbons in the aquatic environment*, edited by U. Varanasi, CRC Press, NY.
- Burke, M. D. and Mayer, R. T. (1974). Ethoxyresorufin : Direct fluorimetric assay of a microsomal O-dealkylation which preferentially inducible by 3-methylcholanthrene. *Drug Metabolism and Disposition* 2(6): 583-588
- Burke, M. D. and Mayer, R. T. (1975). Inherent specificities of purified cytochromes P-450 and P-448 toward biphenyl hydroxylation and ethoxyresorufin deethylation. *Drug Metabolism and Disposition* 3(4): 245-252.
- Burke, M. D.; Prough, R. A. and Mayer, R. T. (1977). Characteristics of a microsomal cytochrome P-448-mediated reaction. Ethoxyresorufin O-deethylation. *Drug*

Metabolism and Disposition 5(1): 1-8

Burke, M. D.; Thompson, S.; Elcombe, C. R.; Halpert, J.; Haapranata, T. and Mayer, R. T. (1985). Ethoxy-, pentoxy- and benzuloxphenones and homologues : a series of substrates to distinguish between different induced cytochrome P-450. *Biochem. Pharmacol.* 34: 3337-3345.

Busby, D.G.; White, L. M.; Pearce, P. A. and Mineau, P. (1989). Fenitrothion effects on forest songbirds : A critical new look. In: *Environmental effects of fenitrothion use in forestry : Impacts on insect pollinators, songbirds and aquatic organisms*. Ernst, W. R., Pearce, P. A. and Pollack, T. L. (Eds.). Environment Canada Publication No. EN40-370/1989E pp. 43-108.

Carlson, R. W. (1982). Some characteristics of ventilation and coughing in the bluegill *Lepomis macrochirus* Rafinesque. *Environ. Pollut.* 29: 35-41

Celander, M. and Forlin, L. (1995). Decreased responsiveness of the hepatic cytochrome P4501A1 system in rainbow trout (*Oncorhynchus mykiss*) after prolonged exposure to PCB. *Aquatic Toxicology* 33: 141-153.

Chambers, J. E. and Carr, R. L. (1995). Biochemical mechanisms contributing to species differences in insecticidal toxicity. *Toxicology* 105: 291-304.

Chambers, J. E. and Yarbrough, J. D. (1976). Xenobiotic biotransformation systems in fishes. *Comp. Biochem. Physiol.* 55C: 77-84.

Cook, G. H.; James, C. M. and Coppage, D. L. (1976). The relationship of malathion

- and its metabolites to fish poisoning. *Bull. Environ. Contam. Toxicol.* 16: 283-290.
- Coppage, D. L. (1971). Characterization of fish brain AChE with an automated pH stat for inhibition studies. *Bull. Environ. Contam. Toxicol.* 6: 304-310.
- Coppage, D. L. (1972). Organophosphate pesticides : Specific level of brain AChE inhibition related to death in sheepshead minnows. *Trans. Amer. Fish. Soc.* 101: 534-536.
- Coppage, D. L. and Braidech, T. E. (1976). River pollution by anticholinesterase agents. *Water. Res.* 10: 19-24
- Coppage, D.L. and Matthews, E. (1974). Short-term effects of organophosphate pesticides on ChEs of estuarine fishes and pink shrimp. *Bull. Environ. Contam. Toxicol.* 11: 483-488.
- Coppage, D. L. and Matthews, E. (1975). Brain acetylcholinesterase inhibition in a marine teleost during lethal and sublethal exposures to 1,2-dibromo-2,2-dichloroethyl dimethyl phosphate (Naled) in seawater. *Toxicol. Appl. Pharmacol.* 31: 128-133.
- Coppage, D. L.; Matthews, E.; Cook, G. H. and Knight (1975). AChE inhibition in fish as diagnosis of environmental poisoning by malathion, O, O-dimethyl S-(1,2-dicargethoxyethyl) phosphorodithioate. *J. Brain. Pest. Biochem. Physiol.* 5: 536-542.
- Day, K. E. and Scott, I. M. (1990). Use of AChE activity to detect sublethal toxicity in stream invertebrates exposed to low concentrations of OP insecticides. *Aquatic Toxicology* 18: 101-114.

Drummond, R. A.; Russom, C. L.; Geiger, D. L. and Defoe, D. L. (1986). Behavioural and morphological changes in fathead minnow (*Pimephales promelas*) as diagnostic endpoints for screening chemicals according to mode of action. In : *Aquatic Toxicology and Environmental Fate* : Ninth volume, STP 921, edited by Poston, T. M. and Purdy, R. American society for testing and materials, Philadelphia, pp 415-435.

Duangasawadi, M. and Klaverkamp, J. F. (1979). Acephate and fenitrothion toxicity in rainbow trout: Effects of temperature, stress and investigations on the sites of action in aquatic toxicology. ASTM STP, 667. L.L. Marking and R.A. Kimerle (Eds.). *Amer. Soc. Testing and Materials* pp: 35-51

Edwards, R. and Millburn, P. (1985). Toxicity and metabolism of cypermethrin in fish compared with other vertebrates. *Pesticide Science* 16: 210-202.

Elcombe, C. R. and Lech, J. J. (1979). Induction and characterization of Hemoprotein (S) P-450 and monooxygenation in rainbow trout (*Salmo gairdneri*). *Toxicology and Applied Pharmacology* 49: 437-450

Ellman, G. L.; Courtney, K. D.; Andres, V. and Featherstone, R. M. (1961). A new and rapid colorimetric determination of acetylcholinesterase activity. *Biochem. Pharmacol.* 7: 88-95

Escartin, E. and Porte, C. (1996). Bioaccumulation, metabolism and biochemical effects of the organophosphorous pesticide fenitrothion in *Procambarus clarkii*. *Environmental Toxicology and Chemistry* 15(6): 915-920

Eto, M. (1974). In: *Organophosphorous pesticides : organic and biological chemistry*. CRC Press, Cleveland, Ohio. 387 pp

- Fairbrothers, A.; Marden, B. T.; Bennet, J. K. and Hooper, M. J. (1991). Methods used in determination of cholinesterase activity. In : *Cholinesterase-inhibiting insecticides, their impact on wildlife and the environment*. Mineau, P. (Ed.) volume 2. Elsevier Science Publisher Co. NY. pp 35-71
- Felstot, A. and Dahm, P. A. (1979). Sorption of organophosphorous and carbamate insecticides by soil. *J. Agric. Food. Chem.* 27: 557-563
- Ferrando, M.D.; Alarcon, V.; Fernandez-Casalderry, A.; Gamon, M. and Andreu-Moliner, E. (1992). Persistence of some pesticides in the aquatic environment. *Bull. Environ. Contam. Toxicol.* 48: 747-755
- Fest, C. and Schmidt, K. J. (1973). In: *The Chemistry of Organophosphorous Pesticides*. Spinger-Verlag Berlin Heidelberg NY pp:171
- Flammarion, P.; Migeon, B. and Garric, J. (1996). Joint effects of copper sulphate and methidathion on rainbow trout (*Oncorhynchus mykiss*) EROD and AChE activities. *Bull. Environ. Contam. Toxicol.* 56: 440-445
- Froede, H. C. and Wilson, I. B. (1971). Acetylcholinesterase. In: *The Enzymes*. Vol.V: Hydrolysis. P. D Boyer (Ed). 3rd Edition, Academic Press NY. 87-114.
- Fukuto, T. R. (1990). Mechanism of action of organophosphorous and carbamate insecticides. *Environmental Health Perspectives* 87: 245-254
- Gadagbui, B. K.; Addy, M. and Goksoyr, A. (1996). Species characteristics of hepatic biotransformation enzymes in two tropical freshwater teleosts, Tilapia (*Oreochromis*

niloticus) and Mudfish (*Clarias anguillaris*). *Comp. Biochem. Physiol.* 114C(3): 210-211

George, S. G. (1994). Enzymology and molecular biology of phase II xenobiotic-conjugating enzymes in fish. In: *Aquatic toxicology : molecular, biochemical, and cellular perspectives*. Malins, D. C.; Ostrander, G. K. (Eds.). Boca Raton, FL : Lewis Publisher; 37-85

Gibson, J.R.; Ludke, J.L. and Ferguson, D.E. (1969). Sources of error in the use of fish-brain acetylcholinesterase activity as a monitor for pollution. *Bull. Environ. Contam. Toxicol.* 4: 17-23

Gillette, J. R.; Conney, A. C.; Cosmides, G. J.; Estabrook, R. W.; Fouts, J. R. and Mannering, G. J. (1969). In: *Microsomes and drug oxidations*. Academic Press, NY 547pp

Goksoyr, A. (1985). Purification of hepatic microsomal cytochromes P-450 from β - naphthoflavone-treated Atlantic cod (*Gadus morhua*), a marine teleost fish. *Biochimica et Biophysica Acta* 840: 409-417

Goksoyr, A. and Forlin, L. (1992). The cytochrome P-450 system in fish, aquatic toxicology and environmental monitoring. *Aquatic toxicology* 22: 287-312

Goksoyr, A.; Andersson, T.; Buhler, D. R.; Stegeman, J. J.; Williams, D. E. and Forlin, L. (1991). Immunochemical cross-reactivity of β - naphthoflavone-inducible cytochrome P-450 (P4501A1) in liver microsomes from different fish species and rat. *Fish Physiol. Biochem.* 9(1): 1-13

- Goodman, L. R.; Hansen, D. J.; Coppage, D. L.; Moore, J. C. and Matthews, E. (1979). Diazinon : Chronic toxicity to, and brain AChE inhibition in the sheepshead minnow, *Cyprinodon variegatus*. *Trans. Am. Fish Soc.* 108: 479-488
- Guengerich, F. B. and Liebler (1984). Enzymatic activation of chemicals to toxic metabolites. *Crit. Rev. Toxicol.* 14: 259-307
- Haasch, M. L.; Prince, R.; Wejksnora, P. J.; Cooper, K. R. and Lech, J. J. (1993). Caged and wild fish : Induction of hepatic cytochrome P-450 (CYP1A1) as an environmental biomonitor. *Environmental Toxicology and Chemistry* 12: 885-895
- Habig, C. and Di Giulio, R. T. (1991). Biochemical characteristics of cholinesterases in aquatic organisms. In : *Cholinesterase-inhibiting insecticides. Their impact on wildlife and the environment*. P. Mineau (Ed.), Elsevier, NY pp 234-243.
- Habig, C.; Di Giulio, R. T.; Nomeir, A. N. and Abou-Donia M. B. (1986). Comparative toxicity, cholinergic effects and tissue levels of S, S, S-tri-n-butyl phosphorothioate (DEFTM) to channel catfish (*Ictalurus punctatus*) and blue crabs (*Callinectes sapidus*). *Aquatic Toxicology* 9: 193-206
- Habig, C.; Di Giulio, R.T and Abou-Donia, M.B. (1988). Comparative properties of channel catfish (*Ictalurus punctatus*) and blue crab (*Callinectes sapidus*) AChE. *Comp. Biochem. Physiol.* C91(2): 293-300
- Haines, T. A. (1981). Effect of an aerial application of carbaryl on brook trout (*Salvelinus fontinalis*). *Bull. Environ. Contam. Toxicol.* 27: 534-542

- Harris, C.R. and Miles, J.R.W (1975). Pesticide residues in the Great Lake region of Canada. *Residue Rev.* 57: 27-29
- Heilmann, L. J.; Sheen, Y. Y.; Bigelow, S. W. and Nebert, D. W. (1988). Trout P-4501A1 : cDNA and deduced protein sequence, expression in liver and evolutionary significance. *DNA* 7(6): 379-387
- Henderson, C.; Pickering, Q. H. and Tarzwell, C. M. (1959). Toxicity of organic phosphorus and chlorinated hydrocarbon insecticides to fish. In: *Transactions of the second seminar on biological problems in water pollution*. April 20-24, 1959. US Public Health Service, Robert A. Taft Sanitary Engineering Center, CN Ohio.
- Hill, E. F. and Fleming, W. J. (1982). Anticholinesterase poisoning of birds : field monitoring and diagnosis of acute poisoning. *Environ. Toxicol. Chem.* 1: 27-38
- Hogan, J. W. and Knowles, C. O. (1972). Metabolism of diazinon by fish liver microsomes. *Bull. Environ. Contam. Toxicol.* 8(1): 61-64
- Johansen, R. E. and Hanstbarger, W. M. (1966). Handbook of insecticides. Colorado State University, Fort Collins, Colorado.
- Keizer, J.; D'Agostino, G. and Vittozzi, L. (1991). The importance of biotransformation in the toxicity of xenobiotics to fish. I. Toxicity and bioaccumulation of diazinon in guppy (*Poecilia reticulata*) and zebra fish (*Brachydanio rerio*). *Aquatic Toxicology* 21: 239-254.

- Kleinow, K. M.; Melancon, M. J. and Lech, J. J. (1987). Biotransformation and induction : Implications for toxicity, bioaccumulation and monitoring of environmental xenobiotics in fish. *Environmental Health Perspective* 71: 105-119
- Klotz, A. V.; Stegeman, J. J. and Walsh, C. (1983). An aryl hydrocarbon hydroxylating hepatic cytochrome P-450 from the marine fish *Stenotomus chrysops*. *Archives of Biochemistry and Biophysics* 226(2): 578-592
- Klotz, A. V.; Stegeman, J. J. and Walsh, C. (1984). An alternative 7-ethoxyresorufin O-deethylase activity assay : a continuous visible spectrophotometric method for measurement of cytochrome P-450 monooxygenase activity. *Analytical Biochemistry* 140: 138-145.
- Klotz, A. V.; Stegeman, J. J.; Woodin, B. R.; Snowberger, E. A.; Thomas, P. E. and Walsh, C. (1986). Cytochrome P-450 isozymes from the marine teleost *Stenotomus chrysops* : their roles in steroid hydroxylation and the influence of cytochrome b₅ . *Archives of Biochemistry and Biophysics* 249(2): 326-338.
- Kuhn, K. and Streit, B. (1994). Detecting sublethal effects of organophosphates by measuring acetylcholinesterase activity in *Gammarus*. *Bull. Environ. Contam. Toxicol.* 53: 398-404
- Lancaster, R. (1972). Inhibition of acetylcholinesterase in the brain and diaphragm of rats by a tertiary organophosphorous anticholinesterase and its quaternary analogue: *In vivo* and *in vitro* studies. *J. Neurochem.* 19: 2587-2597
- Le Bris, H.; Maffart, P.; Bocquene, G.; Buchet, V.; Galgani, F. and Blanc, G. (1995). Laboratory study on the effect of dichlorvos in two commercial bivalves. *Aquaculture*

138(1-4): 139-144.

Lech, J. J.; Vodcnik, M. J. and Elcombe, C. R. (1982). Induction of monooxygenase activity in fish. In : *Aquatic toxicology*, L.J Weber (Ed.) Raven Press, NY pp107-148

Levi, P. E.; Hollingworth, R. M. and Hodgson, E. (1988). Differences in oxidative dearylation and desulfuration of fenitrothion by cytochrome P-450 isoenzymes and in subsequent inhibition of monooxygenase activity. *Pestic. Biochem. Physiol.* 32: 224-231

Levine, S. L.; Oris, J. T. and Wissing, T. E. (1994). Comparison of P-4501A1 monooxygenase induction in gizzard shad (*Dorosoma cepedianum*) following intraperitoneal injection or continuous waterborne-exposure with benzo(a)pyrene : Temporal and dose-dependent studies. *Aquatic Toxicology* 30: 61-75.

Lockhart, W. L.; Metner, D. A. and Grift, N. (1973). Biochemical and residue studies of rainbow trout (*Salmo gairdneri*) following field and laboratory exposures to fenitrothion. *The Manitoba Entomologist* 7: 26-36

Lockhart, W. L.; Metner, D. A.; Ward, F. J. and Swanson, G. M. (1985). Population and cholinesterase responses in fish exposed to malathion sprays. *Pesticide Biochemistry and Physiology* 24: 12-18.

Lowry, O. H.; Rosebrough, N. J.; Farr, A. L. and Randall, R. J. (1951). Protein measurement with the Folin phenol reagent. *J. Biol. Chem.* 193: 265-275.

Ludke, J. L.; Elwood, F. H. and Dicter, M. P. (1975). Cholinesterase (ChE) response and related mortality among birds fed ChE inhibitors. *Archives of Environmental Contamination* 3(1): 1-21

- Macek, K. J.; Walsh, D. F.; Hogan, J. W. and Holz, D. D. (1972). Toxicity of the insecticide Dursban to fish and aquatic invertebrates in ponds. *Trans. Am. Fish Soc.* 101: 420-427.
- Main, A. R. (1964). Affinity and phosphorylation constants for the inhibition of esterases by organophosphates. *Science* 144: 992-993.
- Marshall, W. K. and Roberts, J. R. (1978). In: *Ecotoxicology of Chlorpyrifos*. National Research Council of Canada, Publication No. NRCC 16079.
- Martin, A. D.; Norman, G.; Stanley, P. I. and Westlake, G. E. (1981). Use of reactivation techniques for the differential diagnosis of organophosphorous and carbamate pesticide poisoning in birds. *Bull. Environ. Contam. Toxicol.* 26: 775-780
- Massoulie, J. (1980). The polymorphism of cholinesterases and its physiological significance. *TIBS* 6: 160-164
- Matsumura, F. (1975). In: *Toxicology of insecticides*, Plenum Press, NY. 142-157 pp.
- Matsumura, F. (1985). In: *Toxicology of insecticides*, second edition. Plenum Press, NY.
- Matsumura, F. and Hogendjik, C. J. (1964). The enzymatic degradation of parathion in organophosphate-susceptible and -resistant houseflies. *J. Agr. Food Chem.* 12: 447-453
- McEwen, F.L. and Stephenson, G.R (1979). In: *The use and significance of pesticides in the environment*. John Wiley and Sons NY 538 pp.

McKim, J. M.; Bradbury, S. P. and Niemi, G. J. (1987). Fish acute toxicity syndromes and their use in the QSAR approach to hazard assessment. *Environ. Health Perspectives* 71: 171-186

Mitchell, J. R. and Horning, M. G. (1984). In: *Drug metabolism and drug toxicity*. Raven Press, NY. 436 pp

Monod, G.; Boudry, M. and Gillet, C. (1996). Biotransformation enzymes and their induction by β -naphthoflavone during embryolarval development in salmonid species. *Comp. Biochem. Physiol.* 114C(1): 45-50.

Morgan, M. J.; Fancey, L. L. and Kiceniuk, J. W. (1990). Response and recovery of brain acetylcholinesterase activity in atlantic salmon (*Salmo salar*) exposed to fenitrothion. *Can. J. fish. Aquat. Sci.* 47: 1652-1654.

Moulton, C. A.; Fleming, W. J. and Purnell, C. E. (1996). Effects of two cholinesterase-inhibiting pesticides on freshwater mussels. *Environmental Toxicology and Chemistry* 15(2): 131-137

Mount, M. E. and Oehme, F. W. (1981). Brain cholinesterase activity in healthy cattle, swine and sheep and in cattle and sheep exposed to cholinesterase-inhibiting insecticides. *Am. J. Vet. Res.* 42: 1345-1350

Murphy, S. D. (1980). Pesticides. In: *Toxicology, the basic science of poison*. J. Doull, D.C Klassen and M.O Amdur (Eds.) 2nd Edition. Macmillon Publishing Co. NY pp 357-408.

- Murphy, D. L. and Gooch, J. W. (1997). EROD and CYP1A protein in channel catfish (*Ictalurus punctatus*) from an urban estuary relative to that in benzo(a)pyrene-exposed hatchery specimens. *Environmental Pollution* 95(2): 235-239
- Murty, A. S. (1986). Sublethal effects of pesticides on fish in: *Toxicity of pesticides to fish*. Volume II. CRC Press, Inc. Florida. 55-100 pp.
- Namba, T. (1971). Cholinesterase inhibition by organophosphorus compounds and its clinical effects. *Bull. Wld. Hlth. Org.* 44: 289-307
- Nebert, D. W. and Gonzales, F. J. (1987). P450 genes: Structure, evolution and regulation. *Ann. Rev. Biochem.* 56: 945-993
- Nebert, D. W.; Nelson, D. R.; Adesnik, M.; Coon, M. J.; Estabrook, R. W.; Gonzalez, F. J.; Guengrich, F. P.; Gunsalus, I. C.; Johnson, E. F.; Kemper, B.; Levin, W.; Phillips, I. A.; Sato, R. and Waterman, M. R. (1989). The P450 superfamily : updated listing of all genes and recommended nomenclature for the chromosomal loci. *DNA* 8(1): 1-13
- Nelson, S. D. (1982). Metabolic activation and drug toxicity. *J. Med. Chem.* 25: 753-765
- O'Brien, R. D. (1960). In: *Toxic phosphorus esters : Chemistry, metabolism and biological effects*. Academic Press, New York, NY USA
- O'Brien, R. D. (1967). In: *Insecticides : Action and metabolism*. Academic Press, NY. pp 332

- O'Brien, R. D. (1976). In: *Insecticide Biochemistry and Physiology*, Acetylcholinesterase and its Inhibition. C. F. Wilkinson (Ed.), Academic Press, New York and London. 271-296 pp
- Olson, D. L. and Christensen, G. M. (1980). Effects of water pollutants and other chemicals on fish AChE (*in vitro*). *Environmental Research* 21: 327-335
- Omura, T. and Sato, R. (1964). The carbon monoxide-binding pigment of liver microsomes. *The Journal of Biological Chemistry* 239(7): 2379-2385
- Palace, V. P.; Klaverkamp, J. F.; Lockhart, W. L.; Metner, D. A.; Muir, D. C. G. and Brown, S. B. (1996). Mixed-function oxidase enzyme activity and oxidative stress in Lake Trout (*Salvelinus namaycush*) exposed to 3, 3', 4, 4', 5-pentachlorobiphenyl (PCB-126). *Environmental Toxicology and Chemistry* 15(6): 955-960
- Payne, J. F. (1976). Field evaluation of benzopyrene hydroxylase induction as a monitor for marine petroleum pollution. *Science* 191: 945-946
- Payne, J. F. (1984). Mixed function oxygenases in biological monitoring prog:review of potential usage in different phyla of aquatic animals. In: *Ecotoxicological testing for the marine environment*. Persoone, G.; Jasper, E and Claus, C. (Eds.) Belgium. pp 625-655.
- Payne, J. F.; Fancey, L. L.; Rahimtula, A. D. and Porter, E. L. (1987). Review and perspective on the use on mixed-function oxygenase enzymes in biological monitoring. *Comp. Biochem. Physiol.* 86C: 233-245

- Pesonen, M.; Celander, M.; Forlin, L. and Andersson, T. (1987). Comparison of xenobiotic biotransformation enzymes in kidney and liver of rainbow trout (*Salmo gairdneri*). *Toxicology and Applied Pharmacology* 91: 75-84.
- Post, G. W. (1987). In: *Textbook of Fish Health*. T.F.H Publications, Neptune City NJ US 263-266 pp.
- Post, G. and Leasure, R. A. (1974). Sublethal effect of malathion to three salmonid species. *Bull. Environ. Contam. Toxicol.* 12: 312-319
- Rabeni, C. F. and Stanley, J. G. (1979). Operational spraying of acephate to suppress spruce budworm has minor effects on stream fishes and invertebrates. *Bull. Environ. Contam. Toxicol.* 23: 327-334
- Rath, S. and Misra, B. N. (1981). Toxicological effects of dichlorvos (DDVP) on brain and liver acetylcholinesterase (AChE) activity of tilapia mossambica, Peters. *Toxicology* 19: 239-245
- Reddy, M. S. and Rao, K. V. R. (1988). *In vivo* recovery of AChE activity from phosphamidon and methyparathion induced inhibition in the nervous tissue of penaeid prawn (*Metapenaeus monoceros*). *Bull. Environ. Contam. Toxicol.* 40: 752-758.
- Richmonds, C. R. and Dutta, H. M. (1992). Effects of malathion on the brain AChE activity of bluegill sunfish *Lepomis macrochirus*. *Bull. Environ. Contam. Toxicol.* 49: 431-435.
- Sahib, I. K. A. and Rao, K. V. R. (1980). Correlation between subacute toxicity of malathion and AChE inhibition in the tissues of the teleost *Tilapia mossambica*, *Bull.*

Environ. Contam. Toxicol. 24: 711-718

Sander H. O.; Walsh, D. F. and Campbell, R. S. (1981). Abate : Effects of organophosphate insecticide on blue gills and invertebrates in ponds. Technical paper 104, US fish and wildlife service. 6 pp

Sharom, M. S.; Miles, J. R. W.; Harris, C. R. and McEwen, F. L (1980). Persistence of 12 insecticides in water. *Water Research* 14: 1089-1093.

Smith, G. J. (1987). In: *Pesticide use and toxicology in relation to wildlife : Organophosphorous and carbamate compounds*, US Fish Wild. Serv. Resour. Publi. 170. pp 171

Smith, T. E. and Usdin, E., (1966). Formation of nonreactivable isopropylmethylphosphonofluoridate-inhibited acetylcholinesterase. *Biochem.* 9: 2914-2918

Smith, G. N.; Watson, B. S. and Fischer, F. S. (1966). Metabolism of [¹⁴C] O, O-diethyl O-(3, 5, 6 - trichloro-2-pyridyl) phosphorothioate (Dursban) in fish. *J. Econ. Entomol.* 59: 1464-1475

Soderlund, D. M.; Abdel-Aal, Y. A. I. and Helmuth, D. W. (1982). Selective inhibition of separate esterases in rat and mouse liver microsomes hydrolyzing malathion, transpermethrin and cis-permethrin. *Pestic. Biochem. Physiol.* 17: 162-169

Sofian-Azirun, M. and Ahmad, S. T. A. (1995). Acetylcholinesterase activity and sensitivity to insecticides in resistant and susceptible strains of diamondback moth,

Plutella xylostella (L.) (Lepidoptera: Plutellidae). *Malaysian Journal of Science* 16A: 1-6.

Strauss, D. L. and Chambers, J. E. (1995). Inhibition of AChE and aliesterases of fingerling channel catfish by chlorpyrifos, parathion and S, S, S-tributyl phosphorotrithioate (DEFTM). *Aquatic Toxicology* 33: 311-324.

Stegeman, J. J.; Klotz, A. V.; Woodin, B. R. and Pajor, A. M. (1981). Induction of hepatic cytochrome P-450 in fish and the indication of environmental induction in scup (*Stenotomus chrysops*). *Aquatic Toxicology* 1: 197-212.

Stegeman, J. J. (1981). Polynuclear aromatic hydrocarbons and their metabolism in the marine environment. In : *Polycyclic hydrocarbons and cancer*. Gelboin, H. V., Ts'o, P. O. P. (Eds.). New York, Academic Press. pp: 1-60

Stegeman, J. J.; Woodin, B. R.; Singh, H.; Oleksiak, M. F. and Celander, M. (1997). Cytochromes P-450 (CYP) in tropical fishes : catalytic activities, expression of multiple CYP proteins and high levels of microsomal P-450 in liver of fishes from Bermuda. *Comp. Biochem. Physiol.* 116(C): 61-75

Stegeman, J. J. (1993). Cytochrome P-450 forms in fish. In: *Handbook of experimental pharmacology*. Schenkman, J. B. and Greim, H. (Eds.). Cytochrome P-450, vol. 105. Berlin: Springer-Verlag. pp 279-291

Stegeman, J. J. and Hanh, M. (1994). Biochemistry and molecular biology of monooxygenases : current perspectives on forms, functions, and regulation of cytochrome P-450 in aquatic species. In: *Aquatic toxicology. Molecular, biochemical*

and cellular perspectives. Chapter 3, Baco Raton : Lewis Publishers. 87-206.

Stegeman, J. J. and Kloepper-Sams, P. J. (1987). Cytochrome P-450 isozymes and monooxygenase activity in aquatic animals. *Environment Health Perspective* 71: 87-95

Stegeman, J. J. and Lech, J. J. (1991). Cytochrome P-450 systems in aquatic species : carcinogen metabolism and biomarkers for carcinogen and pollutant exposure. *Environ. Health Persp.* 90: 101-109.

Sterba, G. (1962). In: *Freshwater fishes of the world*. Vista Books. London. 777-804.

Stickel, W. H. (1975). Some effects of pollutants in terrestrial ecosystems in: *Ecological Toxicology Research*. A.D. McIntyre and C. F. Mills (Eds). Plenum Publishing Company, NY. 25-74 pp

Sulaiman, A. H.; Abdullah, A. B. and Ahmad, S. K. (1989). Toxicity of malathion to red tilapia (hybrid mossambica x tilapia nilotica) : behavioural, histopathological and antiChE studies. *Malays. Appl. Biol.* 18(2): 163-170

Sultatos, L. G. and Murphy, S. D. (1983). Kinetic analyses of the microsomal biotransformation of the phosphorothioate insecticides chlorpyrifos and parathion. *Fundam. Appl. Toxicol.* 3: 16-21

Szabo, A.; Nemcsok, J.; Asztalos, B.; Rakonczay, Z.; Kasa, P. and Le Huu Hieu (1992). The effects of pesticides on carp (*Cyprinus carpio L.*). AChE and its biochemical characterization. *Ecotoxicology and Environmental Safety* 23: 39-45

Tagatz, M. E.; Bothwick, P. W.; Cook, G. H. and Coppage, D. L. (1974). Effects of ground applications of malathion on salt-marsh environments in northwestern Florida. *Mosquito News* 34(3): 309-315

Tan, C.E.; Chong, B.J.; Sicar, H. K. and Moulton, T. P (1973). A report on paddy and paddy field fish production in Krian, Perak. Ministry of agriculture and fisheries, Malaysia, Kuala Lumpur.

Tate, L. G. (1988). Characterization of phase I and phase II drug metabolism and the effect of β -naphthoflavone in the liver and posterior kidney of the channel catfish, *Ictalurus punctatus*. *Arch. Environ. Contam. Toxicol.* 17: 325-332

Thangnipon, W.; Luangpaiboon, P. and Chinabut, S. (1995). Effects of the organophosphate insecticide, monocrotophos on acetylcholinesterase activity in the Nile tilapia fish (*Oreochromis niloticus*) brain. *Neurochemical Research* 20(5): 587-591.

Thirugnanam, M. and Forgash, A. J. (1975). Environmental impact of mosquito pesticides : Influence of fementos on the brain AChE of killifish. *Environ. Physiol. Biochem.* 5: 451-459

Thirugnanam, M. and Forgash, A. J. (1977). Environmental impact of mosquito pesticides : Toxicity and antiChE activity of chlorpyrifos to fish in a salt marsh habitat. *Archives of Environmental Contamination and Toxicology* 5: 415-425

Thomson, W. T. (1982). In: *Agriculture chemicals*. Vols. 1-4. Thomson Publishing, Fresno, Calif.

- Van der Wel, H. and Welling, W. (1989). Inhibition of AChE in guppies (*Poecilia reticulata*) by chlorpyrifos at sublethal concentrations : methodological aspects. *Ecotoxicology and environmental safety* 17: 205-215
- Varanasi, U. (1989). In: *Metabolism of polycyclic aromatic h/carbons in the aquatic environment*. CRC Press, Boca Raton, Florida.
- Vignier, V.; Vandermeulen, J. H. and Mossman, D. (1996). Assay conditions and basal activity of CYP1A1-dependent mixed function oxidase in parr and smolt of atlantic salmon (*Salmo salar*). *Comp. Biochem. Physiol.* 113C(3): 325-330.
- Vindimian, E. and Garric, J. (1989). Freshwater fish cytochrome P-450-dependent enzymatic activities : a chemical pollution indicator. *Ecotox. Environ. Safety* 18: 277-285
- Vindimian, E.; Namour, P.; Migeon, B. and Garric, J. (1991). *In situ* pollution induced cytochrome P-450 activity of freshwater fish : barbel (*Barbus barbus*), chub (*Leuciscus cephalus*) and nase (*chondrostoma nasus*). *Aquatic Toxicology* 21: 255-266.
- Wang, C. and Murphy, S. D. (1982). Kinetic analysis of species difference in AChE sensitivity to organophosphate insecticides. *Toxicology and Applied Pharmacology* 66: 409-419
- Weiss, C. M. (1958). The determination of cholinesterase in the brain tissue of three species of fresh water fish and its inactivation *in vivo*. *Ecology* 39: 194-199.
- Weiss, C. M. (1959). Response of fish to sub-lethal exposures of organic phosphorus

insecticides. *Sewage and Industrial Wastes*. 31(5): 580-593.

Weiss, C. M. (1961). Physiological effect of organic phosphorous insecticides on several species of fish. *Trans. Am. Fish Soc.* 90: 143-152

Weiss, C. M. and Gakstatter, J. H. (1964). Detection of pesticides in water by biochemical assay. *Journal of the Water Pollution Control Federation*. 36(2): 240-253

Whitehouse, L. W. and Ecobichon, D. J. (1975). Paraoxon formation and hydrolysis by mammalian liver. *Pestic. Biochem. Physiol.* 5: 314-332.

Whittaker, V.P. (1951). Specificity, mode of action and distribution of cholinesterases. *Physiol. Rev.* 31: 312-343

Wirgin, I. I.; Kreamer, G. L.; Grunwald, C.; Squibb, K. and Garte, S. J. (1992). Effects of prior exposure history on cytochrome P-4501A mRNA induction by PCB congener 77 in Atlantic tomcod. *Mar. Environ. Res.* 34: 103-108

Williams, D. E. and Buhler, D. R. (1982). Purification of cytochrome P-448 from β - naphthoflavone - treated rainbow trout. *Biochimica et Biophysica Acta* 717: 398-404

Williams, D. E. and Buhler, D. R. (1983). Comparative properties of purified cytochrome P-448 from β - naphthoflavone-treated rats and rainbow trout. *Comp. Biochem. Physiol.* 75C: 25-32

Williams, D. E. and Buhler, D. R. (1984). Benzo(α)pyrene - hydroxylase catalyzed by

purified isozymes of cytochrome P-450 from β - naphthoflavone-fed rainbow trout. *Biochemical Pharmacology* 33(23): 3743-3753

Williams, R. T. (1959). In: *Detoxication mechanism*, 2nd Edition, Wiley, NY

Williams, A. K. and Sova, C. R. (1966). AChE levels in brains of fishes from polluted waters. *Bull. Environ. Contam. Toxicol.* 1: 198-204

Wilson, I. B. and Bergmann, F. (1950). Studies on cholinesterase VII. The active surface of acetylcholine esterase derived from effects of pH on inhibitors. *J. Biol. Chem.* 185: 479-489

Zhang, Y. S.; Andersson, T. and Forlin, L. (1990). Induction of hepatic xenobiotic biotransformation enzymes in rainbow trout by β -naphthoflavone. Time course studies. *Comp. Biochem. Physiol.* 95B(2): 247-253.

Zinkl, J. G.; Roberts, R. B.; Henry, C. J. and Lenhart, D. J. (1980). Inhibition of brain cholinesterase activity in forest birds and squirrels exposed to aerially applied acephate. *Bull. Environ. Contam. Toxicol.* 24: 676-683

Zinkl, J. G., Shea, P. J., Nakamoto, R. J. and Callman, J. (1987). Technical and biological considerations for the analysis of brain cholinesterase of rainbow trout. *Transaction of the American Fisheries Society* 116: 570-573

Zinkl, J.G.; Lockhart, W.L.; Kenny, S.A. and Ward, F.J. (1991). The effects of cholinesterase inhibiting insecticides on fish. In: *Cholinesterase-inhibiting insecticides*.

Their impact on wildlife and the environment. P. Mineau (Ed.), pp 234-243