CURRICULUM VITAE

Karl F. Ehrlich, Ph.D

Languages: English and French
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Education:

Master Class, Fine Arts and Science, Woody Omens, past president A.S.C (Amer. Soc. Cinematographers). 2016-2018

Ph. D. Biology, University of Stirling, Stirling, Scotland, 1972.
Thesis Title: Morphometrical, behavioural and chemical changes during growth and starvation of herring and plaice larvae.

M. Sc., Biology, California State University, San Diego, California, 1969.
Thesis Title: The effect of some environmental factors upon the incubation and rearing of grunion, *Leuresthes tenuis* (Ayers).

B. A., Zoology, University of California, Los Angeles, California, 1967.

Forestry Summer Program, University of California Berkeley, Quincy, California. 1965.

Employment (reverse chronological order):

2017 –
Ehrlich Photographie: Oft unseen aspects of nature – light, form and colour

January 1984 - 2017
IET-Aquaresearch Ltd / IET-Aquarecherche Ltée, P.O. Box 2680, North Hatley, QC J0B 2C0
Position: Vice-President,
Duties:
- Aquacultural systems design, consultation and sales;
- Research and development in water recycling systems for aquatic plants and animal production;
- Wastewater treatment systems design with ecological approach;
- Development of ecological filtration systems,
- Development of onsite microbial growing systems,
- Aquatic environmental studies and management,
- Larval fish nutrition studies and consultation;
- Water body restoration;
- Research and development in bioaugmentation for industrial & municipal wastewater;
- Sales and research contracts in wastewater purification and bioremediation;
- Production and marketing of environmental bioaugmentation system;
- Consultant aquatic ecology,
- Professor classes, for wastewater operators, on applied microbial ecology and wastewater treatment.

January 1982 -
Le Centre de Recherche Environnementale, C.P. 375, North Hatley, QC J0B 2C0
Position: Director
Duties:
- Aeroponic/hydroponic system design, consultation and sales;
- Aeroponic plant production and energy evaluation of solar assisted greenhouse;
- Smallmouth bass production, rearing of walleye, muskellunge: including food chain culture of bacteria, algae, rotifers, brine shrimp amongst other species …

August 1981 - 1990
Departement de biologie, Université de Sherbrooke, Sherbrooke, QC J1K 2R1
Position: Adj. Prof.
Duties:
- Teach laboratory and theoretical courses in ichthyology, limnology and aquatic ecology;
- Co-director Master's student, thesis - Sélection de température et influence d'un gradient thermique sur la croissance de trois espèces de poissons, *Salvelinus fontinalis*, *Semotilus atromaculatus* et *Micropterus dolomieui*.
- Director Doctorate's student, thesis- Effects of bacterial augmentation on the growth of aquatic plant, *Myriophyllum spicatum*.

January 1981 - May 1981
MacLaren-Plansearch (Lavalin), 1000 Windmill Road, Dartmouth, Nova Scotia B3B 1L7
Position: Senior Biologist
Duties:
- Provide leadership and guidance to company biologists;
- Aid in proposal writing particularly to expand company business in areas of aquaculture, alternate energy, bioassays and fisheries.

April: 1976 - September 1980
Lockheed Environmental Sciences, 6350 Yarrow Drive, Suite A, Carlsbad, California 92008
Position: Group Scientist
Duties: 1978 - 1980.
- Design bioassay and environmental simulation laboratories and sea water systems;
- Work with team of research biologists and chemists to develop sublethal multifactor stress bioassays in terms of physiological and behavioural responses and bioaccumulation, fates and effects of trace metals on the early life history of fishes and other organisms on different feeding regimes;
- Comparison of high volume pump and conventional nets for collecting ichthyoplankton within power plants;
- Spawning and culture of fishes for experimentation;
- Design of following research programs:
  -Assess effects of discharge from Ocean Thermal Energy Conversion (OTEC) operations, U.S. Dept Energy;
  -Determine distribution of egg and larval fishes as affected by power plant effluents, selected utility companies;
  -Assess sublethal effects of increasing water hardness on fish populations in Pyramid Lake, Nevada, U.S. Bureau Indian Affairs;

-Assess effects of dredge spoils on community of organisms, U.S. Army Corps of Engineers.

1976 - 1978.

Plan and design thermal effects laboratory and studies. Direct and coordinate research of 10 scientists and technicians on project designed to predict effects, on biotic community, of thermal effluent from a nuclear power plant. Experimentation was conducted on selected species of fauna and flora throughout ontogenesis. Personally developed behavioral and physiological methods were used to assess various regimes of temperature and light. Environmental simulation systems included tide, wave, surge and spray.

Specific tasks included:

- Effects of temperature and light on growth, survival and chlorophyll and water content of the red algae, *Iridaea flaccida* ;
- Effects of temperature and light on spore germination and initial development of the brown algae, *Nereocystis leutkeana* ;
- Effects of acclimaltion temperature and tidal cycle on temperature tolerance of black abalone (*Haliotis cracherodii*) - Effects of temperature on larval development following induced spawning.
- Temperature tolerance and temperature - specific long-term growth of black surfperch (*Embiotoca jacksoni)* and blue rockfish (*Sebastes mystinus*).
- Temperature selection and avoidance of the above mentioned fishes and abalone.

Member Steering Committee Lockheed Environmental Sciences.

October 1973

Marine Ecology Laboratory, Bedford Institute Oceanography, Dartmouth, Nova Scotia B3B 1L7

Duties: • Consulting and lecturing on fish larvae and their culturing requirements with particular reference to herring.

October 1973 - April 1976

Biology Dept, Occidental College, 1600 Campus Rd, Los Angeles, California 90041.

Position: Research Associate and Lecturer

Duties: • Designed and directed laboratory investigation, which was coordinated with field studies to assess influence of thermal discharge. Work concerned physiological and behavioral effects of temperature on eggs, larvae, juvenile and adult fishes. Some aspects of the research pertained to temperature selection by larval to adult fishes, rates, conversion ratios and growth and survival rates. Teaching responsibilities included lecturing on fish reproduction, larval fish biology and marine food chains as parts of courses on oceanography and ichthyology.

September 1972 - July 1973

Dunstaffnage Marine Research Laboratory, Scottish Marine Biological Assn, Oban Argyll PA34 4AD, Scotland, U. K.

Duties: • Compared chemical and morphological differences between laboratory reared and wild larvae and O-group herring and plaice. This work involved a considerable amount of time at sea on larval surveys to the west of Scotland, on the Clyde Estuary and on the North Sea.
• Helped organize the International Symposium on the Early Life History of Fish, which was held in Oban in May 1973.

Publications and Reports:

Ehrlich, K.F. & D.A. Farris. 1970. Effect of temperature on number of myomeres in newly hatched grunion (*Leuresthes tenuis*). Copeia, 1970: 774-775.

----1971. Some influences of temperature on the development of the grunion *Leuresthes tenuis* (Ayres). Calif. Fish and Game, 57: 58-68.

Ehrlich, K. F. 1971. Growth, nutrition and rearing of fish larvae. Proceed. Challenger Soc IV, (4).

Ehrlich, K. F. & D. A. Farris. 1972. Some influences of temperature on the rearing of the grunion *Leuresthes tenuis*, an atherine fish. Mar. Biol., 12: 267-271

Balbontin, F., S.S. DeSilva & K.F. Ehrlich. 1973. A comparative study of anatomical and chemical characteristics of reared and wild herring. Aquacult., 2: 217-240.

Ehrlich, K.F. 1974. Chemical changes during growth and starvation of larval *Pleuronectes platessa*. Mar. Biol., 24: 39-48.

----1974. Chemical changes during the growth and starvation of herring larvae. In: The Early Life History of Fish, J.H.S. Blaxter, ed. p. 301-323. Springer-Verlag, Berlin.

Blaxter, J.H.S. & K.F. Ehrlich. 1974. Changes in behaviour during starvation of herring and plaice larvae. In: The Early Life History of Fish. J.H.S. Blaxter, ed. p. 575-588. Springer-Verlang, Berlin.

Ehrlich, K.F. 1975. A preliminary study of the chemical composition of sea-caught larval herring and plaice. Comp. Biochem. Physiol. 51B: 25-28.

---- 1975. Laboratory investigations. In: Effects of Thermal Effluent from Southern California Edison's Redondo Beach Steam Generating Plant on the Warm Temperate Fish Fauna of King Harbor Marina, p. 88-111. J. S. Stephens, ed.

---- 1976. Laboratory study report for Phase II. In: Effects of Thermal Effluent from Southern California Edison's Redondo Beach Steam Generating Plant on the Warm Temperate Fish Fauna of King Harbor Marina, p. 1-47. J.S. Stephens, ed.

Ehrlich, K.F., J.H.S. Blaxter & R. Pemberton. l976. Morphological and histological changes during the growth and starvation of herring and plaice larvae. Mar. Biol., 35: 105-118.

Ehrlich, K.F. 1977. Inhibited hatching success of marine fish eggs by power plant effluent. Mar. Polln Bull., 8: 228-229.

Ehrlich, K.F. & S. B. Robertson. 1977. Literature review of thermal effects on marine zooplankton. In: Heat Treatment Plankton Mortality Studies, San Onofre Nuclear Generating Station Final Report. Lockheed Center for Marine Research.

Ehrlich, K. F., G. E. McGowen & G. Muszynski. 1978. Temperature selection by young topsmelt: Laboratory and field investigations. In: Energy and Environmental Stress in Aquatic Systems. J.H. Thorp & J.W. Gibbons, eds. p. 522-533. Tech. Info. Cntr, U.S. Dept. Energy.

Ehrlich, K. F., J. M. Hood, G. Muszynski & G. E. McGowen. 1979. Thermal behavioral responses of selected California littoral fishes. Fishery Bull., 76: 837-849

Ehrlich, K.F., J.S. Stephens, G. Muszynski & J. M. Hood. 1979. Thermal behavioral responses of speckled sanddabs (*Citharichthys stigmaeus*): laboratory and field investigations. Fishery Bull., 76: 867-872.

Leithiser, R. M., K.F. Ehrlich & A.B. Thum. 1979. Comparison of a high volume pump and conventional plankton nets for collecting fish larvae entrained in power plant cooling systems. J. Fish. Res. Bd Can., 36: 81-84.

Thum, A.B., Ehrlich, K.F., Newton III, F.C. and R.F. Srna, 1979. Ocean sediment study. Independent Research & Development, Department of Defense Project 80011604, Lockheed Aircraft Service Co.; Ontario, California. 73 pp.

Cohen, R.H., Newton III, F.C., Thum, A.B. and K.F. Ehrlich, 1980. Bioassay: A computerized approach. In: Proceedings of Oceans '80. IEEE Council on Ocean Engineering, 489 503.

Ehrlich, K.F., Srna, R.F., Thum, A.B. and F.C. Newton III, 1980. Marine fouling prevention program. Independent Research & Development, Department of Defense Project 80011604, Lockheed Aircraft Service Co.; Ontario, California. 73 pp.

Ehrlich, K.F. 1980. Design of computer controlled seawater laboratories. In: Marine Fouling Prevention - Environmental Effects. Lockheed Environmental Sciences Independent Research & Development, Carlsbad, California.

Ehrlich, K.F. & G. Muszynski. 1981. The relationship between temperature - specific yolk utilization and temperature selection of larval grunion. In: Rapp. P.-v. Reun. Cons. Int. Explor. Mer, 178: 312-313.

Ehrlich, K. F. & G. Muszynski. 1982. Effects of temperature on interactions of physiological and behavioral capacities of larval grunion adaptations to the planktonic environment. J. Exp. Mar. Biol. Ecol., 60: 223-244.

Ehrlich, K.F. & M.-C. Cantin. 1983. The aeroponic production of lettuce in Quebec during winter in a solar assisted greenhouse. In: Proceed. National Agri. Plastics Congr., O. Wells, ed. p. 88-97. Univ. New Hampshire.

Ehrlich, K.F. 1984. Canada needs water recycling systems. / La nécessité de systèmes de recyclage d'eau pour le Canada. Can. Aquacult. Bull., Sept.: 16-18.

Ehrlich, K. F. 1985. L'importance de la diversification en aquaculture et le rôle des systèmes en circuit fermé. *In*: L'Aquaculture au Québec. A.Q.U.A. C.P.A.Q. 8 pp.

Ehrlich, K. F. 1986. Feeding Fish Larvae - A Guide for Aquacultural Production. Zeigler/Rangen.

Ehrlich, K.F., C. Forrest & M.-C. Cantin. 1986. Le rôle des systèmes en circuit fermé et de la biotechnologie dans la production des non-salmonidés au Québec: trois cas les achigans à petite bouche, les dorés et les maskinongés. In: Les perspectives d'avenir en aquiculture, R. Péloquin (prés.) p.73-79. Colloque sur l'aquiculture, C.P.A.Q., M.A.P.A.Q., St-Hyacinthe.

Ehrlich, K.F. & M. Benzine. 1987. La Biotechnologie pour améliorer la production agro-alimentaire, traiter les eaux usées et protéger l'environnement. In: Les Substances Toxiques de l'Environnement à l'Homme. (C. Lebel & H. Varin eds). p. 468-477. 10 e Congrès Assoc. Biol. QC.

Leroux, C. & K. F. Ehrlich. 1987. Accélération de la croissance des ombles de fontaine (*Salvelinus fontinalis*) par l'exploitation d'une diversité thermique. Proc. Ann. Meeting Aquacult. Assoc. Canada 1: 48-49.

Ehrlich, K. F., M.-C. Cantin & F. Horsfall. 1987. Bioaugmentation: Biotechnology to improve aquacultural production and protect the environment. *In*:: Proc. Ann. Meeting Aquacult. Assoc. Canada 1: 80-81.

Motnikar, S., K. F. Ehrlich & M.-C. Cantin. 1987. Growth and Broodstock production of Muskellunge (*Esox masquinongy*) reared on artificial diets in a water recirculation system. *In*:: Proc. Ann. Meeting Aquacult. Assoc. Canada 1: 64-65.

Ehrlich, K.F., M-C. Cantin & F.L. Horsfall. 1989. Bioaugmentation: Biotechnology for improved Aquacultural Production and Environmental Protection. *In*:: Aquaculture

Engineering: Technologies for the Future. K. Murray, ed., Inst. Chem. Eng., U.K. Symp. Ser. no 11, pp. 329-341.

Ehrlich, K. F. & M.-C. Cantin, M. Rust & B. Grant. 1989. Growth and survival of larval and post-larval smallmouth bass fed AP-100 and/or *Artemia* nauplii and feed-specific production costs. J. World Aquacult. Soc. 20(1): 1-6.

Cantin, M.-C. & K.F. Ehrlich. 1989. Etude bibliographique sur l'élevage du grande corégone, de l'omble chevalier et du bar rayé. M.A.P.A.Q.

Cantin, M.-C. & K.F. Ehrlich. 1989. Etude bibliographique sur l'élevage du doré jaune, de la carpe allemande et de l'achigan à petite bouche. M.A.P.A.Q.

Ehrlich, K. F. & M.-C. Cantin. 1989. Status and trends for the aquaculture industry: Market implications for Provesta Yeast products. Provesta Corp.

Ehrlich, K. F. & M.-C. Cantin. 1989. Evaluation of Provesta yeast products on growth and survival of larval walleye, smallmouth bass and goldfish. Provesta Corp.

Ehrlich, K. F., M.-C. Cantin & A. Turcotte. 1991. A diagnostic and ecological approach to the purification of sewage, toxic substances and water bodies. In. Ecological Engineering for Wastewater Treatment.

Ehrlich, K.F. & M.-C. Cantin. 1997. Aquaculture and environmental biotechnology. Canadian Aquaculture 1997 Directory. Contact Canada. pp. 44-48.

Ehrlich, K.F. & M.-C. Cantin. 1997. Advances in environmental biotechnology. Canadian Biotechnology 1997 Directory. Contact Canada. pp. 70-74.

Other Scientific Presentations and Activities:

1970. Invited speaker, Challenger Society, Oban, Argyll, Scotland. Subject: Growth, nutrition and rearing of fish larvae.
1970. Participant, Symposium on Stock and Recruitment, Aarhus, Denmark.
1972. Invited participant, Marine Biochemistry Discussion Group, Aberdeen, Scotland.
1972. Invited participant, British Mariculture Discussion Group, Menai Bridge, Wales.
1972. Invited seminar speaker, National Marine Fisheries Service, La Jolla, Calif. Subject: Chemical and morphological changes during growth and starvation of herring and plaice larvae.
1973. Invited speaker, Symposium on Early Life History of Fish, Oban, Argyll, Scotland. Subjects: • Chemical changes during growth and starvation of herring larvae. •With J.H.S. Blaxter, Changes in behavior during starvation of herring and plaice larvae.
1973. Invited seminar speaker, Marine Ecology laboratory, Dartmouth, Nova Scotia. Subject: Chemical and morphological changes during growth and starvation of herring larvae.
1974. Participant, Symposium on Animal Navigation, California State University, San Diego, California.

1974. Invited seminar speaker, California State University, San Diego, California. Subject: Chemical, morphological and behavioral changes during growth and starvation of herring larvae.
1975. Invited member discussion group, First Annual Fisheries Science Symposium, Autonomous University of Baja California, Ensenada, Baja California, Mexico. Anchovy population management.
1975. Invited seminar speaker, University of California, Santa Barbara, California. Subject: Chemical, morphological and behavioural changes during growth and starvation of herring larvae.
1975. Speaker, CalCOFI Conference, La Jolla, California. Subject: Preliminary observations of the preferred temperature of larval grunion (*Leuresthes tenuis*) during growth and starvation.
1976. Invited seminar speaker, Southern California Coastal Water Research Project, El Segundo, California. Subject: Effects of temperature on growth efficiency and thermal preference of larval *Leuresthes tenuis*. A multidisciplinary approach to the study of larval fish ecology and distribution.
1976. Participant, CalCOFI Conference, Indian Wells, California.
1977. Participant, Symposium on Assessing the Effects of Power-Plant Induced Mortality of Fish Populations.
1977. Speaker, Savannah River Ecology Laboratory - Symposium 1977. Subject: Behavioral responses to temperature by larval and juvenile topsmelt: laboratory and field investigations.
1978. Participant, Symposium on Microcosms in Ecological Research, Augusta, Georgia.
1979. Participant, ASTM meetings on aquatic toxicology assessment methodology, San Diego, California.
1979. Invited Speaker, Symposium on Early Life History of Fish, Woods Hole, Mass. Subject: The relationship between temperature-specific yolk utilisation and temperature selection of larval grunion.
1979. Participant, Naval Underwater Systems, Disposal Area Monitoring System Symposium, Newport, Rhode Island.
1979. Participant, NATO - Advanced Study Institute on Environmental Physiology of Fishes, Lennoxville, Quebec, Canada.
1979. Invited participant, California Fish and Game. Ecological Evaluation of Proposed Discharge of Dredged Material Into Ocean and Inland Waters, Oakland, California.
1980. Seminar Speaker, McGill University, Montreal, Quebec. Subject: Effects of temperature on interactions of physiological and behavioral capacities of larval grunion: adaptations to the planktonic environment.
1983. Invited speaker, EPCOT Center, Lake Buena Vista, Florida. Subject: Integration of aquaculture with aeroponic lettuce production.
1983. Participant, Colloque sur la salmoniculture, Québec, P.Q.
1983. Speaker, 17th National Agricultural Plastics Congress, Manchester, New Hampshire. Subject: Aeroponic production of lettuce during winter in a solar assisted greenhouse.
1983 Invited participant, National Aquaculture Conference, St. Andrews, New Brunswick.
1983. Board of Directors, Aquaculture Association of Canada.
1984. Participant, World Mariculture Society, Vancouver, B.C.
1984. Invited participant, Colloque sur l'avenir de l'aquaculture au Québec.

1984. Invited speaker. Festival des Energies Douces, St. Gabriel de Brandon, Que. Subject: Le recyclage en production agro-alimentaire comme moyen pour augmenter les profits et protéger l'environnement.
1984. Member Publication Committee, Canadian Aquaculture Bulletin. Bulletin Canadien d'Aquaculture.
1985. Speaker, 2nd annual meeting Aquaculture Assoc. Canada. Subject: Role of recycled systems in the seedstock production of warmwater fishes in Canada: two case histories smallmouth bass and walleye.
1985. Invited speaker. Colloque ACFAS - Aquiculture. Chicoutimi, Que. Subject: Diversification de la production aquicole en circuits fermés.
1985. Participant, World Mariculture Society Meeting, Orlando, Florida.
1985. Board of directors, Lake Massawippi Protection Association.
1985. Speaker. Colloque sur les Substances Toxiques de l'Environnement à l'Homme, Montreal, QC. Subject: La biotechnologie pour améliorer la production agro-alimentaire, traiter les eaux usées et protéger l'environnement.
1986. Speaker, World Mariculture Society Meeting, Reno, Nevada. Subjects: •Role of water recycling systems in seedstock production of warmwater fishes in Canada: Three case histories smallmouth bass, walleye and muskellunge. • Growth and survival of larval and post-larval smallmouth bass fed AP-100 and/or *Artemia* nauplii and feed-specific production costs.
1986. Invited Speaker: Colloque, Les Perspectives d'Avenir en Aquaculture C.P.A.Q., Ste-Hyacinthe, QC le14-15 March, 1986. Subject: Le rôle des systèmes en circuit fermé et de la biotechnologie dans la production des non-salmonidés au Québec: trois cas les achigans à petite bouche, les dorés et les maskinongés.
1986. Organizer and Instructor - Aquaculture I: a course for professional fish farmers.
1986. Invited Speaker: To Working Group of Minister of Environment of Quebec on Water Purification and Treatment. Subject: La biotechnologie pour améliorer le rendement des productions agro-alimentaires et l'efficacité du traitement des eaux usées et pour proteger l'environnement.
1987. Speaker, Assoc. Que. Tech. Eau., Mtl, QC. Subject: Bioaugmentation: une nouvelle technique pour proteger et restaurer les plans d'eau et améliorer le rendement aquacole.
1987. Organizer and Instructor - Rearing of non-salmonid fishes, Collège de St-Félicien, QC
1987. Speaker, Aqualcult. Assoc. Canada, Quebec, QC. Subject: Bioaugmentation: A new biotechnology to improve aquacultural production and protect the environment.
1987. Speaker, Bioqual, Montreal, QC. Subject: Biotechnologies for Improving Wastewater Treatment and Protecting the Environment: Case Histories.
1988. Invited Speaker, Syndicat des Pisciculteurs, Notre-Dame du Bon-Conseil, QC. Subject: Amélioration de la qualité d'eau par des traitements à l'aide des ultraviolets et de l'ozone.
1988. Invited Speaker, Conférences régionales de l'AQTE, Alma, QC Subject: Expérience sur les micro-organismes et biotechnologies.
1988. Speaker, Aquaculture Engineering & The Institute of Aquaculture, Stirling, Scotland. Subject: Bioaugmentation: Biotechnology for Improved Aquacultural Production and Environmental Protection.

1988. Speaker, Aquacult. Assoc. Canada, Vancouver, B.C. Subject: Bioaugmentation: Biotechnology to Improve Aquacultural Production and to Protect and Restore Water Bodies.
1988-1989. Co-Chairperson Aquaculture Association of Canada 1989 annual scientific meeting: Canadian Aquaculture Today and Tomorrow, Development and Diversification.
1988. Speaker, Amer. Fish. Soc., Bio-Engineer. Symp. Portland, Or. Phosphorus control in aquaculture and water bodies by bioaugmentation.
1989. Speaker, World Aqua. Soc., L.A., Calif. Bacterial Augmentation: Biotechnology to Improve Aquacultural Production and to Protect and Restore Water Bodies.
1989. U.S. Patent #4,869,019 awarded on aeroponic growing unit for domestic use.
1989. Poster presentation. Water Pollution Control Fed., Annual Meet., San Francisco, Calif. Stabilisation of Municipal / Industrial Wastewater Plant with Bacterial Augmentation.
1990. CND. Patent awarded on aeroponic growing unit for domestic use.
1990. Invited Speaker, Scottish Fish Farming Expo. Subject: Biotechnology in Aquaculture.
1990. Invited Speaker, Ghent Univ. Belgium. Subject: Biotechnology to improve waste water treatment and control lake eutrophication.
1990. Organizer and instructor - Practical Aquaculture Classes for professional fish farmers and government workers on water recirculation and rearing small egg fishes.
1990. Invited Speaker, 1ier Carrefour de la Biotechnologie, Québec: Emergence d'une Entreprise.
1991. Invited Instructor, Centre for Restoration of Water Management, Ocean Arks International, Falmouth, MA. Subject: Course on water management.
1991. Invited Speaker, Ecological Engineering for Waste Water Treatment, International Conference, Trosa, Sweden. Subject: A diagnostic and ecological approach to the purification of sewage, toxic substances and water bodies.
1991. Invited Speaker. Min. Environ. Alberta. Subject: Manipulation of microbial ecosystems to purify municipal and industrial wastes and restore water bodies.
1991. Invited Instructor, Centre for Restoration of Water Management, Ocean Arks International, Falmouth, MA. Subject: Repairing and restoring polluted waters.
1991. Invited Speaker, Int'l Symp. Biotechnologies and Environment for sustainable development. Univ. Montreal, UNESCO. Subject: Manipulation of microbial ecosystems to purify municipal and industrial wastes and restore water bodies.
1992. Seminars on Biotechnologies and Water Purification in Japan, Indonesia and Korea.
1994. Seminar "The Evolution of Wastewater Treatment - The Role of Environmental Biotechnology. Invited speaker Order of Engineers of Quebec.
1994. Seminars: Aquarium management and the role of bioaugmentation. Invited Speaker, England, Germany & France.
1996. Seminar: Water quality management in aquaculture - the possibilities and limits of bacterial augmentation. Invited Speaker, Brackish water Aquaculture Development Center, Jopara, Indonesia.
1996. Invited Speaker: BioAtlantech, Fredericton, New Brunswick. Breakthroughs in Environmental Biotechnologies: Their Role in Water Quality Improvement.
1996. U.S. Patent: awarded Method and Apparatus for *In Situ* Water Purification including Sludge Reduction within Water Bodies by Biofiltration and for Hypolimnetic Aeration of Lakes.

1997. Invited Participant: Team Canada Diplomatic Trade Mission with the Prime Minister to Korea, Thailand and the Philippines.
1997. Invited Speaker: National Research Council Of Canada, VIIIth Industrial Biotechnology Conference. Reclaiming our Planet: The Role of Environmental Biotechnologies.
1998. Invited Speaker: Environmental Biotechnology in the Canadian Economy - Consultation. National Research Council, Biotechnology Research Institute, Montreal, QC.
2000. Speaker: New England Water Environment Assoc. – control of grease and odors in sewers
2001. Invited Speaker: Mass. Water Polln Control Assn. - control of grease and odors in sewers
2001. Invited Speaker: Boston Water & Sewer Commission, Biological Grease Reduction & Odor Control in grease traps to protect & clean sewers *A New Paradigm*
2002. Canadian Patent: awarded Method and Apparatus for *In Situ* Water Purification including Sludge Reduction within Water Bodies by Biofiltration and for Hypolimnetic Aeration of Lakes.
2002. Invited Speaker: Mass. Pretreatment Assoc. - control of grease and odors in sewers
2002. Invited Speaker: EPA Region 1, Pretreatment Coordinators Conference June 19, 2002, Oil & Grease Treatment - A Completely Biological Method
2002. Invited Speaker: Rhode Island Pretreatment Coordinators Association, Sept. 17, 2002 Oil & Grease Treatment & Wastewater Treatment Optimization - *The Natural Solution*
2002. Invited Speaker: Massachusetts Department Environmental Protection August 29, 2002 Oil & Grease Treatment & Environmental Protection
2002. Invited Speaker: New Hampshire Pretreatment Forum - control of grease and odors in sewers
2002. Invited Speaker: Narragansett Bay Commission Nov. 19, 2002 Oil & Grease Treatment & Wastewater Treatment Optimization.
2003. US Patent: BACTIVATOR Industrial design
2003. Canada: BACTIVATOR Industrial design
2003. Invited Speaker: Association of Metropolitan Sewerage Agencies (AMSA) & U.S. Environmental Protection Agency (EPA) Nov. 21, 2002 Biological Oil & Grease Treatment & Wastewater Treatment Optimization, Philadelphia, PA
2003. Invited Speaker: Massachusetts Water Pollution Control Authority, Apr. 3rd, 2003 Wastewater Treatment Optimization, Oil & Grease Treatment, & Cost Reduction
2003. Invited Speaker: MA Water Resources, Deer Island WWTP, Authority, May 14th, 2003 Wastewater Treatment Optimization, Control of Bulking / Poor Settling, & Sludge Reduction
2005. Invited Speaker: St Louis wastewater treatment operators, St Louis, MO – part of class for continuing education for wastewater operators, Purely Biological FOG Treatment & Wastewater Treatment Optimization
2006. Invited Speaker: Iowa Rural Water Association, Pella, IA – part of class for continuing education for wastewater operators, Applied Microbial Ecology to decrease costs (grease, sludge, odors nitrogen) of wwt and to enhance aquatic life

2006. Speaker: Réseau Environnnement, Waste water conference, Boucherville, QC, Canada Le génie écologique et la bioaugmentation : des outils pour l'optimisation du traitement des eaux usées
2007. Canadian Patent: BACTIVATOR® on site microbial growth and conditioning system
2008. AMERICANA waste water conference, Montreal, QC, Canada, Optimisation of Biological Treatment to Abate Pollution in Sewers, to Save Energy & to Reduce Causes of Greenhouse Warming — While Reducing Expenses
2009. Invited seminar. City of Los Angeles, Dept Watershed Protection. Water Quality Improvement of Lakes and Storm water Impoundments.
2009. Invited Speaker. USEPA Region 1 Pretreatment Training. Purely biological control of FOGS in sewers and lift stations: case history City of Framingham, MA.
2009. Invited Speaker. USEPA Region 1 Pretreatment Training – continuing education for wastewater operators. Biodegradation of pharmaceuticals in wastewater.
2010. Invited Speaker. Hydro Quebec, ville de Québec. Biodégradation des hydrocarbures et conservation d'énergie.
2011. Invited Speaker. New Hampshire Dept. Environ. Services, Fat Free Lean and Green Restaurant Workshop, Meredith, NH. Grease Trap Additives: The Good, The Bad and The Ugly
2011. Instructor Bacta-Pur® Class: Les Processus et Les Applications du Système Bacta-Pur® System: Optimisation du Traitement des Eaux Usées et la Restauration des Plans d'Eau
2011. Invited Speaker. New Brunswick, Dept of Environmental Protection, Moncton, NB, Canada Oct. 2011. Applied Environmental Microbiology to Optimize Wastewater Treatment & Water Body Restoration.
2011. Invited Speaker. Vermont, Green Mountain Water Environment Assoc. Burlington, VT, Continuing Education Class for Wastewater Operators. Nov. 2011. Purely Biological FOG Digestion & Optimizing the BIOLOGICAL in biological treatment for Wastewater & Water Body Restoration.
2011. Invited Speaker Continuing Education Class for Wastewater Operators. New Hampshire, Dept Environ. Services, Continuing education class for wwt operators, Franklin, NH, Nov. 2011. Biotreatment in sewers, lift stations and wastewater treatment plants to optimize processes.
2012. Invited Speaker, New York City, Dept Environmental Protection. Purely Biological FOG Digestion & Optimizing the BIOLOGICAL in biological treatment for Wastewater & Water Body Restoration. April 2012
2012. International Class June 2012, Sherbrooke, QC. Optimization of Biological Wastewater Treatment – Applied Environmental Microbiology,