BIOSYNTHESIS, FUNCTION AND EVOLUTION OF A MALE MATING PHEROMONE IN THE SEA LAMPREY.

Li, W[1], K. Li[1], C. Brant[1], M. Siefkes[2], E. Walaszczyk[1], H. Wang[1], T. Buchinger[1], N. Johnson[3], Y. Chung-Davidson[1]

[1]Department of Fisheries & Wildlife, Michigan State University, East Lansing, MI 48824, U.S.A.
[2]Great Lakes Fishery Commission, Ann Arbor, MI, U.S.A.
[3]United States Geological Survey, Great Lakes Science Center, Hammond Bay Biological Station, Millersburg, MI, U.S.A.;

Fish pheromones are chemical cues that modify behavioral, physiological or developmental processes of individuals of the same species. Previous studies have shown that sexually mature male sea lampreys (*Petromyzon marinus*) release mating pheromones that coordinate reproduction with ovulated females during their terminal life stage. Male sea lampreys, after becoming spermiated, actively release a bile acid, 7α,12α,24-trihydroxy-5α-cholan-3-one-24-sulfate (3kPZS), across their gills through specialized glandular cells. Ovulated female sea lampreys respond to synthesized 3kPZS at concentrations as low as 10^{-13}M by swimming directly upstream to the source. Recently, we have integrated multi-disciplinary approaches to examine the diversity of molecular structures and functions of this male pheromones system. Biochemical and molecular analyses indicated that 3kPZS is mainly synthesized in the liver and modified at the gills before secretion into the water. Chemical fractionation, coupled with behavioral assays, demonstrated that compounds with structures similar to 3kPZS likely function as minor components of the male mating pheromone. Physiological and chemical analyses showed that the male pheromone modifies the reproductive neuroendocrine system and progress of sexual maturation in both male and female sea lampreys. Furthermore, our results documented that male pheromone exposure suppresses the nocturnal locomotor rhythm in ovulatory females and affects melatonin production as well as the expression of several clock genes in the pineal complex and the brain. Comparative studies suggested that 3kPZS signaling is likely a conserved system among petromyzonid species. Our studies on lamprey pheromones have mainly been supported by the Great Lakes Fisheries Commission, the National Science Foundation, and the National Institute of General Medical Sciences.