

**Gene expression in the biosynthesis of Paralytic Shellfish Poisoning (PSP)
toxins in dinoflagellates: a mini review**

Abstract

Some dinoflagellates are known to synthesize saxitoxin (STX), a potent neurotoxin that causes severe paralytic shellfish poisoning (PSP). In addition, several freshwater species of cyanobacteria also synthesize the same toxin with the same biosynthetic pathway and genes responsible. This review focuses on the gene expression involved in the biosynthesis pathway of PSP toxins in dinoflagellates. The expression of the PSP biosynthetic genes have been identified in certain cyanobacteria and the dinoflagellate *Alexandrium* sp. with eight genes involved viz. *sxtA*, *sxtB*, *sxtD*, *sxtG*, *sxtH/T*, *sxtI*, *sxtS* and *sxtU*. *sxtA*, a unique starting gene, and *sxtG*, the second "core" gene appearing in the biosynthesis of PSP toxins are found in both cyanobacteria and *Alexandrium* sp. Three theories have been proposed to explain the origin of PSP toxin in dinoflagellates: I) the genes are produced by bacteria associated with the dinoflagellates, II) independent evolution III) horizontal gene transfer between cyanobacteria and dinoflagellates. Useful information regarding the expression and function of genes involved in the STX biosynthesis pathway provides an understanding of toxin production and possible mitigation and public health management of STX poisoning.