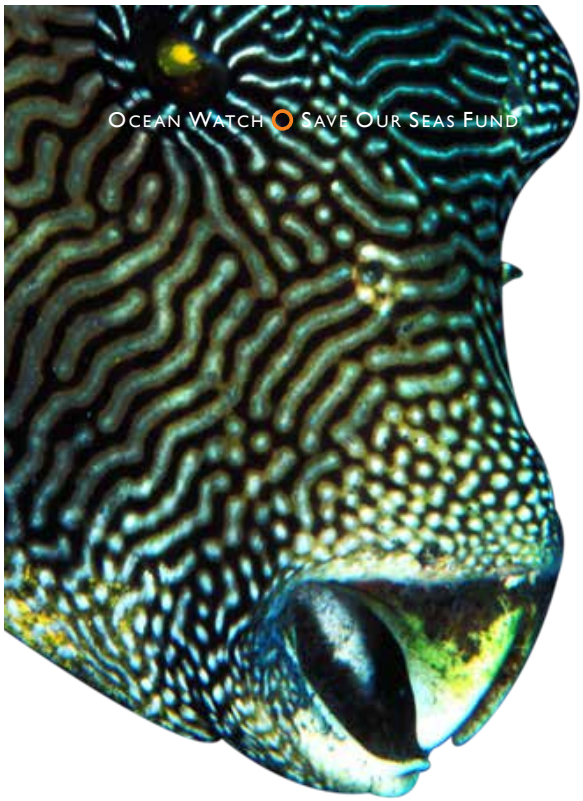

"From TEETH to BEAKS"

Report & Photographs by ***Alexandra Rose***

Puffer fish, some of the most charismatic yet poisonous vertebrates on the planet, could have important evolutionary lessons to teach us about dentistry. One of the most prominent and recognizable features of puffer fish is their large teeth, or more accurately beaks, for which they are named. Puffers belong to the family Tetraodontidae, Latin for "four teeth", and are thus named due to the presence of four partially fused plate-like teeth that form a tough beak instead of the delineated teeth possessed by most other teleosts. They use this hard beak to crush and grind up their food, which consists primarily of shellfish, echinoderms, crustaceans, and all other manner of calcareous invertebrates. This type of abrasive diet puts an extreme amount of wear and tear on their teeth, which conveniently have the ability to grow continuously throughout the fish's lifetime.

This process of vertebrate tooth replacement, referred to as odontogenesis, is of particular interest in the field of dentistry because as humans, we only get two sets of teeth that need to last us our entire lives. By the time we reach age twelve, most humans have all their primary teeth (or "baby teeth") replaced by a full set of larger, permanent teeth which must then remain functional for another eight or nine decades. One set of "adult teeth" was sufficient when human lifespans were much shorter, but due to scientific advancements and sophisticated medical care, most people outlive the durability of their teeth. In an effort to provide our species with a form of regenerative dentistry, research is currently underway, to find a means to determine how fish are able to grow teeth continuously and apply it to humans.

According to Dr. Gareth Fraser, an evolutionary biologist in the University of Sheffield´s Department of Animal and Plant Sciences, we can use the puffer fish beak as a model for a simplified tooth replacement system. "It is of great interest for science to understand the process of tooth replacement, to understand the genes that govern the continued supply of teeth and mechanisms of dental stem cell maintenance," Dr Gareth says. Before puffers grow their characteristic beak, their initial dentition is similar to that of most other bony fishes. These primary teeth eventually fall out and four continually replacing teeth take their place to form the structure of the beak. Each "tooth" is comprised of several horizontally growing layers of a bone-like substance called dentine that is constantly being produced in an effort to replace older layers worn out by eating tough foods.

Dr. Fraser and his team have recently identified the so-called "tooth fairy" cells responsible for this constant regeneration. Further research aims to discover the precise genetic and molecular mechanisms responsible for this, with hopes that we may be able to stimulate similar cells in humans, allowing us to grow extra sets of teeth when needed. Fraser feels that there may even be an evolutionary possibility that human teeth could someday evolve into puffer-like beaks. Unlike teeth, a beak would not be susceptible to the demises of chipping, rotting, or falling out. This kind of evolutionary change would of course take at least several million years, so in the meantime, we had all best continue going to our dentists and taking good care of our single set of non-regenerative teeth. ○