NUS National University of Singapore | Department of Biological Sciences
Faculty of Science

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Hosted by Dr Wu Jinlu

The impacts of pollution on deep-sea fish

Jean-François Rees is professor and head of the school of Biology at the Catholic University of Louvain (UCLouvain) where he teaches animal biology and physiology. He obtained his PhD at the University of Louvain in 1990 before carried out postdoctoral research at the Osaka Bioscience Institute (Japan) and Chulalongkorn University (Thailand). After focusing on the physiology of light-producing fishes, his research analyzed the evolutionary origins of bioluminescent systems in relation to antioxidant mechanisms in deep-sea fish, leading to the discovery that luciferins, i.e. bioluminescent substrates, might have first been selected for their antioxidative properties before shifting function in deep-sea organisms. In particular, he demonstrated that coelenterazine, a widespread luciferin in marine jellyfish, squids and fish, possessed exceptional antioxidant activity. A few years ago, he became interested in the impacts of pollutants reaching the deep sea on the highly adapted fish thriving a few kilometers below the surface.

By Jean-François Rees

Professor and head of the school of Biology at the Catholic University of Louvain, Belgium.

The extreme physico-chemical constraints (low temperature, low to now solar light, high hydrostatic pressure) prevailing in the abyss pose important physiological constraints to animals. Since the onset of the industrial revolution, deep-sea animals which used to develop in a highly stable environment, were subjected to the arrival of anthropogenic chemicals for which the deep-sea is a major sink. Precursor studies in the 80's revealed that deep-sea fish are highly contaminated with organochlorines, such as PCBs and DDTs, far more that surface species.

Unfortunately, analyzing the physiological response to these pollutants proved difficult as the vast majority of deep-sea fish do not survive once brought to the surface. This prompted us to develop in vitro techniques that would allow studies of the impacts of pollutants on deep-sea fish cells. In vitro cultured Precision-Cut Liver slices collected on freshly caught deep-sea rat-tails allowed the first physiological studies of the impacts of pollutants on deep-sea fish. Cultures of these liver slices in hyperbaric chambers revealed that hydrostatic pressure inhibits the induction of CYP1A and Heat Shock Proteins by a model pollutant. This effect, which is also observed in surface species, could explain why deep-sea fish accumulate very high levels of contaminants in their liver.

We are currently studying the possible mechanisms of this phenomenon using a surface fish liver cell-line cultured at high hydrostatic pressure. Thanks to these techniques, we hope to predict the impacts of pollution, already present or likely to be generated by future industrial activities in the deep ocean.

Light refreshments will be provided.