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Development of New Biosensors to detect Ciguatoxins

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Ciguatera Fish Poisoning: the most prevalent intoxication from seafood worldwide!

- Symptoms: variety of gastrointestinal, cardiovascular, neurological symptoms (paresthesia, ataxia, cold allodynia), with persistent neurological effects
- Cause: Ciguatoxins or CTXs, lipid-soluble polyethers produced by dinoflagellates Gambierdiscus spp., mostly found in tropical and subtropical zones, and now also present in temperate waters ¹,²,³,⁴
- Mechanism: CTXs bind to Voltage Gated Sodium Channels (VGSCs) of human sensory neurons.

On-going improvements:
Replace colorimetry by Fluorescence, or other value easily measurable in the field
Use cell wall and signaling mutants to improve CTXs access and amplify the signal
Mutagenesis on the channel protein to improve CTXs binding

Future developments:
Express the Mammalian VGSC in yeast, per se or as chimera with the yeast ion channel, and follow cellular signaling induced.
Measure binding of the different toxins to the receptors by Single Molecule Force Spectroscopy (by AFM or Optical Tweezers).
Develop cell-free sensors systems with the toxins receptor (human VGSC or its yeast homolog) integrated in lipid bilayers.
Create point mutants of the receptors, to identify the residues involved and then design or search for possible cures.

References:
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2 Nuñez et al., 2012. Euro Surveill. 17, 2018
3 Fraga et Rodriguez, 2014 Protist 165, 839
5 Caillaud et al., 2010 Mar. Drugs. 8, 1838