Biomedical research profits from the exploration of the deep sea

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A study published in the scientific journal *PLoS ONE* highlights how the exploration of the ocean depths can benefit humankind. This is the story of a voyage of discovery, starting with marine animals that glow, the identification of the molecules responsible and their application as marker in living cells.

Many marine organisms such as sea anemones and corals produce fluorescent proteins, which come in a variety of dazzling hues. Fluorescent proteins have revolutionized biomedical research by enabling the imaging of processes within living cells and tissues. The impact of this technology is considered so high that the 2008 Nobel Prize in Chemistry was most recently awarded to scientists that discovered and further developed the first green fluorescent protein that was applied as cellular marker.

Many useful fluorescent proteins have been found in species that live in the sun-drenched tropical coral reefs. But much less is known about species living in the darkness of the deep sea.

An international team of scientists led by Jörg Wiedenmann of the National Oceanography Centre, Southampton, Mikhail Matz of the University of Texas in Austin and Charles Mazel from the company NightSea have explored the Gulf of Mexico using a submarine, the US Johnson-Sea-Link II, equipped with a system designed to detect fluorescence.

They discovered a species of a sea anemone-like animal (a ceriantharian, or tube anemone) – possibly a new species –that emits bright green fluorescence. They went on to identify a novel green fluorescent protein.

Although isolated from an animal that lives in essentially complete darkness at depths between 500 and 600 metres and at low temperatures (below 10 °C), the new fluorescent protein, named cerFP505, can be well applied as marker protein in mammalian cells at normal body temperature (37 °C).

The brightness and stability of cerFP505 are similar to other fluorescent proteins used in biomedical research. The fluorescence can be switched on and off in a controlled way by alternating blue and near-ultra violet light. These properties make cerFP505 an ideal lead structure for the development of marker proteins for super-resolution microscopy, say the researchers.

Further useful properties can potentially be built into the fluorescent protein by genetic engineering. "Moreover", they say, "the discovery of photoswitchable cerFP505 from a deep sea animal reveals the lightless depths of the oceans as a new reservoir of proteins with novel and highly desirable properties for imaging applications".

Citation: Vogt A, D'Angelo C, Oswald F, Denzel A, Mazel CH, et al. (2008) A Green Fluorescent Protein with Photoswitchable Emission from the Deep Sea. PLoS ONE 3(11): e3766. doi:10.1371/journal.pone.0003766
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