Press Release

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Wound healing or regeneration – the environment decides?
Flexible self-regeneration in ctenophores discovered

28. November 2017/Kiel. **For humans, the loss of limbs is almost always an irreversible catastrophe. Many animals, however, are not only able to heal wounds but even to replace whole body parts. Biologists from the GEOMAR Helmholtz Centre for Ocean Research Kiel have now been able to prove for the first time that comb jellyfish can switch between two completely different self-healing processes depending on the environmental conditions. The study has been published in the international journal Scientific Reports.**

It may be a bit macabre. But surely most people at some point in their childhood watched fascinated, how an earthworm cut in two parts apparently lived on unimpressed by the severe wound. For humans, the loss of limbs is a severe problem which can only be treated - if at all – by complex surgery. However, among animals there are numerous examples of amazing self-healing mechanisms, especially among invertebrates. How these regeneration mechanisms function genetically and biochemically is one of the most exciting research questions in developmental biology, but also in medicine.

A team of biologists from the GEOMAR Helmholtz Centre for Ocean Research Kiel, the Norwegian University of Science and Technology (NTNU) and the University of Florida has now been able to demonstrate with the comb jellyfish *Mnemiopsis leidyi* that, at least in this type of jellyfish, the mechanism of regeneration can be changed depending on the environmental conditions. The study has been published in the international nature publishing group journal Scientific Reports. “Jellyfish are perfect candidates for this kind of research while holding a key position at the phylogenetic base of the metazoan tree”, says first author Katharina Bading, former Master student at GEOMAR and now PhD student at NTNU, Norway.

Serious injuries to comb jellyfish and their larvae can have various causes: Mechanical stress, for example, in rough seas or even predators. Depending on the season and the area they live in, the jellyfish have to regenerate in an environment with ample or few nutrients. “Whether and how the jellyfish react to these differences was our question”, says Dr. Jamileh Javidpour from GEOMAR, corresponding author of the study.

Comb-jellyfish larvae that lived in a nutrient-rich environment were able to completely restore their bodies. Larvae that had to cope with less nutrients also survived and were able to heal their injuries, but were unable to fully regenerate their bodies. “Apparently, the comb jellyfish larvae are able to activate two fundamentally different regeneration processes, depending on the external circumstances”, explains Dr. Javidpour, “if the circumstances are not good enough for a complete cure, then at least it can save their own survival with a simpler process.”

For the researchers from Kiel, the discovery is interesting because they investigate the pathways and success of invasive species. *Mnemiopsis leidyi* was most likely introduced to the Black Sea and the Baltic Sea through ballast water of ships from North America. “In the pumping operations, the jellyfish are mechanically heavily stressed. A flexible self-regenerating process can be an advantage. However, this aspect has hardly been considered so far”, Katharina Bading points out.

“Apart from that, the discovery is fundamentally interesting in terms of how self-regenerating traits work in nature, and whether we can ultimately learn something from it for human medicine”, Dr. Javidpour adds.

Reference:
Bading, K. T., S. Kaehlert, X. Chi, C. Jaspers, M. Q. Martindale & J. Javidpour (2017): Food availability drives plastic self-repair response in a basal metazoan-case study on the ctenophore *Mnemiopsis leidyi* A. Agassiz 1865. Scientific Reports, http://dx.doi.org/10.1038/s41598-017-16346-w

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