Iron deficiency restrains marine microbes

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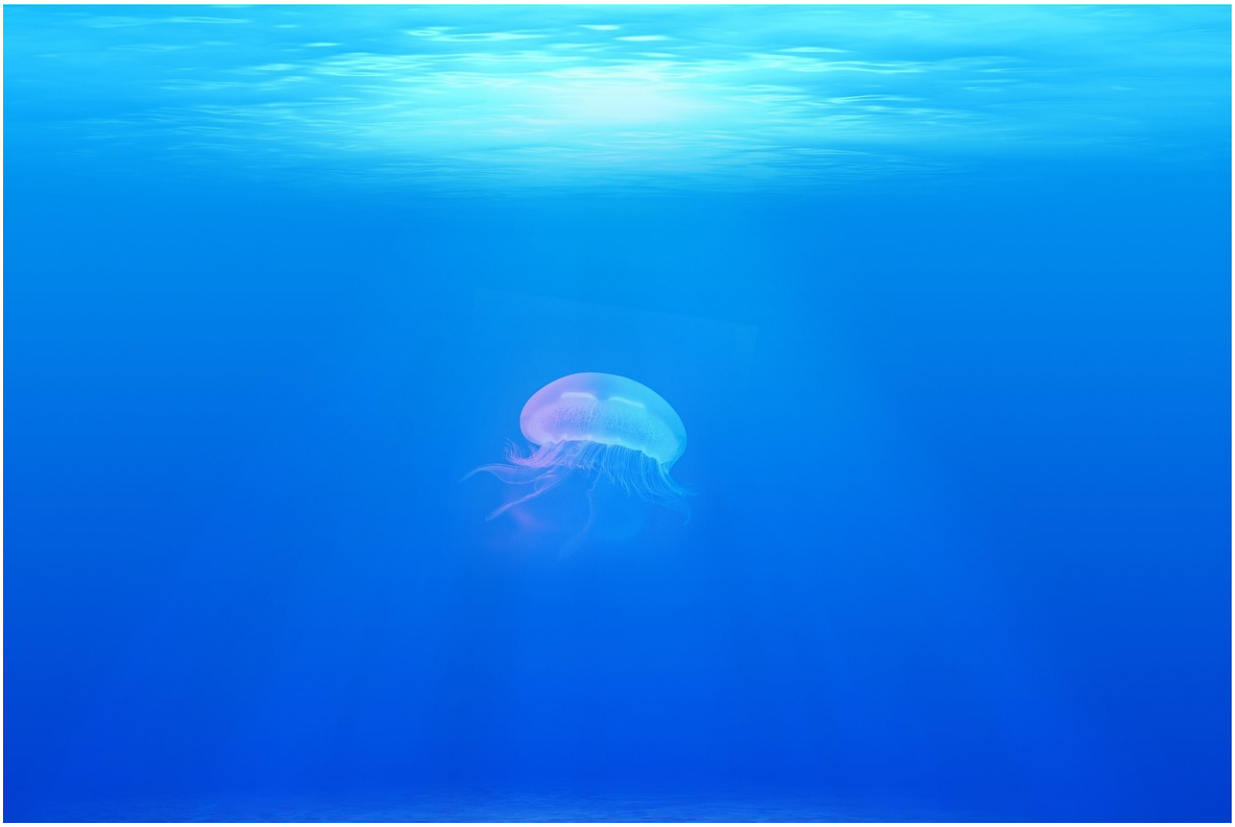

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Iron is a critical nutrient in the ocean. Its importance for algae and the nitrogen cycle has already been investigated in detail. Now, a new discovery shows that microbes also need iron to process phosphorus. A team of researchers from the GEOMAR Helmholtz Centre for Ocean Research Kiel and the University of Southampton, U.K., has published

results in the international journal *Nature Communications* showing that iron can limit phosphorus acquisition in the ocean. Their study contributes to knowledge of nutrient cycling in the ocean.

Scientists describe the tropical ocean often as a 'blue desert.' This is due to the limited tropical growth of unicellular algae compared to other oceanic regions, which would otherwise color the ocean green. The growth of these algae depends on nutrients such as nitrogen and phosphorus. At the same time, other marine organisms depend on these 'ocean plants' to eat and survive in the ocean.

"In principal, nitrogen and phosphorus are present even in the tropical ocean. But often these elements are incorporated into parts of dead plants and animals that are sinking to the ocean floor," explains the lead author Dr. Thomas Browning of GEOMAR Helmholtz Centre for Ocean Research Kiel.

Microbes can get to these hidden nutrients by recycling dead matter with the help of enzymes. As a result, nutrients such as phosphorus become available again. But enzymes require trace elements such as iron to function, as the researchers explain.

"If you look at the nutrient distributions in the oceans on a global scale, you can see regional differences," says Dr. Browning. "Interestingly, we know from previous observations that for regions where nutrients are limiting the growth of marine algae, not all available pools of nutrients are being used. But why?"

During a research cruise, the research team sought an answer to this question. In field experiments, iron was added to seawater and the researchers observed microbial enzyme activity. "We observed that the activity of a widely distributed group of microbial enzymes was influenced by the availability of iron in the seawater," Dr. Browning

says.

The results helped to confirm a hypothesis made in a previous study by scientists at the University of Oxford. "They demonstrated by laboratory experiments that microbial enzymes need iron to process phosphorus, and suggested this could also be important in the ocean. We have confirmed for the first time that this is, indeed, the case," Browning says.

Between the key nutrients nitrogen and phosphorus, nitrogen is primarily seen as the main limiting factor for the growth of algae in the ocean. The additional supply of nitrogen into the world's oceans by human activities, however, could change this situation in the future. Phosphorus limitation might become more widespread and the presence of iron would therefore be expected to play a major role. With respect to ecological cycles in the ocean, this shift would influence algae, their oxygen production, and ability to take up CO2 from the atmosphere.

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