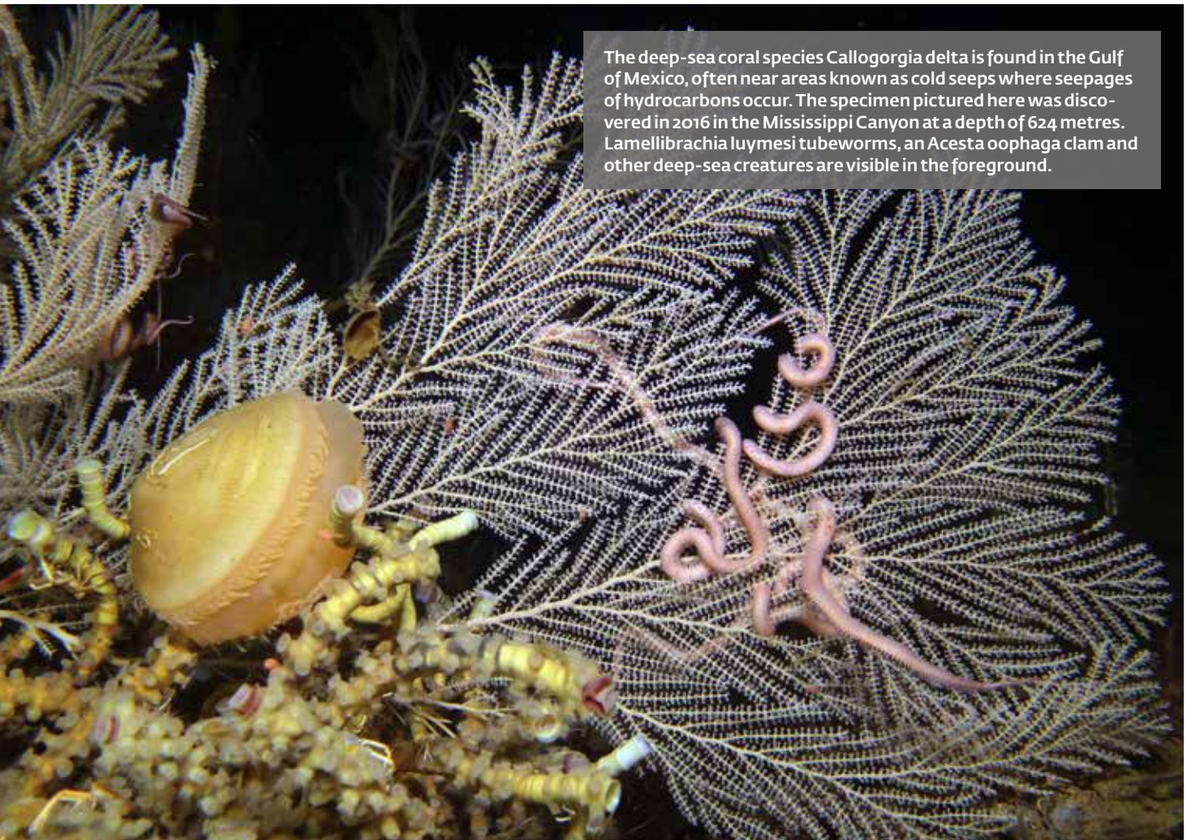
Deep-sea bacteria with minimal genome

A German-American research team led by Prof. Dr Iliana Baums from the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) and Dr Samuel Vohsen from Lehigh University in the US has discovered two highly unusual bacterial species in the tissue of two deep-sea corals from the Gulf of Mexico. The two coral symbionts lack even the ability to obtain energy from carbohydrates – an impressive example of how few genes are required to create a functioning organism. The team's findings were published in the scientific journal Nature Communications.
For their study, the researchers were investigating several colonies of the two soft coral species Callogorgia delta and Callogorgia americana, which live in total darkness at depths of around 300 to 900 metres, when in the course of their analyses they discovered the two closely related and previously unknown bacterial species from the Mollicutes class of bacteria. These microbes often live as parasites on or in the cells of plants, animals and humans, and can be the cause of disease. On the basis of genetic analyses, the researchers have proposed that the newly discovered bacterial species be assigned to a new family called Oceanoplasmataceae.
Further research revealed that the bacteria live in a gelatinous tissue layer that forms part of the coral's immune defence system and also transports nutrients. One of the two species (Oceanoplasma callogorgiae) has only 359 genes to encode proteins for various metabolic functions, while the other (Thalassoplasma callogorgiae) has 385. For comparison, the intestinal bacterium Escherichia coli has more than 4,000 protein-encoding genes and humans have around 21,000.
How the metabolism of the two newly discovered microbes can function with such a reduced genome is a mystery to the researchers: "These bacteria don't even carry genes for normal carbohydrate metabolism, in other words, for converting carbohydrates into energy – a function that every living organism was thought to have," Baums explains. According to the research to date, their only source of energy is the amino acid arginine, which is provided by the host coral. "However, the breakdown of this amino acid generates only tiny amounts of energy. It's truly astonishing that the bacteria can live on so little," Baums stresses. It remains unclear whether the microbes are entirely parasitic or whether the corals benefit in some way from their symbionts.



The deep-sea coral species Callogorgia delta is found in the Gulf of Mexico, often near areas known as cold seeps where seepages of hydrocarbons occur. The specimen pictured here was discovered in 2016 in the Mississippi Canyon at a depth of 624 metres. Lamellibrachia luymesi tubeworms, an Acesta oophaga clam and other deep-sea creatures are visible in the foreground.

How time influences medical decisions

Terminal illnesses, an unfulfilled wish to have children or advancing age: in different phases of life people focus on different aspects of time. The temporal structure of life influences how we assess medical options, or take advantage of them. This is a key finding of the interdisciplinary research group Medicine and the Time Structure of the Good Life, which has been investigating the interactions between medicine and lifetime since 2021.
The German Research Foundation has now approved a further four years of funding for the project, which involves the Universities of Oldenburg, Göttingen, Frankfurt am Main and the Humboldt-Universität zu Berlin. Prof. Dr Mark Schweda from the Department of Health Services Research has been appointed as the group's spokesperson. The research group applied for just under 3.4 million euros in funding. In this second funding phase, the focus will be on the importance of intergenerational aspects for medicine.

Obstacles to growing microorganisms in the lab

Microbial ecosystems such as those found in seawater, soil or the human gut are amazingly diverse. Yet many of these microorganisms die when grown in the lab. Now a new study by biodiversity researchers Dr Tom Clegg and Prof. Dr Thilo Gross from the Helmholtz Institute for Functional Marine Biodiversity (HIFMB) has found a potential explanation for this phenomenon. The microbes' survival depends not only on their individual needs, but also on a hidden network of relationships which can collapse as a result of even minor structural changes. The findings were published in the scientific journal PNAS.

The unique properties of ultra-thin materials

A novel class of ultra-thin materials – also known as two-dimensional materials (2D materials) – is the focus of a newly approved research project. These solids are often less than a nanometer (a billionth of a metre) thick and consist of just a few atomic layers. In the "Dual Twist" project, physicist Prof. Dr Christian Schneider and his team from the Institute of Physics will develop experimental set-ups to explore the unique properties of 2D materials using a special method that involves "twisting light", paving the way for their application in innovative quantum technologies.
The European Research Council has awarded Schneider approximately two million euros in funding over a five-year period for his project. Schneider and his team were able to induce 2D materials to emit coherent laser light at both extremely low temperatures and room temperature in 2021 – a breakthrough that could serve as a basis for the development of highly versatile nanolasers.

How desert ants navigate

Like songbirds or monarch butterflies, desert ants of the species Cataglyphis nodus use the Earth's magnetic field for orientation. Yet, according to the research of a team led by Dr Pauline Fleischmann of the Institute for Biology and Environmental Sciences in the journal Current Biology, the mechanism through which they sense the field is different. The researchers suspect that the desert ants' magnetic sense is based on tiny particles of magnetite, a mineral whose main component is iron oxide. The finding opens up new avenues for research into the evolution of this sensory perception process in animals.

Research on high-energy beaches continues

The north-facing beach of the island of Spiekeroog is home to a unique observatory that delivers a continuous stream of data on what happens when freshwater and salt water converge deep below the sandy surface. Thanks to its complex and innovative infrastructure researchers are able to conduct a detailed analysis of the dynamic subsurface processes in this transition zone between land and sea for the first time.
"The conversion of elements such as carbon or nitrogen in the subsurface of sandy beaches has not yet been incorporated into global models of material cycles," explains Oldenburg hydrogeologist Prof. Dr Gudrun Massmann, who leads the DynaDeep research group. Launched at the beginning of 2021, the team now aims to determine whether sandy beaches should be integrated into future global material cycle models.
The German Research Foundation has extended the project's funding by a further four years, with an additional 4.8 million euros. In the next project phase, the team is conducting similar investigations on beaches in Belgium and France in order to determine the extent to which the findings on Spiekeroog can be extrapolated to other coasts.

The changing Wadden Sea

Biodiversity in the Wadden Sea off the coast of the Netherlands, Germany and Denmark is changing dramatically. This was the finding of a study published by a German-Dutch research team in the journal Global Change Biology, in which a group led by Oldenburg biologist Prof. Dr Helmut Hillebrand of the Institute of Chemistry and Biology of the Marine Environment (ICBM) played a key role. Several fish species, including Atlantic cod and various species of flatfish, were among those worst affected by population decline. However, there was also a downwards trend for many mussels, snails and bristle worms, as well as for phytoplankton and plants such as seagrass and the vegetation in the salt marshes.
For the majority of seabird species, by contrast, the data pointed to an increase in population sizes over an extended period of time. Yet for many wader and gull species this overall positive trend reversed in the late 1990s and early 2000s, and their numbers have been in decline ever since. The study's findings could potentially be used to improve nature conservation strategies.

Interdisciplinarity boosts results

Unusual research approaches in which seemingly unrelated disciplines converge are the hallmark of Oldenburg University's new "booster units". The eight units develop creative solutions at the interface of different research fields. In one team, scientists from the fields of education, musicology and computer science are working together to design a playful musical environment for learning to use artificial intelligence. In another, biologists and religious studies experts have joined forces to search ancient records for references to early human and animal navigation movements.
The goal is to use interdisciplinarity to gain new perspectives on questions such as what digital information we trust and why, the impact of hearing loss on social interactions, and how colonialism affects the carbon cycle. Other projects focus on resilience in premature babies, AI analysis of genetic data and diversity-sensitive healthcare in rural areas.
The booster units are funded by the Strategic Development of Potential funding line as part of the "zukunft.niedersachsen" programme, which is jointly run by the state of Lower Saxony and the Volkswagen Foundation. The university applied for the funding with its "Programme for Excellence" and has been awarded a total of 22.5 million euros. Besides funding numerous other projects, the sum will finance two full-time doctoral candidate or postdoc positions for each booster unit for an initial four-year period.

Parental attitudes to environmental issues

The birth of a child has little impact on how its parents feel about environmental and climate issues, according to a representative study by Prof. Dr Gundula Zoch from the Institute of Social Sciences and Dr Nicole Kapelle from Trinity College Dublin (Ireland). The research team's findings were based on an analysis of longitudinal data from the German Socio-Economic Panel (SOEP) survey carried out between 1984 and 2020.
The widespread assumption that parents become more concerned about the environment and climate issues after the birth of a child cannot be confirmed across the board, said Zoch. The results show a tendency among parents to be less concerned about the environment and climate issues around the time of childbirth, simply because for many people daily life with a newborn sets other, more immediate priorities that push environmental and climate protection into the background. By the time the children reach school age, however, their parents' concerns again correspond with those expressed before the birth.

Outlooks

When will AI make your diagnosis?

Prof. Dr Nils Strodthoff

AI4Health Division

When used correctly, artificial intelligence (AI) already sees more than humans do: one model, for example, detects signs of liver disease or diabetes in electrocardiograms – diseases that at first glance have nothing to do with the heart. This is possible because AI recognises patterns across thousands of data sets that remain hidden to the human eye.

Researchers are now looking into what happens when multimodal AI models combine different data sources, such as ECGs, blood values and X-ray images. The hope is that this broader perspective will make it possible to detect new disease patterns and facilitate predictions. This is also the aim of the highly contentious “foundation models” that form the backbone of generative AI. These are designed not only to perform a specific task – such as detecting a particular disease – but also to respond flexibly to questions posed by physicians. Yet they are still a long way off. Strict regulatory requirements are holding things back for one thing, and transferring research findings into clinical practice is fraught with difficulties: just because AI delivers good results based on curated research data sets does not necessarily mean it will do the same when dealing with real-world patient data. The danger is that it will make incorrect diagnoses. Systems therefore need to be very robust – and standards for measuring this are still very much in their infancy.

That said, initial applications have been in use for years and are running in the background. AI programmes are already detecting abnormalities in X-ray and MRI images as reliably as specialists – without ever getting tired or needing breaks. For patients, however, visiting the doctor remains a familiar experience: the diagnosis is still made by a fellow human being.