# Microbial mats: the ocean's natural vacuum cleaners

## A nature-based solution to address ocean pollution, climate change, and biodiversity loss

Ocean pollution is a major threat to the ocean, climate change, and its diverse ecosystems. However, nature itself offers potential solutions to remove pollutants, restore biodiversity, and mitigate climate change through bioremediation – the use of naturally occurring or deliberately stimulated microorganisms to degrade pollutants. **Microbial mats – multi-layered communities of different species of microorganisms – are capable of digesting pollutants such as oil, microplastics, and even some heavy metals.** They do this primarily through the migration of different species to different layers within the mat. However, largely due to the lack of technology, there is a gap in the understanding of the mechanisms by which they metabolise pollutants and how their structural rearrangement within the mat allows for bioremediation.

## The power of EMBL's cutting-edge technology and scientific expertise

With new spatial-omics techniques at EMBL, we now have the tools to study the metabolism of microbial mats in their natural spatial context and their adaptation to extreme environments. A team of marine experts and molecular biologists will collect microbial mat samples to:

- identify microbial species and their locations in the mat using spatial transcriptomics (a range of methods including light microscopy)
- analyse microbial mat architecture at the single-cell level using a decoded spatial map of gene expression
- study the mechanistic process by which different species change in diversity and location after exposure to contaminants such as crude oil and heavy metals.

**This research can help us better understand how these 'natural vacuum cleaners' break down chemical pollutants from the oceans, making it possible to design microbial mats that target specific pollutants. Lab-designed microbial mats could potentially be a novel and efficient bioremediation solution for cleaning ocean pollution, safeguarding vulnerable ecosystems, and mitigating the threat of climate change and biodiversity loss in the oceans.**



*A microbial mat –a natural ocean ecosystem in itself – is a few centimeters thick and consists of layers of different species of microorganisms, using almost anything found in its environment as 'food.'*

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