MISSION MICROBIOMES

Fondation tara océan explore and share

Marine microorganisms play a fundamental role in oceanic ecosystems. These microbiomes are key actors in regulating our planet's health.
Mission Microbiomes is driven by the need to understand how this invisible population of the ocean functions and to study its vulnerability in a changing climate and increased pollution.

SOURCE OF LIFE

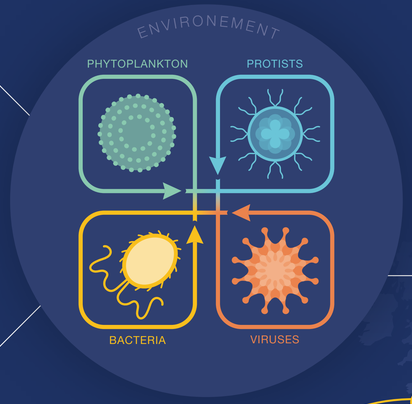
Through photosynthesis, it transforms light energy and nutrients into organic matter, the basis of the marine food chain.

RESOURCES FOR SOCIETY

This ever-changing biodiversity potentially abounds with molecules of great interest for biotechnological innovation.

Benefits

The Ocean microbiome is composed of all marine microorganisms (viruses, bacteria, micro-algae, protists, etc.) and the environment within which they evolve.



REGULATORS OF ECOLOGICAL BALANCES

Marine phytoplankton capture half of the CO2 and contribute to half of the O2 generated

by photosynthetic organisms on Earth. They generate organic matter, which sustains the ocean food webs.

The expedition

Sailing for 21 months to sample the ocean microbiome and share with the public

1 mission, 2 phases

CHILE WITH THE CEODOS PROGRAM

SOUTH ATLANTIC WITH THE ATLANTECO PROGRAM

Nutrients rich upwelling areas

On-board lab

RESEARCH APPROACHES AND FOCUS

OCEAN CURRENTS

How is climate change impacting on ocean currents and microbiome distribution?

1 • Chilean coasts: Oxygen depleted areas

2 • Guyana – Amazonia: connexion and exchanges between South and North Atlantic under the influence of the Amazon river

3 • Weddell sea: a key ocean & climate area with a major drawdown of surface waters and carbon

4 • Chile and Africa: regions of upwelling of rich deep ocean waters, with highly productive fisheries and a strong biological carbon pump

FERTILISATION AND POLLUTION

How do watersheds land use and pollution, including microplastics, alter the microbiomes structure and function?

5 • Chilean coasts: influence of melting glaciers on salinity and local microbiomes

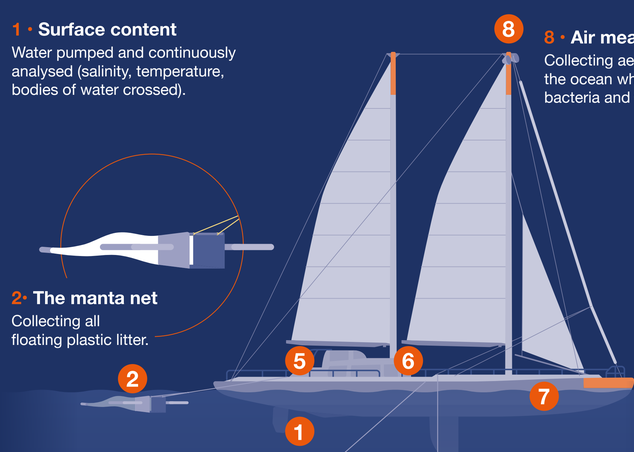
6 • Great rivers: (Amazon, Orange, Congo, Ogooué, Senegal) with an important influence on the Atlantic microbiome

SMALL SCALE PHENOMENA

How do small scale phenomena (e.g., eddies) have to included in models for predicting the ocean microbiome future state?

7 • Atlantic Ocean: understanding the impact of small features (eddies, fronts) on the microbiome.

5 TYPES OF SAMPLING • 3 LABS • 1 STOCK ROOM



1 • Surface content
Water pumped and continuously analysed (salinity, temperature, bodies of water crossed).

2 • The manta net
Collecting all floating plastic litter.

3 • The plankton net
Taking a very large volume of water and specific types of organisms, depending on the size of the net, from depths down to 1000 meters.

4 • The rosette
Sampling at various depths and measuring parameters obtained via sensors (pressure, temperature, conductivity, oxygen levels, carbon pump, chlorophyl).

5 • The wet lab
Where most sampling occur.

6 • Dry labs
inside the boat.

7 • The front hold
Stocking samples.

8 • Air measures
Collecting aerosols above the ocean which can carry bacteria and viruses.

The mission in numbers

ITINERARY

21 stopovers

70 000 kms to cover

COLLABORATING ON BOARD

15 sailors

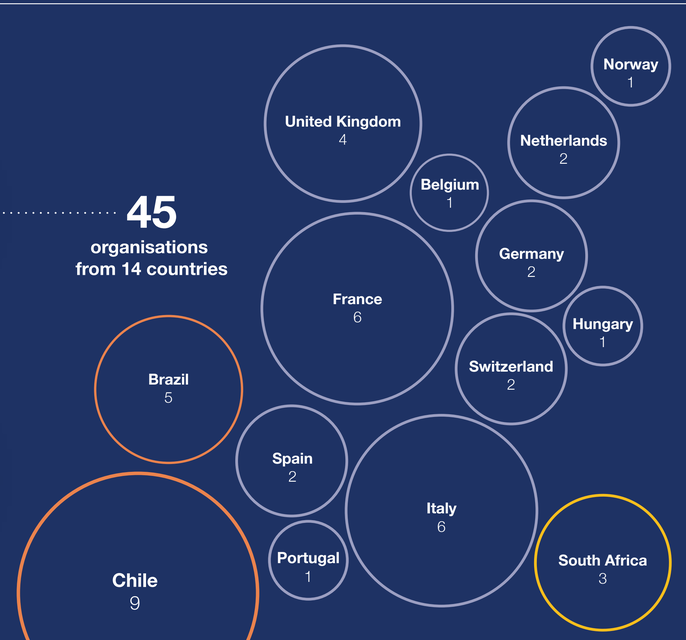
80 researchers

INVOLVED ON A GLOBAL SCALE

around **200** scientists

21 scientific disciplines

45 organisations from 14 countries



studio.v2

WHAT IS THE OCEAN MICROBIOME?

Fondation tara océan explore and share

Every liter of water contains between 10 and 100 billion microorganisms, classified in 4 populations: phytoplankton, protists, bacteria, and viruses. This classification does not reflect the immensely rich biodiversity of plankton, nor their numerous ecological interactions: symbiosis, parasitism, predation, and protection.

The Microbiome Mission will help us understand **WHO DOES WHAT, AND HOW,** in an environment in constant mutation due to climate change

SUBJECTS OF STUDY

exterior stress factors

environ-ment

pollutants

rising temperatures

marine currents

excess of nutrients coming from land and rivers

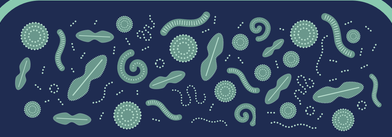
CO_2

CARBON PUMP

MICROBIOME

O_2

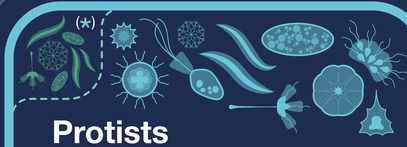
OXYGEN GENERATOR



Phytoplankton(*)

size in micrometers: 0.1 à 10 µm

Phytoplankton consists of all microscopic single-cell algae — the micro-algae. Certain bacteria and protists are phytoplankton. These microorganisms, thanks to chlorophyll pigments, use CO_2 to produce organic matter and generate oxygen. They are equivalent to plants on land.



Protists

size in millimeters: 0.8 to 10 mm

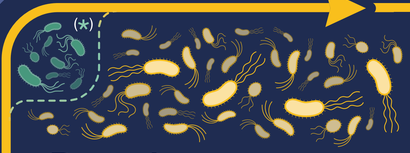
Protists are complex unicellular organisms with a nucleus and sometimes skeletons of glass, stone, or organic matter in extraordinary shapes. Certain are capable of photosynthesis — the phytoplankton. Fueled by solar energy, they produce living matter from carbon dioxide (CO_2), water, and mineral salts. Some of this organic carbon sinks to the bottom of the oceans, sequestering atmospheric CO_2 there for thousands of years.

ASSOCIATION

SYMBIOSIS

PREDATION

PARASITISM



Bacteria

size in micrometers: 0.1 à 2 µm

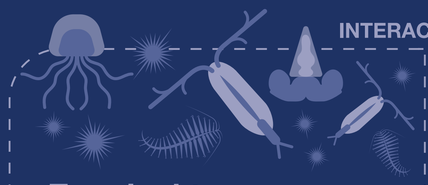
Bacteria are simple unicellular organisms with nuclei. Some participate in the photosynthetic activity of the oceans (cyanobacteria). Others recycle dead plankton into nutritive elements and thus participate in the 'breathing' mechanism of the oceans. Still others live in symbiosis with protists and planktonic animals (zooplankton), providing them vital elements.

Viruses

size in micrometers: 0.01 to 1 µm

Extraordinarily numerous and varied, viruses need a host in order to multiply. Sometimes they provoke the mass death of bacteria, protists or zooplankton, especially those that are multiplying too rapidly in the ecosystem. Most often, they penetrate their hosts without killing them, contributing new genes and participating in the microbiome's equilibrium.

INTERACTION



Zooplankton

size: 0.5 mm to several meters

These are multicellular organisms—the animals in plankton. Often transparent and gelatinous, they show complex behavior, including massive vertical migrations several hundred meters deep. Every night krill, copepods and fish larvae rise to the Ocean's surface to feed without being seen. Zooplankton is in constant interaction with the microbiome.

conductivity

acidity pH

salinity

temperature

nitrogen level

oxygen level

nutrients

JUST AS THE HUMAN MICROBIOME

CONTRIBUTES TO OUR WELL-BEING, THE OCEAN MICROBIOME CONTRIBUTES POSITIVELY TO THE HEALTH OF THE PLANET

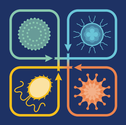
It structures, produces and protects. The microbiome influences the entire oceanic ecosystem, and thus the climate of our planet.

The microbiome is an indicator of the Ocean's state of health. Today the human microbiome is well-studied. In contrast, more than 60% of microbial genes present in the ocean remain to be discovered.

HUMAN MICROBIOME

OCCEAN MICROBIOME

Studying the microbiome means…



understanding a global system

determining what affects its functioning

measuring stress factors

quantifying the impact of rivers

identifying the influence of plastic pollution

assessing the distribution of the microbiome in ocean currents

in a common environment: the Ocean

studio.v2

Fondation tara océan

Mission Microbiomes

The expedition

Sailing for 21 months
to sample the ocean microbiome
and share with the public

START • END
Lorient, Brittany
december 2020
september 2022

Lisbon
september 2022

Rabat

Dakar
august 2022

Sao Tomé
june 2022

Libreville

Boma

Walvis Bay

Capetown
march 2022

Cancún

Pointe à Pitre
july 2021

Cayenne

Belèm

Salvador de Bahia
september 2021

Rio de Janeiro

Florianopolis

Iquique

Valparaiso
avril 2021

Concepcion

Puerto Montt
march 2021

Punta Arenas

Buenos Aires

Weddell Sea

PACIFIC OCEAN

ATLANTIC OCEAN

Amazone · Orange · Congo · Ogooué · Volta · Sénégal

2 · 6 · 4 · 6 · 4 · 1 · 5 · 3

1 mission, 2 phases

CHILE WITH THE CEODOS PROGRAM

SOUTH ATLANTIC WITH THE ATLANTECO PROGRAM

Nutrients rich upwelling areas

RESEARCH APPROACHES & FOCUS

OCEAN STREAMS

How climate change is impacting ocean currents and the microbiome distribution ?

1 • Chilean coasts : oxygen depleted area

2 • Guyane - Amazone : influence of Amazon river's outputs on the link between the South and North Atlantic

3 • Weddell Sea : one of the key ocean & climate area with the major drawdown of surface waters

4 • Chili and Africa : upwellings areas of rich deep ocean waters driving the most productive fisheries on earth and the biological carbon pump

FERTILIZATION & POLLUTION

How watersheds use and pollution such as agriculture or microplastic pollution alter the microbiome structure and function ?

5 • Chilean Coasts : influence of the melting glaciers on salinity and local microbiomes

6 • Great rivers : (Amazone, Orange, Congo, Ogooué, Volta, Senegal) with great influence on local oceans

SMALL SCALE FEATURES

How small scale ocean features alter the ocean microbiome models at large scale ?

7 • Atlantic Ocean : understand how the microbiome is modified by small gyres ?

studio.v2

CEO DOS Chile

AtlantECO