GROMADA

Erasmus+

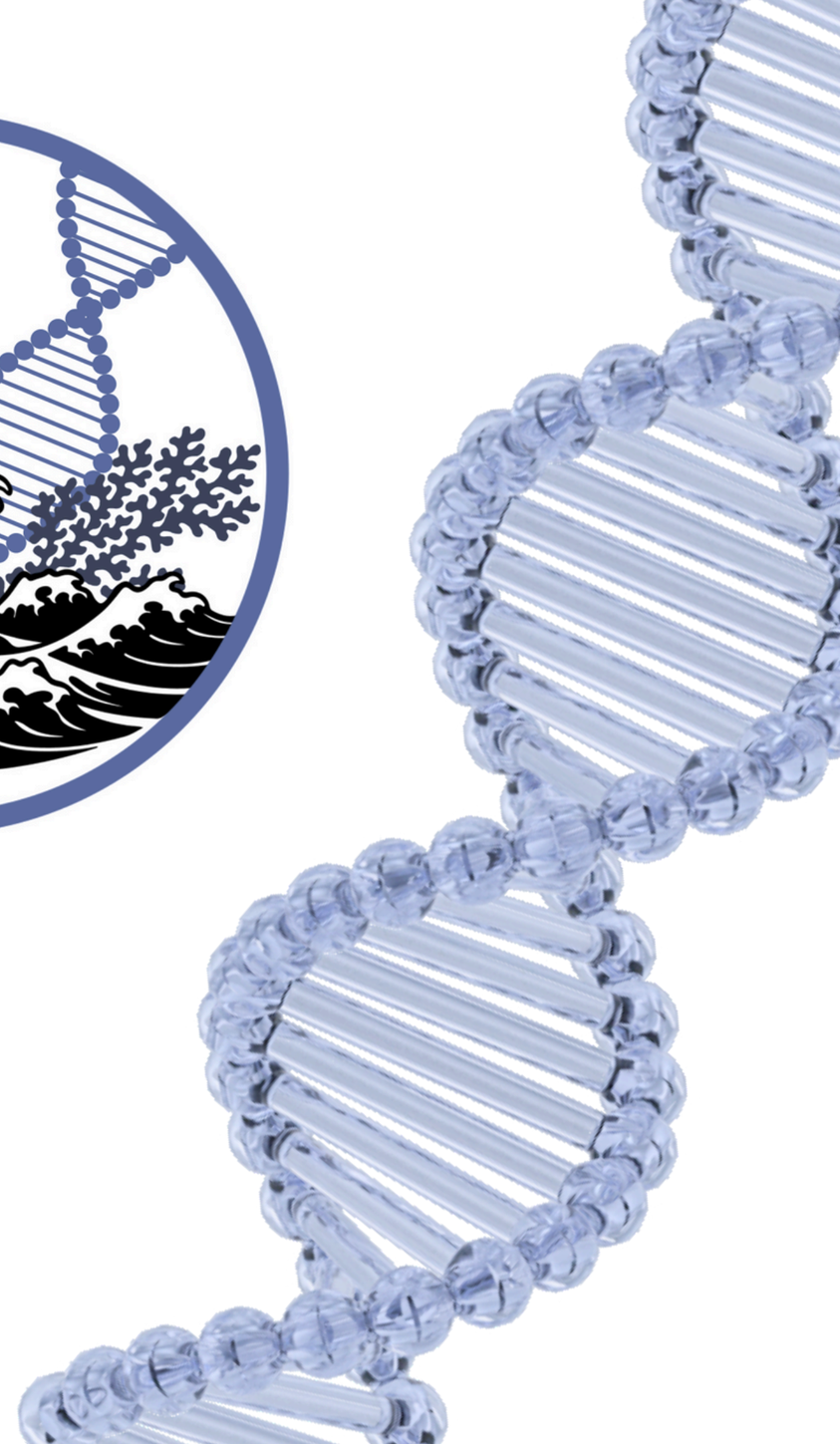
SPRING 2025

MICRODOCTORS

FOR SEA HEALTH

environmental student driven citizen-science project

Odesa I. I. Mechnikov National University

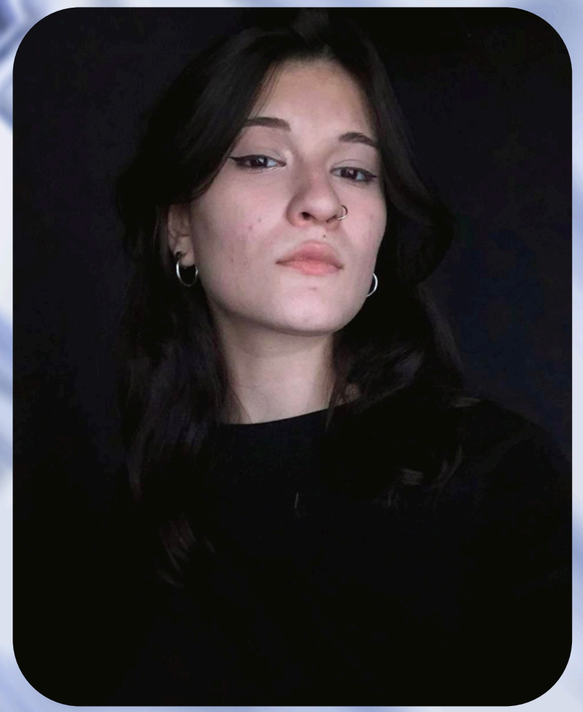


Our team

Oksana Zinchenko
Head of the Department
of Microbiology,
Virology and Biotechnology

Olha Shymbarova
Physics and Astronomy
bachelor student

Adelina Myndru
Chemistry
bachelor Student



Alina Botsu
Mathematics
bachelor student

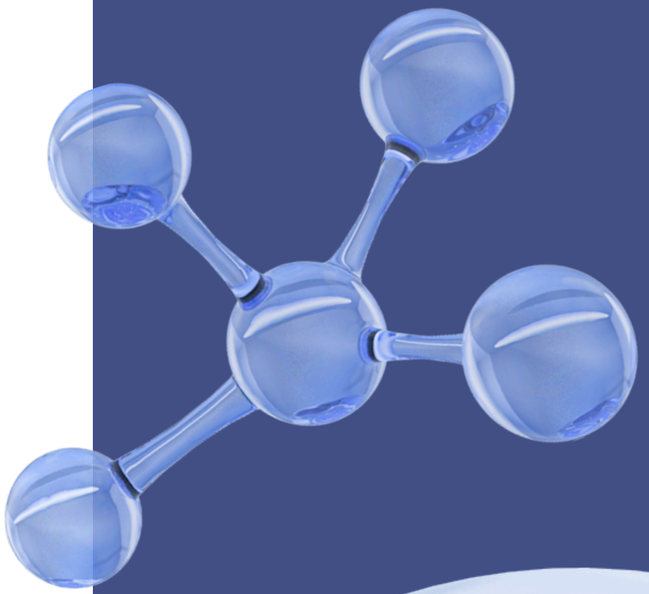
Background

Russian military agression towards Ukraine exacerbated the problem of environmental pollution, in particular, water supply system and wastewater system damages.

It leads to the growth of the danger of spread of diseases through water bodies. Possibilities for treatment of big volumes of water are limited but microbial communities naturally inhabiting seas and other water bodies can help with water sanitation.

Objectives

To evaluate the potential of marine bacteria to clean sea ecosystem from pathogenic microorganisms and possibility to create microbial preparations for water sanitation.



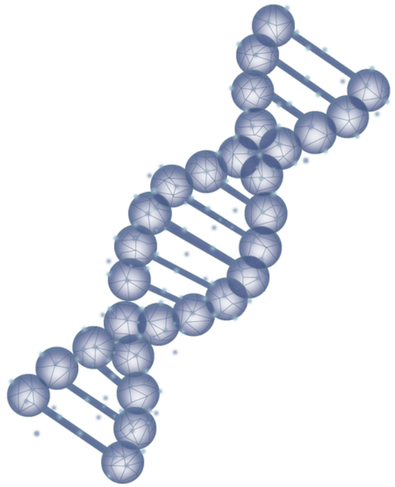
METHODS AND RESEARCH DESIGN

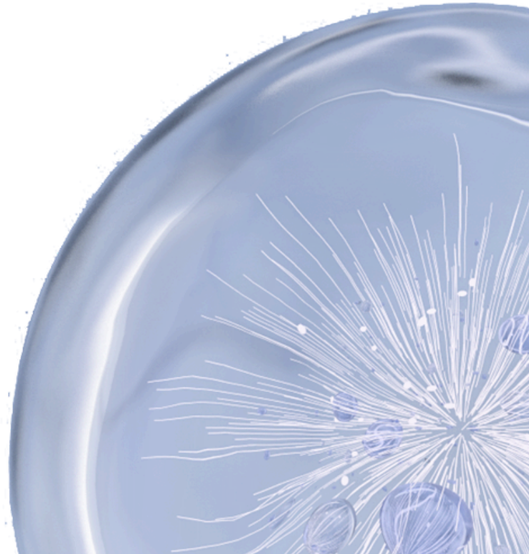
- Primary search for genomes of marine bacteria was carried out in the GenBank database https://www.ncbi.nlm.nih.gov/genbank/

- Filters ocean, marine, water, sediment, hydro were used for selection of bacteria

- Whole genomes of marine bacteria were downloaded from the database

- Genomes were analyzed using the AntiSMASH bacterial version database of biologically active products of bacteria https://antismash.secondarymetabolites.org/#!/start





Timeline

Genomes

Students processed the species list by searching the NCBI database for suitable bacterial genomes for further work.

February 2025

AntiSMASH analysis

March 2025

Using antiSMASH, the students analyzed the obtained bacterial genomes, and the results were processed into summary tables.

Metabolites

Using the antiSMASH analysis result tables, the students presented summary tables of metabolites from these analyses.

April 2025

Spectrum of activity

May 2025

Using data from previous studies from various sources, the students analyzed the activity spectra of the metabolites used.

Results

106 genomes of marine spore-forming bacteria were found and used for analysis

Collection of genomes was created

Genomes › Bacillus velezensis

Тип | Люди | Змінено | Джерело

Назва	Власник	Останні змінені	Розмір файл
GCA_002747285.1	myndruadel	22 лют. 2025 р. myndruadel	—
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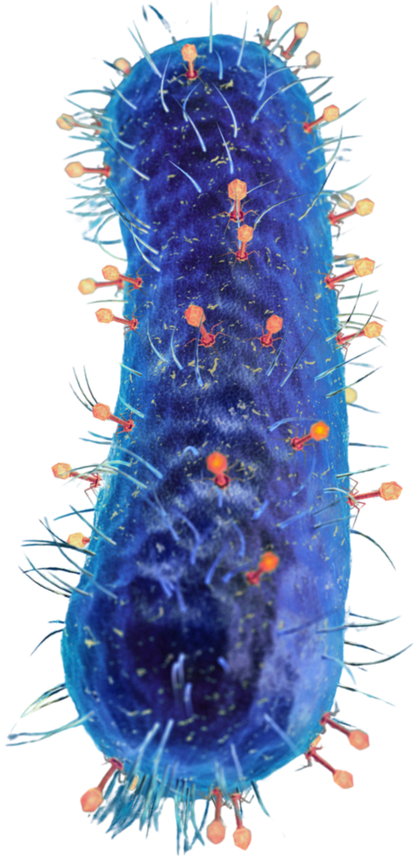
GCA_030758055.1	myndruadel	22 лют. 2025 р. myndruadel	—

https://drive.google.com/drive/folders/1hGe1BjPGdK3eev5f21ibr8w7kuEIZspS?usp=sharing

Results

53 types of antimicrobial substances were identifed and gene clusters coding

49 different antimicrobials were found



	A	B	C	D	E	F	G	H
1	Metabolite		Bacillus subtilis	Bacillus subtilis	Bacillus subtilis	Bacillus subtilis	Bacillus subtilis	Bacillus subtilis
2		COUNTA з Most similar known cluster	ASM1996913v1	ASM1145607v1	ASM1339372v1	ASM523409v1	ASM190255v1	ASM492333v1
3	1-carbapen-2-em-3-carboxylic acid	17	1		1	1	1	1
4	amyloliquecidin GF610	7						
5	andalusicin A/andalusicin B	2						
6	aurantinin B/aurantinin C/aurantinin D	1			1			
7	bacillaene	70	1	1		1		1
8	bacillibactin	100	1	1	1	1	1	1
9	bacillibactin/bacillibactin E/bacillibactin F	13						
10	bacillomycin D	4						
11	bacillothiazol A/bacillothiazol B/bacillothiazol C/bacillothiazol D/bacillothiazol E/bacillothiazol F/bacillothiazol G/bacillothiazol H/bacillothiazol I/bacillothiazol J/bacillothiazol K/bacillothiazol L/bacillothiazol M/bacillothiazol N	2						
12	bacilysin	74	1	1	1	1	1	1
13	bacitracin	9						
14	Bottromycin A2	1						

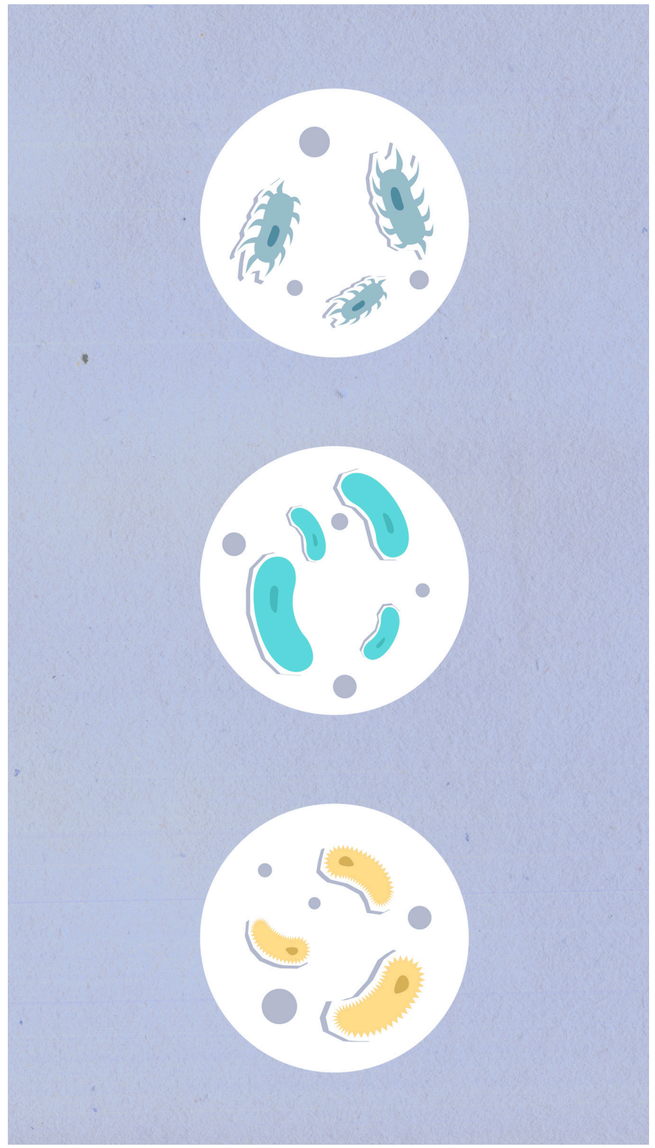
https://docs.google.com/spreadsheets/d/1XN83cBLO-9pW-BRcbIzLbT5lfSuTIUGM/edit?usp=sharing&ouid=108199865362962783921&rtpof=true&sd=true

Results and conclusions

- Detected compounds were characterized using open databases.

- Activity towards common human pathogens was found (including the most dangerous antibiotic-resistant bacteria).

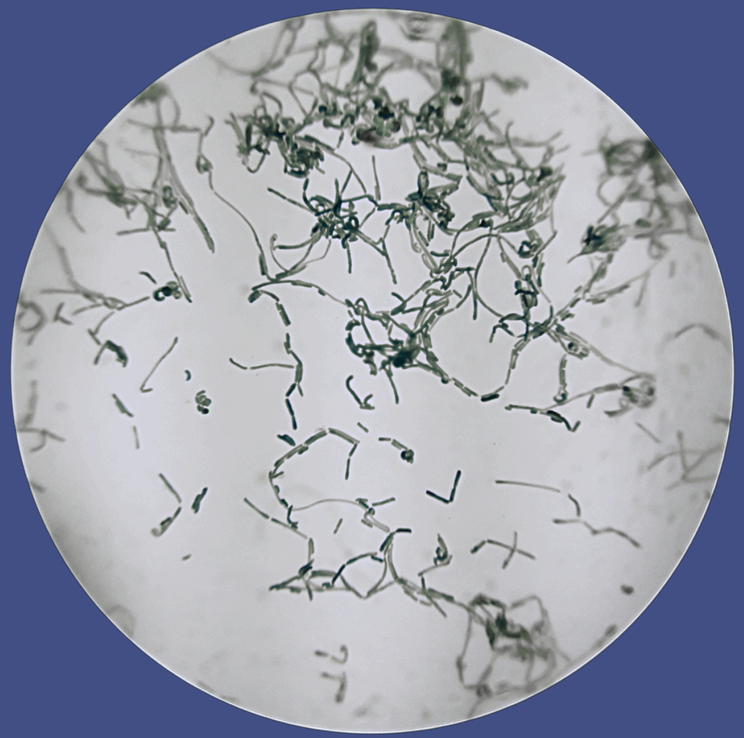
- Marine spore-forming bacteria produce wide variety of antibiotics and can be proposed as the base for microbial preparations for water treatment.



Results and conclusions

Given the scale of environmental damage caused by the war in Ukraine, traditional water treatment methods may be insufficient or logistically challenging to implement in conflict-affected areas.

The findings of the project prove that marine bacteria from natural environments can serve as a base for cost-effective bilogical means for water sanitation from pathogenic bacteria.



Results and conclusions

Great potential of studied microorganisms in producing antibiotics can also be used for the development of novel treatments for infectious diseases. Given Ukraine's urgent need for new antimicrobial solutions due to the high risk of infections in combat-injured individuals and displaced populations, this project represents an important step toward addressing both immediate and long-term challenges in public health and environmental protection.

Thank you for your attention