NATIONAL INSTITUTE OF BIOLOGY

National Institute of Biology - NIB

NIB was established by the Republic of Slovenia as a public, non-profit research institute in 1960 and is today the leading research institution in biological sciences. Its infrastructures are in Ljubljana and Piran and it employs 121 staff.

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NIB performs excellent basic science that helps humanity to understand the living planet, its ecosystems, organisms, their relationships, and the biological processes as well as products. This knowledge advances our understanding of the stressors to the natural world, and to human health and welfare.

Our laboratories in Ljubljana and in Piran are equipped and staffed to allow addressing any biological question, as well as to offer solutions to threats to human kind. Our expertise allows for rapid assessments, and mediation, of damage to humans and their environment, considering the military as well as civilians.

Our services range from detection and bioremediation of chemical and biological agents, to manipulation of cellular and molecular mechanisms that they trigger, to developing environmental biosensors, to modeling ocean dynamics and to improving development of autonomous underwater vehicles.

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Department of Biotechnology and Systems Biology
Department of Organisms and Ecosystems
Department of Genetic Toxicology and Cancer Biology
Marine Biology Station Piran

NIB research competences for the military:

- Plant pathogens (ongoing project with MORS)
- Microbiological toxins in water (ongoing project with MORS)
- Stem cells for regenerative medicine
- Detection of microbes in the air and in waters
- Detection of microbes in natural air filters – spider webs
- Bio and agro defense expertise
- Development of biosensors for the control of water pollution and bioremediation
- Environmental impact assessments
- Methods for rapid detection of mechanisms for the operation of new chemical and biological weapons.

For ongoing projects and references, please visit http://www.nib.si/

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Methods for rapid detection of the mechanisms of action of new chemical and biological weapons

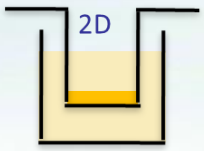
Problem: current methods do not enable to understand how a new threat agents exert their adverse effects in a short time.

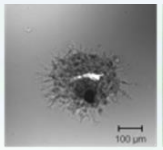
Consequence: medical countermeasures to mitigate threat are unknown, making solders and civilians vulnerable.

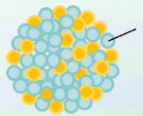
PROPOSAL

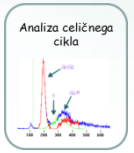
In vitro cell models:

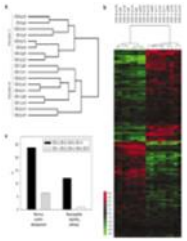
- Various target cells (i.e. liver, lung, brain, neural….)
- 2D and 3D experimental models
- Different time frames of exposure (short,- long-term, detection of changes over extended period after the exposure)
- Analyses of phenotypic responses (apoptosis, cell cycle, DNA damage, oxidative stress, membrane damage…)
- Omics: Genomic, proteomic, metabolomic analyses…

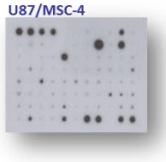








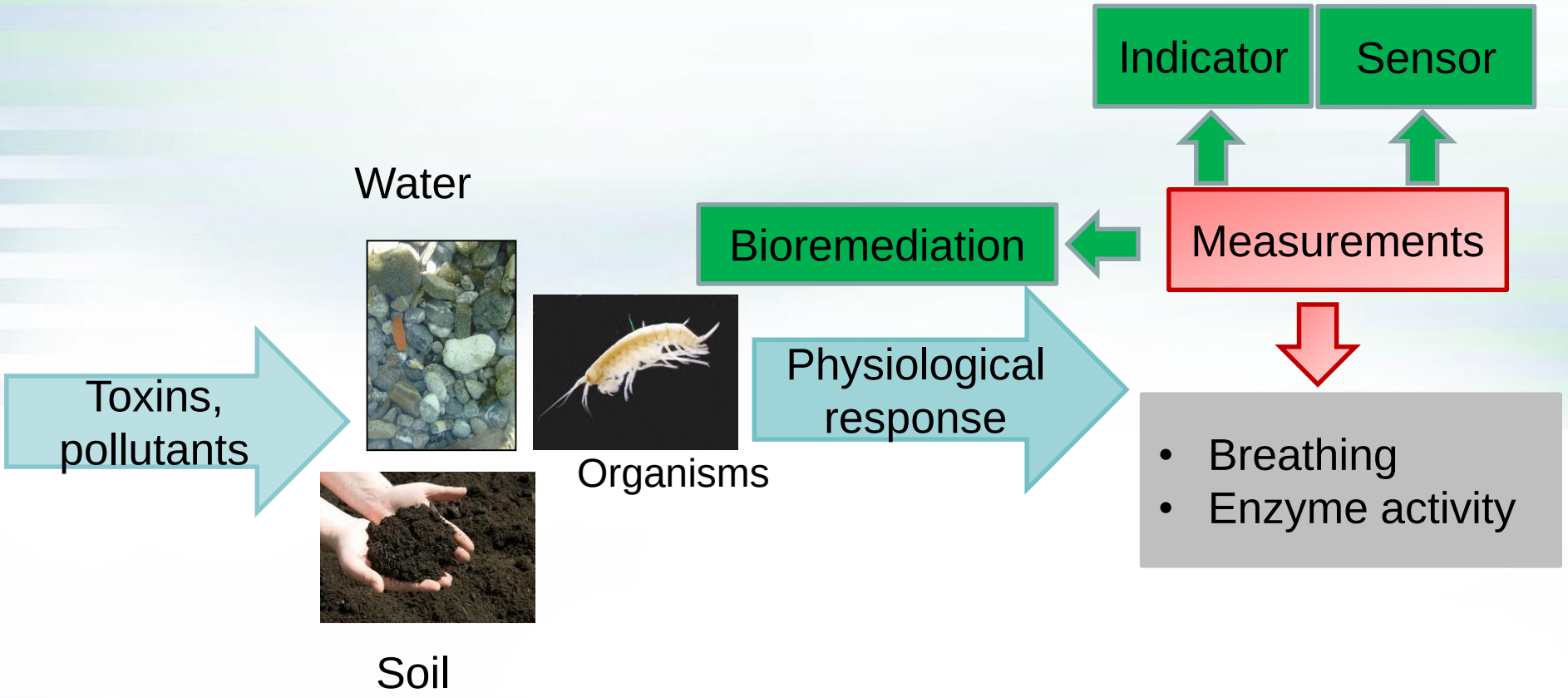




Bioinformatics

Identification of mechanisms of action and targets for medical counteraction

Development of indicators / biosensors for controlling potential pollution in the environment + bioremediation



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Assessment of risks, environmental impacts, natural resources and organisms in case of terrorist attacks

- Biodiversity/natural balance
- Safe water reserves
- Risk assessments of chemical or biological agents

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NIB - Marine Biology Station Piran

- Experimental oceanography and modelling in coastal waters, including the exploration of the dynamics of water masses and the numerical forecasting

- Development of instrumentation, including autonomous underwater vehicles, underwater gliders and other sensors that support military operations

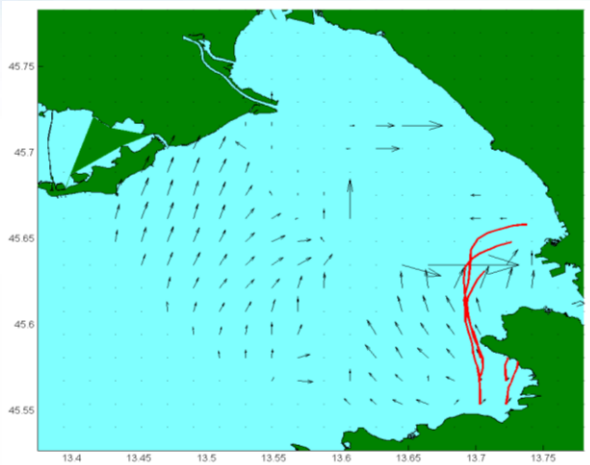

Figure of simulated trajectories of a lost boat

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Bio and Agro defense expertise

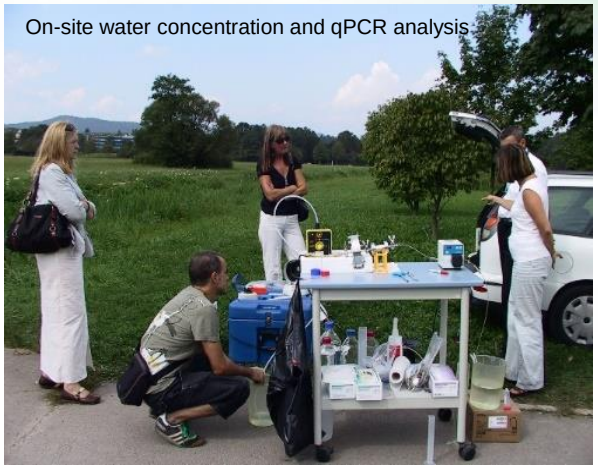
Portable sequencer MinIon Nanopore

Next generation sequencing (NGS) for identification of microbial contamination of water, plants, soil or air

– Untargeted analysis of the microbial population – metagenomics
– Monitoring of viral quazispecies

Point-of-care testing for human and plant pathogenic microbes

– Fast on-site sample preparation (e.g. water concentration) and detection with molecular methods (e.g. isothermal LAMP, qPCR)



On-site water concentration and qPCR analysis

Non-chemical-based elimination of microbial contamination of water

– Disinfection with cold atmospheric plasma*
or hydrodynamic cavitation**

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Bio and Agro defence expertise

State-of-the-art laboratory and equipment for the study of diseases/microbes that threaten agricultural industry and public health

- ability to conduct research and development
- diagnosis of emerging diseases
- train specialists, prepare risk assessments, advice etc.


X. fastidiosa a major threat to olive trees

Developed and applied over 200 qPCR assays and droplet digital PCR (ddPCR) assays

- Detection of (quarantine) plant pathogenic bacteria (e.g. *X. fastidiosa*), viruses (e.g. PepMV), phytoplasma
- Detection of human enteric viruses (*Rotavirus, Norovirus)* in water and environmental samples
- Monitoring of bacteria viability via ddPCR
- Reference material preparation and evaluation
- Detection and quantification of genetically modified organisms in food and feed

enteric viruses in coastal marine environment