

The Instrumental Analysis Laboratory

It is devoted to applications which involve the use of various analytical methods (electrochemical, optical, and spectrometric) for the in-situ and ex-situ experimental determination of a wide range of quality parameters specific to aquatic ecosystems. The equipments in this laboratory may be used for:

- complex analyses of air, water and soil samples;
- direct determination of compounds in the samples to be analyzed;
- determination of inorganic and organic pollutants in water (heavy metals, pesticides, nutrients)
- online and real-time monitoring of Danube water quality);
- in-situ and ex-situ monitoring of aquatic ecosystem quality;
- elaboration of statistical models and algorithms for estimating and monitoring the global water quality index (WQI);
- algorithmization of physical, chemical and biological parameters for determining quality classes for surface aquatic ecosystems;
- development of electrochemical biosensors detecting pesticides;
- development of electrochemical biosensors for detecting hormones, antibiotics, toxic cations and toxic anions.

The Instrumental Analysis Laboratory

Members:

- **Prof. Dr. Constantin APETREI**
<https://dcfm.ugal.ro/index.php/membri/2-uncategorised/27-apetrei-constantin>
- **Lecturer Dr. Mihaela TIMOFTI**
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- **PhD Student Mădălina CĂLMUC**
<https://scholar.google.com/citations?hl=en&user=-V86bqYAAAAJ>
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The Instrumental Analysis Laboratory

Equipment:

***Advanced electroanalytical system type potentiostat/ galvanostat
AUTOLAB PGSTAT302N with equipment, electrodes and reagents
included - Metrohm Autolab, Netherland; Metrohm Dropsens, Spain;
Metrohm AG, Switzerland***

Uses:

- development of new sensitive materials and identification of appropriate technologies for manufacturing (bio)sensors;
- development and characterization of new useful biosensors for surface water analysis;
- the integration of (bio)sensors in a multiparametric device suitable for surface water analysis;
- development of a multivariate algorithm based on data fusion and intelligent models;
- calibration and validation of multiparametric systems for surface water quality analysis.

Cobalt (II and III)

Iron (II and III)

Mn (II and VII)

As(III)

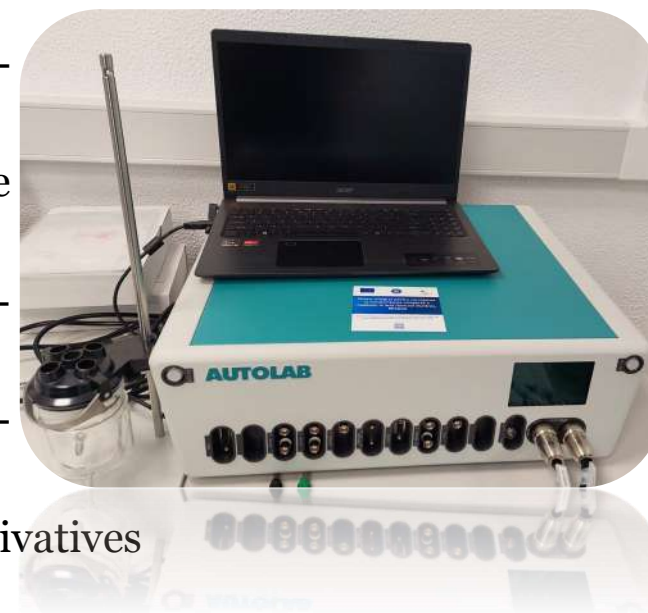
Cd(II)

Nitrite/Nitrate

Phenol derivatives

Pesticides

Sterols etc.



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*Advanced electroanalytical system type potentiostat/ galvanostat
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Metrohm AG, Switzerland*

Technical specifications:

Potentiostat/galvanostat AUTOLAB PGSTAT302N

- current range: 2A
- potential range: 10V
- maximum polarization voltage: 30V

The impedance module

- frequency range: 10mHz – 1MHz
- maximum generated frequency: 32MHz

Rotate disc electrode module

- rotation rate: 100 – 10000 rot/min

Module for low currents

- maximum current resolution: 0.3fA

Quartz crystal electrochemical microbalance module

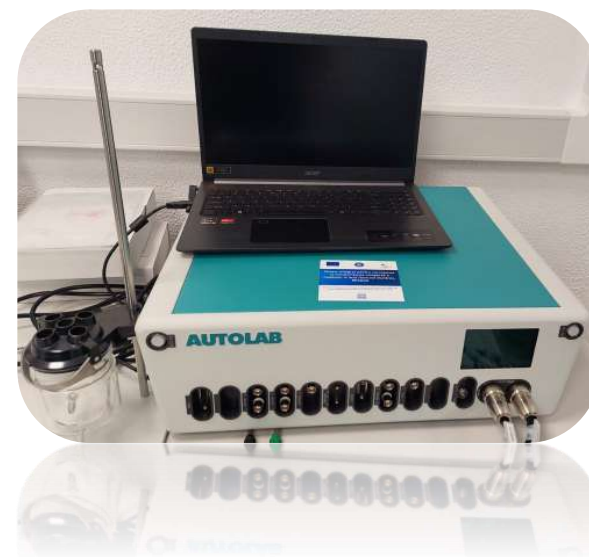
- frequency resolution: 0.007Hz

Ultra-fast sampling rate module

- sampling rate: 10Msample/sec

High scan rate mode

- maximum rate: 250KV/sec



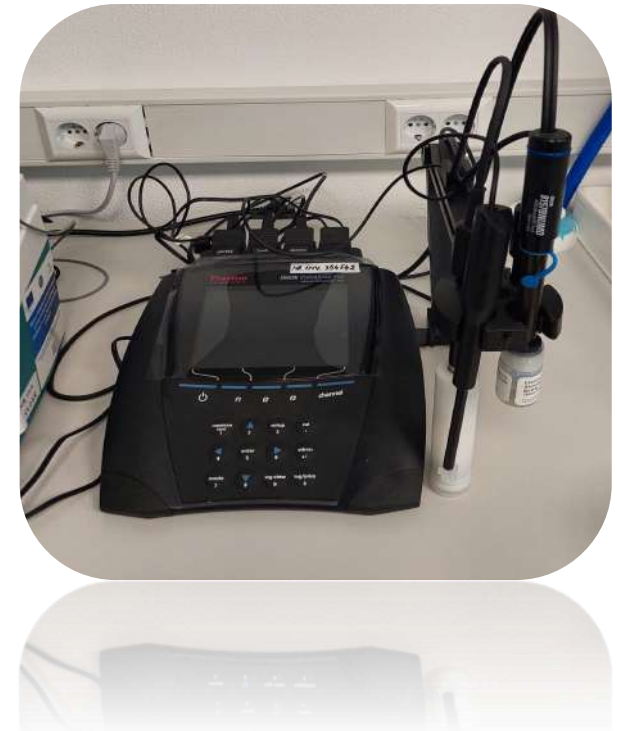
The Instrumental Analysis Laboratory

Equipment:

ORION VERSA STAR 90 pH/ISE/ Conductivity/ Dissolved Oxygen Multiparameter Benchtop, ThermoFisher Scientific.

Uses:

- analysis of pH, F- concentration, conductivity, dissolved oxygen and temperature from different types of samples. Log up to 2000 data point sets with time/ date and easily transfer logs via USB or RS232 to a computer.



The Instrumental Analysis Laboratory

Equipment:

ORION VERSA STAR 90 pH/ISE/ Conductivity/ Dissolved Oxygen Multiparameter Benchtop, ThermoFisher Scientific.

Technical specifications:

pH/ISE Measurement Module:

- measurement of pH, ion concentration, mV, relative mV or ORP with temperature;
- perform up to a 6 point pH calibration using automatic buffer recognition of NIST, DIN or user-defined buffer groups;
- perform up to a 6 point ISE calibration with selectable units of ppm, M, mg/L, %, ppb or none;
- accuracy pH: ± 0.002 .

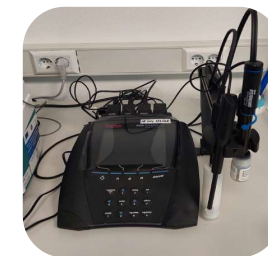
Conductivity Measurement Module:

- measurement of conductivity, TDS, salinity or resistivity with temperature;
- perform up to a 6 point conductivity calibration;
- usage of linear, non-linear, EP (USP) or off conductivity temperature compensation with 5°C, 10°C, 15°C, 20°C or 25°C reference temperatures;

- range: 0.001 $\mu\text{S}/\text{cm}$ to 3000 mS/cm;
- accuracy: 0.5% of reading ± 1 digit $> 3 \mu\text{S}$; 0.5% of reading $\pm 0.01 \mu\text{S} \leq 3 \mu\text{S}$.

DO Measurement Module:

- measurement of dissolved oxygen in percent saturation or mg/L with temperature using Orion polarographic DO probes;
- DO calibration using water-saturated air, air-saturated water, custom value (Winkler titration) and zero point options;
- percent saturation range: 0.0 to 600.0% saturation;
- accuracy: ± 0.2 mg/L or $\pm 2\%$ of reading, whichever is greater.



The Instrumental Analysis Laboratory

Equipment:

Mercury analyzer DMA-80 Evo Double Beam, Milestone

Uses:

- analysis of any matrix (solid, liquid or gas) without any pre-treatment or chemical additions in as few as 6 minutes in full compliance with EPA method 7473.
- mercury determination in environmental applications such as soil, wastewater, sediment and waste testing
- used in the food industry, where fish testing is the primary application.

Technical specifications:

- detection limit as low 0.001 ng Hg.



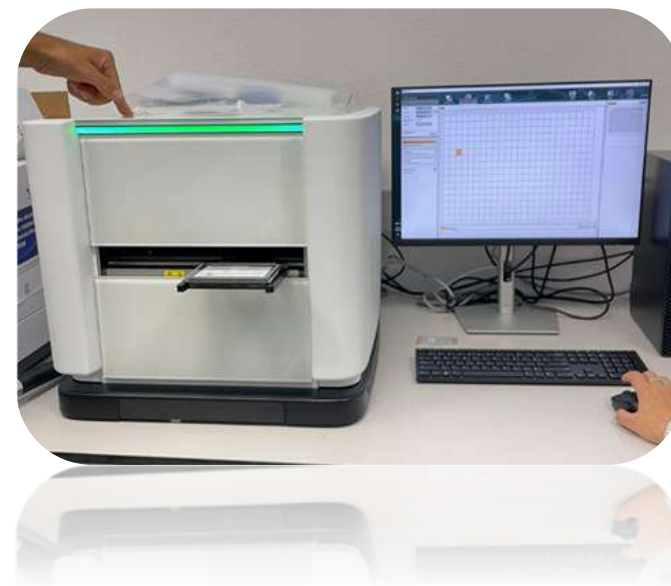
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Equipment:

EnSight Multimode Plate Reader, producer: Perkin Elmer

Uses:

- multiplexed (up to 384 wells) measurement of the absorption of electromagnetic radiation, in the wavelength range of ultraviolet (UV), visible, and near-infrared (NIR) light (230 – 1000 nm).
- detection of compounds of interest is performed spectrophotometrically via (i) absorbance, (ii) fluorescence (including time-resolved fluorescence TRF), and (iii) luminescence provided that the required fluoro/chromophores for each type of analysis are available. Measurement protocols concerning specific target molecules (e.g., proteins, nucleotides) are built-in and can be applied using specific assay kits.
- qualitative/quantitative detection of light-emitting or light-absorbing markers in medical research and drug discovery applications, functional group detection, qualitative/ quantitative analysis of DNA/RNA, proteins (receptor-ligand binding, enzyme assays), cellular assays (growth kinetics), reporter gene assays.



The Instrumental Analysis Laboratory

Equipment:

EnSight Multimode Plate Reader, producer: Perkin Elmer

Uses:

- analysis of different fluorescence stains within cells for several types of cellular assays including cell counting, live-dead and toxicity assays, proliferation, transfection rate analysis etc.
- quality control and phenotypic cellular assays.



Technical specifications:

- detection methods: Absorbance, Image-based Cytometry, Time-Resolved Fluorescence (TRF), Luminescence, Alpha, Fluorescence

The Instrumental Analysis Laboratory

Equipment:

Turbidimeter, TL2360

Uses:

- determination of turbidity in a very wide measurement range from 0.0001 to 10000 NTU for all turbidity measurement applications from ultrapure and potable water to meters in untreated waste water.

Technical specifications:

- complies with ISO 7027, DIN EN 27027, DIN 38404 and NFT 9033
- accuracy: FNU: $\pm 2\%$ of reading plus 0.01 FNU from 0 – 1000 FNU

Resolution:

- Turbidity: 0.001 NTU/EBC
- absorbance: 0.001 Abs
- transmittance: 0.1% T
- repeatability: $\pm 1\%$ of reading or 0.01 NTU, whichever is greater (under reference conditions)



The Instrumental Analysis Laboratory

Equipment:

*TOC elemental analyzer with nitrogen and phosphorus module,
Elementar acquray*

Uses:

- TOC analysis in solids and water, total nitrogen in water and total phosphorous in water.
- determination of total nitrogen in water according to ISO 29441, total phosphorus in water according to ISO 15681, TOC, NPOC, TIC, TC in aqueous samples according to ISO 8245 and TOC, ROC, TIC, TC in solids according to DIN 19539 , DIN EN 15936 and DIN EN

Technical specifications:

- measurement range for the analysis of total nitrogen in liquid samples: 0.05 - 20 mg/l;
- measurement range for the analysis of total phosphorus in liquid samples is: 0.1 – 20 mg/l;
- measurement range for the analysis of organic and inorganic carbon in aqueous samples: 0-20,000 ppm;
- the solids module measures up to 1.2 mg C abs. or 0 - 100 %.



The Instrumental Analysis Laboratory

Equipment:

Fixed online surface water quality monitoring station

Uses:

- monitoring the diurnal variation of different physico-chemical parameters;
- detection of events from episodic discharges of pollution sources (industrial and municipal);
- continuous and automatic analysis of running/standing water.

Technical specifications:

The isothermal cabin fully equipped electrically, mechanically, hydraulically (with air conditioning) includes:

- fast loop sampling system and internal sampling system;
- S::CAN equipment for online water quality monitoring for the following parameters:
- turbidity (0-1400 NTU), NO₃-N (0-100 mg/L), TOC (0-180 mg/L), DOC (0-140 mg/L), UV₂₄₅ (0-500 Abs/m), UV₂₄₅ f (0-400 Abs/m), color (0-3500 Hazen), NH₄-N (0.1 – 20 mg/L), Cl⁻ (0.1 – 200 mg/L), F⁻ (0.05 – 2 mg/ IT);



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Equipment:

Fixed online surface water quality monitoring station

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- detection of events from episodic discharges of pollution sources (industrial and municipal);
- continuous and automatic analysis of running/standing water.

Technical specifications:

The isothermal cabin fully equipped electrically, mechanically, hydraulically (with air conditioning) includes:

- aquaread equipment for online water quality monitoring for physical, chemical and microbiological parameters: pH (0-14 upH), ORP (± 2000 mV), conductivity (0-200 mS/cm), TDS (0-100 000 mg /L), SSG (0-50 σt), SAL (0-70 PSU), DO (0-500%/0-50 mg/L), Ca (0-2000 mg/L;), Chlorophyll (0-500 μ g/L), Phycocyanin (0-300 000 cells/mL), Phycoerythrin (0 – 200 000 cells/mL), hydrocarbons (10 000 μ g/L), Fluorescein Dye (0-500 μ g/L); CDOM/FDOM (0 -20 000 μ g/L) and Rhodamine Dye (0 - 500 μ g/L);
- SaFIA mono-element analyzers for monitoring heavy metals: Cu (0-100 ppb), Pb (0-100 ppb), Cd (0-100 ppb), Zn (0-100 ppb), Fe+3 and Fe+2 in the form of Fe+2 (0-1 mg/L), Cr+6 (0-500 μ g/L), Ni+2 (0-500 μ g/L);
- data acquisition-transmission system to a command center.

