

# **ELEVATOR PITCH SESSION 3**

9:20 - 11:15

IPSSC +  
CMBO

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Jožef Stefan International Postgraduate School  
and Young Researchers' Day CMBO

*15 and 16 April 2019, Planica*

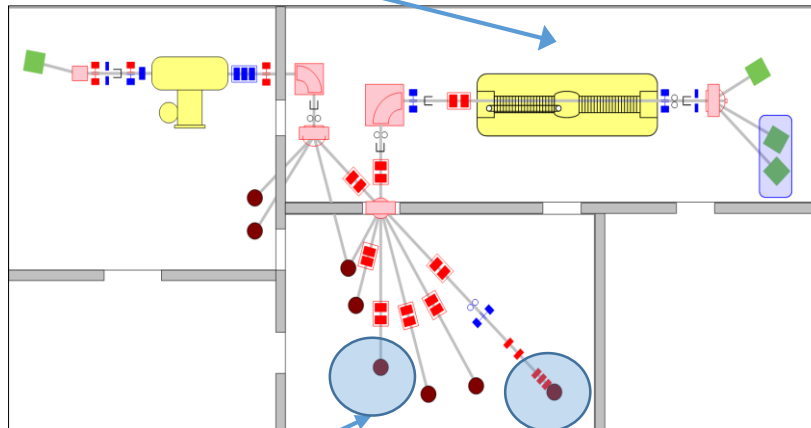
## Overview of computational methods for processing MeV TOF SIMS spectra and 2D images at RBI

Marko Barac,

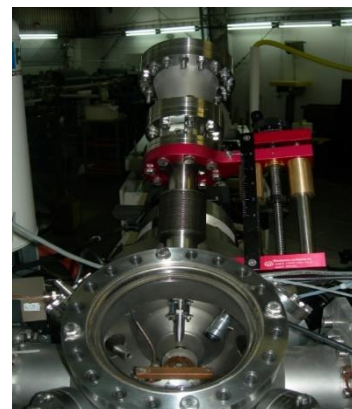
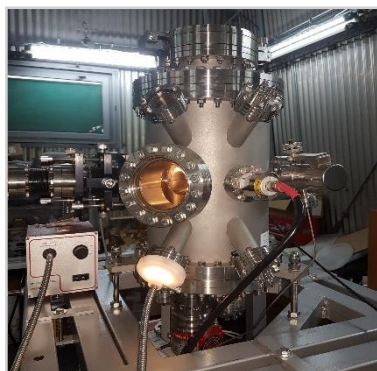
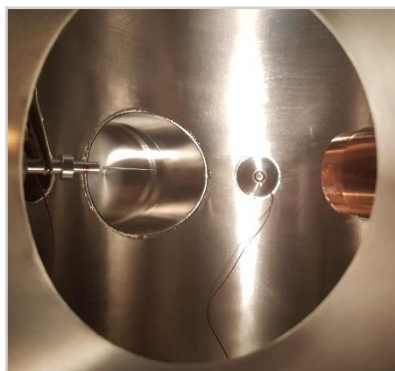
Laboratory for ion beam interactions, Ruđer Bošković Institute,  
Bijenička 54, HR-10000 Zagreb, Croatia

**Poster number: 27**

# 6.0 MV EN Tandem Van de Graaff accelerator



New MeV TOF SIMS capillary microprobe!



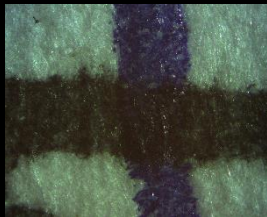
MeV TOF SIMS setup installed on microprobe



An average person today processes **more data** in a single day than a person in the **1500s** did in an entire lifetime

Source: The Human Face of Big data

Big Data has a lot to offer to the future of physics!





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## Lipid droplets - cellular safeguards of stress-free life

Eva Jarc

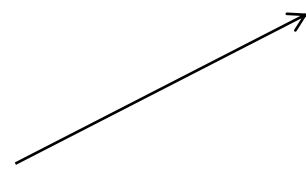
Jožef Stefan Institute, Department of Molecular and Biomedical Sciences

Poster number: **43**

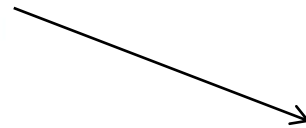
# Lipids are important for body homeostasis



Lipids from food



Energy

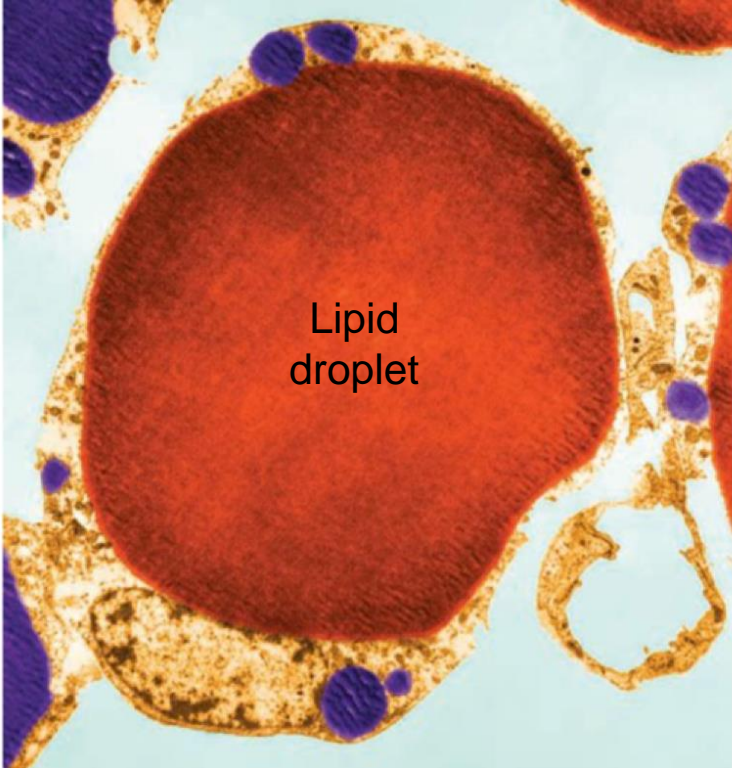


Building blocks

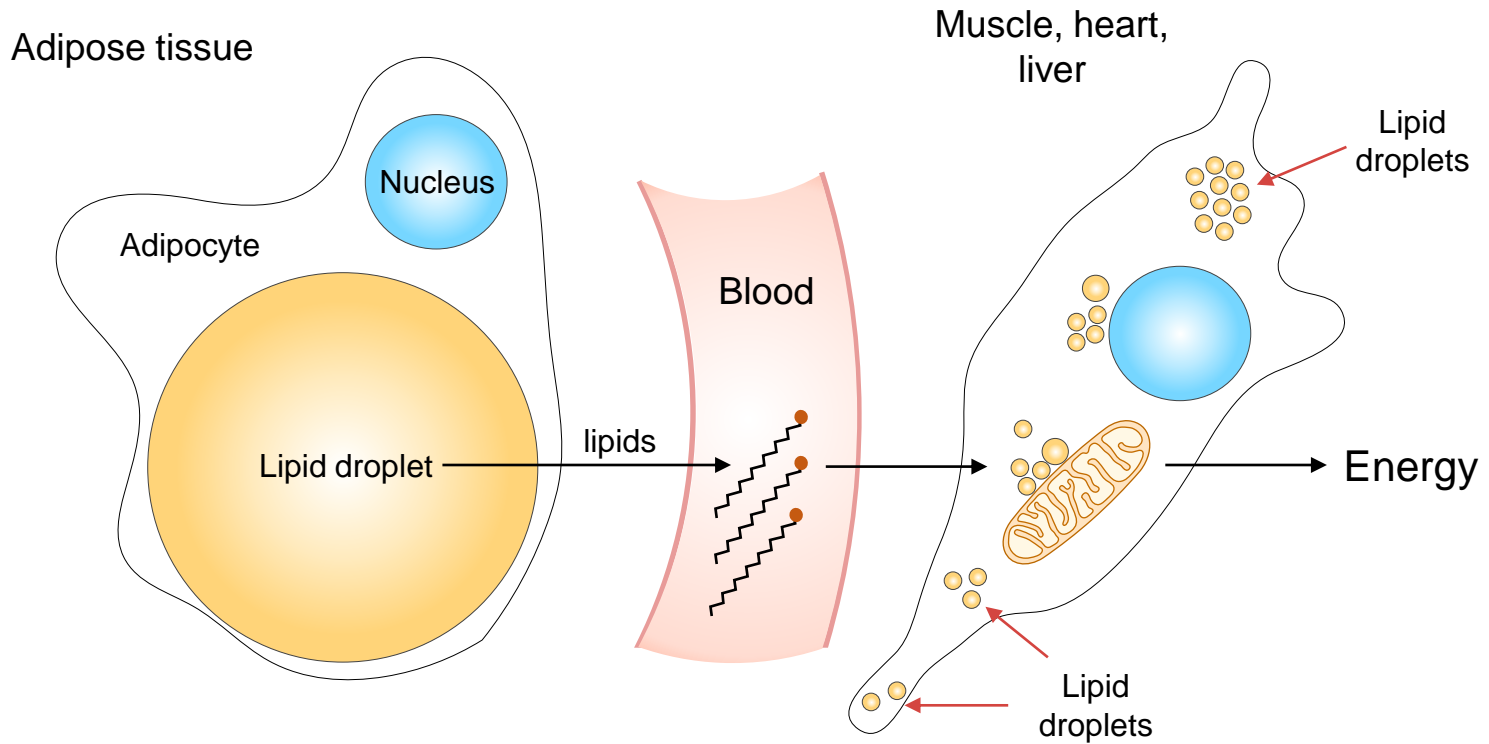
# Adipocytes store fat in lipid droplets



Adipocytes

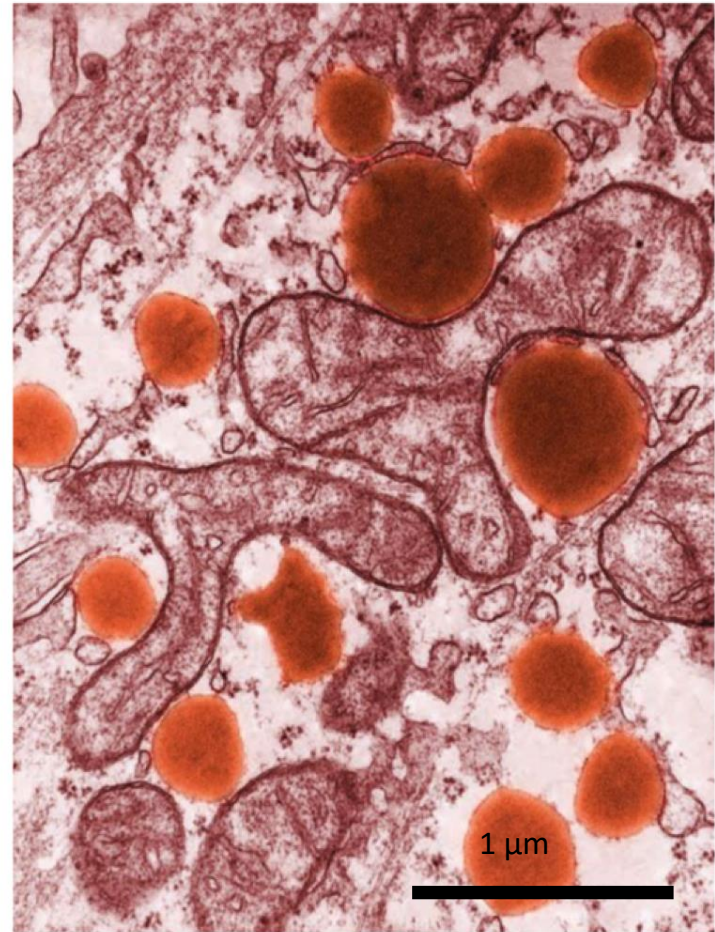
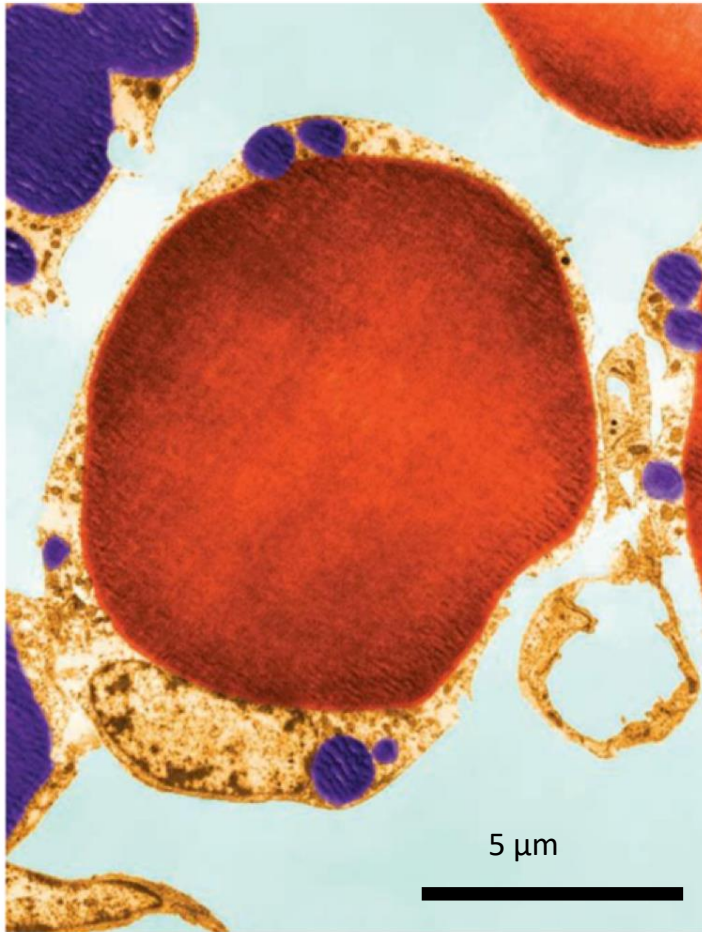


# Adipocytes release lipids into the bloodstream



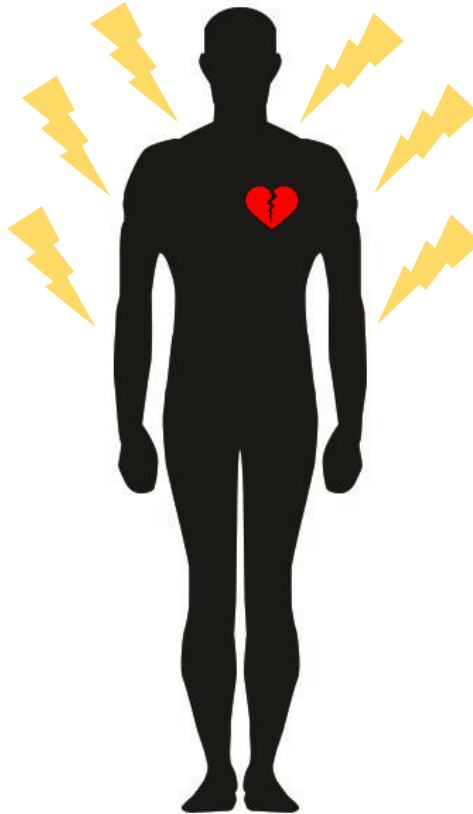


Lipid droplets are present in most of our tissues



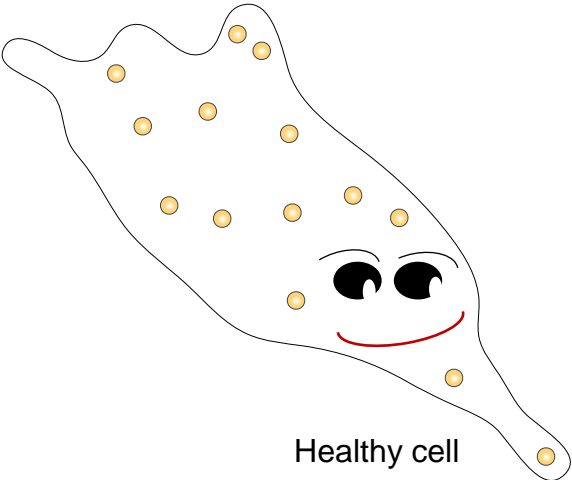


Stress is associated with an imbalance of nutrients and energy

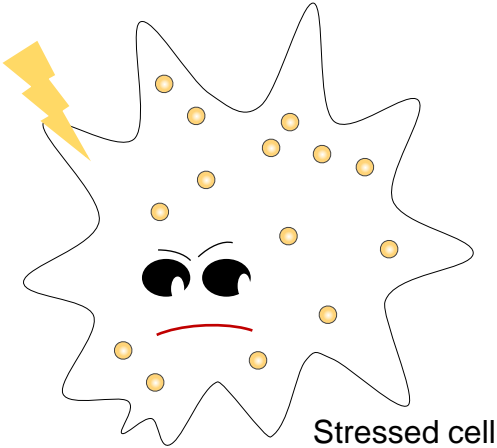


# Cancer cells that are resistant to stress...

...accumulate lipid droplets.



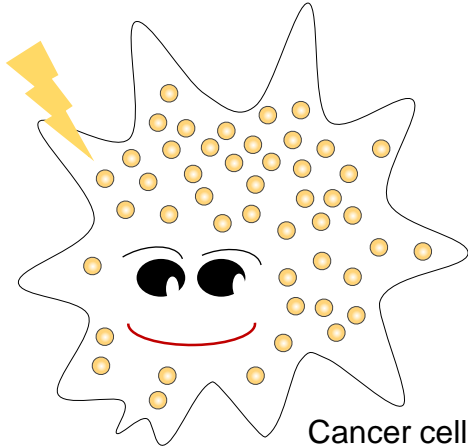
Healthy cell



Stressed cell



Cell death



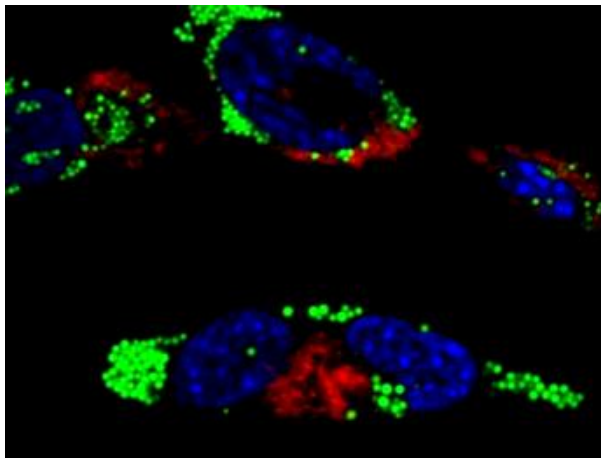
Cancer cell



Cell survival &  
Tumour growth

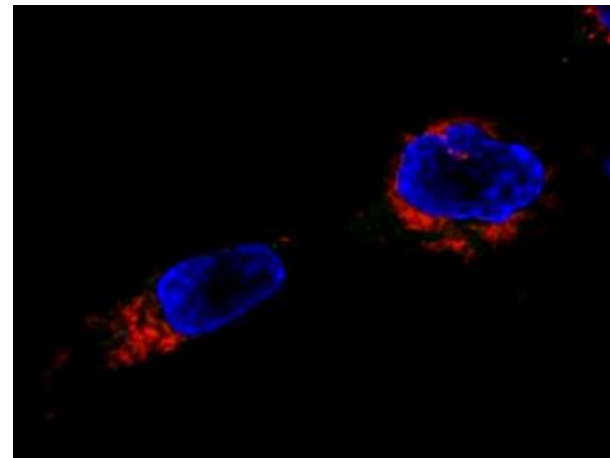
# Targeting lipid droplets to reduce cancer growth

**Stimulated lipid droplet formation**



↓  
**Cancer cell proliferation**

**Blocked lipid droplet synthesis**



↓  
**Cancer cell death**

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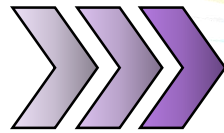
Tripping, smoking, sipping -  
the **sewer** is revealing

Taja Verovšek

Department of Environmental Sciences, Jožef Stefan Institute, Ljubljana, Slovenia  
Jožef Stefan International Postgraduate School (Ecotechnologies), Ljubljana, Slovenia

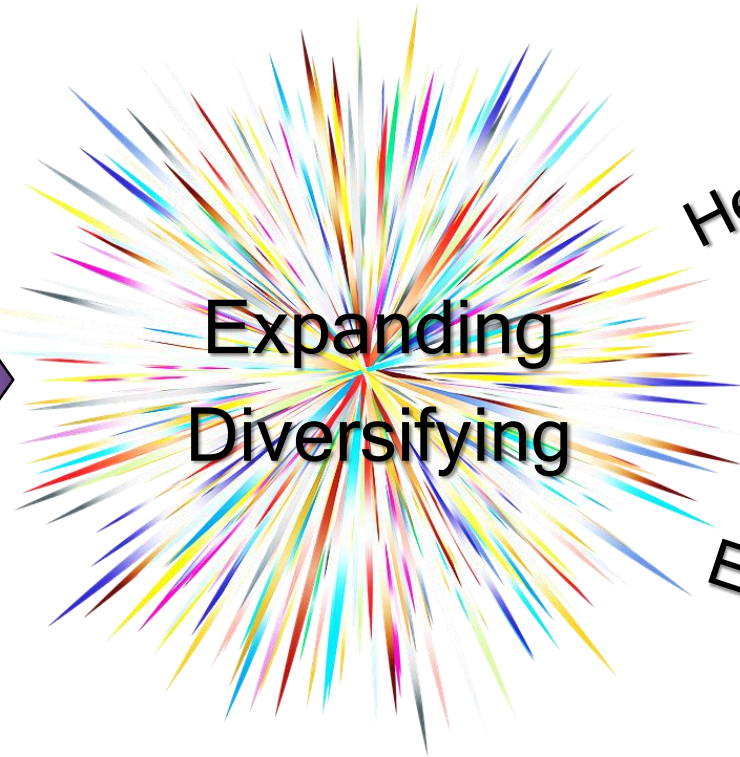
# Estimation of drug use - what for?

Religious rituals



Medicinal therapies

Expanding  
Diversifying



Health burden

Social burden

Economic burden

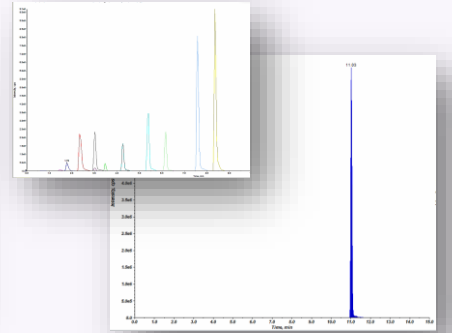
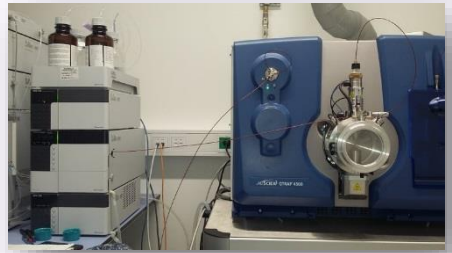
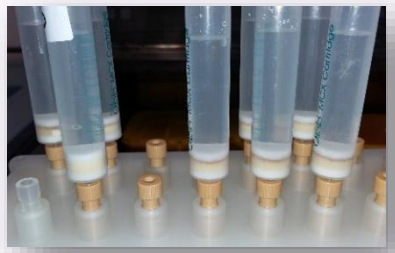
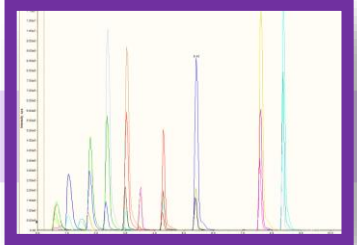




Objective  
 Non-invasive  
 Cost-effective  
 Assess trends over time



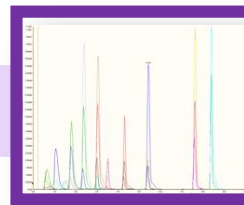
# Wastewater-Based Epidemiology



Filtration

Extraction

Separation, detection, quantification



Cocaine



Methamphetamine



Amphetamine



Ecstasy (MDMA)



Heroin



Cannabis



Methadone



Codeine



Alcohol



Tobacco

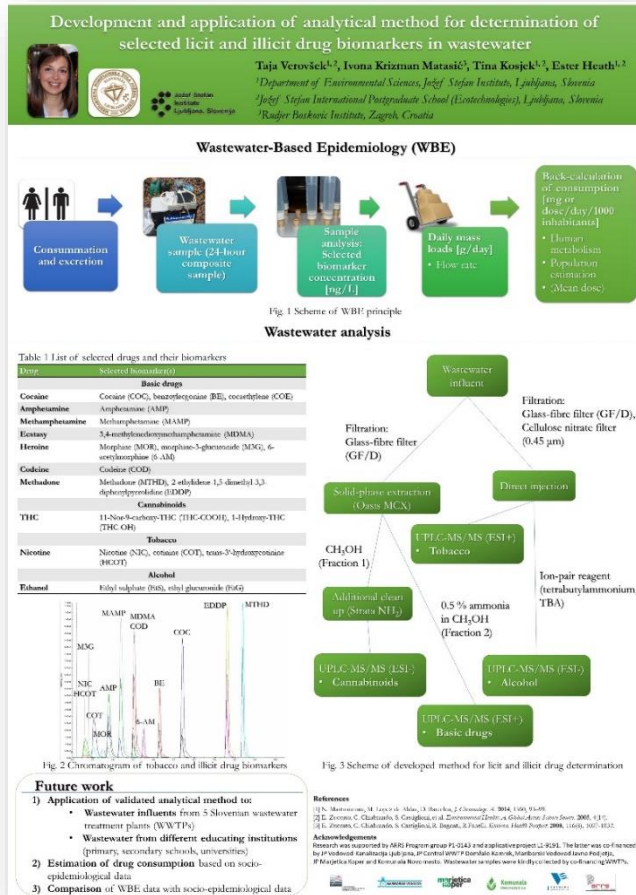
Illicit drugs, alcohol and tobacco picture source: DrogArt

# The best is yet to come...

- Application of validated analytical method to:
  - ✓ Wastewater influents from 5 Slovenian wastewater treatment plants (WWTPs)
  - ✓ Wastewater from different Slovenian educational institutions (primary, secondary schools, universities)



# Tripping, smoking, sipping - the sewer is revealing



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## Screening for new surface anchoring domains for *Lactococcus lactis*

Tina Vida Plavec

Faculty of Pharmacy, University of Ljubljana, Aškerčeva 7, Ljubljana, Slovenia

Department of Biotechnology, Jožef Stefan Institute, Jamova 39, Ljubljana,  
Slovenia

Poster number: **60**



# *Lactococcus lactis*

- Long-term use in food, industrial applicability, health benefits
- Biotechnological and therapeutical applications

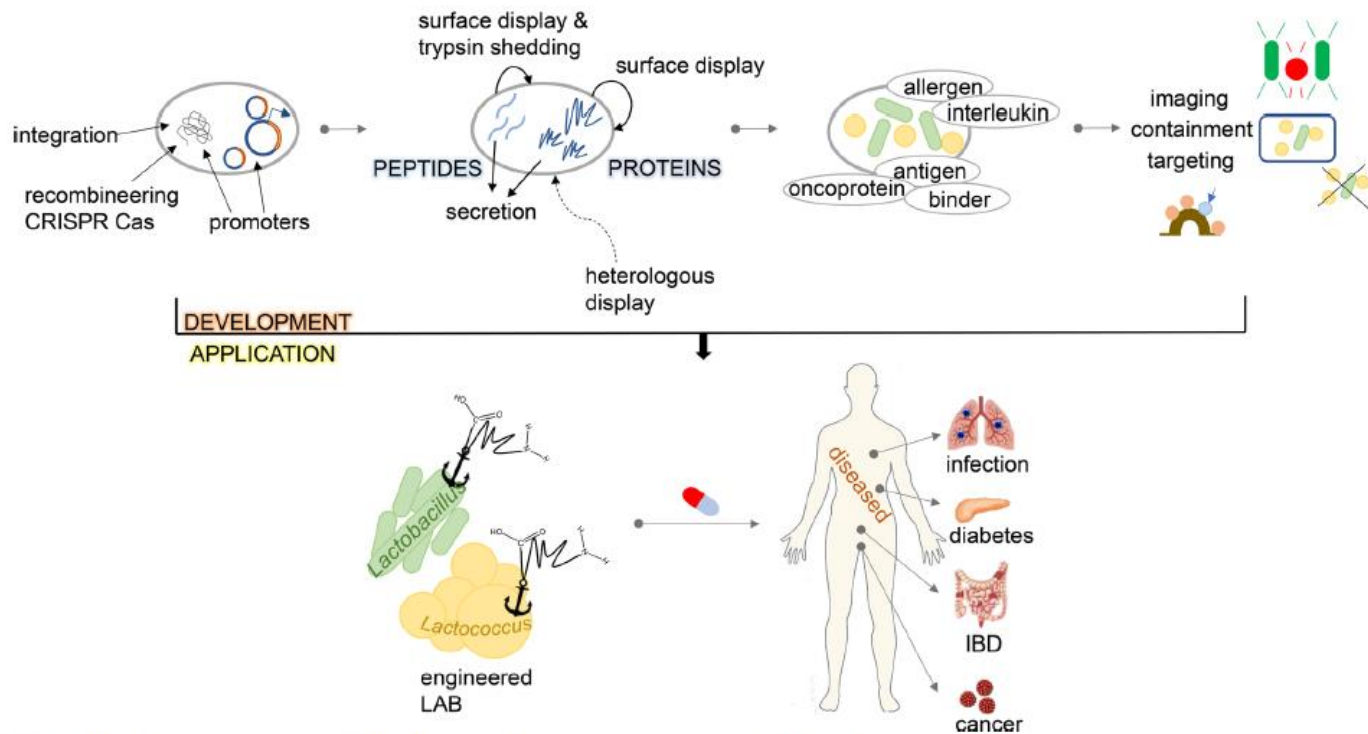
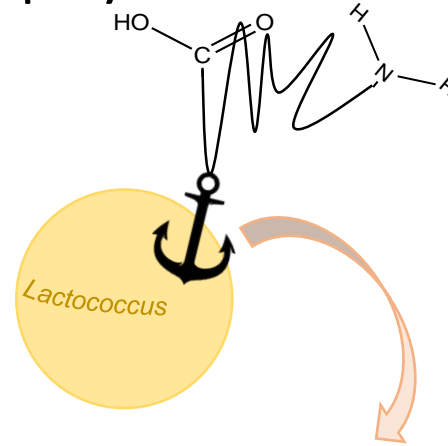


Fig. 1 Schematic representation of the development and application of engineered LAB for therapy

# Surface display of recombinant proteins



## Non-covalent anchoring

Plasmid	Fusion protein	Plasmid	Fusion protein
pSDBA3b	USP B dom cAcmA	pSD_I07	USP DARPin cAcmA
pSD-2LsyM	USP B dom c2Lys	pDARP-2LsyM	USP DARPin c2Lys
pSD-3LsyM	USP B dom cAcmD	pDARP-3LsyM	USP DARPin cAcmD
pSD-CW	USP B dom nCW	pDARP-WxL3	USP DARPin cWxL3
pSD-Cpl	USP B dom nCPL	pDARP-2CW	USP DARPin nCW nCW
pSD-2CW	USP B dom nCW nCW	pDARP-AM7	USP DARPin cAM7
pSD-2CPL	USP B dom nCPL nCPL	pDARP-AM12	USP DARPin cAM12
pSD-WxL1	USP B dom cWxL1	pDARP-1358	USP DARPin c1358
pSD-WxL3	USP B dom cWxL3	pEva-cAcmA	USP Eva-3 cAcmA
pSD-AM7	USP B dom cAM7	pEva-AM12	USP Eva-3 cAM12
pSD-AM12	USP B dom cAM12		
pSD-SK1	USP B dom cSK1	<b>Covalent anchoring</b>	
pSD-1358	USP B dom c1358	pSD-sLPXTG	USP B dom sLPXTG
		pSD-ILPXTG	USP B dom ILPXTG

15 different anchoring domains of lactococcal or phage origins

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# Analytical technique sniffs out aroma frauds

Lidija Strojnik,

Department of Environmental Sciences, Jožef Stefan Institute

Jožef Stefan International Postgraduate School

Poster number: **34**

# WHAT DO YOU KNOW ABOUT FOOD FRAUD?



Food fraud is the intentional adulteration of food for financial gain.

Food fraud occur when a food product is deliberately diluted, misrepresented or substituted with another products.



Frauds can also damage consumer confidence and food businesses.

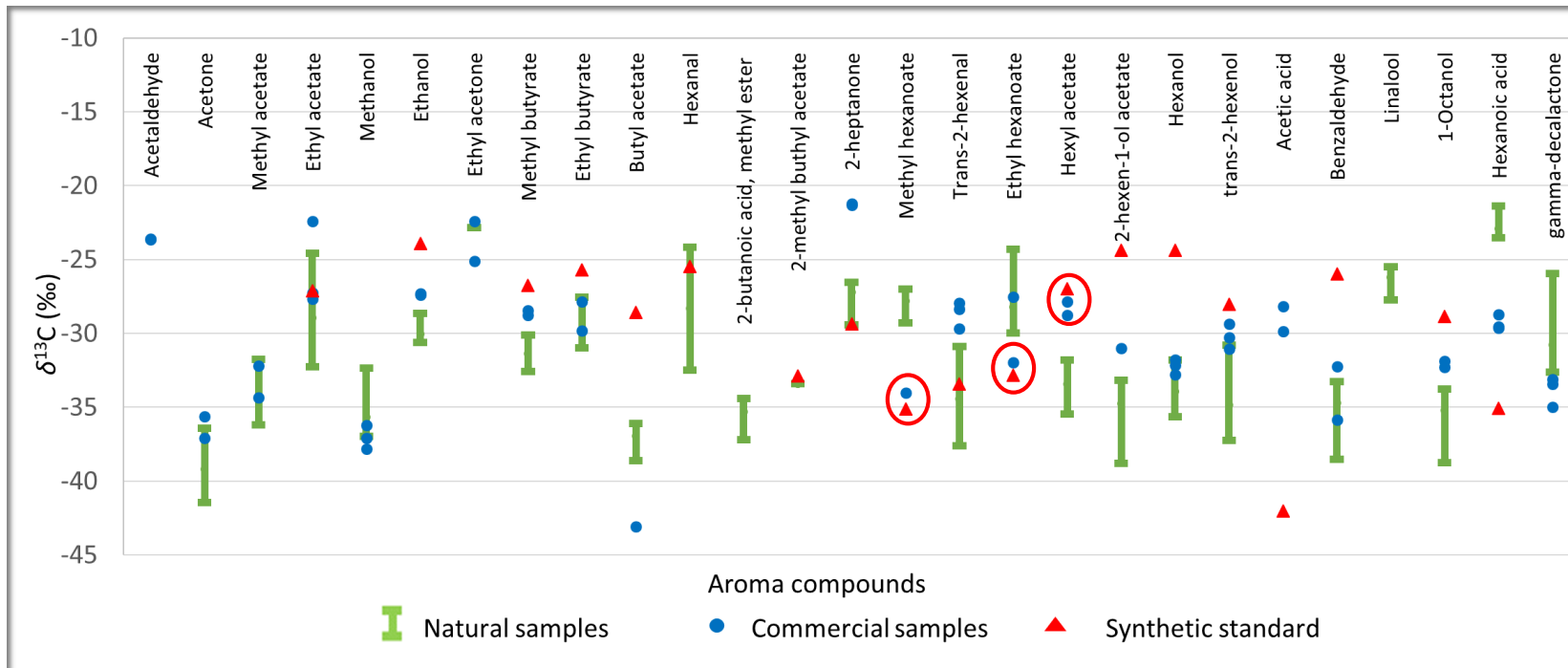
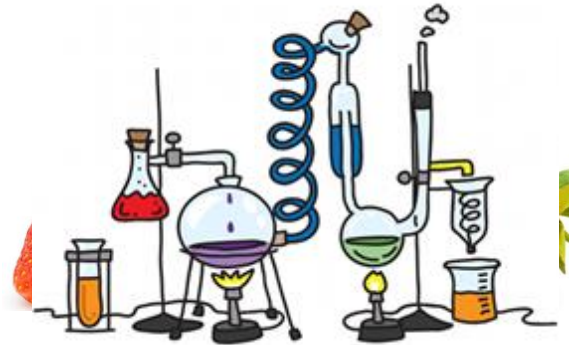
All these can have negative impact on the quality and safety aspects of food.



Major Food Frauds



# NATURAL STRAWBERRY FLAVOUR





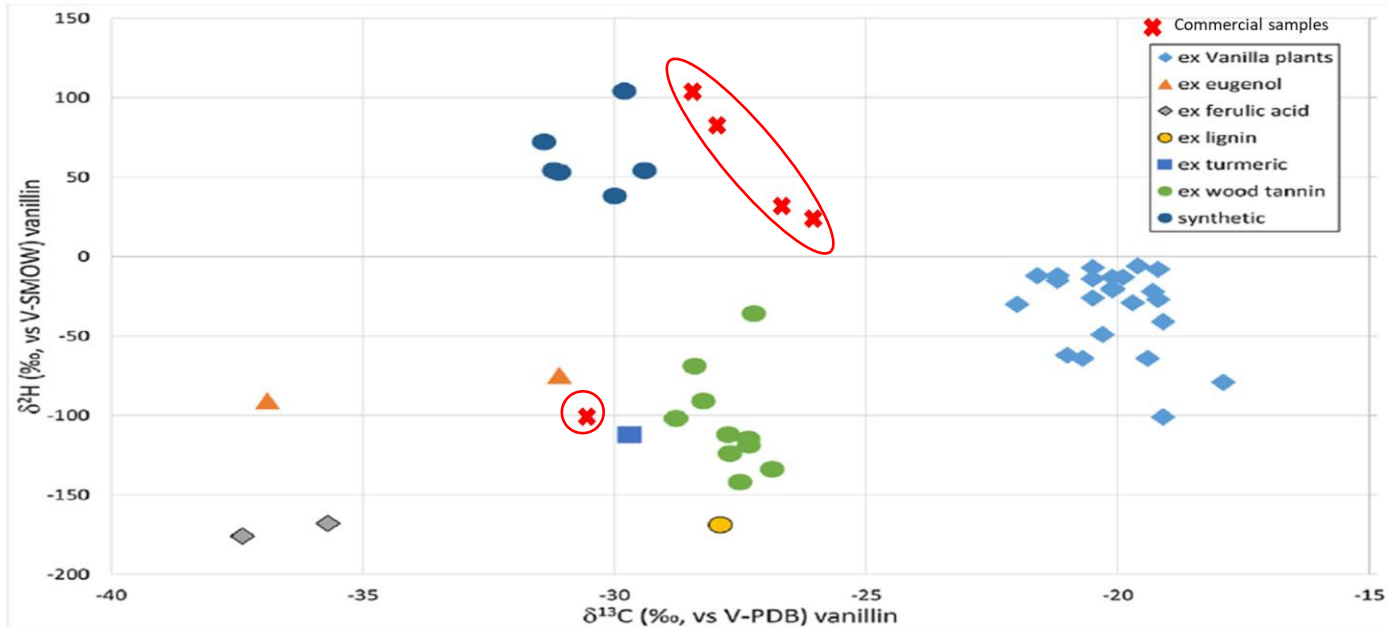
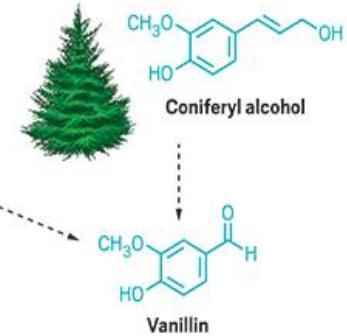
# NATURAL VANILLA FLAVOUR



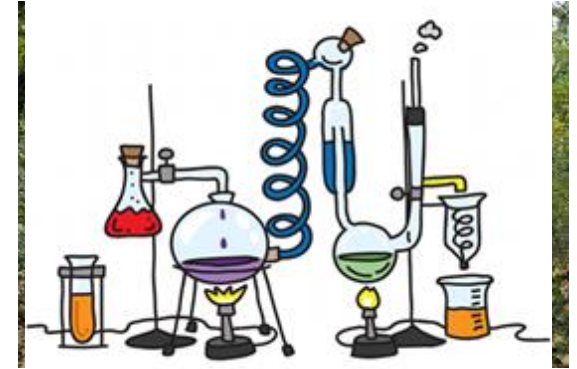
Petroleum



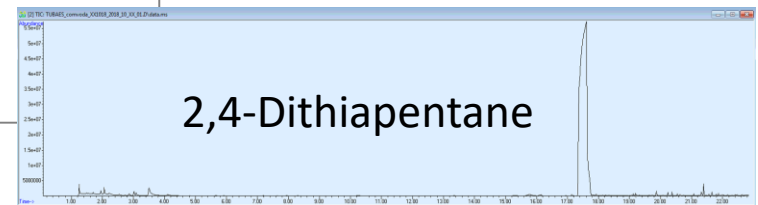
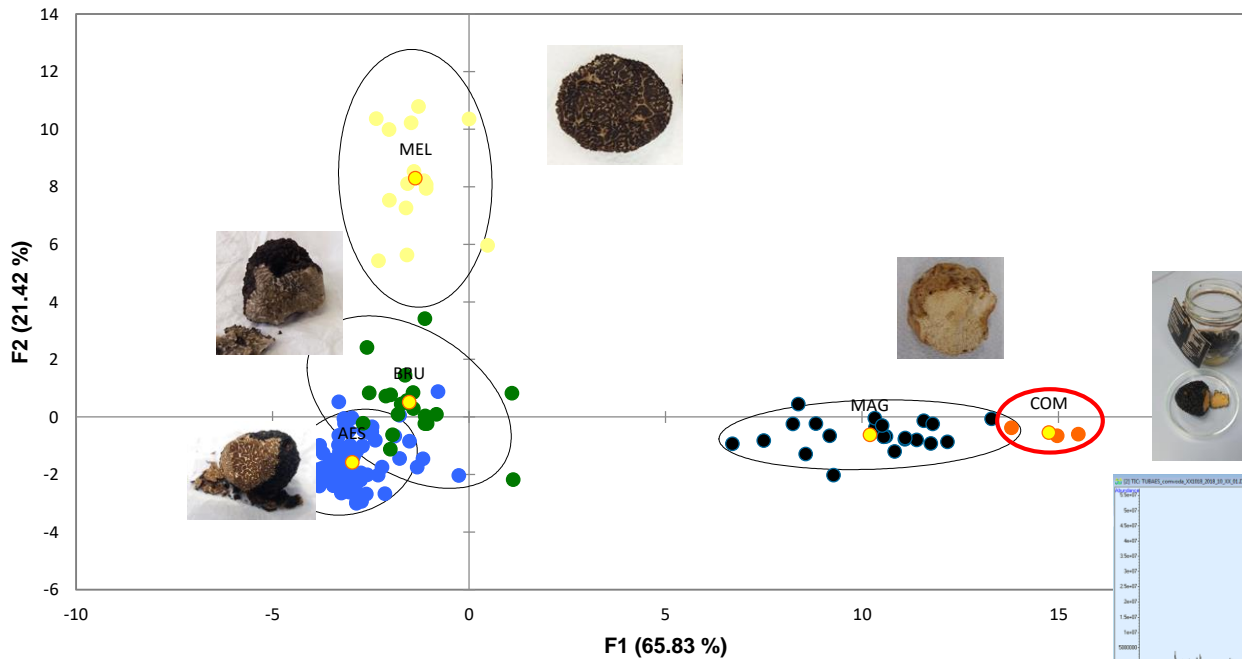
Spruce tree lignin



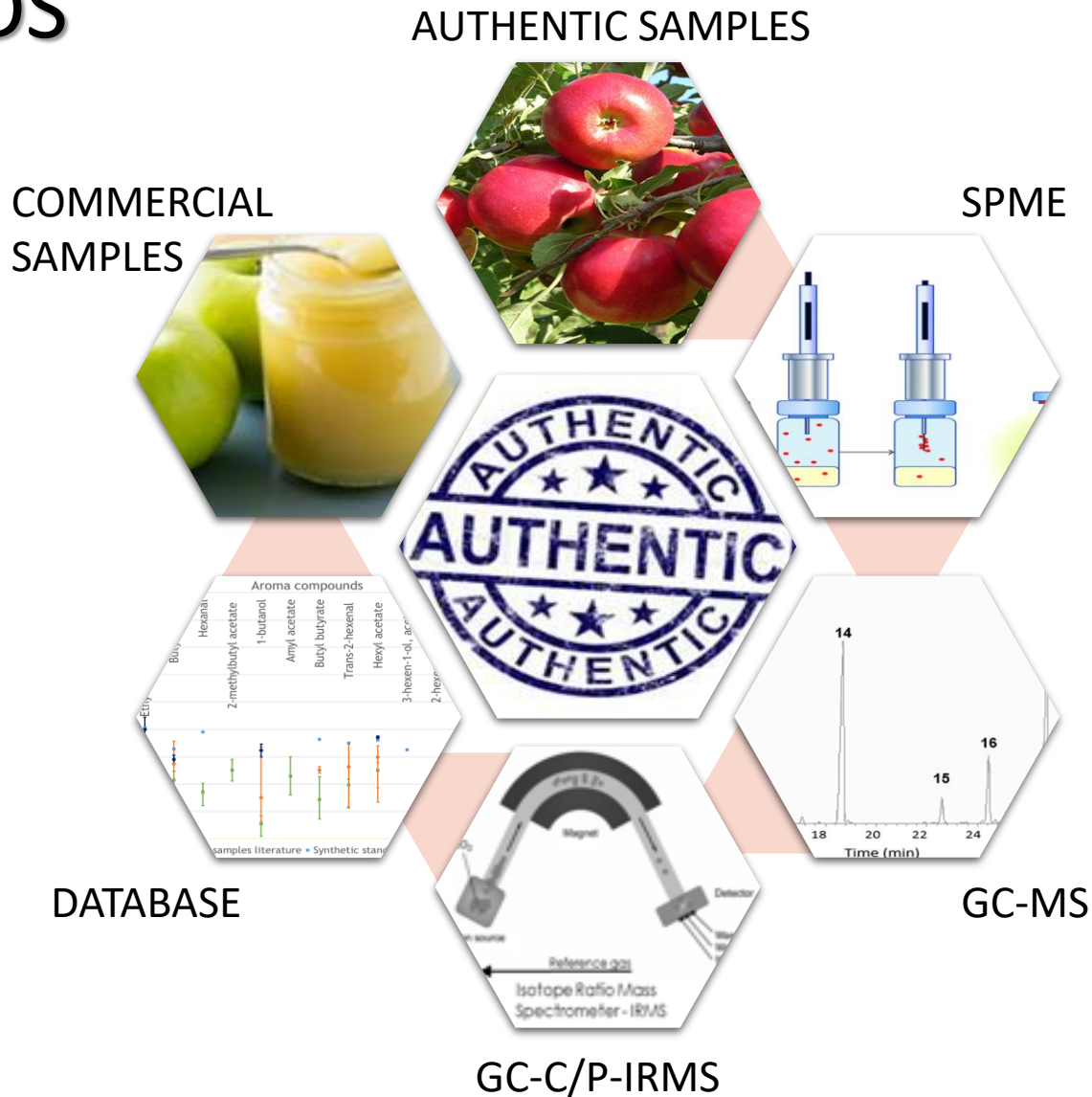
# NATURAL TRUFFLE FLAVOUR



Observations (axes F1 and F2: 87.25 %)



# ANALYTICAL TECHNIQUE SNIFFS OUT AROMA FRAUDS



# Poster number: 34

## Analytical technique sniffs out aroma frauds

Lidija Strojnik<sup>1,2</sup>, Jože Hladnik<sup>3</sup>, Nika Weber<sup>3</sup>, Darinka Koron<sup>3</sup>, Matej Stopar<sup>3</sup>, Emil Zlatič<sup>4</sup>, Doris Kokalj<sup>4</sup>, Mateja Naglič Gril<sup>5</sup>, Tine Grebenc<sup>6</sup>, Matteo Perini<sup>7</sup>, Silvia Pianezze<sup>7</sup>, Federica Camin<sup>8</sup>, Nives Ogrinc<sup>1,2</sup>

<sup>1</sup>Department of Environmental Sciences, Jozef Stefan Institute, Ljubljana, Slovenia; <sup>2</sup>Jozef Stefan International Postgraduate School, Ljubljana, Slovenia; <sup>3</sup>Department of Fruit Growing, Viticulture and Oenology, Agricultural Institute of Slovenia, Ljubljana, Slovenia; <sup>4</sup>Department of Food Science and Technology, Biotechnical Faculty, University of Ljubljana, Ljubljana, Slovenia; <sup>5</sup>R&D Department, Fruiteam Eto, Škofja vas, Slovenia; <sup>6</sup>Department of Forest Physiology and Genetics, Slovenian Forestry Institute, Ljubljana, Slovenia; <sup>7</sup>Experimental and Technological Services Department, Technology Transfer Centre, Fondazione Edmund Mach (FEM), Via E. Mach 1, San Michele all'Adige, Italy; <sup>8</sup>Department of Food Quality and Nutrition, Research and Innovation Centre, Fondazione Edmund Mach (FEM), Via E. Mach 1, San Michele all'Adige, Italy

### METHODOLOGY

### INTRODUCTION

To verify the authenticity of commercial strawberry, vanilla and truffle flavoured products,  $\delta^{13}\text{C}$  ( $\delta^2\text{H}$ ) values of different aroma compounds are determined and compared to the authentic range in stable isotope databases. Any sample with one or more compounds outside this range is then suspected of being adulterated.

### RESULTS

**NATURAL AND COMMERCIAL STRAWBERRY DISTILLATES**

**VANILLINS FROM NATURAL OR SYNTHETIC SOURCE**

**AROMA PROFILE DATA OF DIFFERENT TRUFFLE SPECIES**

### CONCLUSIONS

For most of the selected aroma compounds, there is good discrimination between the range of values for natural and synthetic authentic aromas.

Values of some aroma compounds in commercial distillates indicate possible adulteration.

The commercial food products considered and stated to be flavoured with natural vanillin from vanilla beans (yoghurt, ice-cream, pudding and tea) actually contained synthetic vanillin. Protein powder fell into the range of the ex lignin vanillin origin.

Aroma profile of commercial canned truffles stated to be *T.aestivum*, actually contained only one aromatic compound (2,4-dithiapentane) which is typical for *T.magnatum* and not for *T.aestivum*.

With LDA analysis we get good discrimination between different Tuber species based on their aroma profile.

As these result indicate, significant doubt exists about the authenticity of flavoured products on the market and extensive testing of products is necessary.

Research is implemented in the framework of Smart Specialization Program: Food for Future and takes part of MASSTWIN (H2020, GA no. 692241) and ERA Chair ISO-FOOD (H2020, GA no. 621329) projects.

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## Effect of alkyl chain on corrosion and hydrophobic properties of hybrid sol-gel

Damir Hamulić,  
Jožef Stefan International Postgraduate School

Poster number: **44**



# PHYSICAL CHEMIST



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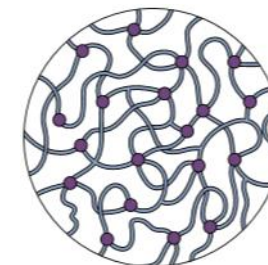
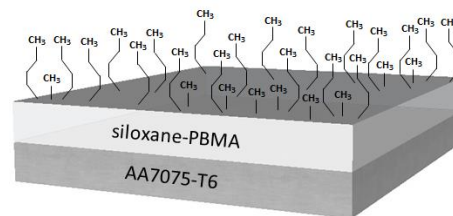
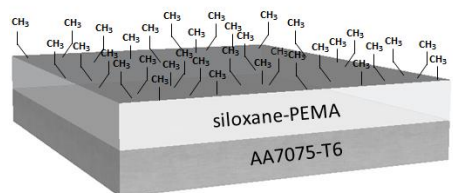
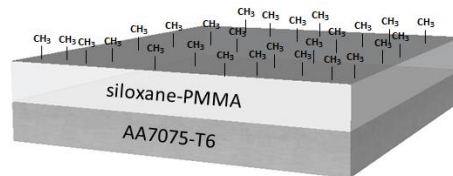
# EFFECT OF ALKYL CHAIN ON CORROSION PROPERTIES

## CORROSION

Corrosion is caused by an electrochemical reaction between the metal and the environment leading to irreversible decomposition of the substance into an oxide, a hydroxide or a salt. For any type of metal, oxygen, chloride ions and **water** play an important role in the corrosion process. Therefore, the corrosion resistance drops greatly when the metal is exposed to a humid environment.

## HYDROPHOBICITY

Hydrophobicity is the physical property of a molecule that repels the water from the surface.



## SOL-GEL

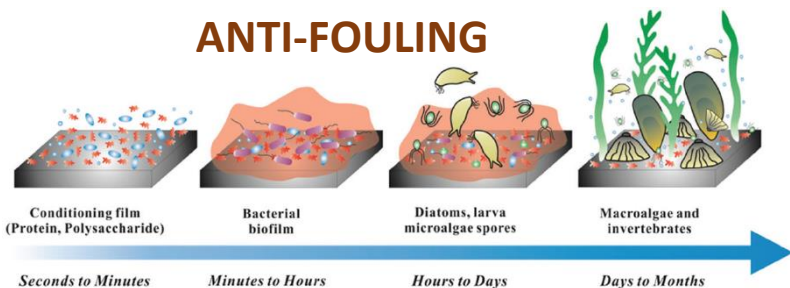
The sol-gel process is a method for producing solid materials from small molecules. Salt is a stable suspension of solid colloidal particles in the solution and the gel is the product of the salt.



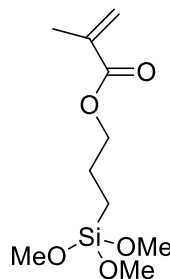
**HYDROPHOBIC**  
LOW SURFACE ENERGY

**HYDROPHILIC**  
HIGH SURFACE ENERGY

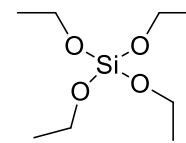
## ANTI-FOULING



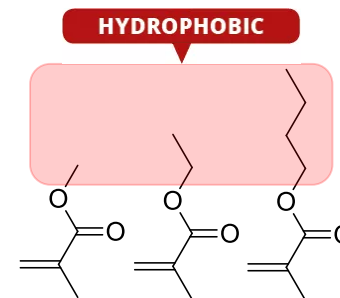
## PRECURSORS



MAPTMS



TEOS



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## Cystatin F and glioblastoma

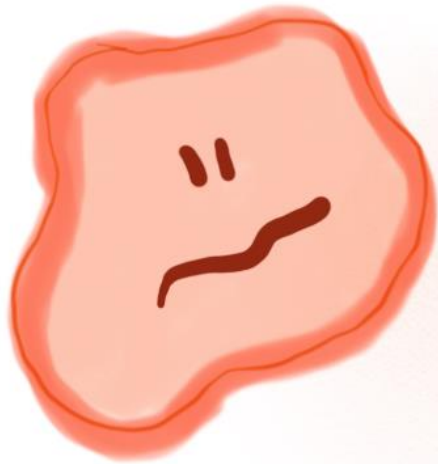
Emanuela Senjor

Jožef Stefan Institute, Department of Biotechnology,  
University of Ljubljana, Faculty of Pharmacy

Poster number: **26**

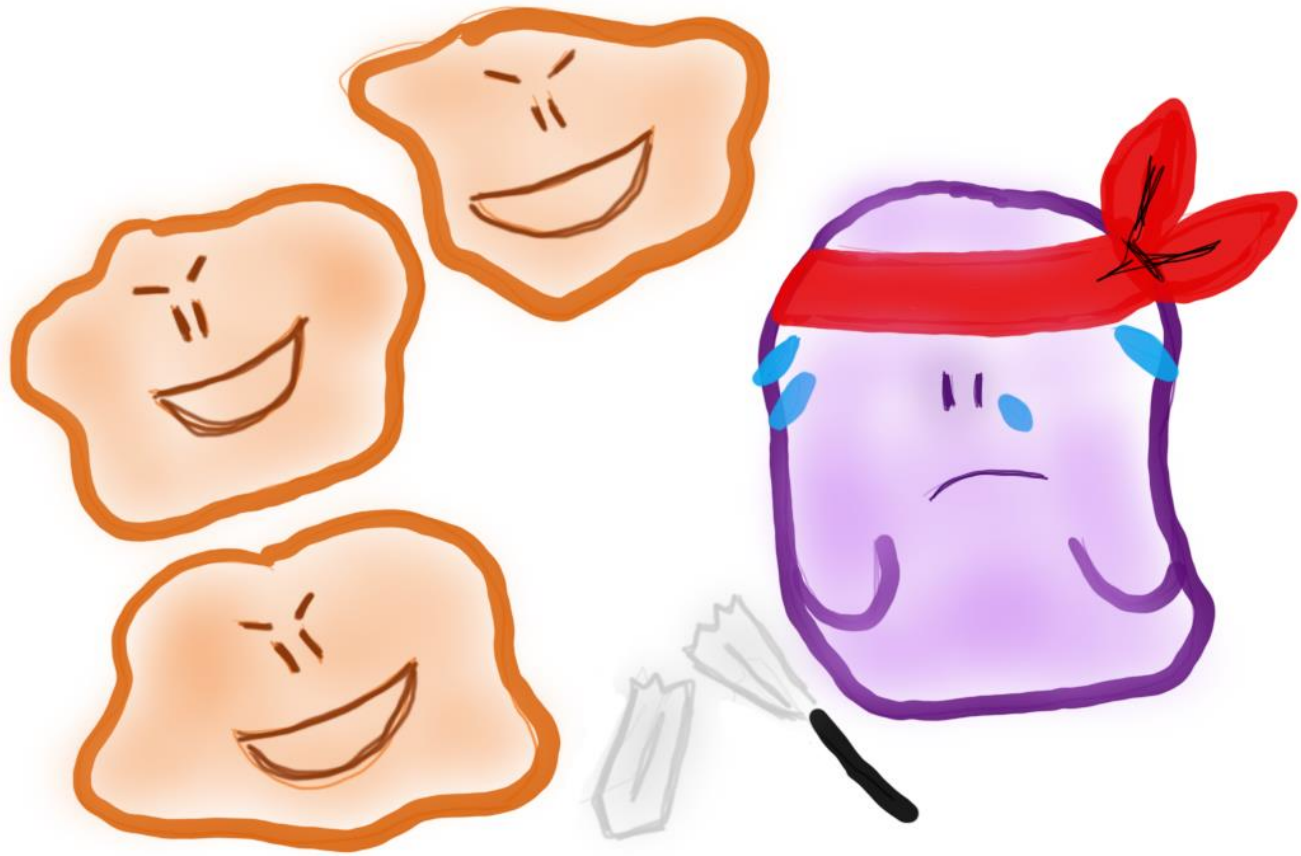
# IMMUNE SYSTEM vs CANCER

cancer cell

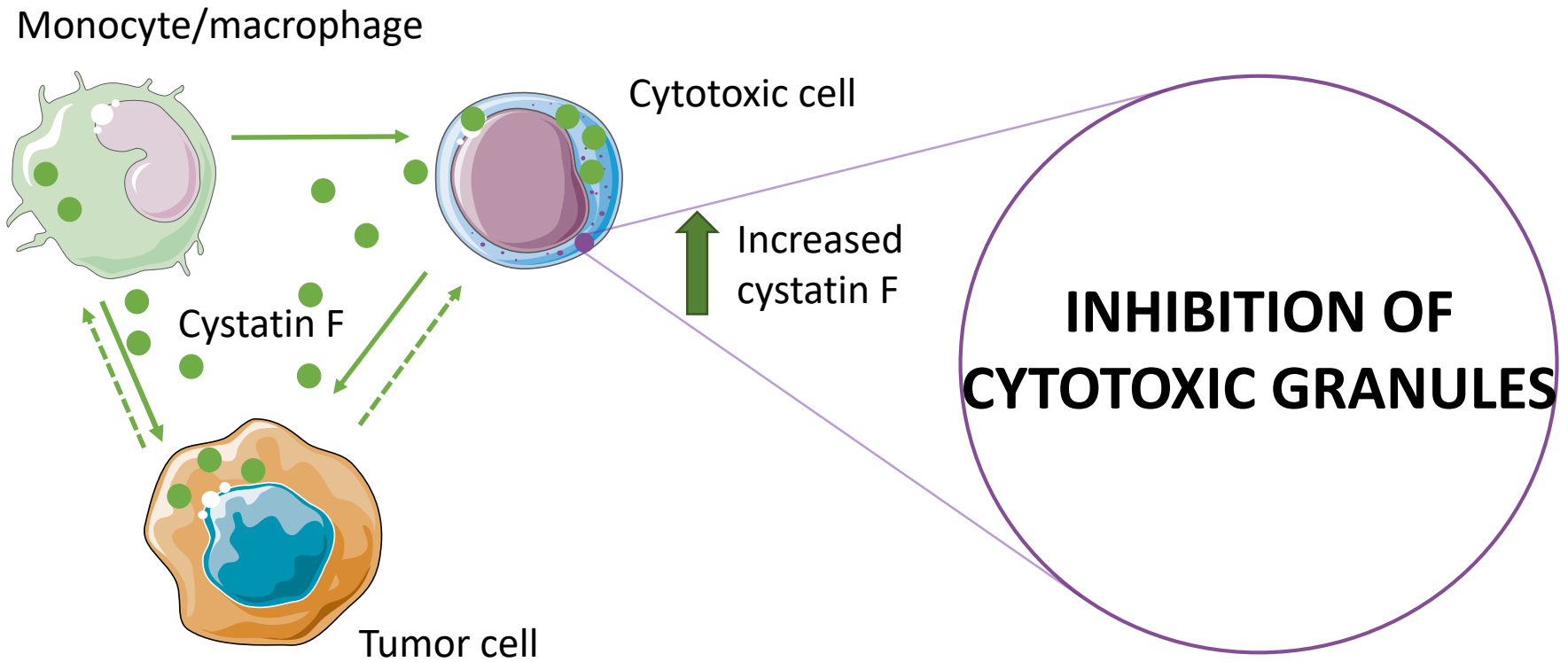


immune cell





# Cystatin F can impair activity of cytotoxic cells

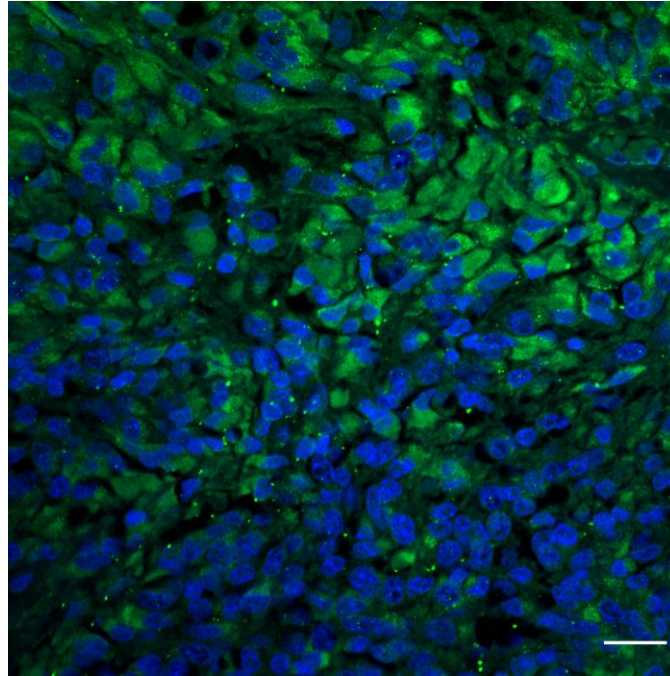


# Glioblastoma

- Brain tumor
- Aggressive, poor prognosis (1 year survival after diagnosis)
- Cytotoxic immune cells are ineffective



# Cystatin F is expressed in glioblastoma



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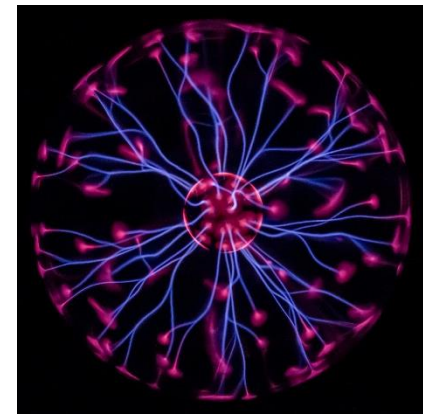
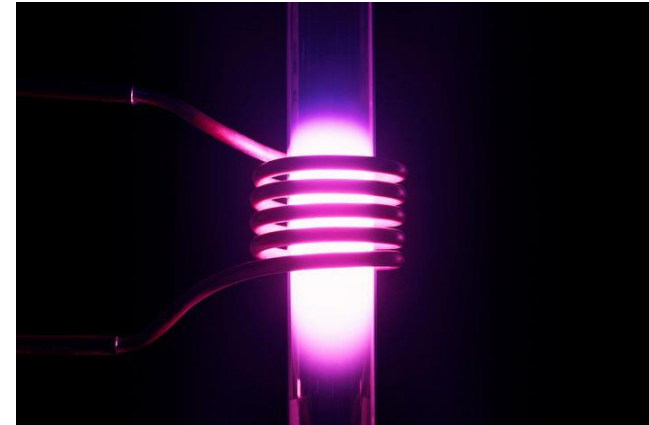
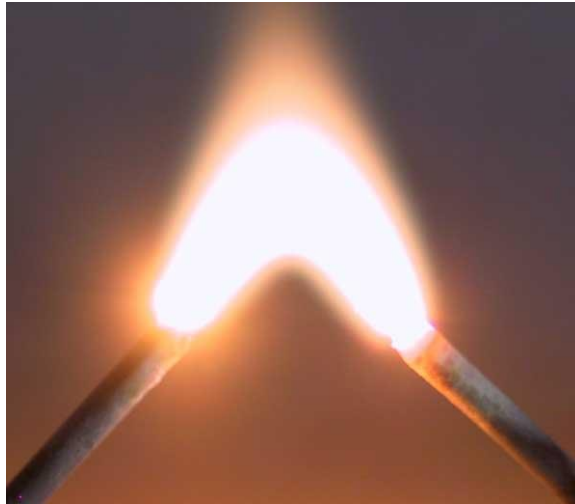
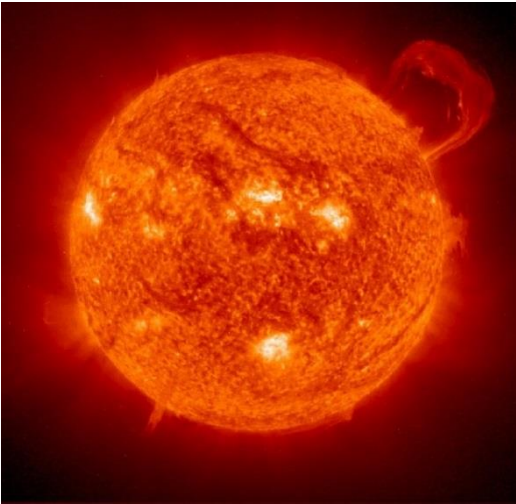
## Metal oxide nanowires – how metals grow hair in plasma

Martin Košiček,  
Jožef Stefan Institute

Poster number: **19**

# About plasma

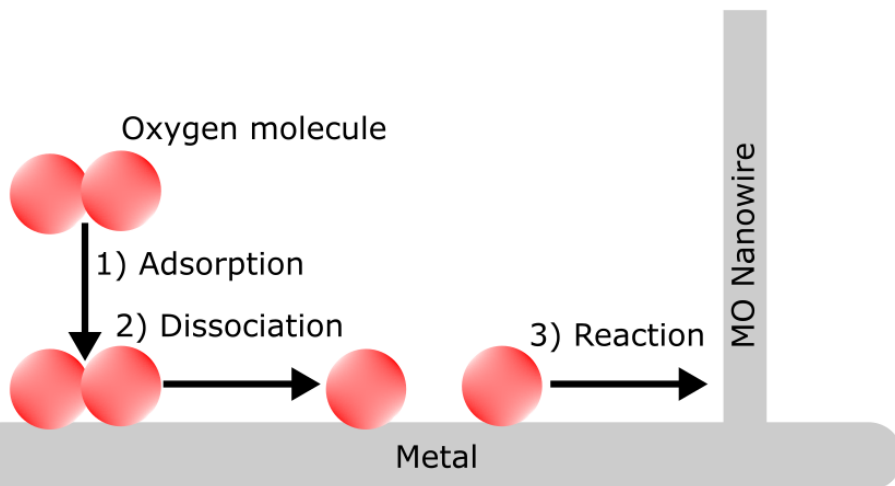
- Where can we find plasma?



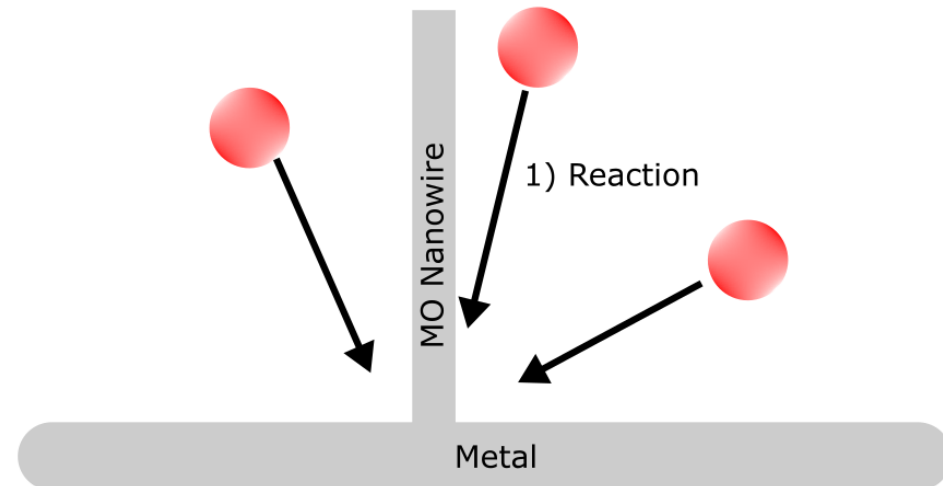
# Why is plasma useful in nanoscience?

- Fast method – reactive species are already present in plasma
- Synthesis of various nanostructures – just put the metal in the plasma and tune the parameters

Classical thermal oxidation

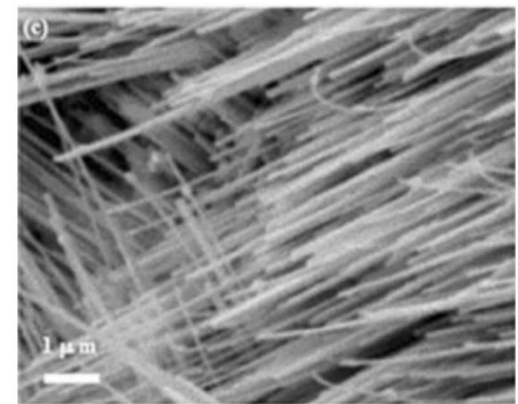
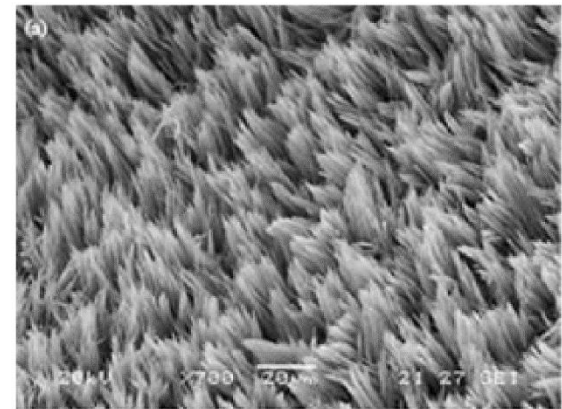
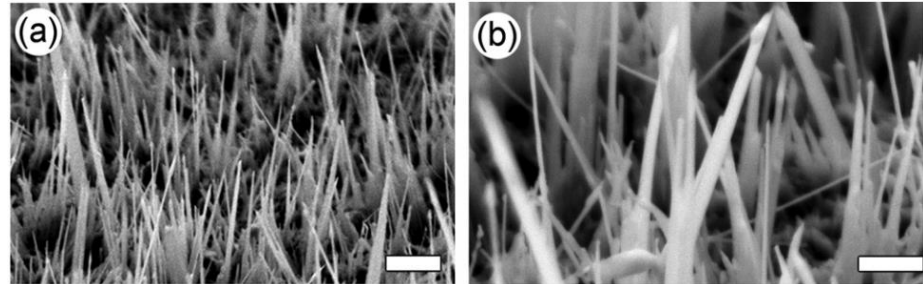


Oxidation with plasma



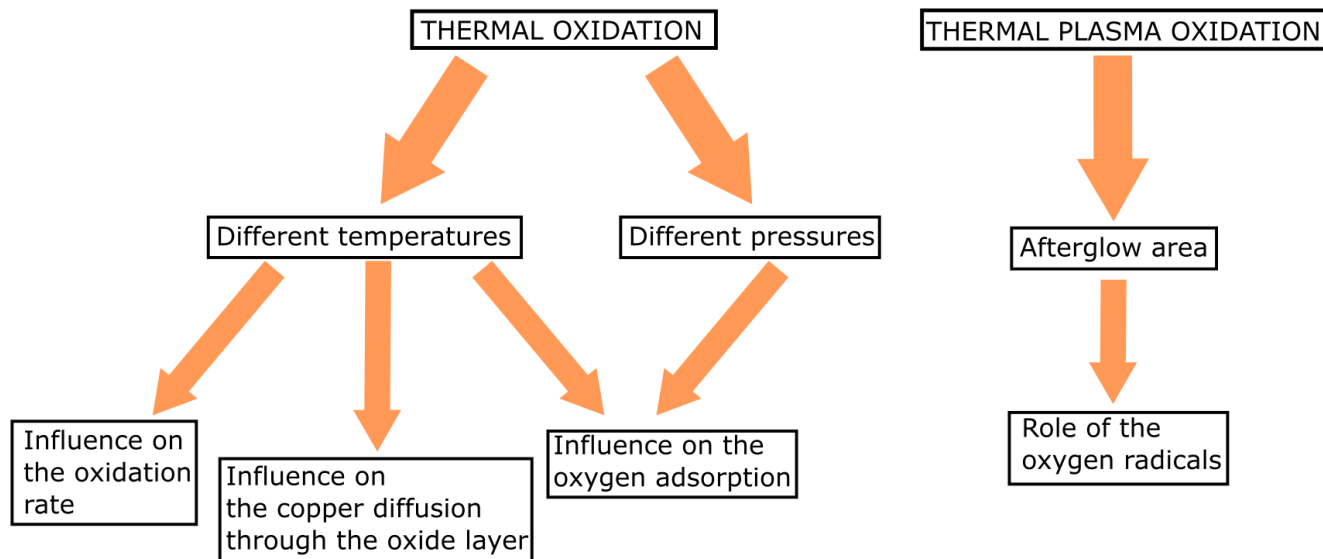
# Nanowires

- Formation in plasma
- Applications
  - Field effect transistors (FET)
  - Transparent electronics
  - UV Lasers
  - Piezoelectric nanogenerators
  - Solar cells
  - Nano field emission sources
  - Gas sensors
  - ...



# Our work

- Development of a theoretical model to describe the growth of nanowires in plasma





Thank you for your attention!

For more information: poster **19**

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*15 and 16 April 2019, Planica*

## The mysterious role of RNA in dementia and muscle wasting

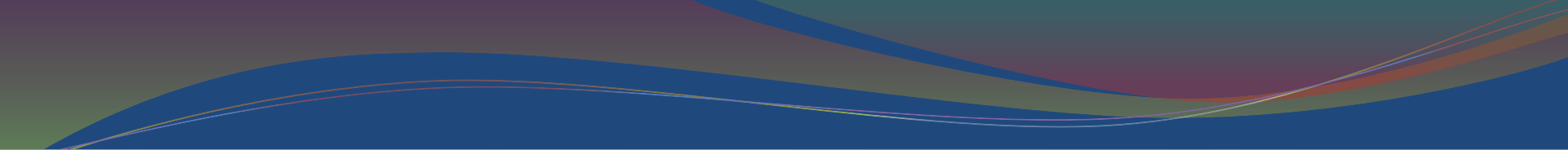
Mirjana Malnar

Department of Biotechnology, Jožef Stefan Institute, Ljubljana, Slovenia

Faculty of Medicine, Ljubljana, Slovenia

Biomedicine, mentor : Boris Rogelj

Poster number: **58**

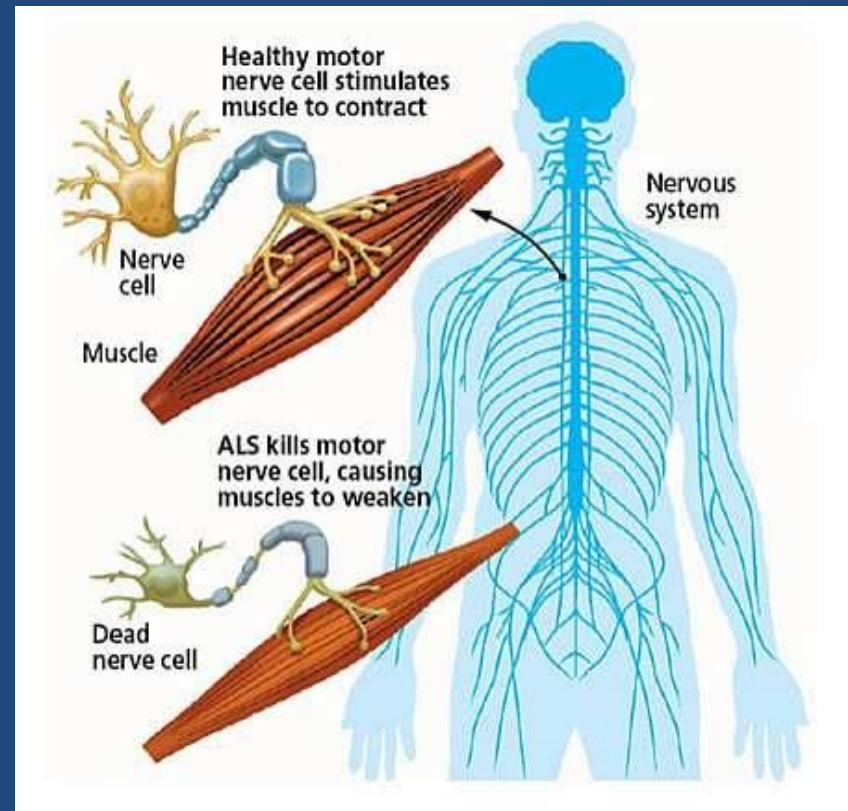


# ALS

- ALS – Amyotrophic Lateral Sclerosis
- most common motor neuron disease
  - 1-2:100 000
  - age of onset ~55
- muscle atrophy
- respiratory failure
- ~3 years
- no cure

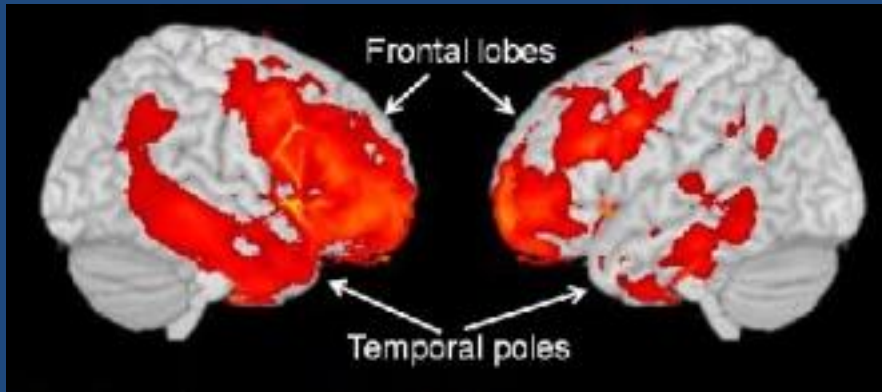


<https://bit.ly/2P2erm9>



(Medical Xpress, ALS Foundation for Life, 2018)

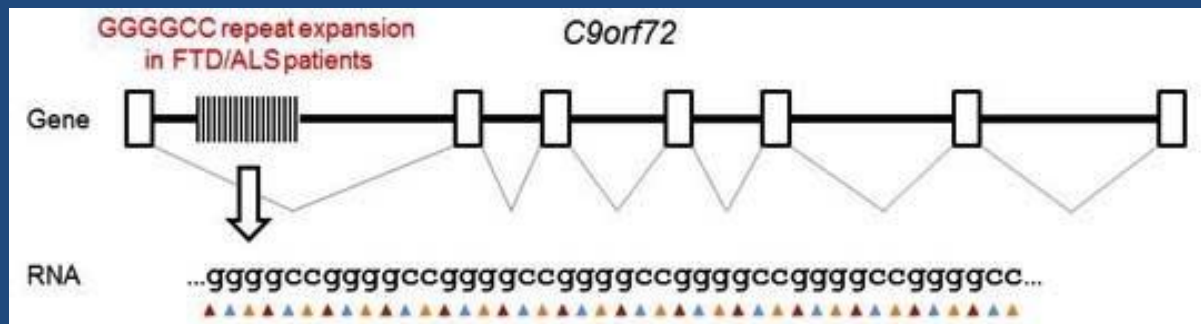
# FTD



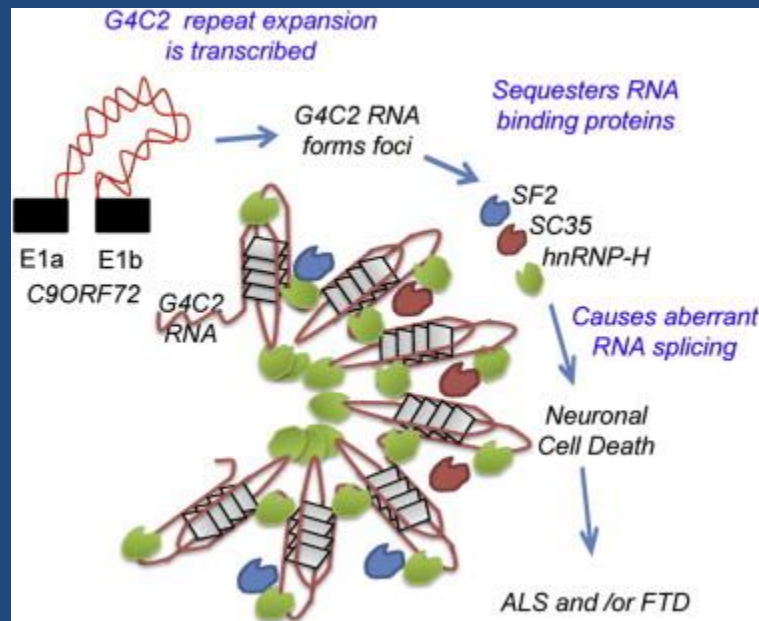
(HVNN, 2015)

- FTD – Frontotemporal Dementia
- second most common dementia
  - 15: 100 000
  - 45-64 years
- frontotemporal lobar degeneration
- pneumonia
- 3 – 10 years
- no cure

# Mutation of *C9orf72* gene



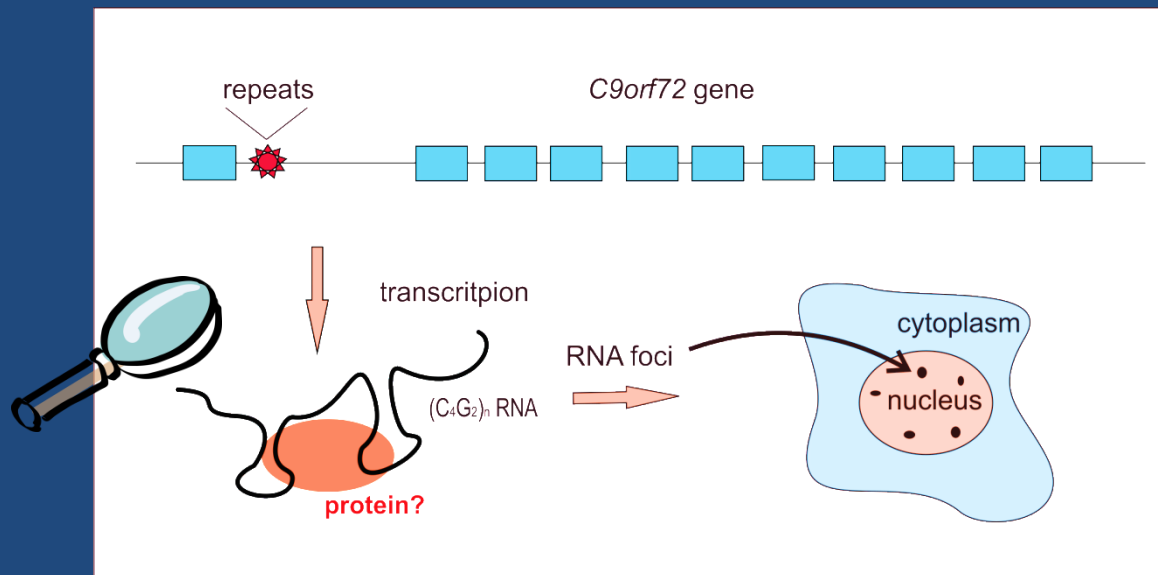
(Mori, 2013)



(Youn-Bok, 2013)



# My research project question – see poster 58



- From RNA to two incurable neurodegenerative diseases: ALS and FTD

THANK YOU FOR YOUR ATTENTION!

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*15 and 16 April 2019, Planica*

## Testing the sample preparation procedures and analytical techniques for radiometric dating, using Rb and Sr isotopes

Dominik Božič,

Department of Geology, Faculty of Natural Sciences and  
Engineering, University of Ljubljana, Aškerčeva 12, 1000  
Ljubljana, Slovenia

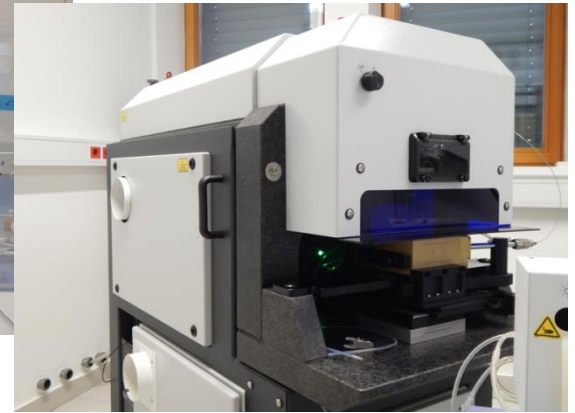
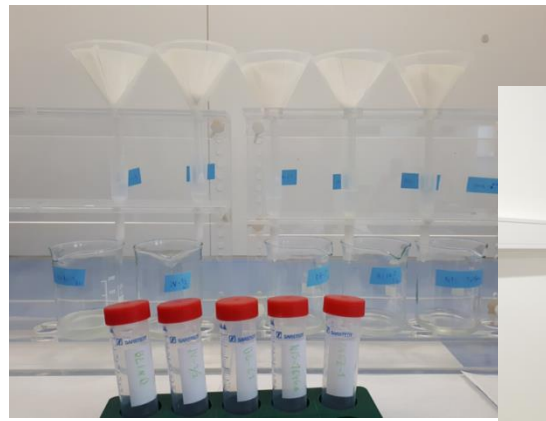
Poster number: **48**





Foto: Andrej Novak

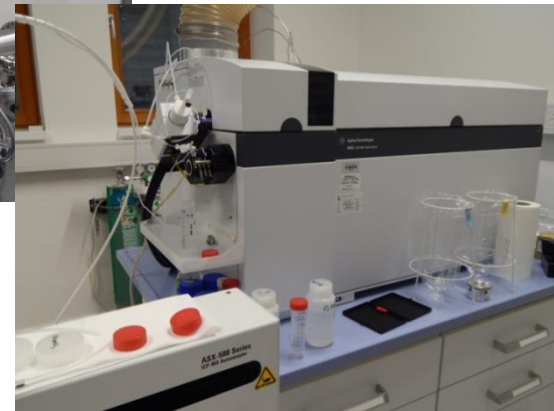
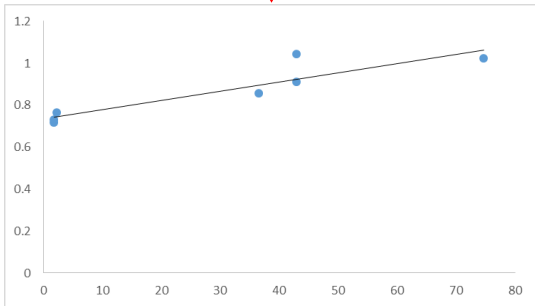
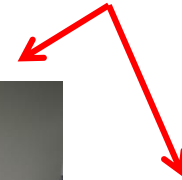
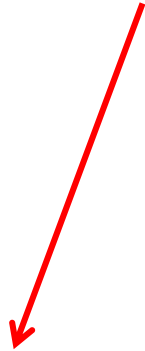




?  
 $A = B$   
 $A \neq B$



Testing the sample preparation procedures and analytical techniques for radiometric dating, using Rb-Sr method



$$t = \frac{1}{\lambda} \ln \left( 1 + \frac{\left( \frac{^{87}\text{Sr}}{^{86}\text{Sr}} \right)_t - \left( \frac{^{87}\text{Sr}}{^{86}\text{Sr}} \right)_0}{\left( \frac{^{87}\text{Sr}}{^{86}\text{Sr}} \right)_t} \right)$$

# How well did we do?

## Disolving & MC-ICP-MS



## Laser & ICP-MS-QQQ



## PREPARATION PROCEDURES



Samples were crushed to 2 mm and manually separated.



They were dissolved in HNO<sub>3</sub>, HF, HCl, and H<sub>2</sub>O<sub>2</sub>.



Rb and Sr isotope separation was carried out using the Sr-Resin.



Mineral phases and fossils were determined by microscope.



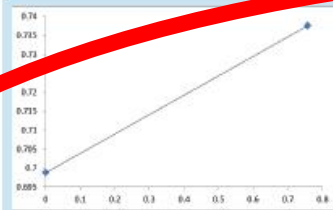
Laser ablation (LA) by Analyte G2 (Teledyne Cetac, NE, USA) system. Rb and Sr were separated using N<sub>2</sub>O gas.

## ANALYTICAL TECHNIQUES

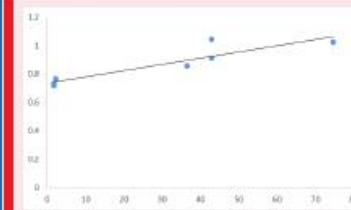
- Rb and Sr isotopes measured with Nu plasma II (Nu instruments Ltd, UK) multi-collector inductively coupled plasma mass spectrometer (MC-ICP-MS). (pictured above)
- Measurements were corrected with NIST SRM 987 using standard – sample bracketing.

- Rb and Sr isotopes measured with Agilent 8800 (Agilent Technologies, CA, USA) plasma mass spectrometer with triple quadruple (ICP-QQQ). (pictured above)
- Measurements were corrected internally and externally using NIST SRM 612.

## RESULTS



- Monzogabbro: completely erroneous results showing negative age.
- Trachybasalt scoria:  $^{87}\text{Sr}/^{86}\text{Sr} = 0.7053$
- Gneiss: 287 Ma
- Nautilid:  $^{87}\text{Sr}/^{86}\text{Sr}$  of 0.7083 placing it in Miocene



- Belemnite:  $^{87}\text{Sr}/^{86}\text{Sr} = 0.7114$
- Nautilid:  $^{87}\text{Sr}/^{86}\text{Sr} = 0.6931$
- L Chondrite: 4.8 Ga

## EVALUATION

- Monzogabbro was likely too young.
- Trachybasalt scoria might have been eroded or has reacted with base rock with different composition.
- Gneiss age might be affected by the later metamorphism.
- It is possible, that nautilid's ratio has been postdiagenetically altered.

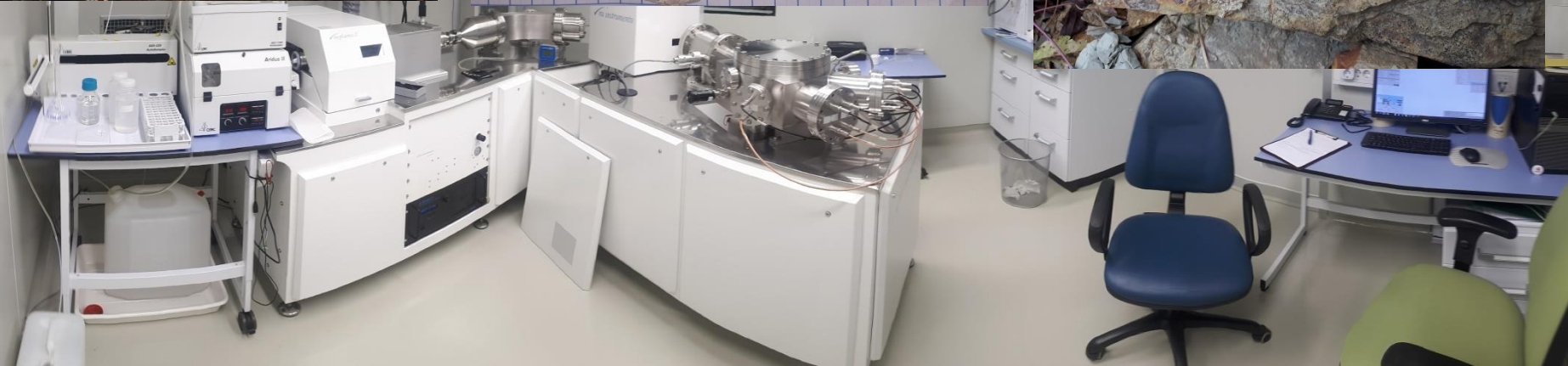
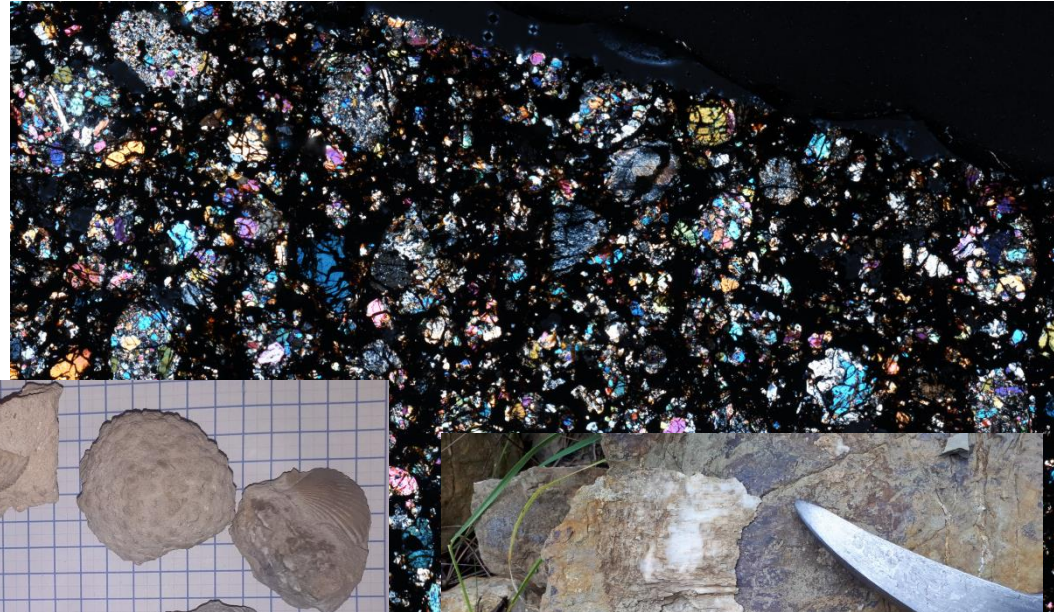
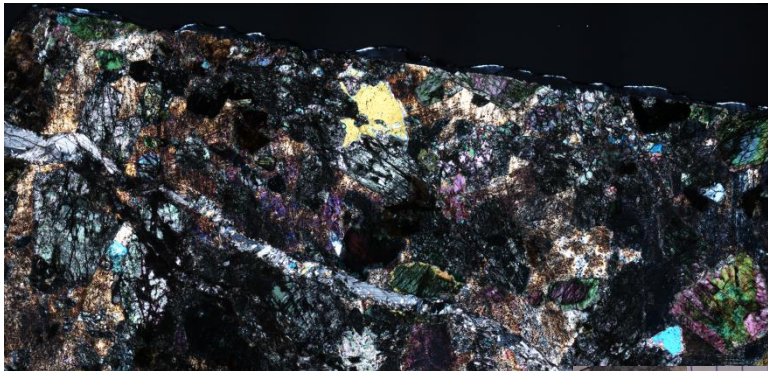
- Both of the  $^{87}\text{Sr}/^{86}\text{Sr}$  values were out of the possible range for fossils. It is possible, that our instruments are not precise enough.
- Due to low quantity of Rb bearing minerals we had to use model age method.

## SYNTHESIS

- These combinations of preparation procedures and analytical techniques have proven to be so far unreliable. They are not yet ready for practical use.
- Some of the sample's data might be questionable. We think that we have hit technical limitations of some instruments and we know that there are some areas of procedures that we might still improve.



# Future?





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## Phytoplankton: embracing the paradox

Ivano Vascotto

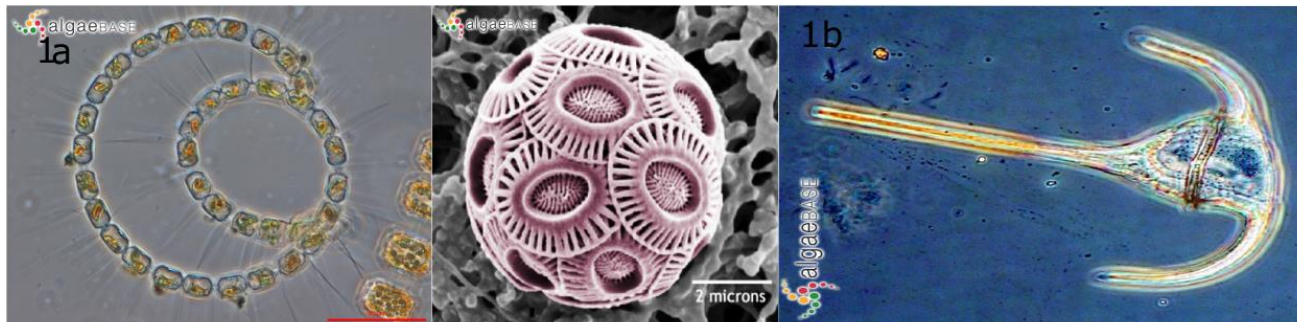
National Institute of Biology - Marine Biology Station Piran  
Jožef Stefan International Postgraduate School

Poster number: **45**

# PHYTOPLANKTON?

*-Phyto* = Photosynthesis

*-Plankton* = Living Seston



1a) Silverdale, Washington, USA; Waterfront Park, 400x, DIC. 22 Feb 2009. Karl Bruun. © Karl Bruun (skogenman@earthlink.net).cell wall. 05 Feb 2011.  
1b) John Dolan (dolan@obs-vlfr.fr). © John Dolan (dolan@obs-vlfr.fr).

1a) Silverdale, Washington, USA; Waterfront Park, 400x, DIC. 22 Feb 2009. Karl Bruun. © Karl Bruun (skogenman@earthlink.net).cell wall. 05 Feb 2011.

1b) John Dolan (dolan@obs-vlfr.fr). © John Dolan (dolan@obs-vlfr.fr).

# A unstable multivariate existence

Table 1: Check out my table.

	$\alpha$	$\beta$	$\gamma$	$\delta$	$\frac{\epsilon}{2}$
A	-0.28449	-0.00742	1.49178	-0.74455	0.31862
B	-1.12765	-1.01338	-0.89603	-1.86767	0.11768
C	-1.85061	1.02936	-0.03117	-0.99901	-0.57419
D	-0.55862	-0.01208	0.71831	0.99452	-0.37008
E	1.20001	0.75165	-0.53868	0.65623	-0.16326

$$t_c \cong t_e$$



Figure: Website; Sound the Midnight cry Current events in the light of Bible prophecy.  
[https://www.soundthemidnightcry.com/life\\_church\\_of\\_lafayette\\_/2017/08/confusing-signs.html](https://www.soundthemidnightcry.com/life_church_of_lafayette_/2017/08/confusing-signs.html)

So?

Table 1: Check out my table.

	$\alpha$	$\beta$	$\gamma$	$\delta$	$\frac{\epsilon}{2}$
A	-0.28449	-0.00742	1.49178	-0.74455	0.31862
B	-1.12765	-1.01338	-0.89603	-1.86767	0.11768
C	-1.85061	1.02936	-0.03117	-0.99901	-0.57419
D	-0.55862	-0.01208	0.71831	0.99452	-0.37008
E	1.20001	0.75165	-0.53868	0.65623	-0.16326

# LONG-TERM VARIABILITY OF THE PHYTOPLANKTON COMMUNITY IN A HIGHLY VARIABLE COASTAL SEA (GULF OF TRIESTE)

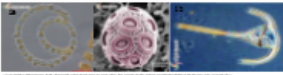
Ivano Vascotto<sup>1</sup>, Janja Franc<sup>2</sup>, Patricija Mozetič<sup>3</sup>  
<sup>1</sup> Institute of Biology, Marine Biology, Station Piran, Romada 41, 6200 Piran, Slovenia  
<sup>2</sup> Zvezni Inštitut za Varnost, Poljska ulica 29, 1000 Ljubljana, Slovenia



THANKS FOR THE ATTENTION  
 HVALA ZA POZORNOST

## ECOLOGY OF PHYTOPLANKTON

A theory on the spatio-temporal distribution of phytoplankton species in littoral sea has been termed of concern for a long time as far as to its general term still unresolved. It is true that variables in temperate coastal sea profiles have an important role in the distribution of those taxa (Clarke 1966) and the phytoplankton seasonal dynamics in such areas exhibit cyclic behavior (Munawar et al. 1997, Hozack et al. 1998), but it is also true that the core problem remains that the phytoplankton taxa richness assumes some paradoxical aspects as we start to consider its distribution in their "habitat-specific" (Hutchinson 1961). It has been pointed out that to interpret long-time changes properly it is important to get access to at least monthly dense data and that patterns are more easily detected from association than singular indicative taxa (Annala et al. 2002).



## MATERIALS AND METHODS

Monthly data from LTER sampling station 000F (Fig. 1; 45.530331N) have been collected and stored as part of the monthly routine sampling on phytoplankton in a period of 12 years from 2005 to 2017. Phytoplankton was sampled using Niskin bottles (5L) at different depths (0m, 5m, 10m, 15m, 21m). Phytoplankton taxa in fixed samples were determined and counted on an inverted microscope (Zeiss Axiovert 125 following Utermöhl method (Utermöhl 1958). Subsamples of 50 or 100 ml were left to settle in the sedimentation chamber for 24 or 48 hours, respectively. The analysis on the data was performed using R software (Version 3.1.1-455 RStudio, Inc.). In Table 1 it is possible to find the list of added packages used in the analysis.



Figure 1: Map of the area. The station 000F is represented by the green star at the southern entrance of the Gulf of Trieste.

species present in each sampling date.

Package	Reference
car	(Ripley and Lloyd 2018)
corrr	(Lorenz and Taus 2012)
ggplot2	(Wickham 2016)
lme4	(Gelman et al. 2014)
matrix	(R Core Team 2018)
mgcv	(Wood and Augustin 2002)
nlme	(R Core Team 2018)
nlmix	(Gelman et al. 2014)
nlmix2	(Gelman et al. 2014)
nlmix3	(Gelman et al. 2014)
nlmix4	(Gelman et al. 2014)
nlmix5	(Gelman et al. 2014)
nlmix6	(Gelman et al. 2014)
nlmix7	(Gelman et al. 2014)
nlmix8	(Gelman et al. 2014)
nlmix9	(Gelman et al. 2014)
nlmix10	(Gelman et al. 2014)
nlmix11	(Gelman et al. 2014)
nlmix12	(Gelman et al. 2014)
nlmix13	(Gelman et al. 2014)
nlmix14	(Gelman et al. 2014)
nlmix15	(Gelman et al. 2014)
nlmix16	(Gelman et al. 2014)
nlmix17	(Gelman et al. 2014)
nlmix18	(Gelman et al. 2014)
nlmix19	(Gelman et al. 2014)
nlmix20	(Gelman et al. 2014)

Table 1: The table contains the list of the packages loaded and used in the analysis performed. The complete reference is reported in the section References.

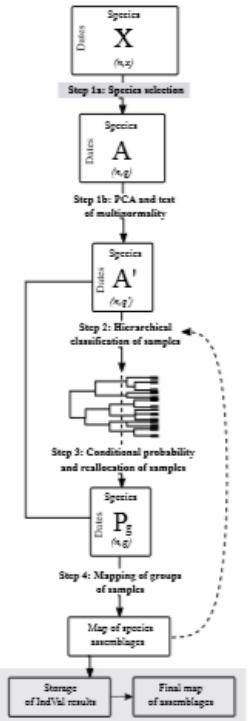


Figure 2: Flowchart of the statistical method, which can be summarized as consisting of four major steps: (1) Species Selection (2) Hierarchical Classification of Samples (3) Computation of Conditional Probability and Reallocation (4) Mapping of Groups of Samples. The grey sections are those not present in the original work of (Annala et al. 2002). The dashed arrows represent the mapping process.

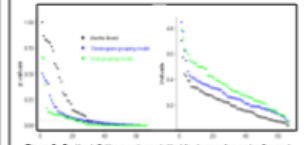


Figure 3: On the left the IndVol is plotted in decreasing order for each species. The Horton index refers to the application to the initial 1x6 matrix of months as growing model for the calculation of the IndVol. The dashed line represents the p-value of 0.05. On the right the IndVol results for each species increasing order.

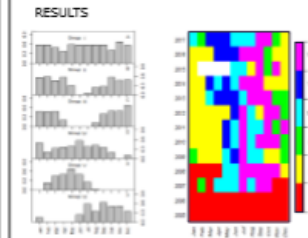


Figure 4: On the left the histograms of monthly average probabilities needed for each of the six groups. On the right the heatmap map describing the seasonal (s) and inter-annual (y) phytoplankton assemblage succession. Groups in both graphs are defined with roman numbers.

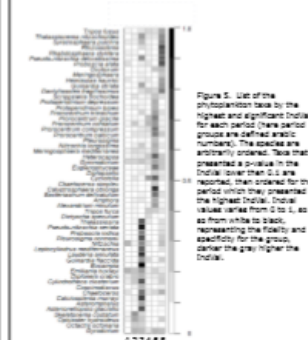


Figure 5: List of the phytoplankton taxa by the highest and significant IndVol for each period (here period groups are defined with roman numbers). The species are arbitrarily ordered. Taxa that presented a p-value in the IndVol lower than 0.5 are reported, then ordered for the period when they presented the highest IndVol. IndVol values varies from 0 to 1, as as from white to black, representing the fidelity and specificity for the group. Darker the grey higher the IndVol.

bioRxiv preprint doi: <https://doi.org/10.1101/2018.08.14.241111>; this version posted August 14, 2018. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.



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*15 and 16 April 2019, Planica*

## Atomic Layer Deposition - protection for biomedical materials

Ivan Spajic,

Department of Physical and Organic Chemistry, JSI

Poster number: **46**

- Biomedical implants – problems

- **Biomedical material:**

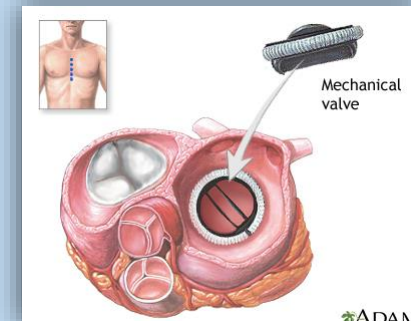
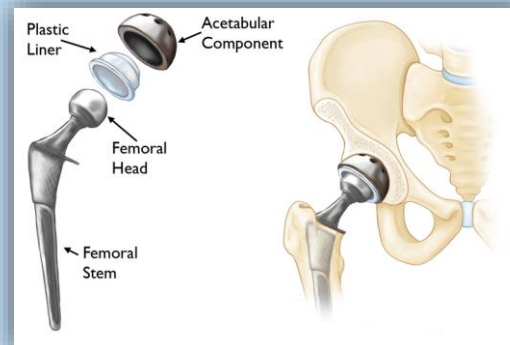
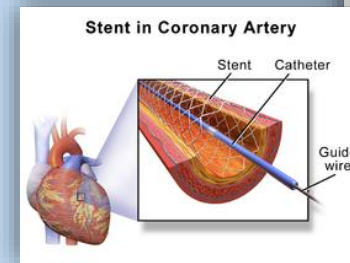
is a nonviable material used in a medical device, intended to interact with biological systems (Williams, 1987).

- **Problems**

- Toxicity to the surrounding biological tissue
- Nanoparticles of metallic implant in the surrounding tissue
- Infection after implantation (biocompatibility question)

- **Result** → **Corrosion**

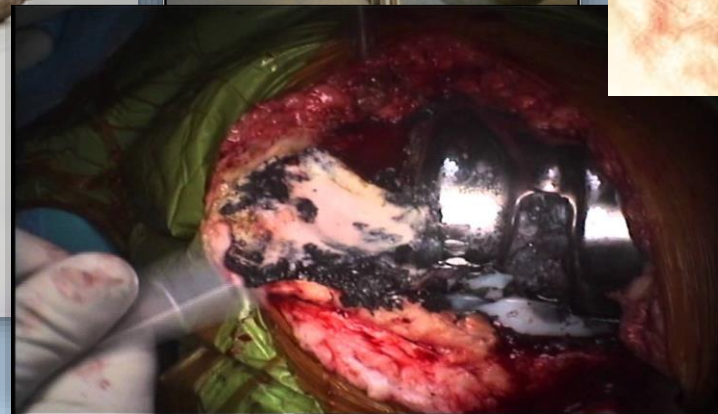
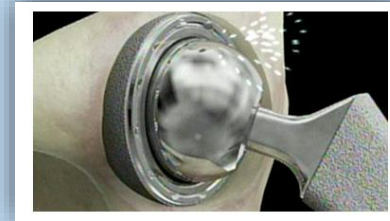
- Complex conditions in the human body  
(fluctuation in the pH and temp.)



- Does corrosion of a metallic implant cause a clinically relevant problem?

- Failure mechanisms of biomedical materials

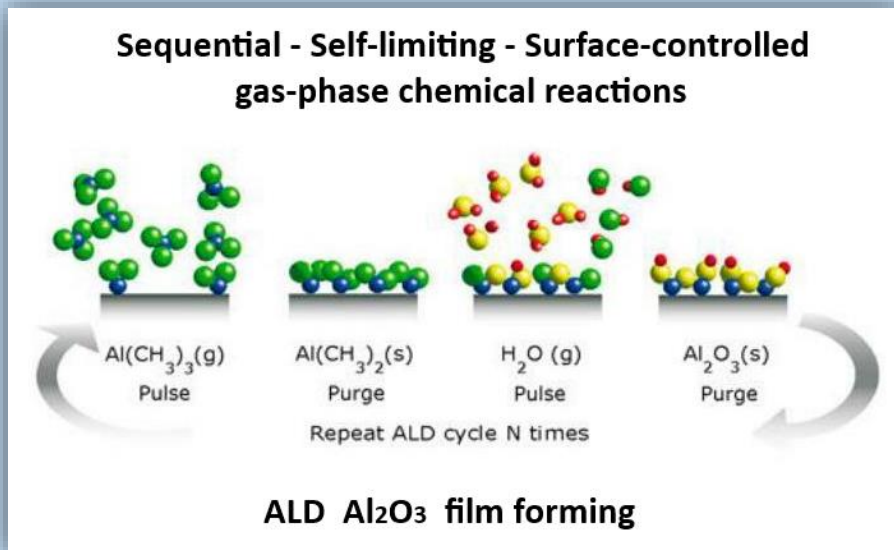
- Stress-corrosion cracking
- Corrosion fatigue
- Fretting corrosion (wear + corrosion)
- Crevice, pitting.....



# • Atomic Layer Deposition ALD

## • Possible applications in biomedical field

- Biomimesis of components
- corrosion protection of implants
- wear minimizing
- chemical barriers to ion leakage
- promotion of osteointegration



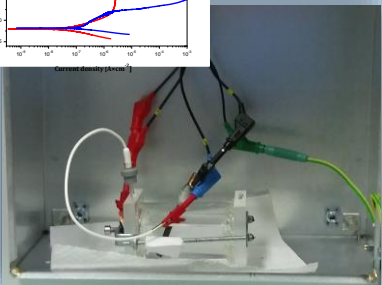
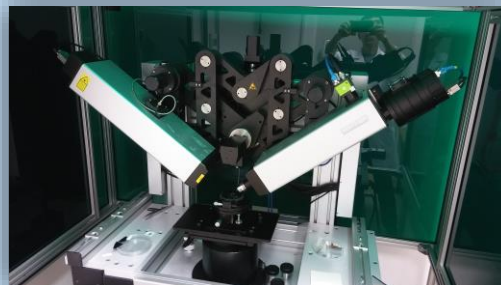
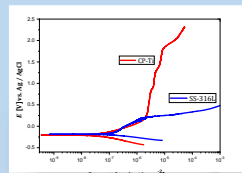
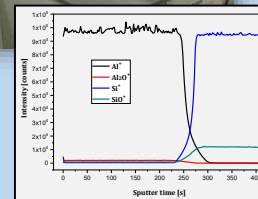
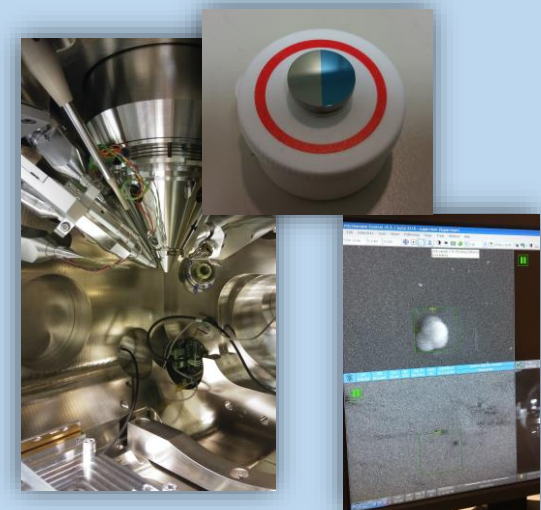
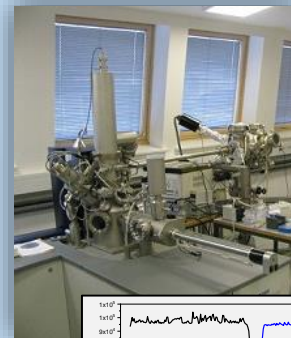
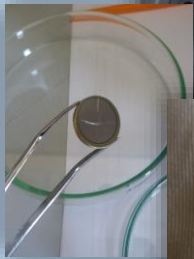
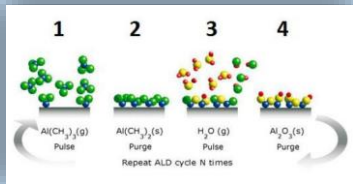


# • Experiments and challenges



## • Experimental process

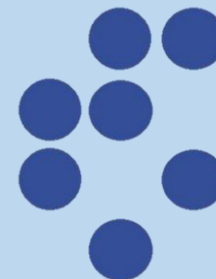
- Metallographic preparation (SS316L & Titanium)
- Electrochemical characterization (OCP, PD, EIS)
- Atomic Layer Deposition ( $\text{Al}_2\text{O}_3$ ,  $\text{TiO}_2$ )  
(temperature, amount of reactants...)
- Electrochemical characterization, thickness, depth profile, composition, conformality  
Ellipsometry, ToF-SIMS, SEM-EDS!





MEDNARODNA  
PODIPLOMSKA ŠOLA  
JOŽEFA STEFANA

JOŽEF STEFAN  
INTERNATIONAL  
POSTGRADUATE SCHOOL



Thank You !!!



Nanocenter



mCBEEs



Horizon 2020  
European Union Funding  
for Research & Innovation



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*15 and 16 April 2019, Planica*

**Don't panic!**  
**I will talk about radioactivity,  
uranium.**

**Leja Rovan,**  
Department of Environmental Sciences,  
Jožef Stefan Institute

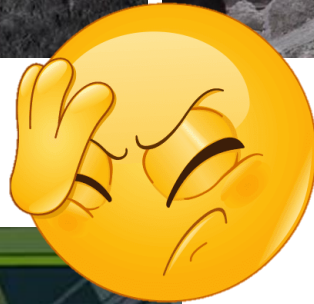
Poster number: **02**



# Bad radioactivity







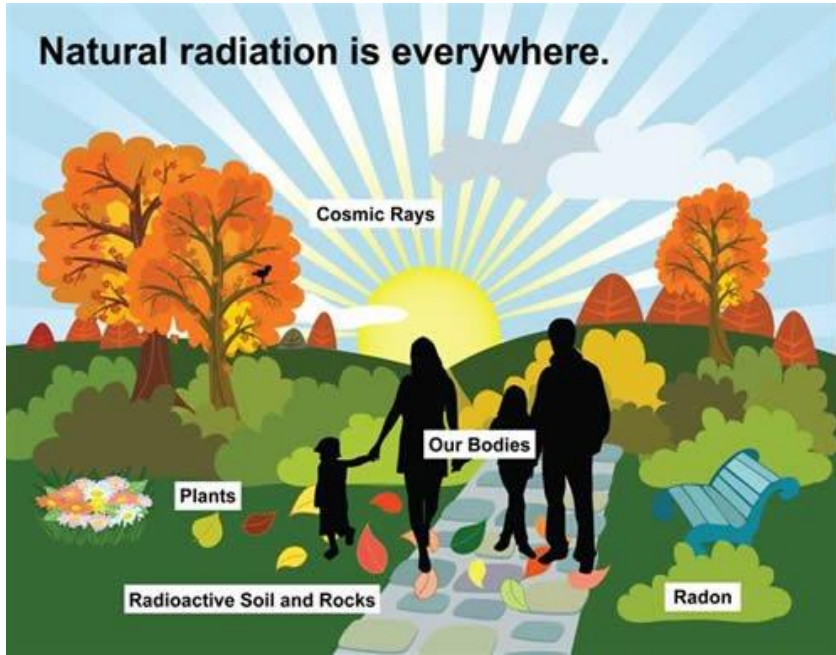
**Worst...**





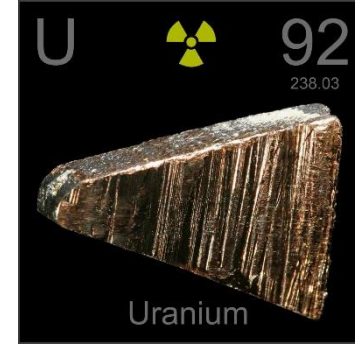


# Good radioactivity

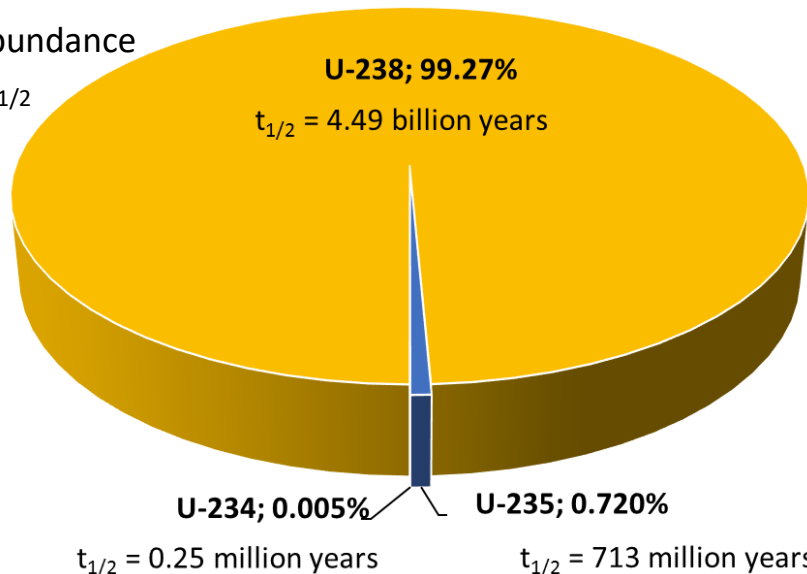


# Uranium (U)

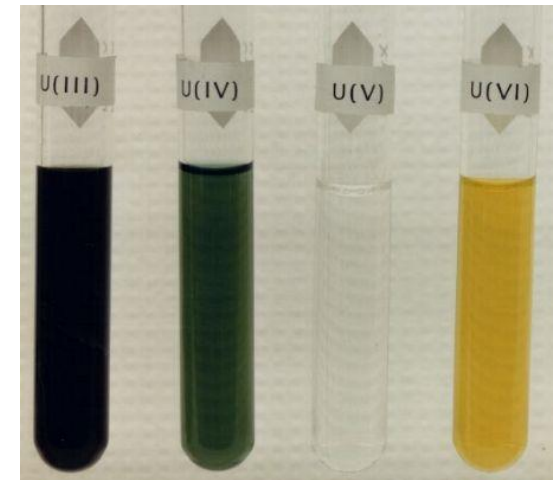
- Natural occurring radionuclide
- Oxidation states  $\rightarrow$  6+ (soluble), 4+ (insoluble)
- Uranium isotopes:



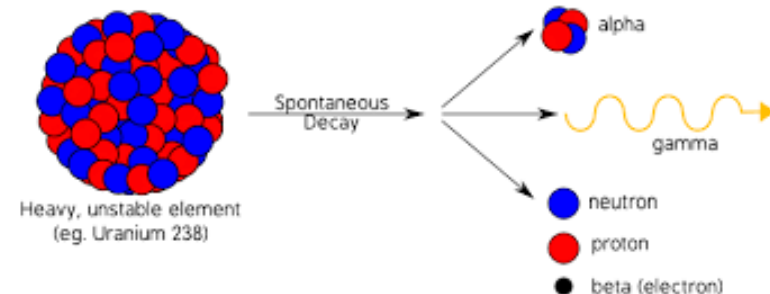
Natural abundance  
Half-life,  $t_{1/2}$



- U-238
- U-235
- U-234



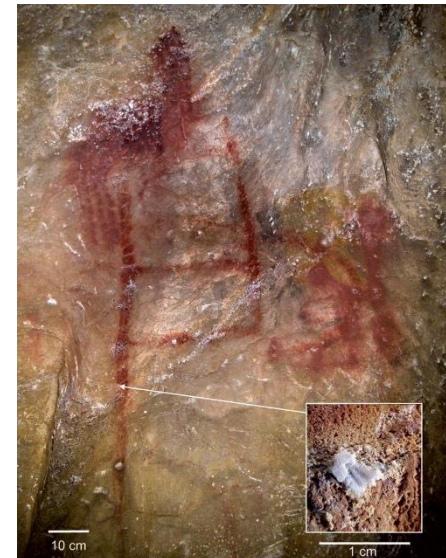
- Radioactive  $\rightarrow$   
unstable and decaying...





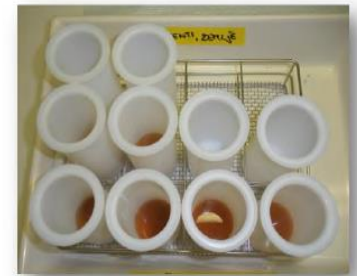
# Uranium applications

- Past climate change
- Ocean chemistry
- Paleoclimate
- Igneous, volcanic histories
- Dating fossil bones, cave painting
- Landform evolution
- Redox conditions
- Chemical weathering
- Mixing processes





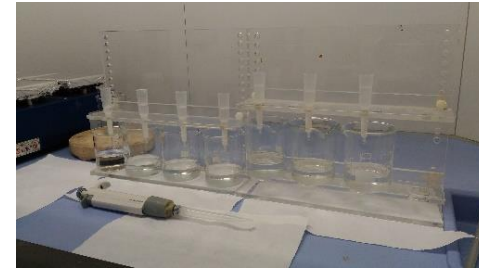
# Hard lab work:



Sampling



Sample pre-concentration  
or digestion



Chemical separation

**MC-ICP-MS**



Measurement



$^{238}\text{U}$ ,  $^{235}\text{U}$ ,  $^{234}\text{U}$



$^{235}\text{U}/^{238}\text{U}$  &  
 $^{234}\text{U}/^{238}\text{U}$   
isotope ratios

# Thank you for your attentions!

Poster number: 02

Contact:

[leja.rovan@ijs.si](mailto:leja.rovan@ijs.si)

## Tracing of uranium isotopes in Ljubljana River catchment

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<sup>2</sup>Jožef Stefan International Postgraduate School, Ljubljana, Slovenia



Programme: Ecotechnologies  
 Supervisor: dr. Marko Štrok  
 Contact: [leja.rovan@ijs.si](mailto:leja.rovan@ijs.si)

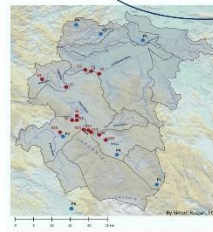
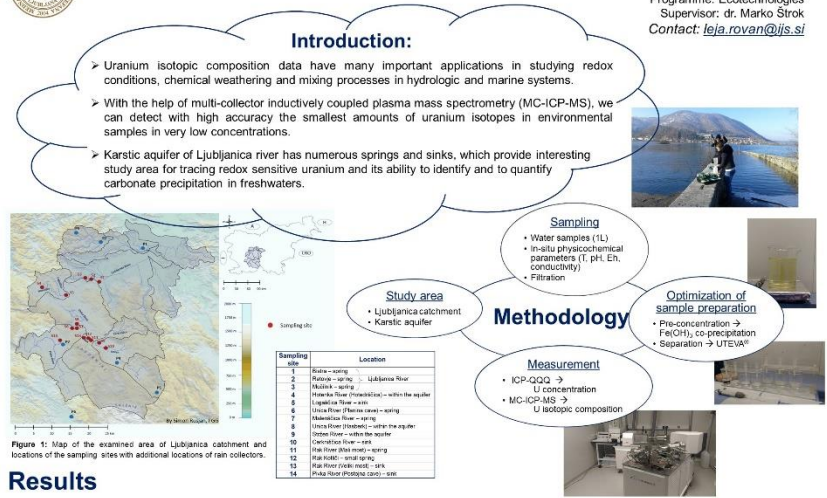


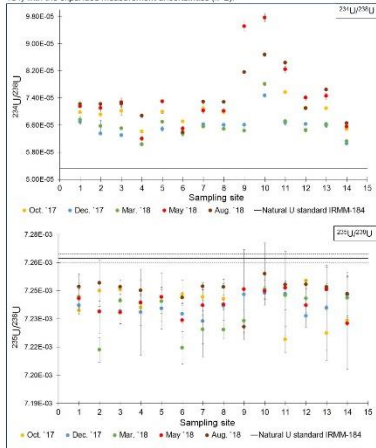
Figure 1: Map of the examined area of Ljubljana catchment and locations of the sampling sites with additional locations of rain collectors.

Sampling site	Location
1	Radna - spring
2	Radna - spring
3	Radna - spring
4	Radna - spring
5	Radna - spring
6	Radna - spring
7	Radna - spring
8	Radna - spring
9	Radna - spring
10	Radna - spring
11	Radna - spring
12	Radna - spring
13	Radna - spring
14	Radna - spring

### Results

Uranium isotopic composition in water samples

Figure 2: <sup>234</sup>U/<sup>238</sup>U and <sup>235</sup>U/<sup>238</sup>U isotope ratios (absolute values) from five sampling campaigns in water samples of karstic aquifer and certified natural U standard value (IRMM-184) with the expanded measurement uncertainties (k=2).



- Water sample concentrations of U varied from 0.23 to 0.68 ng/mL.
- Clear deviation of U isotopic composition between water samples and natural U standard.
- Significant difference in U isotopic composition between wet and dry seasons (December, March & October, May, August).
- <sup>234</sup>U enrichment in water samples → elevated values compared to natural U standard (the alpha recoil process).
- Small correlations between some sampling sites for <sup>234</sup>U/<sup>238</sup>U and <sup>235</sup>U/<sup>238</sup>U in dry seasons (weathering or different source lithology).

### Conclusions & further work

- The objective of this study was to check possible U fractionation in freshwater environment in continental areas with predominantly carbonate lithology, with the help of MC-ICP-MS.
- Uranium isotopic compositions show potential as a tracer of water sources in stream waters at the catchment scale and can be used to track seasonal variations along the flow of karstic waters.
- Study provides a good groundwork for further research to identify and quantify carbonate phases of different origins in a karstic aquifer and in aquatic sediments.

Acknowledgements: This work was supported by the Slovenian Research Agency within the research programme P2-0075 and project J1-9179.

IPSSC +  
CMBO

# STUDENTS' CONFERENCE

Jožef Stefan International Postgraduate School  
and Young Researchers' Day CMBO

*15 and 16 April 2019, Planica*

## Development of the Dual- beam ion irradiation facility for FUSion materials

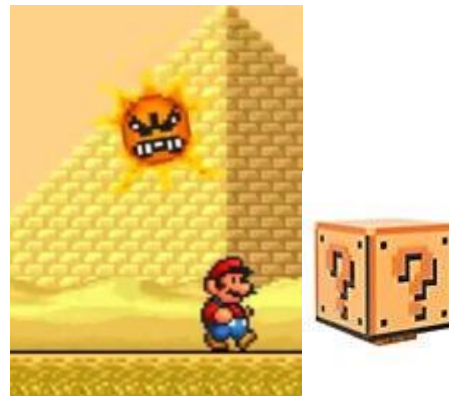
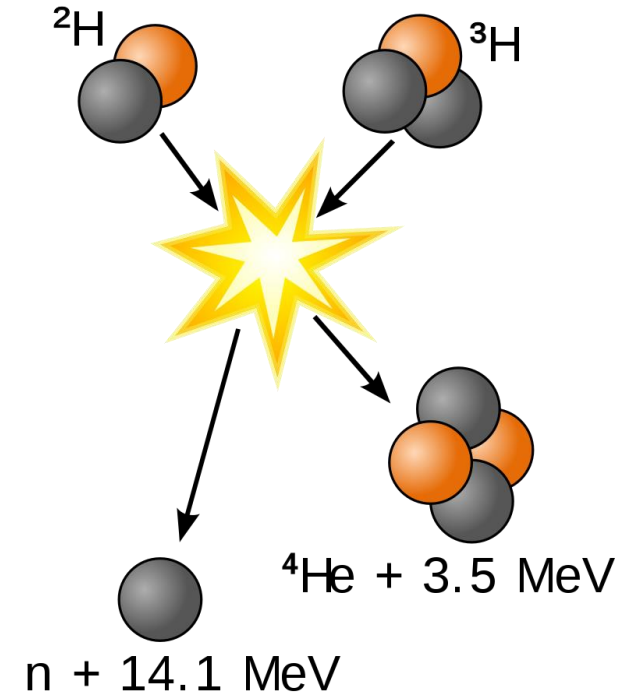
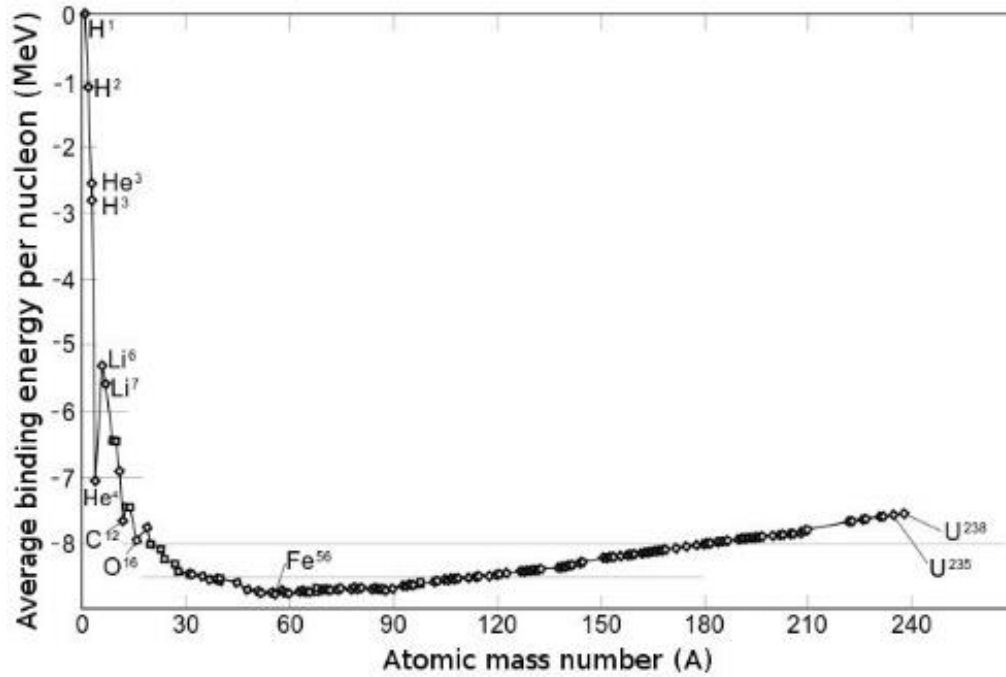
Marin Vukšić

Ruđer Bošković Institute, 54 Bijenička cesta, 10000, Zagreb, Croatia

Jožef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia

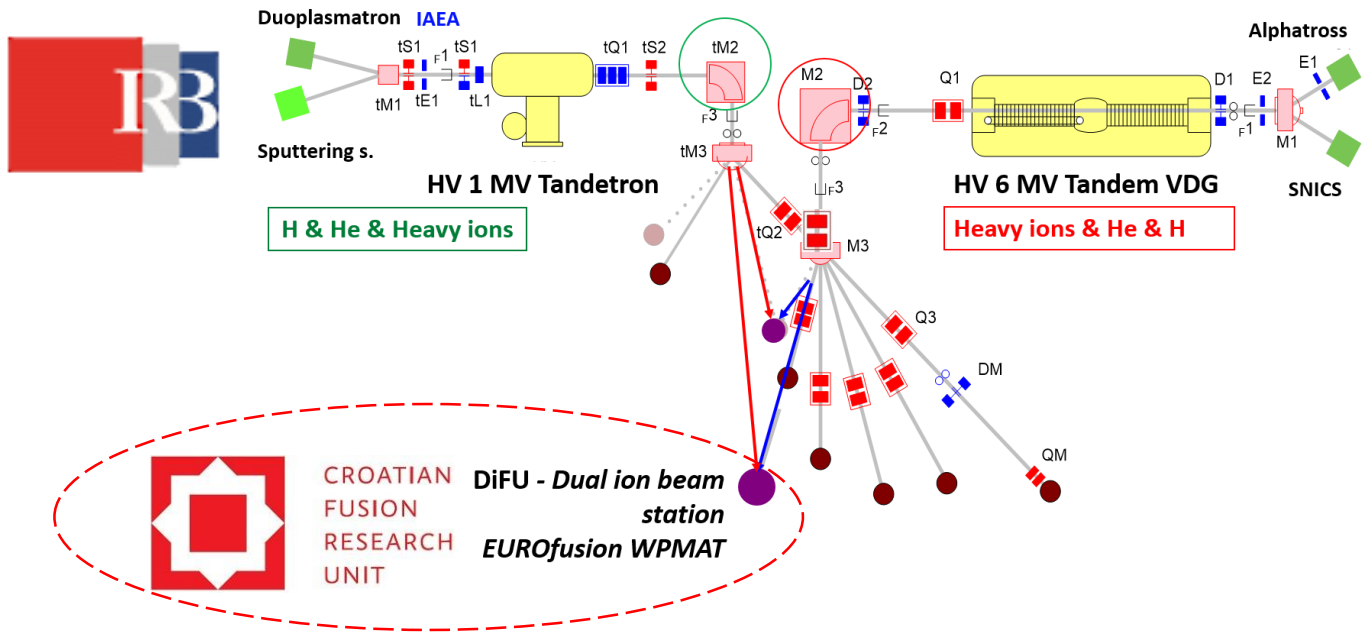
Poster number: **50**

- Nuclear fusion





# EUROfusion



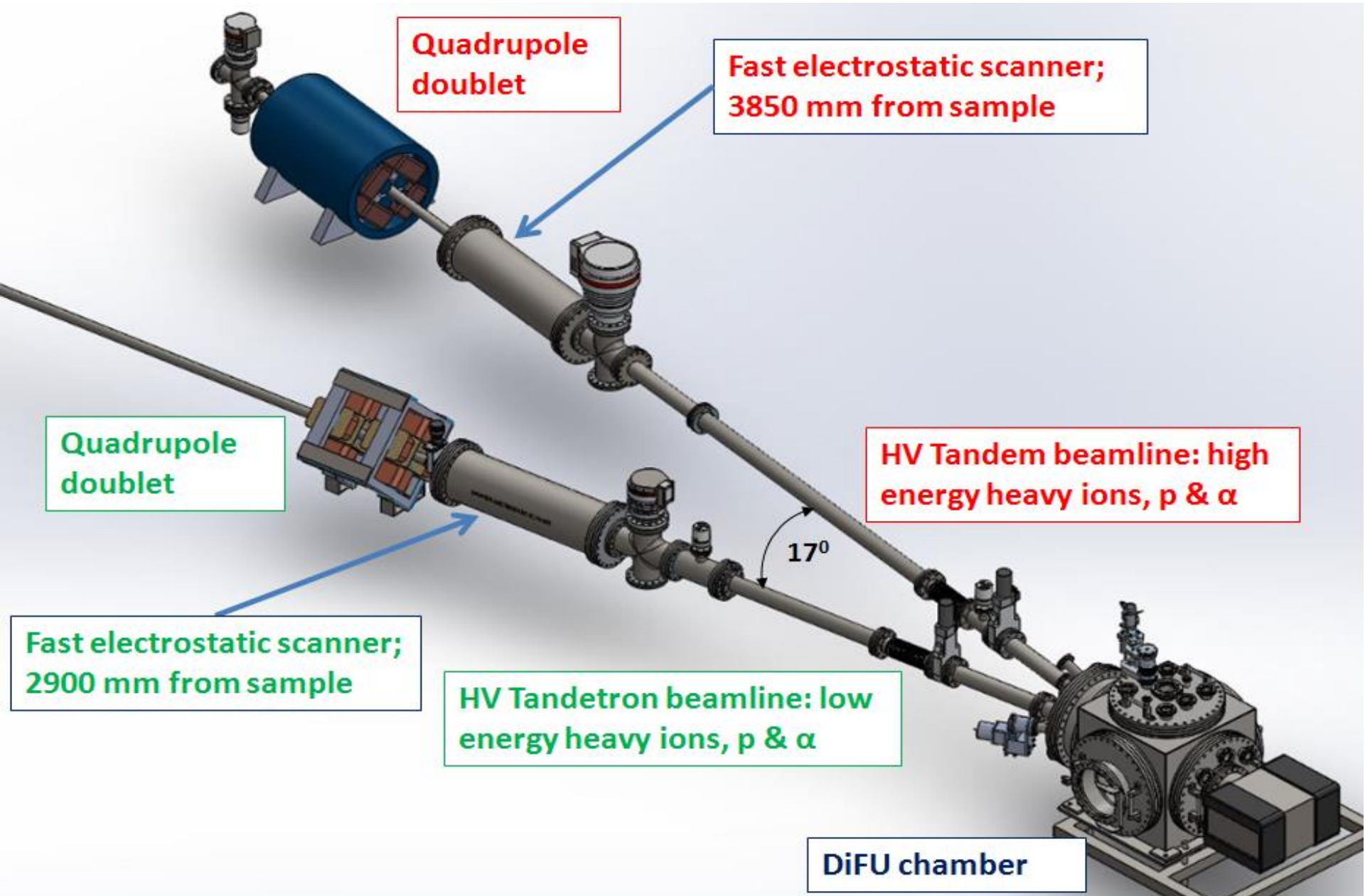
**Ion irradiation and IBA facilities @ Ruđer Bošković Institute, Zagreb, Croatia**

**Maximal magnetic rigidity of ion analysing magnets:**

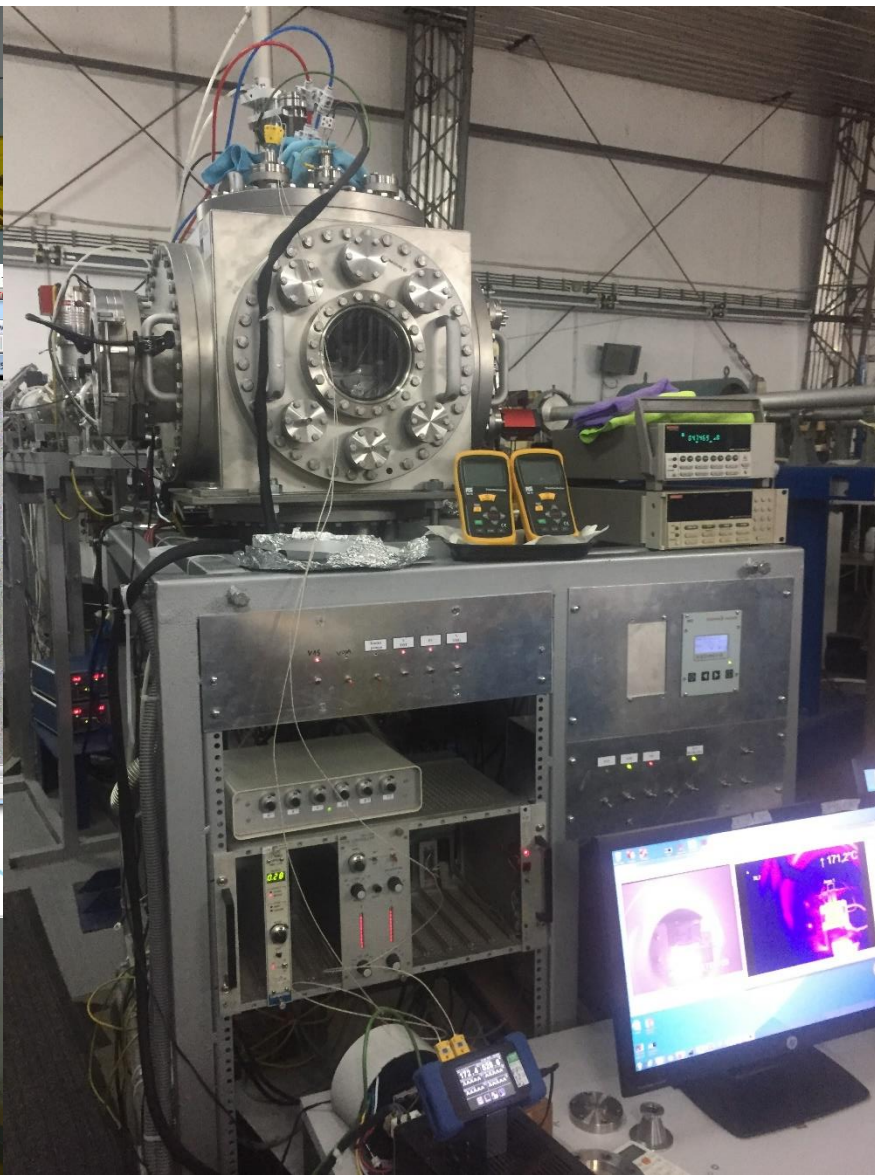
HV Tandetron 1 MV ...  $M * E / Q^2 = 20$       HV Tandem 6 MV ...  $M * E / Q^2 = 90$



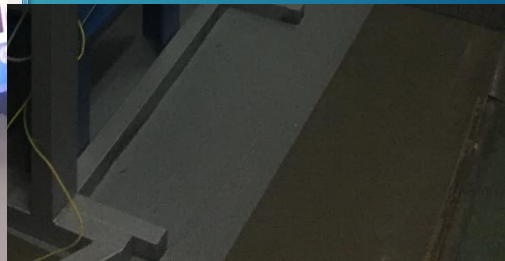
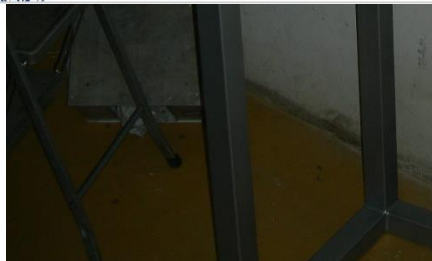
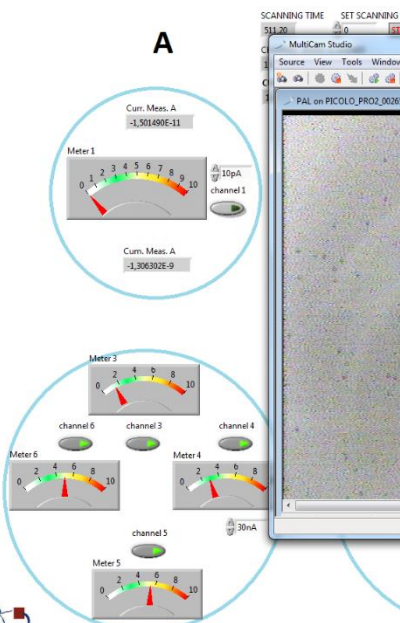
- DiFU







A



Thank you for your attention!



# SHORT BREAK

10 min