Omică? Noi vorbim ReMeNomică! Dumneavoastră?

Câteva cuvinte despre relația noastră ReMeNistă cu plantele, animalele și oamenii

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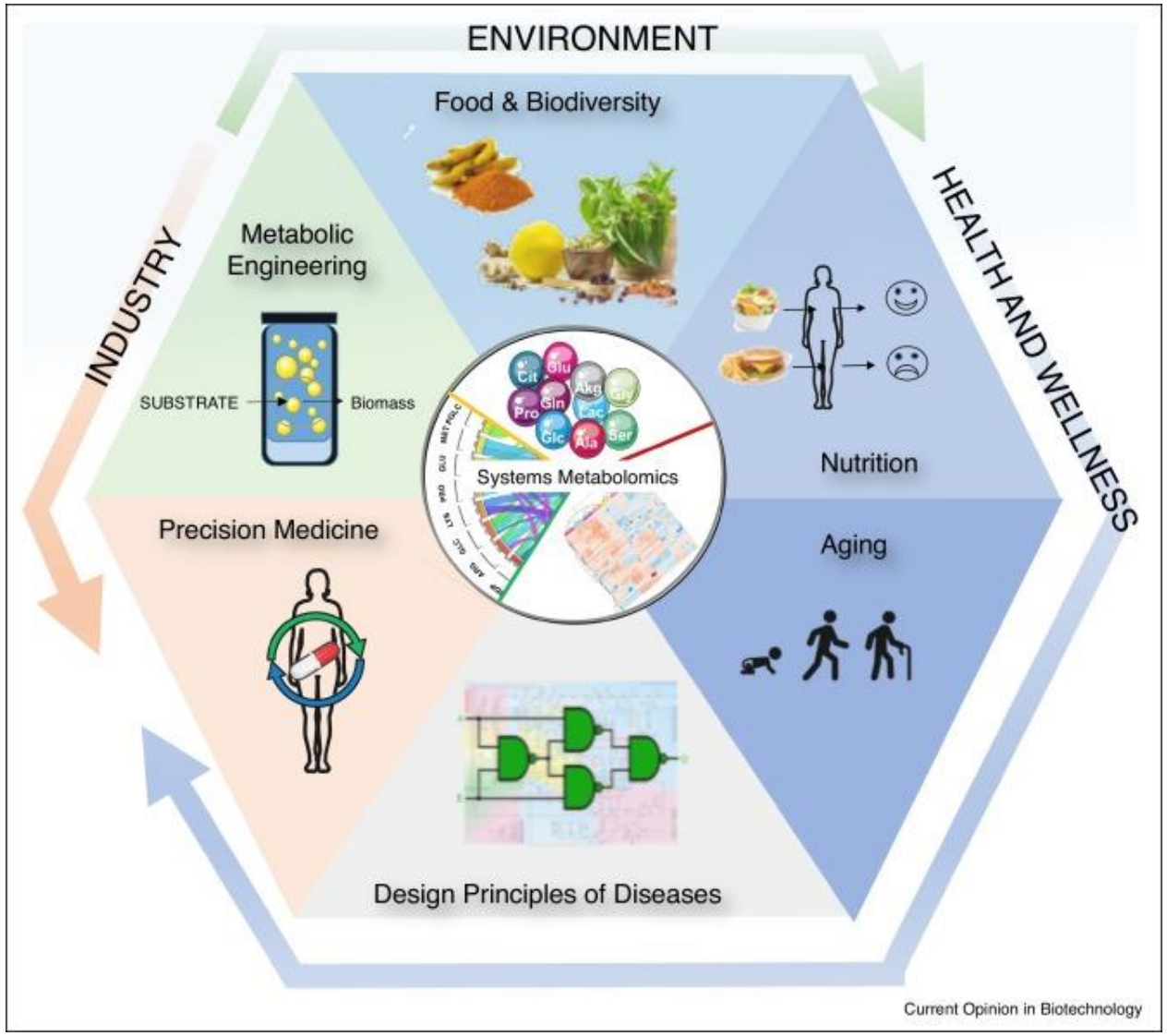
calin.deleanu@yahoo.com

Romanian Academy,
"Costin D. Nenitescu" Institute of Organic and Supramolecular Chemistry,
Bucharest, Romania
&
"Petru Poni", Institute of Macromolecular Chemistry,
Iasi, Romania

Omică? Noi vorbim ReMeNomică!



C. Damiani et al, *Curr. Opinion Biotechnol.*, **2020**, *63*, 190-199.

Omics may be defined by

Field of application:

Medicine;
Agro/food sciences;
Wellness and health;
Nutrition;
Environment/Pollution;
Biochemical industry…

Types of multiparameters:

Genomics; Proteomics;
Lipidomics; Metabolomics;
Phenomics; Microbiomics;
Foodomics; Urinomics…

Methods/Techniques:

Chromatography;
Biochemistry;
Genetics (PCR, Sanger, NGS, cytogenetics…)
MS; NMR…

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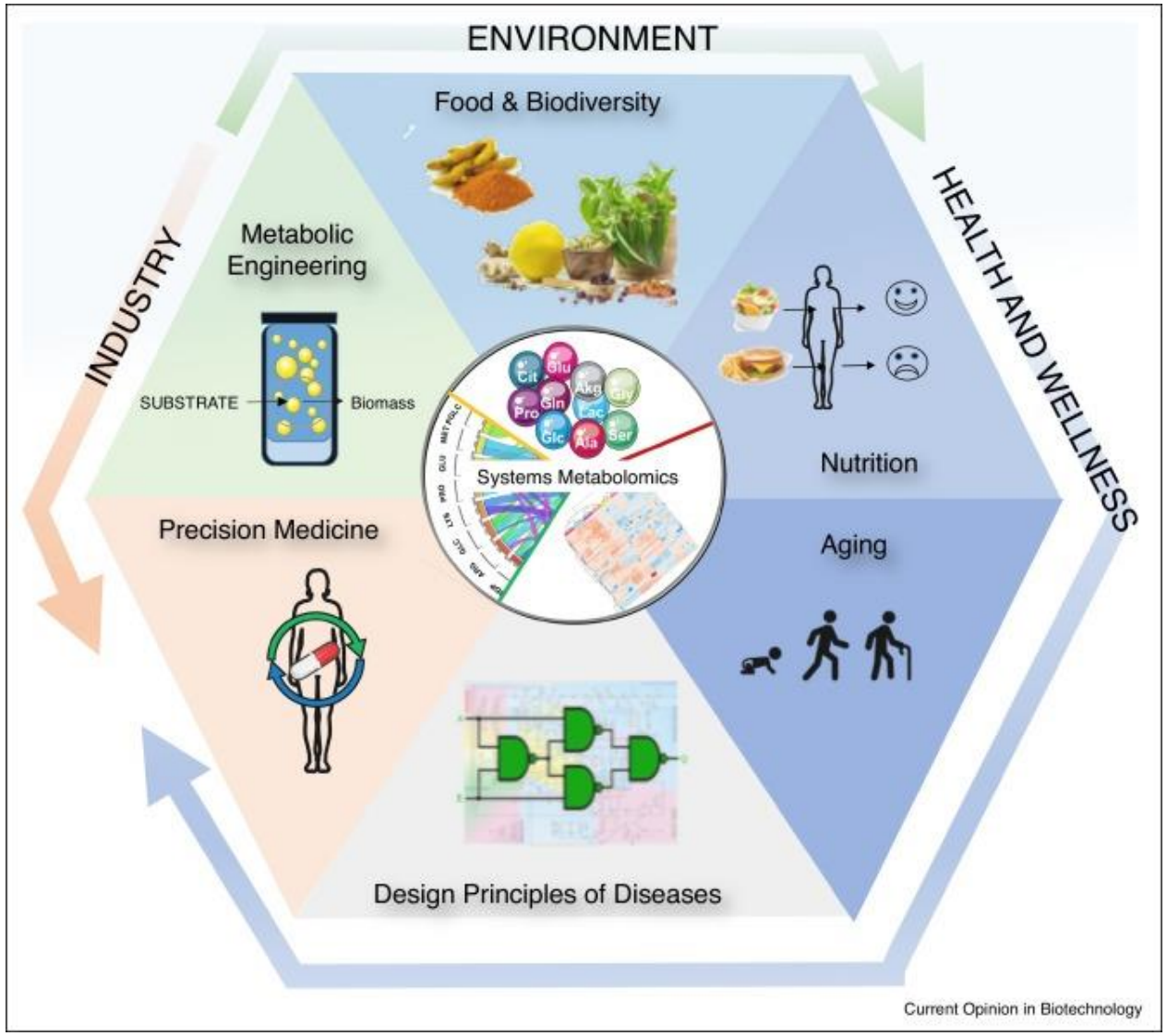

C. Damiani et al, *Curr. Opinion Biotechnol.*, **2020**, *63*, 190-199.

Our expertise:

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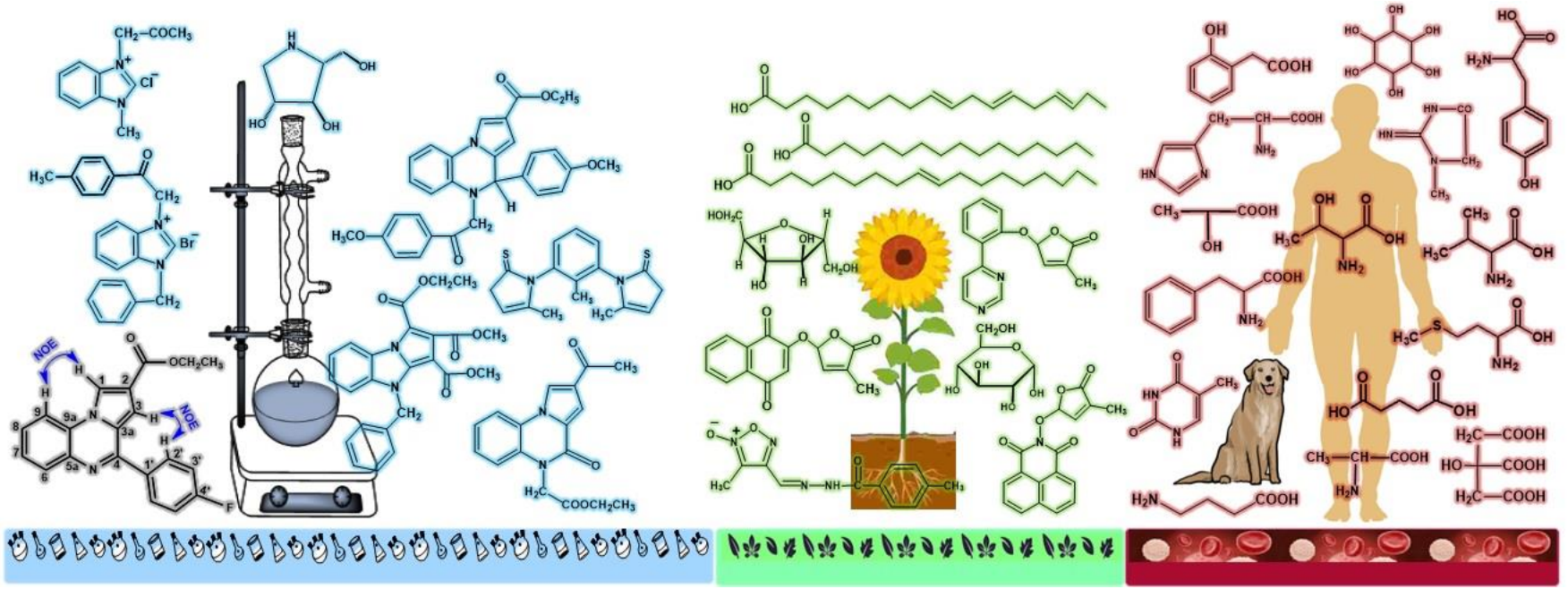
Câteva cuvinte despre relația noastră ReMeNistă cu plantele, animalele și oamenii



"Costin D. Nenitescu" Institute of Organic and Supramolecular Chemistry

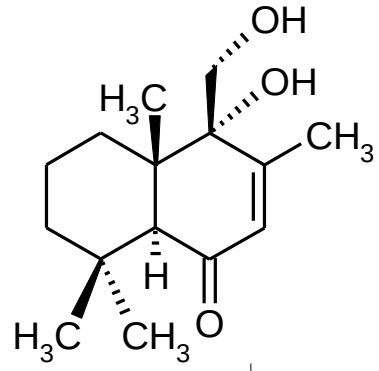
"Petru Poni", Institute of Macromolecular Chemistry

Structure elucidation of isolated compounds

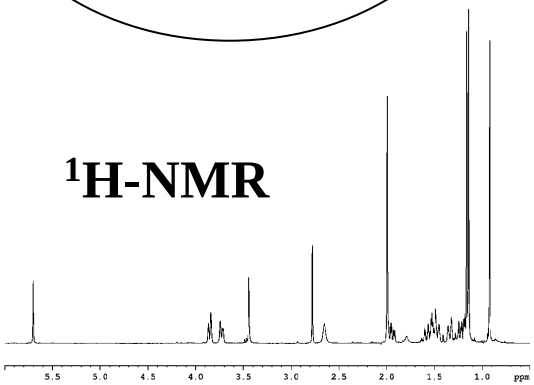
Isolated Compounds – Structure Elucidation

Structure elucidation of isolated compounds

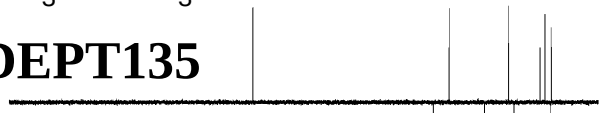
Larixol, extracted from larch (*Larix decidua L., L. europea L.*) (RO: larice/zada)



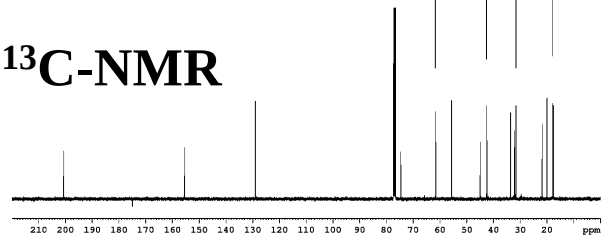
^{1}H-NMR



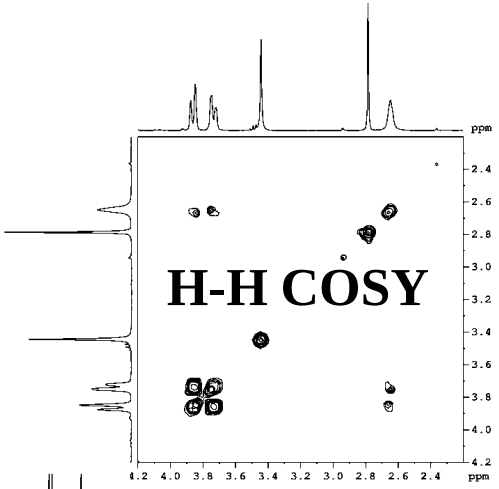
DEPT135



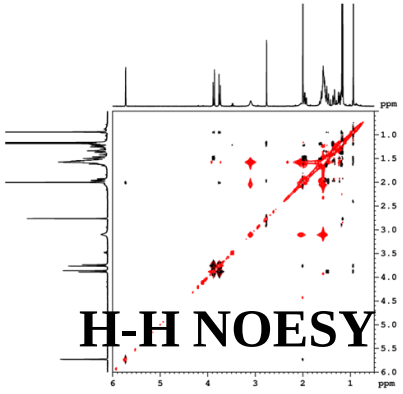
^{13}C-NMR



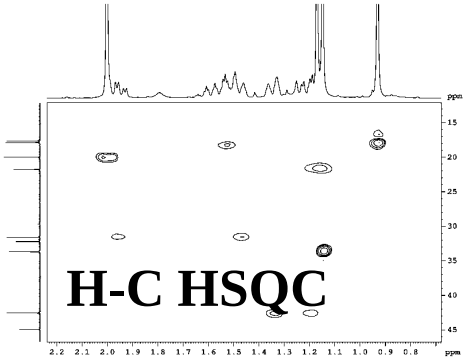
H-H COSY



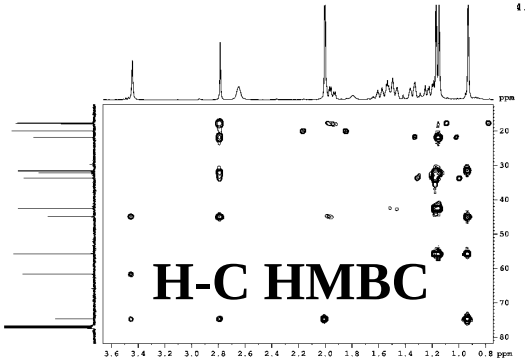
H-H NOESY



H-C HSQC



H-C HMBC



Structure elucidation of isolated compounds

Foods/Plant metabolism

Plant metabolism (Tomatoes)

Metabolic pathways

Ripening

Varieties

Shelf life

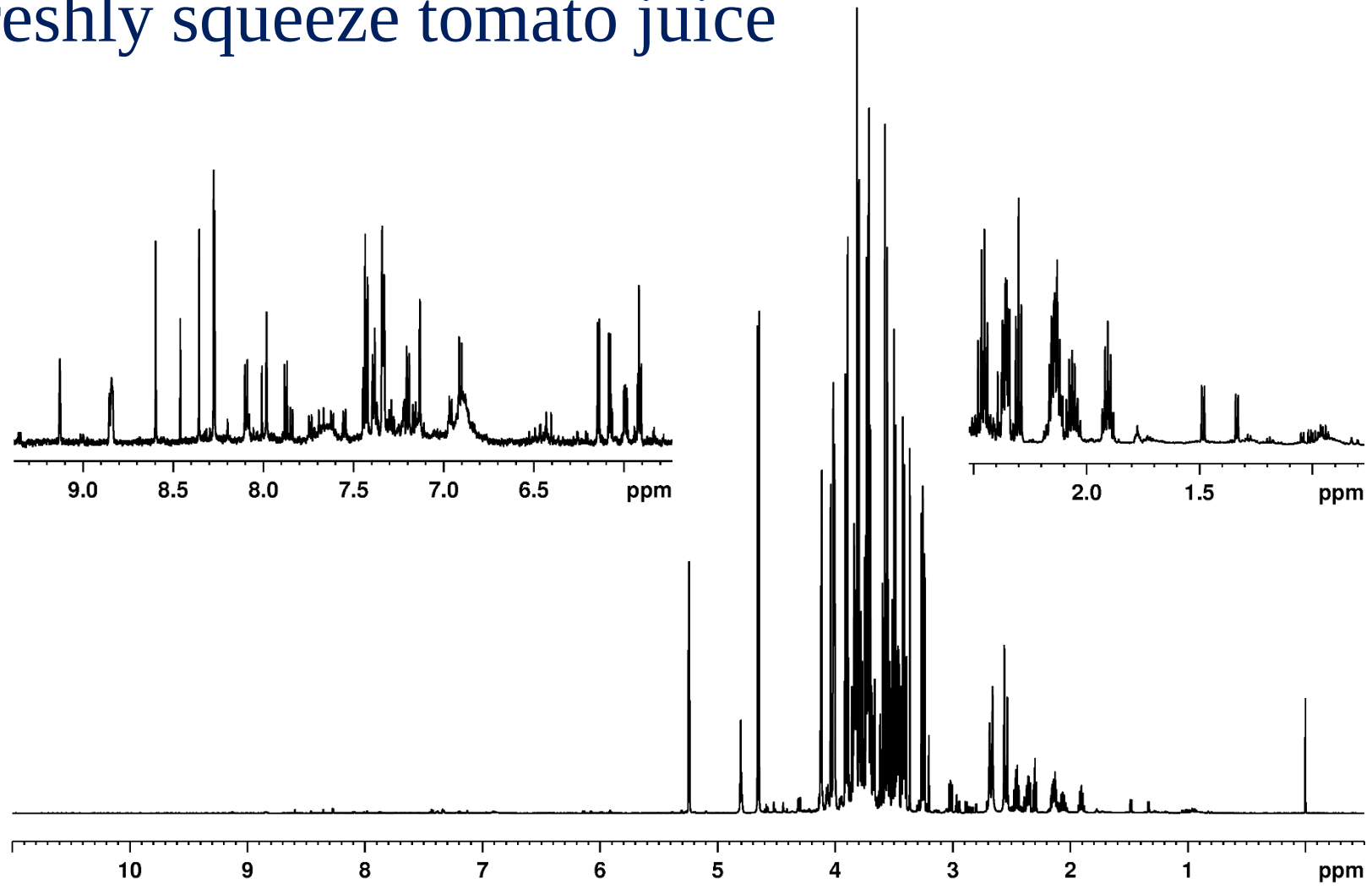
Degradation

Vegetable waste recycling

NMR metabolomics (Tomatoes)

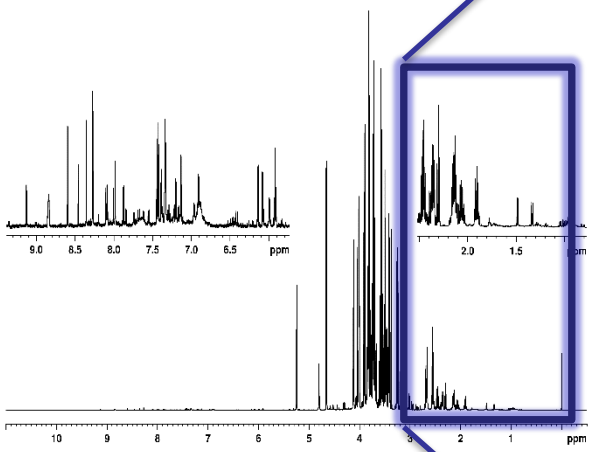
^{1}H NMR with water suppression

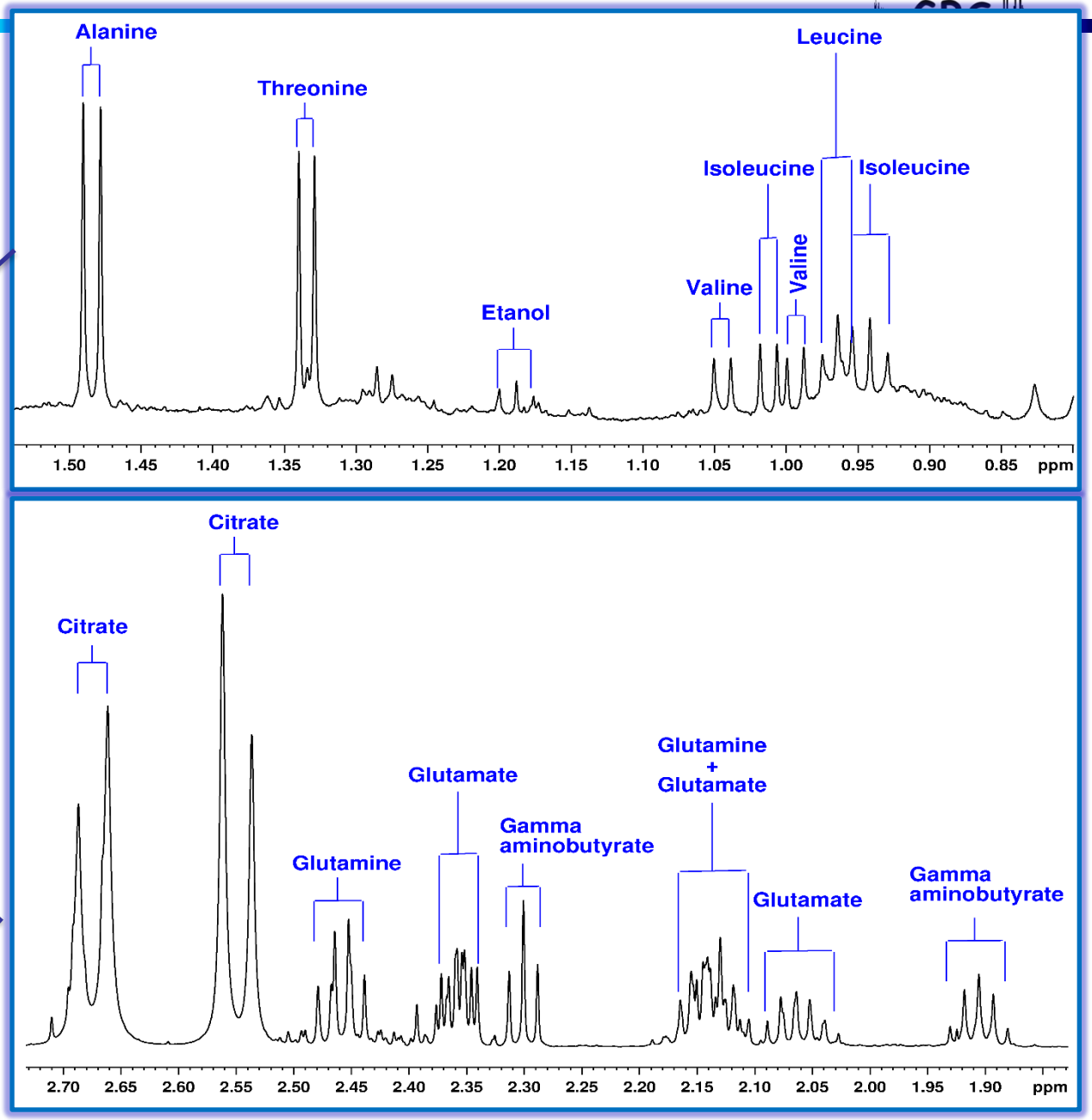
Freshly squeeze tomato juice



NMR metabolomics (Tomatoes)

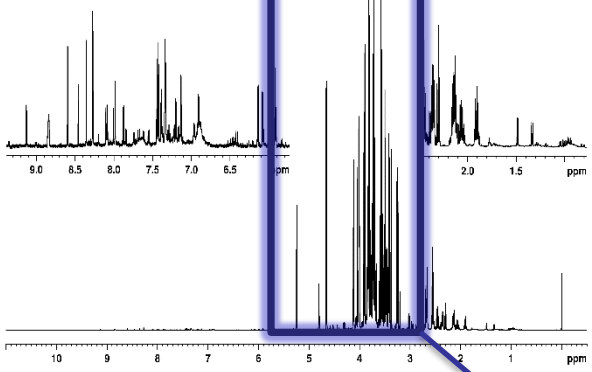
1H NMR with water suppression
Freshly squeeze tomato juice

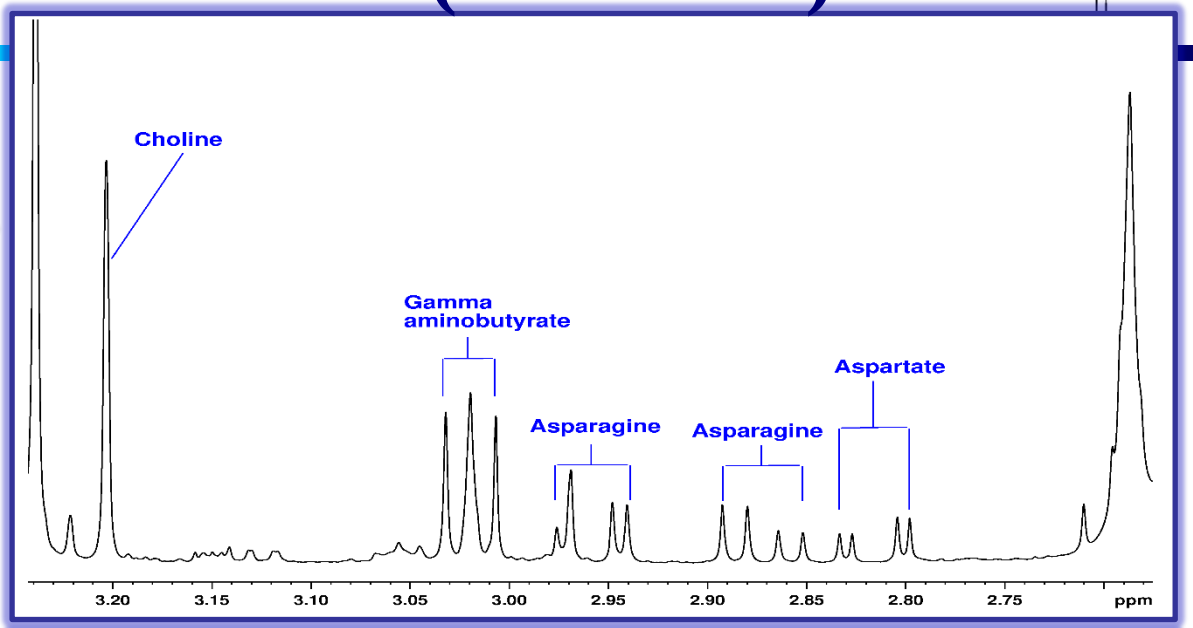


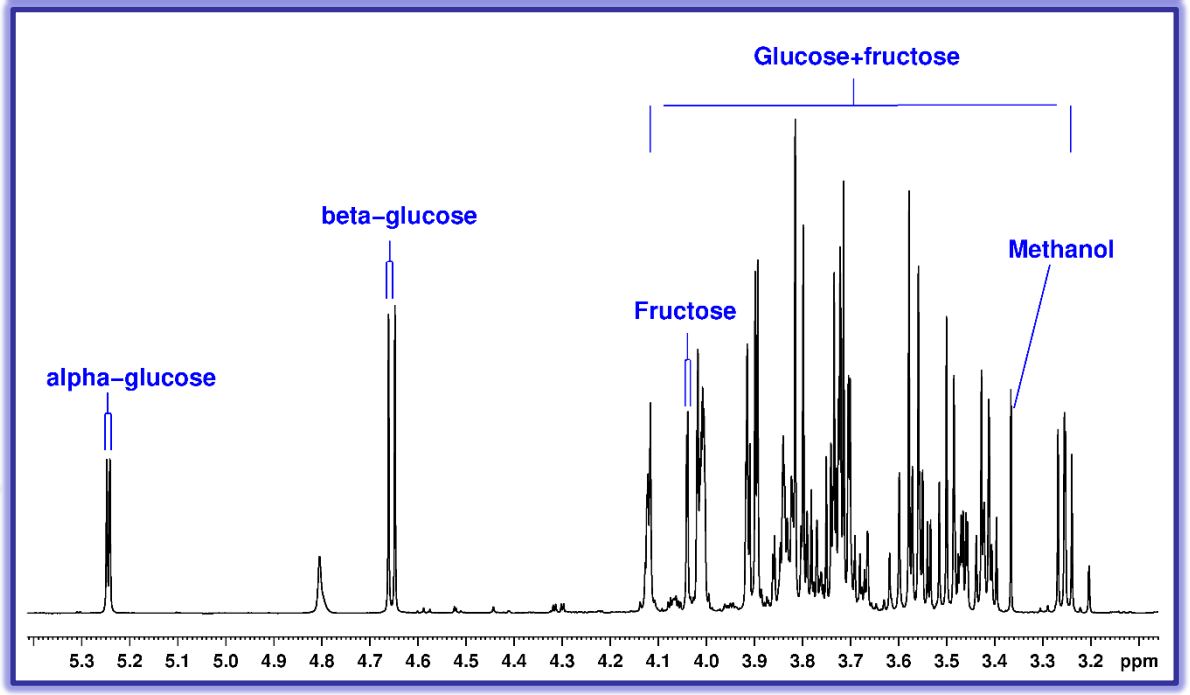


NMR metabolomics (Tomatoes)

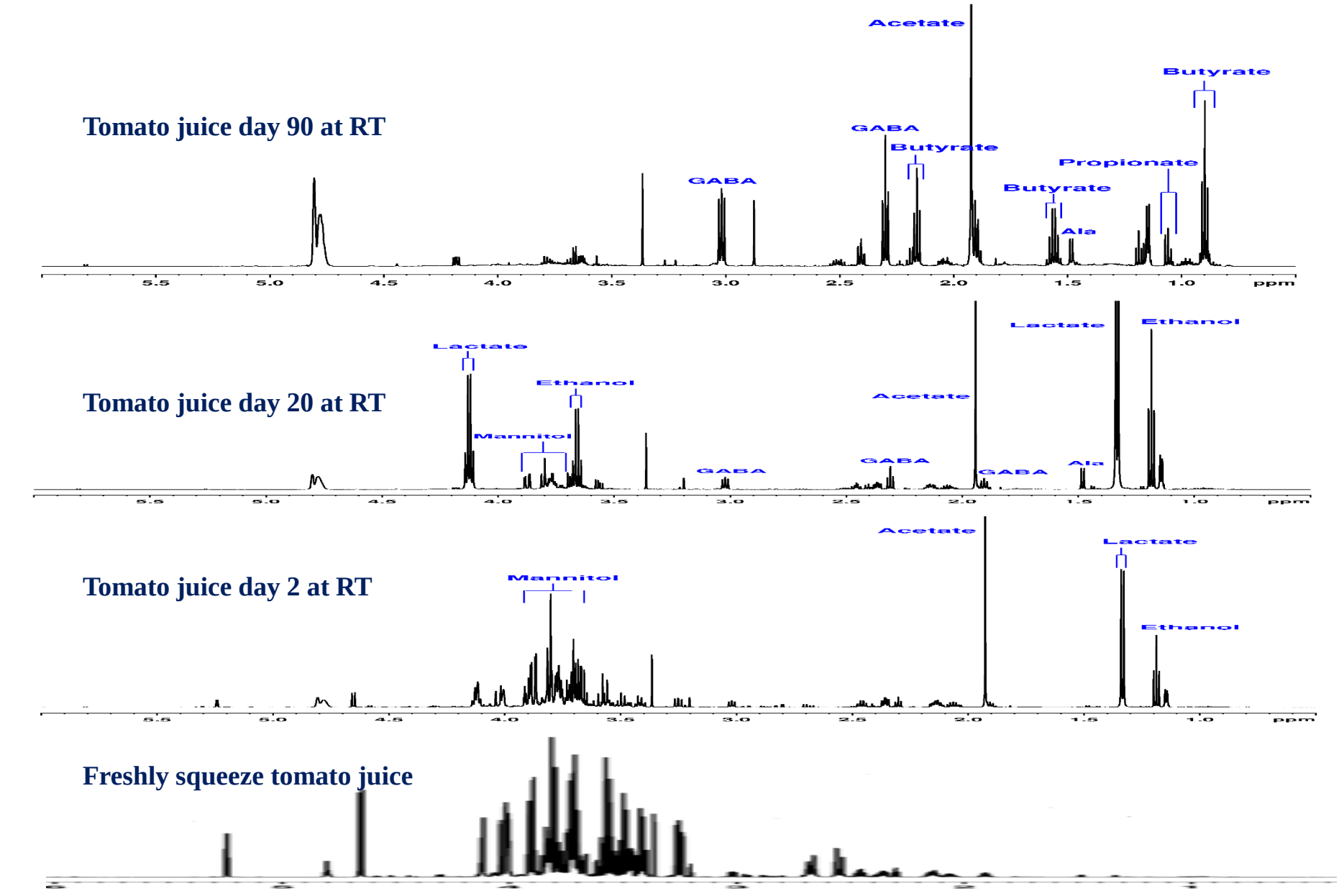
^{1}H NMR with water suppression
Freshly squeeze tomato juice





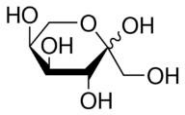


NMR metabolomics (Tomatoes)

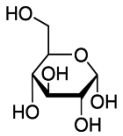


NMR metabolomics (Tomatoes)

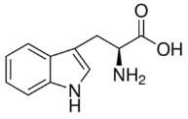
26 metabolites followed by NMR spectroscopy over 8 months (250 days).



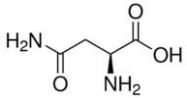
Fructose



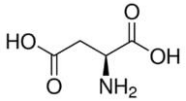
Glucose



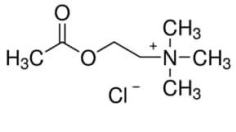
Tryptophane



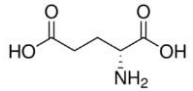
Asparagine



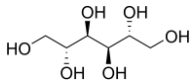
Aspartic acid



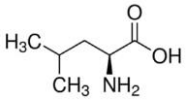
Acetyl choline



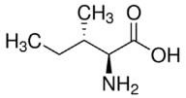
Glutamic acid



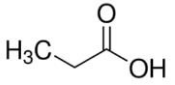
Mannitol



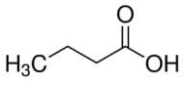
Leucine



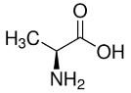
iso-Leucine



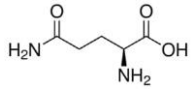
Propionic acid



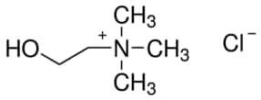
Butyric acid



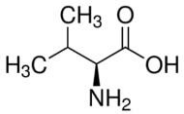
Alanine



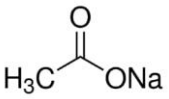
Glutamine



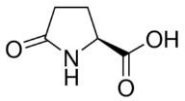
Choline



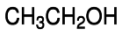
Valine



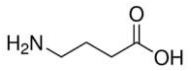
Acetate



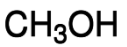
Pyroglutamic acid



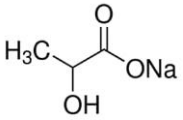
Ethanol



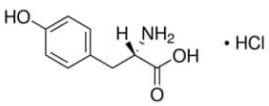
GABA



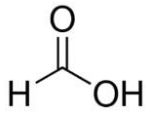
Methanol



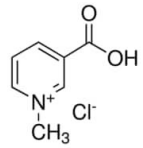
Lactate



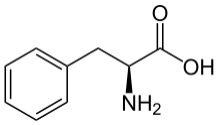
Tyrosine



Formic acid



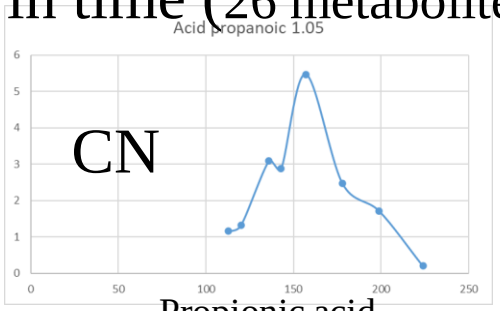
Trigonelline



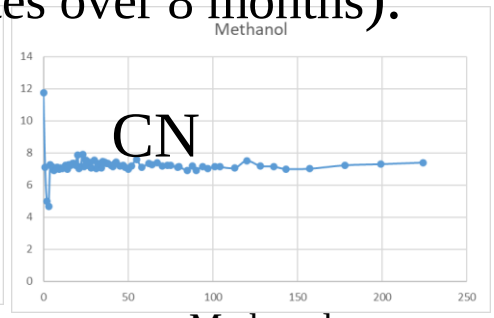
Phenylalanine

NMR metabolomics (Tomatoes)

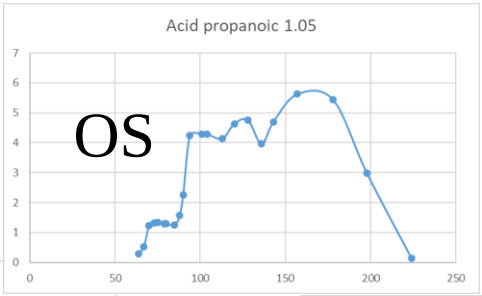
Types of concentration evolutions in time (26 metabolites over 8 months).

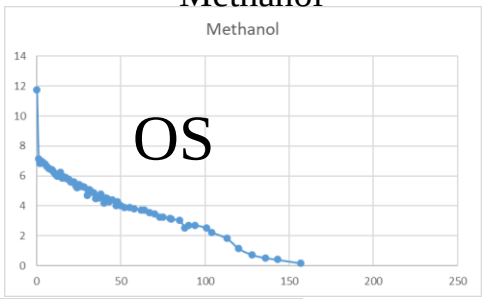


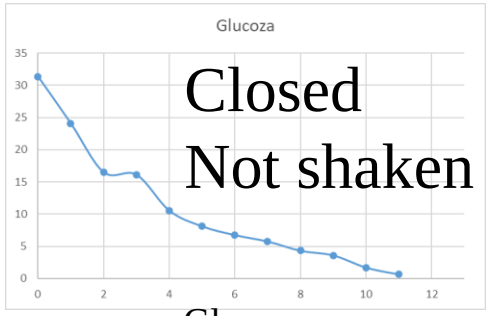
Propionic acid



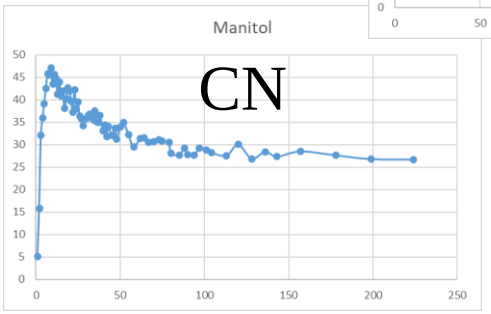
Methanol



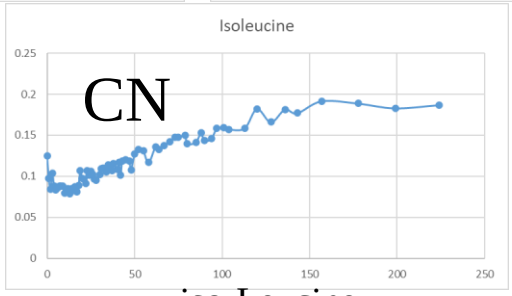




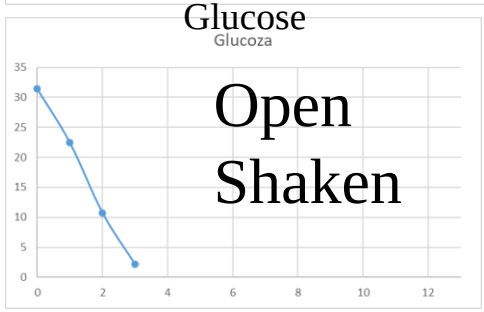
Glucose

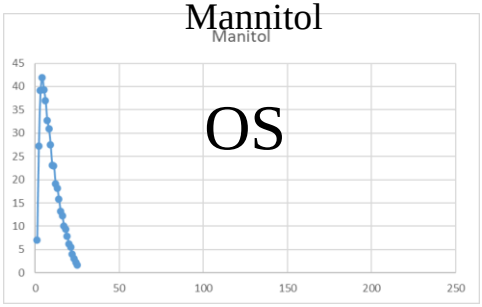


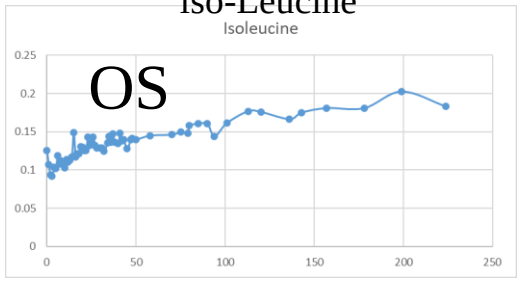
Mannitol



iso-Leucine





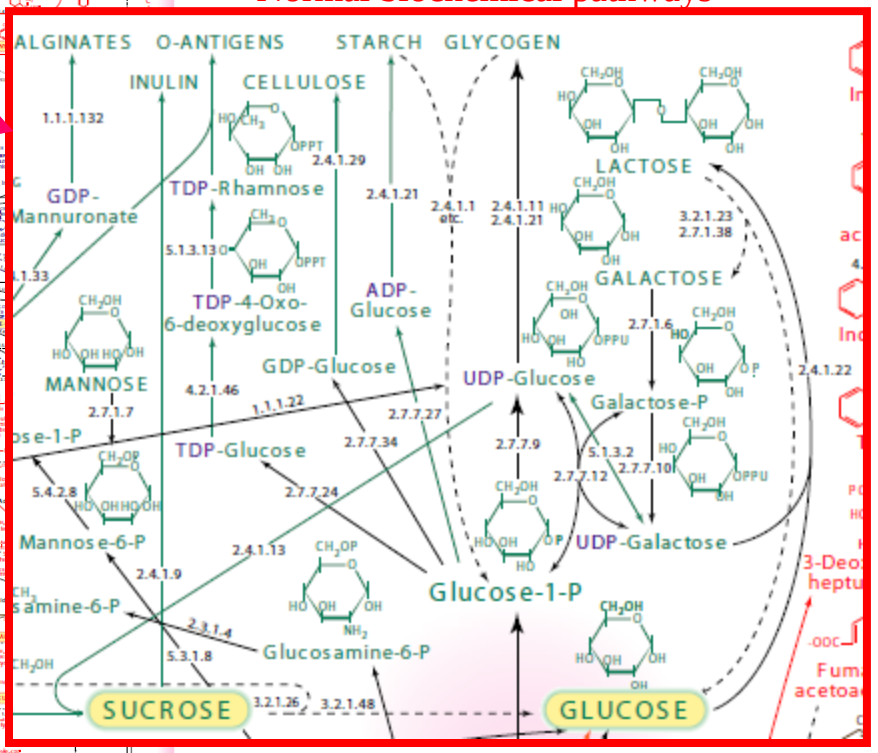


Structure elucidation of isolated compounds

Foods/Plant metabolism

Rare metabolic diseases

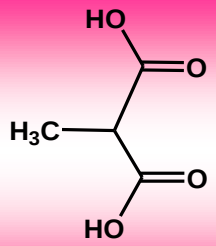
Normal biochemical pathways

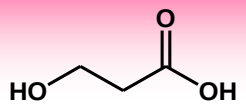


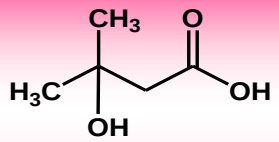
Inborn erros of metabolism

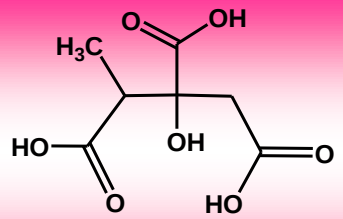
22nd Edn, IUBMB 2003, designed by Donald Nicholson, Univ of Leeds and Sigma-Aldrich.

Rare diseases - Methylmalonic aciduria (MMA)

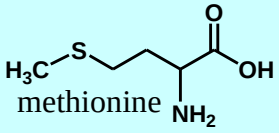

Methylmalonic acid

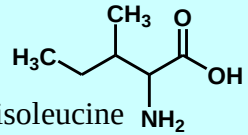

3-hydroxypropionic acid

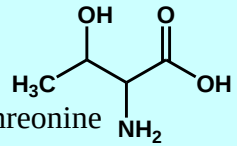

3-hydroxyisovaleric acid

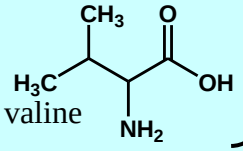

2-methylcitric acid

Odd chain fatty acids

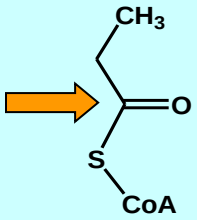

methionine


isoleucine


threonine


valine

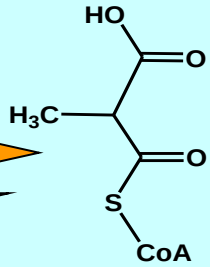
Schematic representation of the methylmalonic metabolism


propionyl-CoA

+ biotin

Propionyl-CoA carboxylase

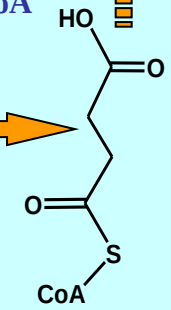
ATP+CO_2 → ADP


methylmalonyl-CoA

+ vitamin B12

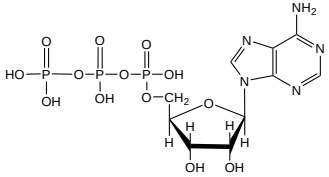
Methylmalonyl-CoA mutase

Blocked

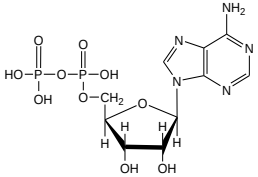

succinyl-CoA

Citric acid cycle & Gluconeogenesis

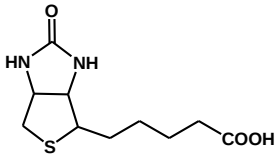
ATP-adenosine triphosphate



ADP-adenosine diphosphate



Biotin



Rare diseases - Methylmalonic aciduria (MMA)

BACKGROUND

Methylmalonic aciduria is an inherited (autosomal recessive) disorder in which the body is unable to process certain proteins and fats (lipids) properly.

The effects of methylmalonic aciduria, which usually appear in early infancy, vary from mild to life-threatening.

Condition occurs in an estimated 1 in 50,000 to 100,000 people.

Treatment : consists of vit. B12 and carnitine supplements and a low-protein diet. The child's diet must be carefully controlled.
If supplements do not help, the doctor may also recommend a diet that avoids isoleucine, threonine, methionine, and valine.
Liver or kidney transplantation (or both) have been shown to help some patients. These transplants provide the body with new cells that help breakdown methylmalonic acid normally.

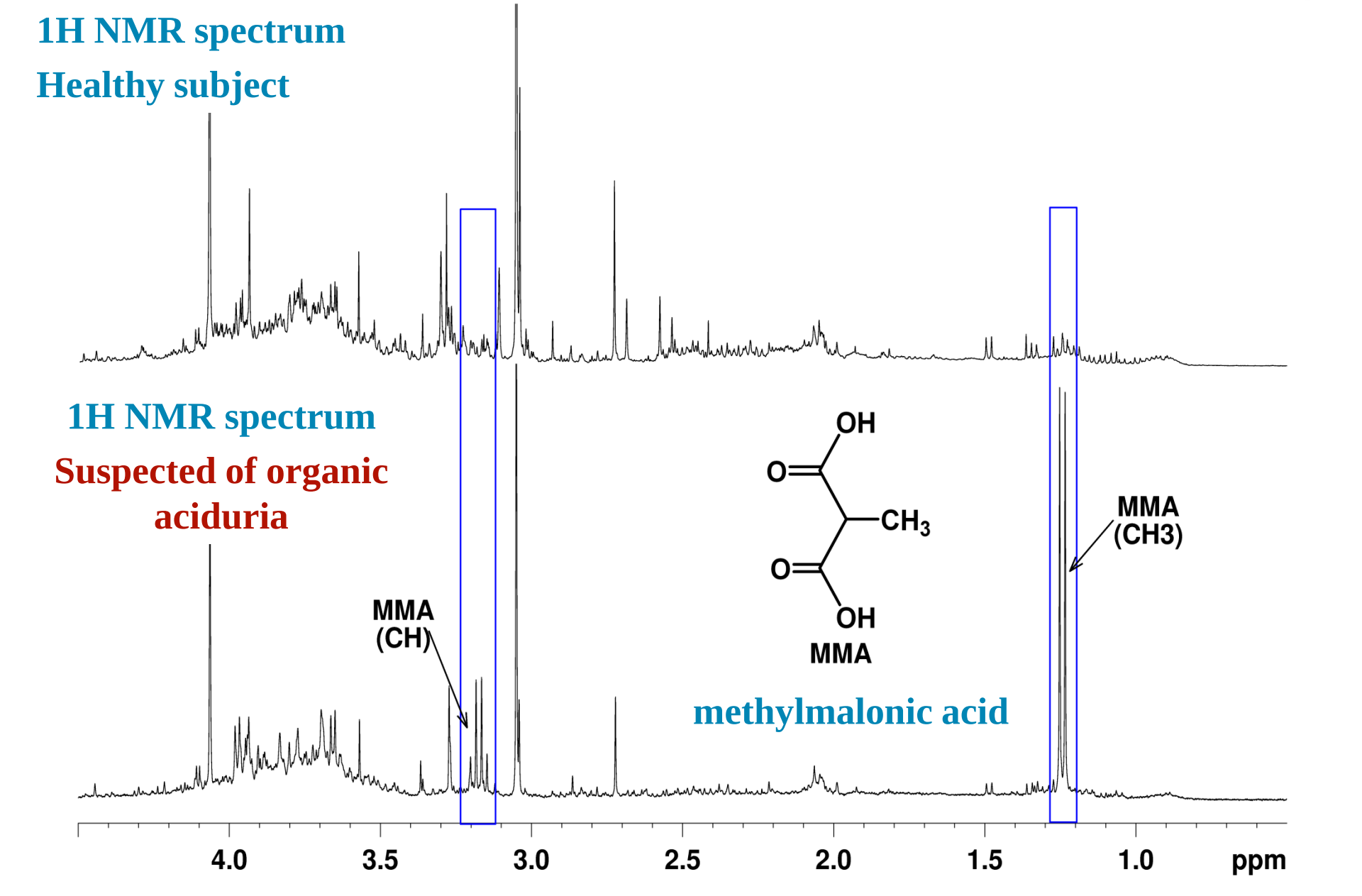
Rare diseases - Methylmalonic aciduria (MMA)

Symptoms: Affected infants experience vomiting, dehydration, weak muscle tone (hypotonia), excessive tiredness (lethargy), and failure to gain weight and grow at the expected rate.

Long-term complications can include feeding problems, intellectual disability, chronic kidney disease, and inflammation of the pancreas (pancreatitis).

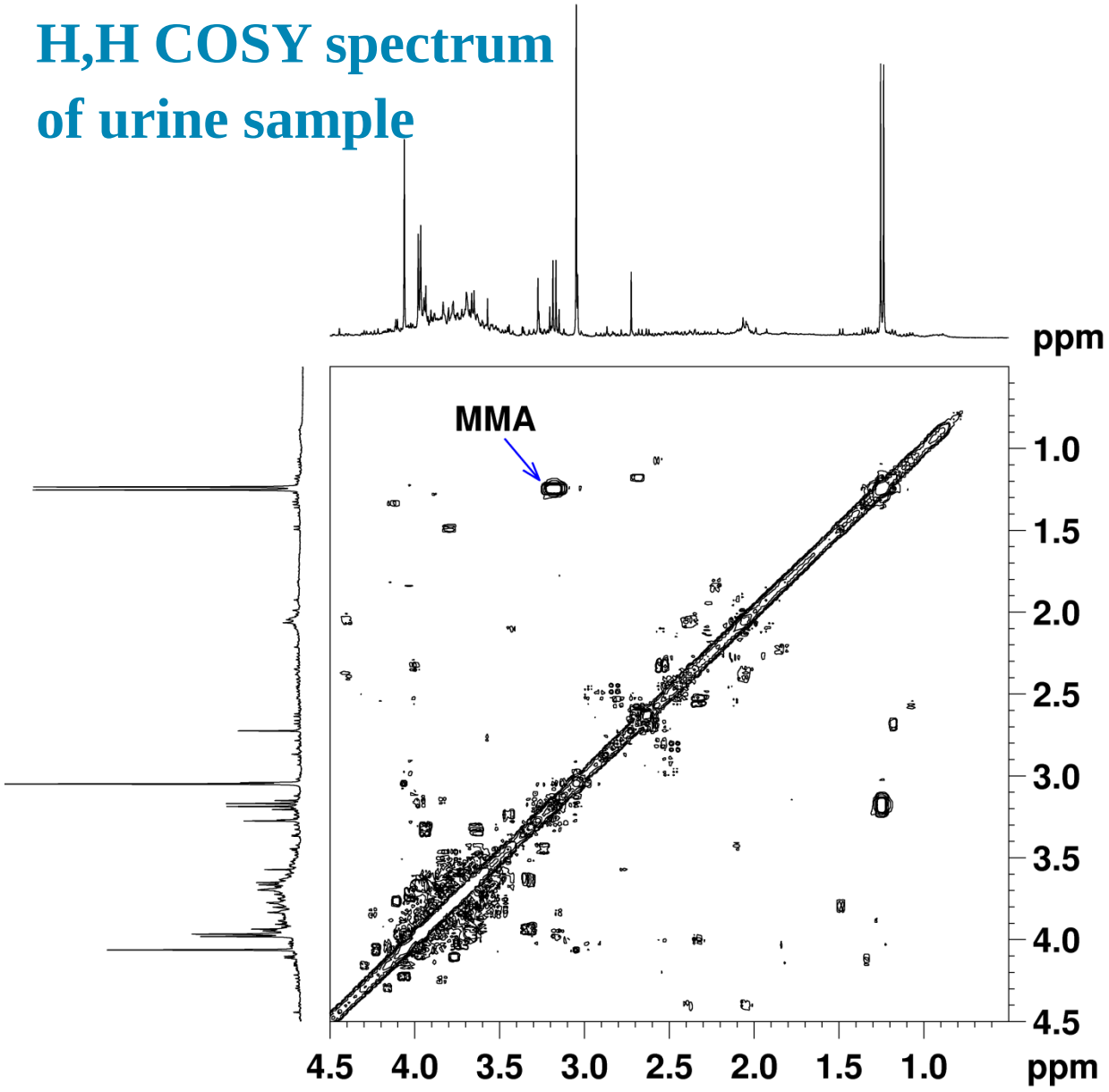
Without treatment, this disorder can lead to coma and death in some cases.

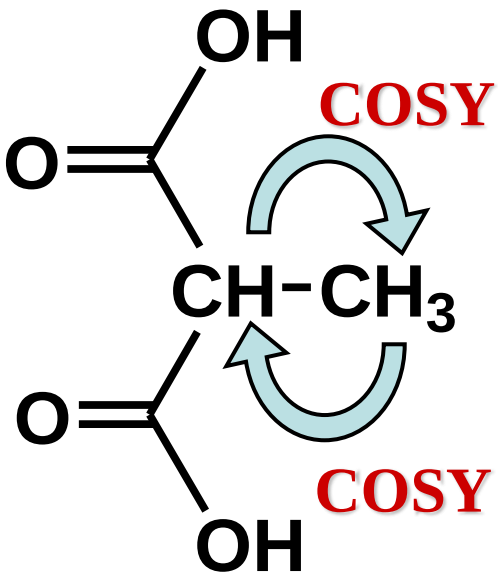
Rare diseases - Methylmalonic aciduria (MMA)



Rare diseases - Methylmalonic aciduria (MMA)

H,H COSY spectrum of urine sample

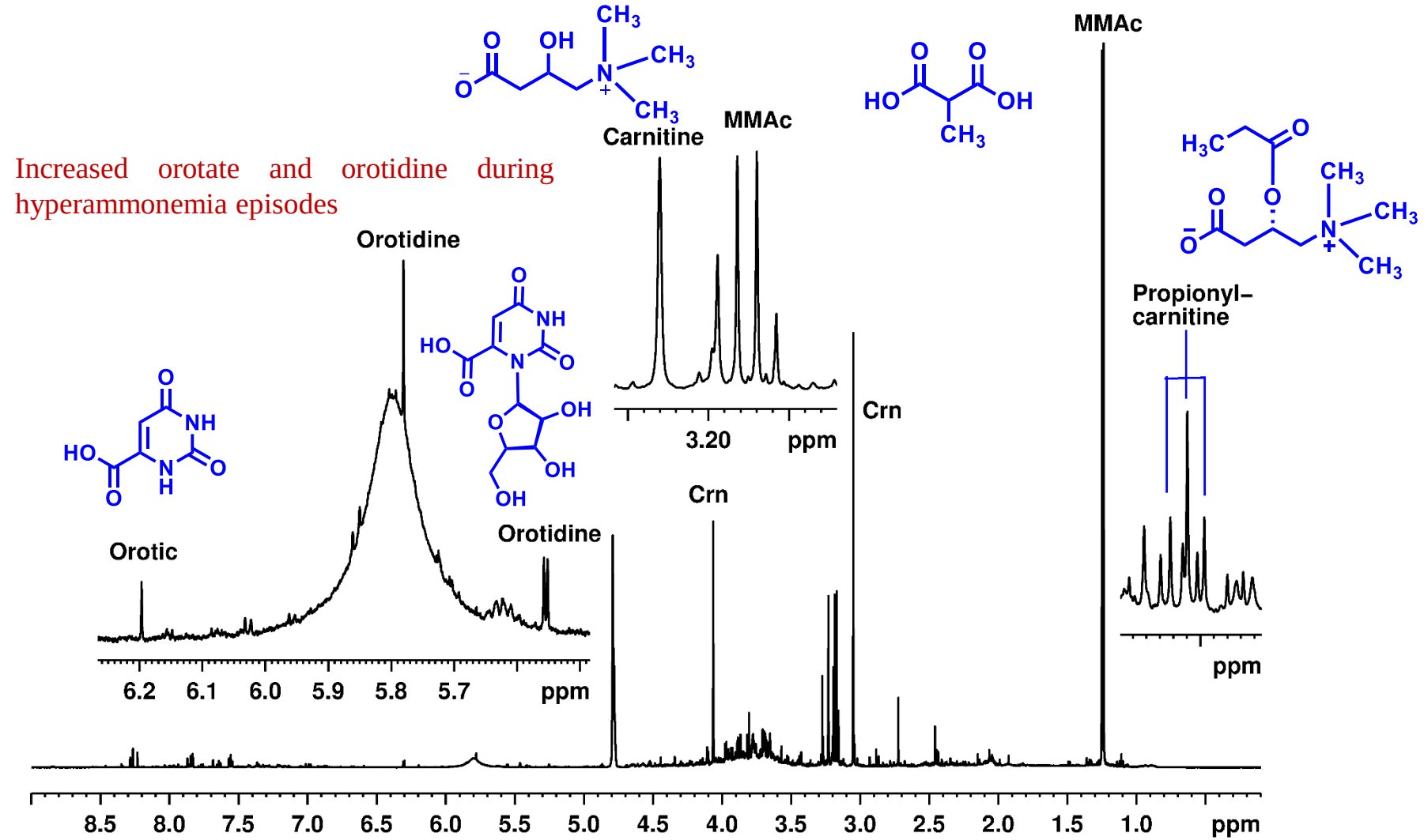




Rare diseases - Methylmalonic aciduria (MMA)

^{1}H NMR spectrum of urine sample from MMA patient under treatment

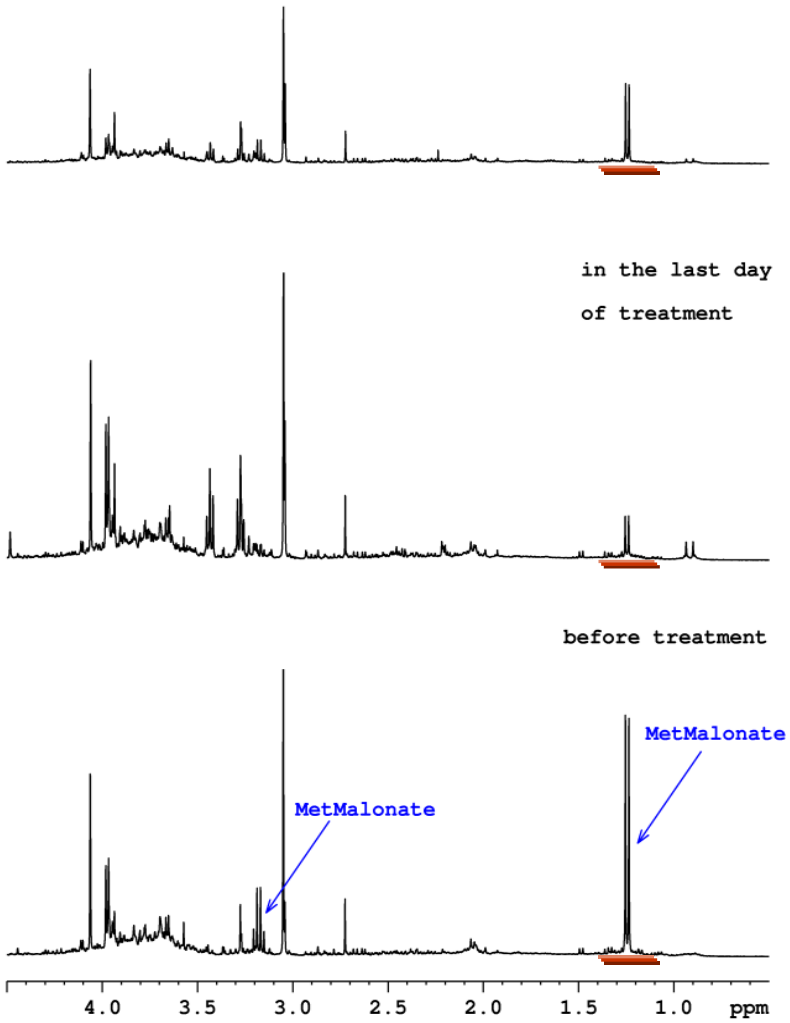
Increased orotate and orotidine during hyperammonemia episodes



A. Nicolescu, D. Blanita, C. Boiciuc, V. Hlistun, M. Cristea, D. Rotaru, L. Pinzari, A. Oglinda, A. Stamati, I. Tarcomnicu, A. Tutulan-Cunita, D. Stambouli, S. Gladun, N. Revenco, N. Usurelu, C. Deleanu, *Molecules* **2020**, *25*, 5312.

Rare diseases - Methylmalonic aciduria (MMA)

NMR Results – 2.5 years old boy from Chisinau



The treatment consists of a specific diet and administration of vitamin B12 1 mg/day and folic acid 5 mg/day.

Sample	Methylmalonic acid [mmol/l]	Methylmalonic acid [mmol / mol Crn]
PL-1-nov2010-1 (Before treatment)	4.78	1631.40
PL-1-ian2011-1A (with treatment)	0.82	262.82
PL-1-ian2011-1B (without treatment)	1.46	1020.98

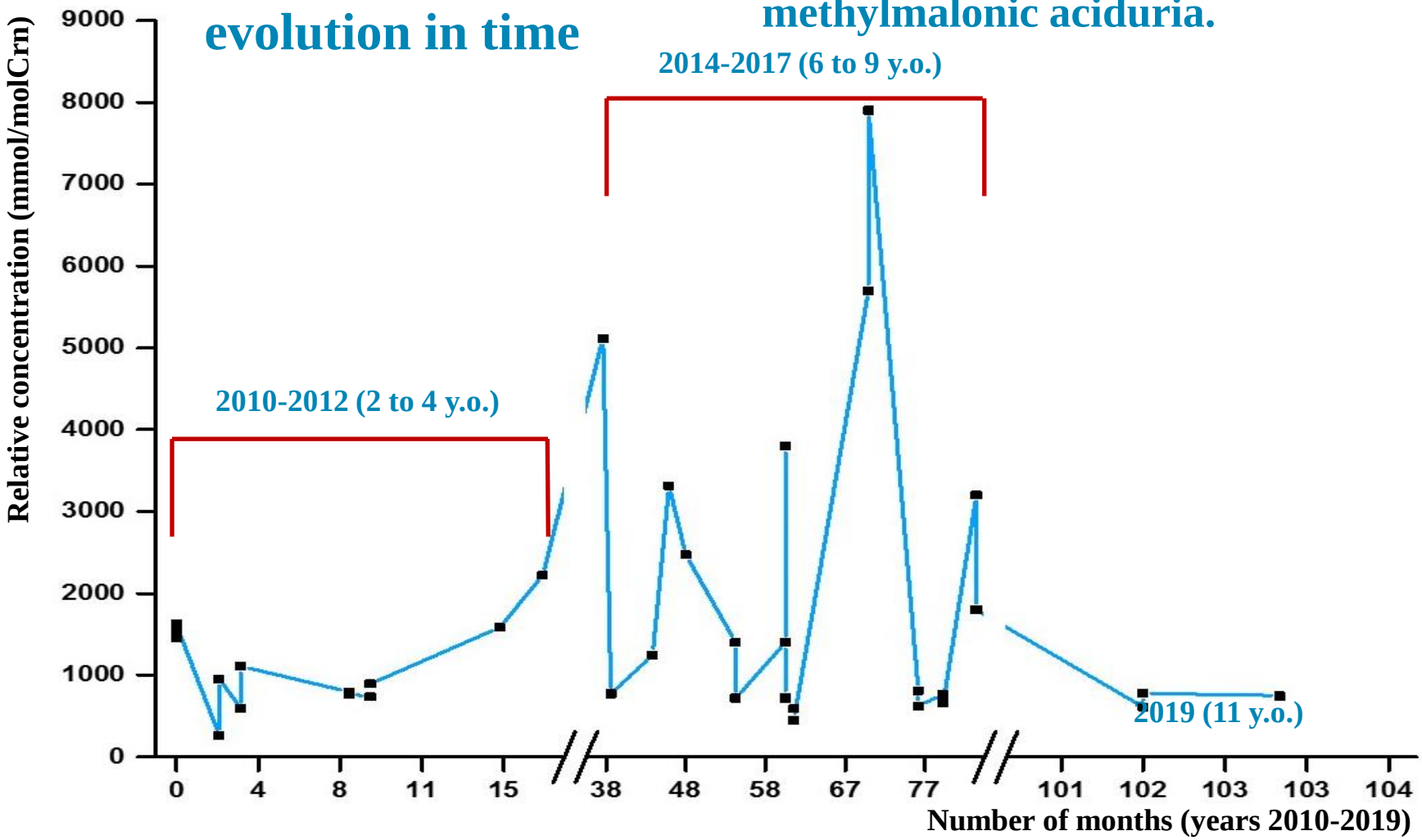
Normal values in urine for children 1-13 yrs. old: 8.2 (1.5-30.8) mmol/mol Crn. (HMDB)

200 times more than normal average!!! – before treatment.

Rare diseases - Methylmalonic aciduria (MMA)

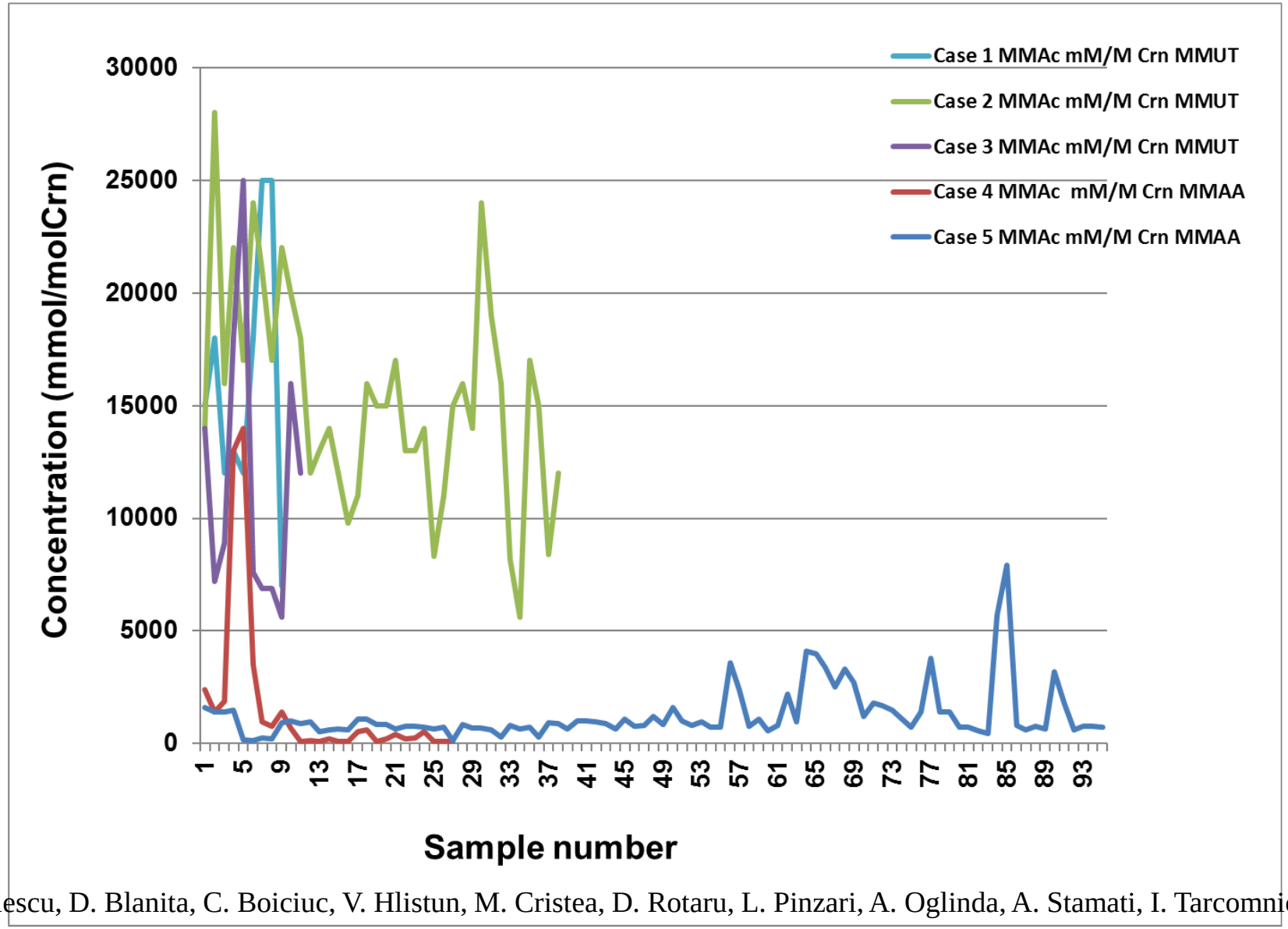
Methylmalonic acid evolution in time

2.5 years old boy from Chisinau with methylmalonic aciduria.



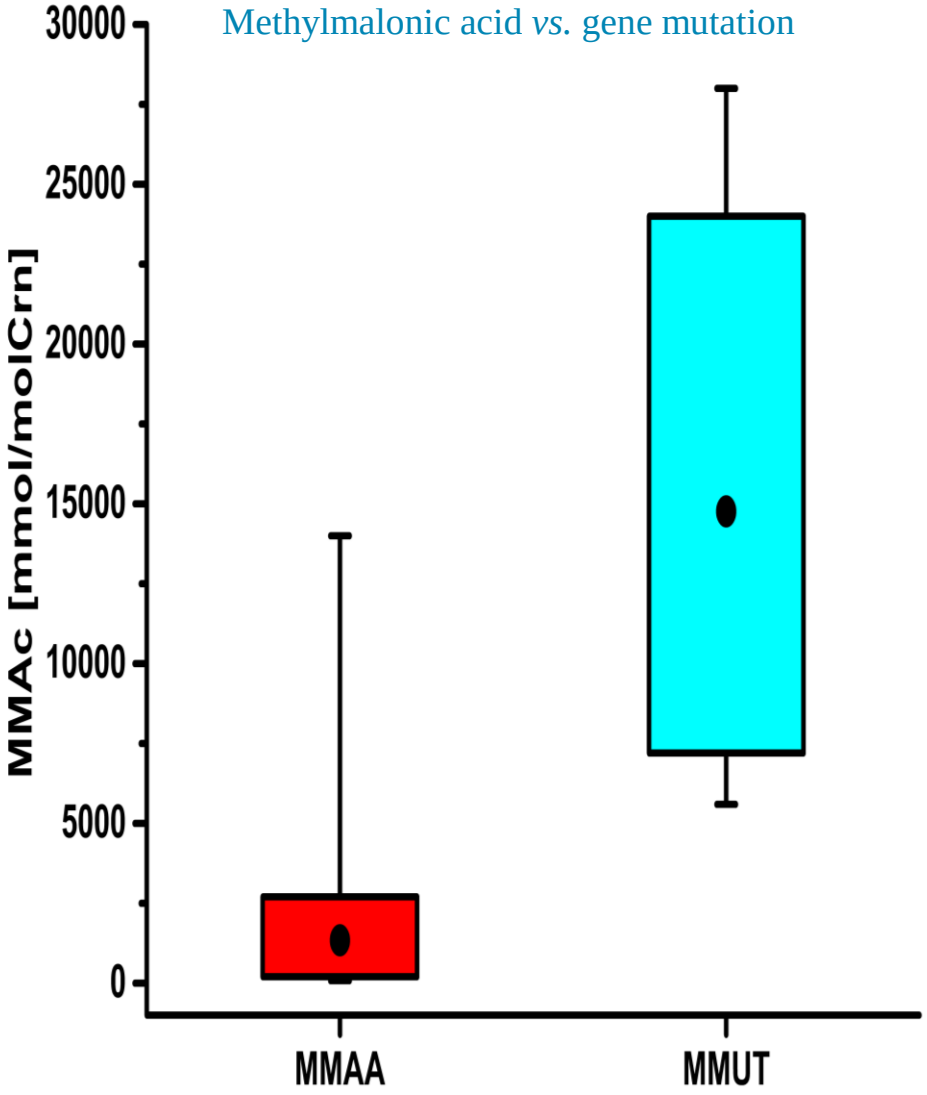
A. Nicolescu, D. Blanita, C. Boiciuc, V. Hlistun, M. Cristea, D. Rotaru, L. Pinzari, A. Oglinda, A. Stamati, I. Tarcomnicu, A. Tutulan-Cunita, D. Stambouli, S. Gladun, N. Revenco, N. Usurelu, C. Deleanu, *Molecules* **2020**, *25*, 5312.

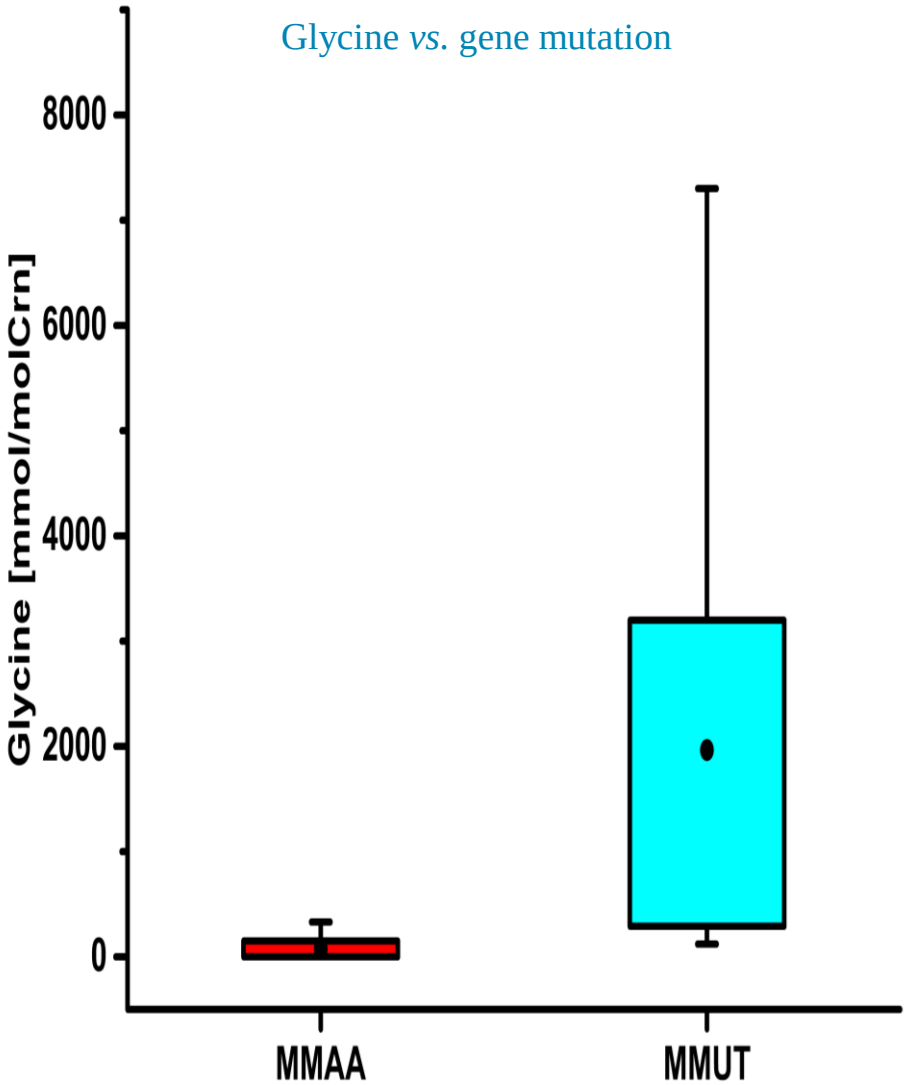
Rare diseases - Methylmalonic aciduria (MMA)



A. Nicolescu, D. Blanita, C. Boiciuc, V. Hlistun, M. Cristea, D. Rotaru, L. Pinzari, A. Oglinda, A. Stamati, I. Tarcomnicu, A. Tutulan-Cunita, D. Stambouli, S. Gladun, N. Revenco, N. Usurelu, C. Deleanu, *Molecules* **2020**, *25*, 5312.

Rare diseases - Methylmalonic aciduria (MMA)





A. Nicolescu, D. Blanita, C. Boiciuc, V. Hlistun, M. Cristea, D. Rotaru, L. Pinzari, A. Oglinda, A. Stamati, I. Tarcomnicu, A. Tutulan-Cunita, D. Stambouli, S. Gladun, N. Revenco, N. Usurelu, C. Deleanu, *Molecules* **2020**, *25*, 5312.

Structure elucidation of isolated compounds

Foods/Plant metabolism

Rare metabolic diseases

Cardiovascular conditions

Cardiovascular diseases (CVD)

HDL: High Density Lipoproteins, known as "Good Cholesterol" are large, dense protein fat particles that circulate in the blood picking up already used or unused cholesterol and taking them back to the liver as part of a recycling process. HDL's are associated with a lower risk of cardiovascular disease

LDL: Low Density Lipoproteins also known as "Bad Cholesterol" transport the cholesterol but carry it into the tissues of the body, including arteries thus LDL are associated with higher risks of cardiovascular disease.

VLDL: Very Low Density Lipoproteins are produced by the liver, and contain relatively large amount of triglycerides. Triglycerides are used as energy reserved and are consumed by the body during physical efforts.

VLDL, HDL and LDL are divided in Subclasses

Cardiovascular diseases (CVD)

Traditional method (centrifugation)

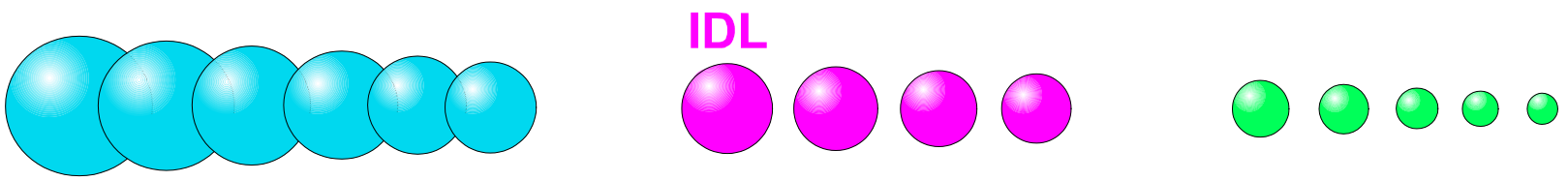
Total Cholesterol (+)

Fractionation ↓ (minutes)

VLDL-C + **LDL-C** + **HDL-C**

(+) (+) (-)

Subfractionation ↓ (many hours)



Association with CHD: Positive (bad) (+) or Negative (good) (-)

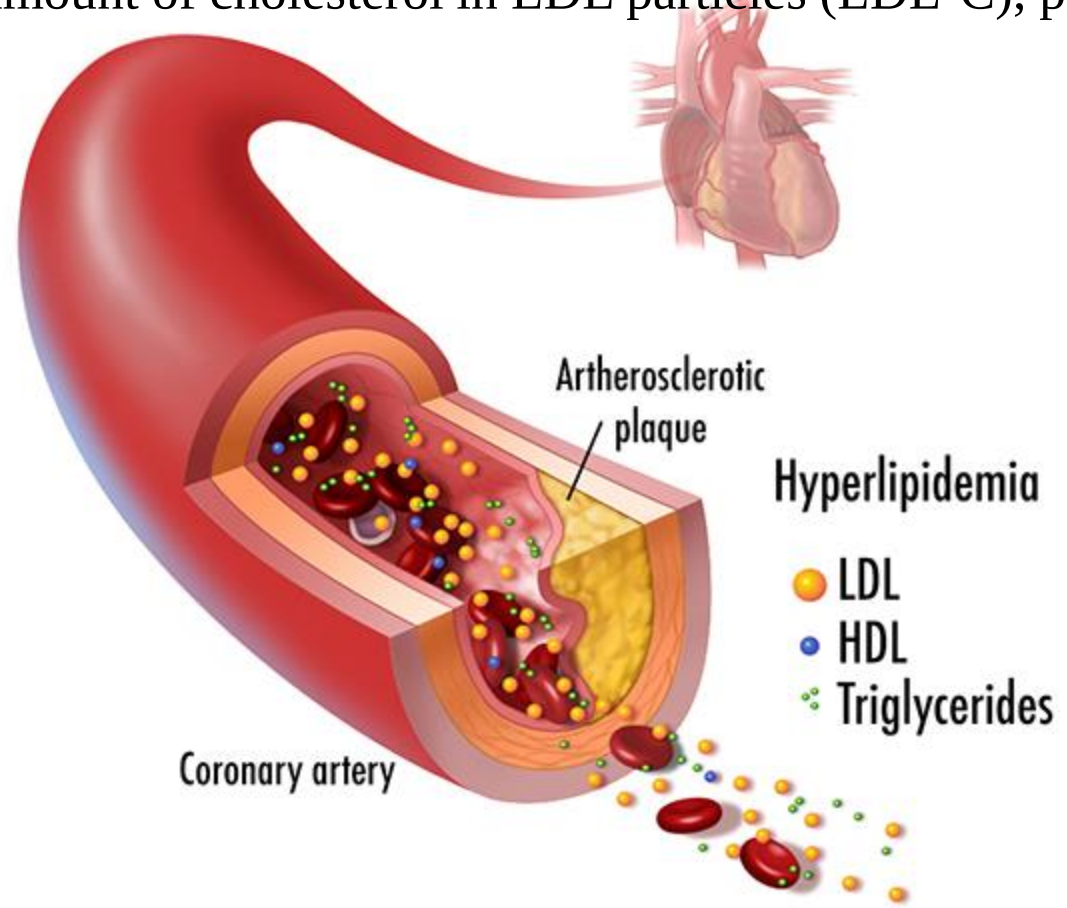
Cardiovascular diseases (CVD)

LDL (bad) / HDL (good) **LDL 1,2,3,4,5,6 / Small Dense LDL(bad) / Large LDL(ok)**

Many heart attacks occur in patients with "normal" cholesterol.

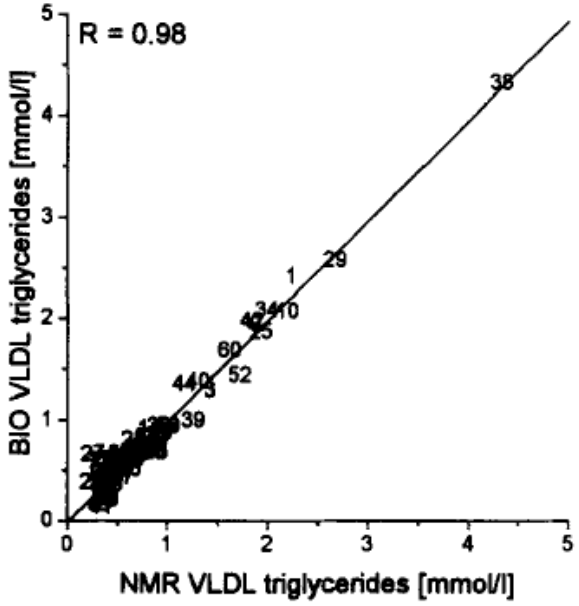
Particle number a better marker than cholesterol concentration.

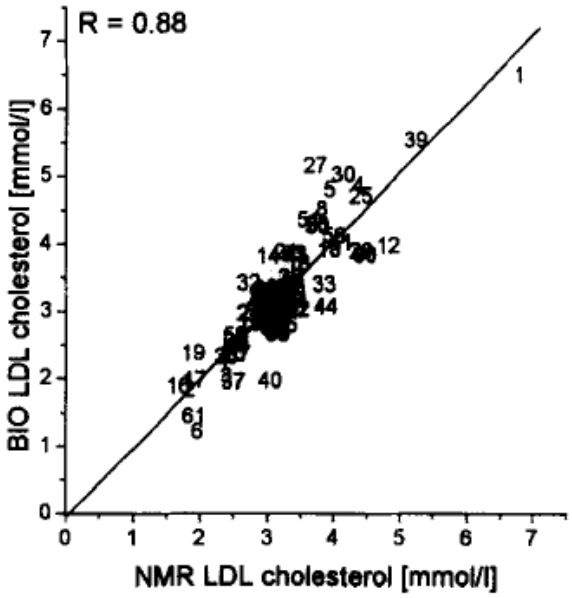
The number of LDL particles (LDL-P), each with Apo B lipoprotein, and not simply the amount of cholesterol in LDL particles (LDL-C), plays a central role in atherosclerosis.

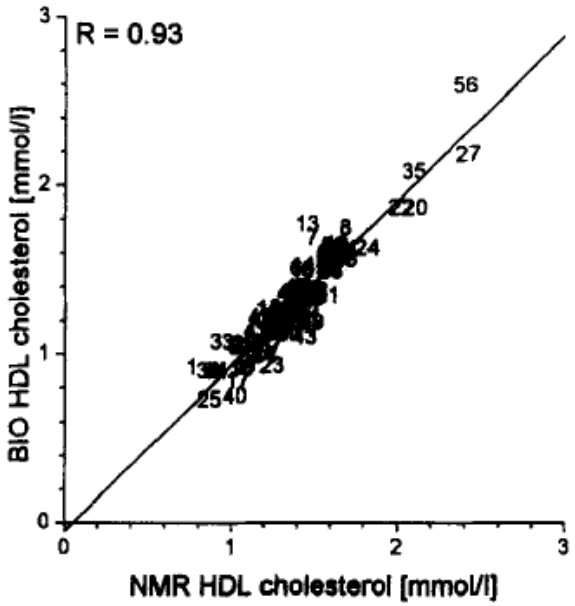


Cardiovascular diseases (CVD) – NMR tests

Comparison of VLDL, LDL and HDL Cholesterol measured by NMR and classical methods



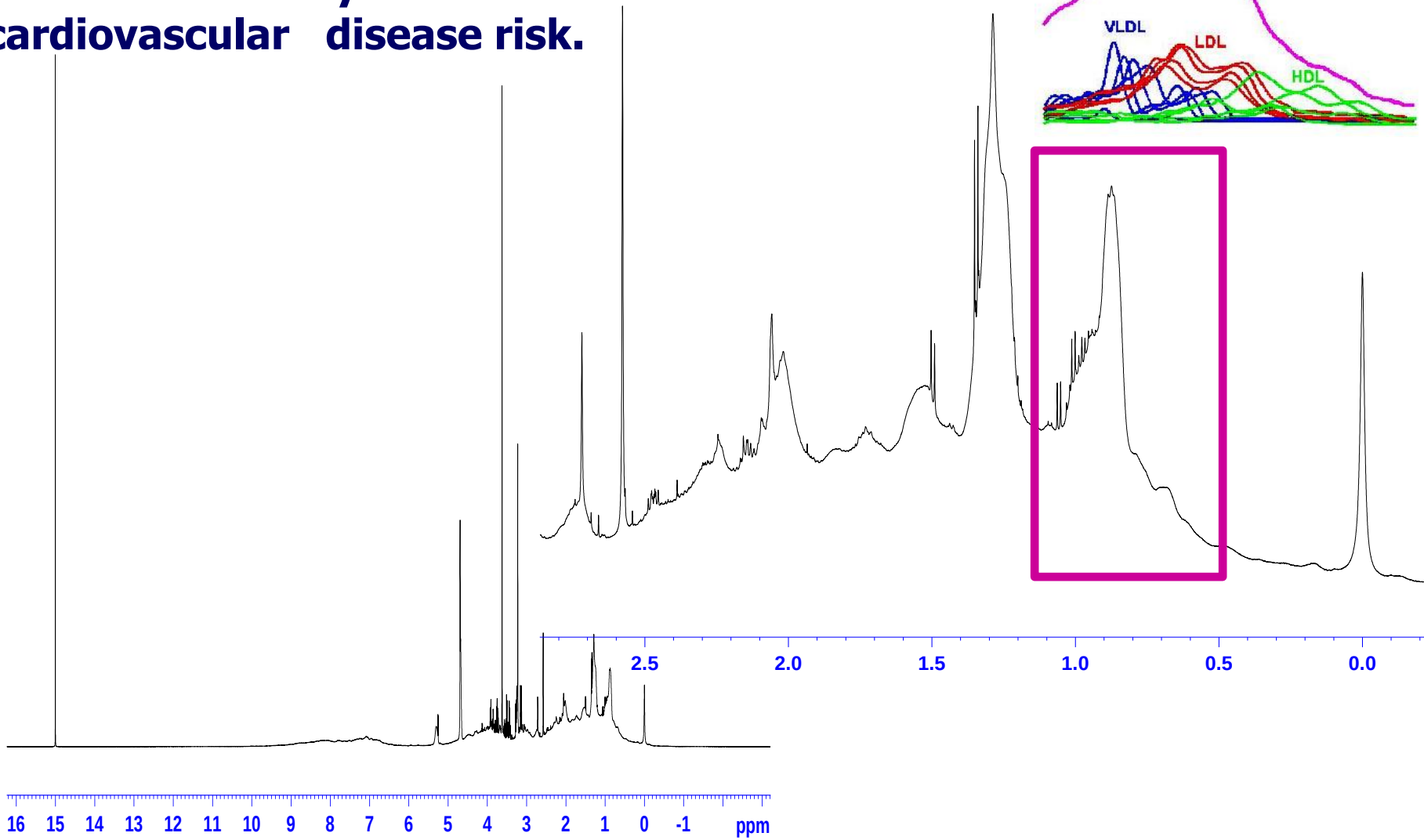




M. Ala-Korpela et al, *J. Lipid. Res.*, **1994**, *35*, 2292-2304.

Cardiovascular diseases (CVD) – NMR tests

After integration of the deconvolution product, the level of each subclass is known and may be correlated to the cardiovascular disease risk.



Cardiovascular diseases (CVD) – NMR tests

After integration of the deconvolution product, the level of each subclass is known and may be correlated to the cardiovascular disease risk.

Analysis Report

Bruker IVDr Lipoprotein Subclass Analysis B.I.LISA™

Sample ID: Plasma-IBPC-1-S5-Proba2-Test-20170724.100000.10r

Measuring Date: 24-Jul-2017 17:11:14
Reporting Date: 24-Jul-2017 19:19:19, 8 page(s), Version 1.0.0
Model Version: PL-5009-01/001

Disclaimer

RESEARCH USE ONLY: This is no clinical diagnostic analysis report. Must not be used for clinical (medical or IVD) diagnosis or for patient management! Additional concentration range information (95% range of model) provided numerically or graphically in this report must not be used for clinical diagnostic interpretation.

Main Parameters

Key	Parameter	Value	Unit	95% Range of Model	Graphics (*)
TPTG	TG	44	mg/dL	53 - 490	
TPCH	Chol	167	mg/dL	140 - 341	
LDCH	LDL-Chol	98	mg/dL	55 - 227	
HDCH	HDL-Chol	62	mg/dL	35 - 96	
TPA1	Apo-A1	142	mg/dL	112 - 217	
TPA2	Apo-A2	29	mg/dL	24 - 48	
TPAB	Apo-B100	62	mg/dL	48 - 160	

(*) Gray horizontal boxes represent 95% range of model, black vertical lines represent sample value.

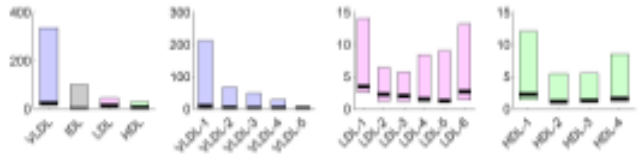
Calculated Figures

Key	Parameter	Value	Unit	95% Range of Model	Graphics (*)
LDHD	LDL-Chol/HDL-Chol	1,58	-/-	0,98 - 4,08	
ABA1	Apo-B100/Apo-A1	0,44	-/-	0,30 - 1,07	

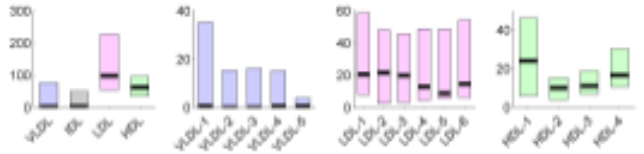
(*) Gray horizontal boxes represent 95% range of model, black vertical lines represent sample value.

Lipid Distribution Overview

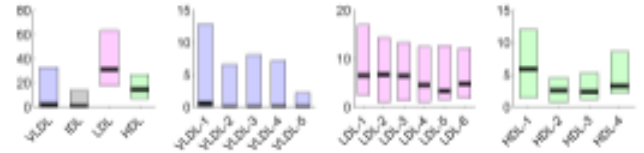
Triglycerides distribution (concentrations in mg/dL together with 95% range of model)



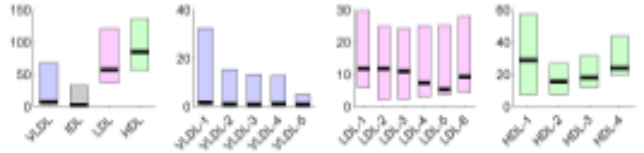
Cholesterol distribution (concentrations in mg/dL together with 95% range of model)



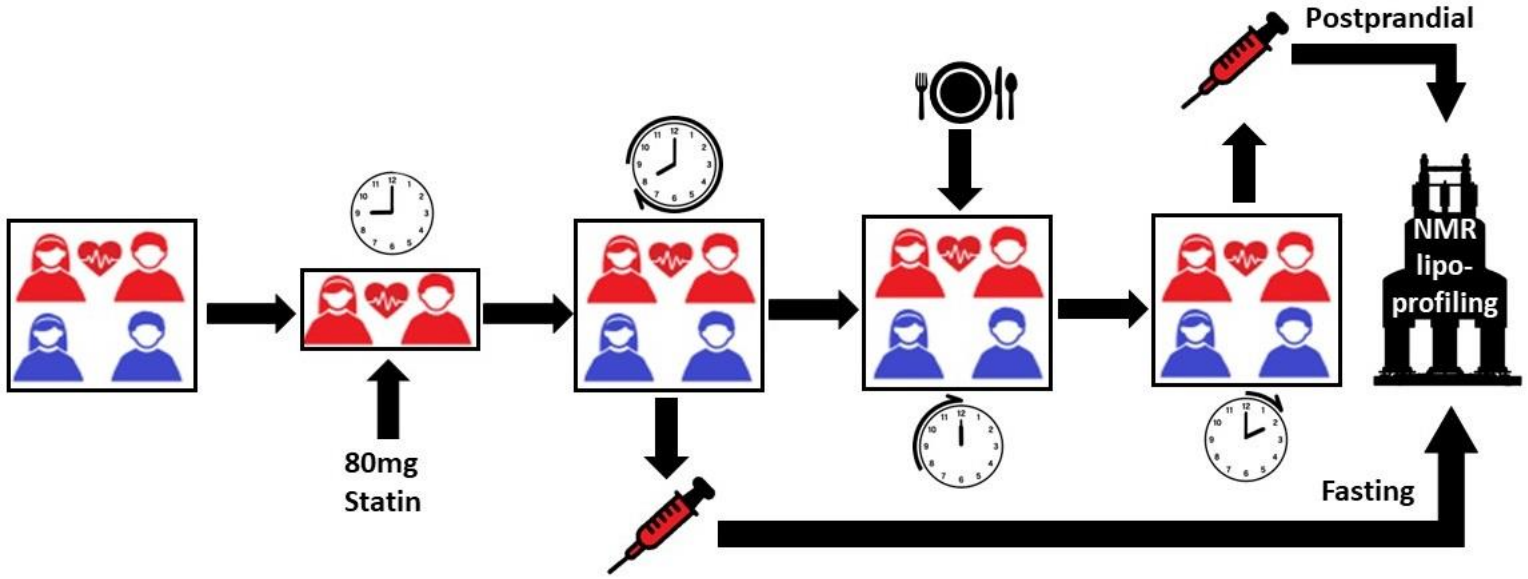
Free Cholesterol distribution (concentrations in mg/dL together with 95% range of model)



Phospholipids distribution (concentrations in mg/dL together with 95% range of model)



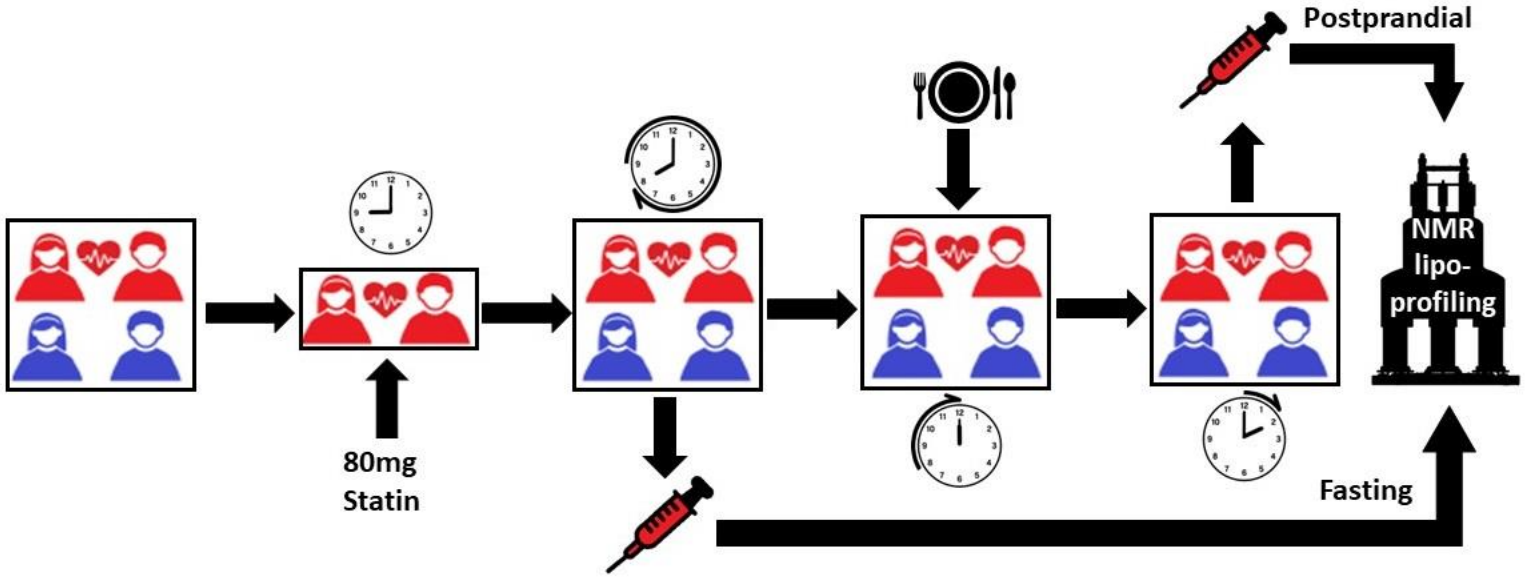
To eat or not to eat?



L.-A. Stanciulescu, A. Scafa, C. Duduianu, R. Stan, A. Nicolescu, M. Dorobanțu, C. Deleanu, *Diagnostics*, **2022**, *12* (*7*), 1675.

To eat or not to eat?

Diagnostics **2022**, *12*, 1675. https://doi.org/10.3390/diagnostics12071675 https://www.mdpi.com/journal/diagnostics

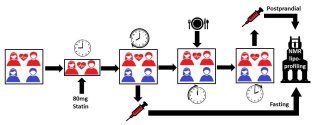


Total of 68 pairs of fasting/postprandial experiments (cases), out of which there were 29 controls and 39 CVD (hospitalized in a cardiovascular emergency unit).

Evaluated the effect of fasting on 16 blood metabolite conc. and 114 lipoprotein parameters.

To eat or not to eat?

Diagnostics **2022**, *12*, 1675. https://doi.org/10.3390/diagnostics12071675 https://www.mdpi.com/journal/diagnostics

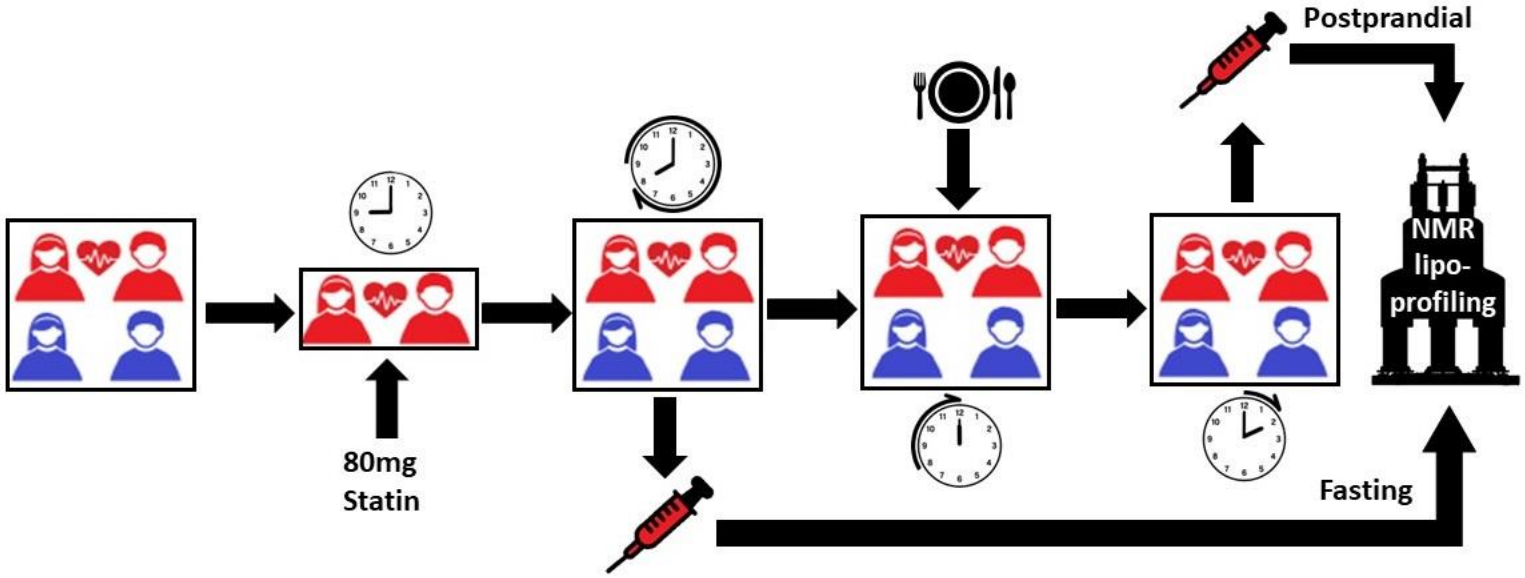


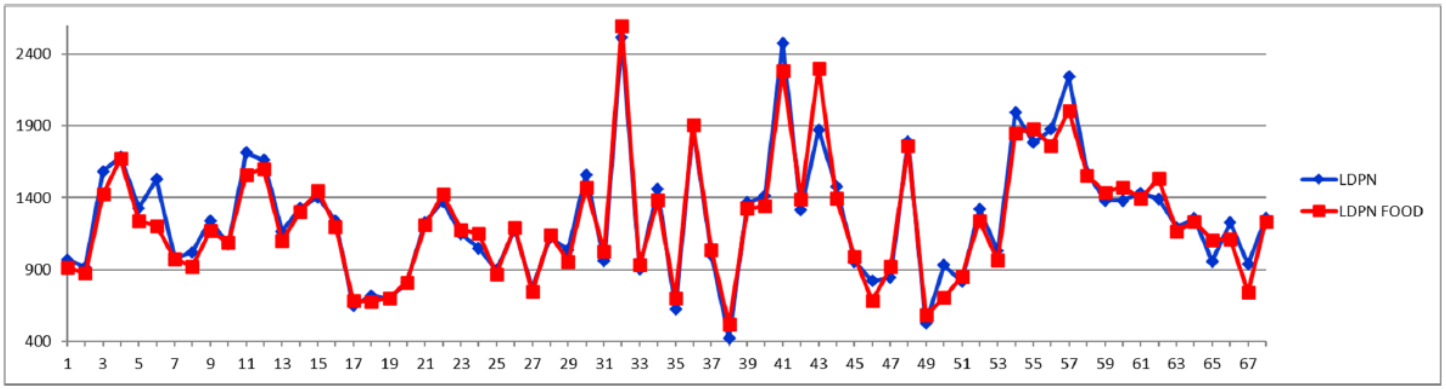
Total of 68 pairs of fasting/postprandial experiments (cases), out of which there were 29 controls and 39 CVD (hospitalized in a cardiovascular emergency unit).

Evaluated the effect of fasting on 16 blood metabolite conc. (alanine (Ala), creatinine (Crn), glutamine (Glut), glycine (Gly), histidine (His), isoleucine (i-Leu), phenylalanine (Phe), tyrosine (Tyr), valine (Val), acetic acid (Ac), formic acid (For), lactic acid (Lac), pyruvic acid (Pyr), and glucose (Gluc)), and 114 lipoprotein parameters (Total Triglycerides (TPTG), Total Cholesterol (TPCH), Total Apo-A1 (TPA1), Total Apo-A2 (TPA2), Total Apo-B100 (TPAB), ApoB100/ApoA1 (ABA1), Total Particle number (TPPN)), High-Density Lipoproteins (HDL-Apo-A1 (HDA1), HDL-Apo-A2 (HDA2), HDL-Cholesterol (HDCH), HDL-Free cholesterol (HDFC), HDL-Phospholipids (HDPL), HDL-Triglycerides (HDTG)), Low-Density Lipoproteins (LDL-Apo-B100 (LDAB), LDL-Cholesterol (LDCH), LDL-Free cholesterol (LDFC), LDL-Phospholipids (LDPL), LDLParticle number (LDPN), LDL-Triglycerides (LDTG), LDL-chol/HDL-chol ratio (LDHD)), Intermediate-Density Lipoproteins (IDL-Apo-B100 (IDAB), IDL-Cholesterol (IDCH), IDLFree cholesterol (IDFC), IDL-Phospholipids (IDPL), IDL-Particle number (IDPN), IDLTriglycerides (IDTG)), Very Low-Density Lipoproteins (VLDL-Apo-B100 (VLAB), VLDLCholesterol (VLCH), VLDL-Free cholesterol (VLFC), VLDL-Phospholipids (VLPL), VLDLParticle number (VLPN), VLDL-Triglycerides (VLTG), and up to 6 subfractions on each main parameter).

To eat or not to eat?

Diagnostics **2022**, *12*, 1675. https://doi.org/10.3390/diagnostics12071675 https://www.mdpi.com/journal/diagnostics

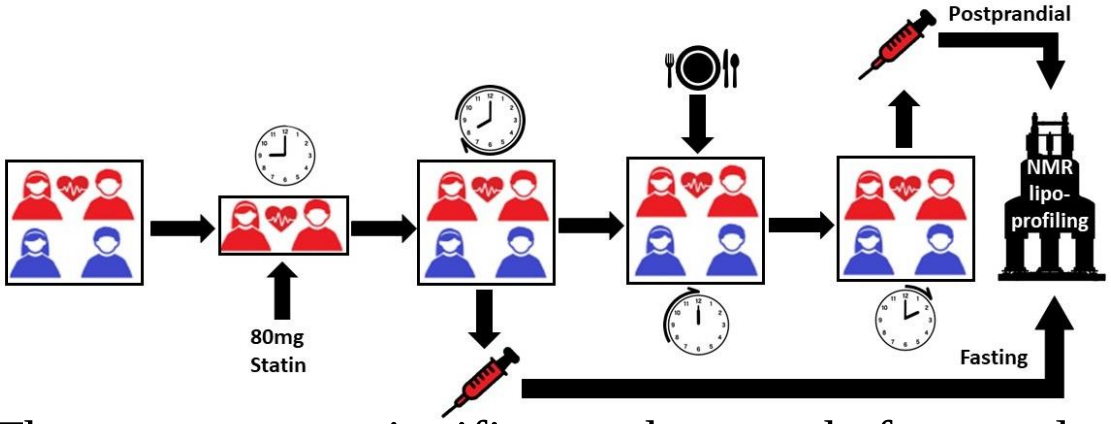


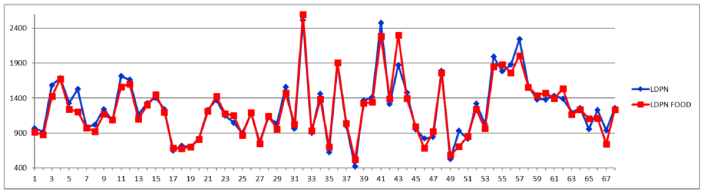


Total LDL particle number (LDPN) (nmol/L) in fasting (blue) and postprandial (red) status for control cases (1–29) and CVD cases (30–68).

To eat or not to eat?

Diagnostics **2022**, *12*, 1675. https://doi.org/10.3390/diagnostics12071675 https://www.mdpi.com/journal/diagnostics





CONCLUSIONS:

There were no significant changes before and after food intake in both groups regarding most tested parameters, with the exception of glucose and triglycerides, where increased values were observed after food intake in both groups. Thus, even though feeding-induced trends have been observed for several parameters, with the exception of triglycerides, the magnitude of the effects should not affect the decision on CVD patients' management in emergency units.

Our findings strengthen the idea that the old paradigm of imposing fasting prior to blood sampling for CVD assessment purposes is no longer valid.

L.-A. Stanciulescu, A. Scafa, C. Duduianu, R. Stan, A. Nicolescu, M. Dorobanțu, C. Deleanu, *Diagnostics*, **2022**, *12* (*7*), 1675.

Structure elucidation of isolated compounds

Foods/Plant metabolism

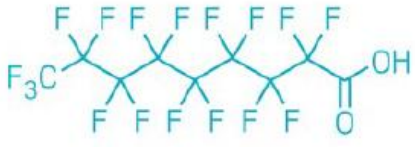
Rare metabolic diseases

Cardiovascular conditions

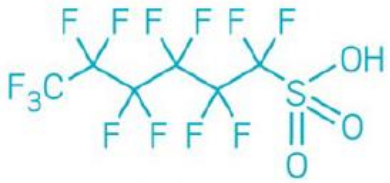
Environment / Pollutants and health effects

NMR lipidomics – PFAS pollutants

Poly- and perfluoroalkyl substances (PFAS)

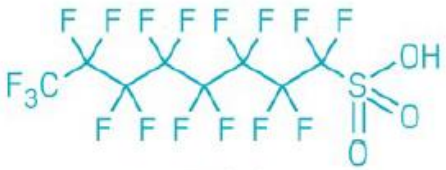


PFNA



PFHxS

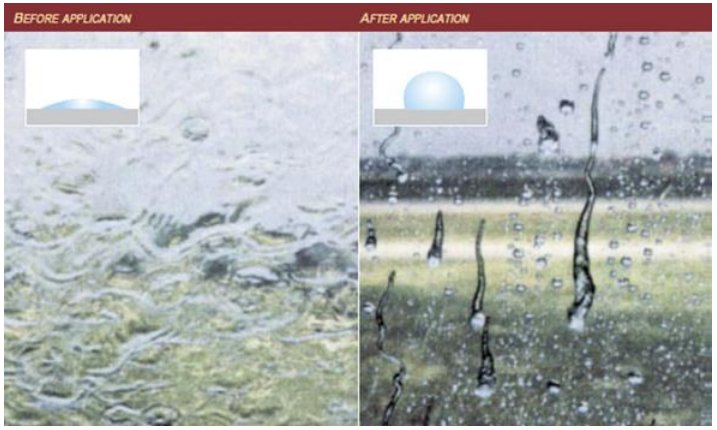
PFOA



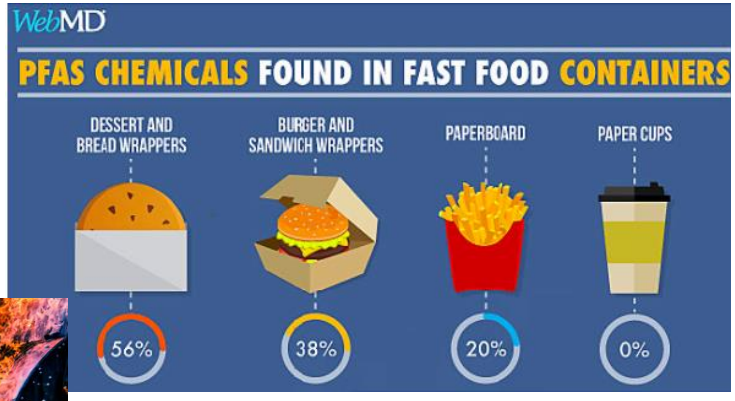
PFOS

- synthetic chemicals found in numerous products including textiles, fire-fighting foams, electronics, and food packaging.
- have the ability to repel water and grease.

NMR lipidomics – PFAS pollutants

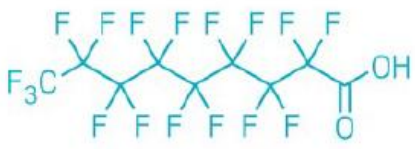


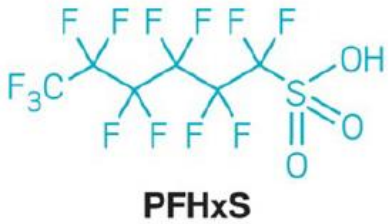
Percentage of packages testing positive in 400 tested packages used in fast-food restaurants in US (2014-15).

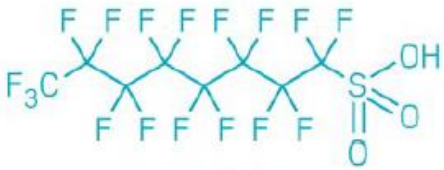


NMR lipidomics – PFAS pollutants

Poly- and perfluoroalkyl substances (PFAS)







- synthetic chemicals found in numerous products including textiles, fire-fighting foams, electronics, and food packaging.
- have the ability to repel water and grease.
- persist in the environment and contaminate drinking water supplies and food.

Exposure to certain PFAS is linked to:

- immune and hormone disorders;
- decrease people's immune system response to vaccinations;
- increased cholesterol (the main health effect).

NMR lipidomics – PFAS pollutants

Both EFSA (EU) and FDA (US) set limits/ban various PFAS

PERSISTENT POLLUTANTS

EU agency sets limit on PFAS in food

Recommended threshold applies to combined exposure to 4 perfluorinated substances

by ***Britt E. Erickson***

SEPTEMBER 17, 2020

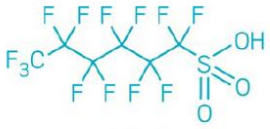
Credit: Shutterstock

Healthy food like fish, eggs, and fruit, often contains some of the highest levels of PFAS, according to the European Food Safety Authority.

Food regulators in the European Union have updated their **guidelines** for protecting consumers from **per- and polyfluoroalkyl substances** (PFAS) in food. The latest recommendations from the European Food Safety Authority (EFSA), released Sept. 17, set a limit for combined exposure to 4 PFAS—perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorononanoic acid (PFNA), perfluorohexane sulfonic acid (PFHxS)—in food. EFSA previously recommended individual limits for PFOA and PFOS.

PFNA

EFSA's new recommended limit for the four PFAS combined is 4.4 ng/kg body weight/week. The agency based that number on the ability of PFAS to decrease people's immune system response to vaccinations. In contrast, in 2018 when EFSA released its previous guidance on PFAS in food, it considered increased cholesterol as the main health effect. Some people in the EU exceed the new threshold level based on blood serum data and estimated exposures, according to EFSA's risk



PFHxS

Environment and health — European Environment Agency

Chemicals

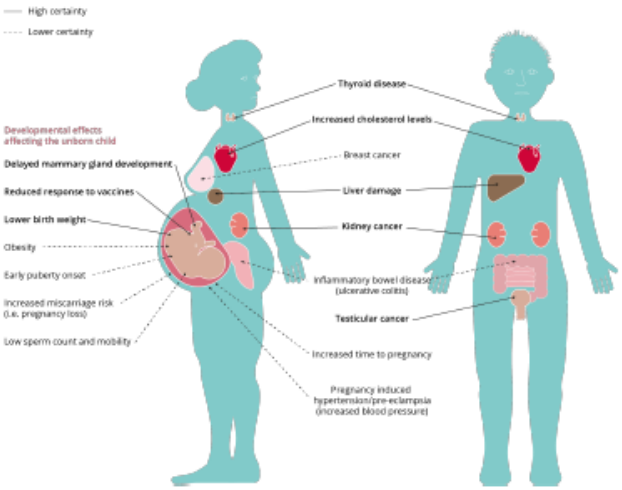
Emerging chemical risks in Europe — 'PFAS'

It is currently not possible to perform in-depth environmental and health risk assessments of all chemical substances in use in Europe because of the great variety of chemicals and their diverse uses. New and legacy chemicals continue to be released into Europe's environment, adding to the total chemical burden on Europe's citizens and ecosystems. Early identification of emerging risks is one of the activities of the European Environment Agency (EEA). This briefing summarises the known and potential risks to human health and the environment in Europe posed by a group of very persistent chemicals, the per- and polyfluorinated alkyl substances (PFAS).

- Comprising more than 4 700 chemicals, per and polyfluorinated alkyl substances (PFAS) are a group of widely used, man-made chemicals that accumulate over time in humans and in the environment.
- National monitoring activities have detected PFAS in the environment across Europe. The production and use of PFAS in products has resulted in the contamination of drinking water supplies in several European countries. In some highly polluted areas, concentrations of perfluorooctanoic acid (PFOA) and perfluorosulfonic acid (PFOS) in drinking water were above the limit value for individual PFAS proposed in the 2018 recast of the EU Drinking Water Directive (EC, 2017).
- Human biomonitoring has detected a range of PFAS in the blood of European citizens. Though the levels for the most prevalent, studied and regulated PFAS, PFOA and PFOS are decreasing, levels of more 'novel' PFAS are increasing. In some areas, concentrations of PFOA and PFOS in the most exposed citizens were above proposed benchmark levels for adverse effects in humans.
- Due to the large number of PFAS chemicals, a substance-by-substance risk assessment and management approach is not adequate to efficiently prevent risk to the environment and human health from a single PFAS or mixtures of them.
- Taking precautionary risk management actions for groups of chemicals and promoting the use of chemicals that are 'safe-and-circular-by-design' could help to limit future pollution.

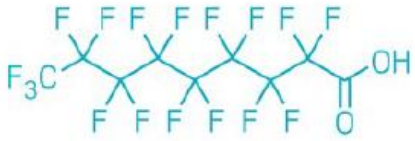
Environment and health › Chemicals › Emerging chemical risks in Europe — 'PFAS'

Figure 1. Effects of PFAS on human health

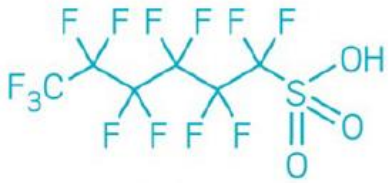


NMR lipidomics – PFAS pollutants

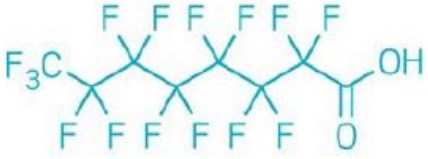
Pollutants poly- and perfluoroalkyl substances (PFAS)



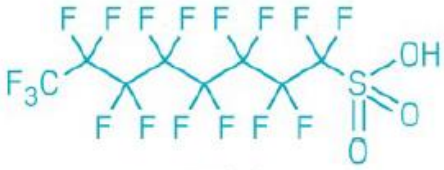
PFNA



PFHxS



PFOA



PFOS

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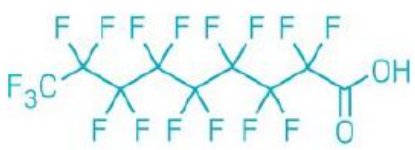
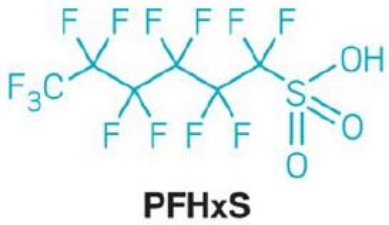
Exposure to certain PFAS is linked to:

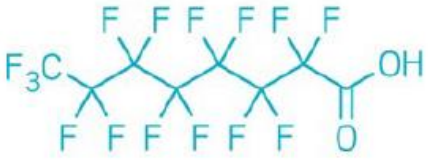
- immune and hormone disorders;
- decrease people's immune system response to vaccinations;
- **increased cholesterol (the main health effect).**

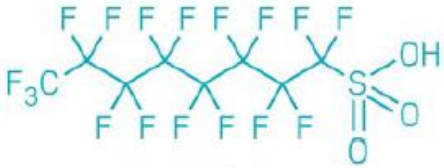
NMR lipidomics – PFAS pollutants

Pollutants poly- and perfluoroalkyl substances (PFAS)



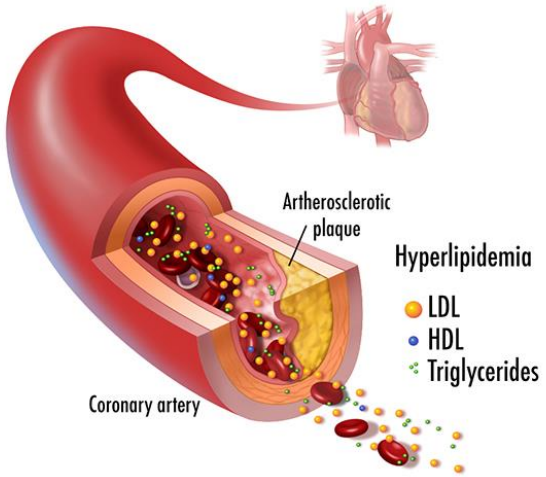


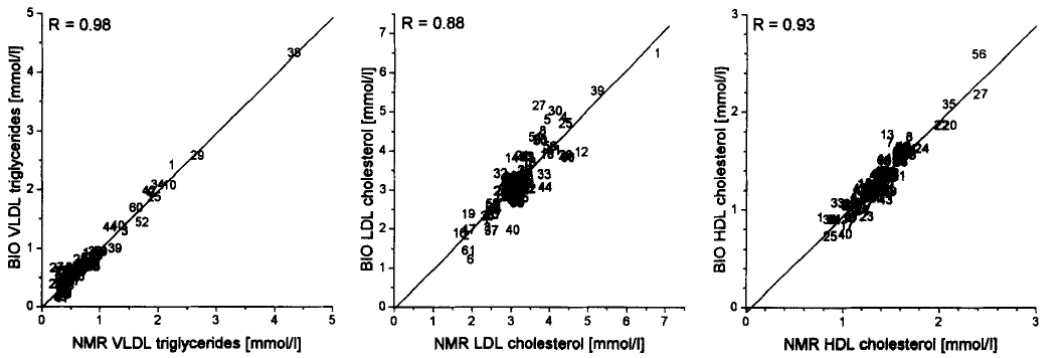




- increased cholesterol (the main health effect)

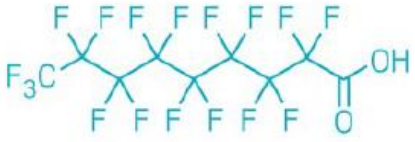
NMR can do more than this



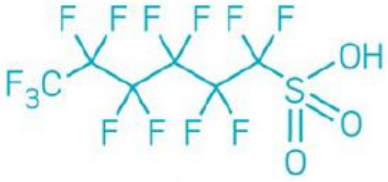


M. Ala-Korpela et al, *J. Lipid. Res.*, **1994**, *35*, 2292-2304.

NMR lipidomics – PFAS pollutants

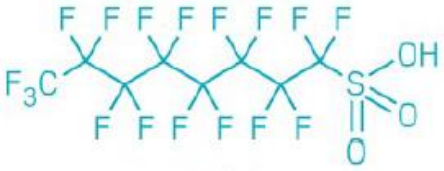


PFNA



PFHxS

PFOA



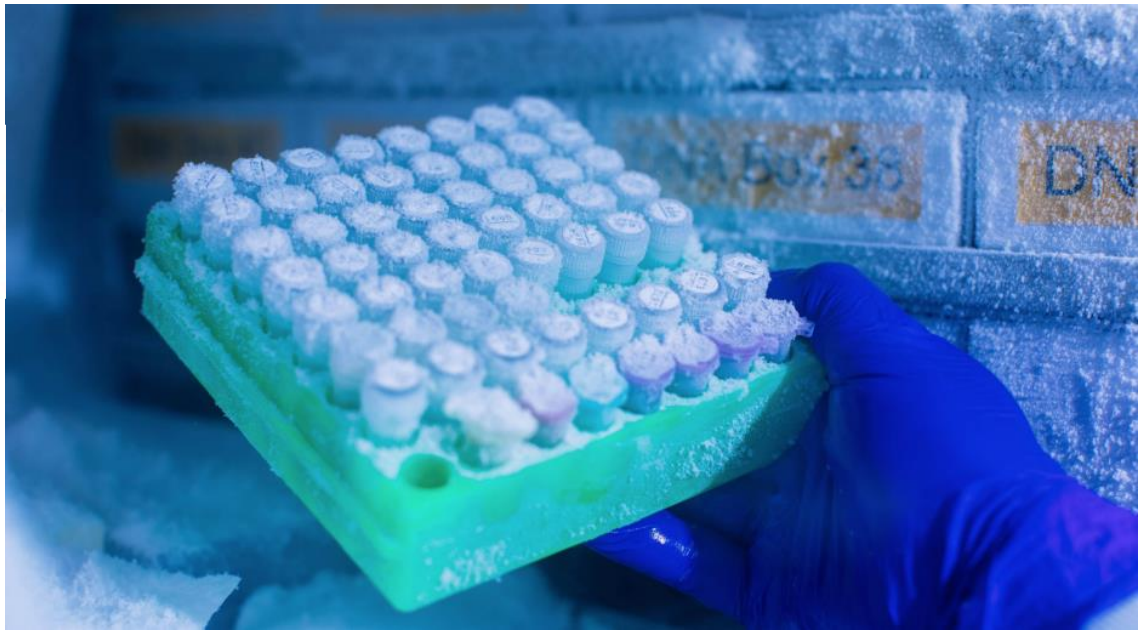
PFOS

NIPH
Norwegian Institute of Public Health

NIVA

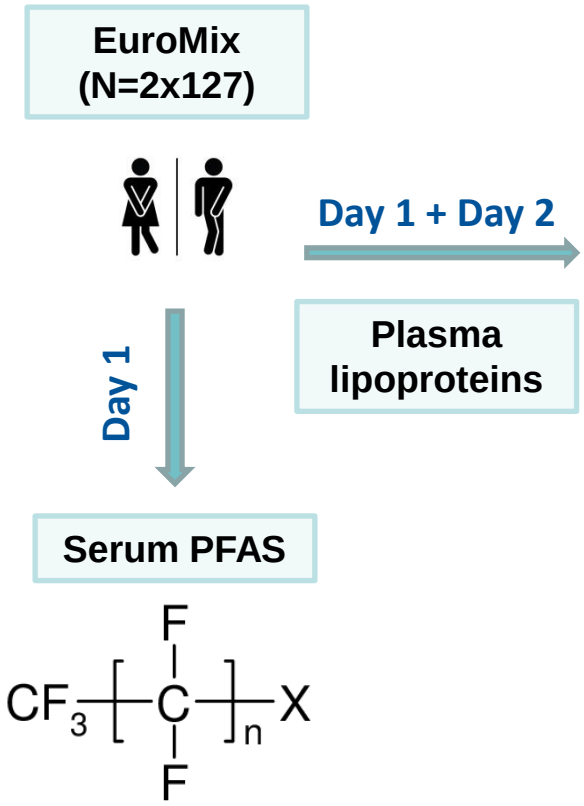
PFAS in chemicals in Norway 2009-2017

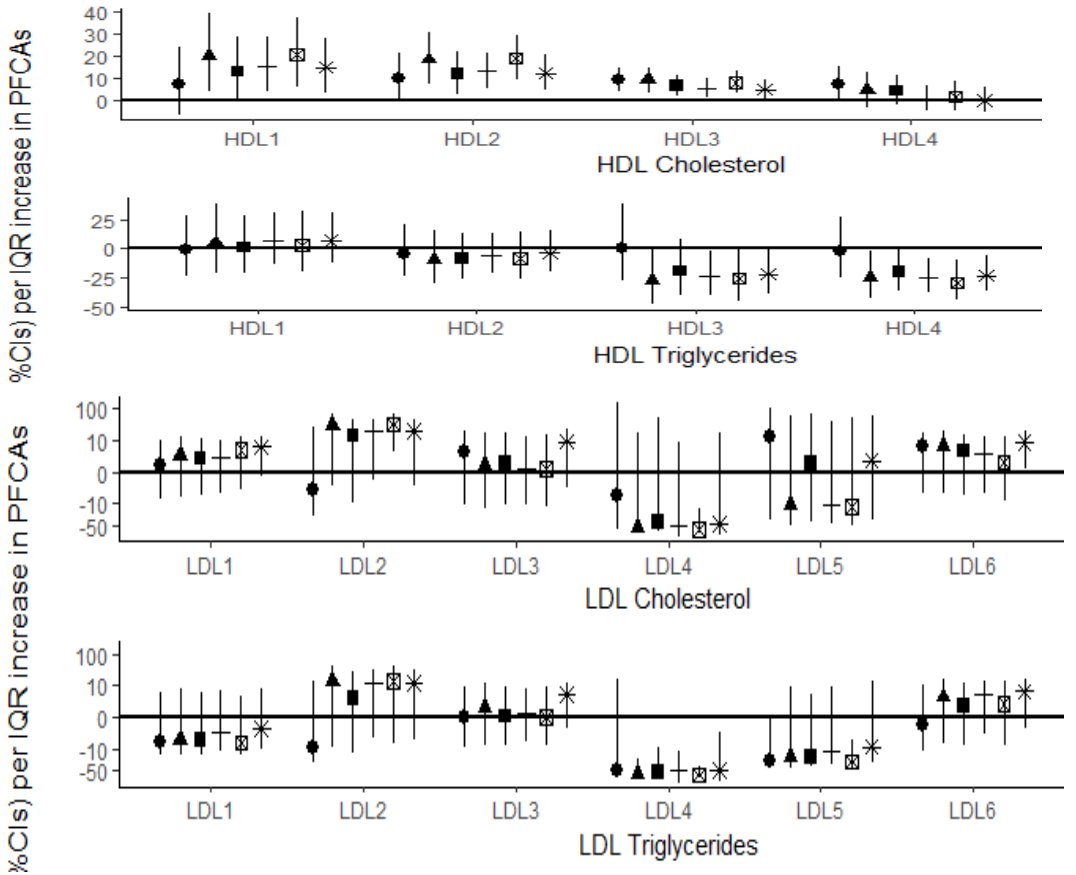
EuroMix Biobank
N = 2 days X 145 subjects



NMR lipidomics – PFAS pollutants

Lipoprotein profiles associated with exposure to poly- and perfluoroalkyl substances





E. Papadopoulou, A. Nicolescu, L.S Haug, T. Husøy, H. Dirven, B. Lindeman, C. Deleanu, *Environ. Pollut.*, **2022**, *308*, 119664.

Structure elucidation of isolated compounds

Foods/Plant metabolism

Rare metabolic diseases

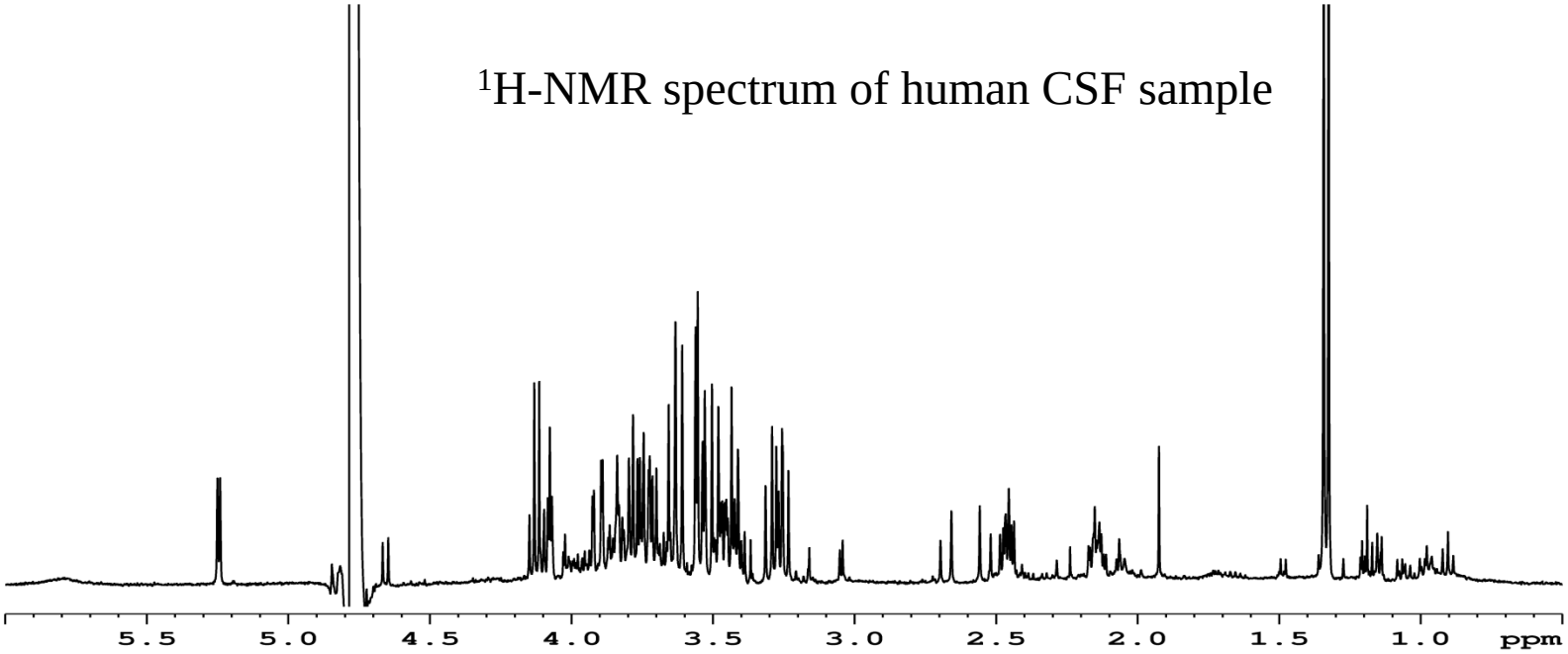
Cardiovascular conditions

Environment / Pollutants and health effects

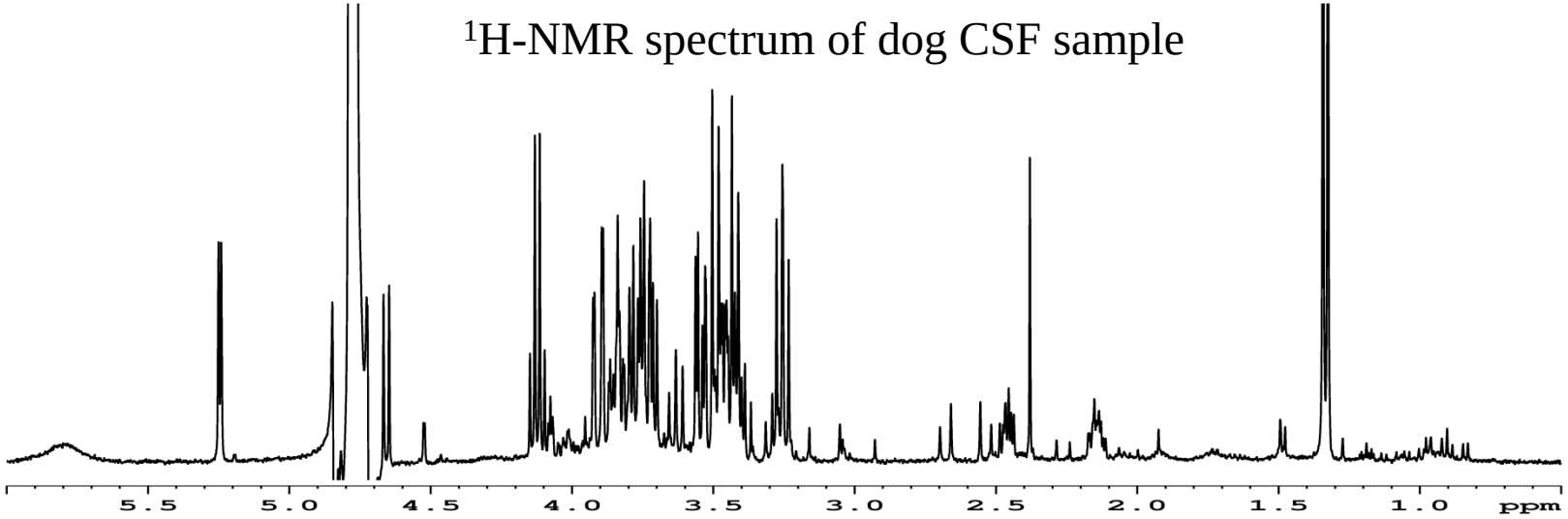
Markers for Central Nervous System Diseases

Cerebrospinal fluid (CSF)

^{1}H-NMR spectrum of human CSF sample



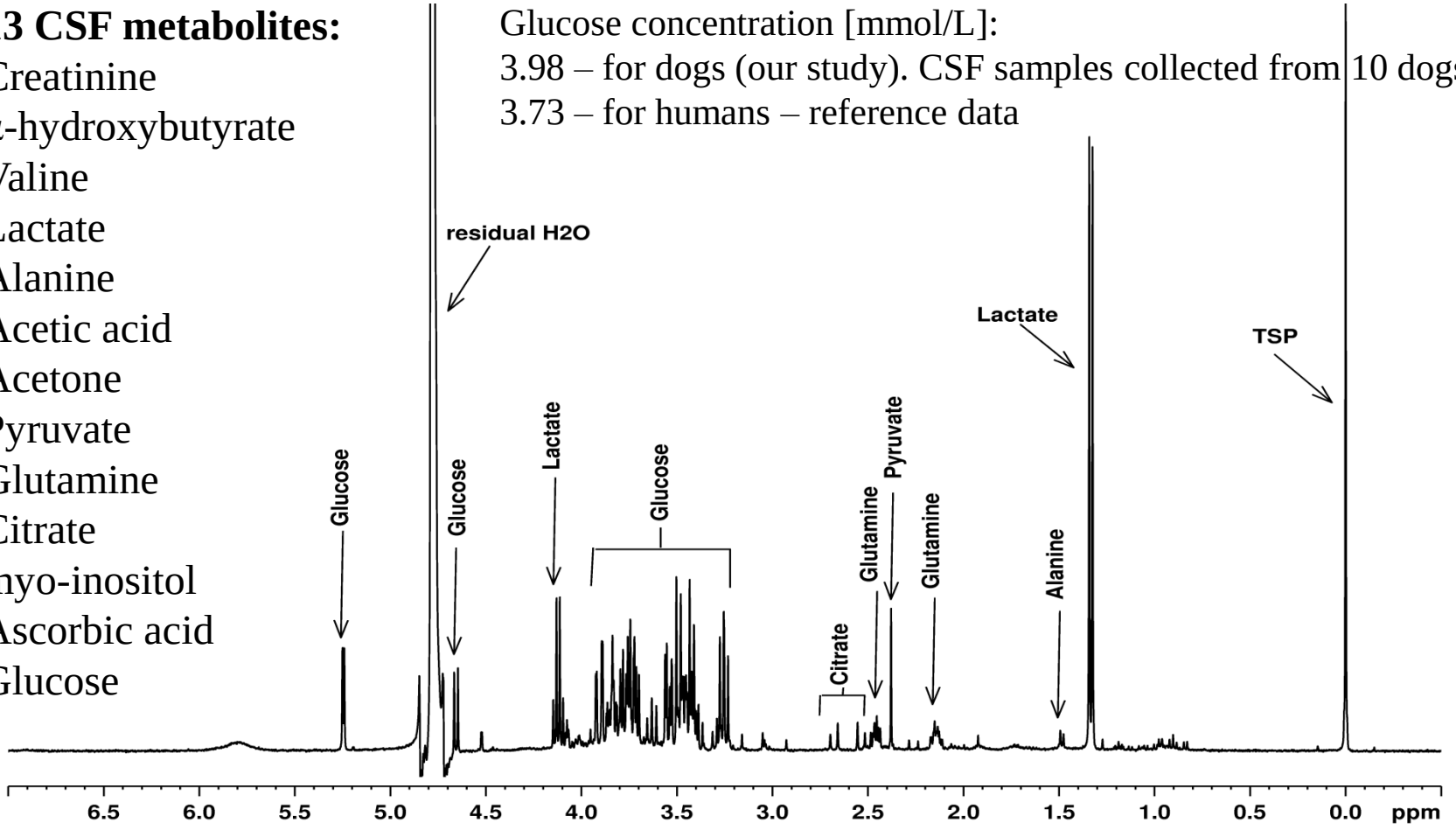
^{1}H-NMR spectrum of dog CSF sample



Cerebrospinal fluid (CSF)

13 CSF metabolites:
Creatinine
α-hydroxybutyrate
Valine
Lactate
Alanine
Acetic acid
Acetone
Pyruvate
Glutamine
Citrate
myo-inositol
Ascorbic acid
Glucose

Glucose concentration [mmol/L]:
3.98 – for dogs (our study). CSF samples collected from 10 dogs.
3.73 – for humans – reference data



^{1}H NMR spectrum of dog CSF. Some of the major metabolites are labeled.

Dog CSF study as model for human Central Nervous System Diseases

M. Musteata, A. Nicolescu, G. Solcan, C. Deleanu, "The ^{1}H NMR profile of healthy dog cerebrospinal fluid", *Plos One*, **2013**, *8* (12), e81192.

Structure elucidation of isolated compounds

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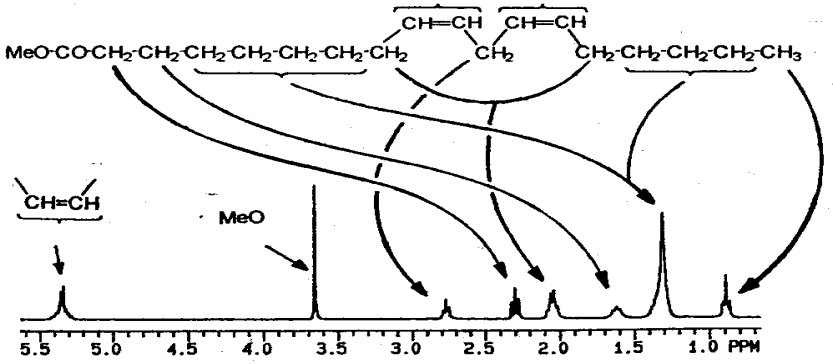
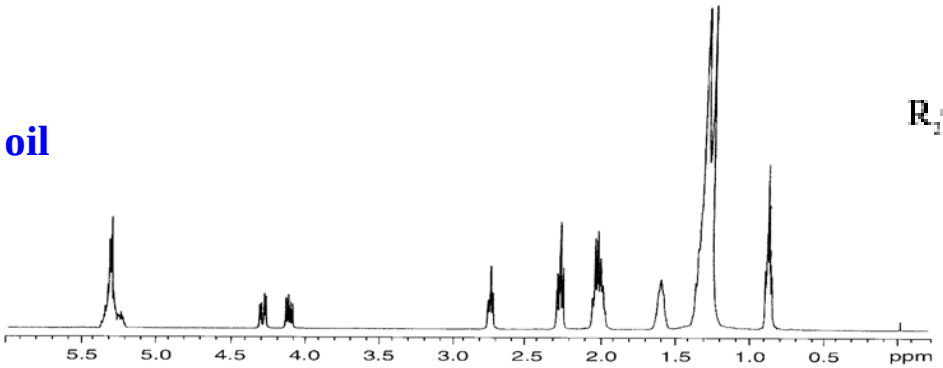
Edible oils

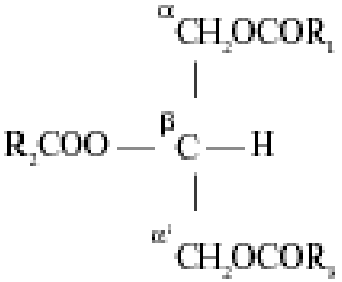
Edible oils

^{1}H NMR (300 MHz, CDCl3)
Methyl linoleate (C18:2)



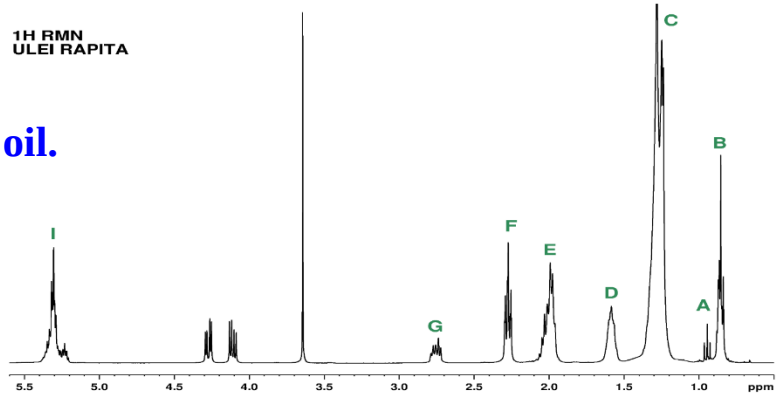
^{1}H NMR (300 MHz, CDCl3) Olive oil





C. Deleanu, C. Enache, M. T. Caproiu, G. Cornilescu, A. Hirtopeanu, *Rev. Chim.*, **1994**, *45* (*12*), 1046-1052.

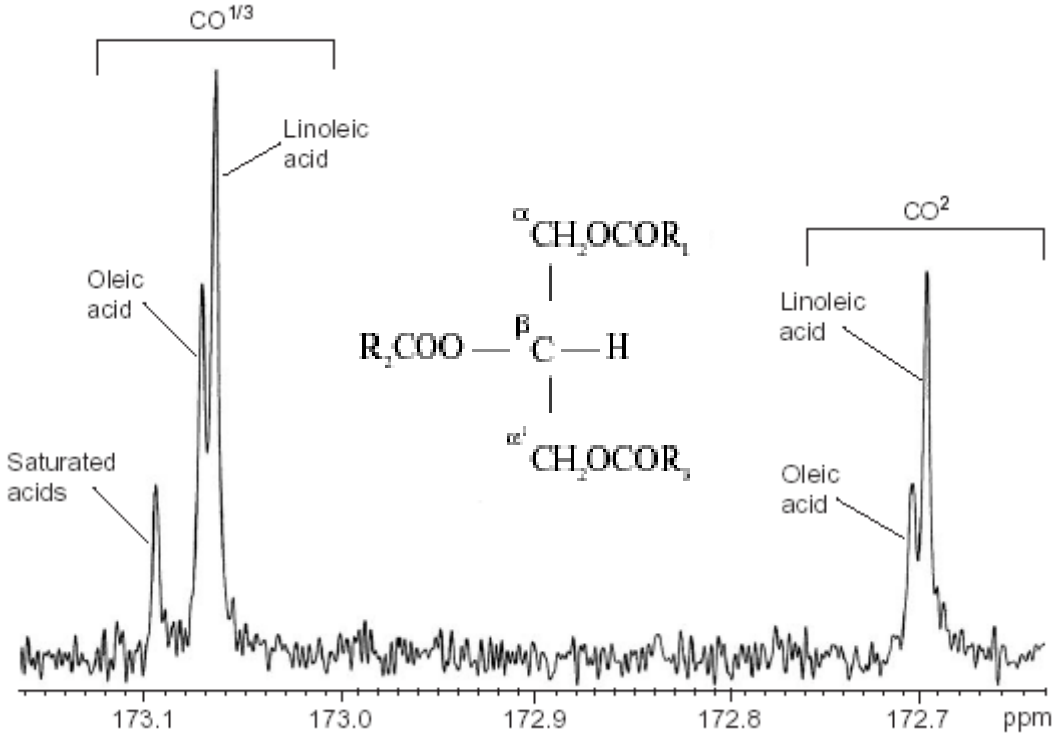
^{1}H-NMR (400 MHz, CDCl3) Canola oil.



N.-A. Chira, M.-C. Todasca, A. Nicolescu, A. Rosu, M. Nicolae, S.-I. Rosca, *Rev.Chim.*, **2011**, *62*, 42-46.

Edible oils

Fatty acids composition on 1,2 versus 3 positions



(1) $CH_3(CH_2)_nCOOH$ n = 14,16

(2) $CH_3(CH_2)_7$-*cis*CH=CH-$(CH_2)_7COOH$

(3) $CH_3(CH_2)_4$-*cis*CH=CH-CH_2-*cis*CH=CH-$(CH_2)_7COOH$

(4) CH_3CH_2-*cis*CH=CH-CH_2-*cis*CH=CH-CH_2-*cis*CH=CH-$(CH_2)_7COOH$

^{13}C-NMR of olive oil.

C. Deleanu, "NMR Spectroscopy. Food Applications" in *Encyclopedia of Analytical Sciences*, Elsevier, Oxford, 2005, Vol. 6., pp. 303-315.

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Publications in the field of Diagnosis by NMR metabolomics and lipidomics

L.-A. Stanciulescu, et al, “Diabetes-induced lipid panel particularities in hypertensive patients: A pilot NMR spectroscopy study”, *J. Hypertens. Res.*, **2022**, *8* (*4*), 129-136.

L.-A. Stanciulescu, et al, “Lipoprofiling Assessed by NMR Spectroscopy in Patients with Acute Coronary Syndromes: Is There a Need for Fasting Prior to Sampling?”, *Diagnostics*, **2022**, *12*, 1675.

E. Papadopoulou, et al, “Lipoprotein profiles associated with exposure to poly- and perfluoroalkyl substances (PFASs) in the EuroMix human biomonitoring study”, *Environ. Pollution*, **2022**, 308, 119664.

C. Stavarache, et al, “A Real-Life Reproducibility Assessment for NMR Metabolomics”, *Diagnostics*, **2022**, *12*, 559.

A. Nicolescu, et al, “Monitoring Methylmalonic Aciduria by NMR Urinomics”, *Molecules*,**2020**, *25*,5312.

A. Nicolescu, et al, “Diagnosis of Inborn Metabolic Disorders Assisted by NMR Spectroscopy – Recent Cases from Institute of Mother and Child Chisinau”, *Bul. Perinatol.*, **2020**, *1* (*86*), 107-111.

R. Vulturar, et al, “A Severe Neonatal Argininosuccinic Aciduria Case Investigated by ^{1}H NMR Spectroscopy”, *Rev. Chim.*, **2020**, *71* (*3*), 210-218.

A. Grama, et al, “Novel Mutation in GALT Gene in Galactosemia Patient with Group B Streptococcus Meningitis and Acute Liver Failure”, *Medicina*, **2019**, *55*, 91.

M. Musteata, et al, “The ^{1}H NMR Profile of Healthy Dog Cerebrospinal Fluid”, *Plos One*,**2013**,*8*, e81192.

A. Nicolescu, et al, “The Effect of Therapeutic Doses of Paracetamol and Aspirin on the NMR Profile of Urine at 400 MHz”, *Rev. Roum. Chim.*, **2012**, *57* (*7-8*), 653-658.

A. Nicolescu, et al, “Diagnosis of Type II Diabetes based on Non-glucose Regions of ^{1}H NMR Spectra of Urine. A metabonomic approach”, *Rev. Chim.*, **2011**, *62* (*12*), 1150-1153.

L.-I. Stefan, et al, “^{1}H-NMR Urine Metabolic Profiling in Type I Diabetes Mellitus”, *Rev. Roum. Chim.*, **2010**, *55*, (*11-12*), 1033-1037.

C. Ciurtin, et al, “Metabolic Profiling of Urine by ^{1}H-NMR Spectroscopy. A Critical Assessment of Interpreting Metabolite Concentrations for Normal and Diabetes Groups”, *Rev.Chim*, **2007**, *58* (*1*), 51-55.

Alina Nicolescu

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Florentina Georgescu
Carmen Stavarache
Cristina Stavarache
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Thank you!