ADVANCES IN FOOD ANALYSIS

Marco Beccaria, PhD

University of Liege, Belgium
email: mbeccaria@uliege.be

Scientific background

- 2003-2008: **Degree in Pharmaceutical Chemistry** and Technologies at University of Messina (Italy)
- 2009-2012: **Ph.D**. in **Food Chemistry And Safety** at University of Messina (Italy)
- 2012-2015: **Postgraduate** and **Postdoctoral Researcher** at University of Messina (Italy)
- 2015-2016: **Specialist in Lipidomics** at Chromaleont Srl (Italy)
- 2016-2018: **Research Scientist** at Dartmouth College (NH, USA)
- 2018-2019: **Associate Researcher** at KU Leuven (Belgium)
- 2020-now: **Senior Researcher** at University of Liege (Belgium)

2008

MESSINA UNIVERSITY (ITALY)

Faculty of Farmacy,
Master Degree in
Pharmaceutical Chemistry and Technologies

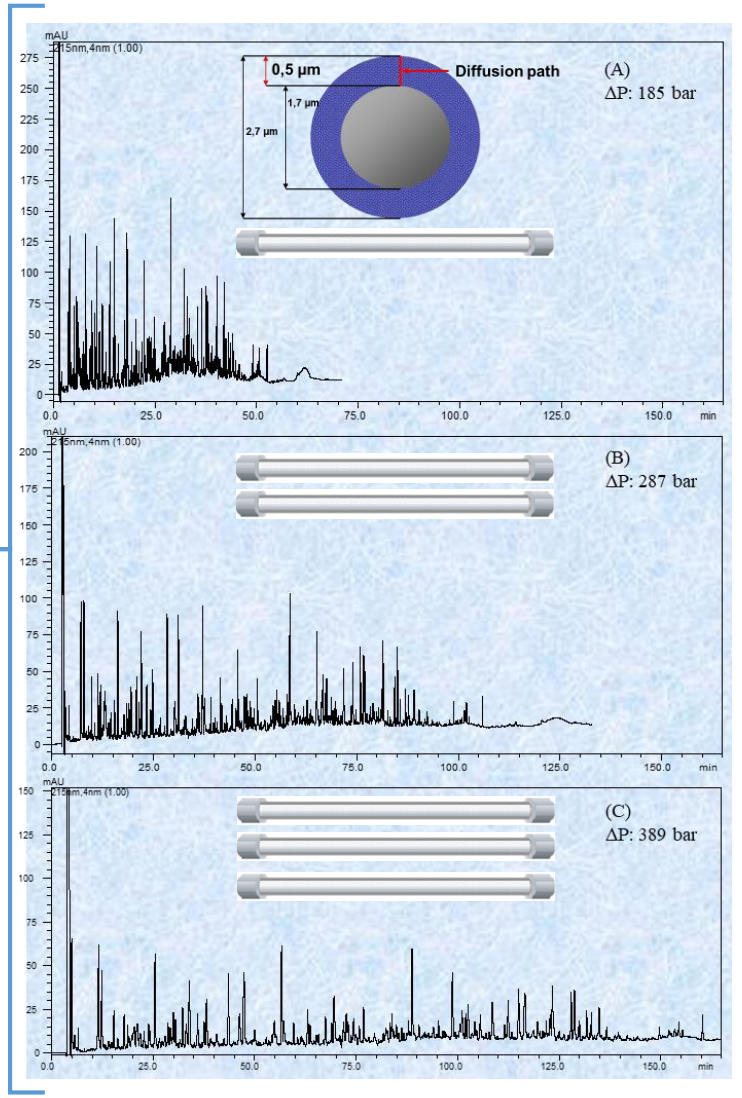
PARTIALLY POROUS STATIONARY PHASES HYPHENATED TO A HYBRID MASS SPECTROMETER (IT-TOF) FOR UNEQUIVOCAL IDENTIFICATION OF PROTEINS

Marco Beccaria

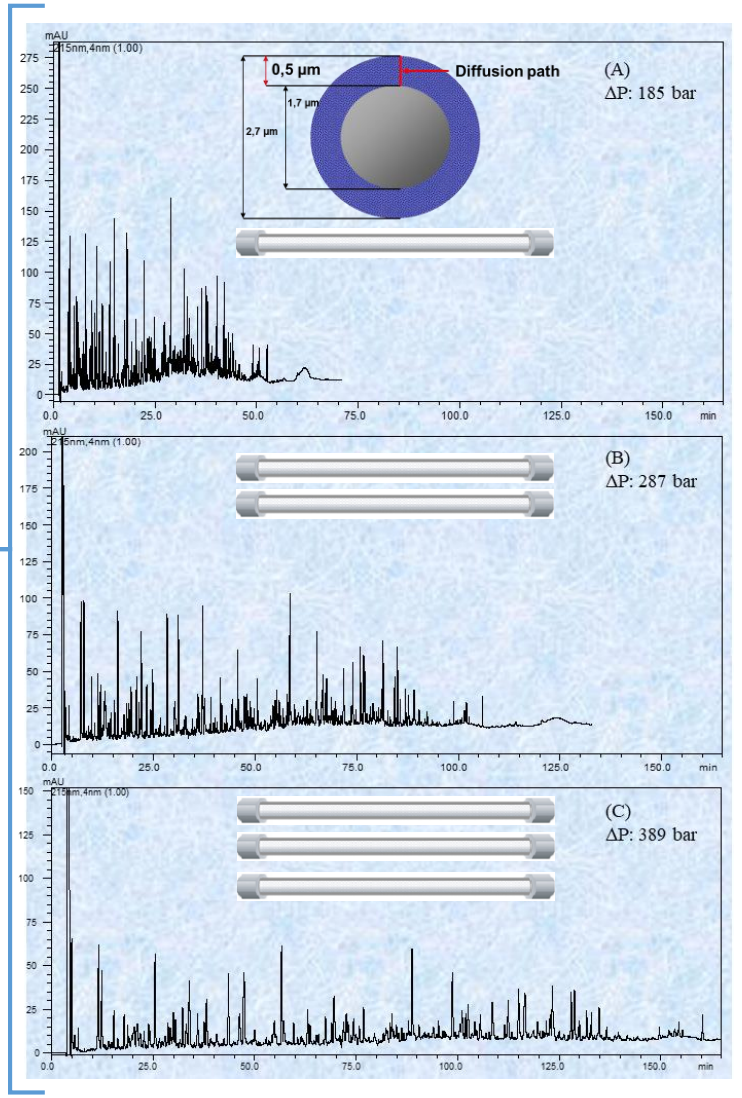
ACCADEMIC YEAR 2007-2008

PARTIALLY POROUS STATIONARY PHASES HYPHENATED TO A HYBRID MASS SPECTROMETER (IT-TOF) FOR UNEQUIVOCAL IDENTIFICATION OF PROTEINS

PARTIALLY POROUS STATIONARY PHASES HYPHENATED TO A HYBRID MASS SPECTROMETER (IT-TOF) FOR UNEQUIVOCAL IDENTIFICATION OF PROTEINS



PARTIALLY POROUS STATIONARY PHASES HYPHENATED TO A HYBRID MASS SPECTROMETER (IT-TOF) FOR UNEQUIVOCAL IDENTIFICATION OF PROTEINS



Match with the original sequence

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 51 FSQYLQQCPF DEHVKLVNEL TEFAKTCVAD ESHAGCEKSL HTLFGDELCK
101 VASLRETYGD MADCCEKQEP ERNECFLSHK DDSPDLPKLK PDPNTLCDEF
151 KADEKKFWGK YLYEIARRHP YFYAPELLYY ANKYNGVFQE CCQAEDKGAC
201 LLPKIETMRE KVLTSSARQR LRCASIQKFG ERALKAWSVA RLSQKFPKAE
251 FVEVTKLVTD LTKVHKECCH GDLLECADDR ADLAKYICDN QDTISSKLKE
301 CCDKPLLEKS HCIAEVEKDA IPENLPPLTA DFAEDKDVCK NYQEAKDAFL
351 GSFLYEYSRR HPEYAVSVLL RLAKEYEATL EECCAKDDPH ACYSTVFDKL
401 KHLVDEPQNL IKQNCDQFEK LGEYGFQNAL IVRYTRKVPQ VSTPTLVEVS
451 RSLGKVGTRC CTKPESERMP CTEDYLSLIL NRLCVLHEKT PVSEKVTKCC
501 TESLVNRRPC FSALTPDETY VPKAFDEKLF TFHADICTLP DTEKQIKKQT
551 ALVELLKHKP KATEEQLKTV MENFVAFVDK CCAADDKEAC FAVEGPKLVV
601 STQTALA
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Start - End	Observed	Mr(expt)	Mr(calc)	Delta	Miss	Sequence	
35 - 44	417.21	1248.61	1248.61	-0.00	1	FKDLGEEHFK	(Ions score 6)
66 - 75	582.32	1162.62	1162.62	-0.00	0	LVNELTEFAK	(Ions score 59)
76 - 88	489.19	1464.55	1464.55	0.00	0	TCVADESHAGCEK	(Ions score 10)
89 - 100	474.23	1419.66	1419.67	-0.01	0	SLHTLFGDELCK	(Ions score 35)
123 - 138	476.47	1901.84	1901.85	-0.01	1	NECFLSHKDDSPDLPK	(Ions score 11)
123 - 138	634.95	1901.84	1901.85	-0.01	1	NECFLSHKDDSPDLPK	(Ions score 35)
139 - 151	526.59	1576.74	1576.74	-0.00	0	LKPDPNTLCDEFK	(Ions score 31)
161 - 167	464.25	926.48	926.49	-0.01	0	YLYEIAR	(Ions score 38)
249 - 256	461.75	921.48	921.48	-0.00	0	AEFVEVTK	(Ions score 27)
257 - 263	395.24	788.46	788.46	-0.00	0	LVTDLTK	(No match)
264 - 280	529.96	2115.83	2115.83	-0.00	1	VHKECCHGDLLECADDR	(No match)
286 - 297	722.81	1443.61	1443.62	-0.01	0	YICDNQDTISSK	(Ions score 89)
298 - 309	384.44	1533.73	1533.74	-0.01	1	LKECCDKPLLEK	(No match)
298 - 309	512.25	1533.74	1533.74	-0.00	1	LKECCDKPLLEK	(Ions score 24)
319 - 340	820.39	2458.14	2458.16	-0.02	1	DAIPENLPPLTADFAEDKDVCK	(No match)
360 - 371	480.61	1438.80	1438.80	-0.01	1	RHPEYAVSVLLR	(Ions score 79)
361 - 371	642.36	1282.70	1282.70	-0.00	0	HPEYAVSVLLR	(No match)
375 - 386	752.79	1503.57	1503.57	-0.00	0	EYEATLEECCAK	(Ions score 50)
387 - 399	519.22	1554.62	1554.63	-0.00	0	DDPHACYSTVFDK	(Ions score 12)
387 - 401	599.61	1795.80	1795.81	-0.01	1	DDPHACYSTVFDKLK	(Ions score 1)
402 - 412	653.36	1304.70	1304.71	-0.01	0	HLVDEPQNLIK	(Ions score 40)
421 - 433	740.40	1478.78	1478.79	-0.01	0	LGEYGFQNALIVR	(Ions score 90)
437 - 451	547.32	1638.93	1638.93	-0.00	1	KVPQVSTPTLVEVSR	(Ions score 67)
499 - 507	570.74	1139.46	1139.46	-0.00	0	CCTESLVNR	(Ions score 63)
508 - 523	627.97	1880.89	1880.90	-0.01	0	RPCFSALTPDETYVPK	(Ions score 46)
529 - 544	636.97	1907.89	1907.90	-0.00	0	LFTFHADICTLPDTEK	(Ions score 7)
548 - 557	571.86	1141.71	1141.71	-0.00	1	KQTALVELLK	(Ions score 37)
588 - 597	554.75	1107.49	1107.49	-0.00	0	EACFAVEGPK	(Ions score 28)
598 - 607	501.79	1001.57	1001.58	-0.00	0	LVVSTQTALA	(Ions score 22)

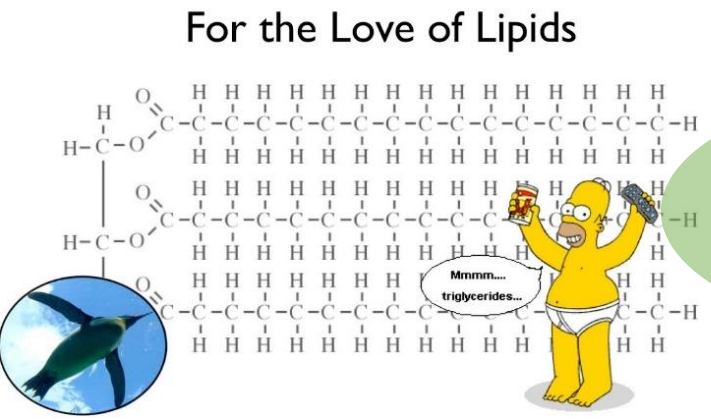
2009-2012

Ph.D. in Food Chemistry and Safety

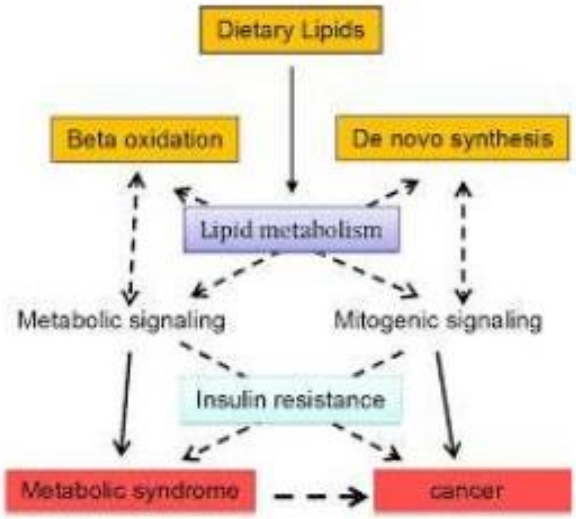
Ph.D. thesis:

"***Advanced chromatographic methods for the analysis of complex lipid samples***".

University of Messina (Italy)



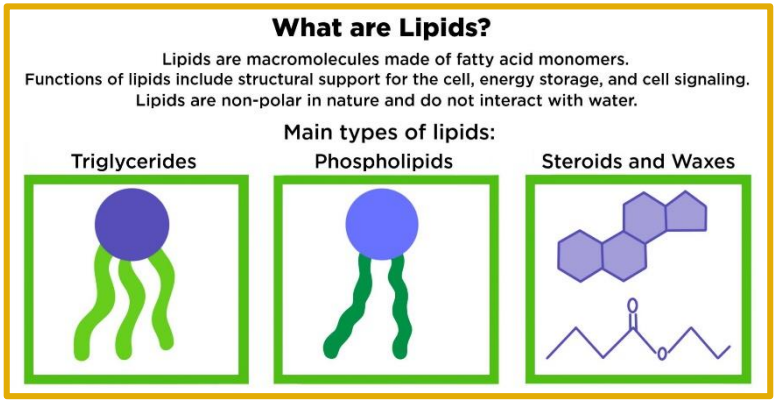
WHY LIPIDS?



- **IN DIET, LIPIDS ARE IMPORTANT AS ENERGY SOURCES AND AS SOURCES OF ESSENTIAL FATTY ACIDS AND FAT-SOLUBLE VITAMINS, WHICH TEND TO ASSOCIATE WITH FATS.**

- **LIPIDS REPRESENT IMPORTANT STRUCTURAL AND FUNCTIONAL CONSTITUENTS OF CELLS IN BIOLOGICAL SYSTEMS AND THEY ARE OFTEN RELATED TO SEVERAL DESEASES.**

- **GENERALLY, THE QUALITY OF FOOD IS CLOSELY RELATED TO THE QUALITY OF THEIR LIPIDS.**



ADVANCED CHROMATOGRAPHIC METHODS FOR THE ANALYSIS OF COMPLEX LIPID SAMPLES

ADVANCED CHROMATOGRAPHIC METHODS FOR THE ANALYSIS OF COMPLEX LIPID SAMPLES

SEPARATION TECHNIQUES

- Chromatographic techniques
- Multidimensional chromatographic techniques
- Hyphenation of chromatographic techniques with Mass Spectrometry

ADVANCED CHROMATOGRAPHIC METHODS FOR THE ANALYSIS OF COMPLEX LIPID SAMPLES

SEPARATION TECHNIQUES

Chromatographic techniques

↓

Multidimensional chromatographic techniques

↓

Hyphenation of chromatographic techniques with Mass Spectrometry

LIPIDS IN FOOD SAMPLES

Isolation of lipid species

↓

Separation of lipid species

↓

Identification of lipid species

Develop advanced analytical methodologies for the characterization of the lipid fraction in food and related sample

J. Sep. Sci. 2011, *34*, 688–692

Luigi Mondello[1,2]
Marco Beccaria[1]
Paola Donato[1,2]
Francesco Cacciola[1]
Giovanni Dugo[1]
Paola Dugo[1,2]

[1]Dipartimento Farmaco-chimico, Facoltà di Farmacia, Università di Messina, Messina, Italy
[2]Università Campus Bio-Medico, Roma, Italy

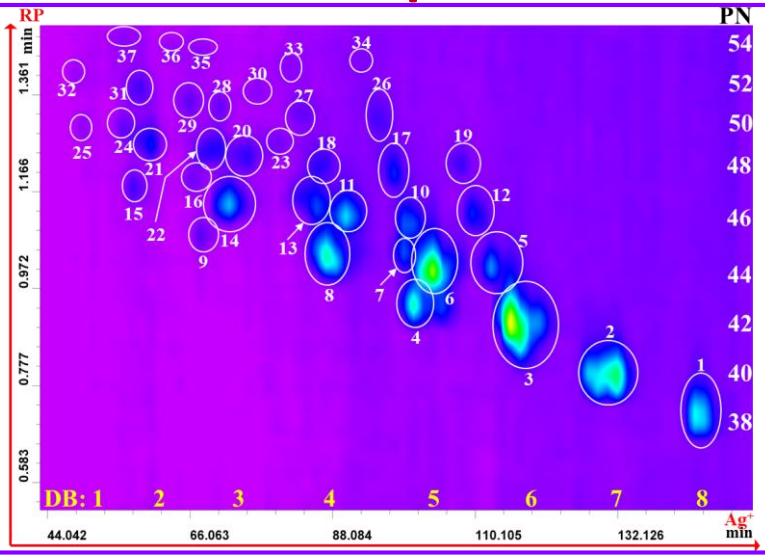
Received November 29, 2010
Revised December 29, 2010
Accepted December 29, 2010

Short Communication

Comprehensive two-dimensional liquid chromatography with evaporative light-scattering detection for the analysis of triacylglycerols in *Borago officinalis*

An optimized 2-D liquid chromatography (LC × LC) set-up, based on the different selectivities of a silver ion (Ag) and a non-aqueous reversed phase (NARP), employed in the first (D1) and the second dimension (D2), respectively, in combination with evaporative light-scattering detection (ELSD), has been developed for the analysis of the triacylglycerol (TAG) fraction in a *Borago officinalis* oil. The 2-D set-up, thanks to the complementary separation selectivity provided by the two columns, allowed to distribute 78 TAGs throughout the 2-D LC retention plane otherwise unachievable by 1-D LC.

Keywords: *Borago officinalis* / Comprehensive LC / Evaporative light-scattering detection / Triacylglycerols
DOI 10.1002/jssc.201000843



Contents lists available at SciVerse ScienceDirect

Journal of Chromatography A

journal homepage: www.elsevier.com/locate/chroma

Mass spectrometric elucidation of triacylglycerol content of *Brevoortia tyrannus* (menhaden) oil using non-aqueous reversed-phase liquid chromatography under ultra high pressure conditions

Paola Dugo[a,b,*], Marco Beccaria[a], Nermeen Fawzy[a], Paola Donato[b,a], Francesco Cacciola[c,a], Luigi Mondello[a,b]

[a] *Dipartimento Farmaco-chimico, Università di Messina, viale Annunziata, 98168 Messina, Italy*
[b] *Centro Integrato di Ricerca (C.I.R.), Università Campus Bio-Medico, Via Álvaro del Portillo 21, 00128 Roma, Italy*
[c] *Chromaleont s.r.l. A spin-off of the University of Messina, c/o Dipartimento Farmaco-chimico, Università di Messina,, viale Annunziata, 98168 Messina, Italy*

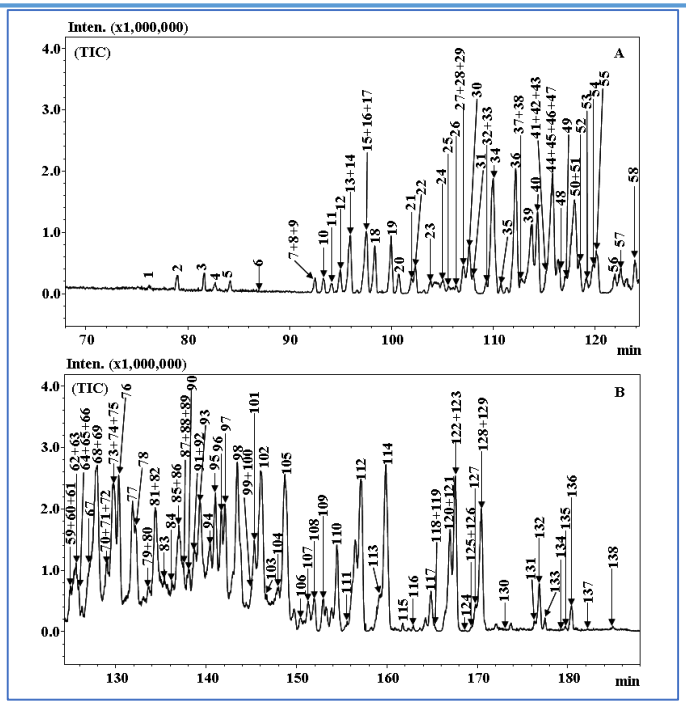
ARTICLE INFO

Article history:
Available online 27 March 2012

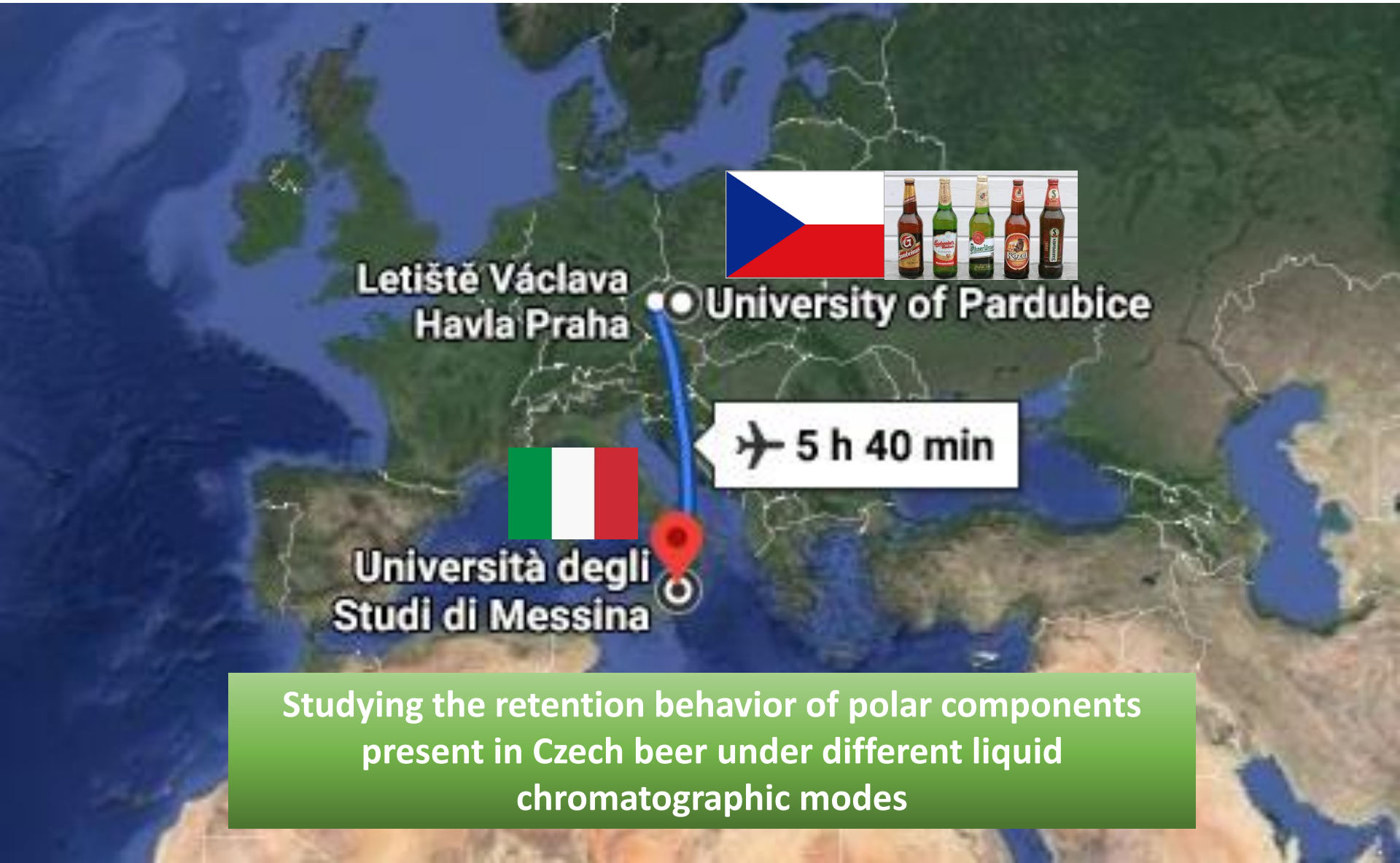
Keywords:
Menhaden oil
Triacylglycerols
UHPLC
Serially coupled columns

ABSTRACT

A non-aqueous reversed phase high performance liquid chromatography method was developed, and optimized for triacylglycerol analysis in a *Brevoortia tyrannus* (menhaden) oil sample. Four columns were serially coupled to tackle such a task, for a total length of 60 cm of shell-packed stationary phase, and operated under ultra high pressure conditions. As detection, positive-ion atmospheric pressure chemical ionization mass spectrometry was used to attain identification of the analyzed sample components. A number of 137 triacylglycerols containing up to 19 fatty acids, with 14–22 carbon atom alkyl chain length and 0–6 double bonds, were positively identified in the complex lipidic sample. This is the first work that reports an extensive characterization of the triacylglycerol fraction of menhaden oil.



2011 - Six months as Visiting Ph.D. at the Analytical Chemistry Department at the Pardubice University (Czech Republic)



Studying the retention behavior of polar components present in Czech beer under different liquid chromatographic modes

2012-2015

Postdoctoral Researcher

in **Food and Analytical Chemistry**

at the University of Messina, Italy.

- **The isolation of lipid bioactive components from food waste products and their chemical characterization**

- **Characterization of best-by-date dairy products to evaluate their nutritional value for possible re-introduction in the food or feed chain**

Isolation of lipid species from different food sources

Contents lists available at ScienceDirect

Journal of Chromatography A

journal homepage: www.elsevier.com/locate/chroma

High performance characterization of triacylglycerols in milk and milk-related samples by liquid chromatography and mass spectrometry☆

Marco Beccaria[a], Giuseppe Sullini[a], Francesco Cacciola[b,c], Paola Donato[a,c,d], Paola Dugo[a,c,d], Luigi Mondello[a,c,d,*]

[a] Dipartimento di Scienze del Farmaco e dei Prodotti per la Salute (S.C.I.F.A.R.), University of Messina, Viale Annunziata, 98168 Messina, Italy
[b] Dipartimento di Scienze dell'Ambiente, della Sicurezza, del Territorio, degli Alimenti e della Salute (S.A.S.T.A.S.), University of Messina, Viale F. Stagno d'Alcontres 31, 98166 Messina, Italy
[c] Chromaleont s.r.l. A start-up of the University of Messina, c/o Dipartimento di Scienze del Farmaco e dei Prodotti per la Salute (S.C.I.F.A.R.), University of Messina, Viale Annunziata, 98168 Messina, Italy
[d] Centro Integrato di Ricerca (C.I.R.), University Campus Bio-Medico of Rome, Via Álvaro del Portillo 21, 00128 Rome, Italy

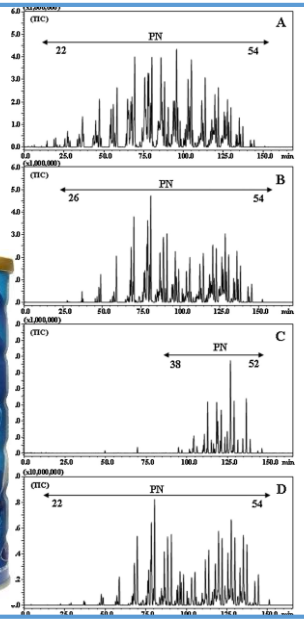
ARTICLE INFO

Article history:
Received 12 December 2013
Received in revised form 26 June 2014
Accepted 23 July 2014
Available online 1 August 2014

Keywords:
Milk
Triacylglycerols
Mass spectrometry
Serially-coupled columns
Fused-core

ABSTRACT

In this work, ultra high performance liquid chromatography was used for the c
lipids (triacylglycerols) in milk samples of different origin, as well as milk-d
a task, three core-shell type octadecylsilica columns were serially coupled
phase length of 45 cm, using acetonitrile-isopropanol gradient elution allo
tion according to increasing partition number. The employment of an ion-t
in conjunction with atmospheric-pressure chemical ionization mass spect
positively identify a number of 243 different triacylglycerols containing up
carbon atom alkyl chain length, and 0–3 double bonds. This work reports ar
of the triacylglycerol fraction in milk and milk-related samples of different s



goat

cow

human milk

mozzarella cheese

Analytica Chimica Acta 875 (2015) 41–53

Contents lists available at ScienceDirect

Analytica Chimica Acta

journal homepage: www.elsevier.com/locate/aca

Sample preparation techniques coupled to advanced chromatographic methods for marine organisms investigation☆

Rosaria Costa[a], Marco Beccaria[a], Elisa Grasso[a], Ambrogina Albergamo[b], Marianna Oteri[a], Paola Dugo[a,c,d], Salvatore Fasulo[b], Luigi Mondello[a,c,d,*]

[a] "Scienze del Farmaco e Prodotti per la Salute" Department, University of Messina, Viale Annunziata, 98168 Messina, Italy
[b] Dipartimento di Scienze Biologiche e Ambientali (DiSBA), University of Messina, Viale Stagno d'Alcontres, 98166 Messina, Italy
[c] University Campus Bio-Medico of Rome, Via Álvaro del Portillo 21, 00128 Rome, Italy
[d] Chromaleont s.r.l., c/o "Scienze del Farmaco e Prodotti per la Salute" Department, University of Messina, Viale Annunziata, 98168 Messina, Italy

Authentication of food products by their lipid profile

Contents lists available at ScienceDirect

Food Chemistry

journal homepage: www.elsevier.com/locate/foodchem

Analytical Methods

Reliability of the ΔECN42 limit and global method for extra virgin olive oil purity assessment using different analytical approaches

Marco Beccaria [a], Erica Moret [b], Giorgia Purcaro [b,*], Lorena Pizzale [b], Antonella Cotroneo [a], Paola Dugo [a,c], Luigi Mondello [a,c], Lanfranco S. Conte [b]

[a] Dipartimento di Scienze del Farmaco e dei Prodotti per la Salute (SCIFAR), University of Messina, Viale Annunziata, 98168 Messina, Italy
[b] Dipartimento di Scienze degli Alimenti, University of Udine, Via Sondrio 2/A, 33100 Udine, Italy
[c] Centro Integrato di Ricerca (C.I.R.), Università Campus Bio-medico, via Alvaro del Portillo 21, 00128 Roma, Italy

ARTICLE INFO

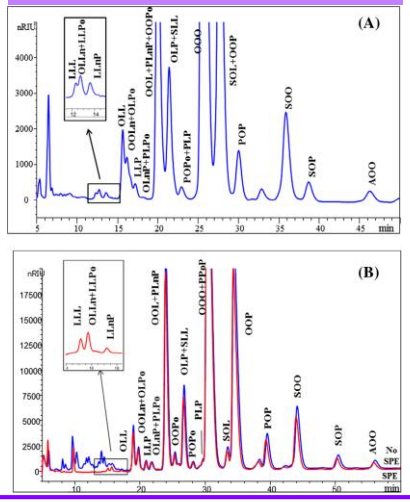
Article history:
Received 4 May 2014
Received in revised form 14 May 2015
Accepted 16 May 2015
Available online 18 May 2015

Keywords:
Authenticity
Olive oil
Triacylglycerol (TAG)
Global method
Delta-ECN42
High performance liquid chromatography (HPLC)
Refractive index detector (RID)
Mass spectrometry (MS)

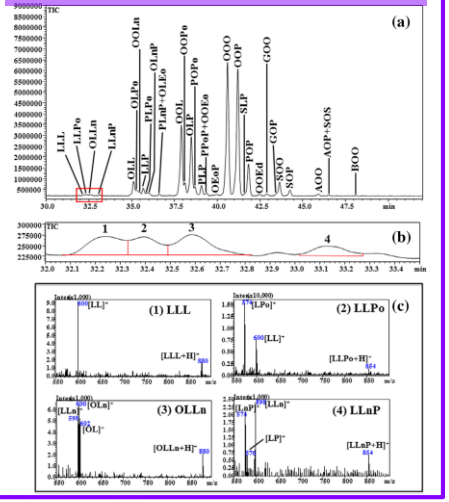
ABSTRACT

Two data elaboration approaches for evaluating olive oils authenticity were compared: (I) determination of the difference between the theoretical and actual amounts of triacylglycerols with partition number 42 (ΔECN42 ⩽ |0.2|); and (II) the global method, which considers also partition numbers 44 and 46 (returning a "*correct*"/"*not correct*" result). Analysis of 31 genuine extra virgin olive oil samples was performed using different analytical methods, namely liquid chromatography (LC) coupled with a refractive index detector (RID) and LC coupled with a mass spectrometry (MS), and the results compared. Several false positives were highlighted using the ΔECN42 limit with both instrumental approaches. The global method algorithm returned "*correct*" results for all the samples analysed (except two that gave no results) with LC–MS; on the other hand, 10 false positives were obtained elaborating data deriving from NARP-LC-RID analysis.

Official methods



Proposed method



Food Anal. Methods (2016) 9:3143–3154
DOI 10.1007/s12161-016-0466-x

Reuse of Dairy Product: Evaluation of the Lipid Profile Evolution During and After Their Shelf-Life

Marco Beccaria [1,2] · Marianna Oteri [2] · Giuseppe Micalizzi [1] · Ivana Lidia Bonaccorsi [2] · Giorgia Purcaro [1] · Paola Dugo [1,2] · Luigi Mondello [1,2]

Received: 16 February 2016 / Accepted: 29 February 2016 / Published online: 12 April 2016

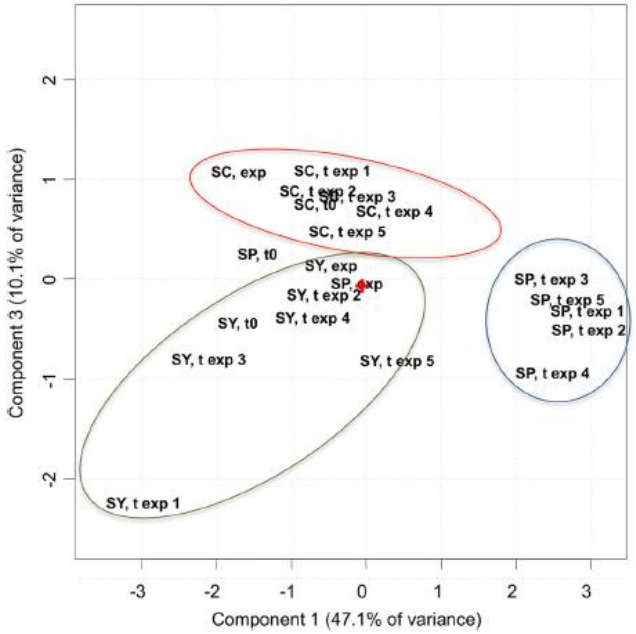


Fig. 5 Score plot on PC1 and PC3 of FAMEs and TAGs of the SC, SY, and SP samples analyzed during the project

2015-2016

LC-MS Specialist in Lipidomics

Chromaleont SrL

(R&D of separation science solutions related to agricultural and food, pharmaceutical, environment, cosmetic, and clinic field)

Duty and responsibility:

i) Develop and optimization of advanced analytical techniques, considering the needs of the customers.

ii) Analytical support to the customers and partners;

iii) Meet with customers and partners to discuss their evolving needs finding reliable solutions for their problems;

iv) Presentation of the new products to the customers, with demonstrations and workshops.

Lipids as bio-markers in muscular diseases and other pathologies

Contents lists available at ScienceDirect

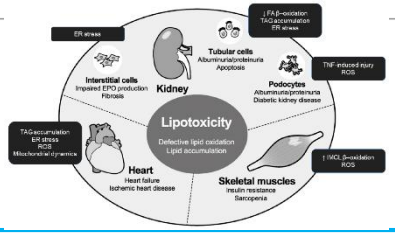
Journal of Chromatography B

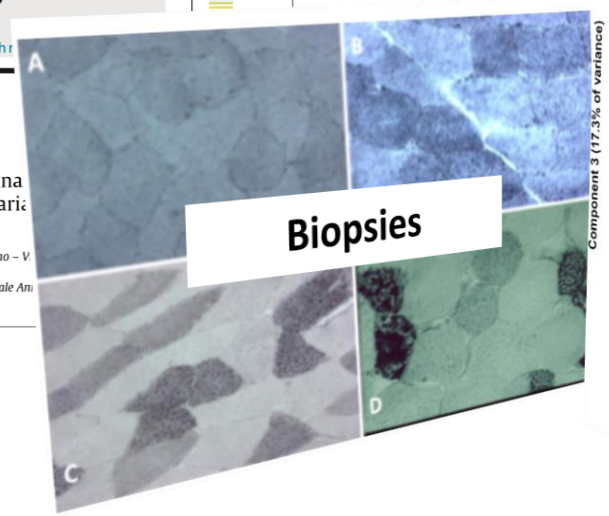
journal homepage: www.elsevier.com/locate/chr

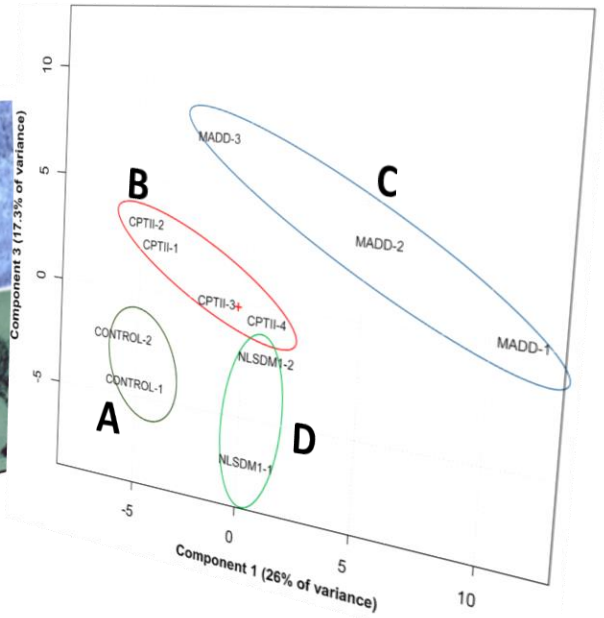
Analysis of lipid profile in lipid storage myopathy

M'hammed Aguennouz[a,1], Marco Beccaria[b,1], Giorgia Purcaro[b], Marianna Giuseppe Micalizzi[b], Olimpia Musumesci[a], Annmaria Ciranni[a], Rosa Maria Antonio Toscano[a], Paola Dugo[b,c], Luigi Mondello[b,c,*]

[a] "Dipartimento di Medicina Clinica e Sperimentale", University of Messina, Padiglione B, I piano – AOU Policlinico G. Martino – V
[b] Chromaleont s.r.l., c/o University of Messina, Polo Annunziata – viale Annunziata, 98168 Messina, Italy
[c] "Dipartimento di Scienze Chimiche, Biologiche, Farmaceutiche ed Ambientali", University of Messina, Polo Annunziata – viale An
Italy







Contents lists available at ScienceDirect

Journal of Chromatography A

journal homepage: www.elsevier.com/locate/chroma

Highly informative multiclass profiling of lipids by ultra-high performance liquid chromatography – Low resolution (quadrupole) mass spectrometry by using electrospray ionization and atmospheric pressure chemical ionization interfaces☆

Marco Beccaria[a,*], Veronica Inferrera[b], Francesca Rigano[a], Krzysztof Gorynski[c], Giorgia Purcaro[a], Janusz Pawliszyn[d], Paola Dugo[a,b,e], Luigi Mondello[a,b,e]

[a] Chromaleont s.r.l., Messina, Italy
[b] Department of "Scienze Chimiche, Biologiche, Farmaceutiche ed Ambientali", University of Messina, Messina, Italy
[c] Department of Pharmacodynamics and Molecular Pharmacology, Faculty of Pharmacy, Collegium Medicum in Bydgoszcz, Nicolaus Copernicus University in Toruń, Poland
[d] Department of Chemistry, 200 University Avenue, West, Waterloo, Ontario, Canada
[e] University Campus Bio-Medico of Rome, Roma, Italy

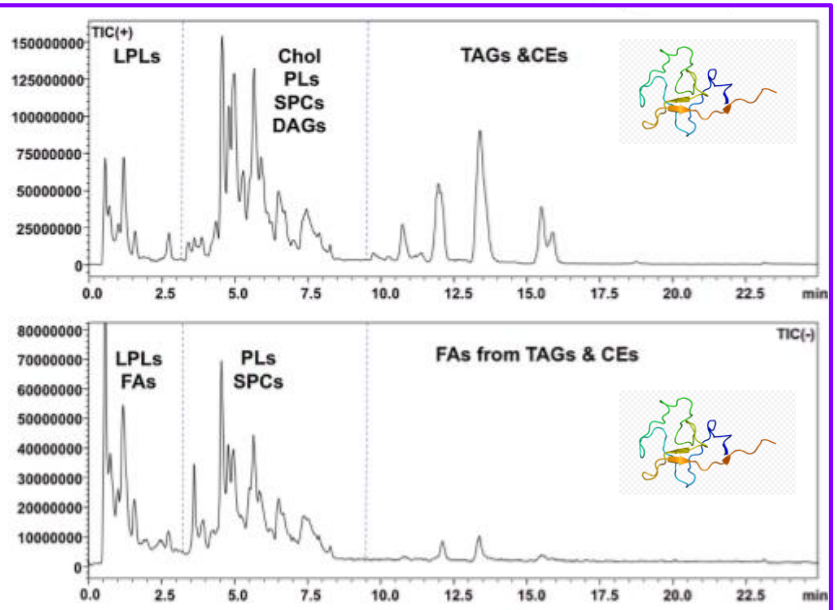


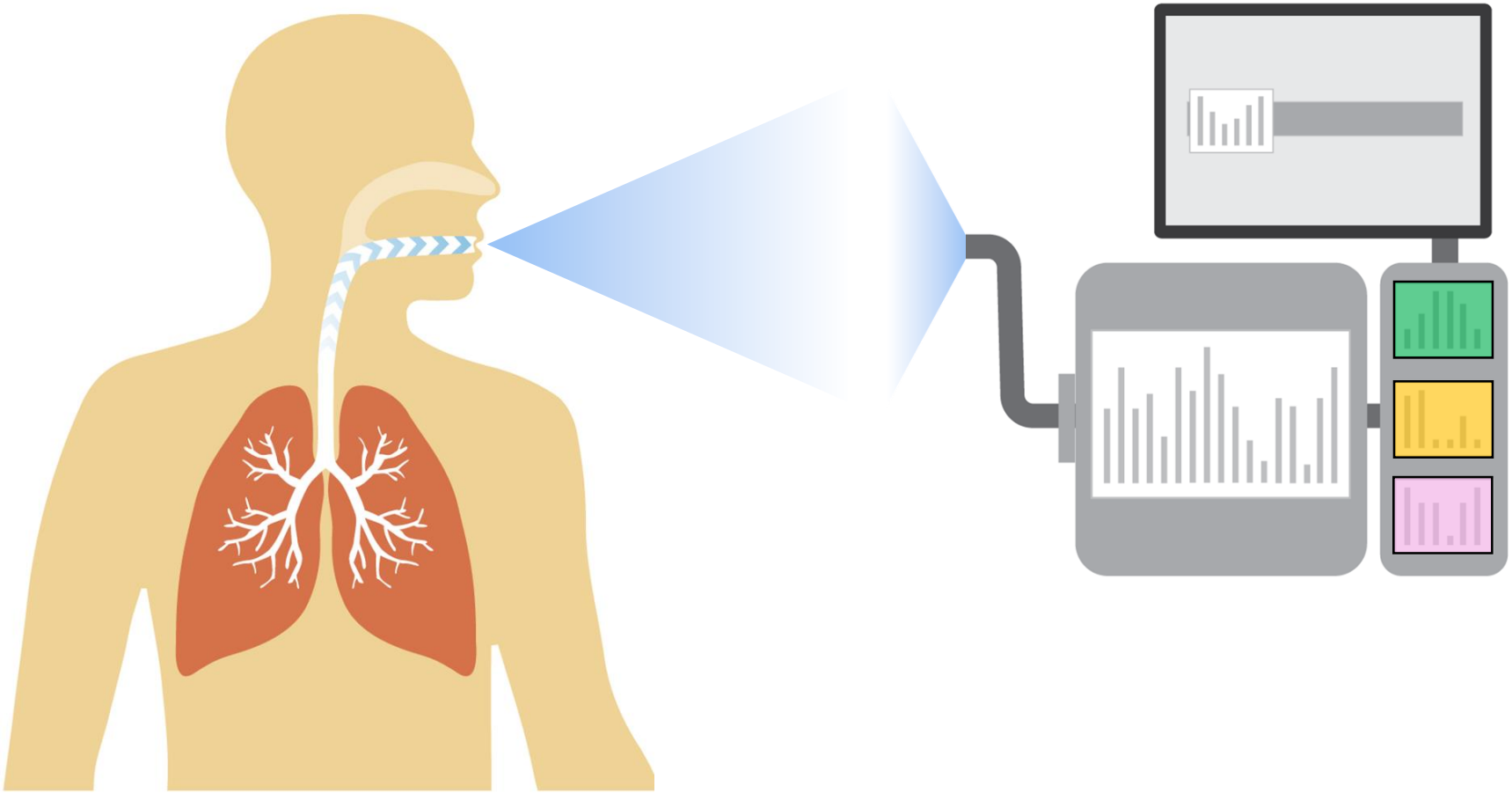
Fig. 8. Total ion current chromatograms of lipid fraction of plasma sample by using both APCI(+) (a) and APCI(−) (b).

2016-2018

Research Scientist

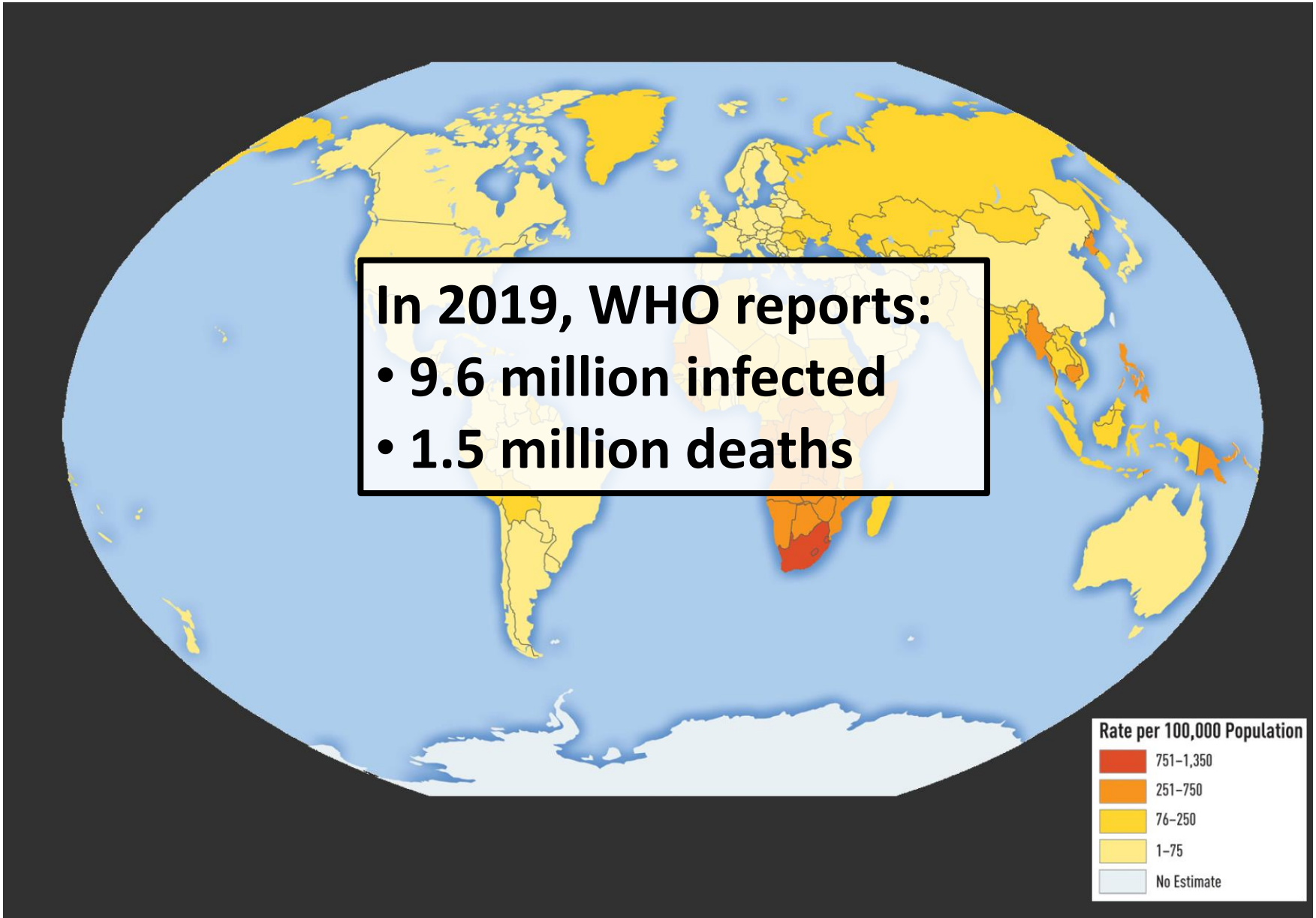
Dartmouth College, Hanover (NH, USA)

USING BREATH TO DIAGNOSE MYCOBACTERIUM TUBERCULOSIS INFECTION

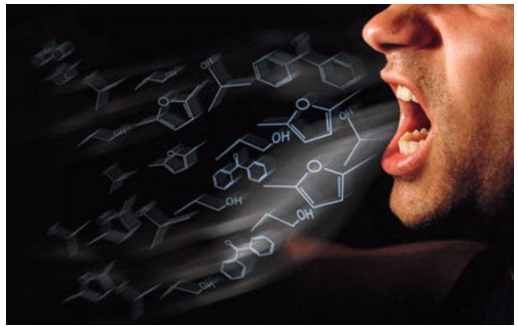


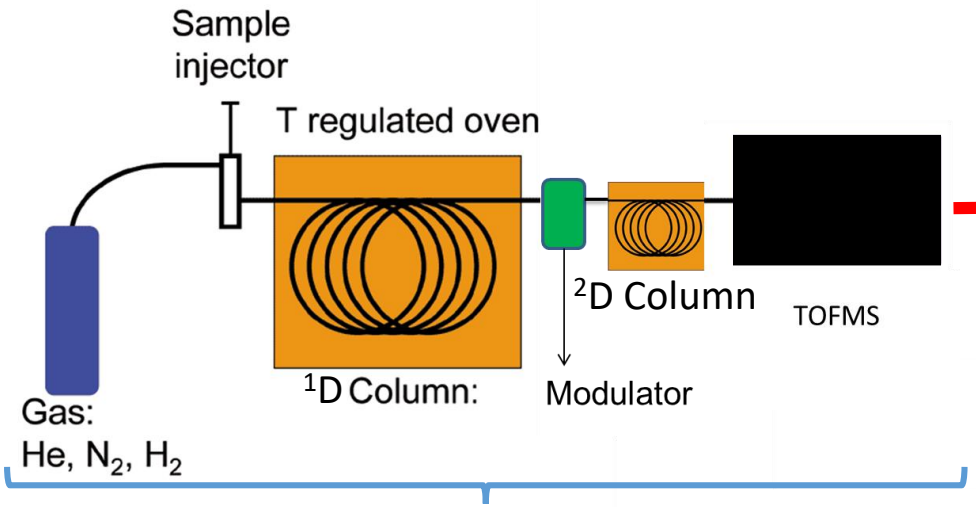
- ✓ Biomarker discovery using human and non-human primate exhaled breath as **not invasive sampling** in the contest of active **pulmonary *Tuberculosis*** by advanced analytical tools and chemometric techniques

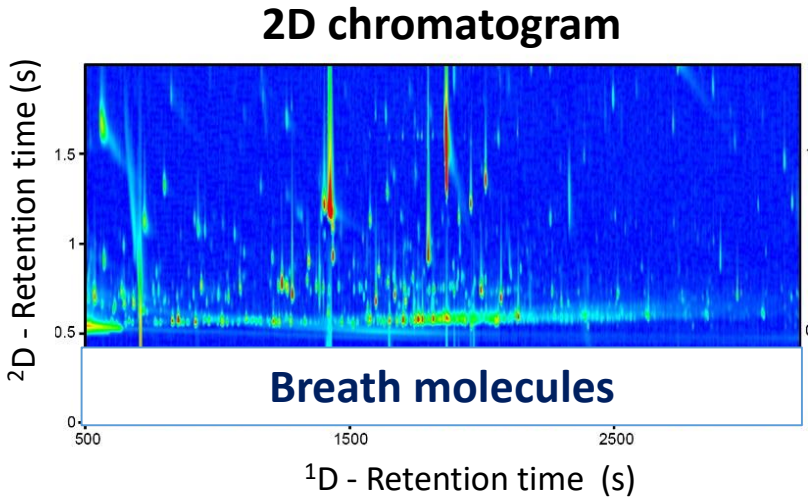
USING BREATH TO DIAGNOSE MYCOBACTERIUM TUBERCULOSIS INFECTION



USING BREATH TO DIAGNOSE MYCOBACTERIUM TUBERCULOSIS INFECTION







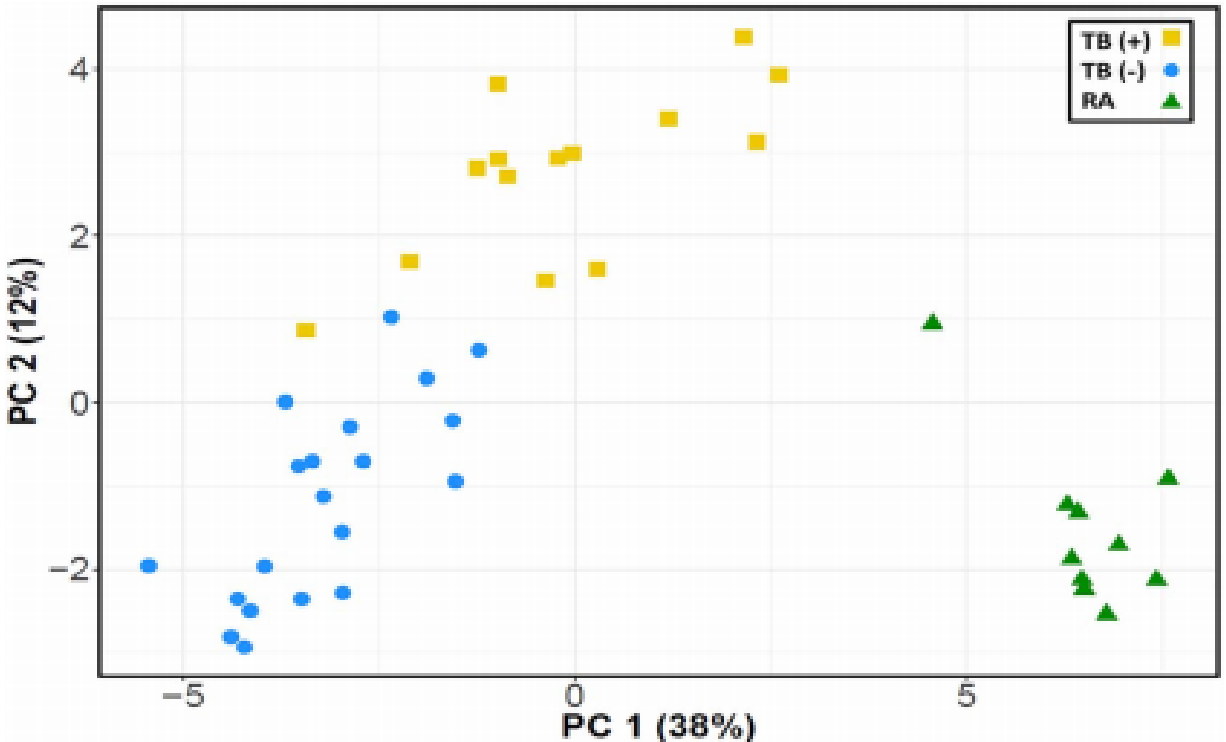
Comprehensive 2D-GC-MS system

USING BREATH TO DIAGNOSE MYCOBACTERIUM TUBERCULOSIS INFECTION

TB(+): Experimental Group (individuals presenting with *Mycobacterium Tuberculosis* infection)

TB(-): Control Group (individuals with no *Mycobacterium Tuberculosis* infection but presenting similar symptoms)

RA: Room Air (sampled in the same rooms of the breath sampling)



USING BREATH TO DIAGNOSE *MYCOBACTERIUM TUBERCULOSIS* INFECTION

Contents lists available at ScienceDirect

Journal of Chromatography B

journal homepage: www.elsevier.com/locate/jchromb

Short communication

Preliminary investigation of human exhaled breath for tuberculosis diagnosis by multidimensional gas chromatography – Time of flight mass spectrometry and machine learning

Marco Beccaria[a], Theodore R. Mellors[a], Jacky S. Petion[b,c], Christiaan A. Rees[d], Mavra Nasir[d], Hannah K. Systrom[d], Jean W. Sairistil[b,c], Marc-Antoine Jean-Juste[b,c], Vanessa Rivera[b,c], Kerline Lavoile[b,c], Patrice Severe[b,c], Jean W. Pape[b,c], Peter F. Wright[e], Jane E. Hill[a,d,*]

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Journal of Breath Research

PAPER

Exhaled human breath analysis in active pulmonary tuberculosis diagnostics by comprehensive gas chromatography-mass spectrometry and chemometric techniques

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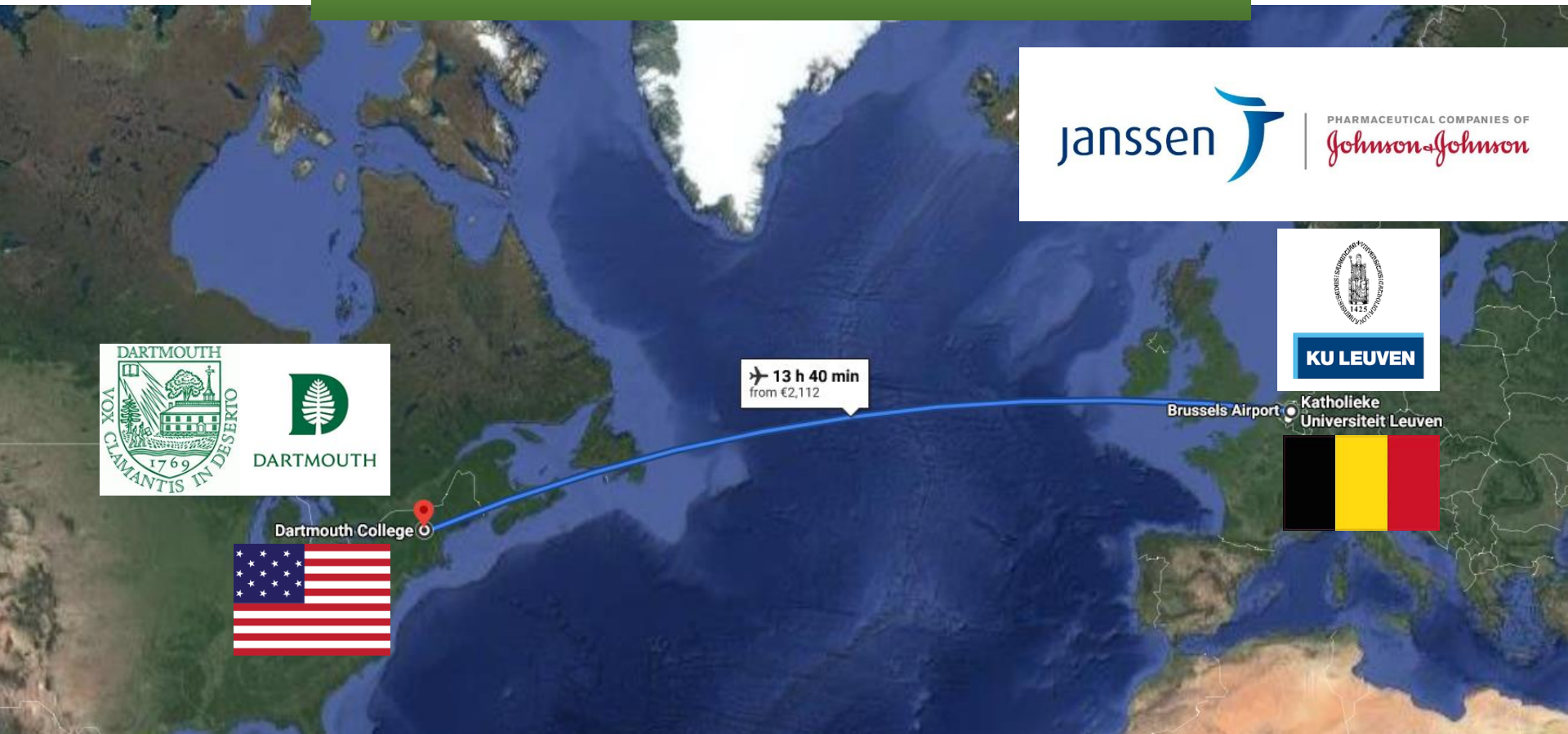
Marco Beccaria[1,2,9], Carly Bobak[3,9], Boitumelo Maitshotlo[4], Theodore R Mellors[1], Giorgia Purcaro[1,5], Flavio A Franchina[1,6], Christiaan A Rees[3], Mavra Nasir[3], Andrew Black[7,8] and Jane E Hill[1,3]

2018-2019

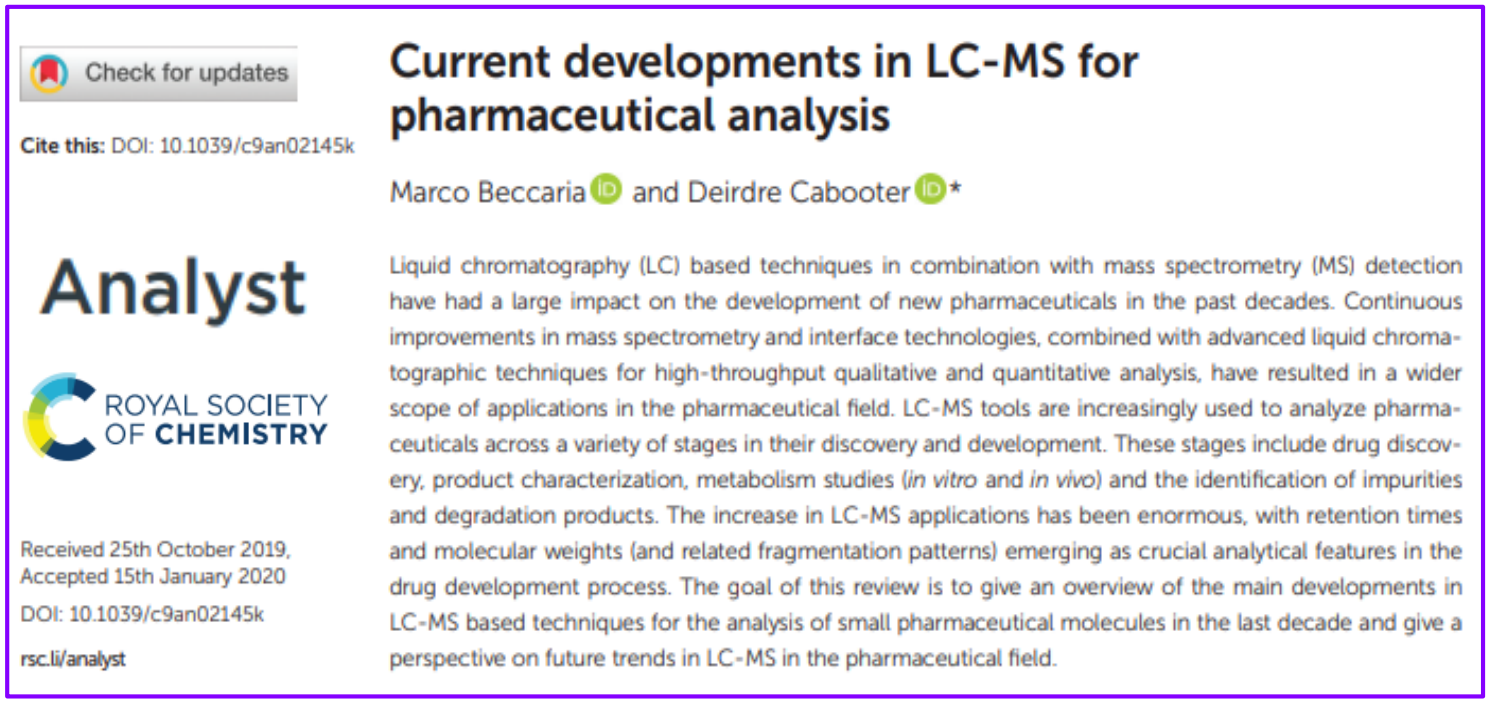
Associate Research

KU Leuven (Belgium)



Project in collaboration with Johnson & Johnson corporation

- Development of validated liquid chromatographic methods for the characterization of small molecules of pharmaceutical interest.
- Implementation of linear and no-linear models for the automatic detection of small pharmaceutical molecules.



Check for updates

Cite this: DOI: 10.1039/c9an02145k

Current developments in LC-MS for pharmaceutical analysis

Marco Beccaria and Deirdre Cabooter*

Analyst

ROYAL SOCIETY OF CHEMISTRY

Received 25th October 2019,
Accepted 15th January 2020

DOI: 10.1039/c9an02145k

rsc.li/analyst

Liquid chromatography (LC) based techniques in combination with mass spectrometry (MS) detection have had a large impact on the development of new pharmaceuticals in the past decades. Continuous improvements in mass spectrometry and interface technologies, combined with advanced liquid chromatographic techniques for high-throughput qualitative and quantitative analysis, have resulted in a wider scope of applications in the pharmaceutical field. LC-MS tools are increasingly used to analyze pharmaceuticals across a variety of stages in their discovery and development. These stages include drug discovery, product characterization, metabolism studies (*in vitro* and *in vivo*) and the identification of impurities and degradation products. The increase in LC-MS applications has been enormous, with retention times and molecular weights (and related fragmentation patterns) emerging as crucial analytical features in the drug development process. The goal of this review is to give an overview of the main developments in LC-MS based techniques for the analysis of small pharmaceutical molecules in the last decade and give a perspective on future trends in LC-MS in the pharmaceutical field.

KU LEUVEN

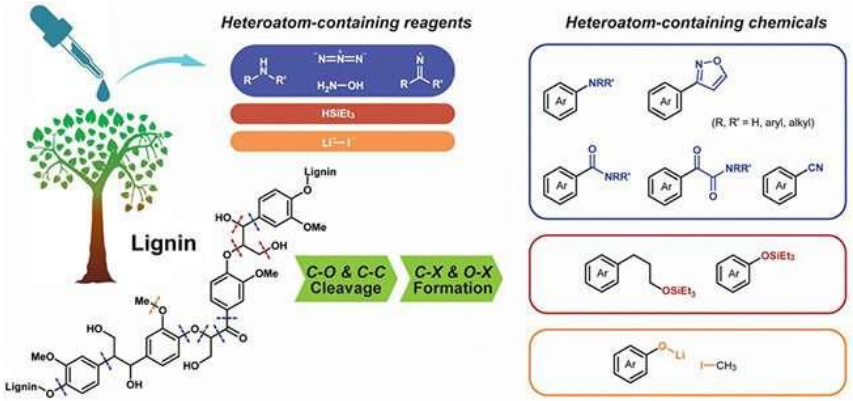
janssen | PHARMACEUTICAL COMPANIES OF Johnson & Johnson

2020 - ongoing

Senior Researcher

University of Liege (Belgium)

Investigation of heteroatoms containing compounds in bio-sources products through advanced analytical tools



AIM: THE USE OF BIO-MASS AS SOURSE OF CHEMICALS AND BIO-FUELS IN ALTERNATIVE OF PETROLEOUM RELATED COMPOUNDS

LIÈGE université

TOTAL

What can you do with your Degree in Pharmaceutical Chemistry?

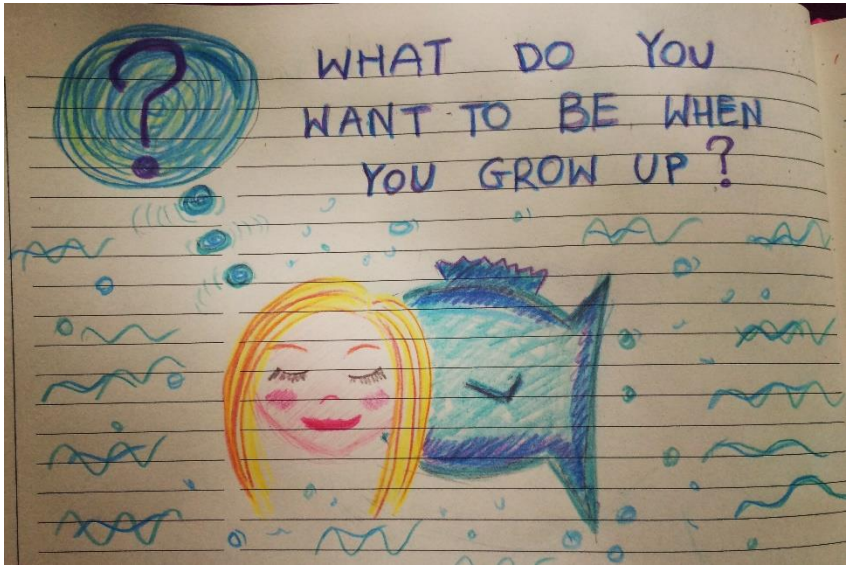
What can you do with your Degree in Pharmaceutical Chemistry?

Pharmacist

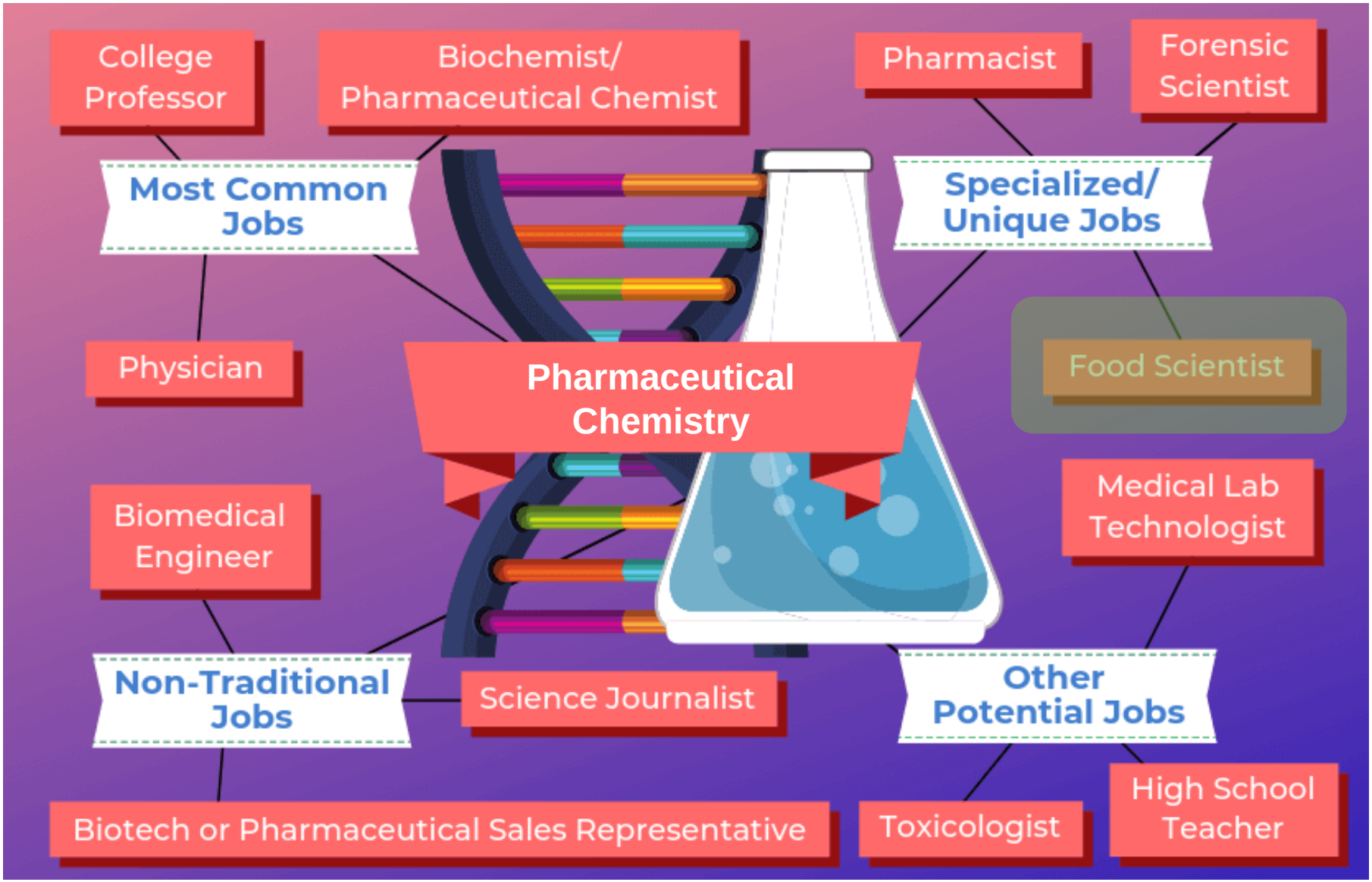
What can you do with your Degree in Pharmaceutical Chemistry?

Pharmacist

Other infinite possibilities



Not exhaustive list of possible jobs with the Degree in Pharmaceutical Chemistry



ADVANCES IN FOOD ANALYSIS

Marco Beccaria, PhD

University of Liege, Belgium
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ADVANCES IN FOOD ANALYSIS

First Part

- 01 – Chromatography
- 02 – Liquid Chromatography
- 03 – Gas Chromatography
- 04 – Mass Spectrometry in Chromatography

Second Part

- 05 – Multidimensional (MD) Chromatography
- 06 – 2D-LC
- 07 – 2D-GC
- 08 – 2D-LC/GC

Third Part

09 – LC×LC in food analysis: applications

CHROMATOGRAPHY

- Chromatography is a separation technique used for the separation and the quali-quantitative determination of known and unknown compounds (analytes) present in a sample.

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- Chromatography is widely applied in different scientific fields, such as **pharmaceutical**, **food**, petrochemical, forensic, and –omics sciences.

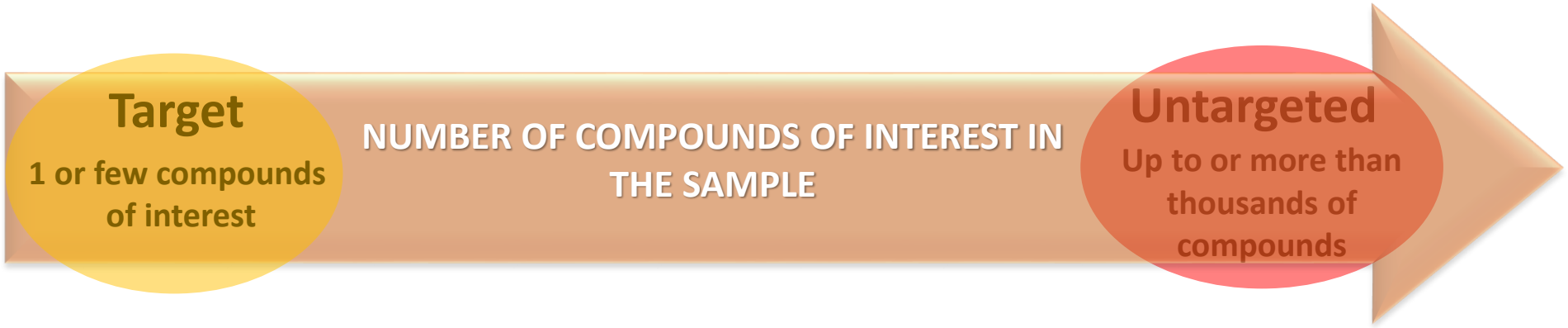
CHROMATOGRAPHY

- Chromatography is a separation technique used for the separation and the quali-quantitative determination of known and unknown compounds (analytes) present in a generic sample.

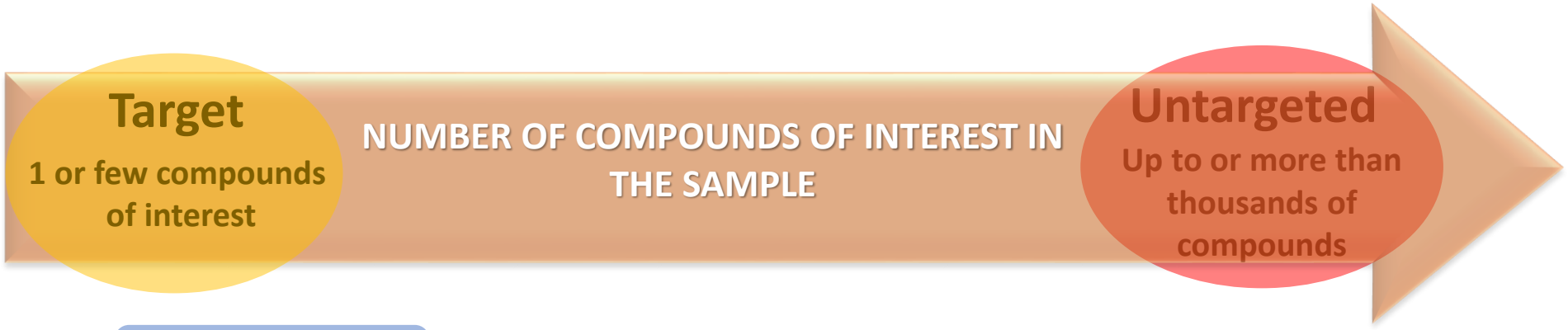
- Chromatography is widely applied in different scientific fields, such as **pharmaceutical**, **food**, petrochemical, forensic, and –omics sciences.

- Even if the physical-chemical principles of chromatography are the same in all the field of applications, the way how to apply chromatography can be different considering the different fields.

CHROMATOGRAPHY



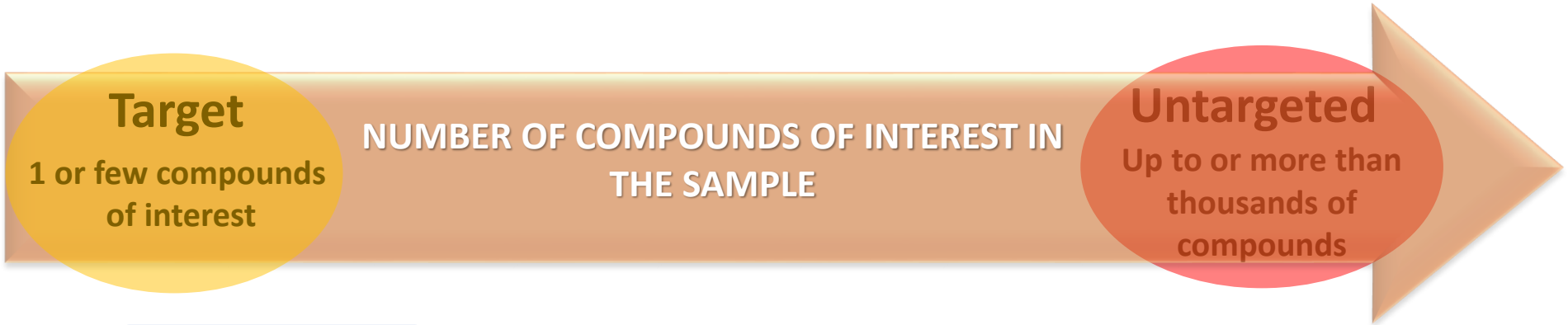
CHROMATOGRAPHY



Pharmaceutical

Development of validated analytical methods considering few compounds of interest

CHROMATOGRAPHY



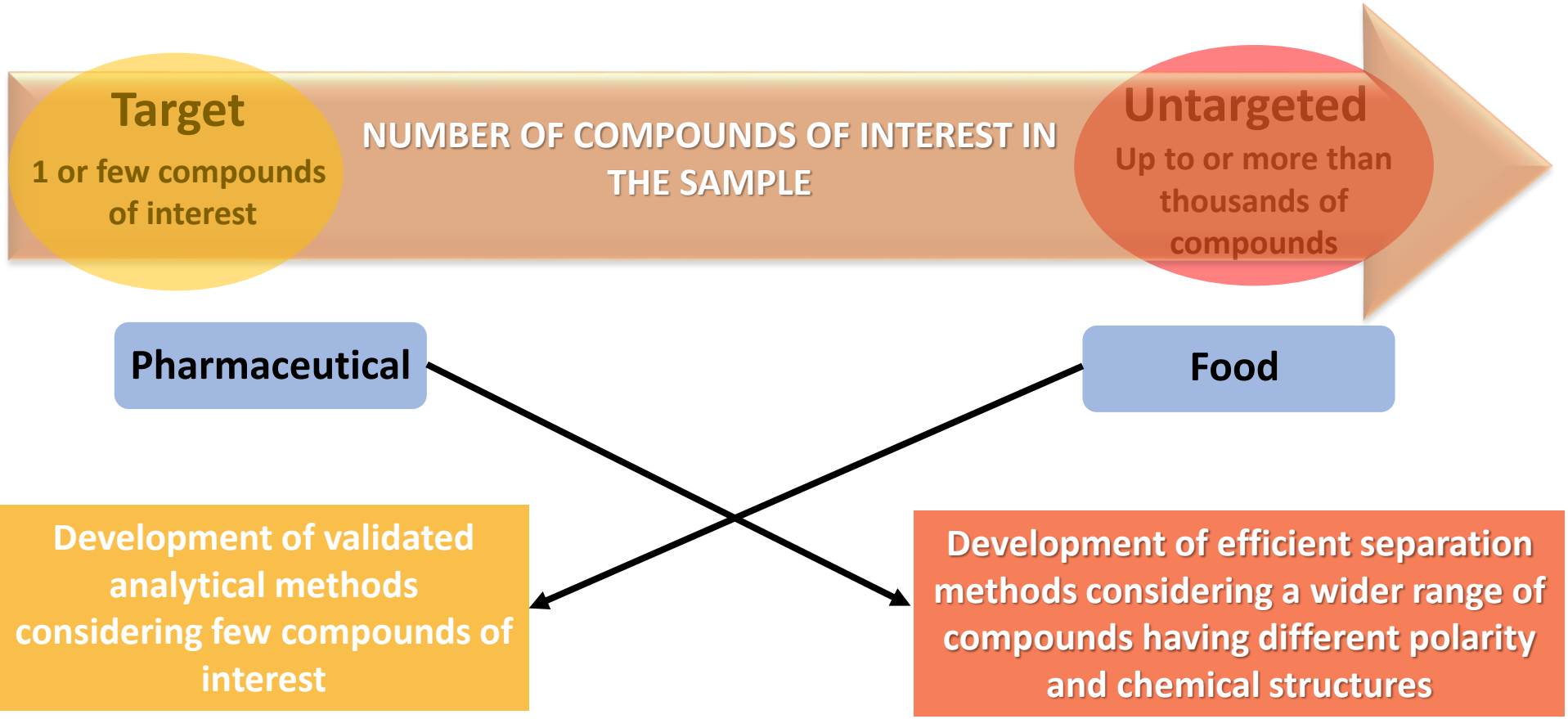
Pharmaceutical

Development of validated analytical methods considering few compounds of interest

Food

Development of efficient separation methods considering a wider range of compounds having different polarity and chemical structures

CHROMATOGRAPHY



ADVANCES IN FOOD ANALYSIS

- First Part

- 01 – Chromatography
- 02 – Liquid Chromatography (LC)
- 03 – Gas Chromatography (GC)
- 04 – Mass Spectrometry (MS) in Chromatography

Basic principles of Chromatography and Mass Spectrometry

- **Mobil & stationary phases in LC and GC**
- **Differences between LC and GC**
- **Analytical parameters**
- **Hyphenation with MS**
- **Some applications in Food analysis**

ADVANCES IN FOOD ANALYSIS

- Second Part

- **What is and how to develop a MD chromatographic method**
- **Analytical parameters to describe a MD chromatographic method**
- **Modulators in MD chromatographic systems**
- **Some applications in Food analysis**

- 05 – Multidimensional (MD) Chromatography
- 06 – 2D-LC
- 07 – 2D-GC
- 08 – LC-GC

ADVANCES IN FOOD ANALYSIS

- Several LC×LC application in the analysis of complex food samples
- The LC×LC separation of analytes with different polarity and chemical structure
- Use of different LC mode combinations (NP, RP, HILIC) in a LC×LC system to improve orthogonality
- Use of different mobile phase gradient modes to improve the chromatographic separation

Third Part

09 – LC×LC in food analysis: applications

ADVANCES IN FOOD ANALYSIS

Please, use this email!

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