MetaboNews

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The Metabolomics Society is an independent non-profit organisation dedicated to promoting the growth, use and understanding of metabolomics in the life sciences

General Enquiries info@metabolomicssociety.org Membership Enquiries

membership@metabolomicssociety.org

Ian Forsythe Editor Department of Computing Science University of Alberta, Canada metabolomics_innovation@gmail.com

Devin Benheim Contributing Editor Evergreen Analytics Pty. Ltd. d.benheim@evergeenanalytics.com.au



MetaboNews is a monthly newsletter published in partnership between The Metabolomics Innovation Centre (TMIC) and Metabolomics Society.

Metabolomics Society News

Conference Corner

Metabolomics 2020 Registration and Abstract Submission Opening Soon!

We are delighted to announce that early bird registration will open in the coming days for Metabolomics 2020 – the 16th Annual Conference of the Metabolomics Society. We look forward to seeing you in Shanghai! Please visit the new website for more information.

FEBRUARY 2020 Vol 10 Issue 1

Website: Metabolomics 2020 Hosted by: The Metabolomics Society Where: Shanghai, China When: July 6-10, 2020

Abstract submission will open at the same time as registration, through March 6, 2020. Be sure to note this EARLY deadline for oral abstract submissions. In order to provide abstract acceptance letters as early as possible to allow for travel and Visa arrangements, we will close oral abstracts on March 6. We look forward to seeing your latest findings!

Like previous years, there will be pre-conference Workshops offered on Monday afternoon, July 6 and the morning of Tuesday, July 7. The conference will officially kick-off in the afternoon of July 7. You don't want to miss the only official conference of the Metabolomics Society!

The website will have additional details added in the coming weeks, but mark your calendars for the early bird registration deadline, as well as the abstract deadline.





Metabolomics Society News | Board of Directors



Jules Griffin Metabolomics Society President



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www.chenomx.com

Board of Directors

Words From the President

It feels that I should start this section with a quote that "rumours of my death have greatly been exaggerated!" I apologise for not updating you all on the business of the board of the Metabolomics Society for the past few months. In my defence I have been moving lab from Cambridge to Imperial College and that has sucked in a lot of my time. That is not to say we have not been meeting though! We have held our monthly TCs and this has also been augmented by the conference committee meetings stepping up pace as we get closer to Shanghai 2020. In terms of the conference we are making excellent progress. The meeting will be July 6th - 10th, so the first thing to note is that the conference will start on a Monday rather than a Sunday as has occurred in a number of the previous meetings, but in turn will then run until the Friday. This means is you want to extend your stay into the weekend you are perfectly placed in downtown Shanghai and can explore both the traditional and modern parts of the city centre. We also have a number of our sponsors in place and have worked with the sponsors to keep the costs down for the meeting - in particular the early bird student registration, so I would encourage all students to apply early. As in previous years we also plan to make a large number of bursaries available to help with travel costs for early career scientists. So I hope to see many of you in Shanghai in July and expect more updates (hopefully on a monthly basis!) between now and then.

One final point this will be the last year that Krista, Nichole and I will be officers of the Society. It is written into the bylaws that we can only serve for two terms of two years, and we are now well into a fourth year as Officers. This means we will not only need new directors these elections but also we need a new President, Treasurer and Secretary as Officers of the Board. This is an open invitation to all full members to consider being a director or Officer of the Board. Krista, Nichole and I would be very happy to answer any of your questions so please don't hesitate to get in touch if you have any questions about the role.

Right, now back to the RFMF-Metabomeeting in Toulouse so à bientôt until next month.

Spotlight | Metabo*INDICATOR*™

SpOtlight



Metabo*INDICATOR*TM Translate Metabolomics & Lipidomics into Knowledge

Feature article contributed by:

Alice Limonciel, Barbara Ustaszewski, Stephen Dearth, Gordian Adam, Martin Buratti, Therese Koal. BIOCRATES Life Sciences AG, Innsbruck, Austria

Making the Most of Metabolomics Data

Identifying meaningful results in omic datasets remains a challenge for experts and beginners alike. Whether in the context of systems biology, biomarker discovery, or mechanistic investigations, better tools are required to combine the expertise of biologists and bioinformaticians to extract biological significance from increasingly larger datasets.

Biocrates has recently launched Metabo*INDICATOR*TM, a new software tool that calculates sums and ratios of metabolites, termed metabolism indicators, to provide meaningful insights for the analysis and interpretation of targeted metabolomic and lipidomic datasets.

Metabo*INDICATOR*TM is incorporated directly into the Met*IDQ*TM software from Biocrates to easily calculate sums and ratios with high relevance to biological and clinical applications. In precision medicine for instance, the use of robust signatures is essential for metabolomics and lipidomics to become standard tools for diagnosis, treatment prediction, and drug development (1). In addition, the use of quantitative data is mandatory to enable the generation of metabolic reference ranges and the future development of cutoff values for clinical applications of metabolomics and lipidomics.

There is increasing evidence for the usefulness of metabolism indicators in the literature. As one example, the spermidine/tryptophan ratio in serum is a better predictor of the response of HER2-positive breast cancer patients to a neoadjuvant therapy than the single metabolites alone (2). There may even be a mechanistic explanation for this predictive potential since elevated spermidine and decreased tryptophan levels have synergistic effects with the therapeutic agents themselves and, consequently, with the response to therapy.

The idea to use combinations of metabolite concentrations for improving diagnosis has already been successfully implemented long before the dawn of personalized medicine, such as in newborn screening (NBS). Public health programs around the world screen infants shortly after birth for monogenetic inborn errors of treatable metabolic conditions. NBS tests for more than 10 inborn errors of metabolism in dried blood spots (DBS) based on multiplexed mass spectrometry-based analysis of amino acids, acylcarnitines (ACs), and steroid hormones. With the diagnosis of phenylketonuria (PKU) dating back to the 1960s, today, it includes the phenylalanine/tyrosine ratio as a proxy of the activity of the hepatic enzyme phenylalanine hydroxylase (3). For the diagnosis of medium-chain acyl-CoA dehydrogenase (MCAD) deficiency, cutoff levels on individual, circulating ACs are combined with ratios of ACs (4).



Spotlight | Metabo/NDICATOR™

Combining sums and ratios of metabolites can also help to assess hepatic health by analyzing the ratio of branchedchain amino acids (isoleucine, leucine, valine) to aromatic amino acids (phenylalanine, tryptophan, tyrosine) in blood plasma, also known as the Fischer ratio, which has already been described in the 1970s (5). Later research extended the application of the Fischer ratio to other conditions including cardiac events and hepatocellular carcinoma (6, 7).

Metabo*INDICATOR*[™]: Sums and Ratios in a Few Clicks

Metabo*INDICATOR*TM comes with more than 230 predefined, biologically meaningful metabolite sums and ratios. The first prerequisite to use these indicators at their full potential is to use quantitative targeted metabolomic and lipidomic data, such as that provided by the MxP^{\circledast} Quant 500 kit from Biocrates.

Together, the MxP[®] Quant 500 kit and Metabo*INDICATOR*TM enable the measurement of more than 860 quantitative metabolic features (630 metabolites and lipids + 232 metabolism indicators). The predefined metabolism indicators are automatically calculated in Met*IDQ*TM and can improve statistical power of analysis, facilitate biological interpretation, and provide links to biochemical pathways (**Figure 1**). Metabo*INDICATOR*TM also offers the possibility to expand the list of metabolism indicators and create custom-defined sums and ratios that can be calculated alongside the starting set. To further support users in their data interpretation, every metabolism indicator comes with the corresponding mathematical formula, a detailed description, and related scientific literature references.



Sharpen your data quality

- Increase confidence by higher statistical power
- Find subtle differences between groups
- See patterns in the data you missed before
- Advance pathway interpretation
 Access underlying enzyme activities
 Study relevant pathways instead of metabolites

Metabolism Indicators in the Literature Bile Acids and Microbiota

As part of the mammalian gut microbiota, commensal bacteria residing in the intestine convert primary bile acids into secondary bile acids. In case of microbial imbalance, or dysbiosis, owing to various factors such as diet, drug intake, or disease, the ratio of secondary to primary bile acids may be altered (**Figure 2a**). For instance, an increased ratio of deoxycholic acid/cholic acid (DCA/CA) in human serum and brain tissue is strongly associated with cognitive decline and Alzheimer's disease progression indicating a role for the gut-liver-brain axis in the pathogenesis of dementia (8).

Lipids and Inflammation

The enzyme phospholipase A2 (PLA2) hydrolyzes phosphatidylcholines (PCs) into lysophosphatidylcholines (LPCs) and fatty acids. These fatty acids, e.g. arachidonic acid, may serve as precursors for lipid-derived signaling molecules such as prostaglandins, which are known to contribute to inflammatory conditions. Hence, an elevated ratio of total LPCs to total PCs is a proxy of enhanced PLA2 activity, which might reflect a state of inflammation (**Figure 2b**).

The ratio has been described to be significantly higher in serum from patients with osteoarthritis than from healthy controls and to predict response to anti-inflammatory treatment (9).

Kynurenine Pathway in Immuno-Oncology

The enzyme indoleamine 2,3-dioxygenase (IDO) catalyzes the first and rate-limiting step of tryptophan catabolism. IDO is also known to be an important immune modulator that can enable tumor cells to evade control by the immune system, making this enzyme a potent target for cancer therapies (10). Within metabolomic datasets, IDO activity can be estimated by calculation of the kynurenine/



Expand your data readout

- Use over 230 predefined sums and ratiosCreate your own metabolism indicators and
- include them in your analysis
- Unravel relations between metabolite concentrations

Let your data tell the story

- Established institutional knowledge
- Access scientific references in one click
- Supports biomedical interpretation

Figure 1. Key benefits of MetaboINDICATOR[™].

The software tool enables the calculation of metabolite sums and rations for a comprehensive analysis and interpretation of metabolomics and lipidomics data.



Spotlight | Metabo*INDICATOR*™



Figure 2. Examples of metabolism indicators applied in human serum. A) An altered ratio of secondary to primary bile acids in serum can reflect an imbalance of the gut microbiota, or dysbiosis, associated with numerous conditions. An elevated DCA/CA ratio has been associated with Alzheimer's disease. B) An increased ratio of total LPCs to total PCs in serum can reflect enhanced PLA2 activity and has been associated with inflammatory conditions like osteoarthritis. Abbreviations: CA: cholic acid, DCA: deoxycholic acid, PLA2: phospholipase A2.

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For more information, please download the <u>MetaboINDICATORTM</u> flyer, visit the <u>MxP[®] Quant 500 product page</u>, or <u>contact us</u>.



Recent Publications

Recent Publications

Recently published papers in metabolomics

- Impact of Bovine Diet on Metabolomic Profile of Skim Milk and Whey Protein Ingredients
- <u>Serum metabolic fingerprinting of pre-lameness dairy cows by GC-MS reveals</u> <u>typical profiles that can identify susceptible cows</u>
- <u>A Metabolomic Study to Identify Potential Tissue Biomarkers for Indomethacin-</u> <u>Induced Gastric Ulcer in Rats</u>
- ¹<u>H-NMR metabolomics profiling of recombinant tobacco plants holding a promoter</u> of a sesquiterpene cyclase
- <u>Profiling nucleotides in low numbers of mammalian cells by sheathless CE-MS in</u> <u>positive ion mode: circumventing corona discharge</u>
- <u>Metabolome and Transcriptome Analysis Reveals Putative Genes Involved in</u> <u>Anthocyanin Accumulation and Coloration in White and Pink Tea (Camellia</u> <u>sinensis) Flower.</u>
- <u>Direct Implementation of Intestinal Permeability Test in NMR Metabolomics for</u> <u>Simultaneous Biomarker Discovery-A Feasibility Study in a Preterm Piglet Model</u>
- <u>LC-MS/MS-based metabolomic analysis of caffeine-degrading fungus Aspergillus</u> <u>sydowii during tea fermentation</u>
- <u>Mass Spectrometric Characterization of Metabolites in Ear Cartilage: Congenital</u> <u>Microtia and Normal Auricle</u>
- <u>Metabolomic profile overlap in prototypical autoimmune humoral disease: a comparison of myasthenia gravis and rheumatoid arthritis</u>
- Newborn metabolomic profile mirrors that of mother in pregnancy.

BIRMINGHAM METABOLOMICS TRAINING CENTRE

30 Mar - 1 Apr 2020

Metabolomics with the Q Exactive

Venue:

Birmingham Metabolomics Training Centre, University of Birmingham, United Kingdom

Overview

This 3-day course introduces you to using the Q Exactive mass spectrometer in your metabolomics investigations. The course is led by experts in the field of metabolomics and includes lectures, laboratory sessions and computer workshops to provide a detailed overview of the metabolomics pipeline applying the Q Exactive mass spectrometer.

Topics Covered

- Introduction to Metabolomics on the Q Exactive, the metabolomics workflow, and case studies using the Q Exactive
- Using the Q Exactive family of instruments in your metabolomics investigations
- Experimental design and the importance of quality control samples
- Sample preparation including polar and non-polar preparation methods on biofluids (urine and plasma) and tissue samples
- Preparation of samples for profiling and targeted analyses on the Q Exactive
- Hands-on data acquisition for profiling and targeted studies, setting up the Vanquish UHPLC coupled to the Q Exactive MS
- Data processing workshop
- Data analysis workshop (univariate and multivariate analysis)
- Introduction to metabolite identification applying Data Dependent Analysis and Data Independent Analysis
- Question and answer session with a panel of experts
- Tips and tricks
- Problem solving

Course link:

https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/ Metabolomics-with-the-Q-Exactive-April-2020.aspx



30 Mar - 2 Apr 2020

Introduction to Metabolomics Analysis

Venue:

European Bioinformatics Institute (EMBL-EBI) - Wellcome Genome Campus, Hinxton, Cambridge, CB10 1SD, United Kingdom

Overview

Application opens: Monday 23 September 2019
Application deadline: Friday 29 November 2019
Participation: Open application with selection
Contact: Meredith Willmott
Registration fee: £650 - Including meals and accommodation

Learn more at https://www.ebi.ac.uk/training/events/2020/introduction-metabolomics-analysis-1



2-3 April 2020

Metabolite identification with the Q Exactive and LTQ Orbitrap

Venue:

Birmingham Metabolomics Training Centre, School of Biosciences, University of Birmingham, Birmingham, UK

Overview

This two-day course will provide a hands-on approach to teach the attendees about the latest techniques and tools available to perform metabolite identification in non-targeted metabolomics studies. The course will be led by experts working within the fields of metabolomics and chemical analysis and will include a significant proportion of hands-on experience of using mass spectrometers, software tools and databases. A maximum of four people will be working on each mass spectrometer in a session. We will apply these tools on the Q Exactive and LTQ-Orbitrap family of mass spectrometers.

Topics Covered

- Importance of mass spectral interpretation
- Types of data which can be collected on the QE and LTQ-Orbitrap (m/z, retention time, MS/ MS, MSn)
- Conversion of raw data to molecular formula and putative metabolite annotations
- MS/MS experiments in metabolic phenotyping for on-line data acquisition using the QE (DDA, DIA, all-ion)
- MS/MS and MSn experiments for sample fractions using the LTQ-Orbitrap
- Mass spectral libraries (using mzCloud)
- Searching mass spectral libraries
- Tools for mass spectral interpretation
- Reporting standards for metabolite identification
- · Question and answer session with the experts

Course link: https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/metabolite-identification.aspx



LIVERPOOL 6-9 April 2020

Spring SciX 2020

Venue: University of Liverpool, UK

Overview

This April (Monday 6th to Thursday 9th) the University of Liverpool is hosting Spring SciX 2020, a satellite meeting of the highly successful Federation of Analytical Chemistry and Spectroscopy Society (FACSS) SciX series, covering a wide range of analytical chemistry research.

Spring SciX will address the exciting interface of the physical sciences with the life sciences and covers developments and applications of many different analytical methods to health & disease, plant sciences and microbiology, as well as many other areas that require measurement - including materials science and chemistry. There is also a focus on metabolomics methods.

There will be opportunities for oral and poster presentations - at all levels from established researchers to early career researchers - with an additional aim for ECRs to help to establish career mentors.

Join leaders in the analytical sciences as they present progress on emergent topics, meet with exhibitors, and network over four days in Liverpool.

We look forward to welcoming you to Liverpool in April 2020.

The Deadline for abstracts is Midnight 29th February 2020.

Registration and Abstracts: https://www.springscix.org/







27-29 April & 7-9 Oct 2020

Introduction to Metabolomics for the Microbiologist

Venue:

Birmingham Metabolomics Training Centre, School of Biosciences, University of Birmingham, Birmingham, UK

Overview

This three-day course introduces how untargeted metabolomics can be applied to study microbial systems in academic and industrial research. The course provides an overview of the metabolomics pipeline, experimental design, sample preparation and data acquisition. The course is led by experts in the field of metabolomics and will include lectures, hands-on laboratory sessions in sample preparation and data acquisition and computer workshops focused on data processing and data analysis.

Topics Covered

- Introduction to metabolomics, both targeted and untargeted approaches
- Experimental design and the importance of quality control samples in untargeted metabolomics
- Analytical strategies applied in metabolomics with a focus on mass spectrometry
- Hands-on laboratory sessions focused on sample preparation and to include metabolic quenching and extraction procedures, intracellular and exometabolome samples and polar and non-polar extraction methods
- Hands-on laboratory sessions focused on sample analysis for untargeted metabolomics studies using an Acquity UPLC coupled to a Xevo QToF mass spectrometer
- · Hands-on workshop focused on data processing and data analysis
- Hands-on workshop focused on an introduction to metabolite identification
- Question and answer session with the experts

Course Link:

April 2020

https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/Introduction-to-Metabolomics-for-the-Microbiologist-April-2020.aspx

October 2020

https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/Introduction-to-Metabolomics-for-the-Microbiologist-October-2020.aspx



28-29 April 2020

Dietary Biomarkers - Where to Next?

Venue:

University College Dublin, Ireland

Overview

This workshop brings together experts from metabolomics, nutritional epidemiology, public health and personalised nutrition. It will focus on dietary biomarkers and health and what is needed in the field and potential future opportunities. The workshop will include open round table discussion for participant interaction.

Workshop Fee: €100 (Light Refreshments & Dinner Included); strictly limited places available. Register Here: <u>https://www.ucdnutrimarkers.com/workshop-2020</u>





6-10 July 2020

Metabolomics 2020

Venue: Shanghai, China

Overview

The 16th Annual International Conference of the Metabolomics Society will be held in Shanghai, China from July 6-10, 2020.

Check back for updates in the coming months at http://metabolomics2020.org.



23-25 Sep 2020

Multiple Biofluid and Tissue Types, From Sample Preparation to Analysis Strategies for Metabolomics

Venue:

Birmingham Metabolomics Training Centre, University of Birmingham, United Kingdom

Overview

This 3-day course provides a theoretical overview and hands-on training to apply multiple sample preparation and UPLC-MS methods to characterise the metabolomes of complex biological samples using the mass spectrometer (Xevo QToF G2-XS - a maximum of 4 people working on the instrument in a session). The course is led by experts in the field who have experience of the analysis of microbial, plant and mammalian samples, and illustrates the different approaches that are available to analyse a range of biological samples and applying complementary liquid chromatography approaches to maximise the coverage of the metabolome.

Topics Covered

- Introduction to dealing with the complexity of biological samples using UPLC-MS
- Overview of different sample collection, sample quenching and sample extraction methods
- The challenges of working with cellular and tissue samples
- Overview of different UPLC methods including HILIC and reversed phase methods
- Hands-on sample preparation of plasma, urine, cell and tissue samples
- Monophasic and biphasic solvent extraction methods to target polar and non-polar metabolites
- SPE and liquid-liquid sample clean-up methods
- · Hands-on HILIC and reversed-phase liquid chromatography
- Hands-on UPLC-MS analysis for untargeted studies (maximum of 4 people)
- Overview of data analysis and metabolite identification
- · Problem solving and tips and tricks session with the experts

Course Links:

September 2020

 $\label{eq:https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/Multiple-biofluid-and-tissue-types-from-sample-preparation-to-analysis-strategies-for-metabolomics-September-2020.aspx$





2-4 Nov 2020

Metabolomics with the Q Exactive

Venue:

Birmingham Metabolomics Training Centre, School of Biosciences, University of Birmingham, Birmingham, UK

Overview

This three-day course introduces you to using the Q Exactive mass spectrometer in your metabolomics investigations. The course is led by experts in the field of metabolomics and includes lectures, laboratory sessions and computer workshops to provide a detailed overview of the metabolomics pipeline applying the Q Exactive mass spectrometer.

Topics Covered

- Introduction to Metabolomics on the Q Exactive, the metabolomics workflow, and case studies using the Q Exactive
- Using the Q Exactive family of instruments in your metabolomics investigations
- Experimental design and the importance of quality control samples
- Sample preparation including polar and non-polar preparation methods on biofluids (urine and plasma) and tissue samples
- · Preparation of samples for profiling and targeted analyses on the Q Exactive
- Hands-on data acquisition for profiling and targeted studies, setting up the Vanquish UHPLC coupled to the Q Exactive MS
- Data processing workshop
- Data analysis workshop (univariate and multivariate analysis)
- Introduction to metabolite identification applying Data Dependent Analysis and Data Independent Analysis
- · Question and answer session with a panel of experts
 - Tips and Tricks
 - Problem Solving

Course link:

https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/ Metabolomics-with-the-Q-Exactive-November-2020.aspx



BIRMINGHAM METABOLOMICS

5-6 November 2020

Metabolite identification with the Q Exactive and LTQ Orbitrap

Venue:

Birmingham Metabolomics Training Centre, School of Biosciences, University of Birmingham, Birmingham, UK

Overview

This two-day course will provide a hands-on approach to teach the attendees about the latest techniques and tools available to perform metabolite identification in non-targeted metabolomics studies. The course will be led by experts working within the fields of metabolomics and chemical analysis and will include a significant proportion of hands-on experience of using mass spectrometers, software tools and databases. A maximum of four people will be working on each mass spectrometer in a session. We will apply these tools on the Q Exactive and LTQ-Orbitrap family of mass spectrometers.

Topics Covered

- Importance of mass spectral interpretation
- Types of data which can be collected on the QE and LTQ-Orbitrap (m/z, retention time, MS/ MS, MSn)
- · Conversion of raw data to molecular formula and putative metabolite annotations
- MS/MS experiments in metabolic phenotyping for on-line data acquisition using the QE (DDA, DIA, all-ion)
- MS/MS and MSn experiments for sample fractions using the LTQ-Orbitrap
- Mass spectral libraries (using mzCloud)
- Searching mass spectral libraries
- · Tools for mass spectral interpretation
- Reporting standards for metabolite identification
- · Question and answer session with the experts

Course link:

https://www.birmingham.ac.uk/facilities/metabolomics-training-centre/courses/2020/Metabolite-identification-with-the-Q-Exactive-and-LTQ-Orbitrap-Elite-November-2020.aspx



Metabolomics Jobs

Metabolomics Jobs & Collaborations

If you have a job you would like posted, please email Ian Forsythe (metabolomics.innovation@gmail.com).

Jobs Offered

Job Title	Employer	Location	Posted	Closes	Source
Research Engineer position in "in vivo Fluxomics for cancer and Human health"	MetaToul- MetaboHUB	Toulouse, France	9-Jan-20	31-Jan-2020	<u>MetaboNews Jobs</u>
Two postdoctoral fellowships	Università Cattolica del Sacro Cuore	Piacenza, Italy	8-Jan-20		<u>MetaboNews Jobs</u>
Various positions			8-Jan-20		<u>Metabolomics</u> <u>Association of North</u> <u>America Jobs</u>
Pos-Doc Fellowship, School of Pharmaceutical Science	University of São Paulo	São Paulo, Brazil	20-Dec-19	Until filled	<u>Metabolomics</u> <u>Society Jobs</u>
Postdoctoral position in meta-metabolomic: CRIOBE	Université de Perpignan	Perpignan, France	13-Dec-19	28-Feb-20	<u>Metabolomics</u> <u>Society Jobs</u>
Postdoctoral position in Dr. Andres-Lacueva's group	University of Barcelona	Barcelona, Spain	5-Dec-19	Until filled	<u>Metabolomics</u> <u>Society Jobs</u>
Postdoctoral Fellow in Metabolomics	Wake Forest University Health Sciences	Winston- Salem, NC, USA	20-Nov-19	Until filled	<u>Metabolomics</u> <u>Society Jobs</u>
Business Development Manager - (Western USA)	Biocrates Life Sciences	US based	12-Feb-19	Until filled	Biocrates
Postdoctoral Researcher Position Microbial Metabolomics	Friedrich Schiller University Jena	Jena, Germany	7-Oct-19		Friedrich Schiller University Jena
Assistant Research Professor	Penn State University	University Park, PA, USA	23-Sep-19	Until filled	<u>Metabolomics</u> <u>Society Jobs</u>
Postdoctoral Fellow, GC- MS Metabolomics	Wake Forest University Health Sciences	Winston- Salem, NC, USA	7-Sep-19	Until filled	<u>Wake Forest</u> <u>University Health</u> <u>Sciences</u>
Senior Scientific Officer	The Cancer Research UK Beatson Institute	Bearsden, Glasgow, UK		14-Feb-2020	Beatson Institute



Metabolomics Jobs

Jobs Wanted

This section is intended for very highly qualified individuals (e.g., lab managers, professors, directors, executives with extensive experience) who are seeking employment in metabolomics.

We encourage these individuals to submit their position requests to Ian Forsythe (<u>metabolomics.innovation@gmail.com</u>). Upon review, a limited number of job submissions will be selected for publication in the Jobs Wanted section.

• Seeking New Challenges in Metabolomics