



# nutrishield

Welcome to the second  
**NUTRISHIELD e-Bulletin!**

Issue 2 / September 2020

## In this issue

- Welcome
- Project Overview
- Latest articles  
in our blog
- Scientific Publications

## Key Facts

Grant Agreement:

No 818110

Call:

H2020-SFS-2018-1

Start date:

01 November 2018

Duration:

48 months

Coordinator:

Alpes Lasers SA



## Project Overview

**NUTRISHIELD** is an innovative solution, providing personalised nutrition advice and support that will assist people in achieving their optimal health and well-being and adopting long-term healthy and sustainable diets.

**NUTRISHIELD** aims to integrate laboratory techniques, methodologies, ICT devices & applications, algorithms and other components into one platform and validate it in clinical conditions.



## The Challenge

To create a platform that

- promotes safe food for the population,
- enables consumers to make informed choices and
- ensures that the proposed choices will have good chances of being adopted

Assist consumers understand:

- why each food is being suggested,
- what implications each choice may have on their health



## Expected Impact

- Empowered consumers able to make healthy and sustainable dietary choices
- Personalised diets upon scientific-based dietary assessment and advice
- Increased consumer trust in personalised nutrition advice and/or support
- Prevention of diet-related and non-communicable diseases
- Quality of life, health and safety of the citizens

## Latest Articles in Our Blog

### Technology assisted means for weight management interventions in children - benefits and risks

Obesity rates have been rising to alarmingly high levels during the last decade, especially among young populations, i.e. children and adolescents (1). Recently, it has been proposed that the use of technology means may serve as a valuable tool for supplementing or conducting weight management interventions in children (2).

[Read the full post](#)



### Novel laser technology to serve the need for personalised nutrition for the young

At first sight, lasers and personalised nutrition are two unrelated topics. A new approach, however, implemented within the EU funded project **NUTRISHIELD** brings significant benefits to novel nutrition approaches by taking advantages of recent developments in laser technology.

[Read the full post](#)



### Impact of mother's diet on human milk composition and growth of preterm infants

For the favourable development and growth of preterm infants, optimum nutrition is crucial in the early stage of life. The digestive system of preterm infants is immature, and they are prone to suffer from severe diseases such as necrotizing enterocolitis during the neonatal period.

[Read the full post](#)



### Novel analyser based on photonics technology assists personalised nutrition

Personalised nutrition is based on specific information about the person the nutrition is for. This specific information may include data which can easily be recorded such as e.g. weight and size, but could include other data, which are more specific to the person, such as information about genetics or biome.

[Read the full post](#)

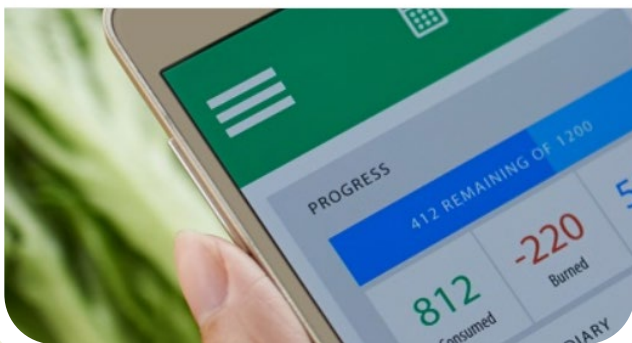




### **NUTRISHIELD Human Milk and Urine Analyser – easy to use alternative to conventional methods**

Nutrition is a topic, which surrounds us everywhere we go. People are getting more aware of what they should eat and what is healthy or not. However, metabolism is not a universal code that is applicable to the whole population.

[Read the full post](#)



### **Method development for NUTRISHIELD Human Milk and Urine Analyser**

One of the major milestones within the **NUTRISHIELD** project are the novel laser-based analysers, allowing fast measurement of clinically relevant parameters in urine and human milk. Before the analyser prototypes will be implemented, comprehensive method development to specify the framework for hardware development is conducted by Technische Universität Wien.

[Read the full post](#)

### **The Diet - Gut microbiome - Breath Axis**

From the time of Hippocrates, physicians used the body odours as effective means of identifying health issues and diagnosing some diseases. Nowadays, the modern breath analysis has connected these odours with specific volatile metabolites (some established as biomarkers) or profile of several metabolites.

[Read the full post](#)





## Our Publications

**Title:** VarGen: an R package for disease-associated variant discovery and annotation, Bioinformatics

**Authors:** Corentin Molitor, Matt Brember, Fady Mohareb

**Link:** <https://doi.org/10.1093/bioinformatics/btz930>

### Summary

Over the past decade, there has been an exponential increase in the amount of disease-related genomic data available in public databases. However, this high-quality information is spread across independent sources and researchers often need to access these separately. Hence, there is a growing need for tools that gather and compile this information in an easy and automated manner. Here, we present 'VarGen', an easy-to-use, customizable R package that fetches, annotates and rank variants related to diseases and genetic disorders, using a collection public databases (viz. Online Mendelian Inheritance in Man, the Functional Annotation of the Mammalian genome 5, the Genotype-Tissue Expression and the Genome Wide Association Studies catalog). This package is also capable of annotating these variants to identify the most impactful ones. We expect that this tool will benefit the research of variant-disease relationships.




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**Title:** The validity of technology-based dietary assessment methods in childhood and adolescence: a systematic review

**Authors:** Kouvari M, Mamalaki E, Bathrellou E, Poulimeneas D, Yannakoulia M, Panagiotakos DB.

**Link:** <https://doi.org/10.1080/10408398.2020.1753166>

### Abstract

Technology-based dietary assessment has promising benefits on improving accuracy and reducing cost of dietary data collection. The validity of technology-based tools in children/adolescents was examined. A systematic literature search was performed to identify studies published till September 2019. In total, 26 studies with 29 validation-related estimations were selected; 13 web-based 24-h dietary recalls (image assisted; n = 12, drop-down food list; n = 13), 4 mobile applications and 3 web-based dietary records (image based; n = 2 and image assisted; n = 1, drop-down food list; n = 3) and 6 web-based food frequency questionnaires (FFQs) (image assisted; n = 3). Fourteen studies were addressed to adolescents, ten studies to children (principally 9–11 years old) and two studies to mixed study samples. Validation was mostly performed through 24-h dietary recalls and dietary records while in some cases objective methods were used. Image-assisted 24-h dietary recalls presented good level of agreement with paper-based methods, yet principally in adolescents. Mobile-application dietary records with image-based facilities and drop-down food lists were found to accurately record dietary intake even when compared with objective methods. FFQs, mainly examined in adolescents, had good level of agreement with the "gold standard" dietary records method. The validity of technology-based methods could be supported yet various technical/ methodological issues need better clarification.

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**Title:** Feeding the preterm infant: an overview of the evidence

**Authors:** Poulimeneas D, Bathrellou E, Antonogeorgos G, et al.

**Link:** <https://doi.org/10.1080/09637486.2020.1754352>

### Abstract

Feeding from own mother's milk is not always an option for preterm infants, and choosing between alternative means of feeding should be made in light of their effect on infants' health. In this work, we aimed to present evidence regarding feeding pre-term infants with human milk, either own mother's or donor milk (DM), and the potential effects on growth and other health related outcomes. Exclusive breastfeeding (BF) remains the optimal option, whereas feeding with DM as a sole diet or supplemental to maternal milk confers immunological advantages and fewer rates of necrotising enterocolitis against preterm formula

feeding, yet the latter results in greater growth velocity. Literature gaps in the use of DM, practical suggestions for choosing suitable feeding means (i.e. continuous support of BF, adequate education regarding feeding preterm infants, including DM), and future perspectives on the potential effects of dietary manipulations of the maternal diet, are also discussed.

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**Title:** Current Practice in Untargeted Human Milk Metabolomics

**Authors:** Ten-Doménech, I.; Ramos-Garcia, V.; Piñeiro-Ramos, J.D.; Gormaz, M.; Parra-Llorca, A.; Vento, M.; Kuligowski, J.; Quintás, G.

**Link:** <https://doi.org/10.3390/metabo10020043>

#### Abstract

Human milk (HM) is considered the gold standard for infant nutrition. HM contains macro- and micronutrients, as well as a range of bioactive compounds (hormones, growth factors, cell debris, etc.). The analysis of the complex and dynamic composition of HM has been a permanent challenge for researchers. The use of novel, cutting-edge techniques involving different metabolomics platforms has permitted to expand knowledge on the variable composition of HM. This review aims to present the state-of-the-art in untargeted metabolomic studies of HM, with emphasis on sampling, extraction and analysis steps. Workflows available from the literature have been critically revised and compared, including a comprehensive assessment of the achievable metabolome coverage. Based on the scientific evidence available, recommendations for future untargeted HM metabolomics studies are included.

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**Title:** Generation of IR Spectroscopy: EC-QCL based mid-IR Transmission Spectroscopy of Proteins with Balanced Detection

**Authors:** Christopher Karim Akhgar, Georg Ramer, Artur Trainerowicz, Jaroslaw Pawuczyk, Andreas Schwaighofer, Bernhard Lendl

**Link:** <https://pubs.acs.org/doi/abs/10.1021/acs.analchem.0c01406>

#### Abstract

We report a mid-IR transmission setup for the analysis of the protein amide I and amide II band in aqueous solutions that achieves a limit of detection as low as 0.0025 mg mL<sup>-1</sup> (outperforming our previous results and other state-of-the-art mid-IR-based techniques by almost an order of magnitude). This large improvement is made possible by combining the latest-generation external cavity-quantum cascade laser (EC-QCL) operated at room temperature with an optimized double-beam optical setup that adjusts the path length (26 μm) to ensure robust sample handling. For minimizing the noise introduced by the high-intensity laser light source, a thermoelectrically cooled mercury cadmium telluride balanced detection module was employed. In this way, noise levels better by a factor of up to 20 were achieved compared with single-channel measurements. Characteristic spectral features of proteins with different secondary structures were successfully identified at concentrations as low as 0.1 mg mL<sup>-1</sup>. Furthermore, a highly linear response was demonstrated for concentrations between 0.05 and 10 mg mL<sup>-1</sup>. The total acquisition time of the setup can be adapted to fulfill the required sensitivity of the protein measurements and to ensure maximum flexibility for future applications. The presented setup combines high sensitivity, large optical path lengths, and short measurement times and thus outperforms previous research type EC-QCL setups as well as commercially available instruments. This opens a wide range of future applications including protein–ligand interaction studies as well as qualitative and quantitative analyses of proteins in complex matrices such as those found in up- and downstream bioprocess monitoring and similar challenging applications which can not be readily met by conventional FT-IR spectroscopy.

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[www.nutrishield-project.eu](http://www.nutrishield-project.eu)

**Title:** Effect of donor human milk on host-gut microbiota and metabolic interactions in preterm infants

**Authors:** José David Piñeiro-Ramos, Anna Parra-Llorca, Isabel Ten-Doménech, María Gormaz, Amparo Ramón-Beltrán, María Cernada, Guillermo Quintás, María Carmen Collado, Julia Kuligowski, Máximo Vento

**Link:** [doi.org/10.1016/j.clnu.2020.08.013](https://doi.org/10.1016/j.clnu.2020.08.013)

### Summary

**Background & aims:** Human milk is the gold standard for infant nutrition. Preterm infants whose mothers are unable to provide sufficient own mother's milk (OMM), receive pasteurized donor human milk (DHM). We studied metabolic signatures of OMM and DHM and their effect on the interplay of the developing microbiota and infant's metabolism.

**Methods:** Metabolic fingerprinting of OMM and DHM as well as infant's urine was performed using liquid chromatography–mass spectrometry and the infant's stool microbiota was analyzed by 16S rRNA sequencing.

**Results:** Significant differences in the galactose and starch and sucrose metabolism pathways when comparing OMM and DHM, and alterations of the steroid hormone synthesis and pyrimidine metabolism pathways in urine were observed depending on the type of feeding. Differences in the gut-microbiota composition were also identified.

**Conclusion:** The composition of DHM differs from OMM and feeding of DHM has a significant impact on the metabolic phenotype and microbiota of preterm infants. Our data help to understand the origin of the observed changes generating new hypothesis: i) steroid hormones present in HM have a significant influence in the activity of the steroid hormone biosynthesis pathway in preterm infants; ii) the pyrimidine metabolism is modulated in pre-term infants by the activity of gut-microbiota. Short- and long-term implications of the observed changes for preterm infants need to be assessed in further studies.



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