







## MRC-PHE/ Exposomics Short Course Stat-XP

Statistical approaches to characterize the exposome from **OMICs platforms** 

**Overview and Perspectives** 



Monday 7th to Friday 11th December, 2015, London, United Kingdom:

Royal Statistical Society (Old Street)

## MRC-PHE Centre for Environment & Health





Imperial College





#### **COURSE OUTLINE**

**STAT XP** is an introductory short course to statistical models required to explore environmental drivers of disease risk and the way their effect is biologically mediated using high throughput data from well-established OMICs platforms. Main OMICs data includes genetic, transcriptomic, metabonomics and epigenetics profiles.

After introducing the concept of the exposome and its practical implementation, the course will provide an in-depth description of the OMICs data, their features, and the challenges their statistical analysis raises.

Stat XP will also propose a series of lectures describing the main statistical methods used in molecular epidemiology. These include univariate models and multiple testing correction strategies (FWER, FDR), dimension reduction techniques, and variable selection approaches.

Corresponding seminars will show how these methods are used in practice, and computer-based practical sessions will give the students the opportunity to use and get familiar with the well-established software/packages enabling such analyses. Finally, we will describe methodological perspectives to improve the analysis of OMICs data in the context of the exposome.

### Course Objectives

**STAT XP** will enable research professionals to better understand the growing literature relying on the analysis of OMICs data. Participants will be able to run their own analyses at the end of the course (readily usable scripts from practicals will be provided). This should open doors to the implementation of novel studies building upon existing underexploited data or publicly available databases. Potentially interested audience ranges from academics with statistical/biological/clinical backgrounds, to non-academics with interests in risk stratification.

## Course Accreditation

**STAT XP** is integrated in the teaching activities of the MRC-PHE Centre for Environment and Health. It is also part of the dissemination activities of the statistical workpackage of the FP7 Exposomics project, co-led by ICL and Utrecht University. The course is done in rotation the Molecular Epidemiology Course at Utrecht University (one first edition in 2013, and a second in 2015). The first London-based Stat-XP successfully took place in December 2014.

# COURSE FORMAT

**STAT XP** wil take place at the Royal Statistical society in London 7<sup>th</sup>-11<sup>th</sup> December, 2015.

The course comprises 4 and ½ days teaching that articulated as follows: the day starts with lectures introducing the theoretical concepts. These are subsequently illustrated on the same day by a seminar and practical.

Throughout the week, several lunchtime seminars will be given to illustrate the practical use, validity, strength of the methods presented in the course.









## SPECIFIC LEARNING OUTCOMES

After STAT-XP, students will:

- Be familiar with the exposome concept
- Understand the main statistical issues raised by the molecular characterisation of the internal exposome
- Know what are the main OMICs data routinely available, what they measure, and what are their main features, and what statistical challenge they raise
- Know what are the main types of approaches available to analyse OMICs data
- Be able to independently implement, run and interpret such analyses using R software
- Be familiar with the main limitations and complementarity of the wellestablished methods
- Understand future direction of statistical research for exposome characterisation

# TARGET AUDIENCE

**STAT XP** will be of interest to academics (students, and researchers), and scientists from the industry (pharmaceutical companies, insurance companies, food industries...). No prior knowledge is required, but experience in basic statistics, and use of statistical software (preferably R) is desirable. Participants should bring their own laptops.

Up to 60 participants can register

### REGISTRATION/FEES

**REGISTRATION** can be done online:

https://fomcoursebookings.ic.ac.uk/stat-xp-2015.html

For any question please send an email to:

m.chadeau@imperial.ac.uk

#### Course fees:

Early bird registration (until October 1st 2015)

Academic: £1,000 Non-academic: £1,500 Standard registration Academic: £1,200 Non-academic: £1,800

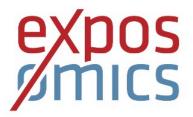
LOCATION

TEACHING will take place at the Royal Statistical Society (Old Street, London).









#### **CONTRIBUTORS**

#### IMPERIAL COLLEGE LONDON (UK):

**PROF PAUL ELLIOTT,** Professor of Epidemiology and Public Health Medicine, Head of Dept of Epidemiology and Biostatistics. Director of MRC-PHE Centre for Environment and Health.

**PROF PAOLO VINEIS,** Professor of Environmental Epidemiology. Dept of Epidemiology and Biostatistics. Adjunct Professor, Columbia University, NYC – USA.

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DR TIM EBBELS, Reader in Computational Bioinformatics, Dept of Surgery & Cancer DR GIANLUCA CAMPANELLA, Research Fellow, Dept of Epidemiology and Biostatistics DR RAPHAËLE CASTAGNÉ, Research Associate, Dept of Epidemiology and Biostatistics DR FLORENCE GUIDA, Research Associate, Dept of Epidemiology and Biostatistics

#### **UTRECHT UNIVERSITY (NL):**

**DR ROEL VERMEULEN**, Associate Professor, Institute for Risk Assessment Sciences. Honorary Professor, Imperial College London.

#### UNIVERSITY OF PAU (FR):

PROF BENOÎT LIQUET, Professor in Statistics, University of Anglet

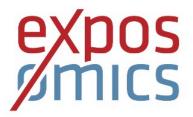
#### INTERNATIONAL AGENCY FOR RESEARCH ON CANCER (FR):

DR PIETRO FERRARI, Nutritional Epidemiology Group









### **PROGRAMME**

## DAY 1 Monday 07/12- Introduction to the Exposome concept, Omics data:

9.15-09:45 WELCOME AND REGISTRATION

9.45-10:00 Introduction: Overview of the course - Presentation of the speakers

Speaker: M Chadeau-Hyam

**10:15-11:00 LECTURE 1:** 'The exposome concept: origin and implementations'

Speaker: P Vineis

11:00-12:00 LECTURE 2: 'OMICs data in practice: introduction to OMICs platforms'.

Speaker: G Campanella

12:15-13:00 Lunch Seminar: 'The Benzene example: from OMICs to Policy'

Speaker: R Vermeulen

13:30-15:00 Lecture 1: '\*-WAS: univariate approaches – multiple testing correction

strategies - modelling nuisance variation'

Speaker: M Chadeau-Hyam

15:00-17:30 PRACTICAL: 'Introduction to R - Handling OMICs data in R'

Tutor: F Guida / G Campanella

## DAY 2 Tuesday 08/12/2015- Statistical Analyses of Omics data:

#### **MULTIVARIATE MODELS**

09:30-11:00 Lecture 1: 'Introduction to multivariate approaches: dimension reduction

and variable selection' Speaker: M Chadeau-Hyam

11:15-12:00 LECTURE 2: 'Introduction to pathway analyses'

Speaker: R Castagné

12:30-13:15 Lunch Seminar: 'Epigenetic markers of smoking'

Speaker: F Guida

14:00-17:30 Practical: 'Performing \*WAS using R'

Tutors: G Campanella; R Castagné





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#### **PROGRAMME**

### DAY 3 WEDNESDAY 09/12/2015- TUTORIALS - MULTIVARIATE MODELS

**09:30-10:30 LECTURE 1:** 'A tutorial for penalized regression models'

Speaker: B Liquet

11:00-12:30 LECTURE 2: 'A tutorial for PLS and Bayesian Variable Selection'

Speaker: B Liquet

13:00-13:45: Lunch Seminar 'PLS and mediation analyses applied to metabolomics'

Speaker: P Ferrari

### DAY 4 THURSDAY 10/12/2015 - OMICS INTEGRATION

09:30-10:15 Lecture 1: 'OMICs integration: rationale and statistical needs'

Speaker: M Chadeau-Hyam

**10:15-11:00 LECTURE 2:** 'Introduction to network models'

Speaker: G Campanella

11:15-12:00 LECTURE 3: 'Differential networks in practice'

Speaker: T Ebbels

13:00-13:45: LUNCH SEMINAR 'Sparse and sparse group extensions of PLS models'

Speaker: B Liquet

14:00-17:30 Practical: 'Using variable selection in R'

Tutors: F Guida / B Liquet

## DAY 5 FRIDAY 11/12/2015 - WRAP-UP/PERSPECTIVES

09:00-13:00 PRACTICAL: 'Real-case analysis of omics data'

Tutors: G Campanella, B Liquet, R Castagné

13:30-14:15 Lunch Seminar 'Exposome research in the MRC-PHE Centre for Env &

Health'

Speaker: P Elliott

**14:30-15:15 S**EMINAR: 'Emerging data and guestion in the exposome field'

Speaker: R Vermeulen

**15:30-16:15 Seminar: 'From exposome to Mechanome'** 

Speaker: M Chadeau-Hyam

16:15 -16:45 WRAP-UP SESSION: Q & A





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## Maps/Directions

ROYAL STATISTICAL SOCIETY

VENUE: LECTURE THEATRE (1<sup>ST</sup> FLOOR) — CHAMBERS ROOM
CLOSEST TUBE STATIONS: OLD STREET / BARBICAN / MOORGATE

