

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)

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 will take place at the Royal Statistical society in London 7th-11th 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 well-established 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.

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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

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 SEMINAR: 'Emerging data and question 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

MAPS/DIRECTIONS

ROYAL STATISTICAL
SOCIETY

VENUE: LECTURE THEATRE (1ST FLOOR) – CHAMBERS ROOM

CLOSEST TUBE STATIONS: OLD STREET / BARBICAN / MOORGATE

