



# Principles and dynamics governing transmission of mycobacterial infection

Symposium and Workshop

22 – 24 May 2018

Wageningen University, The Netherlands

# Symposium, 22 May 2018: Preliminary programme

**Venue:** Wageningen Campus, Zodiac building number 122. Room A0107.

| Time  | Speaker   | Topic   |
|-------|---|---|
| 9:00  | Ynte Schukken<br>(WUR, NL)                                    | Welcome   |
| 9:05  | Yrjö T. Gröhn<br>(Cornell, USA)                               | US-UK Collab.: Mycobacterial Transmission Dynamics in Agricultural Systems  |
| 9:20  | Rowland R. Kao & Liliana Monteiro Salvador<br>(Edinburgh, UK) | <b>Review</b> Using pathogen sequence data to interpret <i>M. bovis</i> dynamics in a multi-host system                                 |
| 10:00 | Suelee Robbe-Austerman<br>(USDA, USA)                         | Use of WGS to track mycobacterial transmission, and the World <i>M. bovis</i> WGS sequencing project                                    |
| 10:20 | <b>Coffee break</b>   |   |
| 10:50 | Vivek Kapur<br>(Penn State University)                        | <b>Review</b> Accelerating control of bTB in developing countries   |
| 11:30 | Adrian Muwonge<br>(Edinburgh, UK)                             | <i>Mycobacterium bovis</i> evolution & history in Africa: Lessons for future control strategies   |
| 11:50 | Mart de Jong<br>(WUR, NL)                                     | Design and analysis of trails to quantify vaccination against <i>M. bovis</i> in the field and in experimental settings                 |
| 12:10 | Inma Aznar<br>(UCD, IE)                                       | Infection dynamics and effective control options of <i>M. bovis</i> in cattle and badgers in Ireland                                    |
| 12:30 | <b>Lunch break</b>  |   |
| 13:20 | Dick van Soolingen<br>(RIVM, NL)                              | <b>Review</b> Advances in the use of Whole Genome Sequencing of <i>Mycobacterium tuberculosis</i> to study transmission of tuberculosis |
| 14:00 | Maarten Weber<br>(GD, NL)                                     | Milk quality assurance for paratuberculosis: efficacy of on-farm control  |
| 14:20 | Scott Wells<br>(UMN, USA)                                     | Use of WGS to inform transmission of MAP  |
| 14:40 | Yuanyuan Wang<br>(UMN, USA)                                   | Compute strain proportions from mixture samples of Mycobacterial diseases to improve transmission inference                             |
| 15:00 | <b>Coffee break</b>   |   |
| 15:30 | Ad Koets<br>(WUR, NL)   | The time of their life: cellular dynamics and <i>Mycobacterium avium</i> ssp. <i>paratuberculosis</i> (MAP) infection in ruminants.     |
| 15:50 | Annette Nigsch<br>(WUR, NL)                                   | Who infects whom - within host and within farm dynamics of MAP infection using WGS  |
| 16:10 | Rebecca Lee Smith<br>(Univ. of Illinois, USA)                 | Introduction into agent based models and economics  |
| 16:40 | Ynte Schukken   | <b>Summarizing discussion</b>   |
| 17:00 | Ynte Schukken   | <b>Closing remarks, drinks</b>  |

# Workshop, 23 - 24 May 2018: Preliminary programme

The workshop consists of three individual half-day workshop sessions. Each workshop session focusses on a cutting-edge methodology and starts with a key lecture on a recent paper. The key lecture is followed by a practical session where participants will be trained hands-on in the use of selected methods to model mycobacterial disease transmission.

## Workshop session 1

Title: Introduction to bacterial phylodynamics and cross-species transmission

Content: The purpose of this workshop is to introduce participants to the concept of bacterial phylodynamics and give them hands on experience in creating phylogenetic trees from genomic data to infer the dynamics and structure of pathogen populations. Some theoretical concepts on bacterial phylodynamics and current research on cross-species transmission at the wildlife/livestock interface will be presented. Participants will have the opportunity to run their own analysis on the publicly available software "Bayesian evolutionary analysis by sampling trees (Beast2)" with provided mycobacteria sequence datasets.

Learning objectives:

- Understand the concept of bacterial phylodynamics
- Learn how to estimate mycobacteria evolutionary rates and how they differ from RNA virus evolutionary rates
- Determine cross-species transmission parameters
- Get familiarised with the software beast2

## Workshop session 2

Title: Reconstruction of transmission trees in an endemic phase of *Mycobacterium avium* subsp. *paratuberculosis* (MAP) infection in dairy herds by use of sequence data

Content: The purpose of this workshop is to introduce participants to the concepts of phylogenetic networks to evaluate individual-level transmission chains of MAP in dairy herds. The question "who infects whom" will be approached by the best possible combination of epidemiological data and sequence data to inform transmission networks. The challenge is to model an endemic disease situation with multiple infection chains going on in parallel. Participants will get hands on training on the SeqTrack algorithm (implemented in the *adegenet* package in R), with provided datasets of MAP sequences and epidemiological data.

Learning objectives:

- Better understand the complex transmission dynamics of mycobacterial disease in endemic situations
- Identify individual-level transmission chains ("who infects whom")
- Become familiar with the SeqTrack algorithm

## Workshop session 3

Title: Building agent based models of disease control incorporating economic and policy elements

Content: The purpose of this workshop is to introduce workshop participants to the concept of agent based modeling, and give them hands on experience in constructing simple agent models using the software NetLogo as the modeling language. The concept of agent modeling will be introduced and some current research using agent models to study disease control in dairy herds will be presented. Then each workshop participant will have the opportunity to do some hands on modeling.

Learning objectives:

- Become familiar with the concept of agent based modeling
- Understand the benefits of agent based modeling over other modeling approaches, including compartment based modeling
- Understand the procedure of incorporating economic components into livestock models

## Schedule

Due to high interest in the workshop, participants will be split into two groups:

Workshop sessions for **Group 1**: 23 May morning + afternoon, **24 May morning (finish: 12:30)**.

Workshop sessions for **Group 2**: 23 May morning + afternoon, **24 May afternoon (finish: 16:30)**.

| Group          | Session 1         | Session 2       | Session 3         |
|----------------|-------------------|-----------------|-------------------|
| <b>Group 1</b> | 23 May, morning   | 24 May, morning | 23 May, afternoon |
| <b>Group 2</b> | 23 May, afternoon | 23 May, morning | 24 May, afternoon |

## Tutors and responsible for the scientific content

- Kristina CERES, DVM/PhD student, Cornell University College of Veterinary Medicine, Ithaca, USA
- Yrjö GRÖHN, Professor of Epidemiology, Cornell University College of Veterinary Medicine, Ithaca, USA
- Rowland R. KAO, Professor of Veterinary Epidemiology and Data Science, Royal (Dick) School of Veterinary Studies, University of Edinburgh, UK
- Annette NIGSCH, Postdoctoral associate, Quantitative Veterinary Epidemiology, Wageningen University, NL
- Liliana SALVADOR, Research Fellow, Royal (Dick) School of Veterinary Studies, University of Edinburgh, UK
- Ynte SCHUKKEN, Professor of Management of Farm Animal Health, Quantitative Veterinary Epidemiology, Wageningen University, NL
- Rebecca SMITH, Assistant Professor of Epidemiology, University of Illinois, College of Veterinary Medicine, Urbana, USA
- Loren TAUER, Professor, Dyson School of Applied Economics and Management, Cornell SC Johnson College of Business, Cornell University, Ithaca, USA
- Leslie VERTERAMO CHIU, Research Associate, Cornell University College of Veterinary Medicine, Ithaca, USA

**Credit points:** 1 ECTS (20 hours supervised lectures and practicals, 10 hours preparatory time by self-study).

Participants will receive a certificate of attendance.

## Workshop materials (to be provided beforehand)

- Workshop lecture notes.
- Exercises and test data for group practice and discussion.
- A supplementary reading list.

## Local organisers

- Ynte SCHUKKEN, Professor of Management of Farm Animal Health, WUR
- Annette NIGSCH, Postdoctoral associate, WUR

Point of contact for the organisation: Annette Nigsch: [annette.nigsch@wur.nl](mailto:annette.nigsch@wur.nl)

## Sponsors and supporters

The symposium and workshop are funded in part by USDA-NIFA AFRI grant # 2014-67015-2240 and BBSRC award # BB/M01262X/1 as part of the joint USDA-NSF-NIH-BBSRC-BSF Ecology and Evolution of Infectious Diseases program.



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Programme Version: 19 Mar 2018.

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