



## MSc internship at EPICx lab

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### Epidemics on temporal networks with application to livestock diseases.

Our understanding of infectious disease prevention and control is rooted in the theory of host population transmission dynamics. The pattern of host-to-host contacts along which transmission can occur drives the epidemiology of infectious diseases, determining how quickly they spread and who gets infected. Network epidemiology has made great progress in this area in the last decades, moving from homogeneous approximations to networked patterns that allow for the integration of the variation of contacts over time [1-4]. An intense activity currently focuses on the role of specific structural and temporal properties of the time-evolving contact network that are critical for disease transmission. The MSc internship will focus on these aspects through a data-driven application to livestock infections [5-7]. Data is available that trace cattle movements as they are sold/purchased between premises over time. It can be represented in the form of a spatial and temporally resolved network of directed contacts between farms. Though vital to the food chain, such trade may however contribute to the introduction of exotic diseases or maintenance of endemic diseases with large incurred costs. Understanding the impact of specific trade dynamics on disease circulation would thus improve our preparedness and control. The student will analyze a national dataset of cattle trade movement to identify specific patterns related to cattle managing practices (pastures, markets) and evaluate how they affect the disease dynamics. The work will involve analytical approaches for the study of the critical behavior of the system, as well as data-driven numerical simulations of the epidemic process.

*Requirements:* good programming skills, experience in numerical simulations, strong background in statistical physics and applied maths, enthusiasm and motivation.

*Plus:* experience with data, with complex systems/networks analysis and modeling, with modeling of diffusion/spreading processes.

*To apply:* send a cover letter describing your research interests and qualification for the internship and a CV detailing your exams with marks to [vittoria.colizza@inserm.fr](mailto:vittoria.colizza@inserm.fr)

The internship offers the possibility to continue with a PhD program along the outlined research direction.

- [1] Giesecke J (2002) *Modern infectious disease epidemiology*. 2nd ed. London: Arnold.
- [2] Bansal S, Grenfell BT, Meyers LA (2007) *Journal of The Royal Society Interface* 4(16):879–891.
- [3] Masuda N, Holme P (2013) *F1000Prime Reports* 5 (2013).
- [4] Petter Holme. *The European Physical Journal B*, 88(9):234, Sep 2015
- [5] Bajardi P, Barrat A, Natale F, Savini L, Colizza V (2011) PLOS ONE, 6(5):e19869
- [6] Bajardi P, Barrat A, Savini L, Colizza V (2012) J Roy Soc Int
- [7] Valdano E, Poletto C, Giovannini A, Palma D, Savini L, Colizza V (2015) *PLoS Comput Biol* 11(3): e1004152