



A One Health approach of host-pathogen interactions

Delphine Destoumieux-Garzón - Jérôme Boissier

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Scientific objectives

Human populations increase, industrialization, and geopolitical problems have accelerated global changes causing significant damage to biodiversity, extensive deterioration of ecosystems, and considerable migratory movement of both mankind and species in general. These rapid environmental changes have promoted the emergence and re-emergence of infectious diseases over the past decade. With the spread and emergence of epizootics, zoonoses, and epidemics, the risks of pandemics became more and more critical. This highlights the increasing globalization of health risks and the importance of the human–animal–ecosystem interface in the evolution and emergence of pathogens. It is now urgent to improve our knowledge on the consequences of human activities, lifestyles, and behaviors on ecosystems for a better understanding of disease dynamics and to drive public policies. Therefore **we aim at deciphering the factor driving the emergence of infectious diseases through holistic, multi-disciplinary and multiple scale approaches.**

The emergence and re-emergence of infectious diseases are closely linked to the biology and ecology of infectious agents, their hosts, and their vectors. Therefore, our research efforts are directed towards **a comprehensive understanding of ecosystem dynamics that informs on the processes leading to the occurrence or the recurrence of infectious agents, and their dissemination and extinction in natural habitats.** This is made possible thanks to a close collaboration with (i) shellfish farmers, ecologists and survey networks for diseases affecting marine invertebrates, or (ii) physicians, veterinaries, ecologists, livestock breeders, wildlife management organisations and public health institutions from endemic areas for Human and/or animal pathogens.

The genomes of microorganisms (virus, prokaryotes and eukaryote) evolve in their natural environment through mutation, recombination, horizontal transfer and hybridization. Some genotypes, which acquire higher fitness, are selected in the environment and eventually cause damages to (new) hosts. Therefore, we aim at **elucidating the life cycles of pathogens, transmission pathways and the molecular mechanisms underpinning transgression of species barriers.** We also direct our research efforts towards **a better knowledge of the intra-host and inter-host dynamics of pathogens in natural habitats** and the future development of **models recapitulating the complexity of diseases under environmental constraint.**

Link to Major Themes of Research of TULIP

This project essentially falls into MTR2 “organism-organism interactions” and MTR3 “Environment effect on interactions between organisms” as it will provide examples of emergence of diseases in both humans and animal species. Here the environment will be considered in its broad complexity, by embracing not only its biotic and abiotic components but also social/economical factors often neglected.

Working forces involved in the project

3.5 ETP, 2 non-permanent staffs