

# Vector and vector-borne disease research: need for coherence, vision and strategic planning

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Mosquitoes and other blood-feeding arthropods are vectors of serious parasitic, viral or bacterial diseases, the most devastating of which are malaria and dengue, which together cause over 300 million cases and kill over one million people every year. Vector-borne diseases (VBDs) have devastated Europe in the past but have been either eliminated or reduced to only sporadic cases in the second half of the last century. However, in the last few years, we have witnessed a significant increase in the frequency of VBD cases and outbreaks, and the risk of resurgence now looks ever more probable. The lack of vaccines and other effective prevention for most VBDs and the complexity of the disease lifecycles require highly integrated approaches that target the disease transmission system rather than only the pathogens. The current issue of *Pathogens & Global Health* is dedicated to vector and VBD research, with the opportunity of reporting the Mosquito Kolymbari Meeting, the most important meeting in the field, held on 15–19 July 2013 at the Orthodox Academy of Crete.

The Mosquito Kolymbari Meeting was established as part of the EMBO conference series portfolio in 2003. At that time many of the original milestones, set as part of the MacArthur Foundation initiative some 15 years earlier, had been met including the *An. gambiae* genome sequencing and germline transformation of the major disease vector mosquitoes. The uncharted and largely unexplored territories that emerged after these monumental discoveries made the establishment of such a forum an ideal place to promote community building, to disseminate new and largely unpublished data and to facilitate technology transfer.

The venue chosen to hold these meetings, the Orthodox Academy of Crete found at the outskirts of the Kolymbari village at the northwestern most part of Crete, is both magically beautiful and highly symbolic. The *Drosophila* Kolymbari meetings had already been happening there for over 25 years with great success, and this great tradition was catalytic

for the new meeting. The place also provided the necessary isolation for the exchange of ideas and strategic planning.

Indeed in the years since these meetings started, the meetings have catalysed and witnessed immense progress in the field, including the introduction and exploitation of functional genomics technologies and the optimization of RNAi-based gene silencing, which together guided great discoveries that advanced our understanding of the vector/pathogen interactions, the sequencing of many vector genomes and the establishment of robust informatics resources and databases, the beginning of understanding of mosquito population structure and the capacity to elevate such studies to a genome-wide scale. In this short 10-year period, the community has also increased in size substantially, by attracting people from other disciplines such as ecology, microbiology, genetics, and evolutionary biology as well as from more distant disciplines such as epidemiology, mathematics, and engineering.

These advances have brought the field to the verge of being able to translate the knowledge generated into public health interventions, which was a central topic in the last meeting. Key issues currently being researched and in need to be tackled in the future include the fast spreading of insecticide resistance, the use and impact of genetically modified vectors, the development of transmission blocking interventions, the potential impact of environmental changes on vectors and VBDs, and the understanding of mosquito population structure, speciation and changing behaviour.

In this clear success story, the Framework Programmes of the European Commission have played a significant part, by strategically funding various European as well as intercontinental consortia. Over 50 million Euros have been invested in the last 15 years on vector biology research, including two Research Training Networks, the BioMalPar and EViMalaR Networks of Excellence, the EDEN

project, the Infrastructure project INFRAVEC (see separate article in this issue), the TransMalariaBloc, the MALVECBLOC and the AvecNet collaborative projects, to name but a few.

In the current issue of *Pathogens & Global Health*, in addition to the Kolymbari Meeting Report, there is the report from a workshop held last year in Paphos, Cyprus. There, vector biologists, epidemiologists, mathematical modellers, meteorologists, and atmospheric chemists gathered to discuss the increase of VBD outbreaks in Europe, especially in its south and south-eastern most parts, in the last 10 years, and its putative connection to climate change. These include the very alerting outbreak of Chikungunya in Italy, the *Plasmodium vivax* outbreaks in Greece, and the West Nile fever outbreaks in Greece and the rest of the Balkan countries. The workshop concluded that a connection is probable between some of these outbreaks and the changing environment, and possibly the changing climate, as well as between these outbreaks and societal issues such as illegal immigration, the unrest in regions neighbouring its eastern borders, and the economic crisis. It also concluded that the most worrisome of these VBDs at the moment is Dengue fever due to the establishment of its secondary vector *Aedes albopictus* across southern Europe and the presence of its primary vector *Aedes aegypti* in some parts of Europe and Russia. The latter mosquito had transmitted Dengue in Europe in the past killing thousands of people. Indeed, while the workshop was still happening, autochthonous Dengue transmission began to be reported in Madeira, where *Ae. aegypti* is

present, with thousands of cases reported before the end of 2012. The fears of the disease spreading to the rest of Europe in the next summer did not come true but the outbreak was a major warning sign.

In the last few months, the European Commission has released a draft agenda for the funding of research within the new Framework Programme, the Horizon 2020 (H2020). Strikingly, despite the history, no single specific action to support research on vectors and VBDs or to highlight their importance for that matter is anywhere to be found in H2020. This major omission generates a massive disappointment among the scientific community and apprehension in public opinion as it leaves Europe exposed to such diseases. It also leaves a large number of scientists who have been trained and built their career in this field through specific actions in previous Framework Programmes without funding and future.

In this hostile environment, vector and VBD research in Europe cannot survive, and it will be left to overseas scientists to identify ways to protect the European public from possible resurgence of VBDs. At the same time, European science will not be able to contribute to the international struggle for reduction and eventual eradication of VBDs from the developing world. With the first calls of H2020 expected within the next weeks, there might be no time left for major corrections to these obvious inconsistencies. However, such important issues of public health must not be taken lightly, but as a result of in depth discussion with the scientific community and other stakeholders. Now more than ever before, Europe needs coherence, vision, and educated strategic planning.