Vector-Borne Diseases: Research priorities in the face of future challenges

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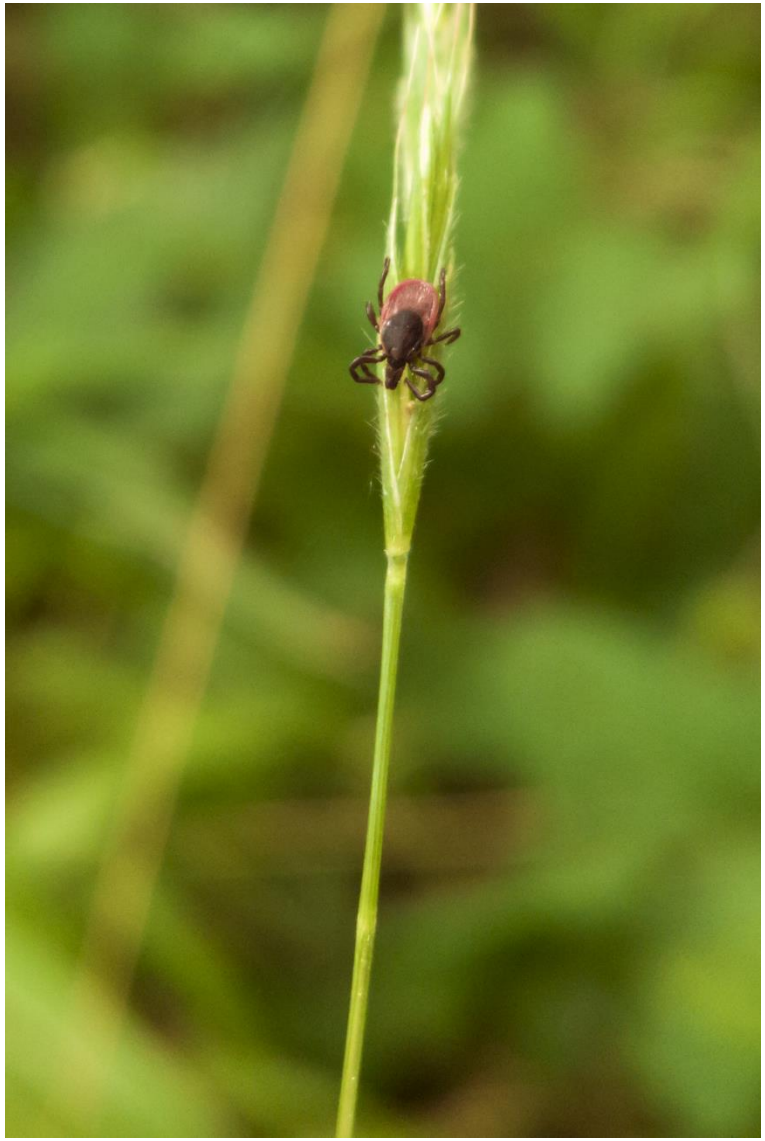

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Vector-borne diseases: What lies ahead?

Globalization, worldwide travel activity, changes in micro- and macroclimatic conditions → increase of risk of importation and establishment of arthropods and of pathogens they transmit

Examples:

- *Aedes albopictus*, *Ae. japonicus*
- Lumpy Skin Disease virus, West Nile virus, Zika virus
- Epidemic Bluetongue virus, Schmallenberg virus outbreak

- One Health issue: threat to both animals and humans
- Arthropod infections no longer restricted to tropical developing countries

Vectors and vector-borne diseases – where do we stand in Europe today?

Past decades:

Global increase in infectious diseases transmitted by arthropod vectors

Expansion of vector populations

Research on arthropods and their taxonomy

Today?

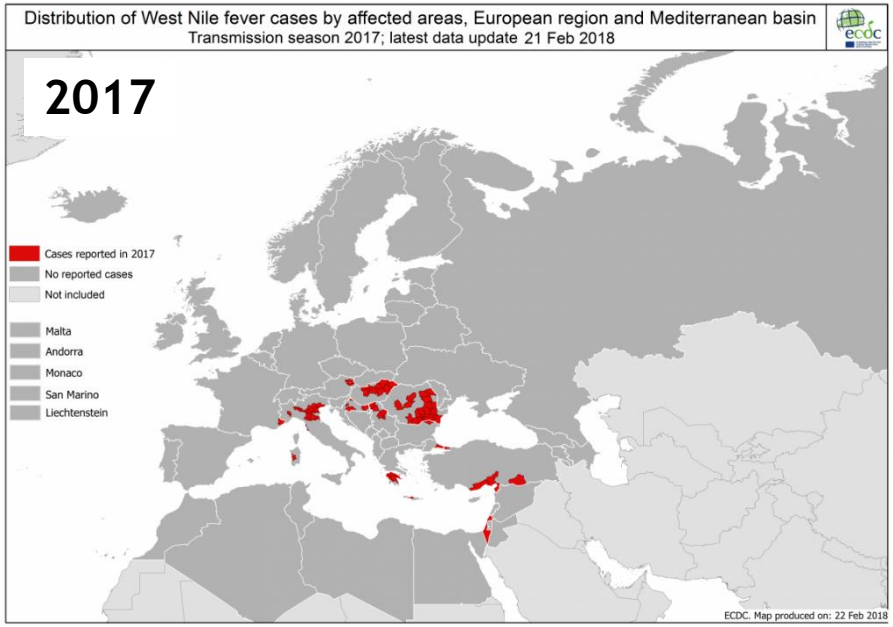
Growing scientific interest

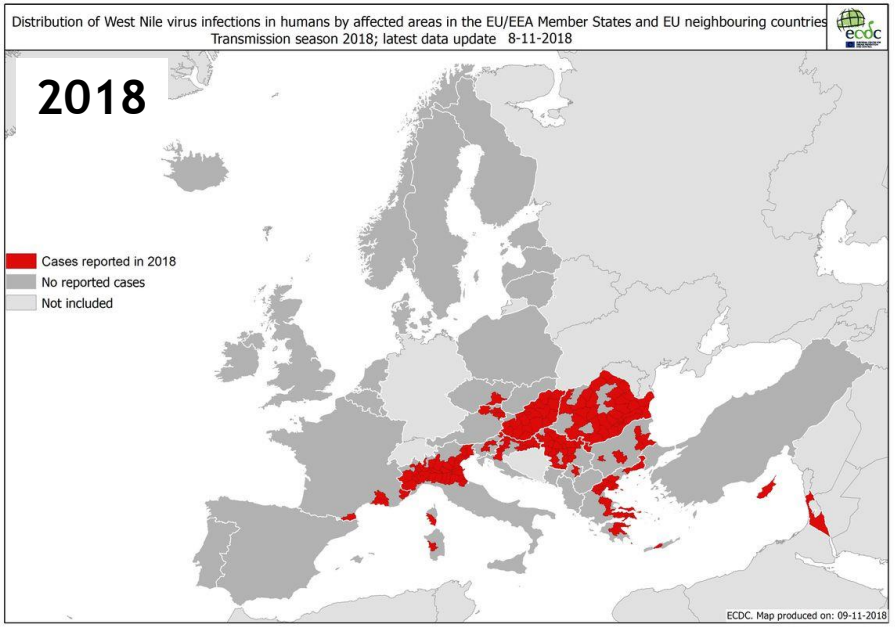
Multitude of expertise and disciplines

Need for coordinated efforts

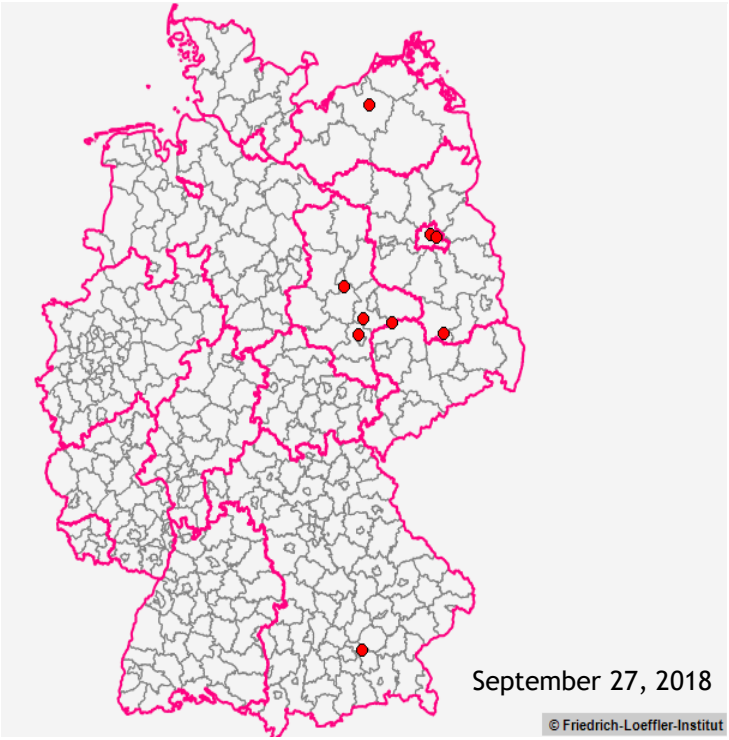
West Nile virus 2018

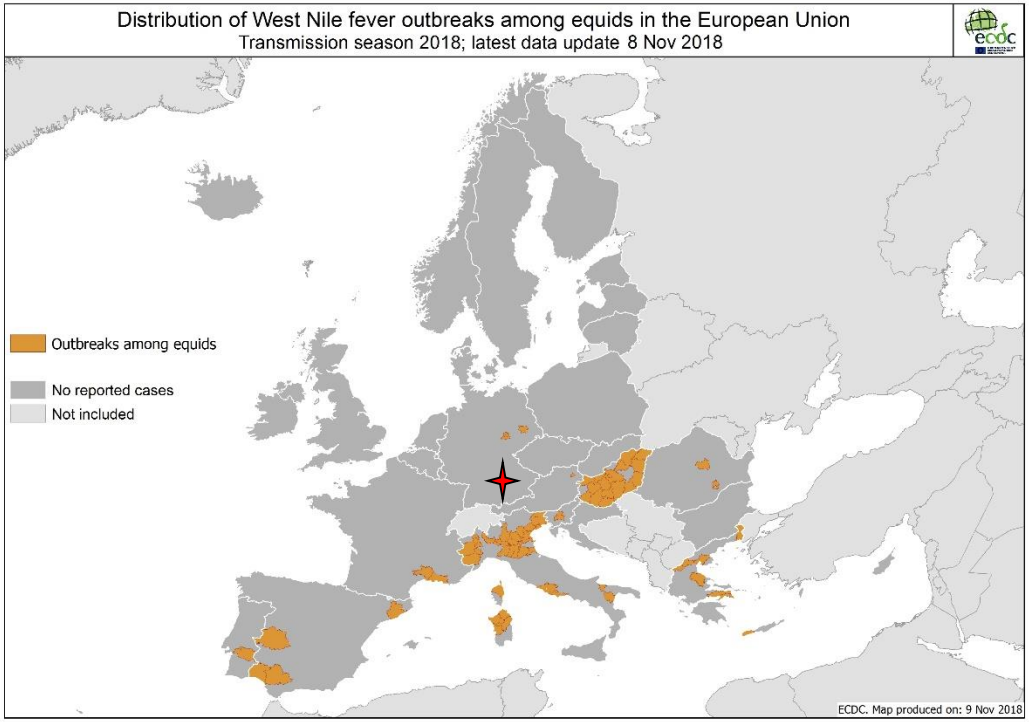
WNv epidemic season 2018:
2023 reported cases (171 fatalities) as of November 12, 2018





West Nile virus in Germany





- August 2018: First detection in captive birds
- September 2018: Notification of first transmissions to equines
- ✦ Human case acquired during dissection of infected bird

→ autochthonous transmission cycle of *WNv* in Germany
→ emergence and spread of *WNv* requires up-to-date risk assessment

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Research for animal health

- Independent higher federal authority
- Research contract embedded in animal health law: Law to the prevention and treatment of animal diseases (TierGesG)
- Health and welfare of food producing animals – from the honey bee to cattle
- Protection of humans against zoonoses

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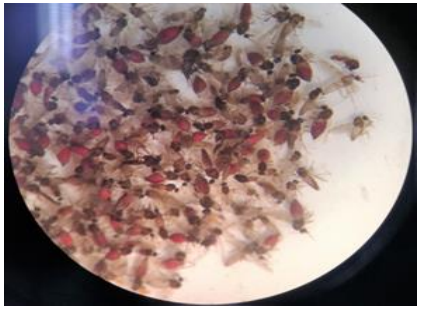
Vector-borne disease research at FLI

BSL2 and BSL3 laboratories
Large breeding insectaries and „tickarium“
BSL2 and BSL3 arthropod infection units
BSL2 and BSL3 small and large animal experimental facilities

Vector-borne disease research at FLI

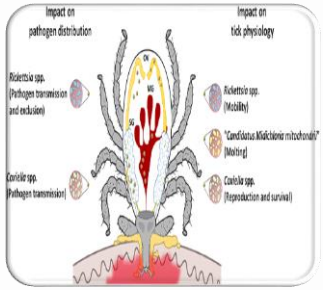
Institute (head)	Activities
Institute of Infectology (Prof. Dr. Cornelia Silaghi)	Medical entomology, monitoring, vector capacity, molecular vector-pathogen-interactions
Institute of Epidemiology (Prof. Dr. Franz J. Conraths)	Modelling, risk maps, risk assessments
Institute of Diagnostic Virology (Prof. Dr. Martin Beer)	Development and improvement of diagnostic methods, next generation sequencing
Institute of Novel and Emerging Infectious Diseases (Prof. Dr. Martin Groschup)	Research on pathogenicity and diagnostic methods of zoonotic arboviruses incl. BSL4
Institute of Bacterial Infections and Zoonoses (Prof. Dr. Heinrich Neubauer)	Bacterial tick-borne pathogens



Institute of Infectology







Distribution	Host preference	Vector capacity	Molecular genetics	Vector-pathogen-interactions
Abundance	Bionomics	Parasites		
Entry points		Viruses		
Breeding sites		Bacteria		





Field

Laboratory

Images: UZH

Challenges in vector and vector-borne disease research on **international** level

- Different timing of invasion and outbreak events across Europe → different levels of expertise at country level
- Lack of harmonisation of monitoring/surveillance approaches across Europe
- Need of multidisciplinary expertise and interdisciplinary interaction
- Improvement of interactions between academics, public health professionals and policy-makers at the national and international level
- Integration of private sector and more engagement of civil society

Challenges in vector and vector-borne disease research on **research** level

Fundamental research issues:

- Differentiating screening tests between pathogen strains
- Mathematical modelling of outbreak and endemisation scenarios
- Co-infections in different scenarios such as pathogenicity and changes in virulence
- Research on neglected vectors and pathogens so far remains neglected…

Practical research issues:

- Correct vector identification is difficult → new tools are needed
- Longterm monitoring and surveillance → Sustainibility
- Standardisation of methods and harmonisation of measurements in the EU (and beyond!)

Of utmost importance: Capacity building!

What has been achieved: 3 examples

1. Citizen Science

- Mosquito atlas

2. Networking and Harmonization

- COST action AIM-COST

3. Capacity building

- AMSAR project (SCOPES*)

*Scientific Cooperation between Eastern Europe and Switzerland (2013-2016)

1. Citizen Science – Mosquito atlas

www.mueckenatlas.de

Passive Mosquito Monitoring since 2012

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Dr. Helge Kampen

zalf
Leibniz-Zentrum für **Agrarlandschaftsforschung** (ZALF) e.V.

Dr. Doreen Walther

So far about 100.000 mosquitoes!

This year (as of 10.12.18) 22.222

2. Networking & Harmonsition

AIM Aedes Invasive Mosquitoes

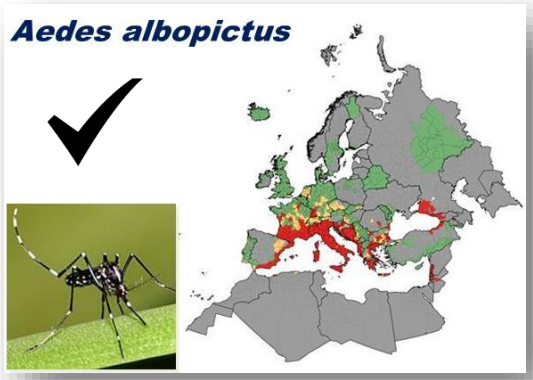
Funded by the Horizon 2020 Framework Programme of the European Union

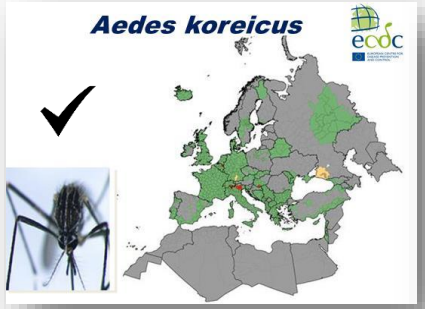
cost

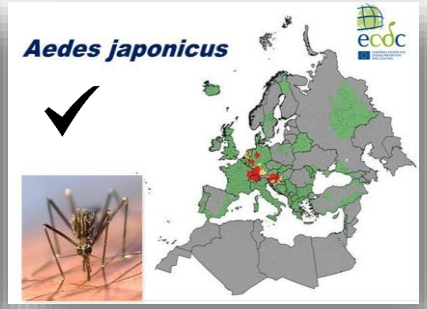
Action Chair: Alessandra della Torre, Università di Roma

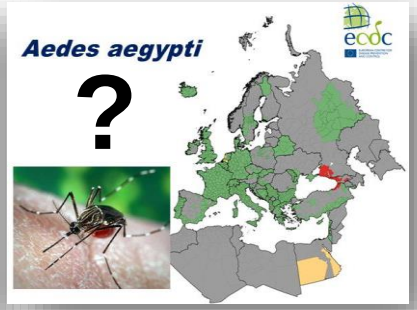
→ develop synergies between scientists, decision-makers, productive sector and civil society necessary to harmonise and rationalise sustainable approaches - both conventional and novel – for the surveillance and control of *Aedes* invasive species across Europe and beyond.

→ So far 29 EU and neighbouring countries and 4 others









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How to achieve these goals

WG1 MONITORING & SURVEILLANCE of AIMs and AIM-BVs

- Identification of needs and gaps in protocols and methods
- Promotion of citizen science
- Guidelines for best practice

WG2 CONVENTIONAL & INNOVATIVE CONTROL TOOLS

- Review and optimisation of control optioins
- Assessment of new control tools

WG3 DISSEMINATION, CUSTOMISATION & COMMUNICATION

- Surveillance and control guidelines
- Customisation for different end-user groups

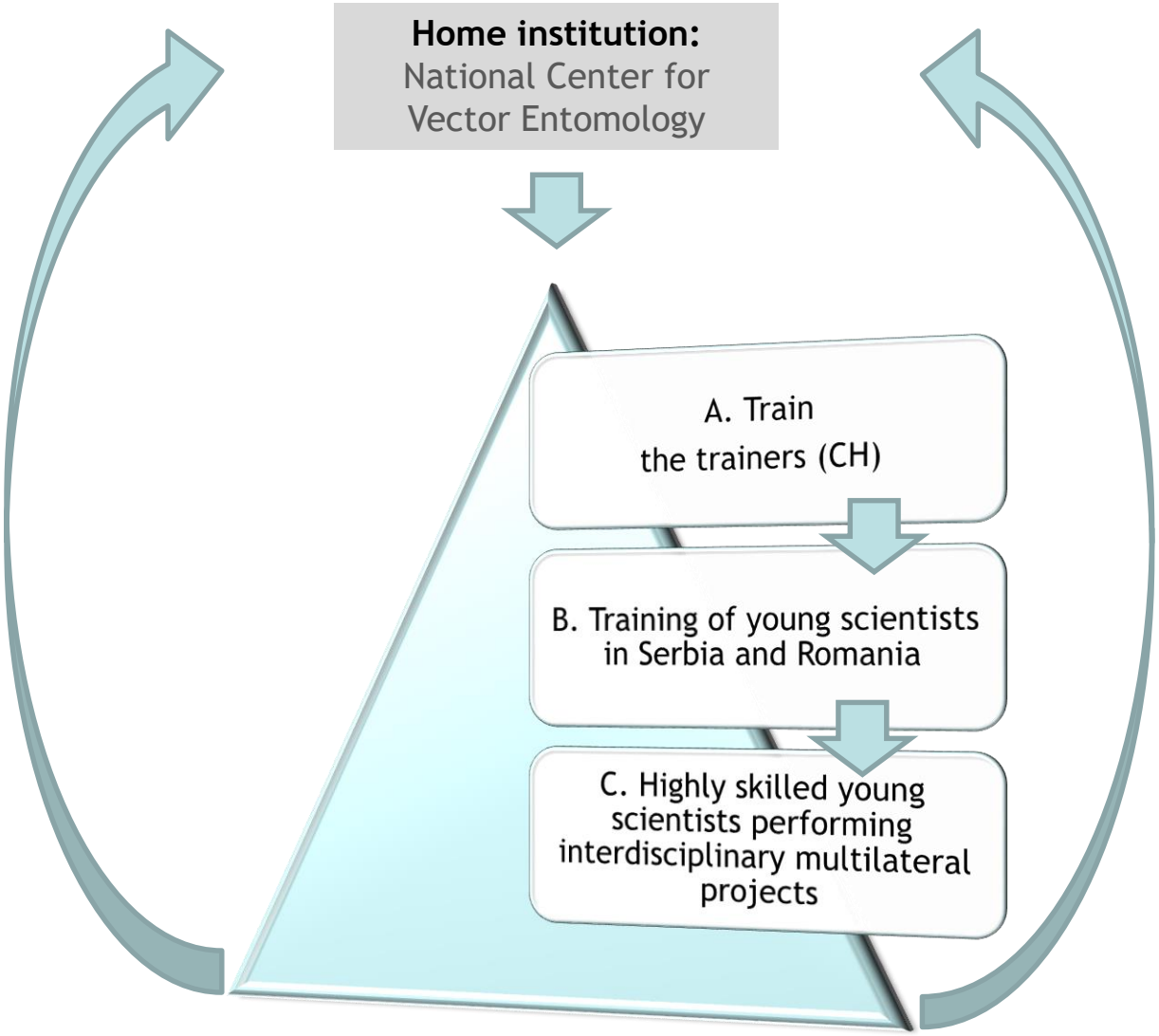
WEB SITE: http://www.aedescost.eu/

AMSAR: a capacity building project based on the 'training the trainers' concept






AMSAR: **A**rbovirus **M**onitoring, **S**urveill**A**nce and **R**esearch



A. Intensive training in field and laboratory skills

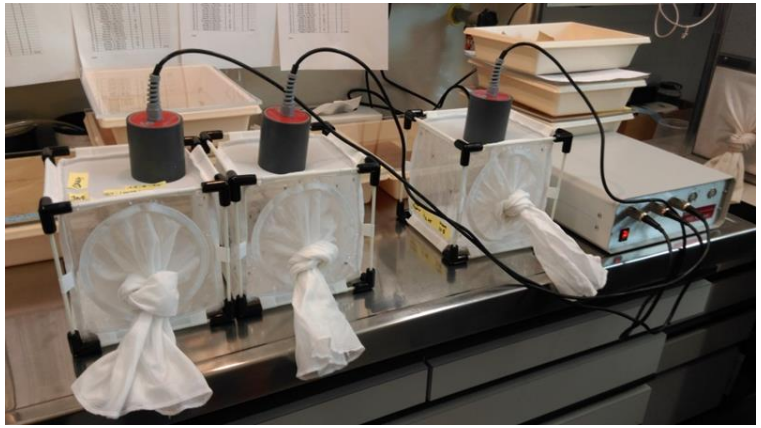
B. 3 trainings schools: „from field to lab“

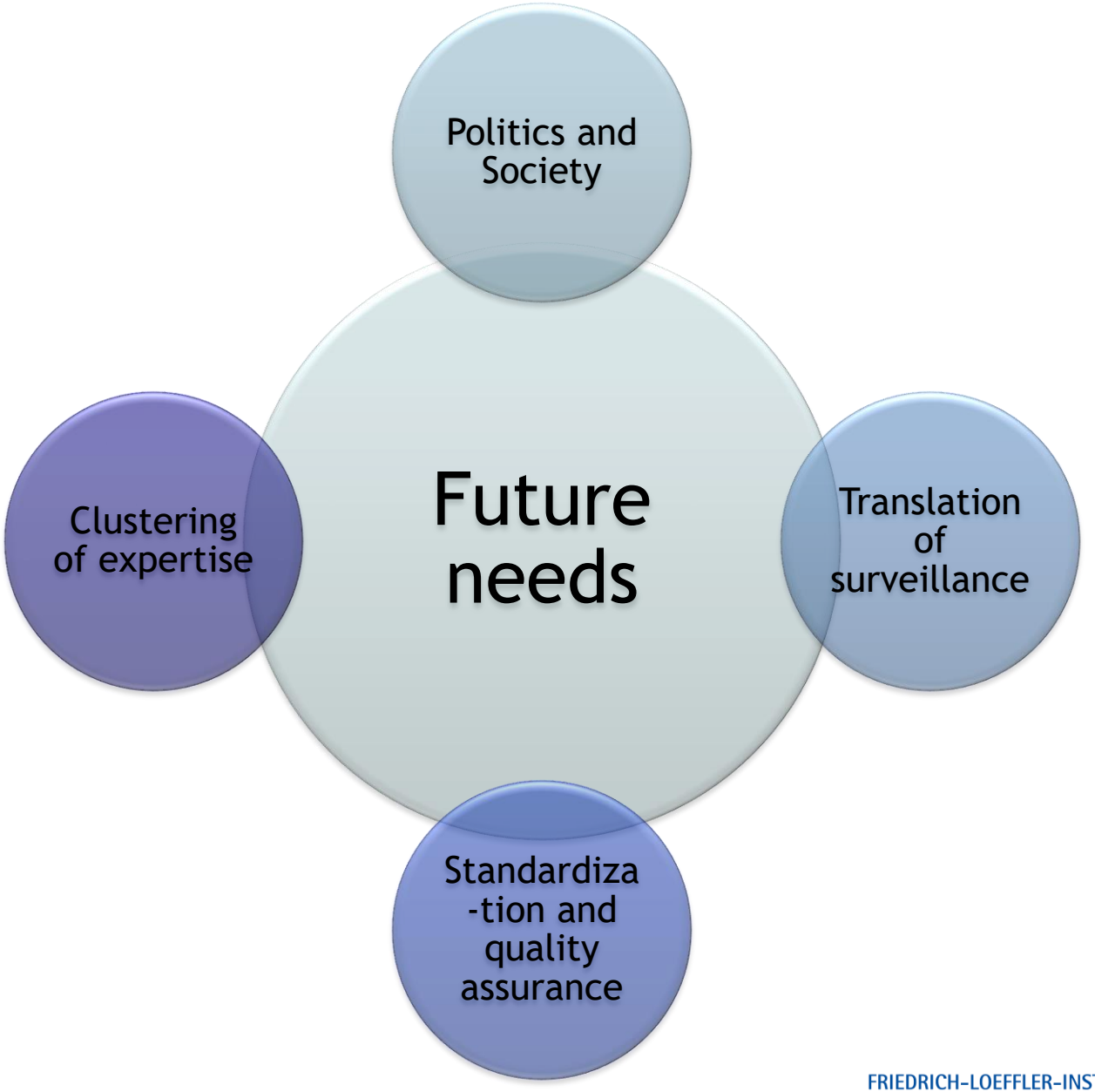
C. Knowledge base for future research

Multiplying effect of input and output of institutional partnership

Conclusion on „train-the-trainers“-Concept?

- ✓ Training period intense for both hosts and trainee-trainers
- ✓ Strong ties and collaborations formed
- ✓ Very efficient due to multiplying effect → highly recommendable!
- ✓ A good and solid investment in the future!!



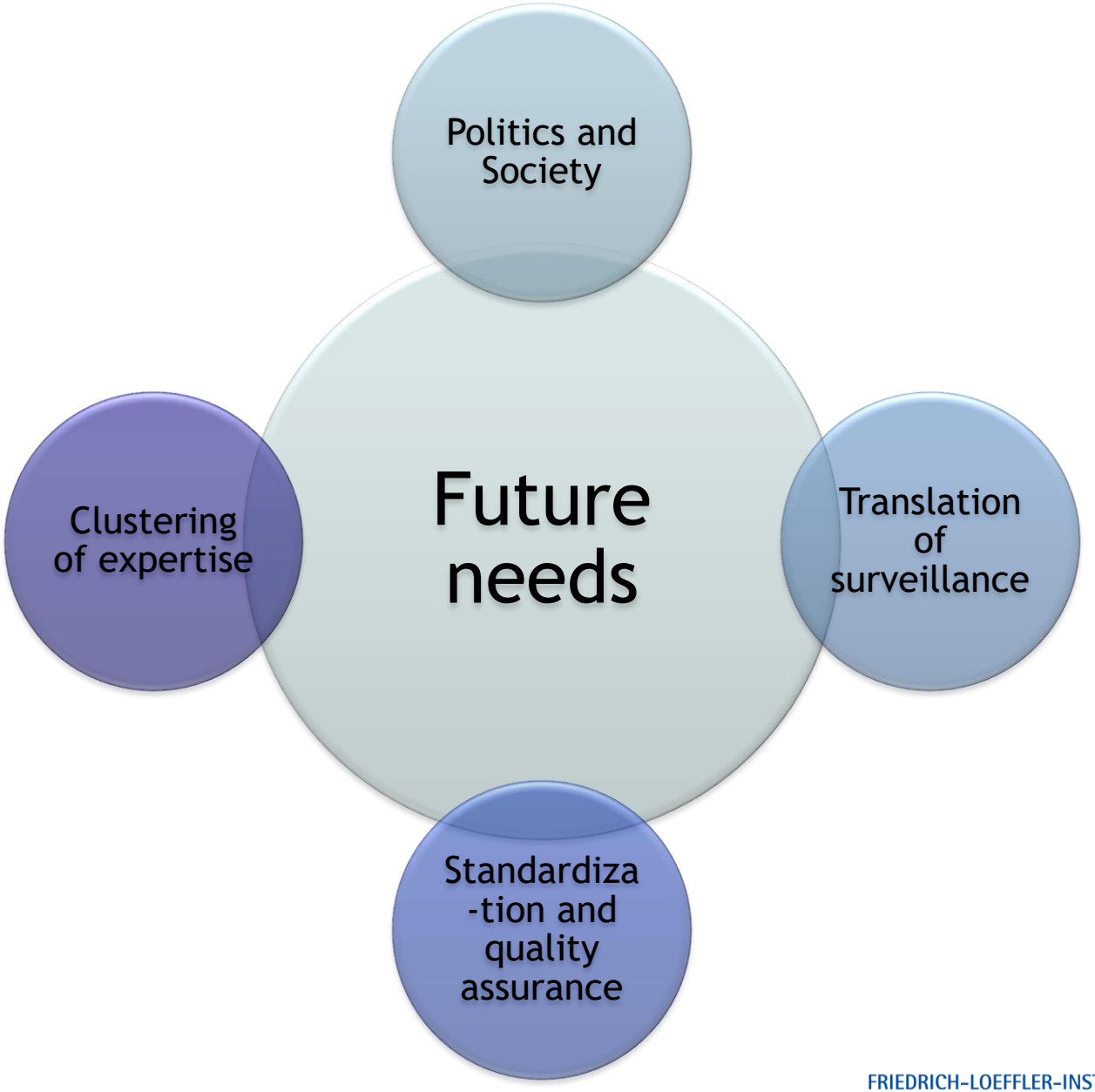


Politics and Society:

- Education of the public
- Capacity building
- Raising awareness of medical community to the new pathogens transmitted by vectors

Translation of surveillance:

- Maximisation of effect of surveillance activities
- Translation of research data into control of vectors and vector populations

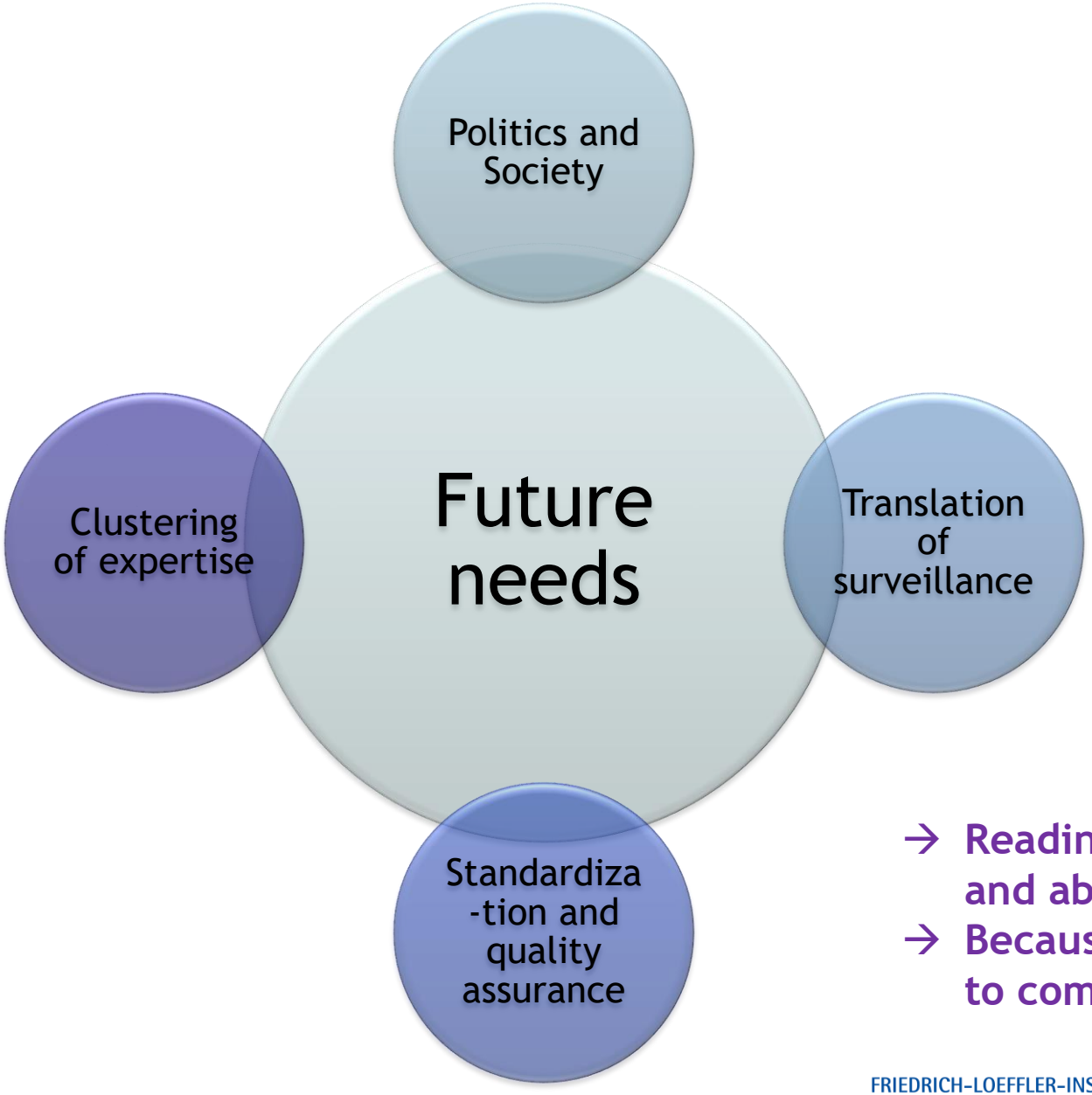


Standardization and quality assurance:

- Guidelines for taxonomy, specimens maintenance and handling, management of results…
- SOPs, method validation, quality assurance

Clustering of expertise:

- Conduction of coordinated research
- Fundemental research on mechanisms, pathogenicity, vector capacity,
- Development of tests, vaccines and models
- Transboundary networks of partners integrating expertise and stakeholder groups



→ **Readiness to future challenges and ability to react fast**
→ **Because new events are for sure to come!**

Thank you very much for your attention!
Questions?