

The first European workshop on

Emergence of pathogens in natural *Vibrio* populations : ecology, evolution and pathogenesis

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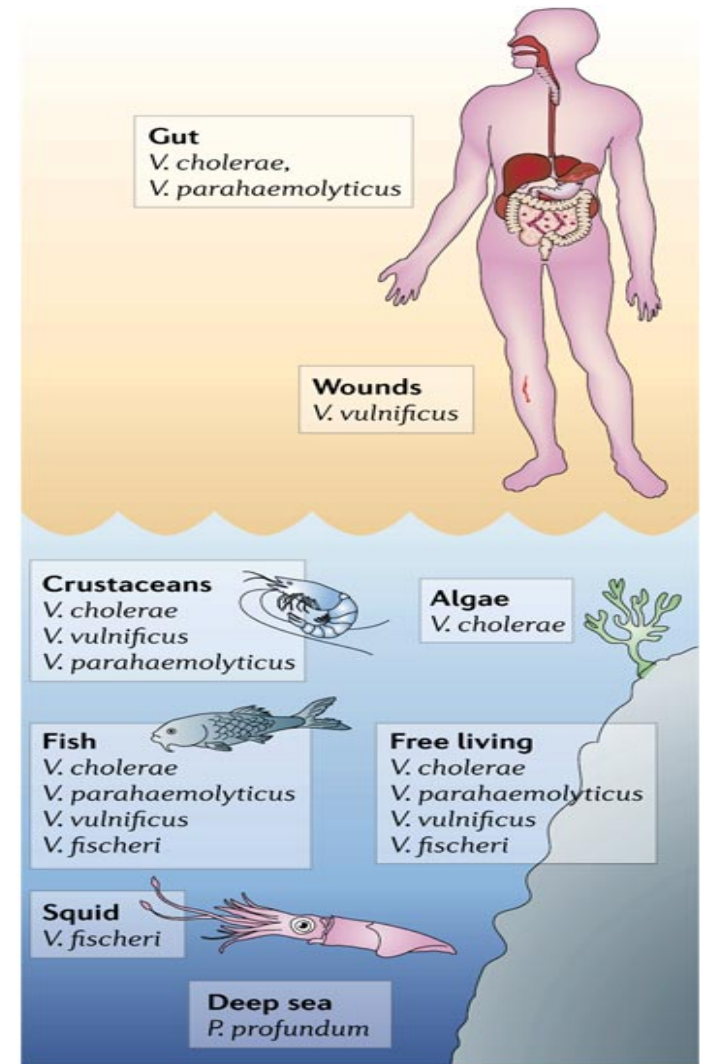


Vibrionaceae Phenotype diversity-Genome diversity

- Ubiquitous in marine environments
- Wide range of niches
- Free living, attached
- Commensal, symbiotic, pathogen

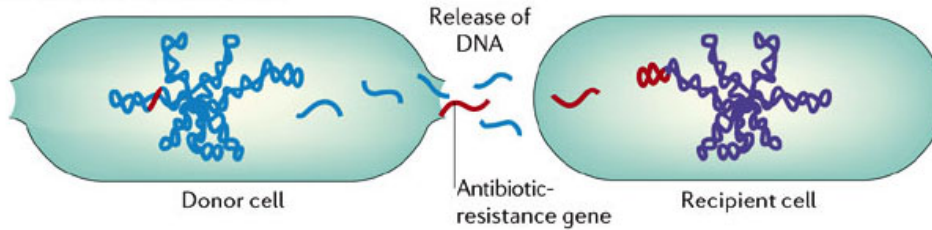


Able to generate genetic diversity at high rates

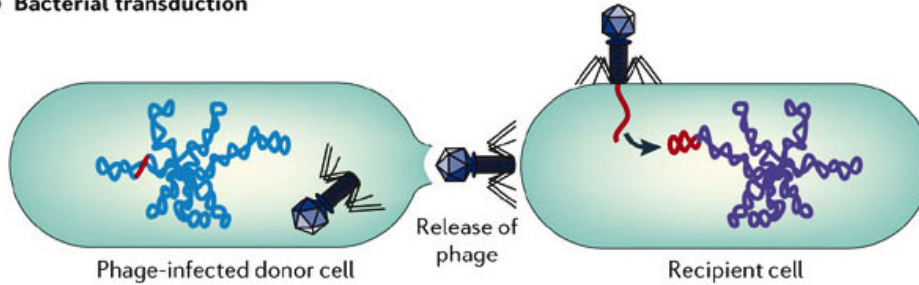


Genome diversity and lateral gene transfer

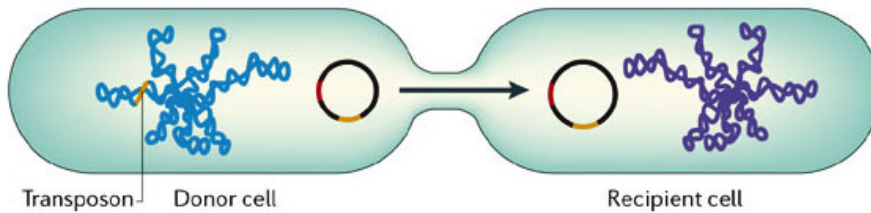
a Bacterial transformation



b Bacterial transduction



c Bacterial conjugation



d- Integrative conjugative element

Many pathogenicity/resistance determinants are found grouped into and spread by mobile genomic element

Mutual objectives

Vibrio: Ecology, evolution and pathogenesis



Different scales:

- Population/metagenome
- Strain/genome
- Gene, protein, sRNA

Methods



Experimental ecology/strain collection



Experimental infection

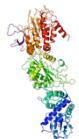
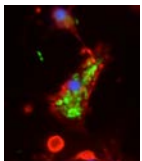


Sequencing



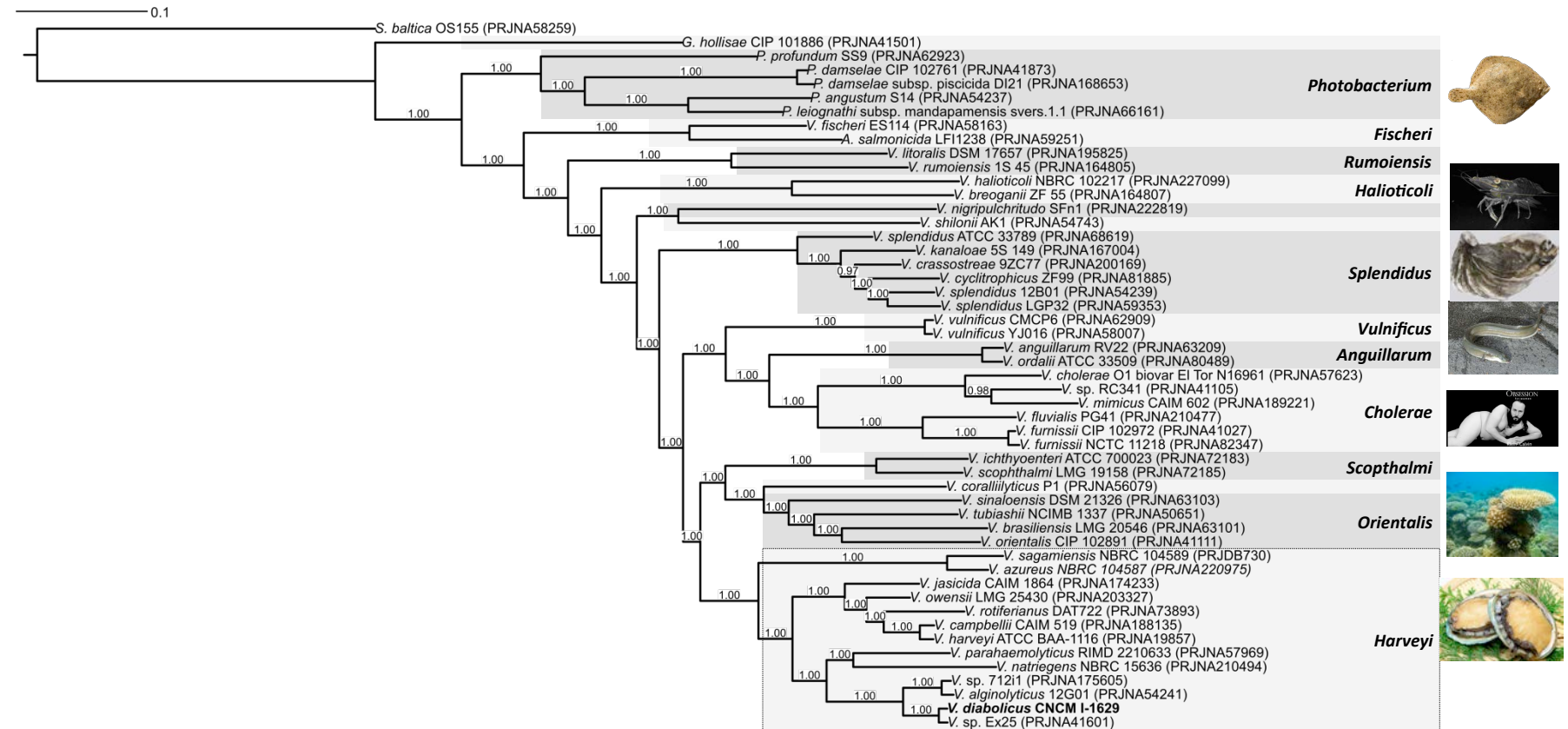
Phylogeny/comparative genomics

Functional genomics



Cellular, molecular, structural biology

Vibrio teams in Europe



Vibrio teams in Europe

worldatlasbook.com

Europe



Workshop 2015 outline

ECOLOGY

PATHOGENESIS

MOLECULAR MECHANISMS

RISK SURVEY AND MANAGEMENT

Workshop outline

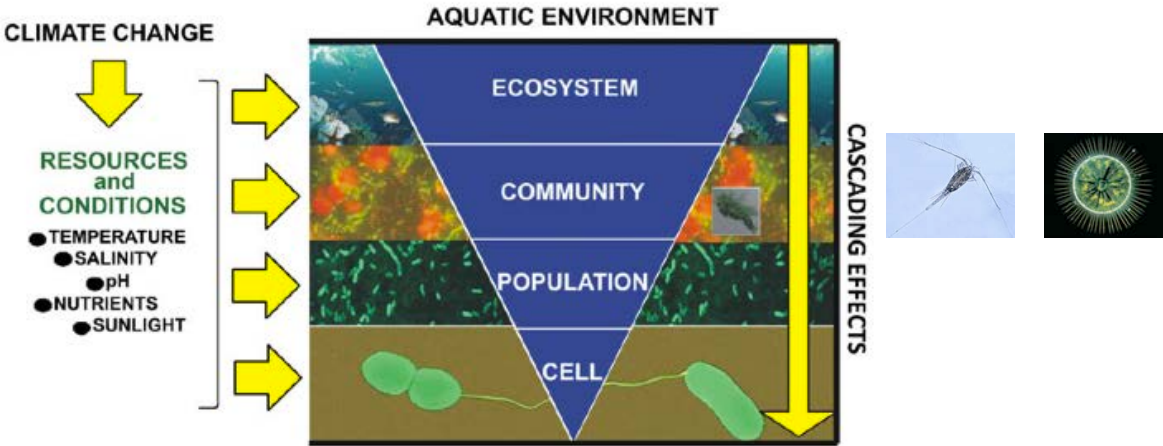
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Vibrio and Climate change



Vezzulli and Pruzzo's team
Vezzulli et al., ISME J. 2012; env mic 2014

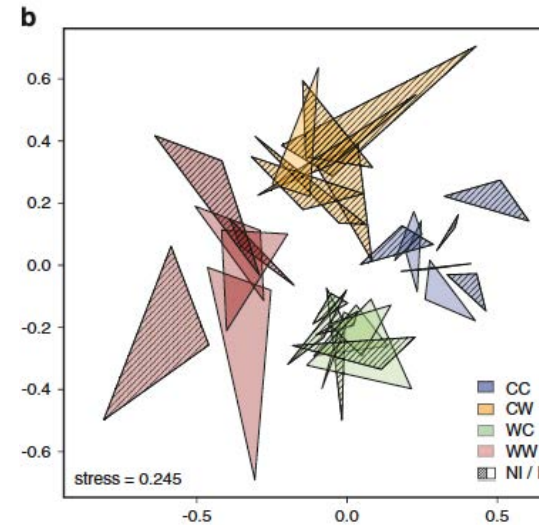
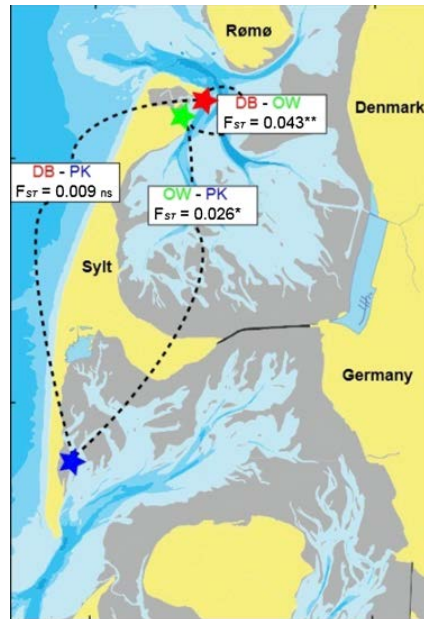


Craig Baker Austin's team
Grimes et al., Microb ecol, 2014



Microbial community/oyster diseases

3 genetically differential beds of oyster



Effects of environment and infection on individual microbiome dynamics

Wegner's team
Lokmer and Wegner, ISME J. 2014

Experimental ecology/vibrio community assembly

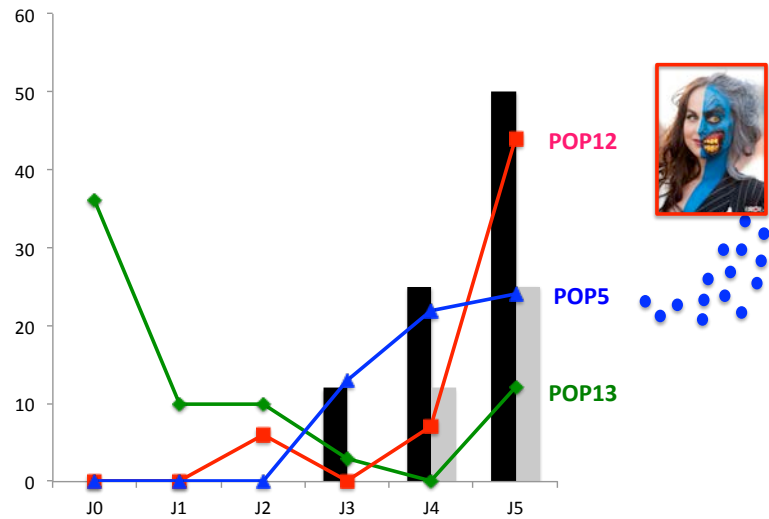
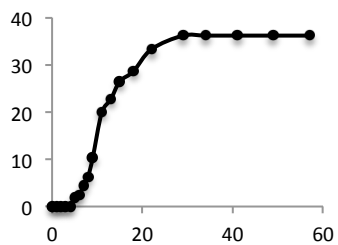
Specific pathogen free oyster



Field



Laboratory



Le Roux's team
Lemire et al., ISME J 2014



Workshop outline

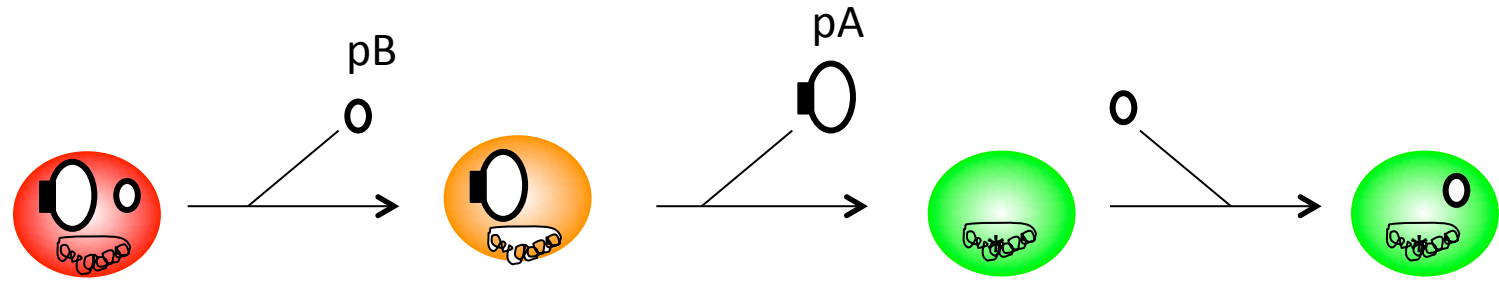
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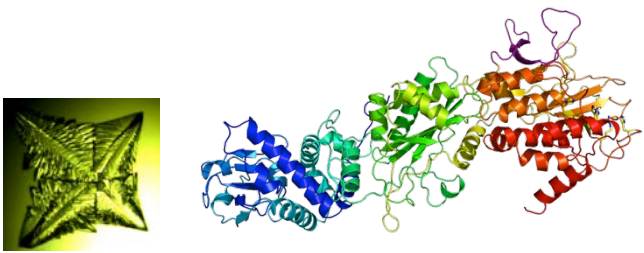
RISK SURVEY AND MANAGEMENT

Plasmids and virulence



pA encodes a new toxin...

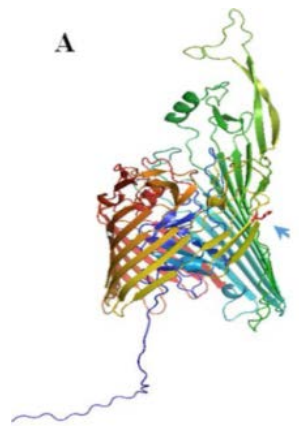
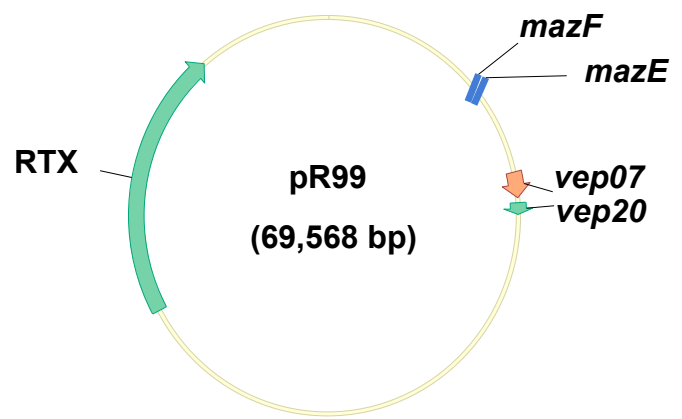
With arthropod's specific toxicity



Shrimp/*V. nigripulchritudo*
Le Roux's team
Goudenege et al., ISME J 2013



Plasmids and virulence



Vep20: the first representant of a new family of fish transferrin receptors



Eels/*V. vulnificus*
Amaro's team
Pajuelo et al., Env Mic 2015



Turbot/*P. damselae*
Osorio's team
Rivas et al., infect immun 2015



In vivo models of *Vibrio*-mediated human disease



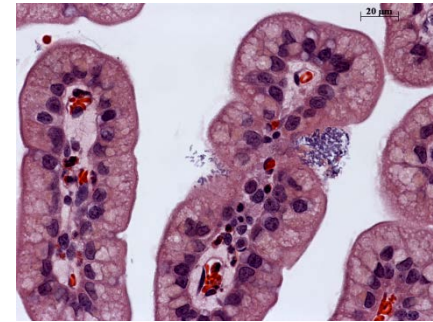
V. parahaemolyticus infected small intestine



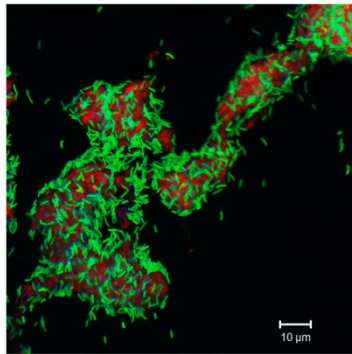
mock infected small intestine



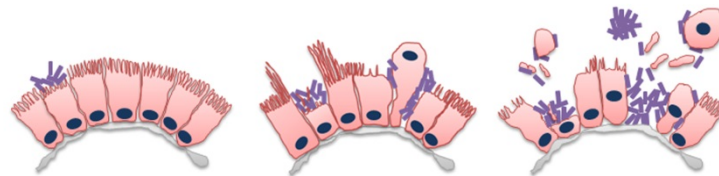
diarrhoeal
fluid



Distinct microcolonies formed
by *V. parahaemolyticus*
in the mammalian intestine



Aggregates of gfp-expressing
V. cholerae exiting the intestine



Schematic representation of *V. parahaemolyticus*
induced intestinal pathology.

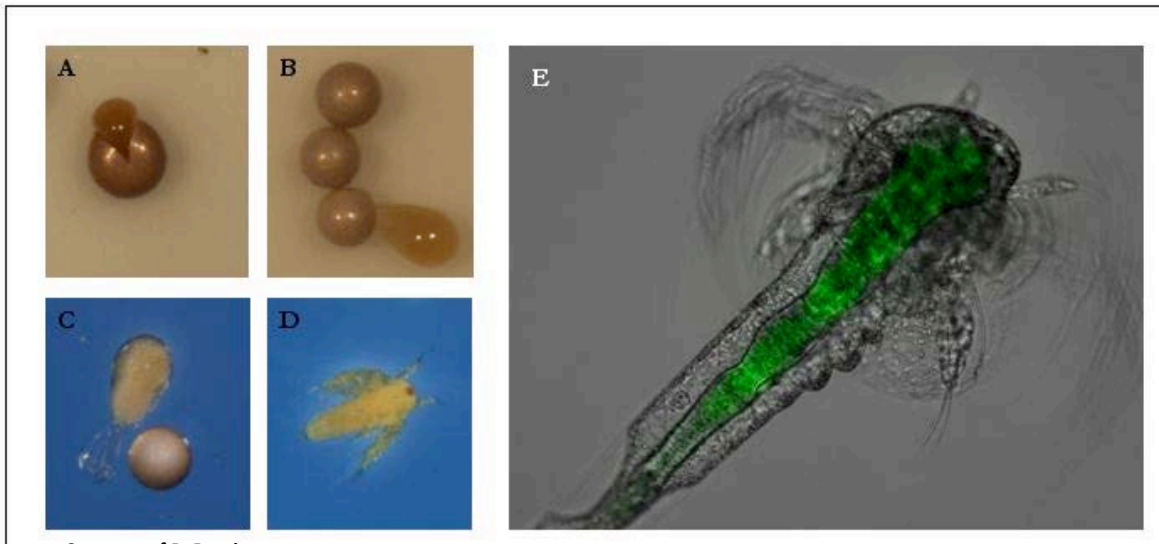
Ritchie's team

Ritchie et al., PloS pathogen 2012



Artemia to study animal pathogens

Gnotobiotic System



Courtesy of P. Bossier

Defoirdt's Team

Defoirdt T and Sorgeloos P *ISME J.* 2012.



Workshop outline

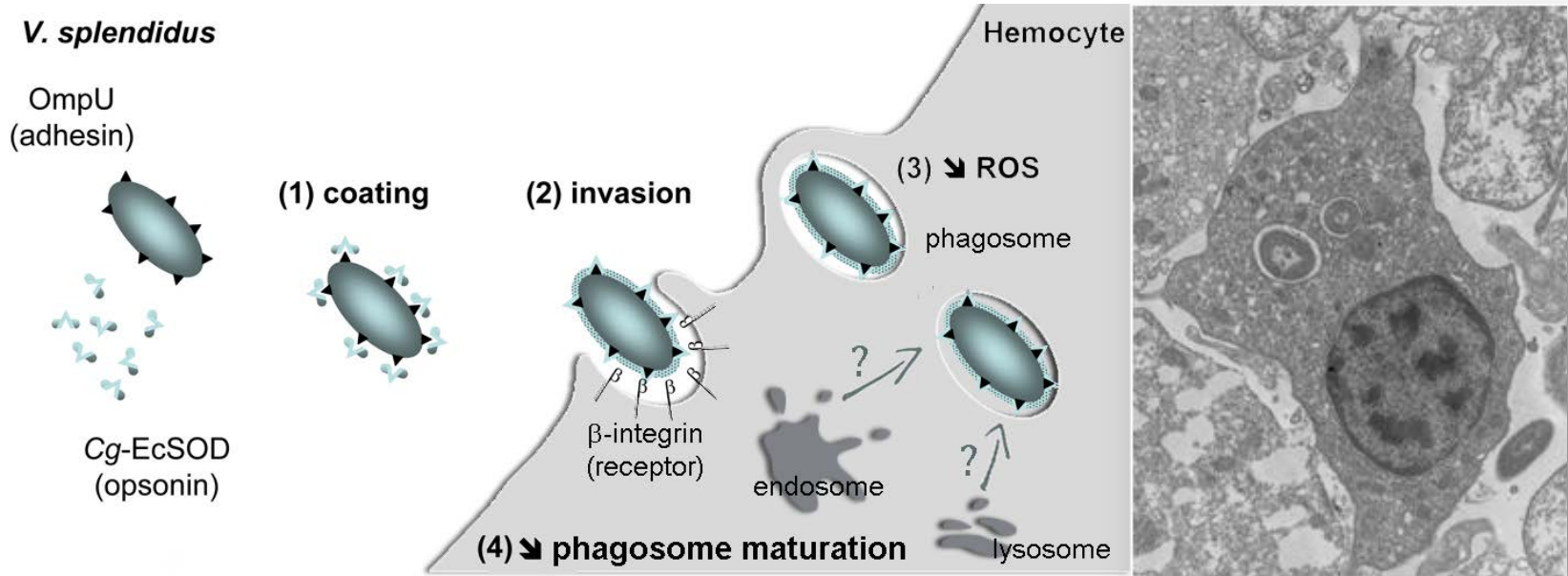
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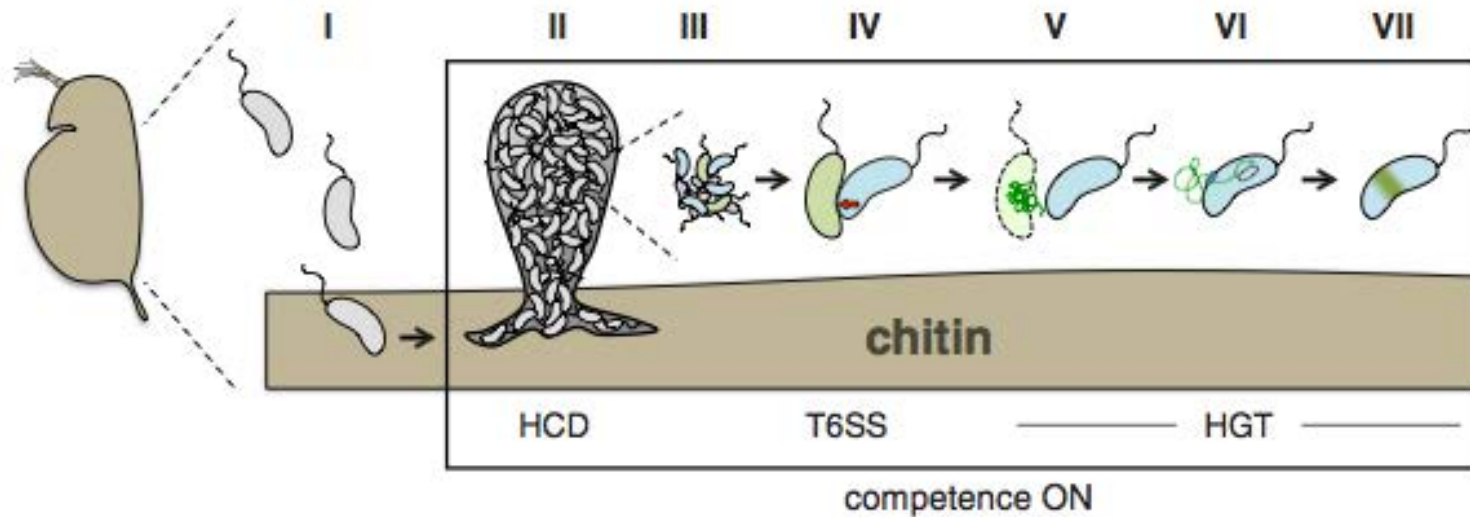
Intracellular survival in phagocyte



Destoumieux-Garzon's Team

Duperthuy et al., PNAS 2011

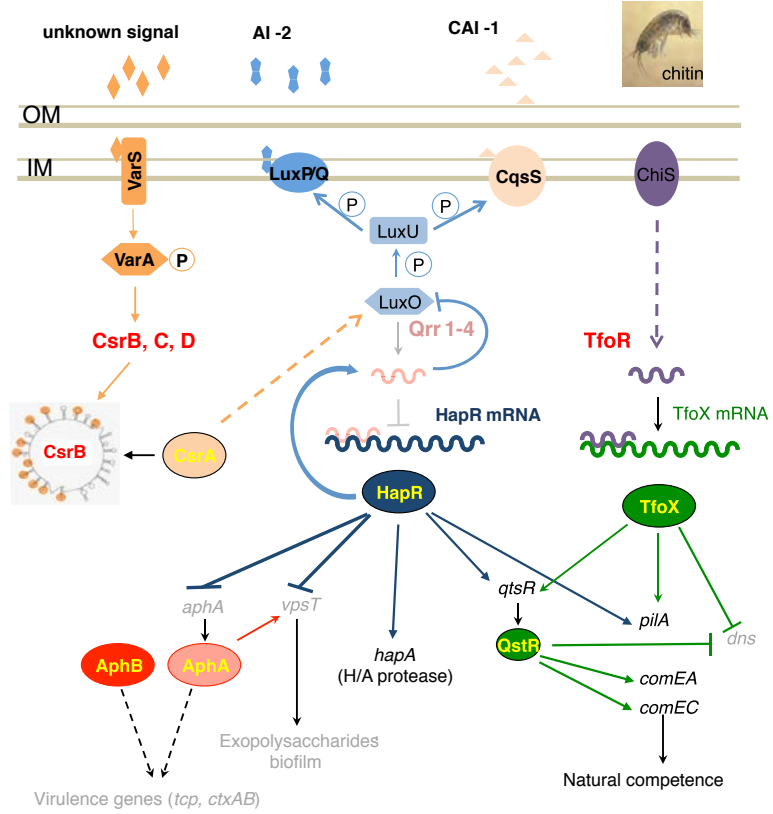
Natural competence for transformation



Blokesch's team
Borgeaud S, et al. Science. 2015



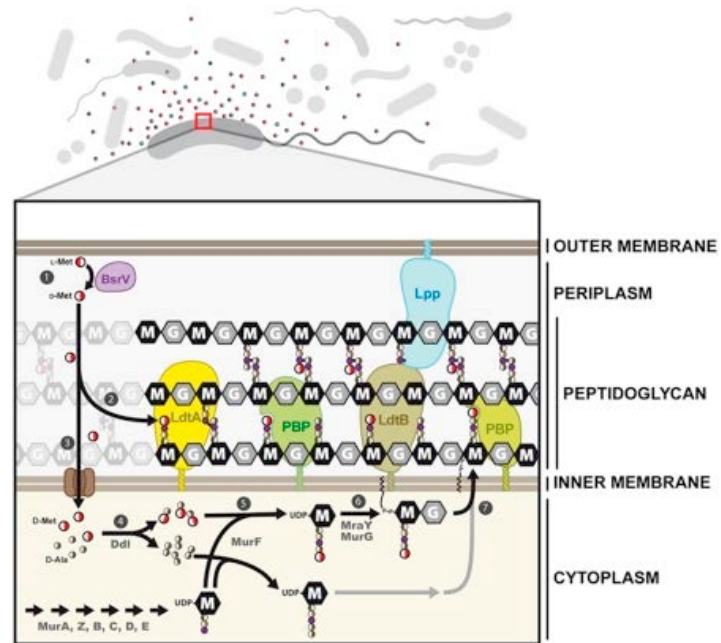
Regulatory sRNAs/virulence



Jacq's team
 Toffano-Nioche et al., RNA 2012



Cell wall plasticity/environmental changes



Cava team

Cava et al., Science 2009



The integrons: agents of bacterial evolution

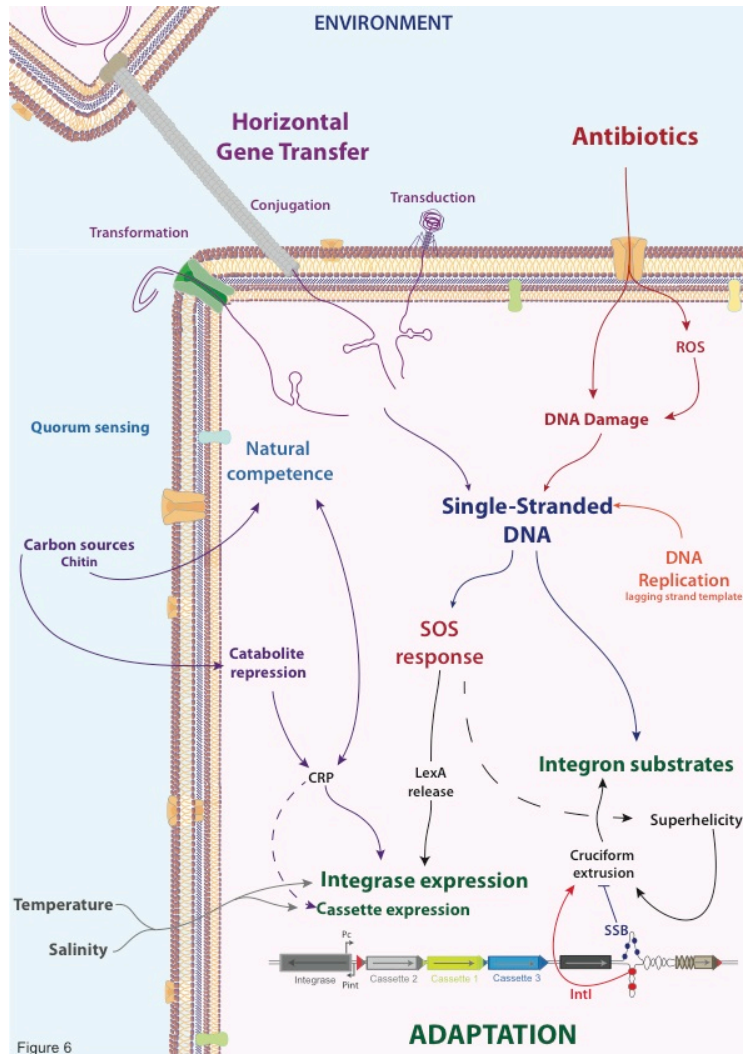


Figure 6

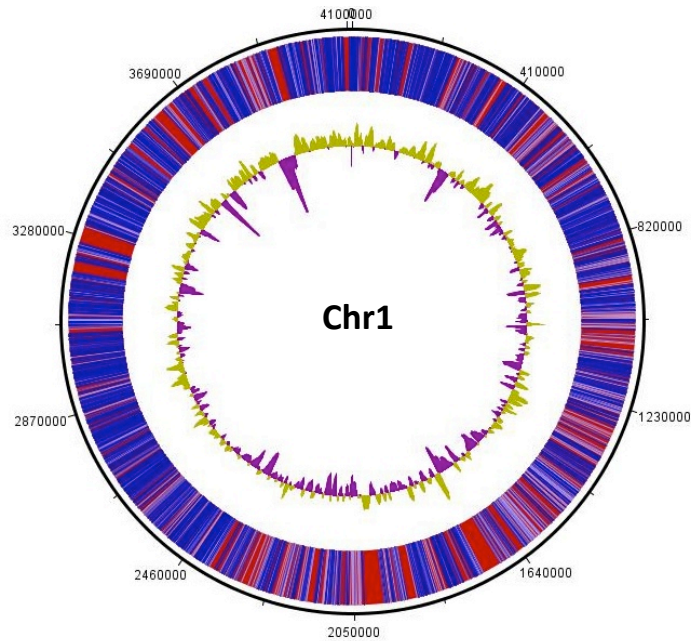
From Escudero et al., Mobile DNA III

Mazel team

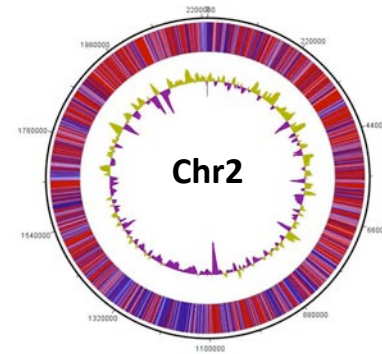
Guerin et al., Science 2009



Genome diversity and genome structure



Core



Accessory

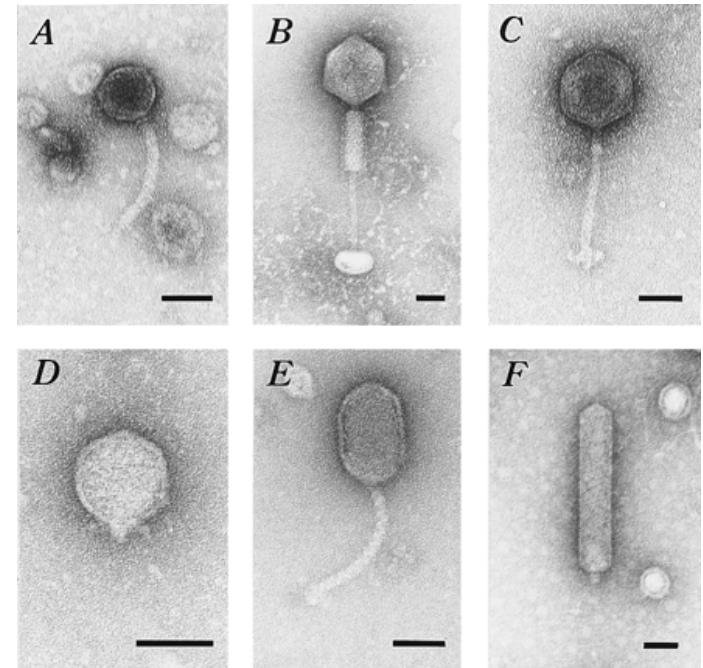
Mazel team

Val et al., Current Opinion in Microbiology, 2014

Phages

- The CTX ϕ phage transfers the toxin to *V. cholerae* (lysogenic conversion)
- The role of lytic infection in the population structure of vibrios starts to be explored as well as the use of phages in therapy

In sea water: Phages 10X/bacteria !

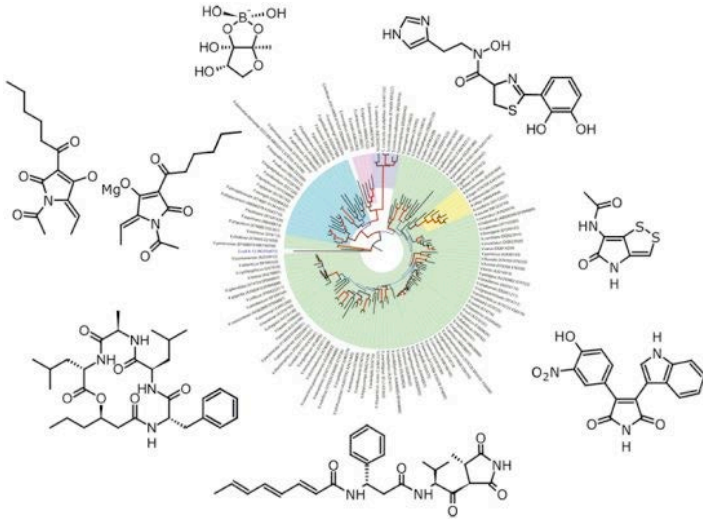


Wendling's team



Gerdt's team

Production of bioactive molecules by and against vibrio



Gram team
Mansson et al. Marine Drug 2011

Technical University of Denmark



Workshop outline

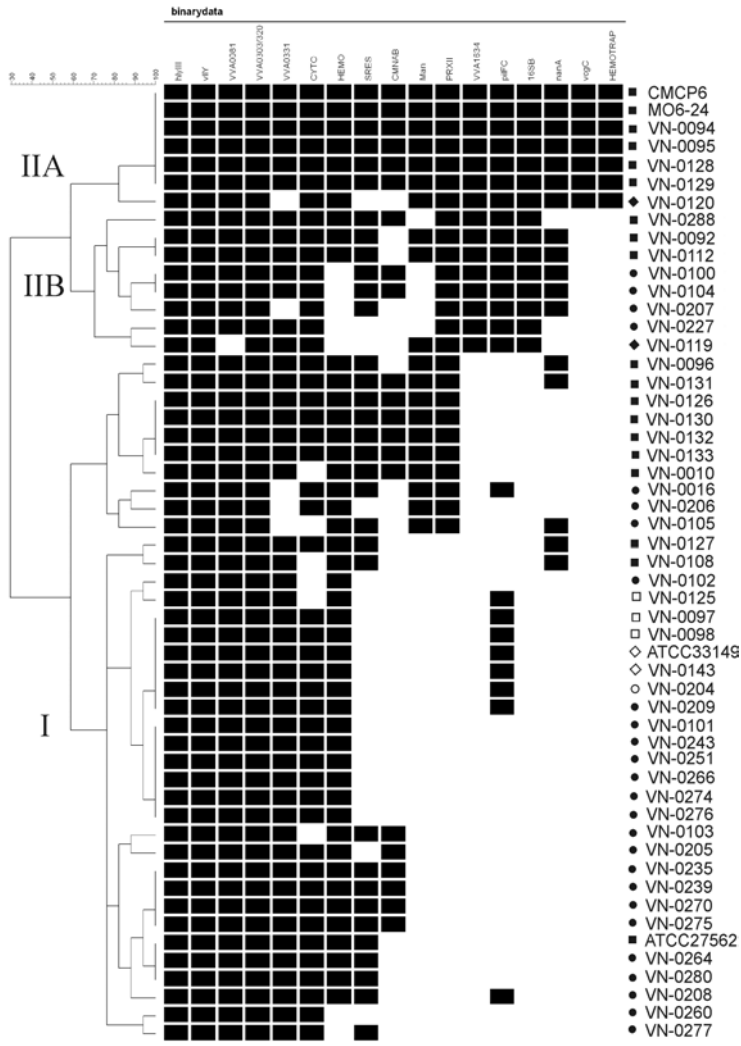
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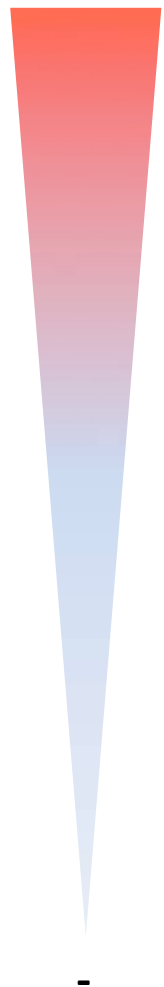
RISK SURVEY AND MANAGEMENT

Risk survey and management



+

Vibrio vulnificus strains from the Baltic Sea



Risk assessment

Identification of virulence factors and virulence-associated traits

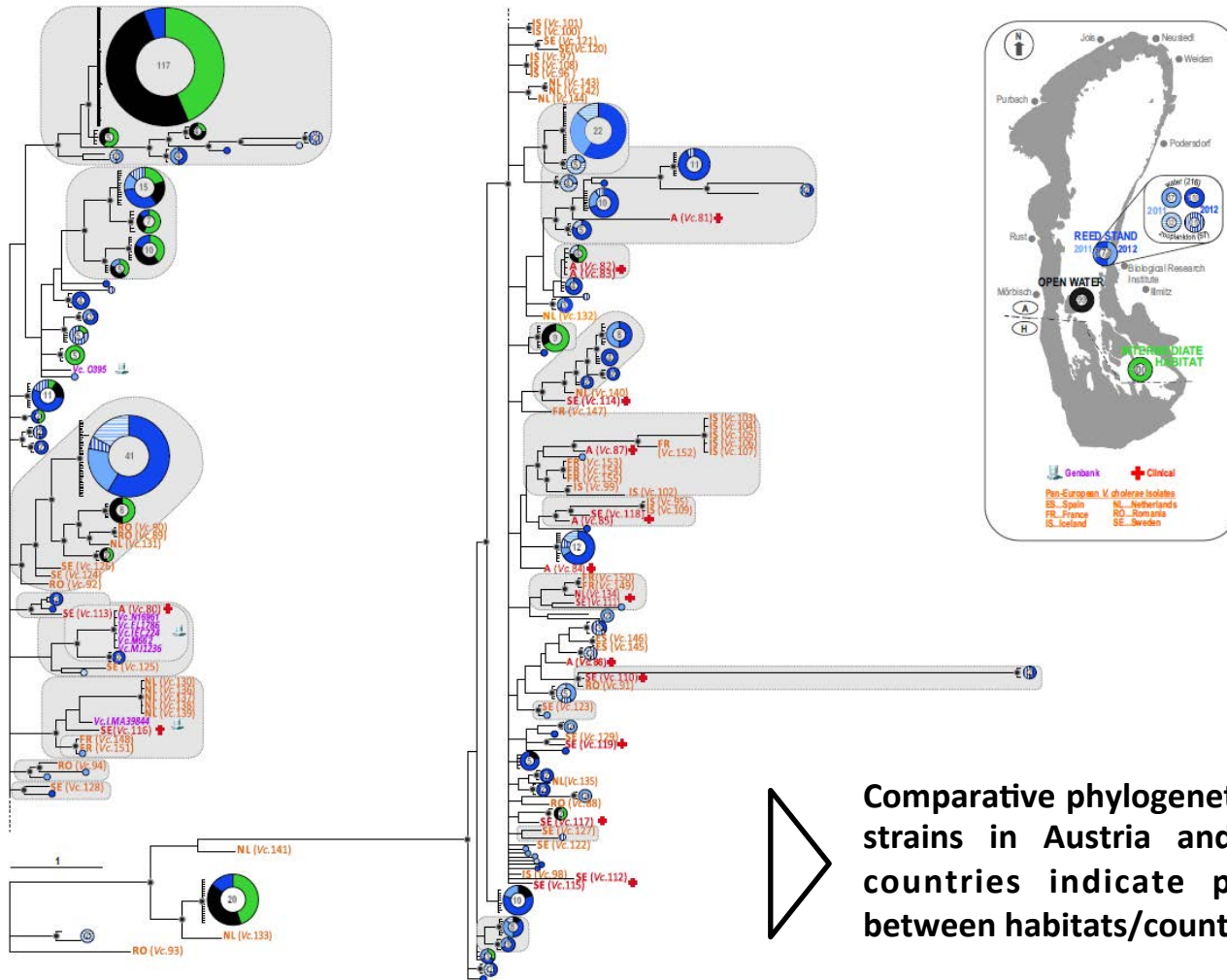
Risk management

Monitoring of recreational waters by identification of pathogenic strains by multiplex PCR

-

Strauch's team
Bier et al., AEM 3013

Microdiversity of *V. cholerae*



Comparative phylogenetic analysis of *V. cholerae* strains in Austria and from other European countries indicate pan-European transfer between habitats/countries

Kirschner's team



Conclusion

Why a disease is induced? (virulence/sensitivity)

Transmission?



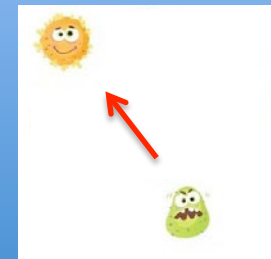
Reservoir?



How to discriminate the pathogen from mutualist?



How a mutualist become a pathogen?



Conclusion

And how global change influence all of that...



Why a disease is induced? (virulence/sensitivity)

Transmission?



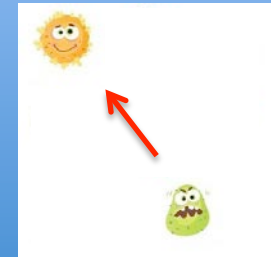
Reservoir?



How to discriminate the pathogen from mutualist?



How a mutualist become a pathogen



Perspectives

- **11-12 March 2015: First workshop at Paris**
- **24 Mars 2015: COST project application**
- **27 May 2015: Perspective article to be submit to Frontiers in Microbiology**

- **29 mars-1 avril 2016: Vibrio international conference at Roscoff**



- **Regular scientific meetings?**
- **Student/Post doc exchanges?**
- **H2020 call?**
- **ERC?**
- **Bilateral ANR?**