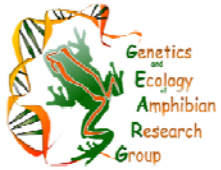



Laurentian University  
Université Laurentienne



Genetics  
and  
Ecology  
Amphibian  
Research  
Group



## Ranaviruses and Amphibians: outside the box of host-parasite relationships.

Dr. David Lesbarrères

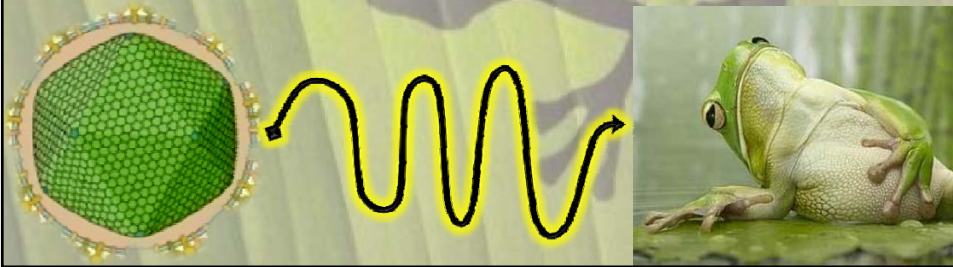


## Acknowledgements

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  - Valérie St-Amour
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  - Dr. Robert
  - Dr. Chinchar
  - Dr. Garner
  - Bruce Pauli



- ✓ From a small virus to a big problem!
- ✓ Condition-dependent expression of ranaviral infection and life history trade-offs
- ✓ Life-history stage susceptibility
- ✓ Genotype x Genotype x Environment interactions
- ✓ Perspectives and future work



## ***Global Distribution of Ranavirus Die-offs***

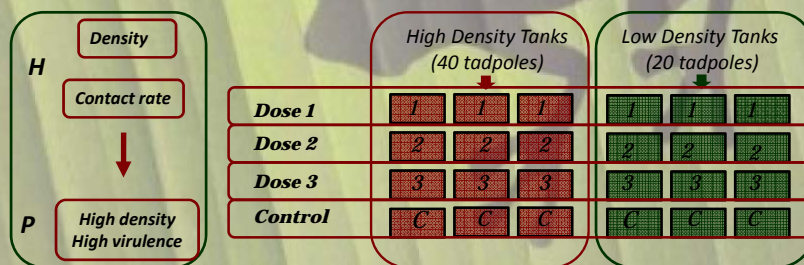


**11** *Ranidae, Hylidae, Bufonidae, Leptodactylidae, Dendrobatidae, Discoglossidae, Rhacophoridae, Myobatrachidae, Ambystomatidae, Salamandridae, Hynobiidae*

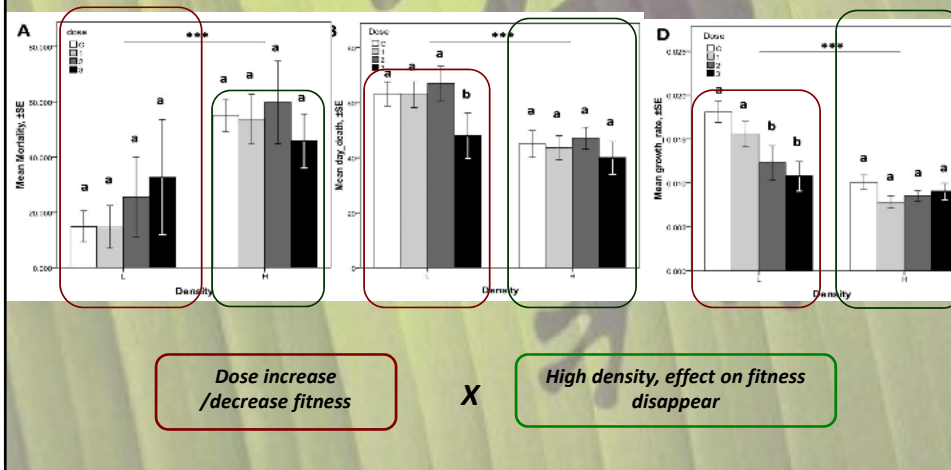


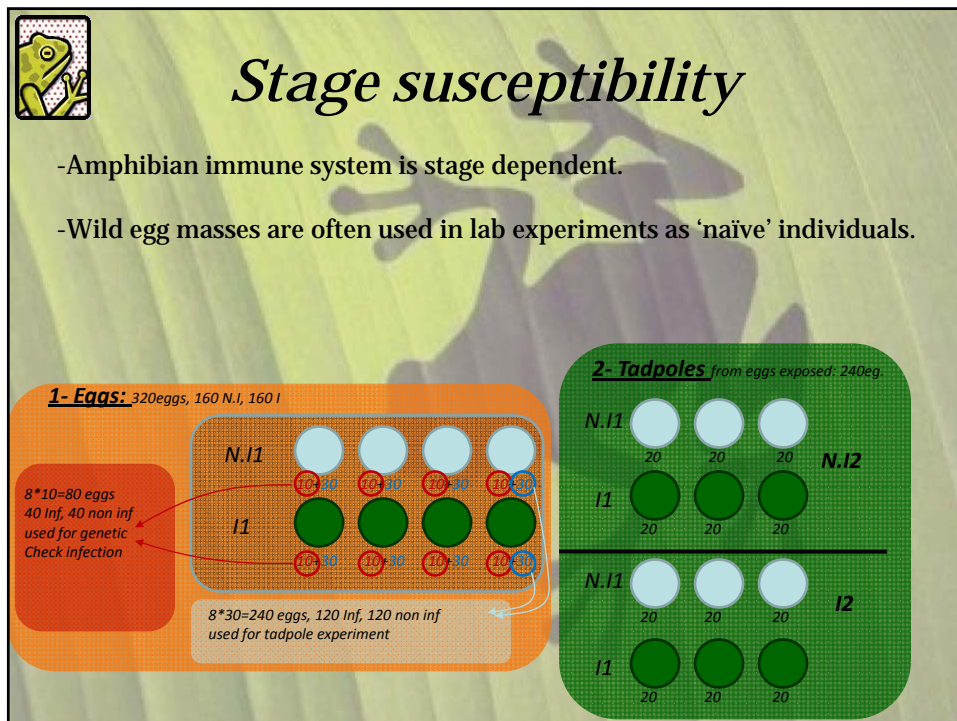
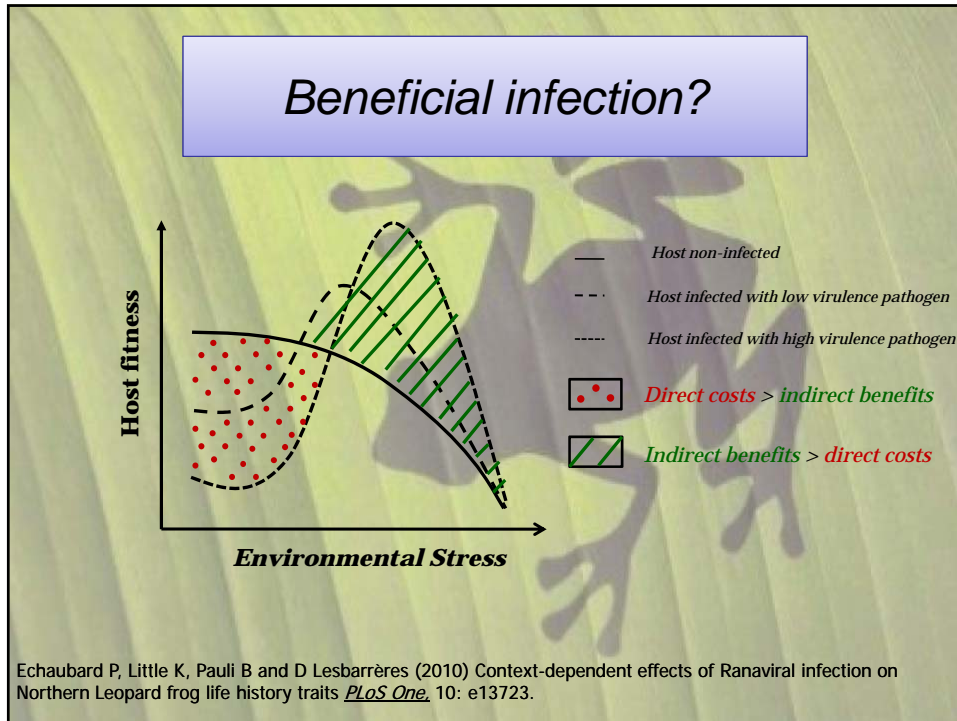
## Condition-dependence of *Rv* expression

- Pathogens have important effects on host life-history traits.
- Magnitude of these effects is often strongly context-dependent.
- Outcome of an interaction between a host and an infectious agent is often associated with the level of stress experienced by the host

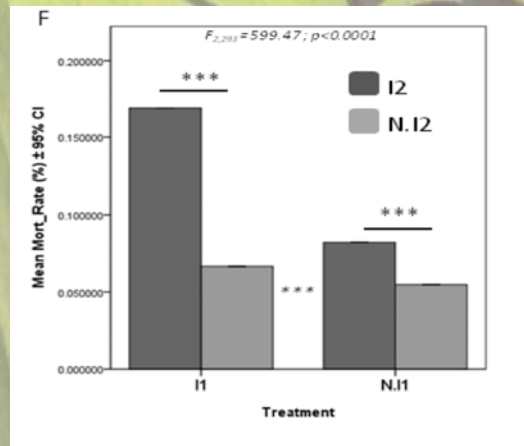


## Ranavirus virulence is density-dependent



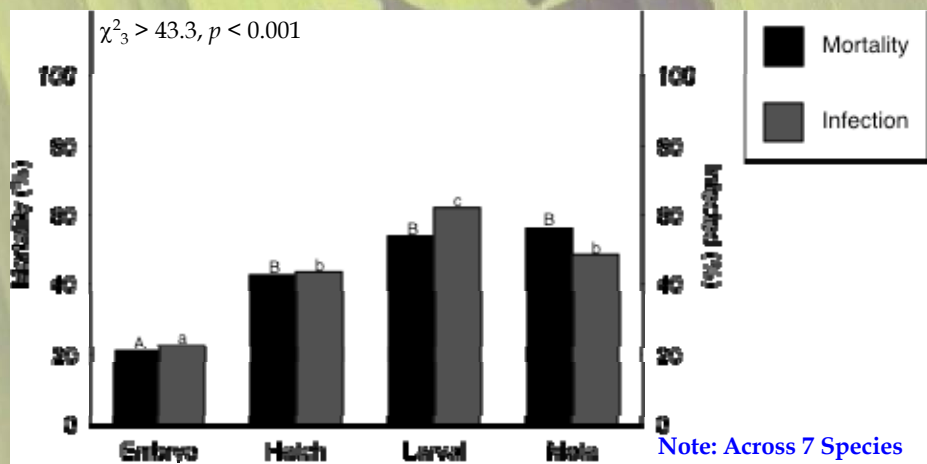


## Mortality reflects infection scenarios




$I1-I2 \gg NI1-I2 > I1-NI2 \gg NI1-NI2$

## Species Comparison



Haislip NA, Gray MJ, Hoverman JT and DT Miller (in press) Development and disease: how susceptibility to an emerging pathogen changes through anuran development. *PLoS One*.



## Genotype by genotype interactions


→ Coevolution of host resistance and parasite infectivity/virulence

Complex Gene : matching allele


		Host clone										
		1	3	4	5	7	8	13	14	15	Av.	
Parasite isolate	1	1	1	1	1	1	1	1	1	1	1	41
	3	1	1	1	1	1	1	1	1	1	1	56
	4	1	1	1	1	1	1	1	1	1	1	31
	5	1	1	1	1	1	1	1	1	1	1	39
	7	1	1	1	1	1	1	1	1	1	1	29
	8	1	1	1	1	1	1	1	1	1	1	14
	13	1	1	1	1	1	1	1	1	1	1	26
	14	1	1	1	1	1	1	1	1	1	1	20
	15	1	1	1	1	1	1	1	1	1	1	41
	Av.	27	74	50	41	13	18	16	20	39		

Carius et al. 2001 Evolution

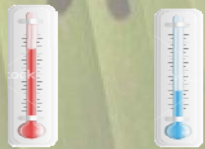
Species



Strains



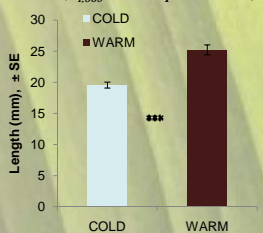
Temperature



## Multiple contingency - Length

**Temperature** (interaction accounted)

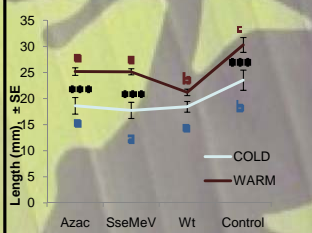
( $F_{1,389} = 4.348; p = 1.78 \times 10^{-5}$ )



**1-Tads smaller in cold**

**Temperature\*Strain**

( $F_{7,385} = 11.96; p = 8.11 \times 10^{-14}$ )

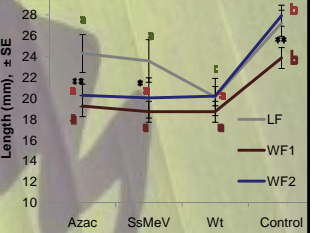


**2-Strain effect is contingent of Temperature**

- Control do always better (cold or warm)
- In cold, no diff between virus strains
- Strongest effect of Wt in warm.

**Species\*Strain**

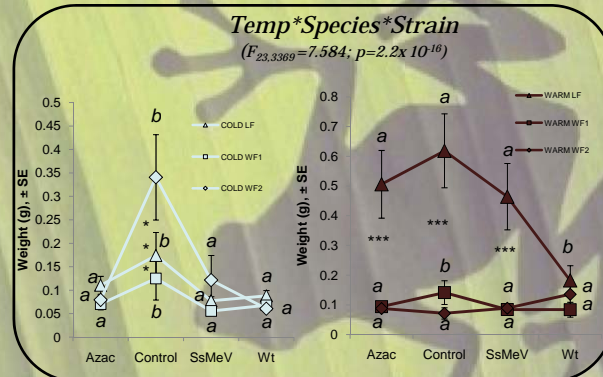
( $F_{11,385} = 11.96; p = 6.249 \times 10^{-6}$ )



**3-Strain effect is contingent of Species**

- Control do always better
- No genotypic difference for WF1-2
- Strongest effect of Wt in LF only

## Multiple contingency - Weight



### **Strain effects are conditional of both Temperature and Species)**

-Overall effect of infection in cold, regardless of Species or Strain

-Strongest effect of Wt in LF only in Warm



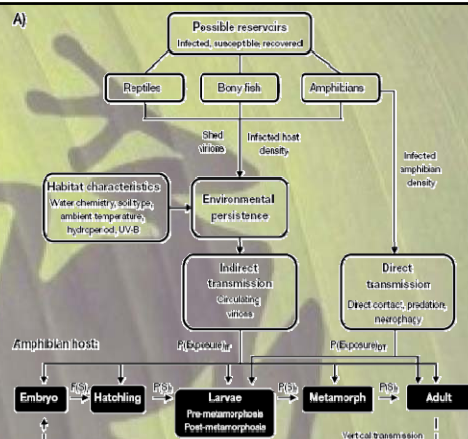
## *Outside the host-pathogen box*

- ✓ Key role of the environment (density, temperature)
  - infection may be beneficial in stressful environments
- ✓ Key role of the timing of infection
  - conservation and experimental implications
- ✓ Considerable variation in life history traits in response to environmental variation (temperature, host, viral strain)
  - coevolution and frequency-dependent selection



## What's next

- Transmission
  - Vertical vs. Horizontal
- Landscape genetics of an infection
  - Gene flow vs. Disease dynamics
  - Phylogeography of Ranavirus
- Metal-Induced Immunosuppression
  - Health-related trade-offs



## Thanks for your attention

"The gates of hell are open  
 night and day;  
 smooth the descent,  
 and easy is the way:  
 But to return,  
 and view the cheerful skies,  
 In this the task  
 and mighty labor lies."

Virgil's Aeneid

