

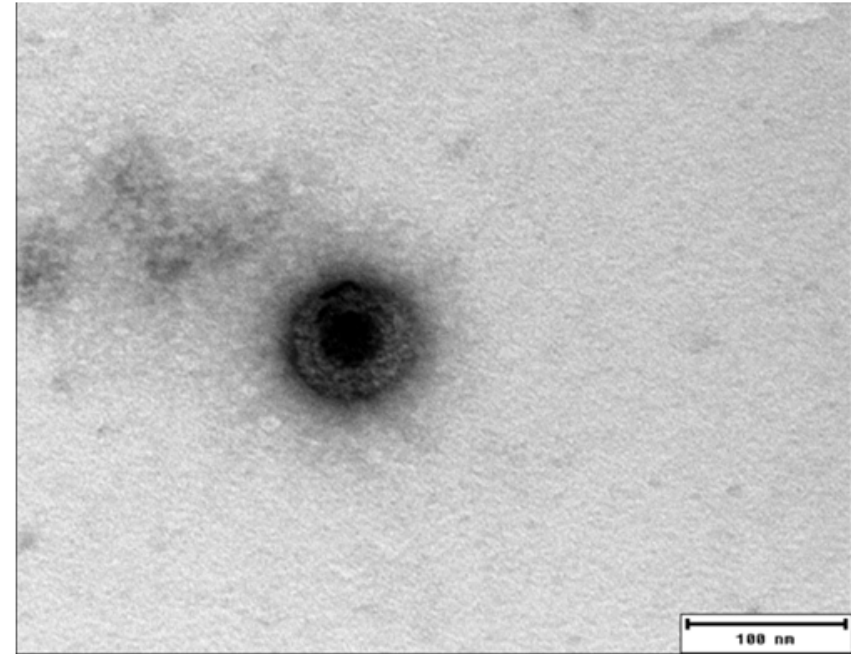
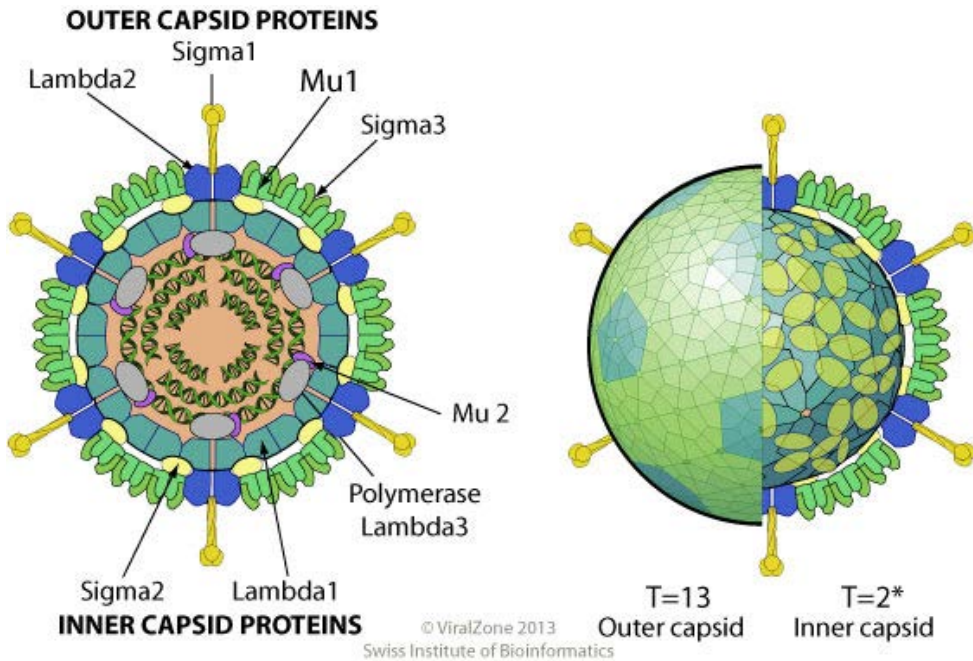
Piscine orthoreovirus (PRV-3) associated with disease in RAS

23rd AW

27th May 2019

Niccolò Vendramin DVM, PhD

Piscine Orthoreovirus -PRV



- dsRNA virus segmented non-enveloped RNA virus
- Belongs to the Reoviridae Family
- Contains 10 segments
- No cell lines available

Orthoreovirus – replication

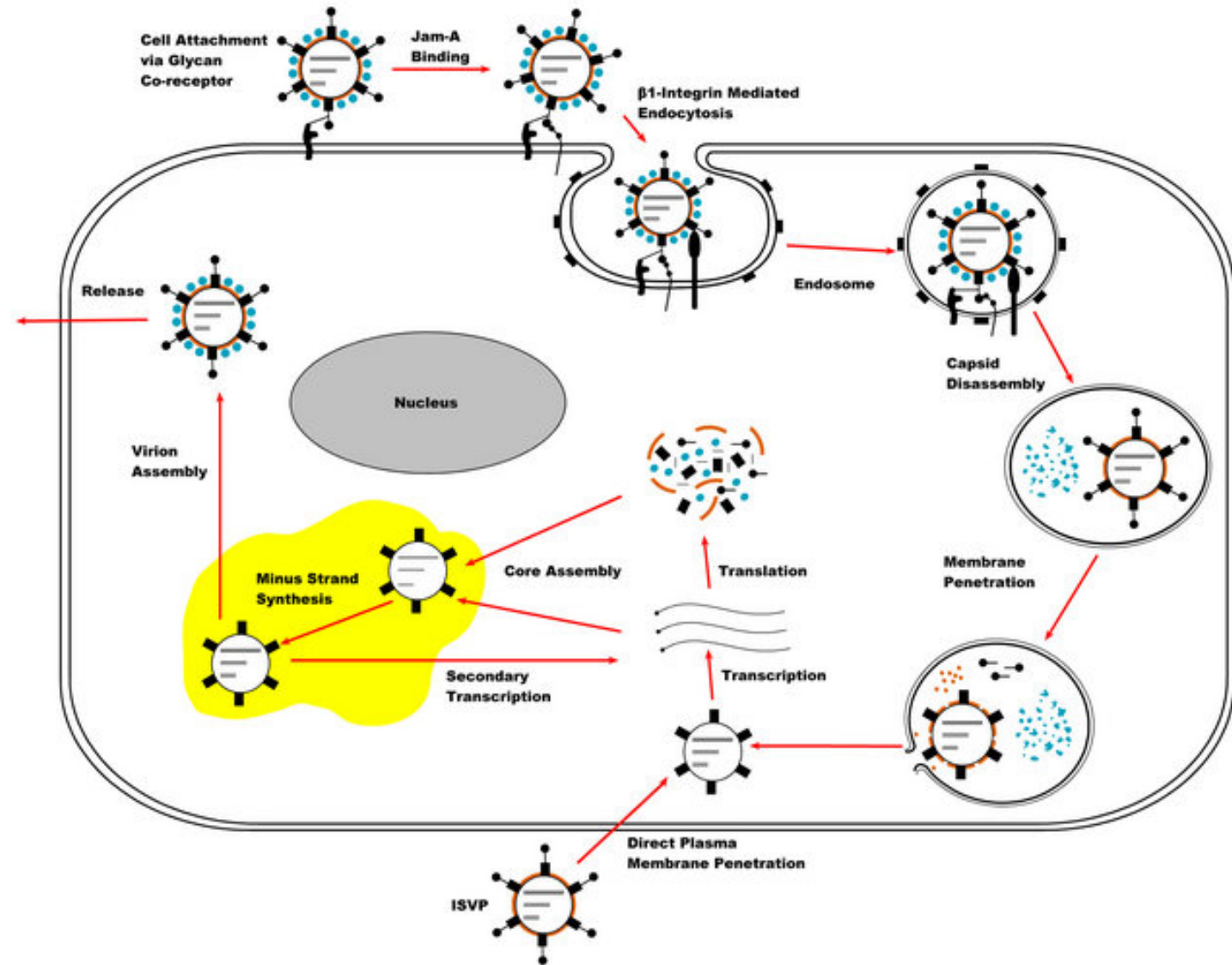
In mammals

REOV-
Respiratory
Enteric
Orphan (no disease)

In salmonids, PRV

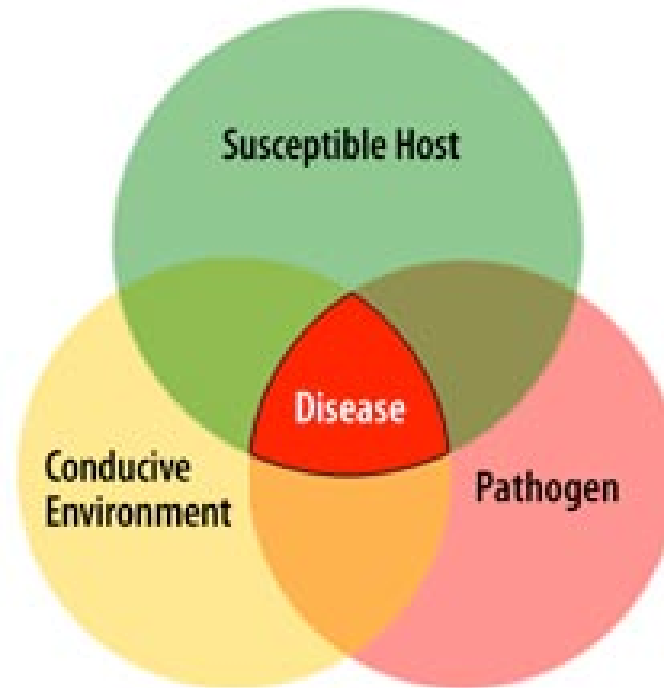
Infects Erythrocyte and (cardio)myocytes
Causes disease

Reoviral disease occurs also in poultry
Why?



Disease VS pathogen detection

- Pathogen detection has been a good proxy for disease diagnostics when dealing with highly virulent viruses (VHSV in Rt, IHNV As)



How to deal with PRV that are ubiquitous?

PRV or PRVs?

	Atlantic salmon	Rainbow trout	Pacific Salmon (Coho-Chinook-Sockeye)	Brown trout
PRV-1	HSMI	N/A	Jaundice (Chinook)	N/A
PRV-2	N/A	N/A	EIBS (Coho)	N/A
PRV-3	Experimental	Pancarditis **	Jaundice (Coho)	Pancarditis** (PDS?)

HSMI described in **1999**

PRV-1 causing HSMI **2017**

PRV-1 detected 1977

EIBS described in **1977** and **1987**

PRV-2 causing EIBS **2016**

N/A

RT disease described in **2013**

PRV-3 causing HSMI-like **2018**

PRV-3 detected in 1995

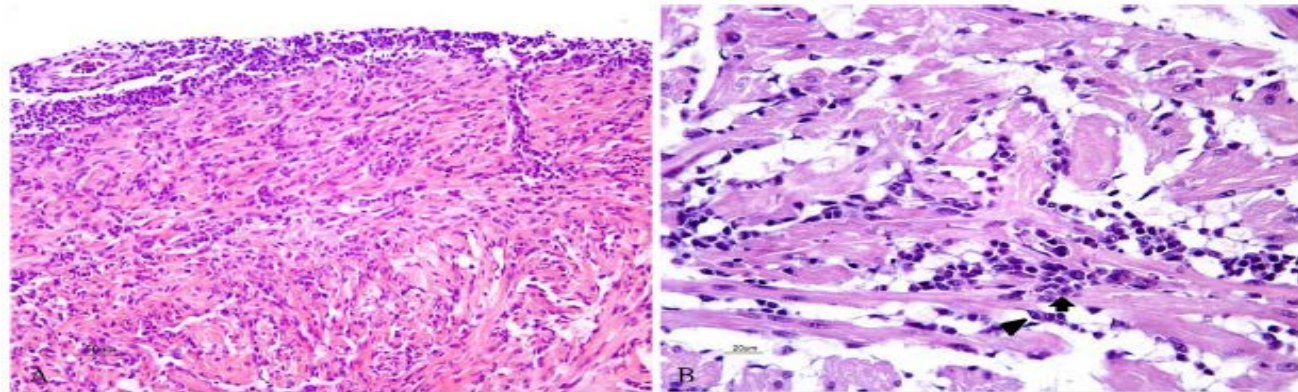
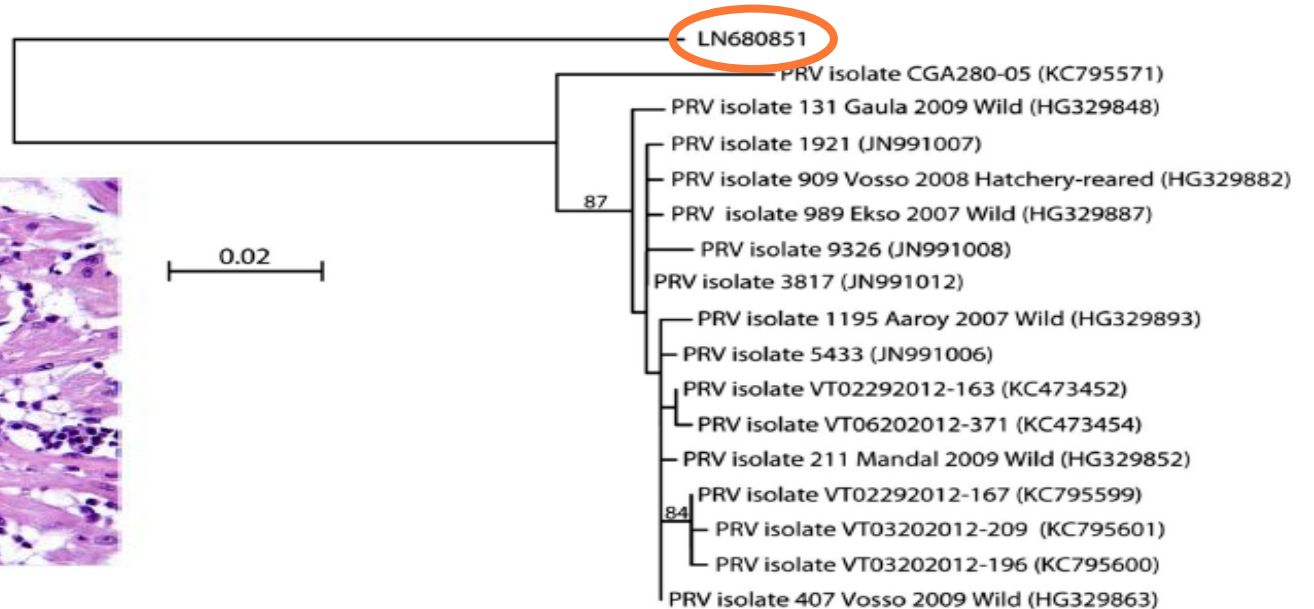
Why "old" widespread viruses become pathogenic recently?



RESEARCH ARTICLE

First Description of a New Disease in Rainbow Trout (*Oncorhynchus mykiss* (Walbaum)) Similar to Heart and Skeletal Muscle Inflammation (HSMI) and Detection of a Gene Sequence Related to Piscine Orthoreovirus (PRV)

Anne Berit Olsen^{1*}, Monika Hjortaa², Torstein Tengs², Hege Hellberg^{1,2a}, Renate Johansen^{2,2ab}



Vendramin *et al. Vet Res* (2019) 50:14
<https://doi.org/10.1186/s13567-019-0632-4>




RESEARCH ARTICLE

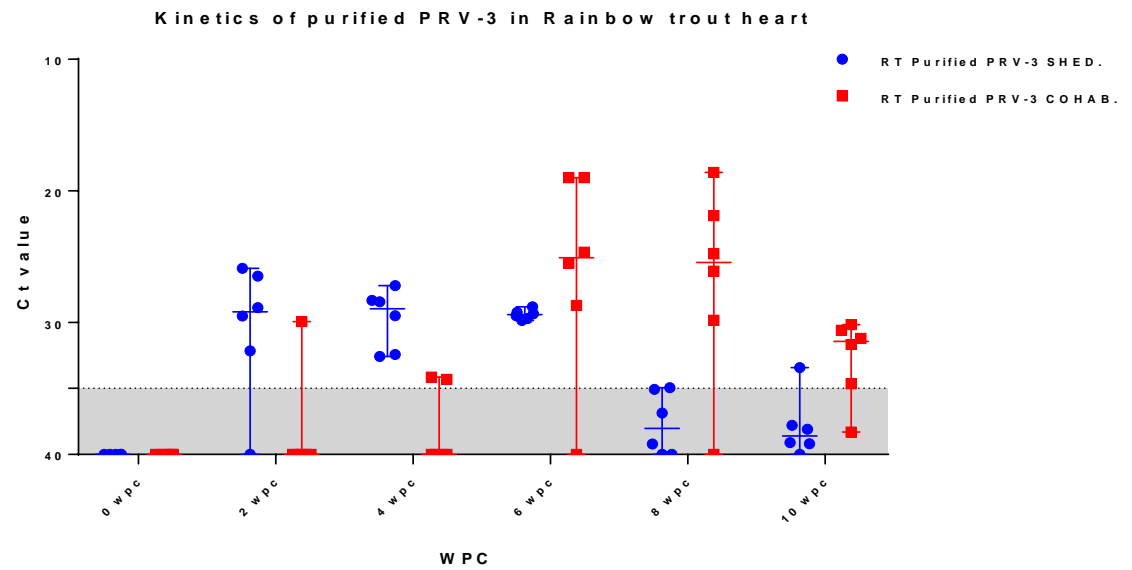
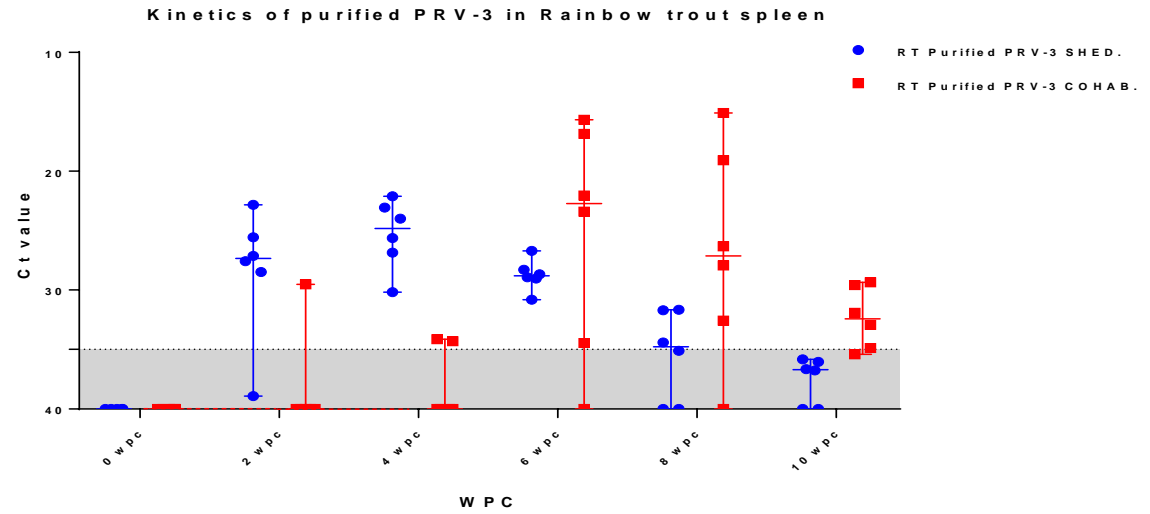
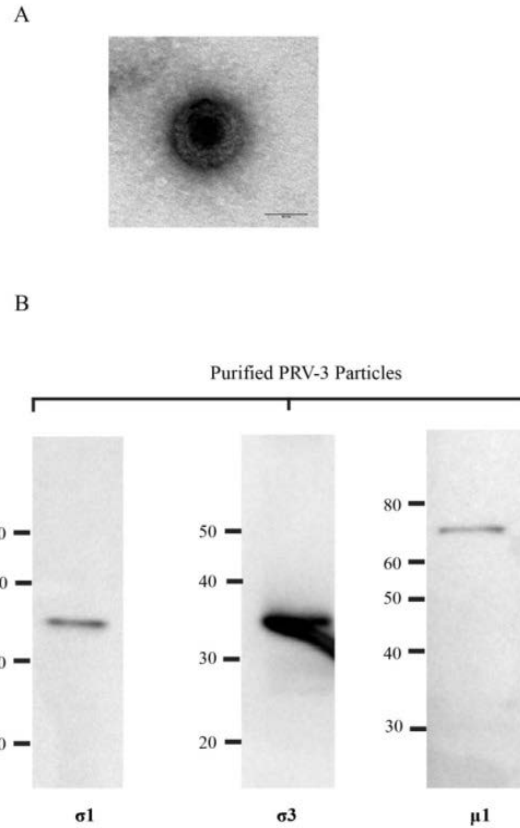
Open Access

Piscine orthoreovirus subtype 3 (PRV-3) causes heart inflammation in rainbow trout (*Oncorhynchus mykiss*)

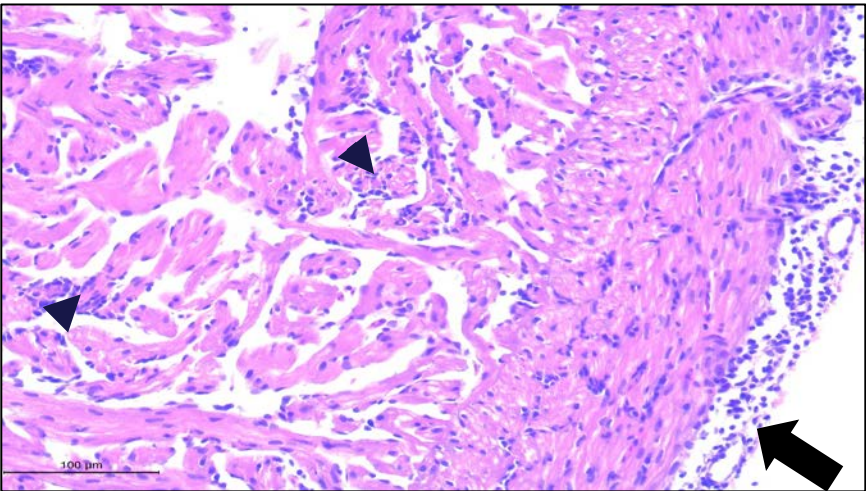
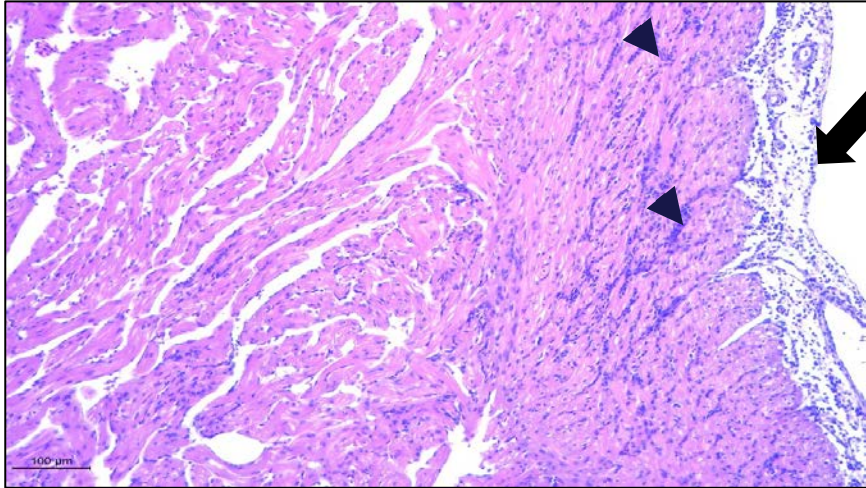


Niccoló Vendramin^{1††} , Dhamotharan Kannimuthu^{2†}, Anne Berit Olsen³, Argelia Cuenca¹,
Lena Hammerlund Teige², Øystein Wessel², Tine Moesgaard Iburg¹, Maria Krudtaa Dahle⁴, Espen Rimstad²
and Niels Jørgen Olesen¹

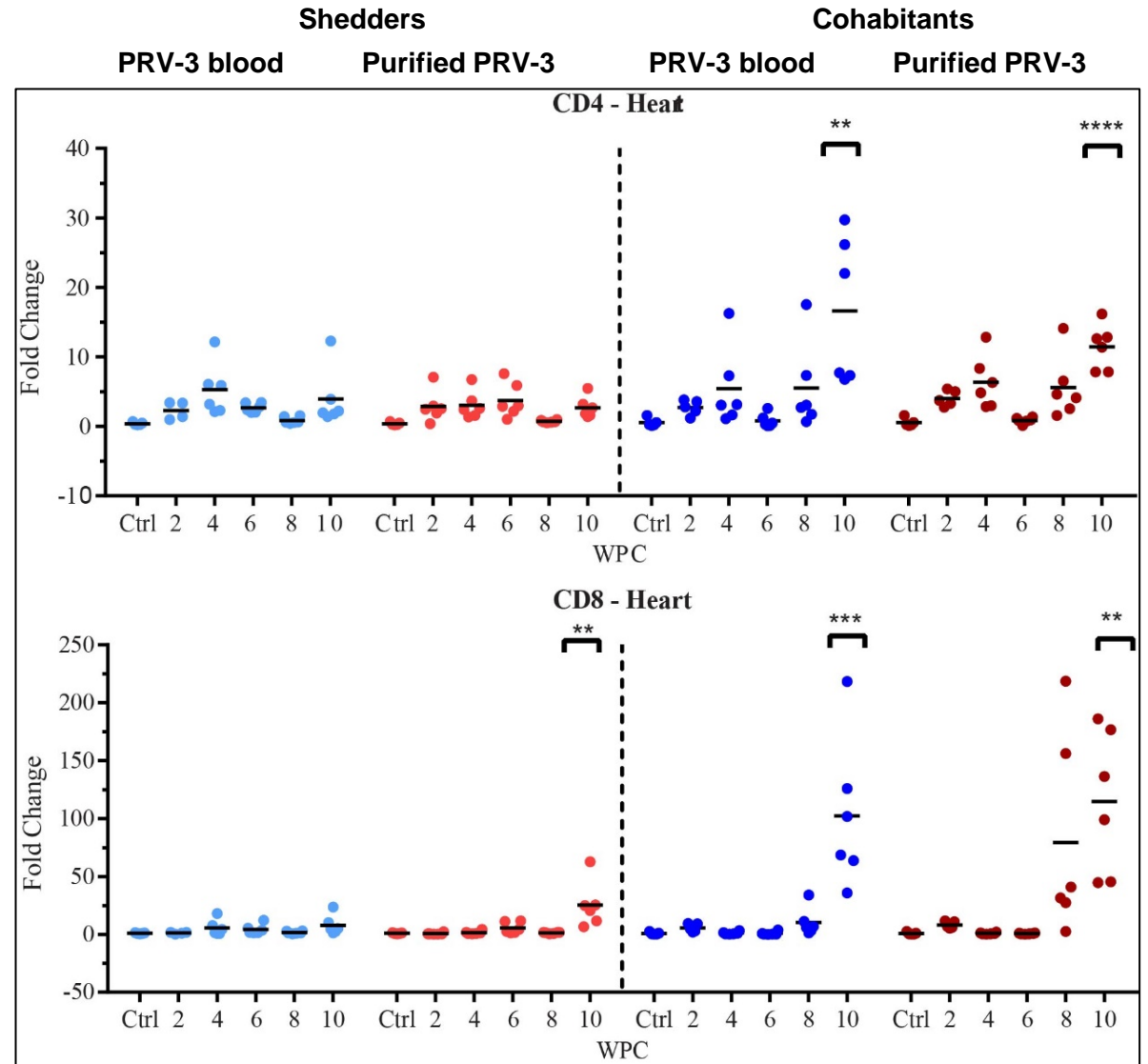
PRV-3 Causative relationship



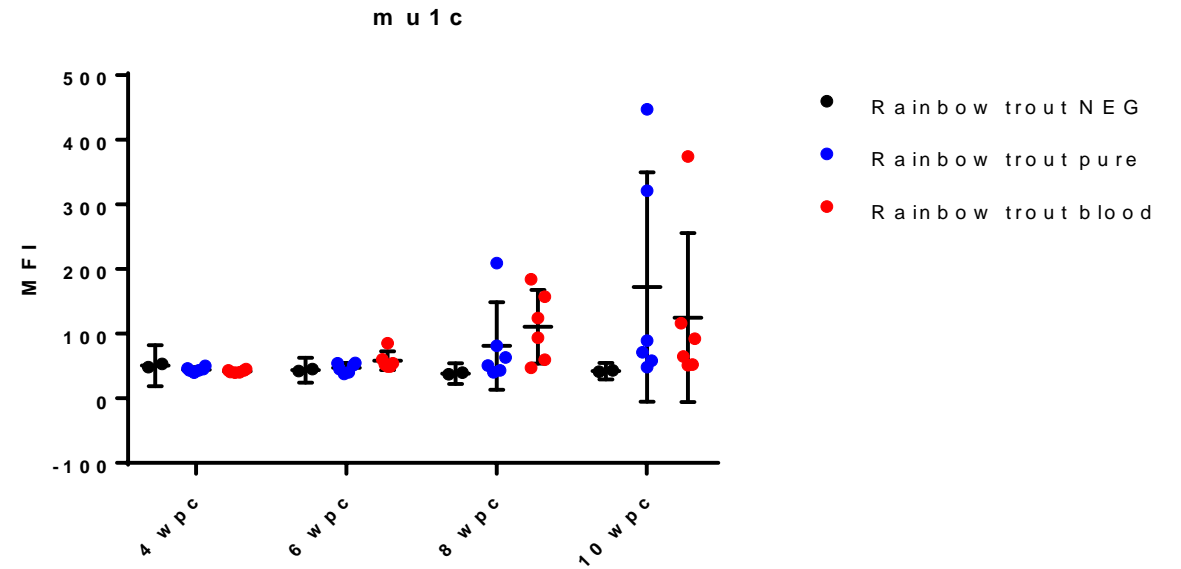
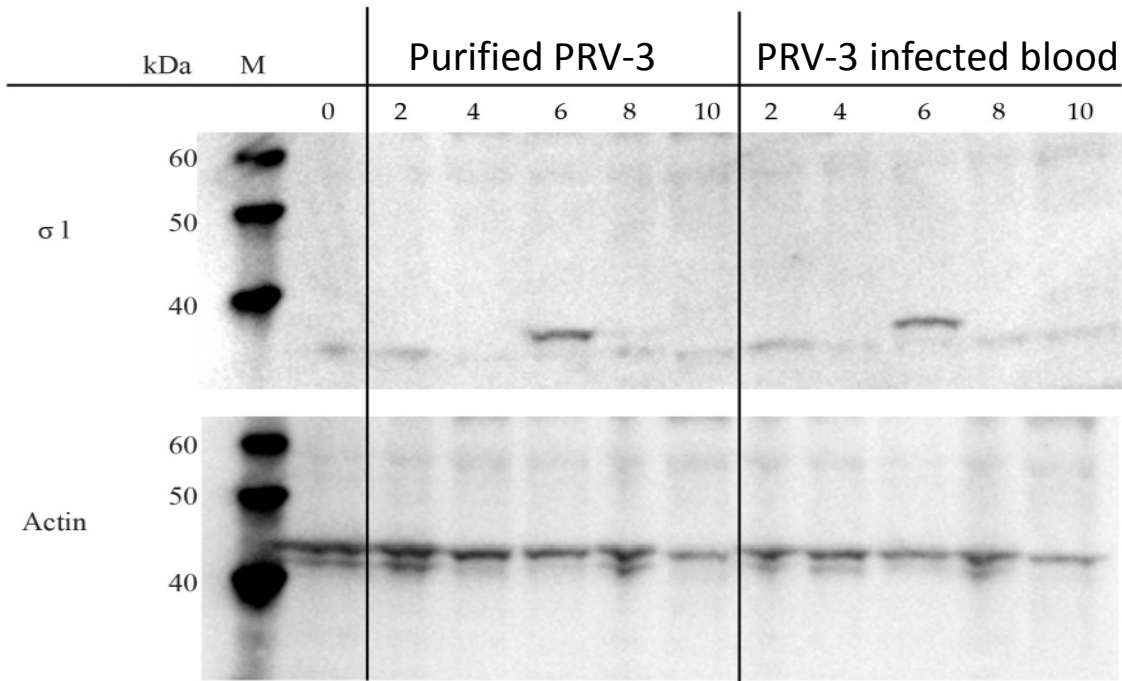
Heart Pathology - Immune response



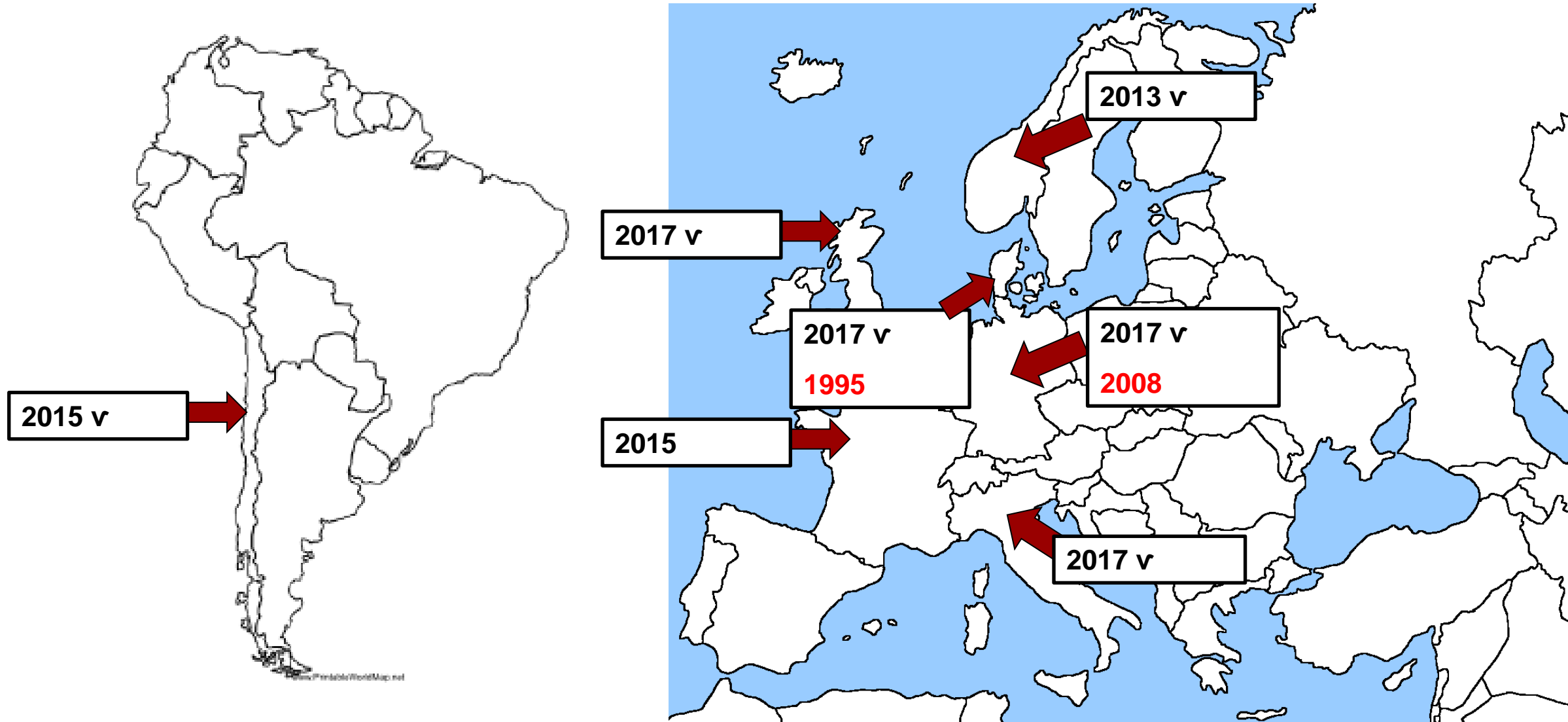
Pics. Anne Berit Olsen



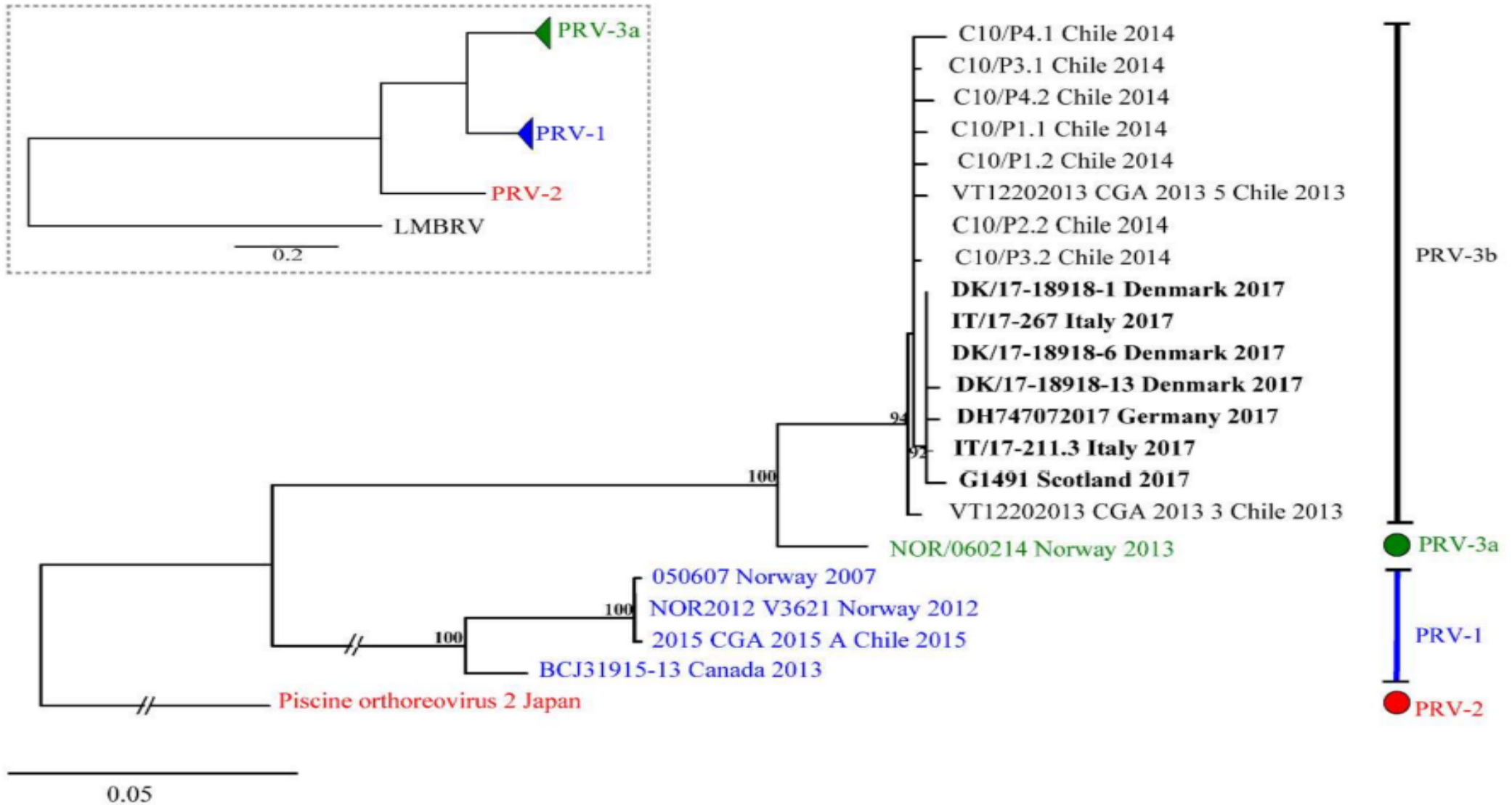
Antigen detection – Antibody response



Recent history of PRV-3

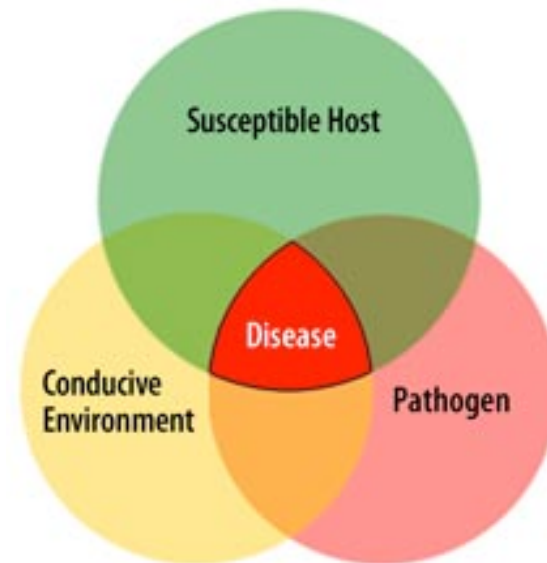


PRV-3 Molecular characterization



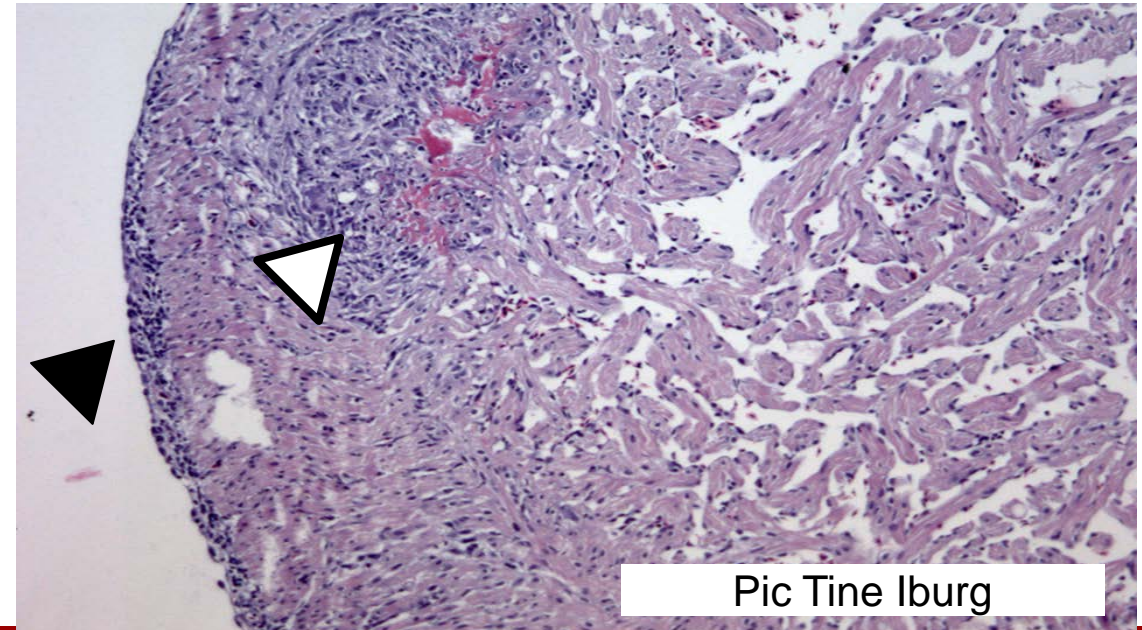
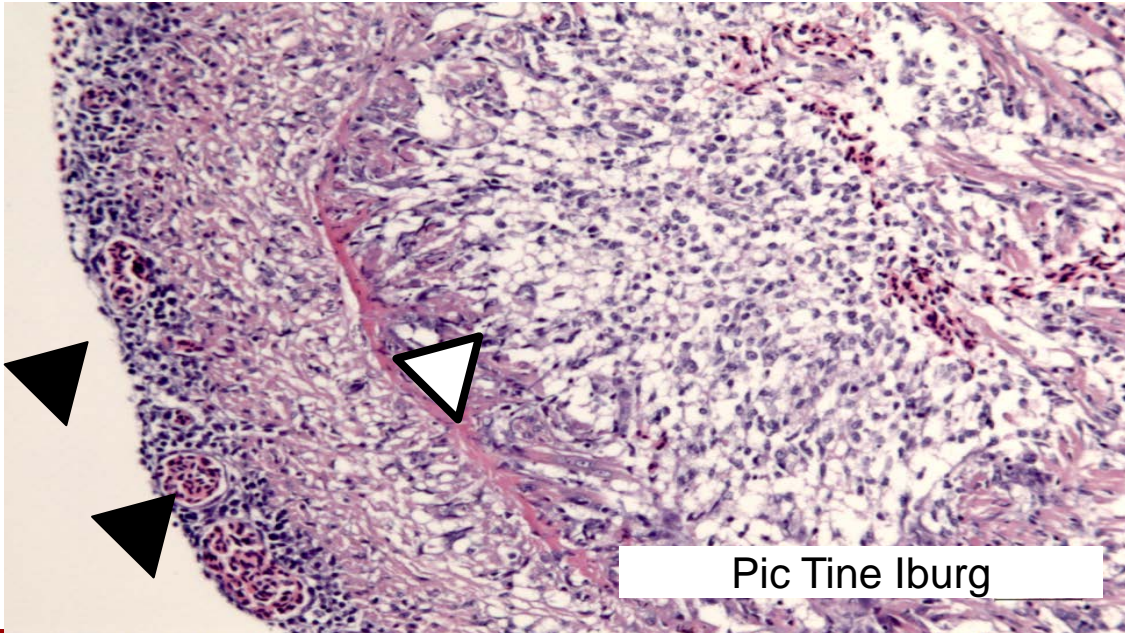
Disease related to PRV-3

Farm type	Fish species	# farms tested	# PRV-3 +ve	Presence of disease
Re-stocking	Brown trout	3	3	0
Broodstock	Rainbow trout	21	10	0
Nursery	Rainbow trout	13	9	0
RAS Grow out	Rainbow trout	15	13	10

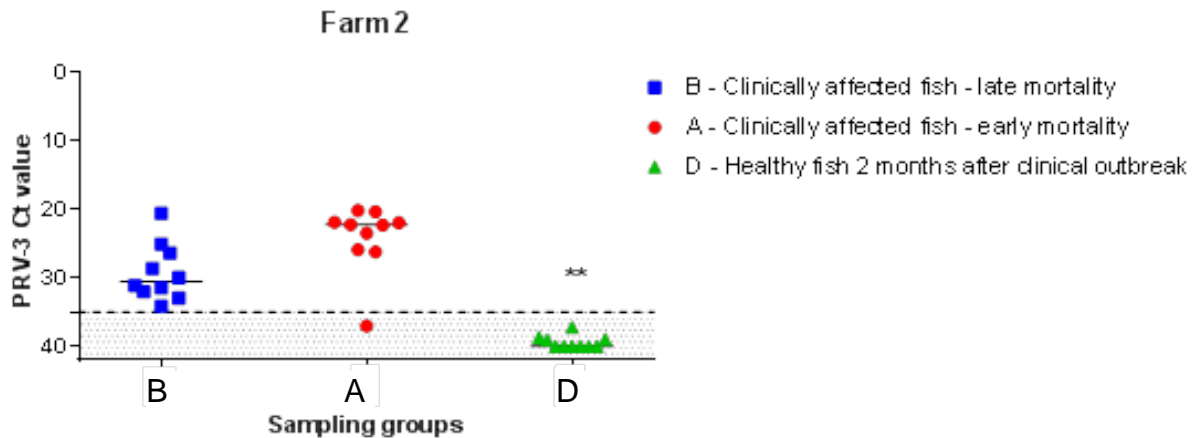
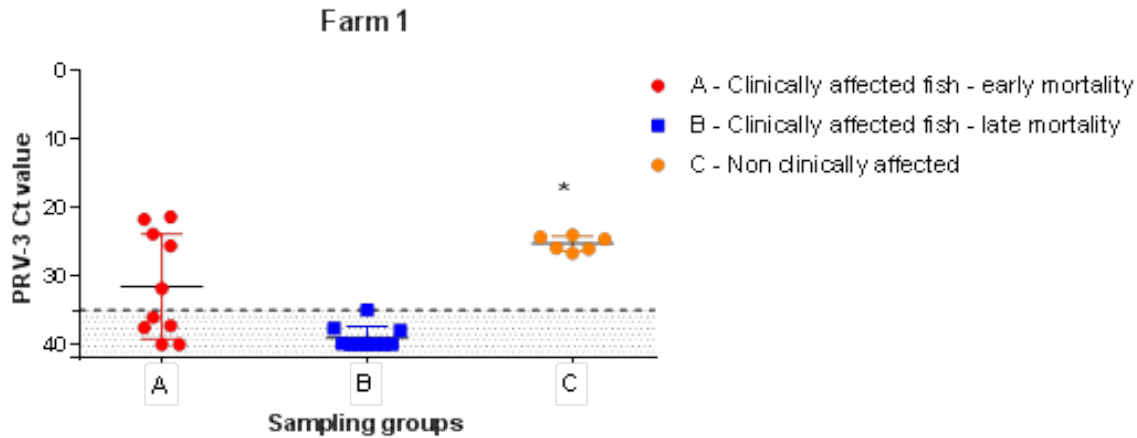


Disease related to PRV-3 in Denmark

- Affect Rainbow trout in RAS
- Neurological symptoms/ Gill diseases
- Severe anemia
- Complex disease cases (IPNV, BKD, *F. psychr.*)
- Histopath: Epicarditis, mainly mild was seen in most of the fish. Many of the fish have multifocal granulomatous myocarditis and hepatitis indicative of BKD



PRV-3 load in Rainbow trout in RAS

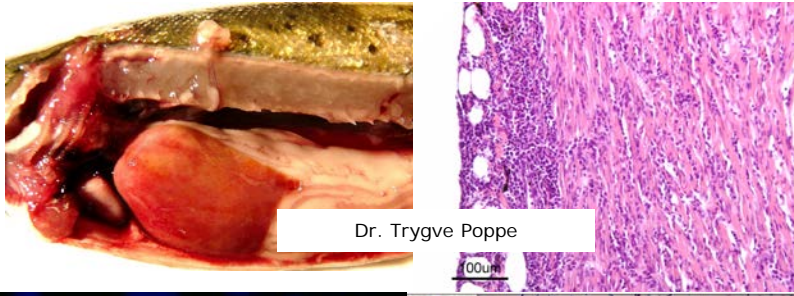


	A	B	C
PRV-3	++	-/+	+++
BKD	Neg	Neg	N/A
IPNV	+	+	N/A
<i>F. psych.</i>	(+)	(+)	N/A

	B	A	D
PRV-3	++	+++	-
BKD	Susp	Susp	Susp
IPNV	-	-	-
<i>F. psych.</i>	+	+	-

PRV pathogenesis

PRV-1 / HSMI



Dr. Trygve Poppe

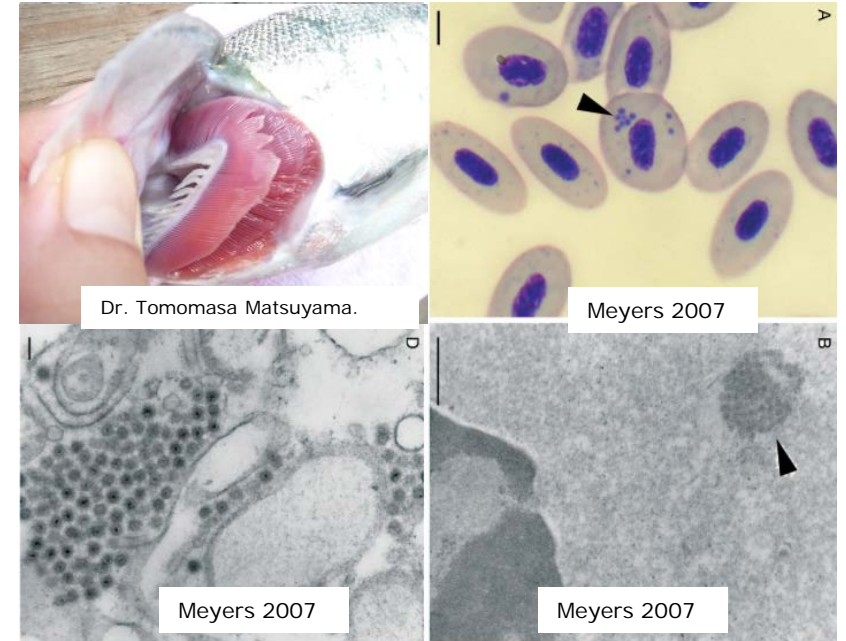
100µm

Wessel et al.2015

Wessel et al.2012

- Persistent infection
- Chronic disease
- low -moderate mortality
- Inflammatory Cytotoxic response
- Heart pathology
- *Salmo salar*

PRV-2/ EIBS



Dr. Tomomasa Matsuyama.

Meyers 2007

Meyers 2007

Meyers 2007

- Acute infection
- Acute disease with high mortality severe anemia
- *Onchoryncus nerka* / *Onchorynchys tshawytscha*



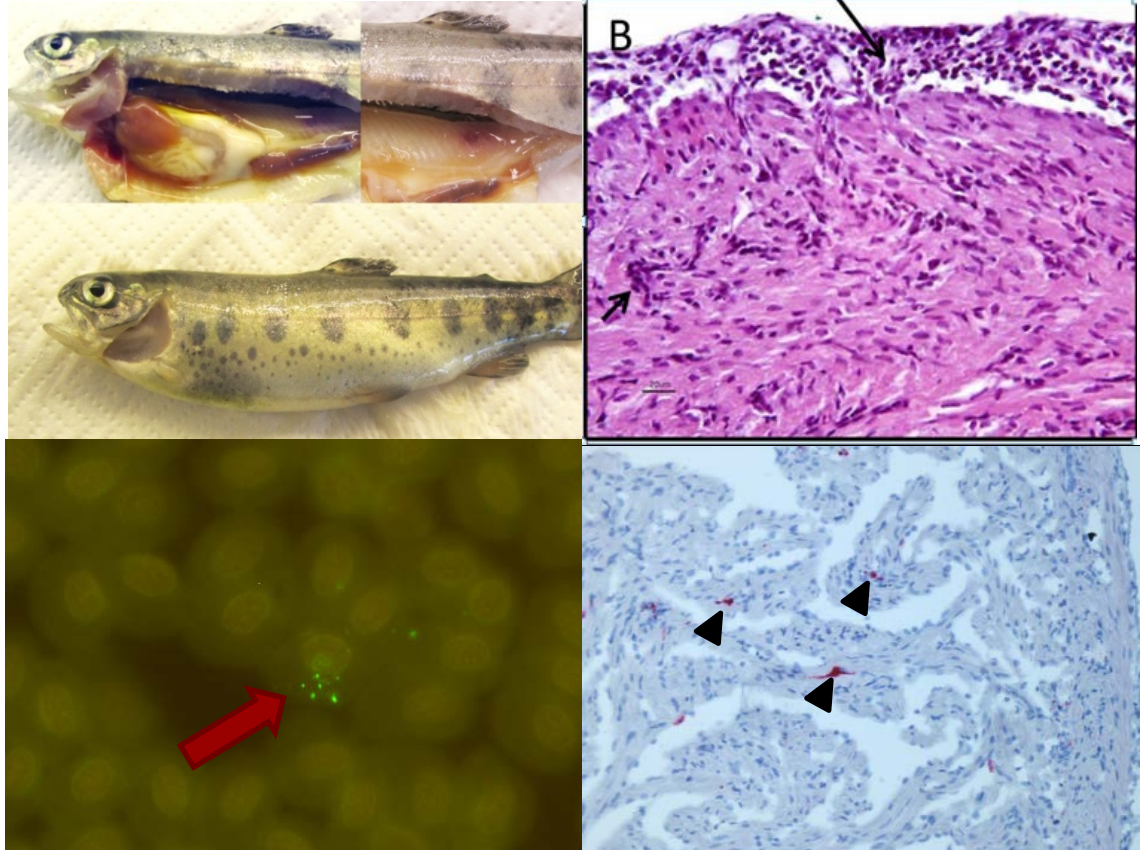
PRV-3 ? RT

PRV-3 pathogenesis in Rainbow trout

PRV-1 / HSMI



PRV-2/ EIBS



PRV-3
Under experimental conditions/ Flow through farm

- Acute infection
- Chronic disease
- Low mortality
- Infl. Cytotoxic response
- Heart pathology
- Anemia +/-
- Rbc inclusions

PRV-3 in RAS

- Acute infection
- Acute disease
- Moderate/high mortality
- Anemia
- Rbc inclusions

Thanks to everyone who contributed to the project...

- **NMBU** Espen Rimstad, Øystein Wessel, Dhamotharan Kannimuthu
 - **NVI** Maria Dahle, Anne Berit Olsen
 - **Aquatic Animal Health Group at DTU AQUA** especially Teena, Christina, Juliane, Argelia and Tine
 - **Dansk Akuakultur** Niels Henrik Henriksen
 - **Fish Vets** Simon Madsen ,Thomas Clausen, Torsten Boutrup
 - **FVST** Henrik, Morten, Jette
 - **IZS**Ve Anna Toffan
 - **Marine Scotland Science** Eann Munro
 - **University of Hannover** Mikolaj Adamek
- And ALL CO-AUTHORS!

And thank you for your attention

Questions ?

