

TriNation 2021

# PRV-1 isolates differ in virulence

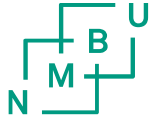
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FHF-project: PRV characterization

Øystein Wessel, NMBU

## Background

# Virulence differences between PRV-1 isolates?



VIRUS

**Piscine orthoreovirus 1 (PRV-1)**

DISEASE

**Heart and skeletal muscle inflammation (HSMI)**

*VIRULENCE DIFFERENCE?*

**Norway**

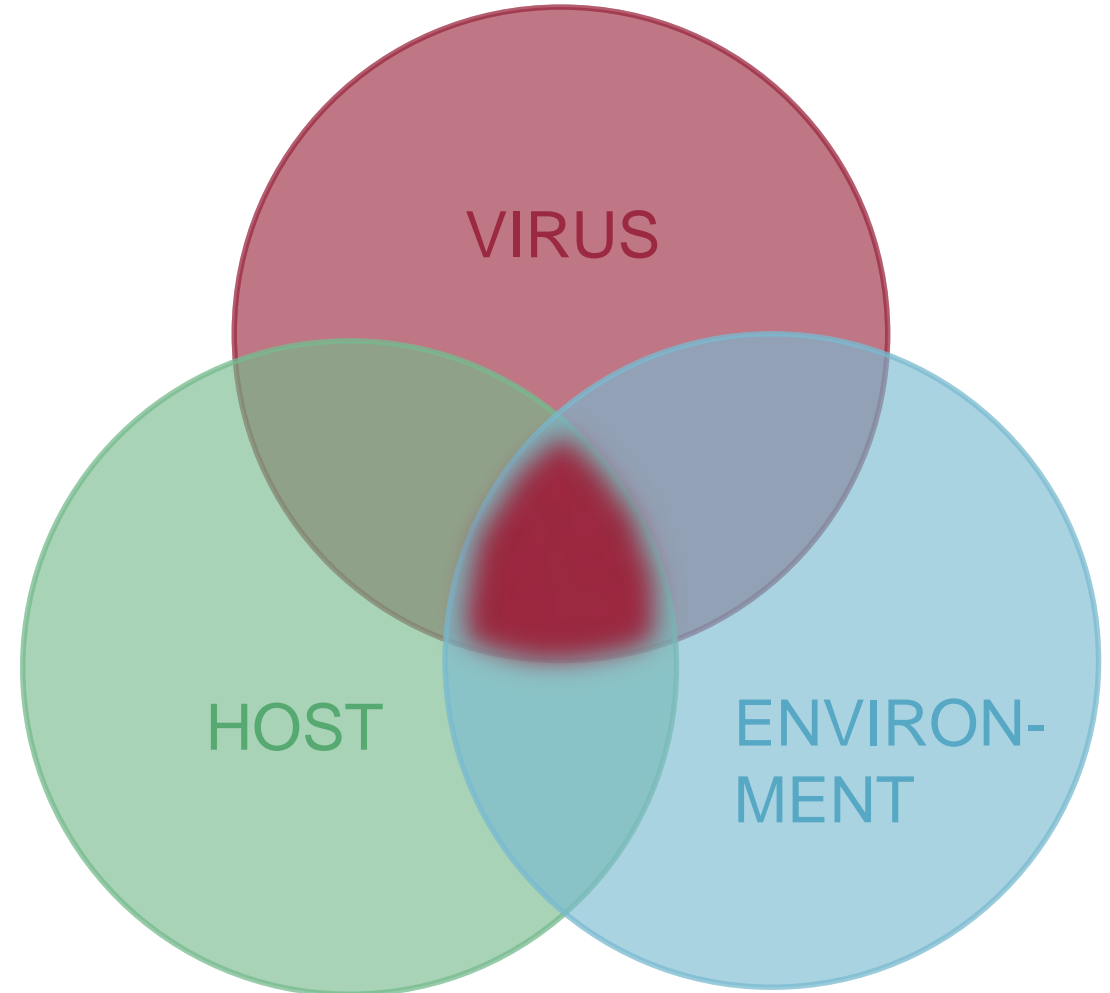
HSMI described in 1999

PRV-1 found in samples from 1988

**Canada**

PRV-1 widespread

HSMI is not

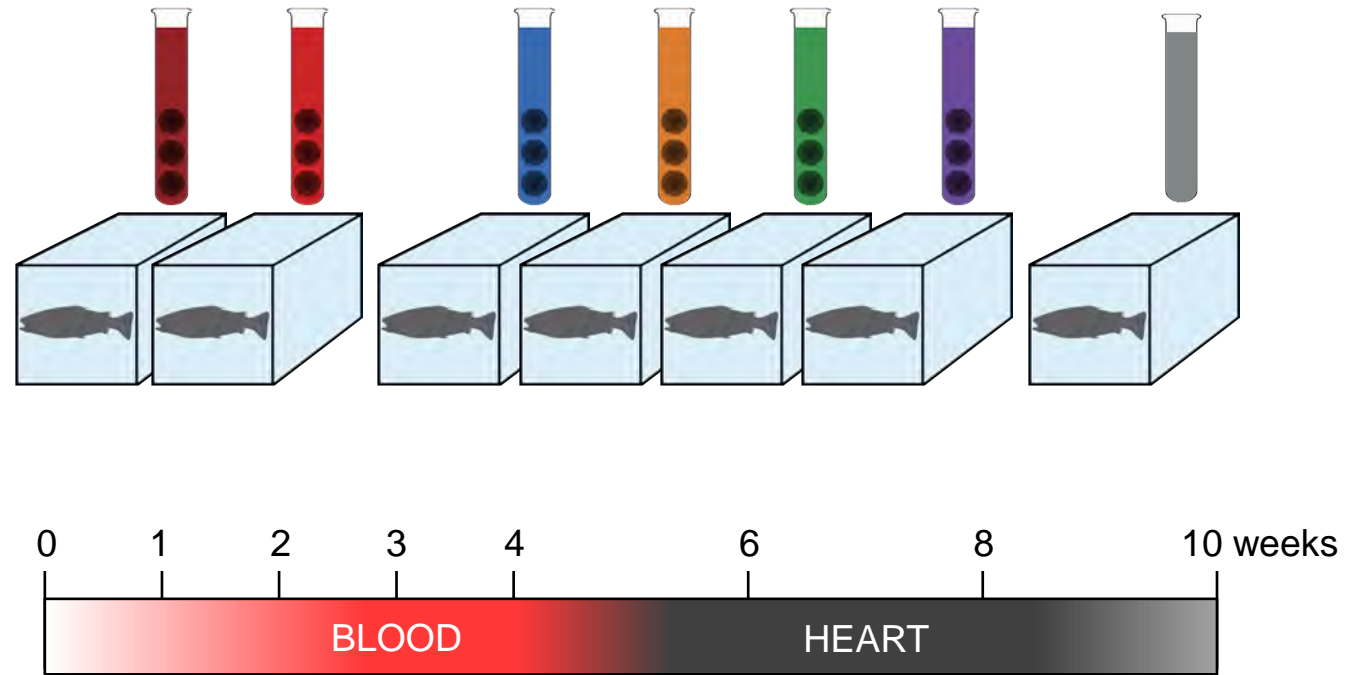


# PRV-1 virulence

## Dose standardized trial

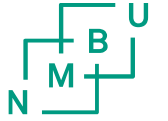


- 
- NOR-2018/SF Field, Norway (PatoGen)
  - NOR-2018/NL Field, Norway (PatoGen)
- 
- NOR-1997 Archive (NMBU)
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- NOR-1996 Archive (VetInst)
  - NOR-1988 Archive (NMBU)
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- CAN BC Canada BC (Kyle Garver)
- 



# PRV-1 virulence

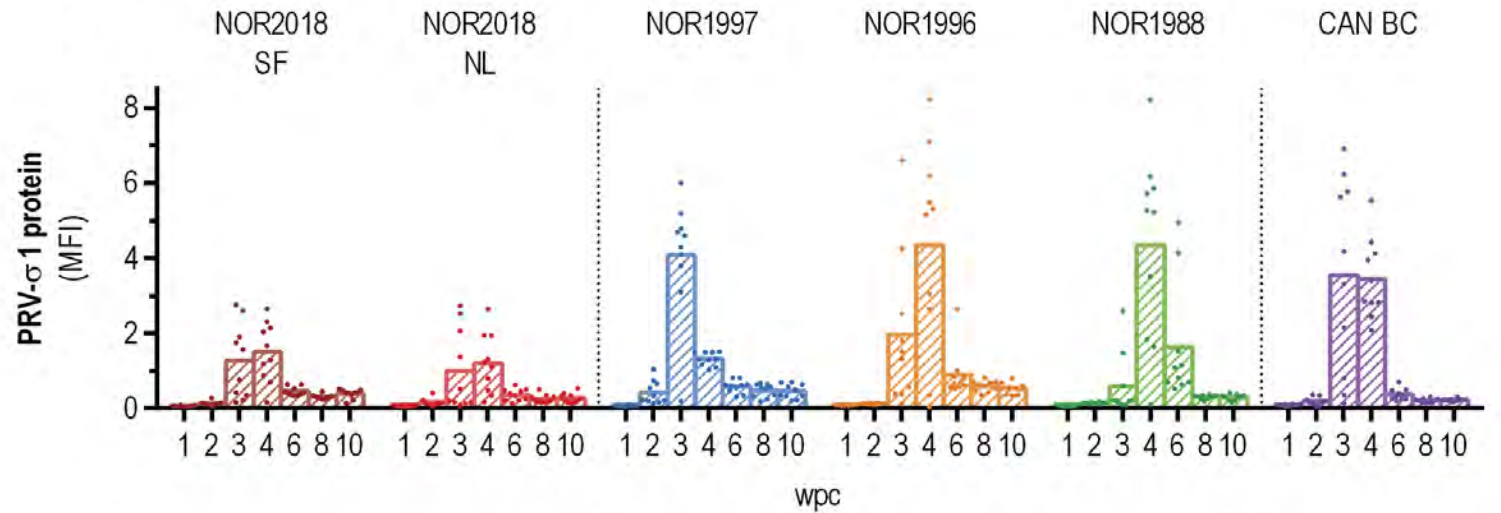
## Viral load in blood



### Blood cells

#### NOR-2018 isolates

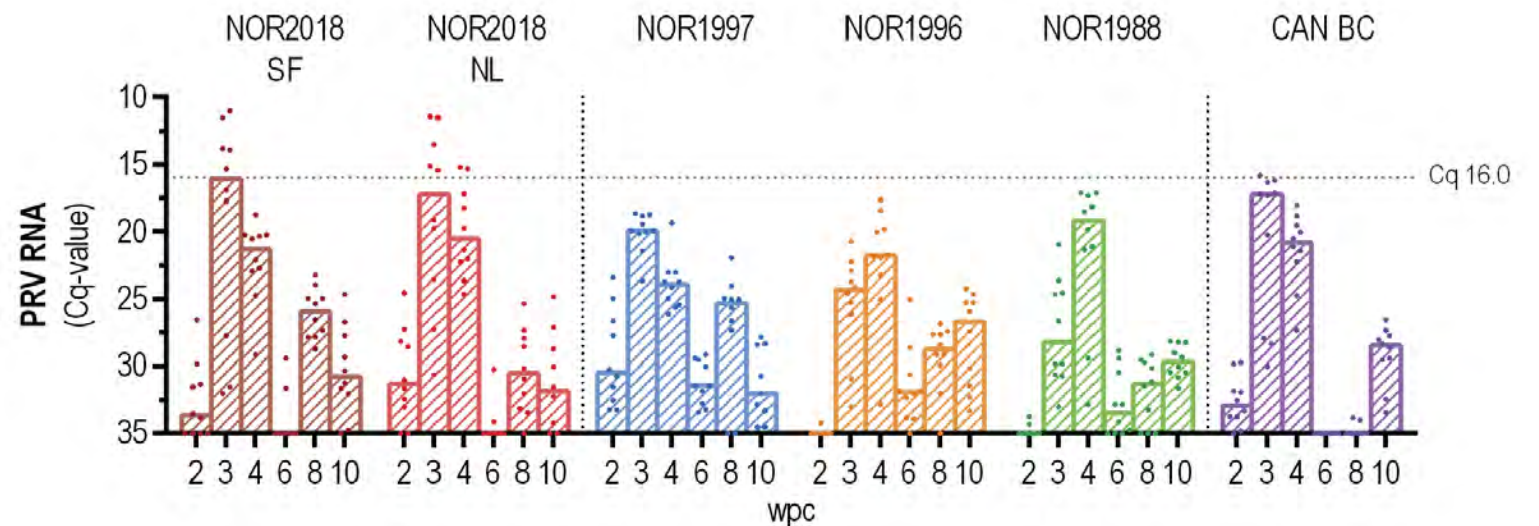
- Lower load of viral protein



### Plasma

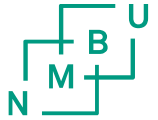
#### NOR-2018 isolates

- Higher load of viral RNA
- Higher load of viral protein



# PRV-1 virulence

## Cardiac lesions



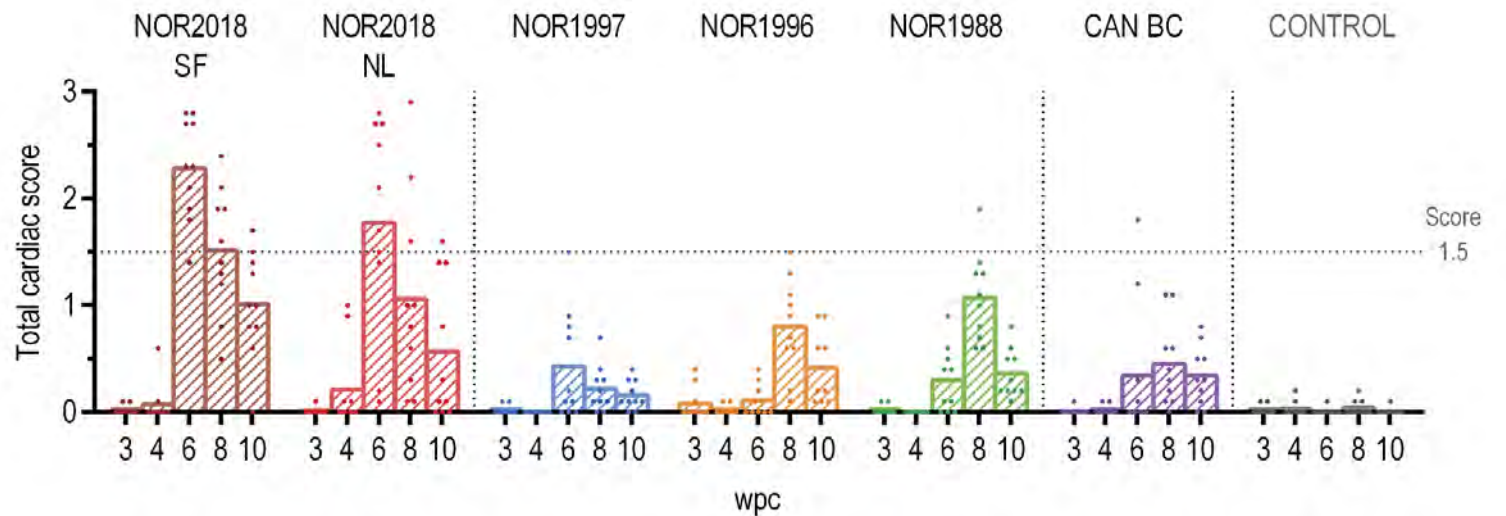
### Difference in ability to induce cardiac lesions

#### NOR-2018 isolates

- Higher cardiac score
- Early onset of lesions

#### Historic Norwegian, Canadian isolate

- Lower cardiac score
- Individual fish with score 1.5





# PRV-1 virulence Cardiac lesions

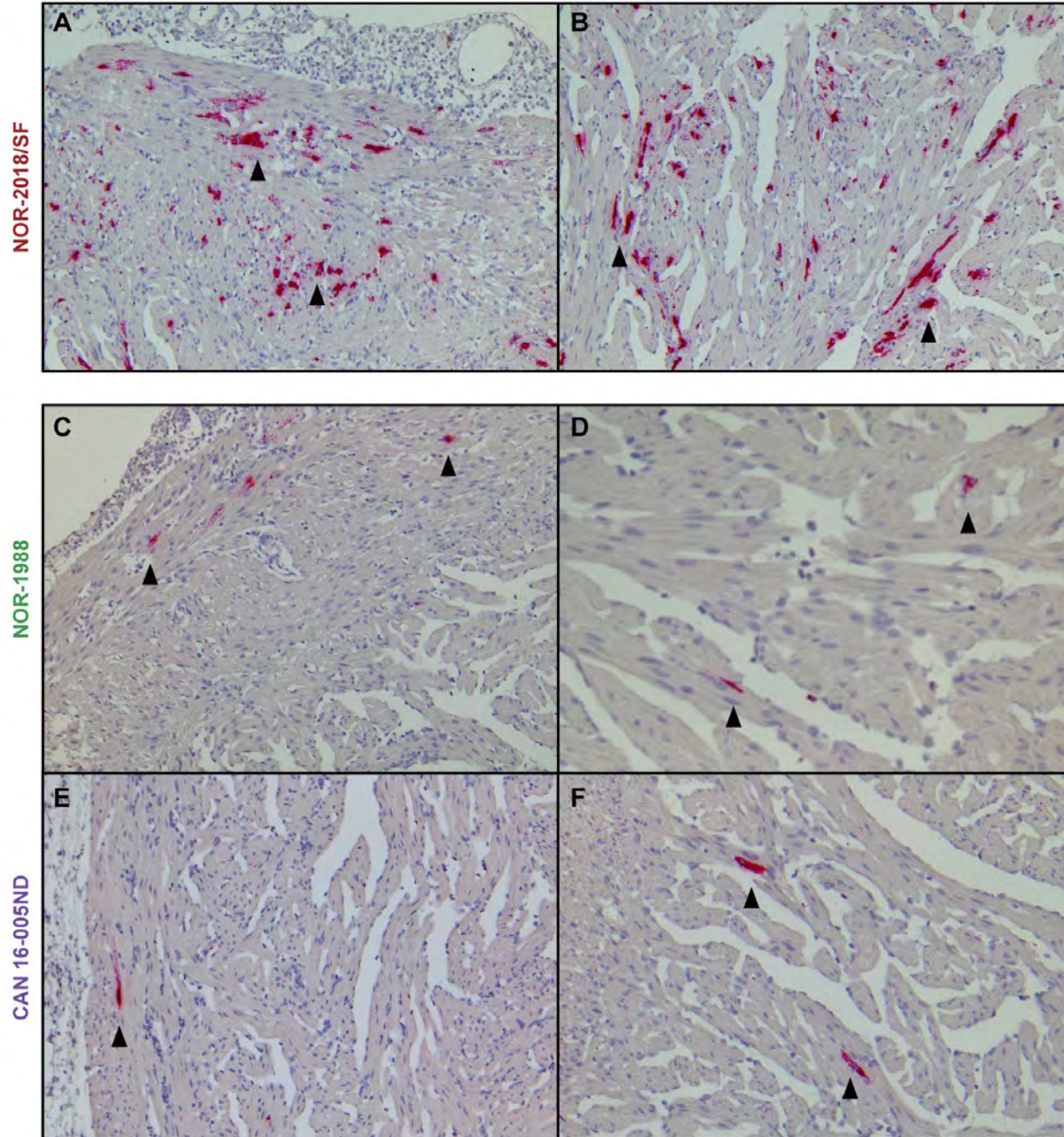
## Difference in ability to Induce cardiac lesions

### NOR-2018 isolates

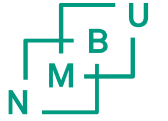
- Higher cardiac score
- Early onset of lesions
- Multiple infected cardiomyocytes

### Historic Norwegian, Canadian isolate

- Lower cardiac score
- Individual fish with score 1.5
- Single infected cardiomyocytes



# PRV-1 virulence Sequence analysis



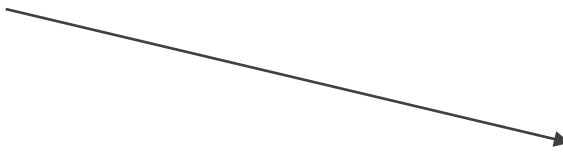
## Virulence difference linked to five segments



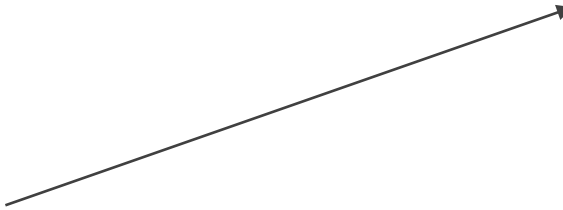
# PRV-1 virulence Reassortment



NOR-1988  
NOR-1996  
CAN-BC



NOR-1997



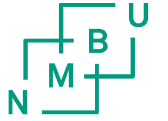
1999

NOR-2018 SF NOR-2018 NL





# PRV-1 virulence Summary



## CONCLUSION

### Virulence difference between PRV-1 isolates

#### Virulent variants

- Plasma viremia
- Severe cardiac lesions

5 segments linked to virulence

#### Practical implications

- Target high virulent variants
- Reduce impact of PRV-1 related disease

**pathogens**

Article  
**Piscine Orthoreovirus-1 Isolates Differ in Their Ability to Induce Heart and Skeletal Muscle Inflammation in Atlantic Salmon (*Salmo salar*)**

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**Abstract:** Piscine orthoreovirus 1 (PRV-1) is the causative agent of heart and skeletal muscle inflammation (HSMI) in farmed Atlantic salmon (*Salmo salar*). The virus is widespread in Atlantic salmon and was present in Norway long before the first description of HSMI in 1999. Furthermore, in Canada the virus is prevalent in farmed Atlantic salmon but HSMI is not and Canadian isolates have failed to reproduce HSMI experimentally. This has led to the hypothesis that there are virulence differences between PRV-1 isolates. In this study we performed a dose standardized challenge trial, comparing six PRV-1 isolates, including two Norwegian field isolates from 2018, three historical Norwegian isolates predating the first report of HSMI and one Canadian isolate. The Norwegian 2018 isolates induced lower viral protein load in blood cells but higher plasma viremia. Following peak replication in blood, the two Norwegian 2018 isolates induced histopathological lesions in the heart consistent with HSMI, whereas all three historical Norwegian and the Canadian isolates induced only mild cardiac lesions. This is the first demonstration of virulence differences between PRV-1 isolates and the phenotypic differences are linked to viral proteins encoded by segment S1, M2, L1, L2 and S4.

**Keywords:** PRV-1; heart and skeletal muscle inflammation; virulence; Atlantic salmon

# PRV-1 virulence Acknowledgement



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