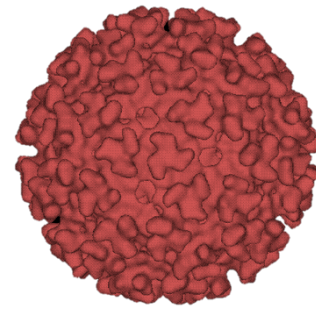


CELLULAR IMMUNE RESPONSES IN RAINBOW TROUT FOLLOWING VACCINATION AND CHALLENGE AGAINST SALMONID ALPHAVIRUS (SAV)

K. Veenstra, K. Hodneland, K. Takehana,
R. Belmonte, U. Fischer

• Introduction : Salmonid Alphavirus



- Causative agent of:
Pancreas Disease (salmon)
& Sleeping Disease (trout)
- Six subtypes
- Associated with:
frequent and high mortality
& reduced weight gain
- Commercially available
inactivated vaccines have
been found to be
efficacious
- Despite comprehensive
vaccination programs, SAV
is becoming increasingly
prevalent and eradication is
a challenge

**Inactivated oil-adjuvanted vaccines
are often sub-optimal against viruses**

- **Introduction**

Investigate immune mechanisms after vaccination
& challenge

Focusing on cytotoxicity gain insights on:

- pathogenesis of SAV
- host responses which contribute to protection



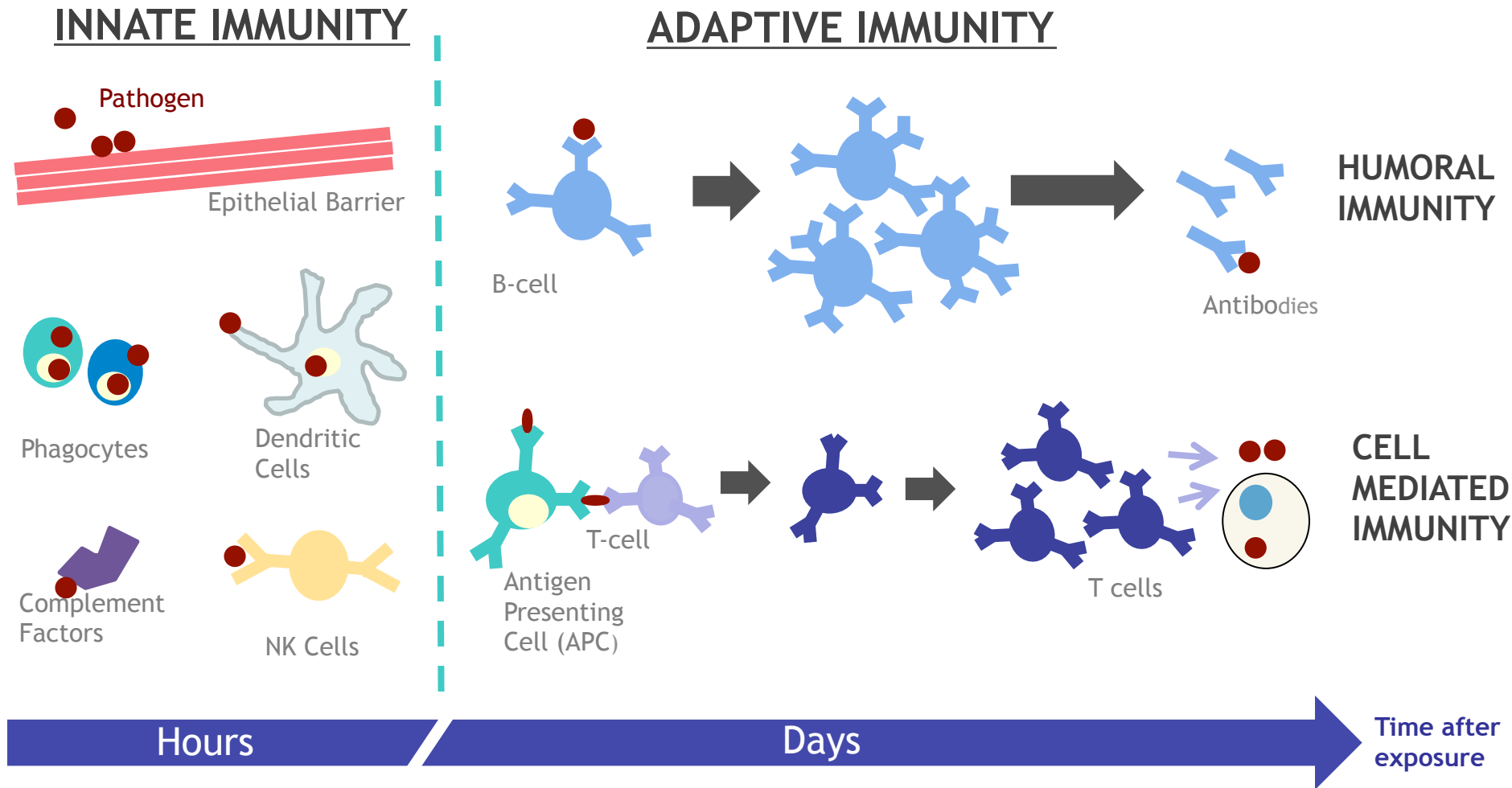
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• Introduction : Immune System



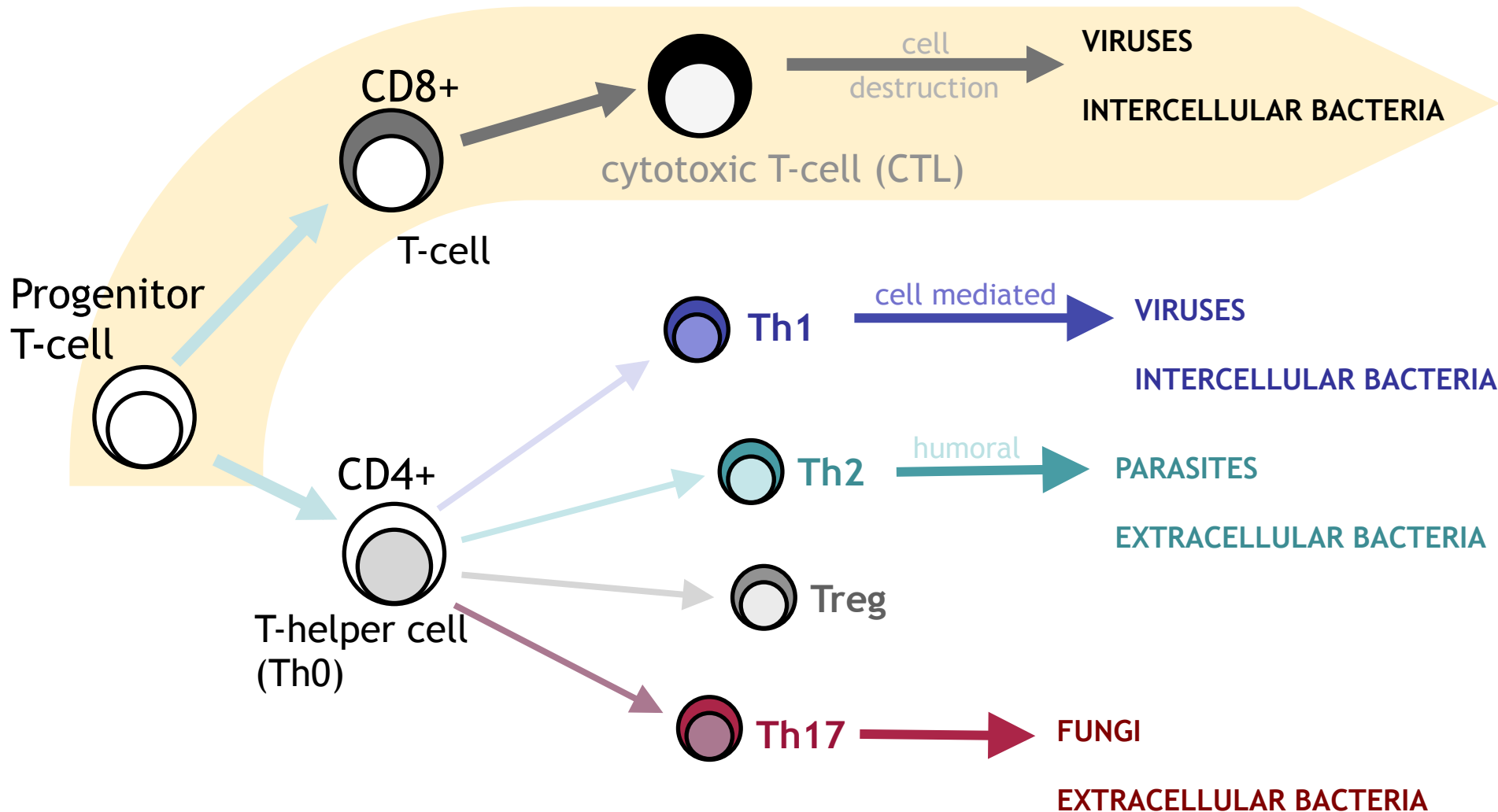
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• Introduction : T cells



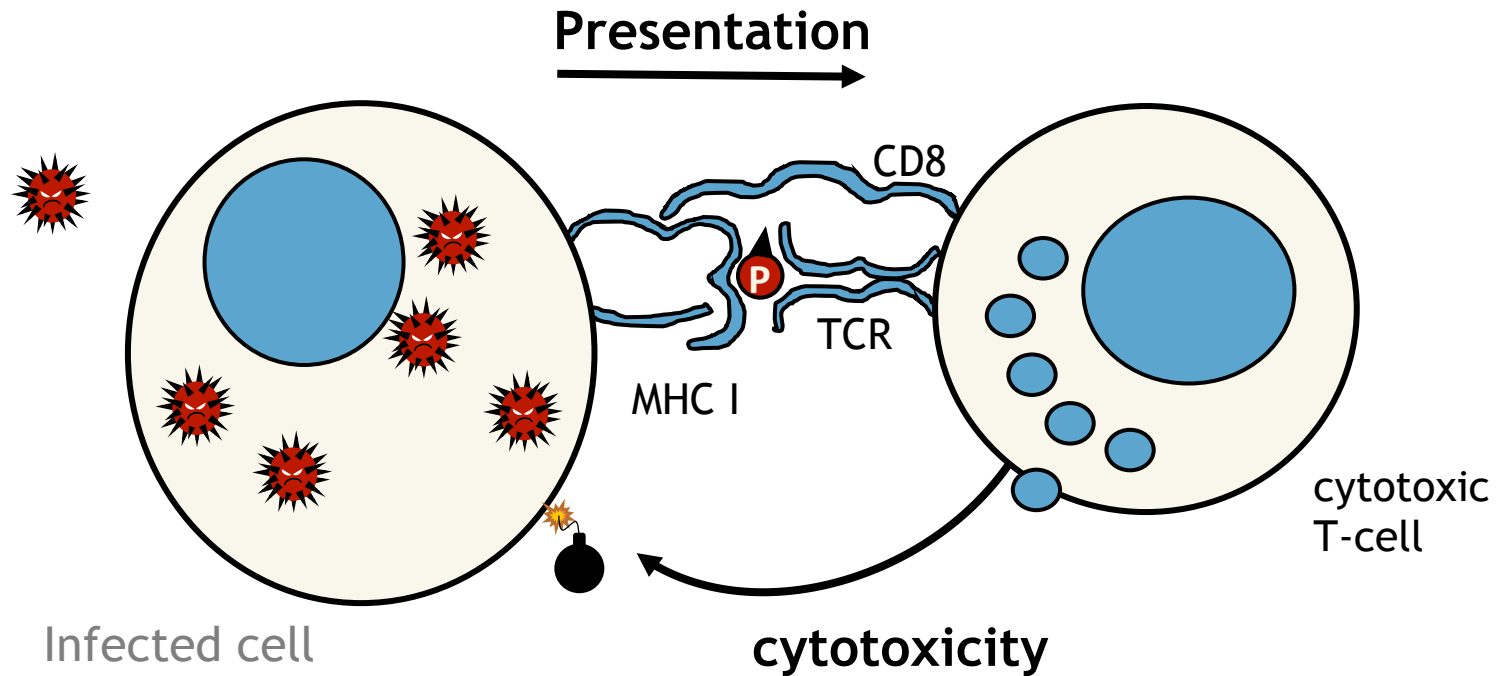
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- Introduction : Cytotoxicity



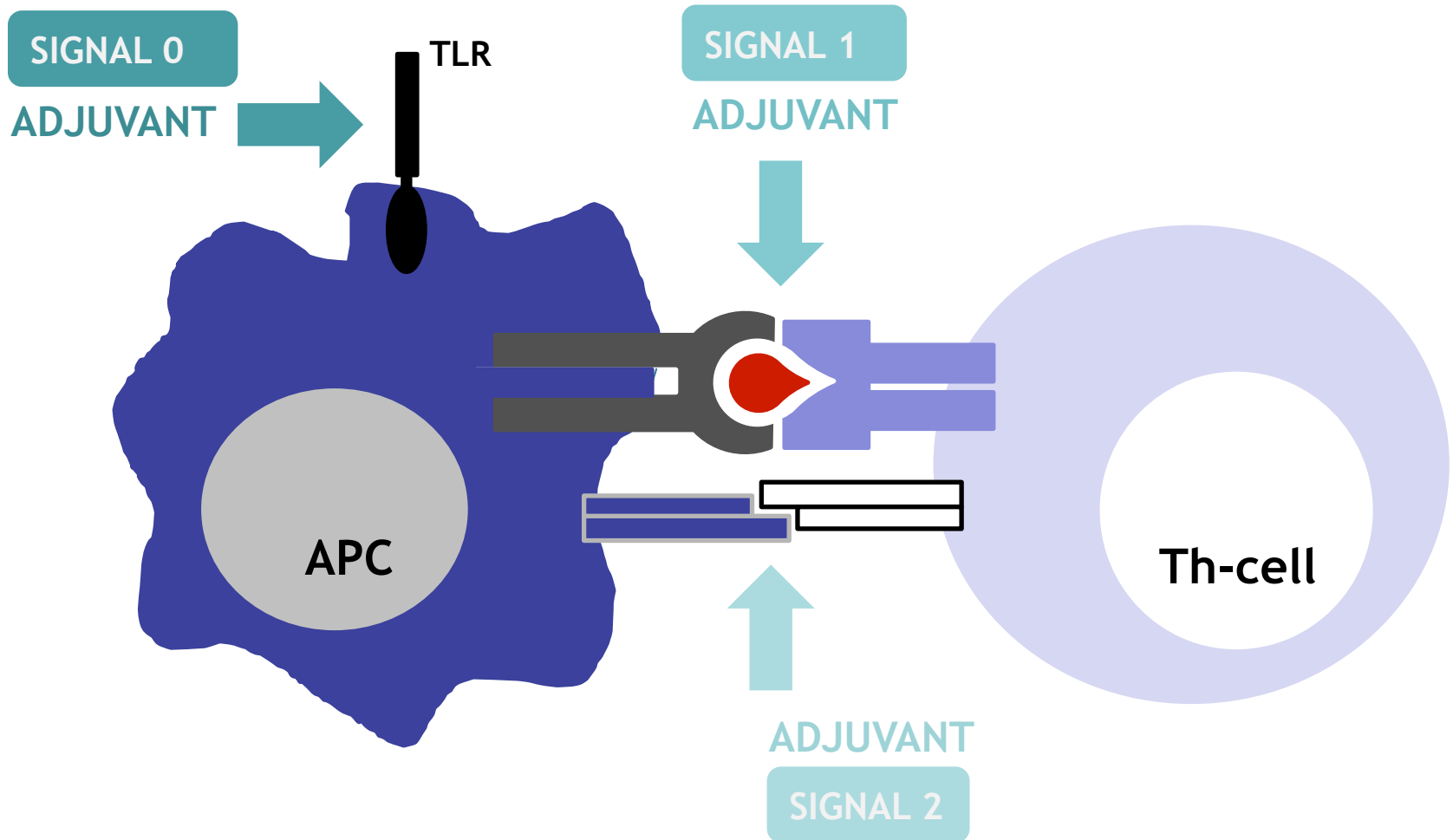
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- Introduction : Adjuvant mode of action



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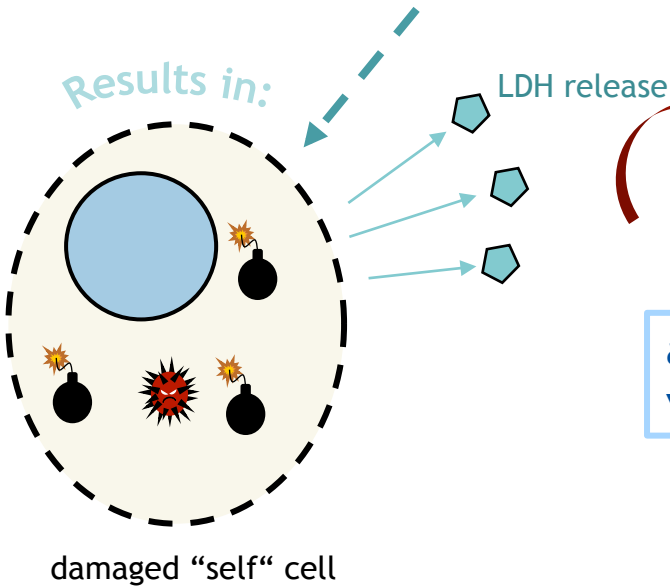
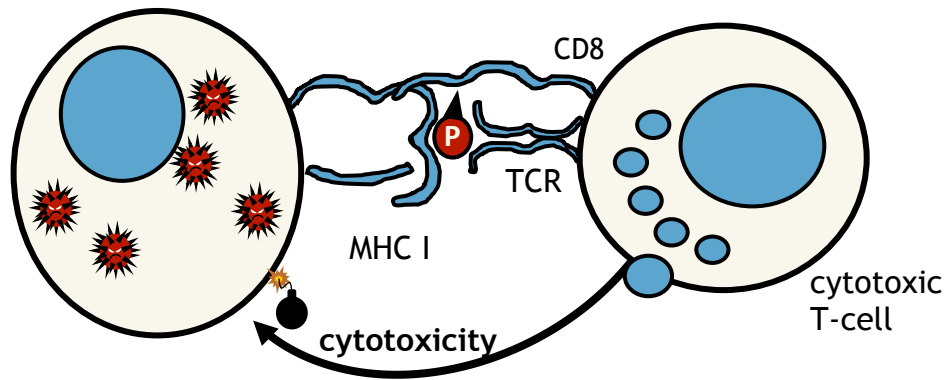
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• Methodology

* 6 weeks post vaccination (wpv)



MEASURE

antibody titres
viral load

CYTOTOXICITY

ADJUVANT

VACCINE

VACCINE +
CHALLENGE*

CHALLENGE

blood

spleen

heart

pancreas

cell markers

pathology



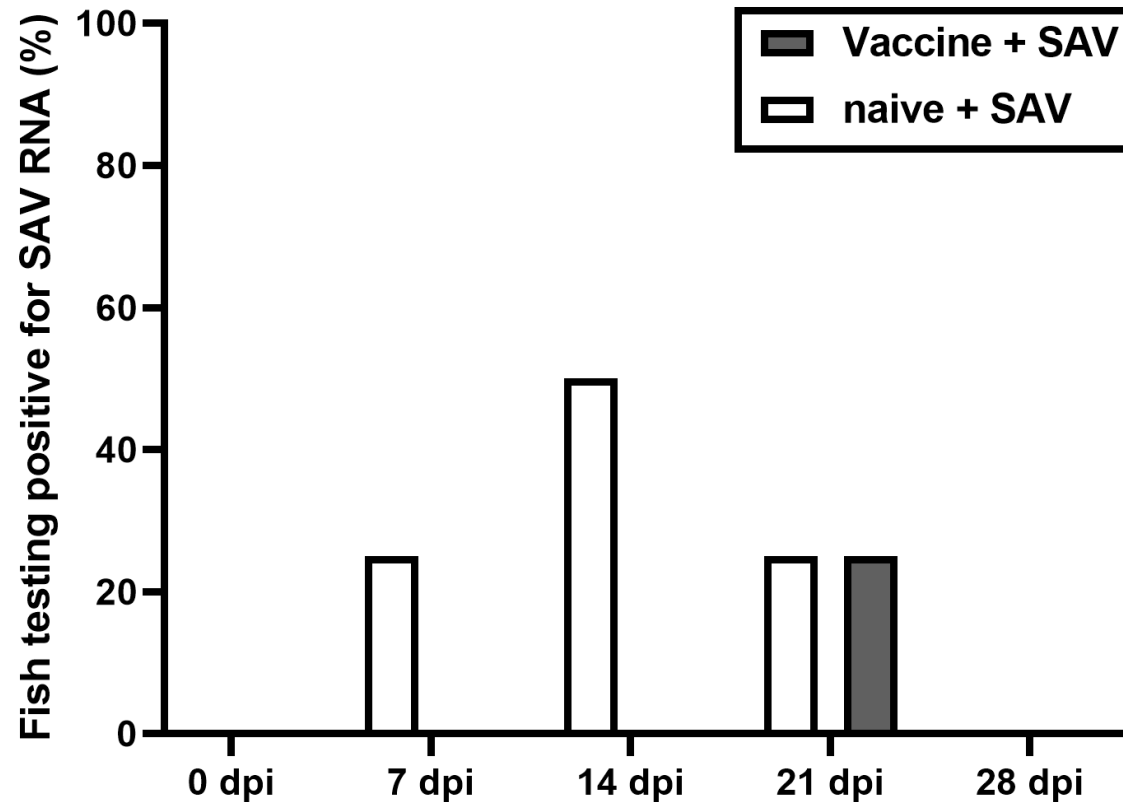
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- Results : Challenge in Rainbow trout



**Vaccination
reduces
viral load in
trout**



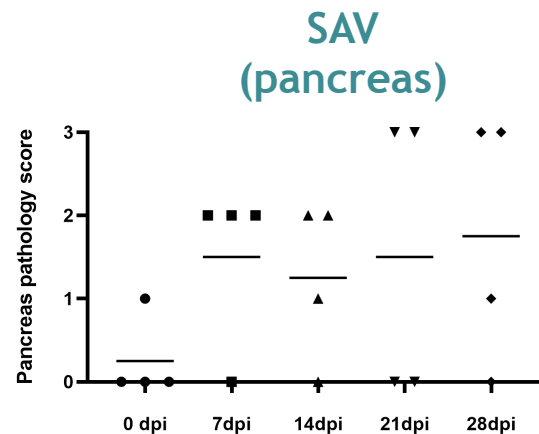
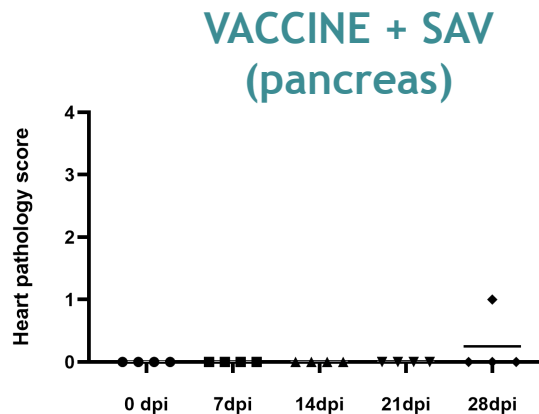
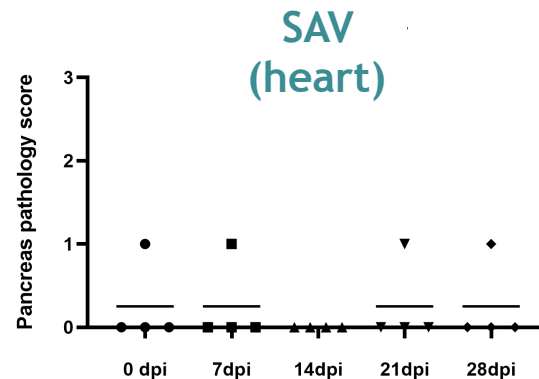
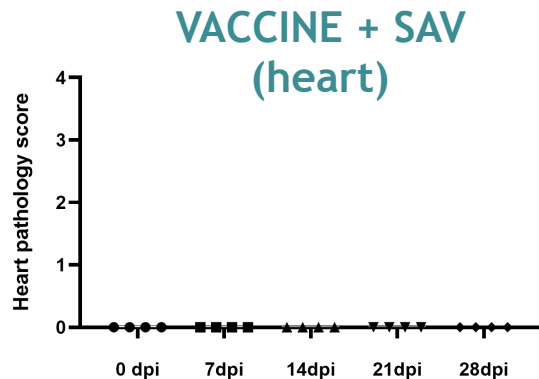
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• Results : Challenge in Rainbow trout



**Vaccination
significantly
reduces
pancreas
pathology**



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• Results : Cytotoxicity

ADJUVANT

		PBL		SPLEEN	
MHC-I		✗	✓	✗	✓
Time (dpi) ↓	0	0	0	0	0
	3	0	0	0	0
	7	6	0	7	0
	14	8	14	17	11
	21	4	0	4	0
	28	0	0	0	0
↓	0	4	9	0	5
	3	0	12	0	10
	7	8	8	10	10
	14	21	24	19	9
	21	6	4	8	0
	28	0	0	0	0

VACCINE

		PBL		SPLEEN	
		✗	✓	✗	✓
0	0	0	0	0	0
	3	0	0	0	0
	7	0	0	0	0
	14	0	0	0	0
	21	6	0	9	0
	28	0	0	0	0
3	0	4	9	0	5
	3	14	13	11	13
	7	5	3	11	0
	14	0	7	0	0
	21	0	0	4	0
	28	24	0	14	0

VACCINE + SAV

		PBL		SPLEEN	
		✗	✓	✗	✓
0	0	0	0	0	0
	3	0	0	0	0
	7	0	4	0	0
	14	0	0	0	0
	21	0	0	0	0
	28	0	0	0	0
3	0	4	9	0	5
	3	0	12	3	8
	7	17	32	15	19
	14	18	14	17	10
	21	0	26	4	8
	28	9	10	8	9

SAV

		PBL		SPLEEN	
		✗	✓	✗	✓
0	0	0	0	0	0
	3	0	0	0	0
	7	0	0	0	0
	14	0	0	0	0
	21	0	0	0	0
	28	0	0	0	0
3	0	4	9	0	5
	3	0	0	0	0
	7	0	13	5	3
	14	0	5	1	3
	21	9	33	11	27
	28	3	4	0	0

ADJUVANT: Non-specific cytotoxicity (non-infected & infected cells)

VACCINE: Non-specific cytotoxicity

VACCINE + SAV: Early response; non-specific; high cytotoxicity

SAV: High & specific cytotoxicity at later time point



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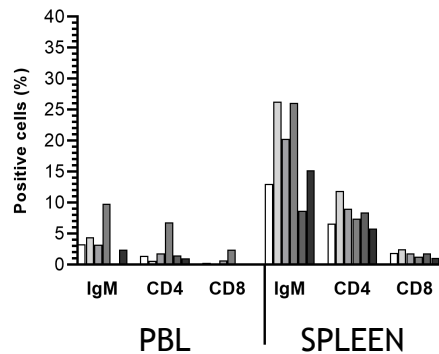
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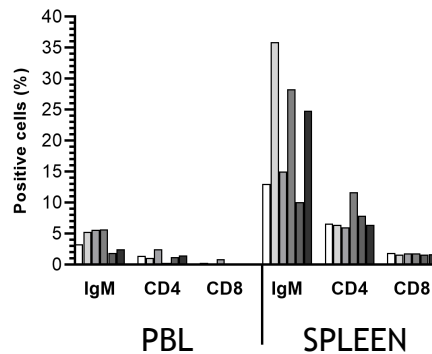
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• Results : Cellular Responses (proteins)

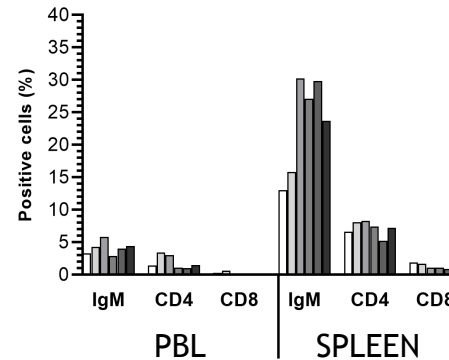
ADJUVANT



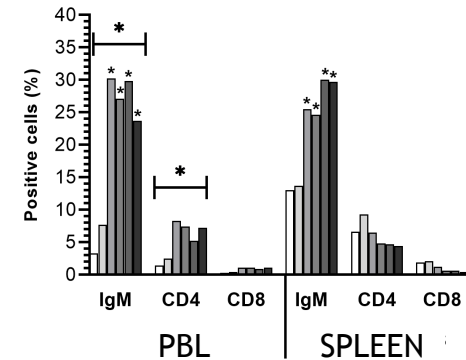
VACCINE



VACCINE + SAV



SAV



ADJUVANT: Increase in IgM+ cells (cell movement)

VACCINE: Similar response to ADJUVANT group, but stronger

VACCINE + SAV: Delayed but stable increase of IgM+ cells

SAV: Significant increase of IgM+ and CD4+ cells in PBLs (unique profile)



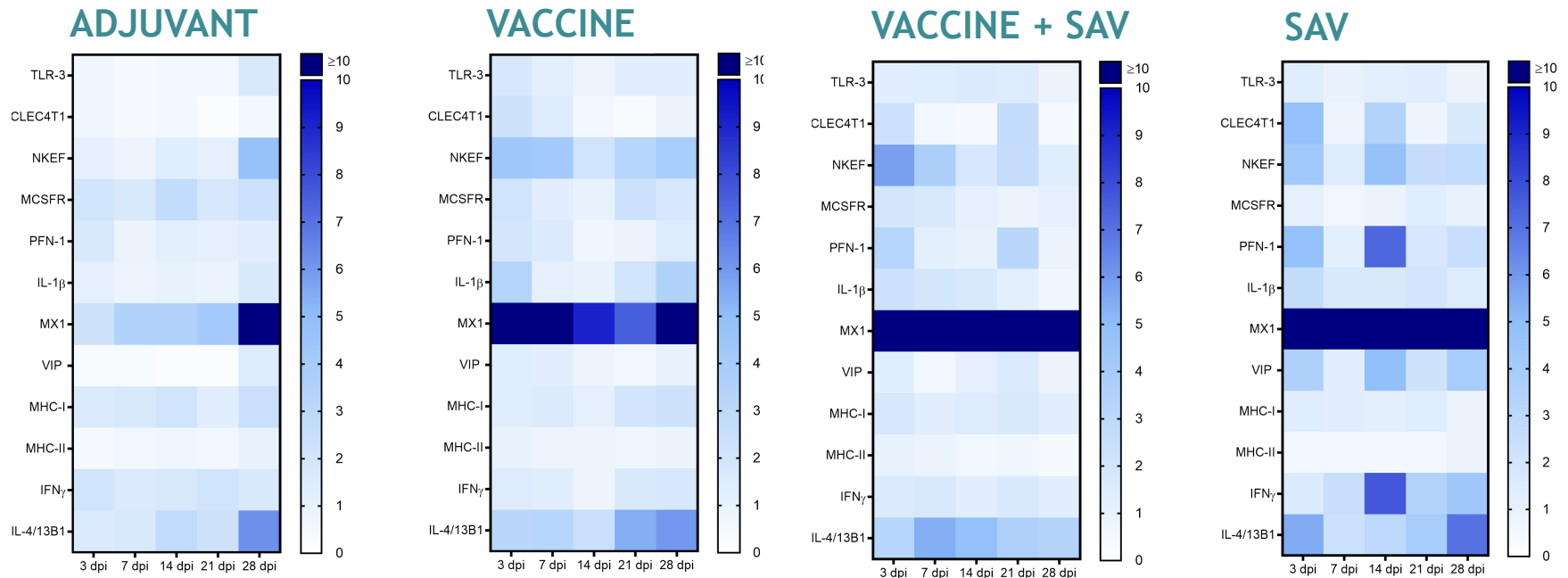
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• Results : Cellular Responses (genes)



Th1 pathway plays a role after infection, but not after vaccination

Vaccination induces early response of IL-1β, NKEF, PFN

Dendritic cells more highly modulated than macrophages after infection



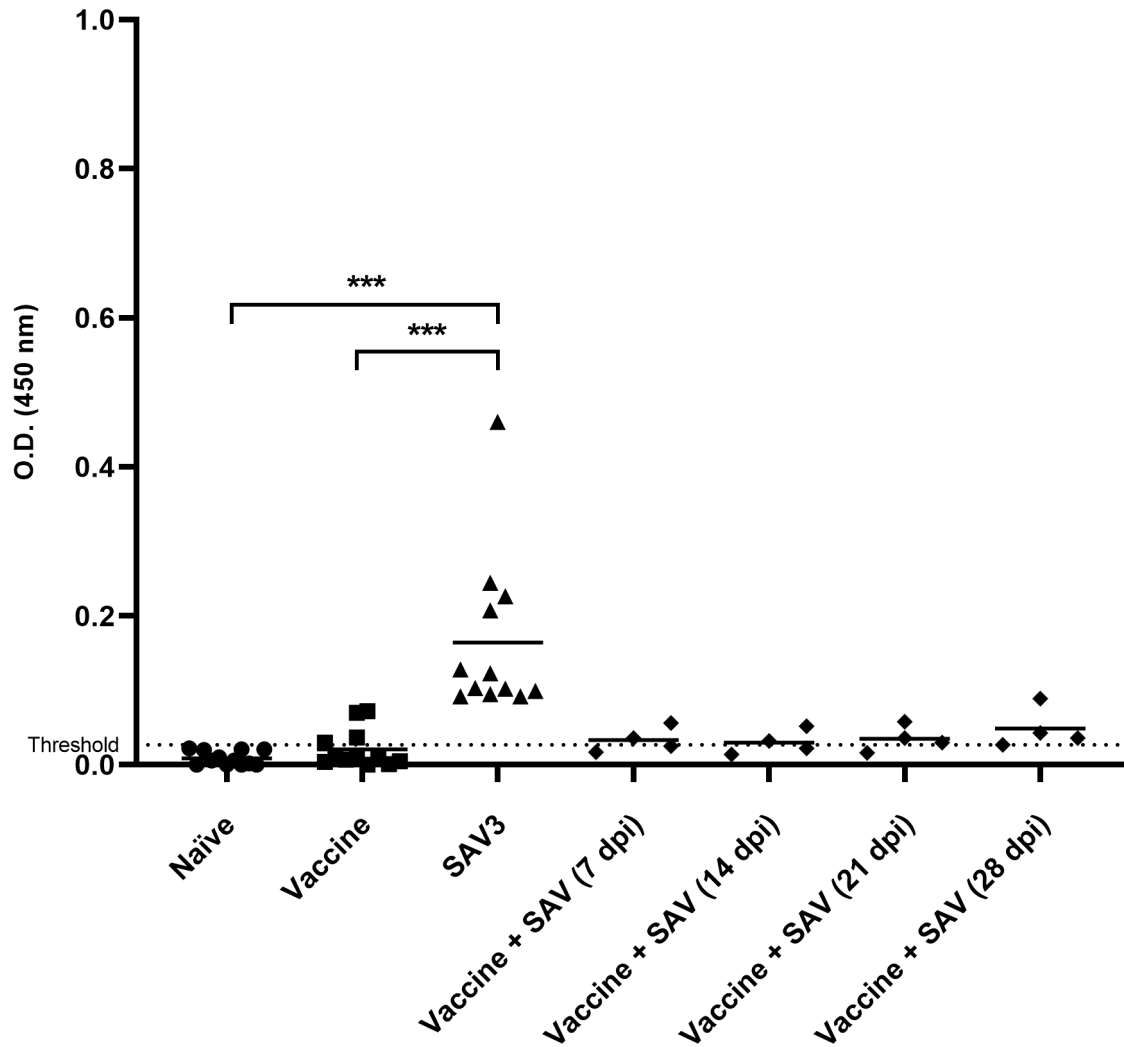
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- Results : SAV-specific serum antibodies



Infection with SAV induced a significantly higher antibody titer than other groups



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• Conclusions

♦ A successful challenge model and cytotoxicity assay was developed for SAV infection in rainbow trout

♦ Vaccination itself will not trigger a strong or specific cytotoxic response, HOWEVER it will result in:

- reduced viral load
- reduced pathology
- faster induction of some cellular responses
- faster induction of cytotoxicity following infection



Efficient and specific memory response



Testing a vaccines ability to induce cytotoxicity requires a challenge

♦ There are indications that different protective mechanisms are being triggered by vaccination and infection



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Thank you for your attention!



vaccines



Article

Cellular Immune Responses in Rainbow Trout (*Onchorhynchus mykiss*) Following Vaccination and Challenge Against Salmonid Alphavirus (SAV)

Kimberly A. Veenstra ¹, Kjartan Hodneland ², Susanne Fischer ¹, Kota Takehana ³,
Rodrigo Belmonte ² and Uwe Fischer ^{1,*}

Vaccines **2020**, *8*, 725; doi:10.3390/vaccines8040725

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