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In vivo evaluation of Lumpy Skin Disease vaccine efficacy in controlled environment

Budapest
Hungary

Andy Haegeman, Laurent Mostin, Maria Vastag, Willem Van Campe, Nadav Galon, Estelle Venter, Annebel De Vleeschauer, Eeva Tuppurainen, Kris De Clercq

08/03/2017 FAO Regional workshop on LSD prevention and control strategies. 



LSDV: Infection Model

- Infection route:
 - Intravenously
 - Intra-dermal: 4 sites, 2 on each side of the neck
- Infection dose:
 - $10^{5.4-6}$ TCID₅₀/100 μ l
- Number of animals per group: N = 8
- Clinical scoring (21 days) includes:
 - Body temperature, Lnn swelling, nodule development (number and size), feed uptake, conjunctivitis, general behaviour, local reaction (vaccination and challenge sites)
- Sampling
 - EDTA blood, buccal swabs: PCR, Virus isolation
 - Bopsies, tissues and organs: PCR , Virus isolation
 - Serum: IPMA and virusneutralisation test
 - Heparinized blood: IFN release

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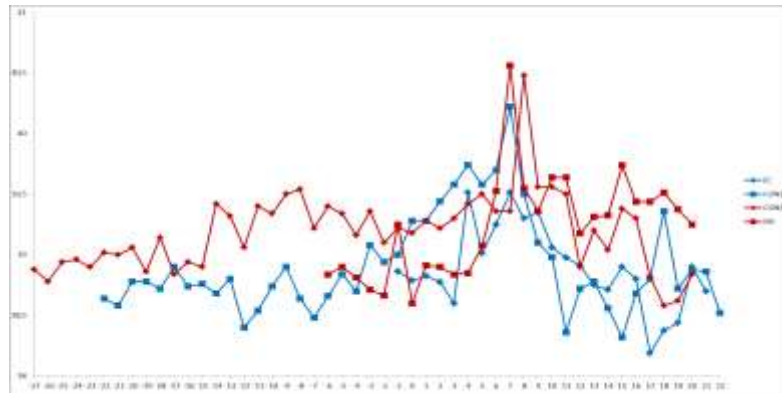
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LSDV: Infection Model

Neethling strain Vs a field isolate from Israel

- Some data of the comparison: **Similarities**
 - Body temperatures:



→ **Both** show a fever spike around 7/8 dpi. Prolonged fever period can occur (app. 25% for both)



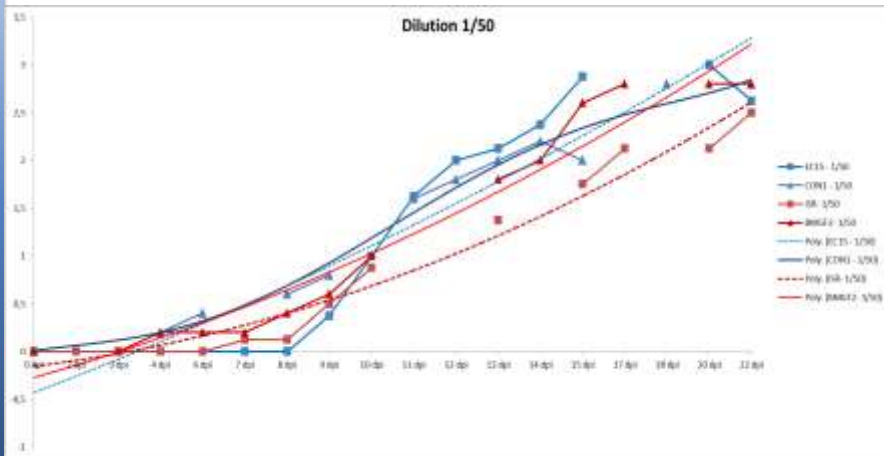
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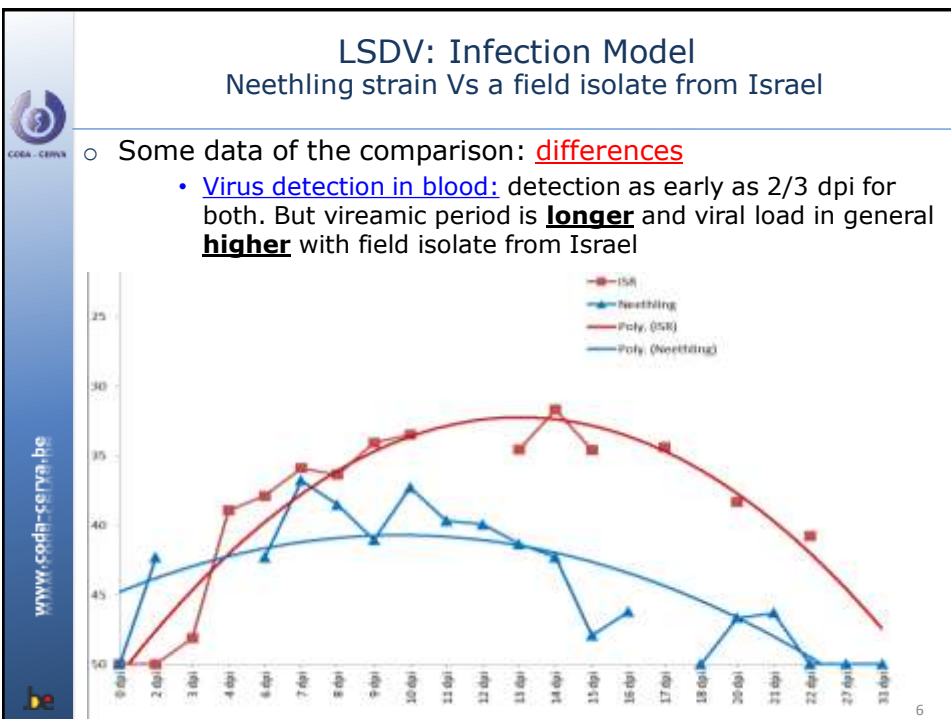
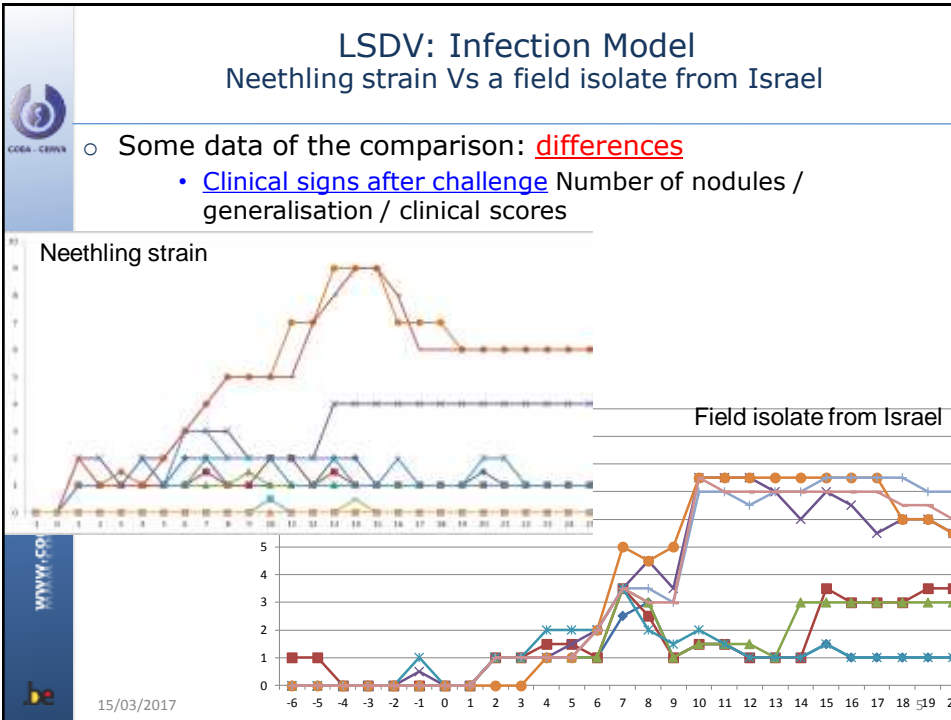
LSDV: Infection Model

Neethling strain Vs a field isolate from Israel

- Some data of the comparison: **Similarities**
 - Seroconversion



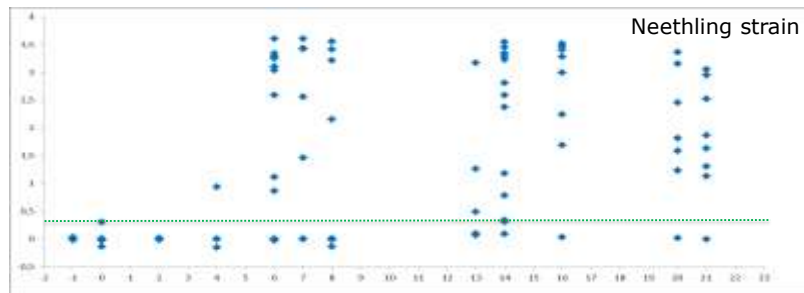
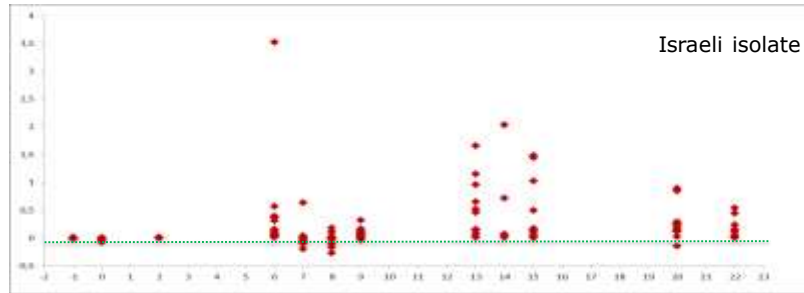
Onset : 4 to 13 dpi (**both**) → a tendency to have more Abs with Neethling₄





- IFNg release upon stimulation in vitro:

Much **lower** IFNg release in animals infected with the Israeli field isolate.



LSDV: Infection Model

Neethling strain Vs a field isolate from Israel

- Some data of the comparison: Conclusion

When all data was analysed the Israeli field isolate is more interesting to be used for our vaccine trials.



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LSDV: Vaccine trials

- **Commercial available → Live attenuated vaccines (LAV)**
 - Sheeppox based (RM-65)
 - ✓ JoviVac (Jordan Bio-Industries Center (JOVAC); Jordan)
 - ✓ Abic (Abic Biological Laboratories Ltd (Phibro); Israel)
 - ✓ Penpox (Pendink Institute; Turkey)
 - LSDV-based
 - ✓ OBP (Onderste Poort; South-Africa)
 - ✓ LumpyVax (MSD; South-Africa)
 - ✓ HerbiVac (Deltamune, South-Africa)
 - Goatpox based
 - ✓ CapriVac (Jordan Bio-Industries Center (JOVAC); Jordan)
 - Sheep and goatpox based or LSDV?^(Cfr Tuppurainen et al., 2014)
 - ✓ KSGP 0240/0180 (Jordan Bio-Industries Center (JOVAC); Jordan)
- **New Inactivated Vaccine (MCI, Morocco)**
 - Sheeppox-based
 - LSDV-based

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LSDV: Vaccine trial set-up

- **Number of animals:**
 - 7 animals per vaccine group
 - 5 control animals (not vaccinated)
- **Vaccination: as described by company**
- **Single vaccination**
- **Challenge: 21 days after vaccination**
- **Sampling and follow-up: as described for model**

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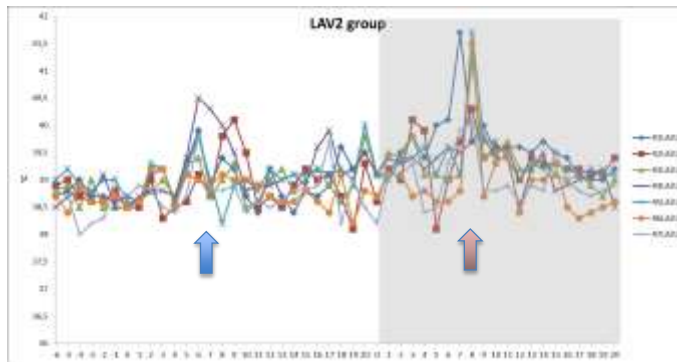
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LSDV Vaccine trials: preliminary results

- Trials and analyzes are **still ongoing**, some **preliminary** results:
 - Limited **side effects** were seen for some vaccines:
 - Elevated temperatures around 7/8 dpv (time point similar to the 7/8 dpi fever spike after infection)



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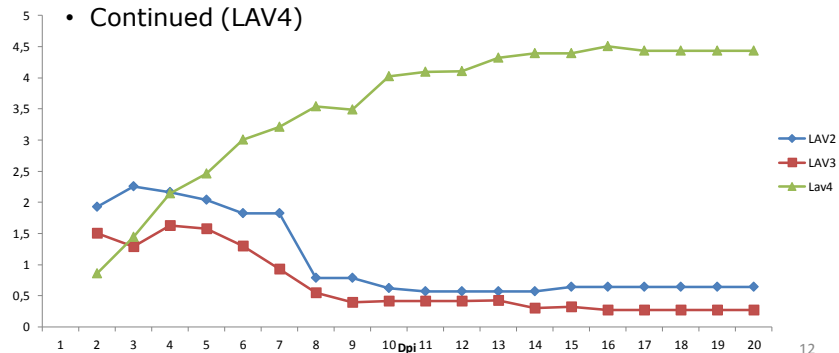
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LSDV Vaccine trials: preliminary results

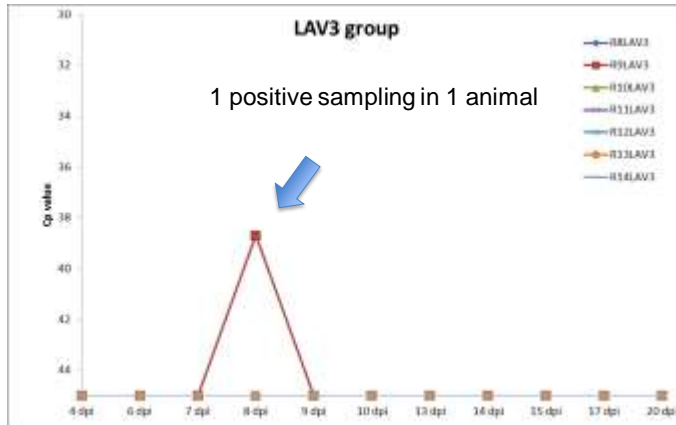
- **Clinical signs**
 - None (for example LAV2, LAV3)
 - Nodule formation (onset 7->9 dpi; similar to control group) (for example LAV4)
- **Local reaction at inoculation site**
 - Transiently (LAV2, LAV3)
 - Continued (LAV4)



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LSDV Vaccine trials: preliminary results

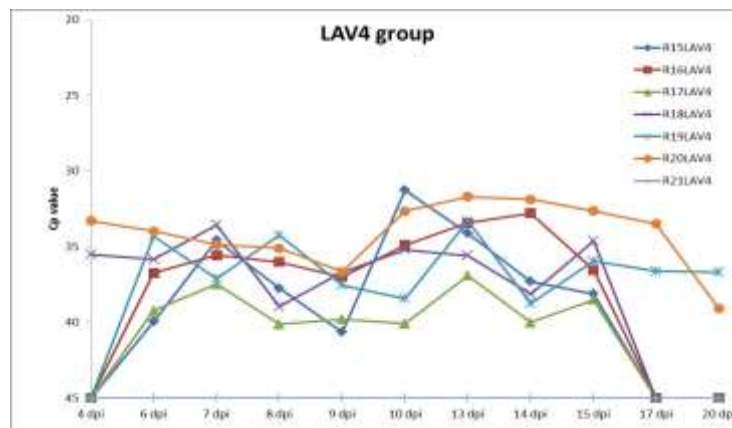
- Viremia following challenge:
 - Completely blocked → Strong Vaccine effect (LAV2)
 - Almost completely blocked → Vaccine effect (LAV3)



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LSDV Vaccine trials: preliminary results

- Viremia following challenge:
 - Completely blocked → Strong Vaccine effect
 - All most completely blocked → Vaccine effect
 - No blocking → No Vaccine effect (LAV4)



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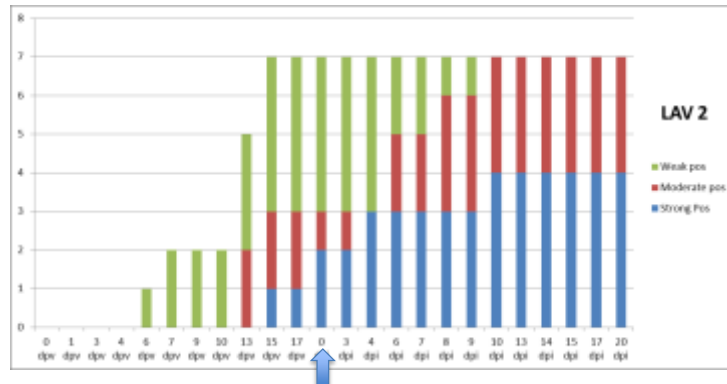
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LSDV Vaccine trials: preliminary results

- o Serological response:
 - **Strong**
 - ✓ Early detection
 - ✓ At moment of challenge:
 - o 100% seroconverted
 - o Some moderate to strong positive



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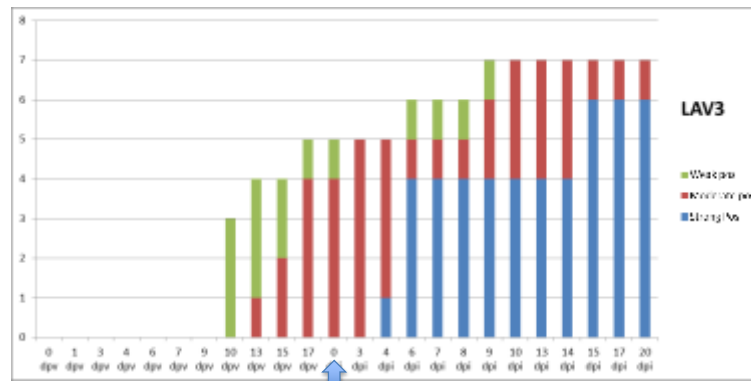
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LSDV Vaccine trials: preliminary results

- o Serological response:
 - **Moderate**
 - ✓ Starts later
 - ✓ At moment of challenge:
 - o Not 100% seroconverted but the majority
 - o Some moderate positive





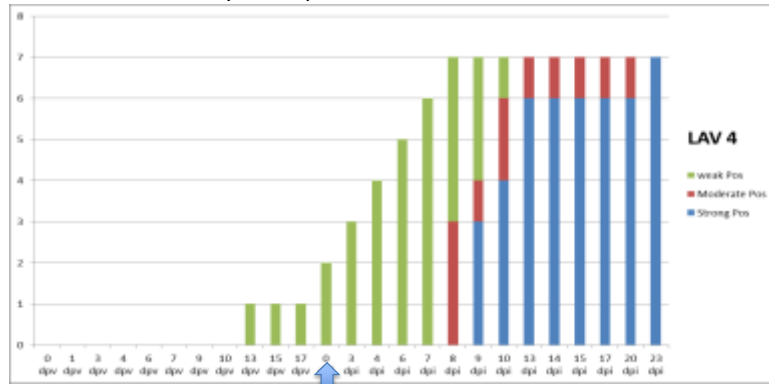
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LSDV Vaccine trials: preliminary results

- o Serological response:
 - **Weak**
 - ✓ Starts later
 - ✓ At moment of challenge:
 - o Minority was seroconverted
 - o Only weak positive



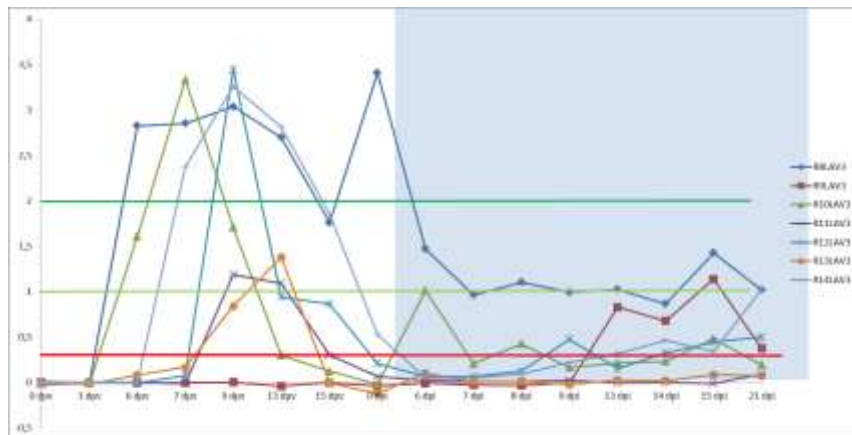
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LSDV Vaccine trials: preliminary results

- o IFNgamma release upon stimulation:
 - **Strong**





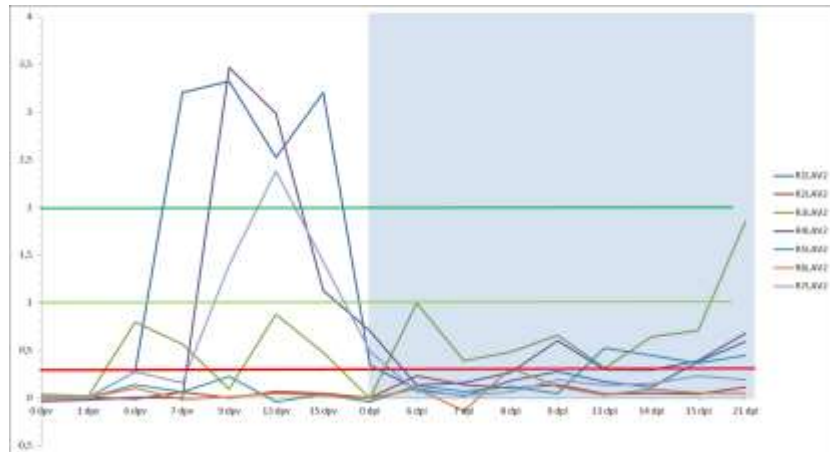
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LSDV Vaccine trials: preliminary results

- IFN γ release upon stimulation:
 - **Moderate**



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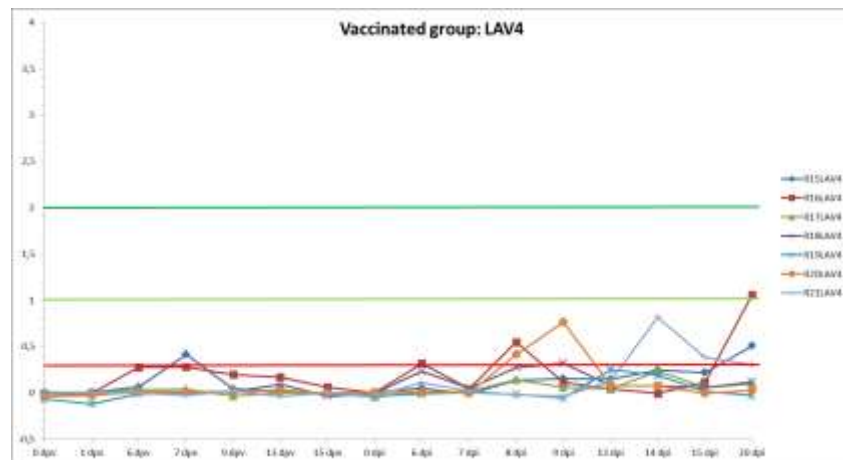
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LSDV Vaccine trials: preliminary results

- IFN γ release upon stimulation:
 - **Weak**



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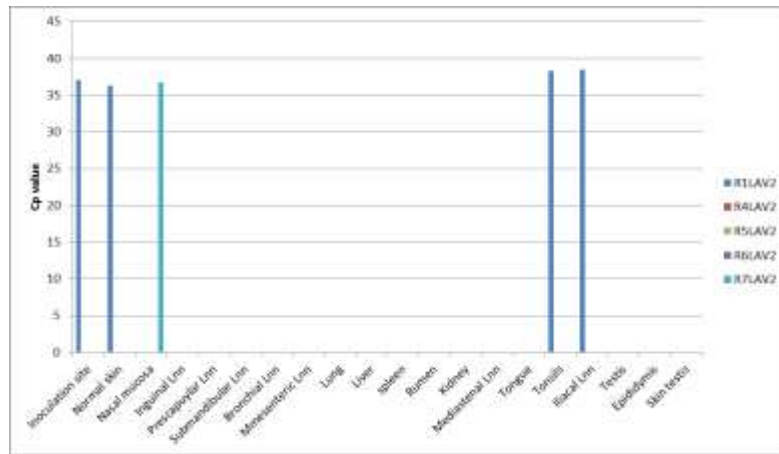
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LSDV Vaccine trials: preliminary results

- Virus distribution in organs/tissues
 - **None or very limited** and with very low viral load (LAV2 and 3)



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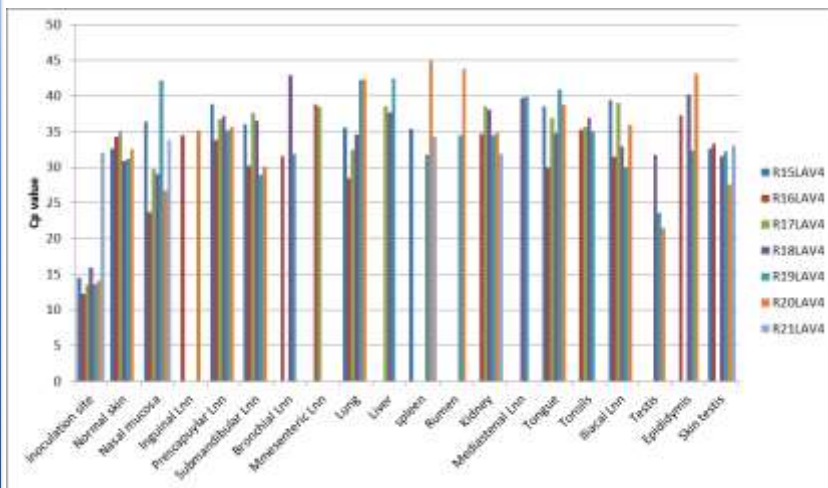
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LSDV Vaccine trials: preliminary results

- Virus distribution in organs/tissues
 - **Broad** distribution pattern (LAV4)



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LSDV Vaccine trials: First conclusions

The LSD challenge model allows the identification of:

- Vaccines with very good potential
 - **No** viremia, elicits **high** Abs response and **good** IFNg release, **almost no** traces of viral DNA found in organs
 - Although very slight side effects after vaccination (fever)
- Vaccines with good potential
 - **Almost no** viremia, elicits **good** Abs and IFNg response, **almost no** traces of viral DNA found in organs
- Vaccines (partially) failing to protect the animals
 - **Strong** viremia, **Low** Abs and IFNg response, virus **widely spread** in the organs. Animals in this groups also **secreted** the virus as detected by buccal swabs.
- None of the LAV vaccines protected against the initial fever spike !
- **Inactivated vaccines**: booster vaccination needed; promising results after one vaccination.

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Acknowledgements



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