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Are vaccine-induced antibodies useful for phagocytosis of mastitis associated *Escherichia coli* ?

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➤ Are **vaccine-induced** antibodies useful for phagocytosis of **mastitis** associated *Escherichia coli* ?



➤ Mastitis in numbers...

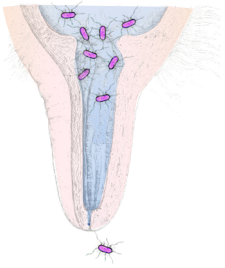
- Still a disease with significant impact
 - High prevalence
 - 30-35% of dairy cows des animaux ont une mammite au cours d'une lactation
 - High economic cost
 - Cost : 230€ per case (IDELE)
 - Overall cost : 121 to 165 € /cow (Hogeveen 2019)
 - Reduced producing lifetime (2,5 lactations per cow)
 - High antibiotic usage (70% of antibiotics in dairy farms => mastitis)
- Pathogens involved (Poutrel, 2015)
 - Clinical mastitis : *Streptococcus uberis* (22 %), *Escherichia coli* (16 %), *Staphylococcus aureus* (16 %)
 - Sub-clinical mastitis : *Streptococcus uberis* (20-30 %), *S. aureus* (20-30 %)



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➤ Mastitis: **inflammation** of the mammary gland, in general of **bacterial** origin



1. Entry of the pathogen through the teat canal
2. Bacterial multiplication in milk
3. Recognition of bacteria by the host immune system => inflammation
4. Production of anti-microbial peptides + phagocytosis by neutrophils => bacterial clearance

➤ One strategy to improve bacterial clearance is **vaccination to promote antibody-mediated opsonisation** and increase phagocytosis by neutrophils...

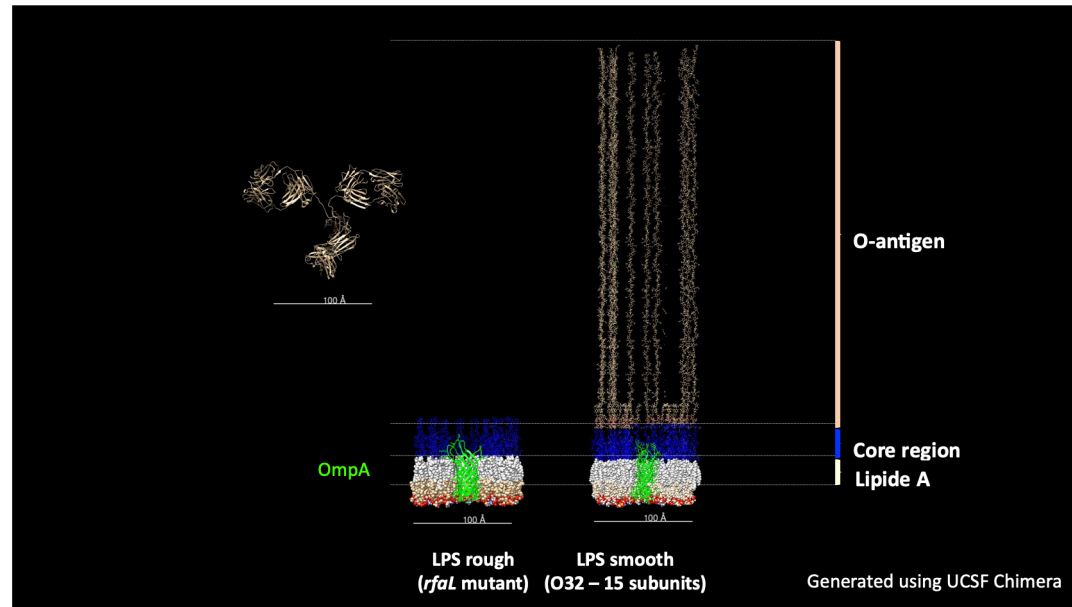
➤ This is the rationale behind the use of the *E. coli* J5 vaccine to prevent *E. coli* mastitis



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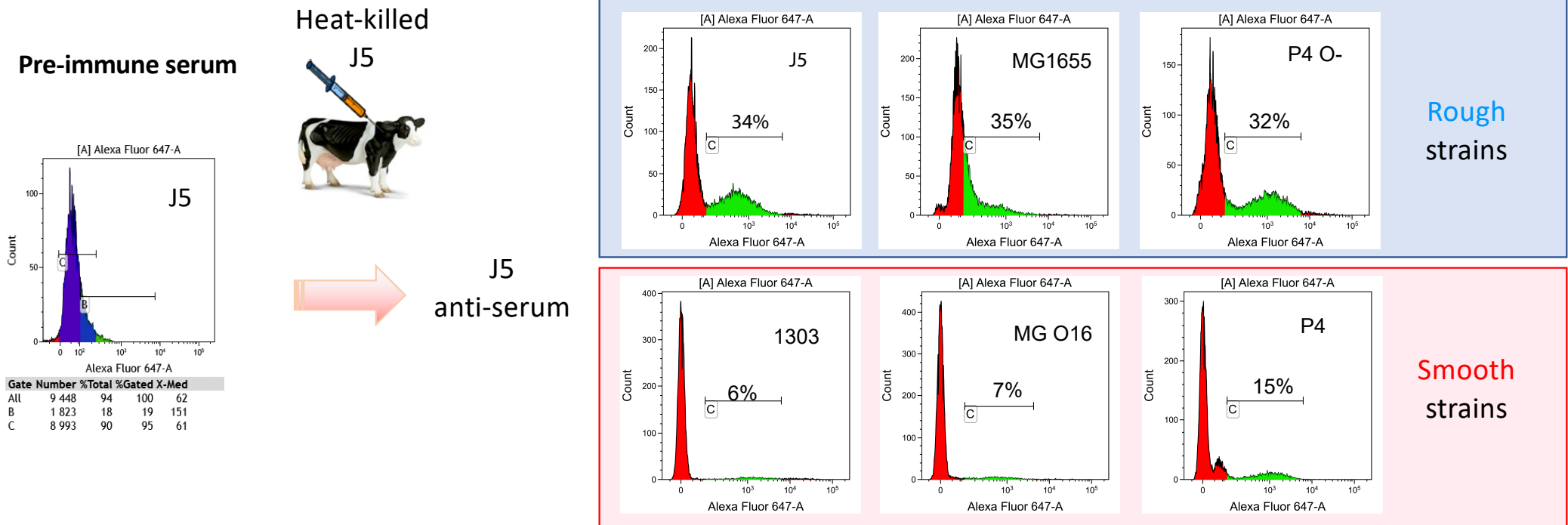
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- But, given the size of an antibody and the potential protective shield provided by *E. coli* O-antigen,...



1. Are J5 vaccine-induced antibodies able to reach their target antigen ?
2. Are these antibodies able to improve the phagocytosis of mastitis associated *Escherichia coli* ?

1. Are J5 vaccine-induced antibodies able to reach their target antigen ?



➔ J5 vaccine-induced antibodies only weakly recognize smooth strains

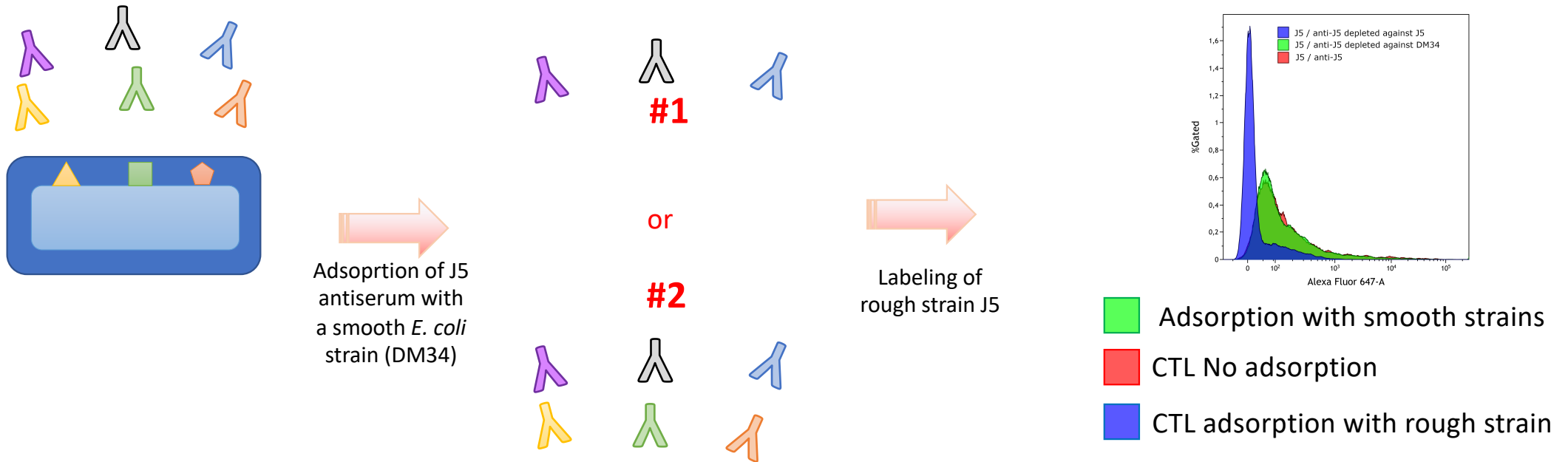


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2. Are antigens responsible for labeling of rough strains accessible to antibodies in smooth strains ?



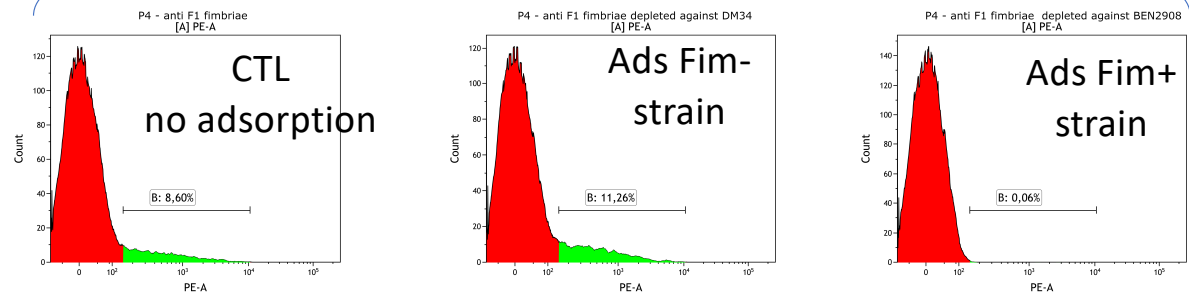
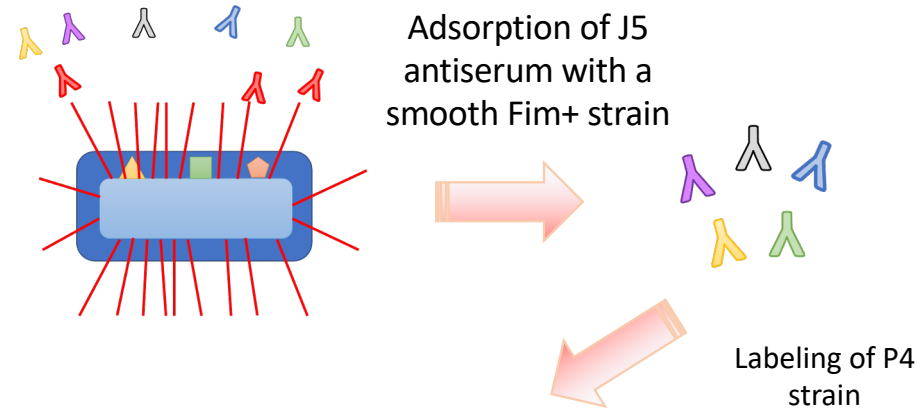
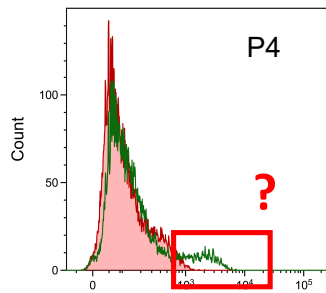
➔ Result: Adsorption with smooth strain doesn't remove antibodies recognizing rough strains (case #2)

➔ Conclusion: Rough strains surface antigens recognized by J5-antiserum are not accessible on smooth strains



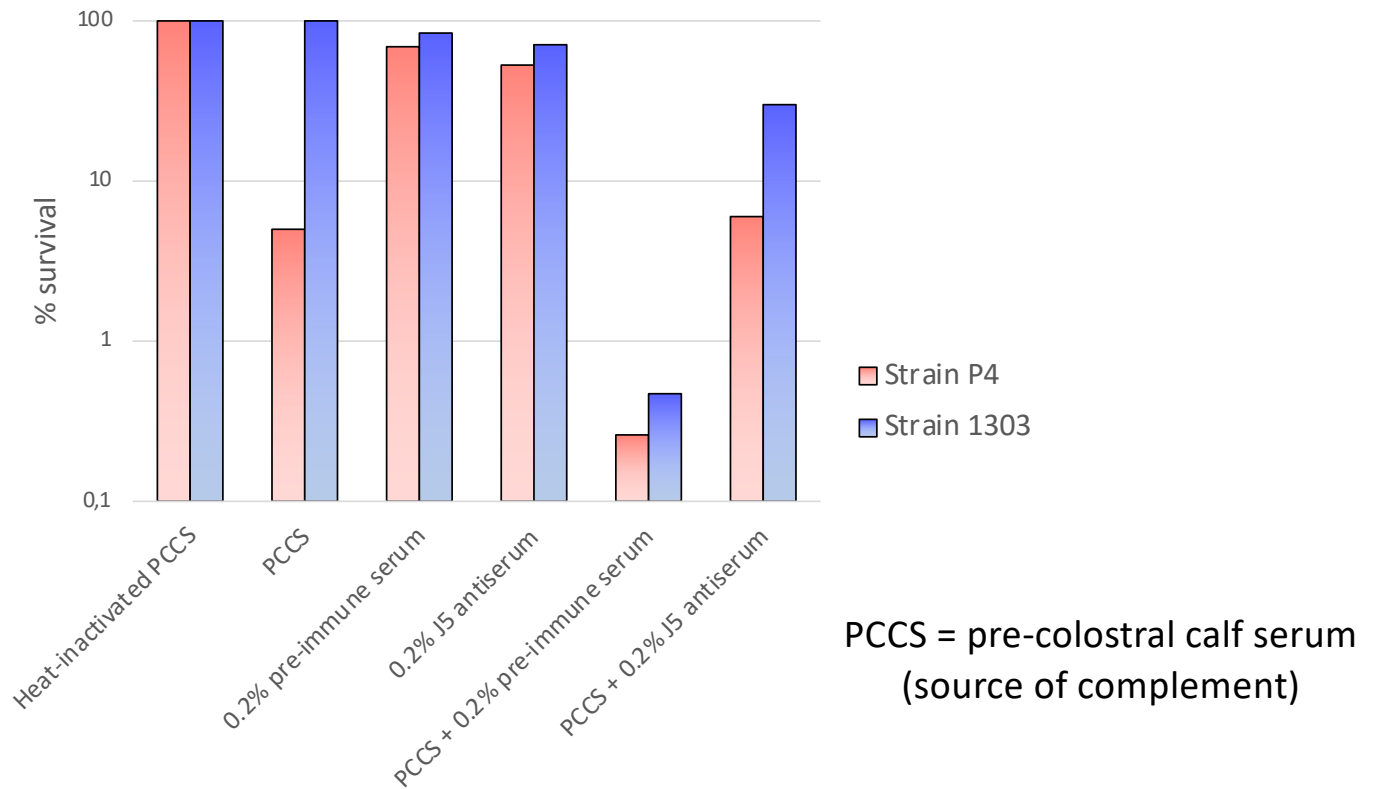
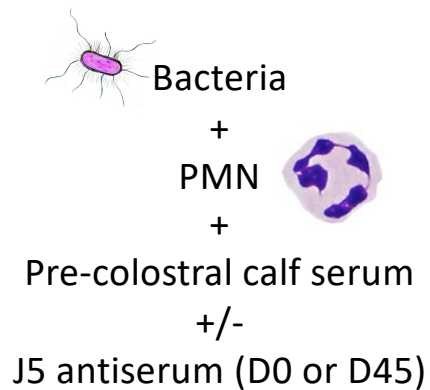
3. Why is a small fraction of smooth strains still labelled with J5 antiserum ?

Hypothesis : labeling is due to expression of type 1 fimbriae



- ➔ **Result:** Adsorption of J5 antiserum with fimbriated strain removes antibodies recognizing smooth P4 strains
- ➔ **Conclusion:** Labeling of strain P4 by J5 antiserum is linked to labeling of type 1 fimbriae

4. Are J5-induced antibodies improving phagocytosis by neutrophils ?



→ J5-induced antibodies do not improve phagocytosis compared to pre-immune serum

5. Summary

- ➔ J5 vaccine-induced antibodies only weakly recognize smooth strains
- ➔ Rough strains surface antigens recognized by J5-antiserum are not accessible on smooth strains (case #2)
- ➔ Labeling of strain P4 by J5 antiserum is linked to labeling of type 1 fimbriae
- ➔ J5-induced antibodies do not improve phagocytosis compared to pre-immune serum

Rainard, P., M. Reperant-Ferter, C. Gitton and P. Germon (2021). Shielding Effect of *Escherichia coli* O-Antigen Polysaccharide on J5-Induced Cross-Reactive Antibodies. *mSphere* 6(1).

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