



**HAL**  
open science

## Genetic and proteomic comparison of [i]Staphylococcus aureus[/i] isolates causing gangrenous or subclinical intramammary infections in a dairy sheep flock

Caroline Le Maréchal, M. Chevalier, Gwénaél Jan, Julien Jardin, Sergine Even, John Anthony Mc Culloch, Fabio Rogerio Rosado, V. Azevedo, R. Thiéry, E. Vautor, et al.

### ► To cite this version:

Caroline Le Maréchal, M. Chevalier, Gwénaél Jan, Julien Jardin, Sergine Even, et al.. Genetic and proteomic comparison of [i]Staphylococcus aureus[/i] isolates causing gangrenous or subclinical intramammary infections in a dairy sheep flock. 3. Congress Federation of European Microbiological Societies (FEMS), Jun 2009, Goteborg, Sweden. 2009. hal-01190819

**HAL Id: hal-01190819**

**<https://hal.science/hal-01190819>**

Submitted on 1 Sep 2015

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

# Genetic and proteomic comparison of *Staphylococcus aureus* isolates causing gangrenous or subclinical intramammary infections in a dairy sheep flock

Le Maréchal, C.<sup>1,2</sup>, M. Chevalier<sup>2</sup>, G. Jan<sup>1</sup>, J. Jardin<sup>1</sup>, S. Even<sup>1</sup>, J.A. McCulloch<sup>1</sup>, F.R. Rosado<sup>1</sup>, V. Azevedo<sup>3</sup>, R. Thiéry<sup>2</sup>, E. Vautor<sup>2</sup> and Y. Le Loir<sup>1</sup>.

<sup>1</sup>INRA, Agrocampus Ouest, UMR1253 STLO, Rennes Cedex, France <sup>2</sup>Unité de pathologie des ruminants, AFSSA Sophia Antipolis, France <sup>3</sup>ICB, Federal University of Minas Gerais, Belo Horizonte, Brazil  
caroline.le-marechal@rennes.inra.fr / yves.leloir@rennes.inra.fr

## Introduction

*Staphylococcus aureus* is a major causative agent of mastitis in ruminants worldwide. Infection acuteness ranges from subclinical to lethal gangrenous mastitis. The genomic and proteomic profiles of 2 strains isolated from ewe mastitis (1 subclinical and 1 gangrenous) were compared.

## *S. aureus* strains analyzed and approaches used

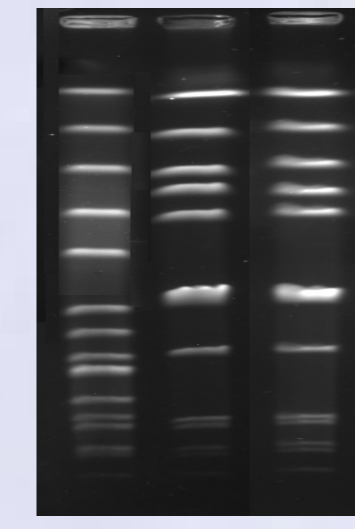
***S. aureus* O11:** isolated from a ewe gangrenous mastitis in South East of France, november 2002



***S. aureus* O46:** isolated from a ewe subclinical mastitis in South East of France, january 2002



## Genotyping of O11 and O46



Macrorestriction of the chromosome (pulse field gel electrophoresis): O11 and O46 belong to the same pulsotype

Spa type: O46 (Spa type 3568) and O11 (Spa type 524) belong to the same Spa clonal complex (1173)

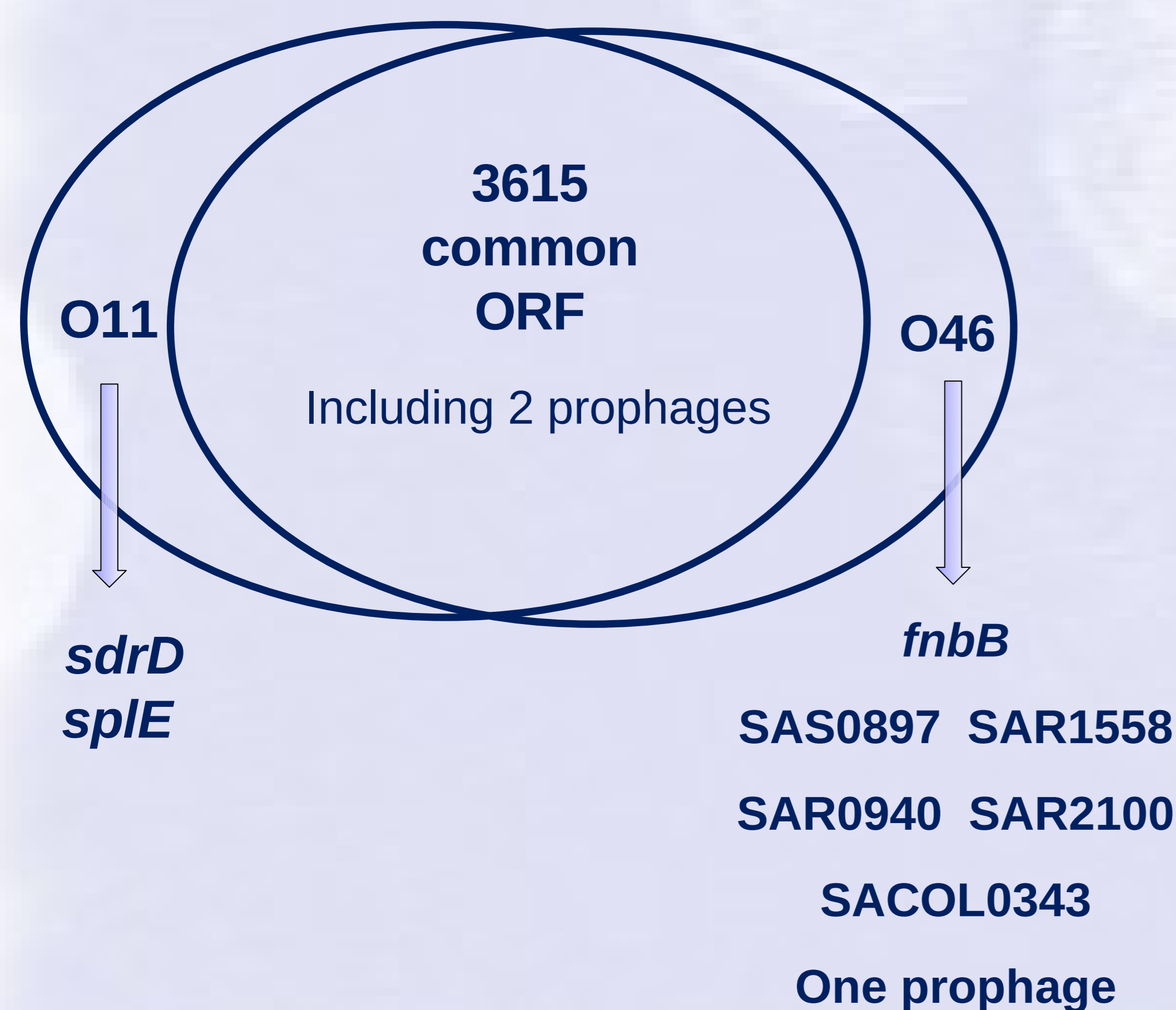
MLST: O11 (6-33-6-2-7-12-7/18) and O46 (6-2-6-2-7-14-2/5) belong to the same Sequence Type (ST130)

- Strain characterisation
  - Multiple techniques used for O11 and O46 genotyping
- Strain comparison
  - Comparative genomics: DNA-DNA hybridization on a pangenomic microarray
  - Comparative proteomics: 2D gels on samples prepared from culture on iron depleted RPMI (without aeration)

→ *S. aureus* O11 and *S. aureus* O46 are genotypically closely related. These results were reinforced by other genotyping techniques (MLVA, RAPD, Sas Typing)

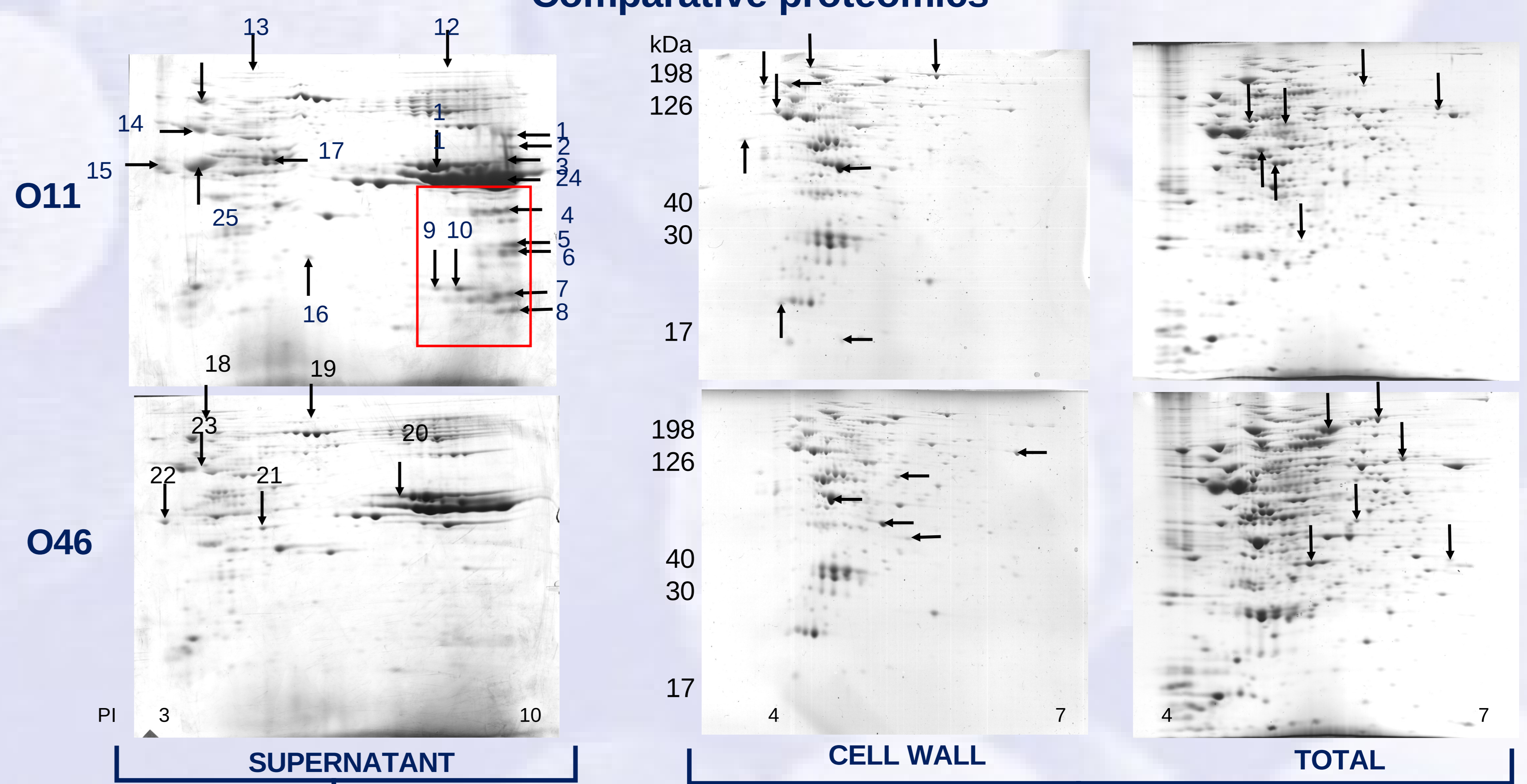
## Genomic and Proteomic comparison of O11 and O46

### Comparative genomics



→ Gangrenous mastitis isolate (O11):  
- variant versions of several surface proteins (*sdrD* and *spIE*)  
- missing *fnbB* and a prophage.

### Comparative proteomics



→ Overproduction of secreted proteins by O11 (especially those indicated in the red square)

→ Very few differences between O11 and O46 (indicated by arrows)

- Immunoglobulin-binding protein *sbi* (1,7,24)
- Alpha-hemolysin, Gamma-hemolysin (12,6,24)
- LukF-PV, LukM, uncharacterized leukocidin-like protein1/2 precursor (12,6,7,24,11,7,8,2)
- Serine protease *spIE*, F, B, C, (25,4)
- Staphopain A, B (4)
- Phospholipase C (24,11,12)
- Iron-regulated surface determinant protein B, H, A (13,12,7,4)

## Conclusions & Perspectives

- Despite opposite pathogenicity degrees, O11 and O46 are closely related as shown by both genotyping and CGH.
- CGH approach revealed that gangrenous mastitis isolate (O11) carried variant versions of several surface protein genes (*sdrD* and *spIE*) and was missing *fnbB* and a prophage.
- Cell wall and cytoplasmic proteomes were almost similar whereas secreted protein pattern were clearly different: O11 overproduces toxins including LukM/F'PV (important factor in the development of gangrenous mastitis in ruminants?).
- Serine protease E (encoded by *spIE*) together with other serine proteases were oversecreted by O11. Association between secretion of serine proteases and mastitis acuteness remains unclear.