



**HAL**  
open science

## Extracellular vesicles from *Staphylococcus aureus* follow different pathways to manipulate host cells

Julia Papail, Ligia Prado, Nathalie Daniel, Brenda Silva Rosa da Luz, Daniele Vassaux, Yann Le Gouar, Nadia Berkova, Julien Jardin, Svetlana Chabelskaia, Yves Le Loir, et al.

### ► To cite this version:

Julia Papail, Ligia Prado, Nathalie Daniel, Brenda Silva Rosa da Luz, Daniele Vassaux, et al.. Extracellular vesicles from *Staphylococcus aureus* follow different pathways to manipulate host cells. 18e congrès national de la SFM “ Un monde à explorer ”, Société Française de Microbiologie (SFM), Oct 2023, Rennes, France. hal-04234337

**HAL Id: hal-04234337**

**<https://hal.inrae.fr/hal-04234337>**

Submitted on 10 Oct 2023

**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.



Distributed under a Creative Commons Attribution - NonCommercial - NoDerivatives 4.0 International License

# Extracellular vesicles from *Staphylococcus aureus* follow different pathways to manipulate host cells

**Julia PAPAIL<sup>1</sup>**, Ligia PRADO<sup>1,2</sup>, Nathalie DANIEL<sup>1</sup>, Daniele VASSAUX<sup>1</sup>, Yann LE GOUAR<sup>1</sup>, Nadejda BERKOVA<sup>1</sup>, Julien JARDIN<sup>1</sup>, Svetlana CHABELSKAIA<sup>3</sup>, Yves LE LOIR<sup>1</sup>, Vasco AZEVEDO<sup>4</sup>, Éric GUÉDON<sup>1</sup>

MICROBES 2023, 18<sup>e</sup> Congrès National de la SFM  
Rennes, 05/10/2023



<sup>1</sup>INRAE, Institut Agro, STLO, Rennes, France;

<sup>2</sup>Institute of Biological and Natural Sciences, Federal University of Triângulo Mineiro, Uberaba, Brazil;

<sup>3</sup>Université de Rennes, INSERM U1230, BRM, Rennes, France;

<sup>4</sup>Laboratory of Cellular and Molecular Genetics, Institute of Biological Sciences, Federal University of Minas Gerais, Belo Horizonte, Brazil.



Société Française  
de Microbiologie

**MICROBES 2023**  
18<sup>e</sup> CONGRÈS NATIONAL DE LA SFM

4-6  
octobre

**LE COUVENT  
DES JACOBINS**

CENTRE DES CONGRÈS DE  
DE RENNES MÉTROPOLE

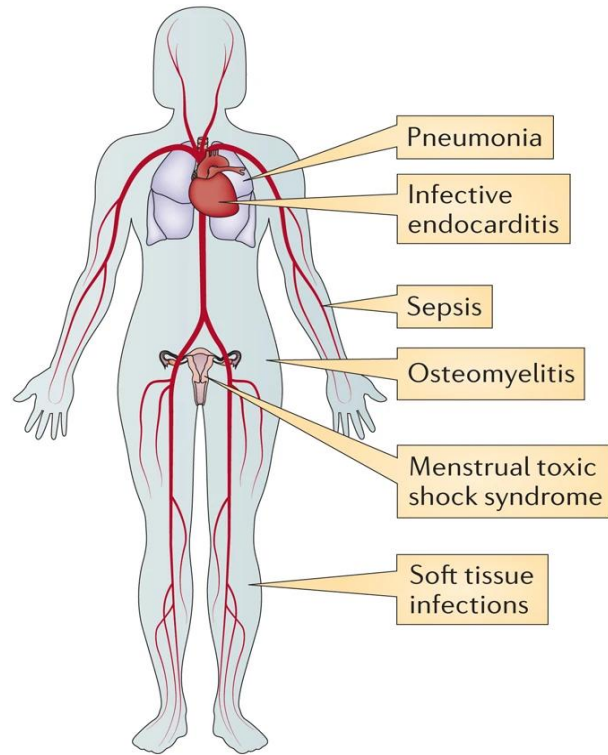


## Conflict of interest declaration

For this presentation,  
I declare that I have no conflict of interest.

# ✓ *Staphylococcus aureus*

## ➤ Human opportunist pathogen



Diseases caused by *Staphylococcus aureus*  
Salgado-Pabón W and Schlievert P., 2014

## ➤ Significant impact on the veterinary medicine and food fields → Etiological agent of mastitis

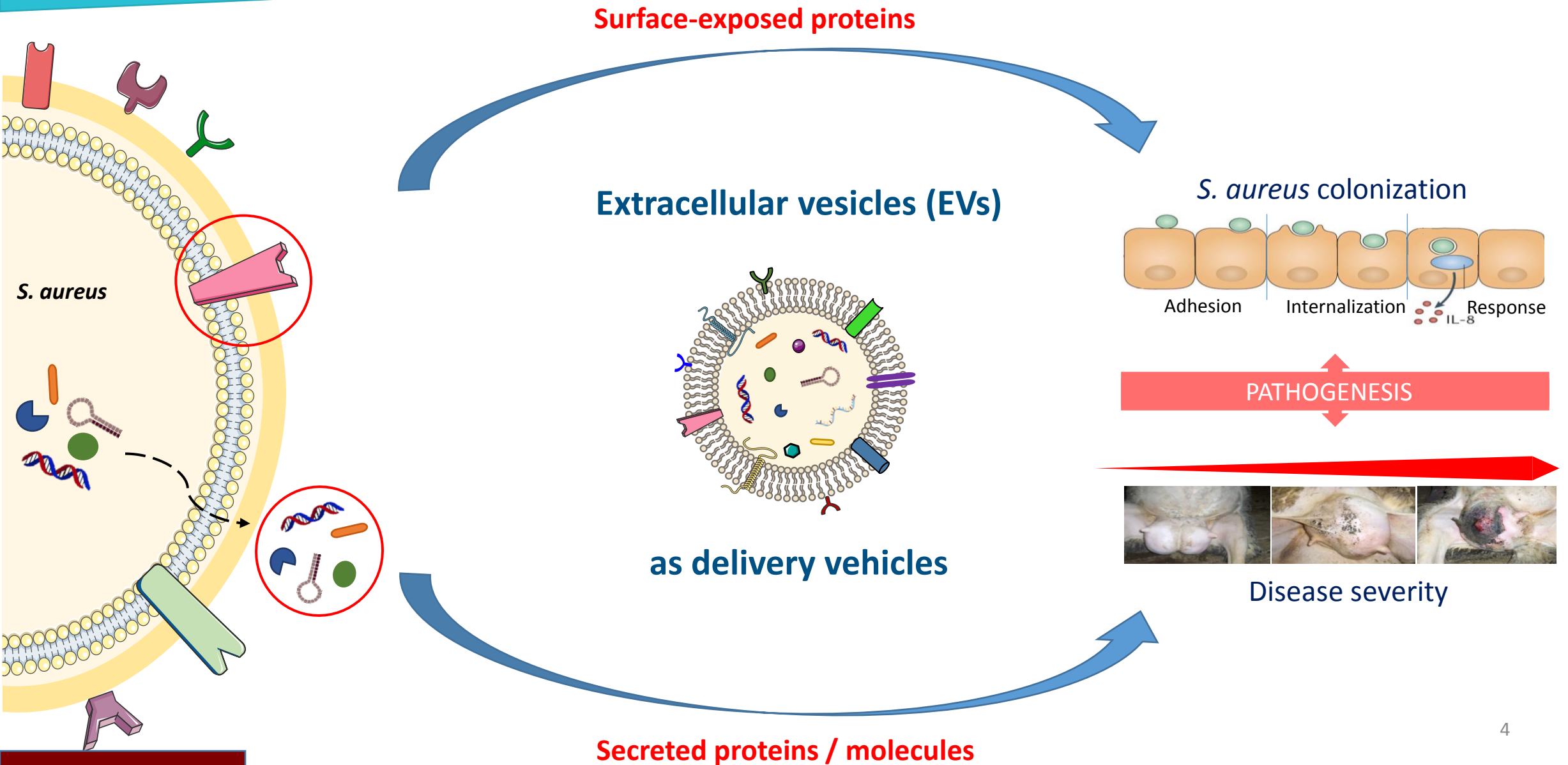


## ➤ The six highly virulent and antibiotic resistant bacterial pathogens

ESKAPE

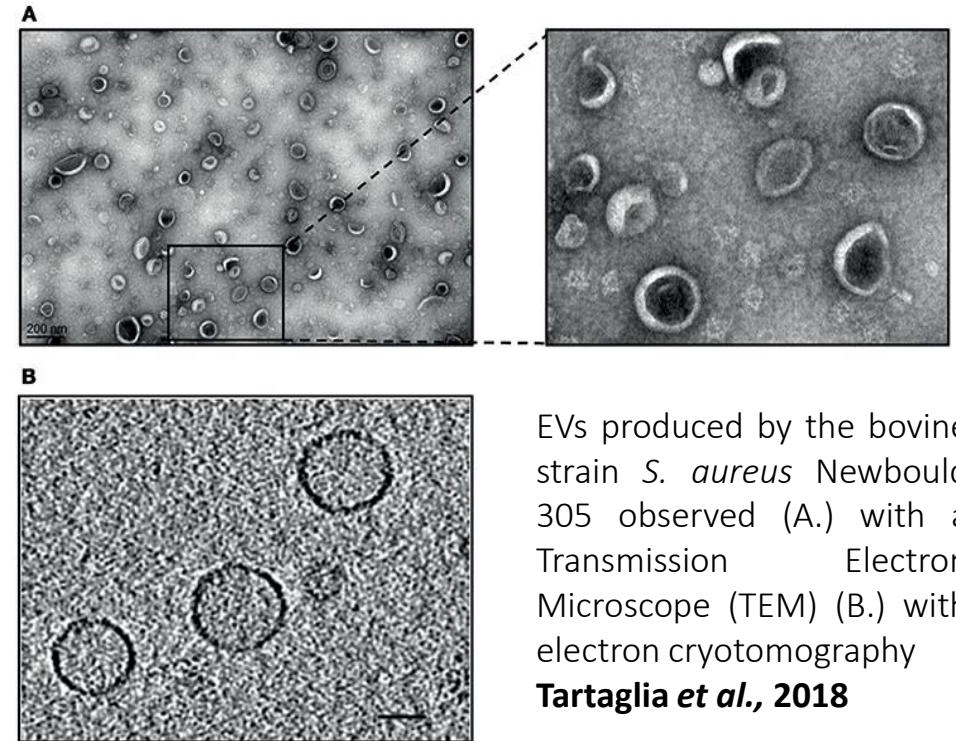


✓ *Staphylococcus aureus* virulence factors



# ✓ Extracellular vesicles (EVs)

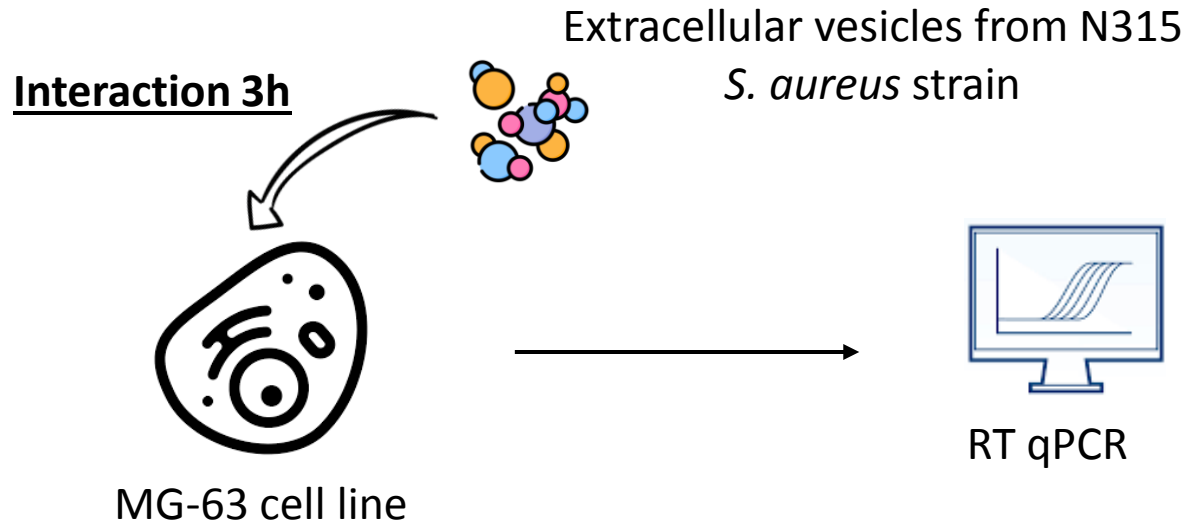
- Lipid bilayer spherical nano-sized particles (30-300 nm) which carry various molecules (eg, lipids, nucleic acids, proteins)
- Vehicles that transport and deliver molecules to local or distant cellular targets
- Imply in cell-to-cell communication and especially in host-pathogen interaction



**What is the contribution of extracellular vesicles from *S. aureus* in pathogenesis ?**

# ✓ Role of extracellular vesicles in pathogenesis

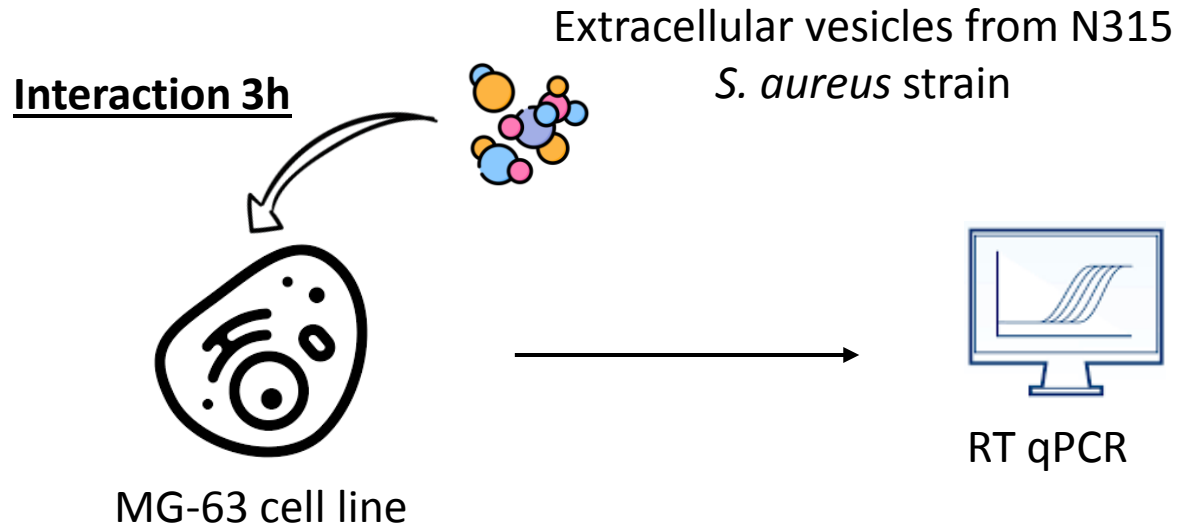
Impact of EVs on the expression of several inflammatory genes



- Human osteoblast-like non-phagocytic cell line
- Taken from patient with osteosarcoma

# ✓ Role of extracellular vesicles in pathogenesis

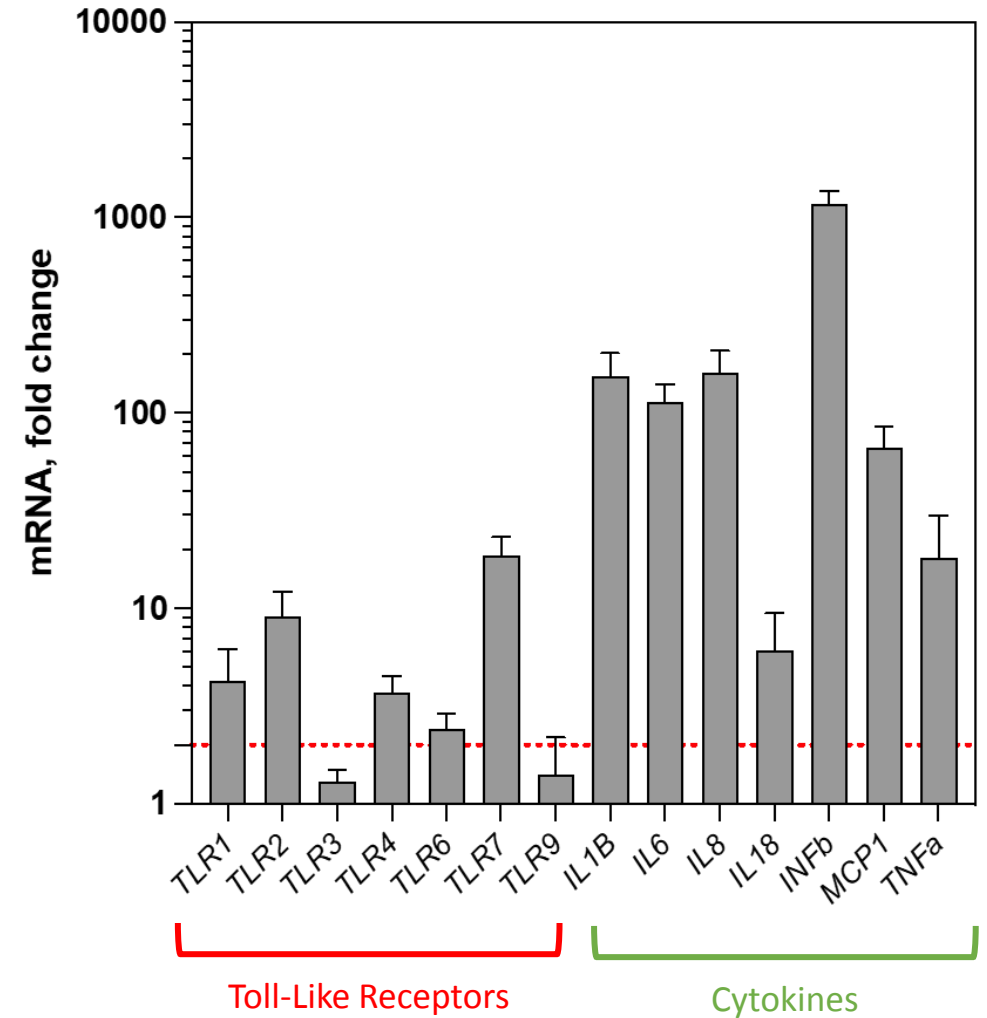
Impact of EVs on the expression of several inflammatory genes



Increased expression of genes coding for :

✓ Cytokines

✓ Toll-Like Receptors (TLR)

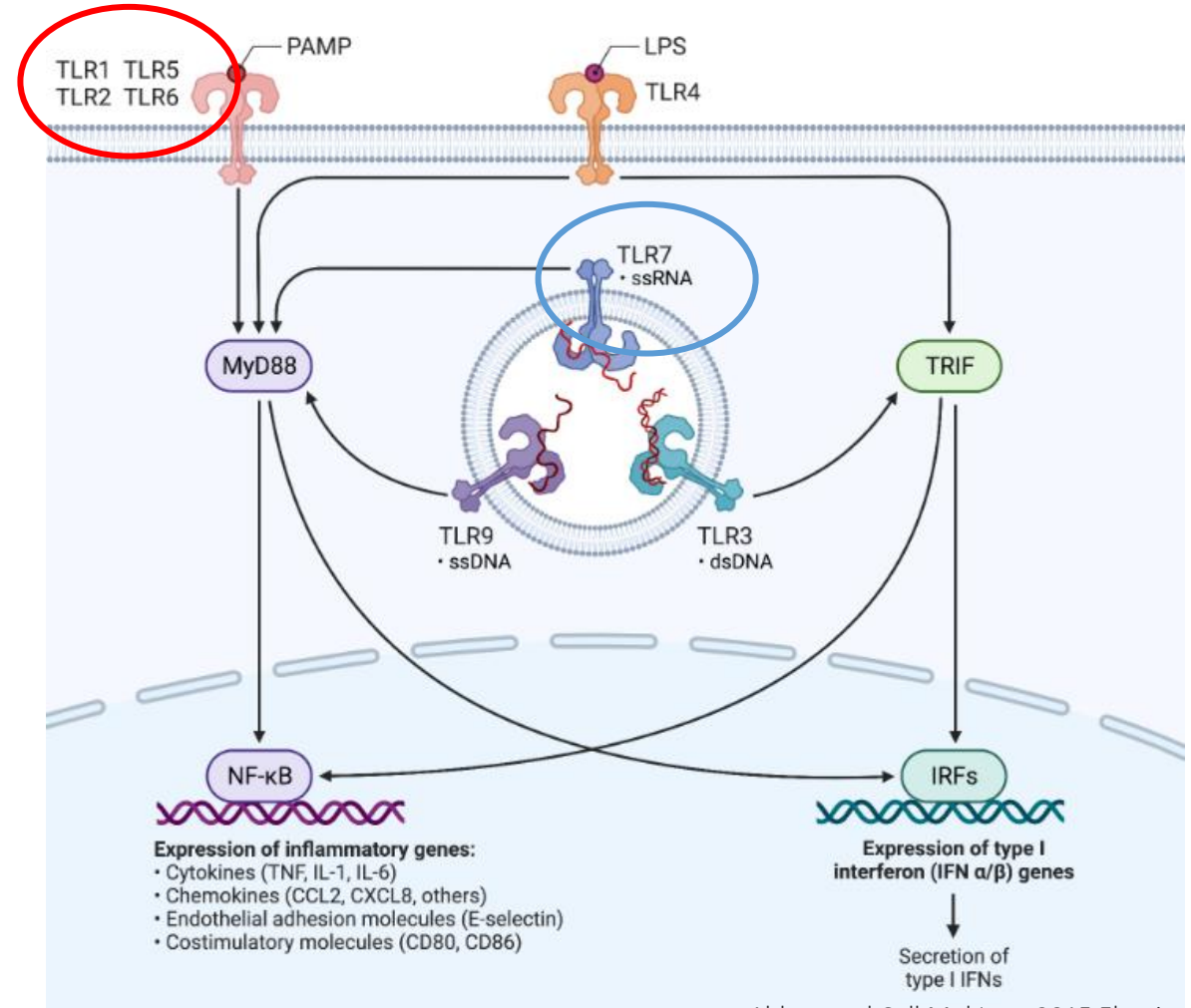
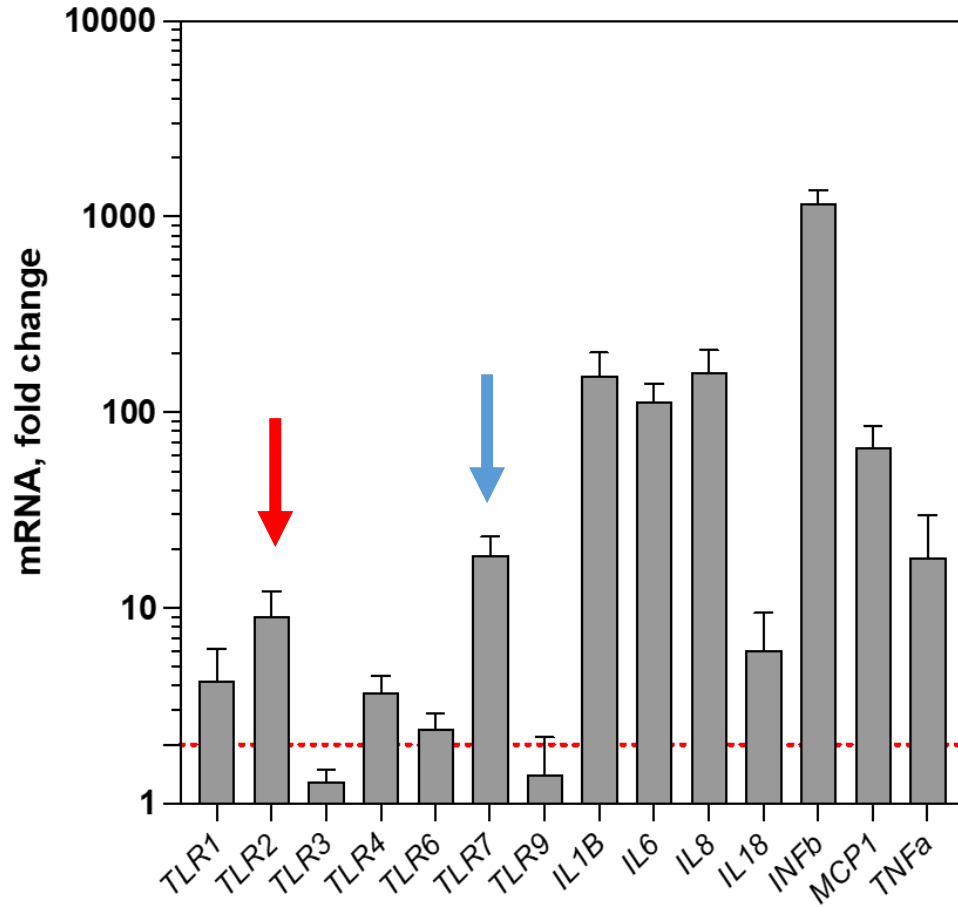


→ N315-derived EVs induce the expression of various *TLR* and immune genes in MG-63 cells



# ✓ Role of extracellular vesicles in pathogenesis

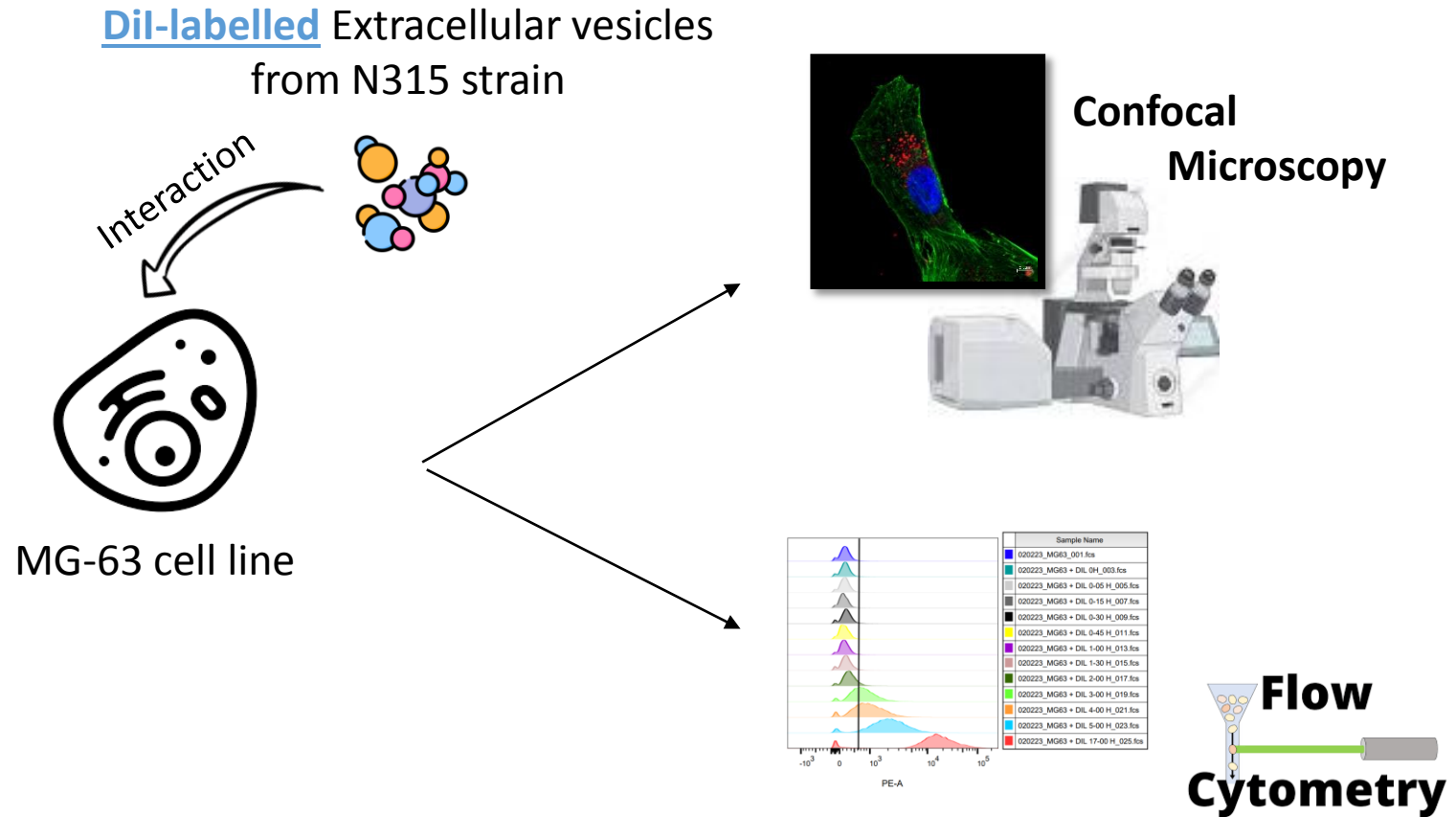
Impact of EVs on the expression of several inflammatory genes



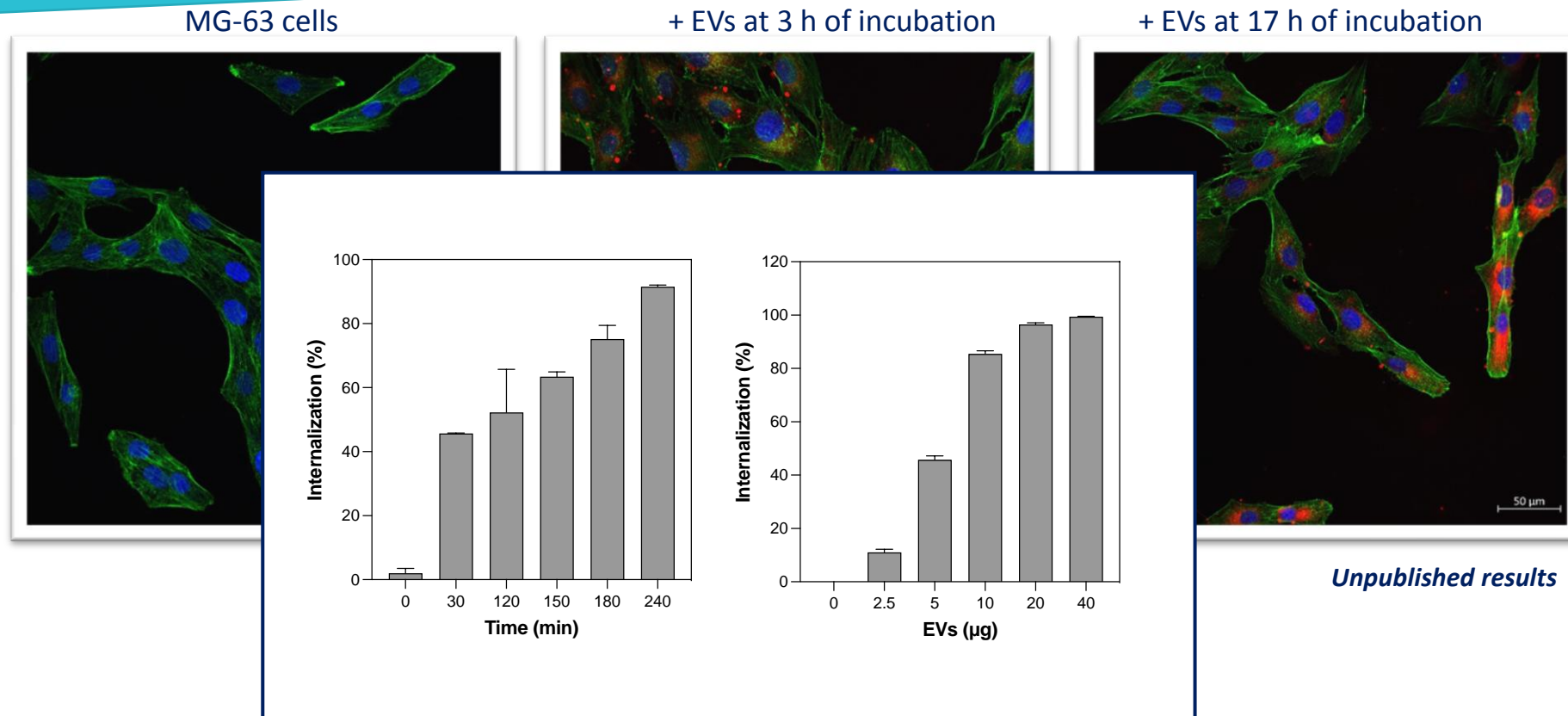
Abbas et al Cell Mol Imm 2015 Elsevier

➔ N315-derived EVs induce the expression of various *TLR* and immune genes in MG-63 cells





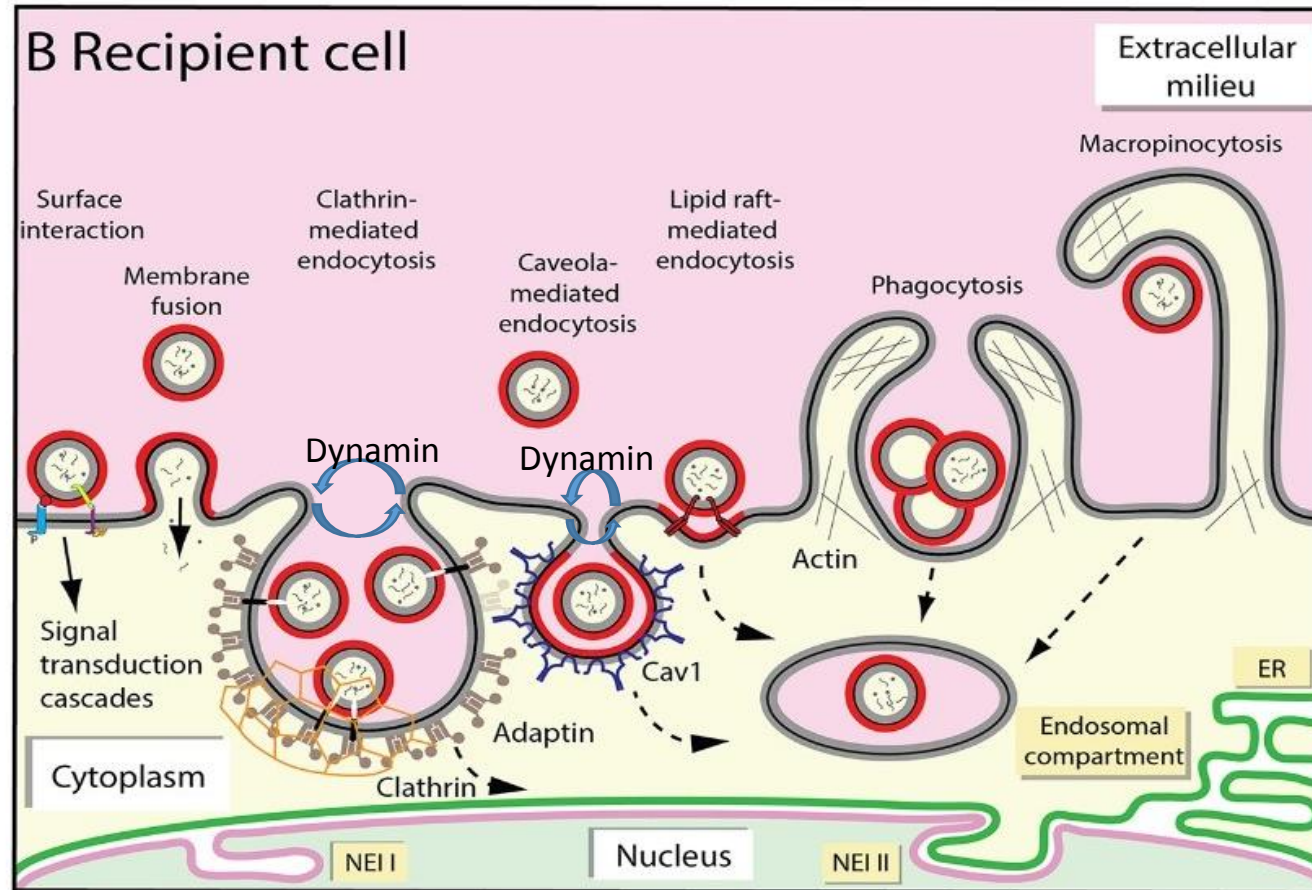
# ✓ Internalization of EVs by MG-63 cells



→ *S. aureus* N315-derived EVs are internalized by MG-63 cells

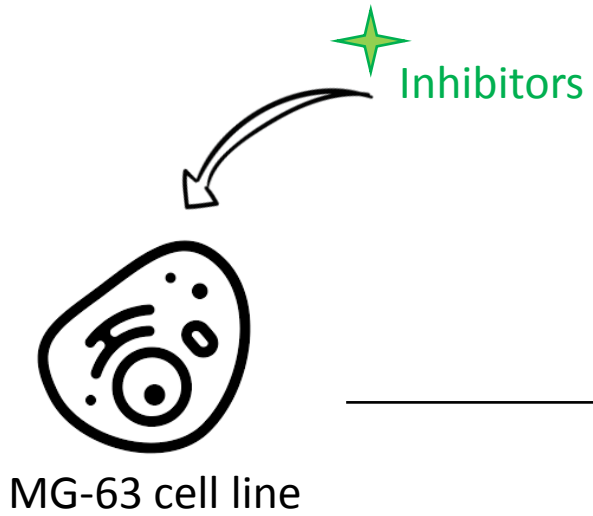
- in a dose-dependent manner
- in a time-dependent manner

✓ Internalization of EVs by MG-63 cells

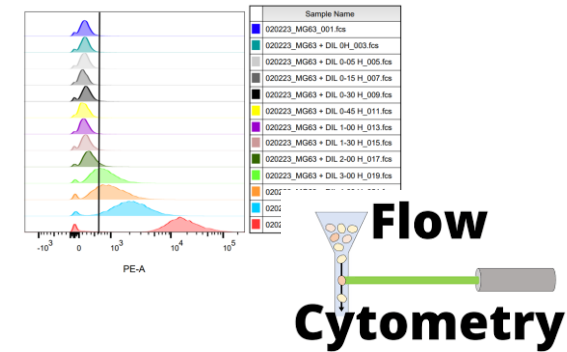
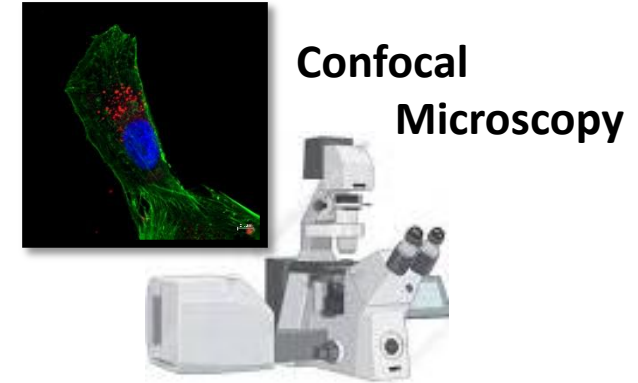
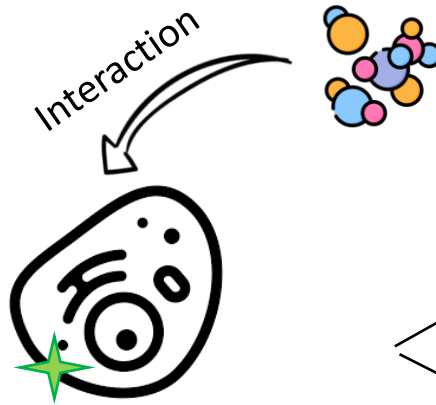


Corbeil et al., 2020

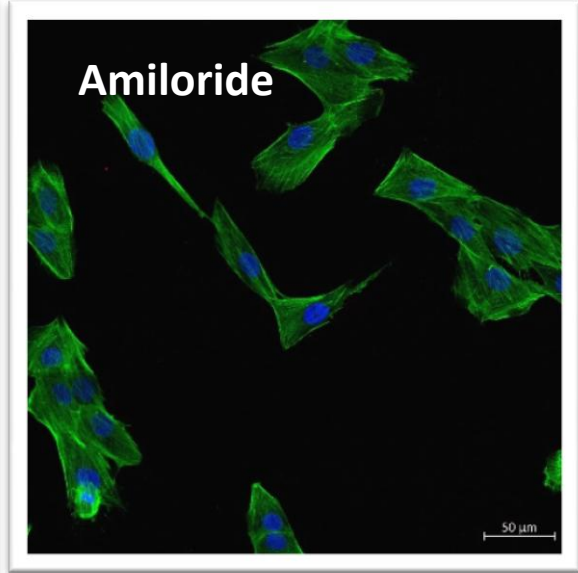
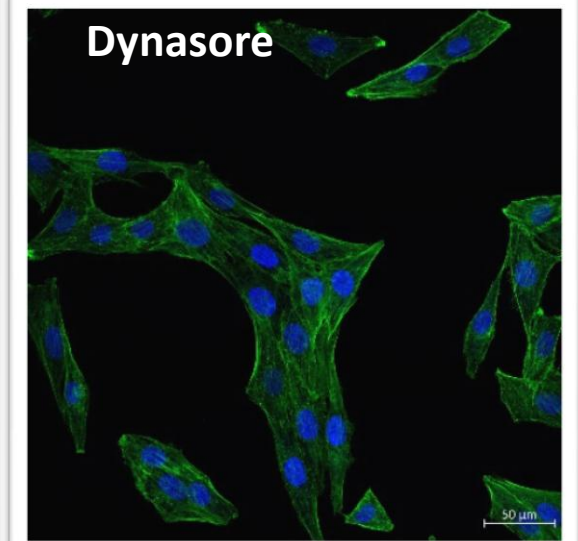
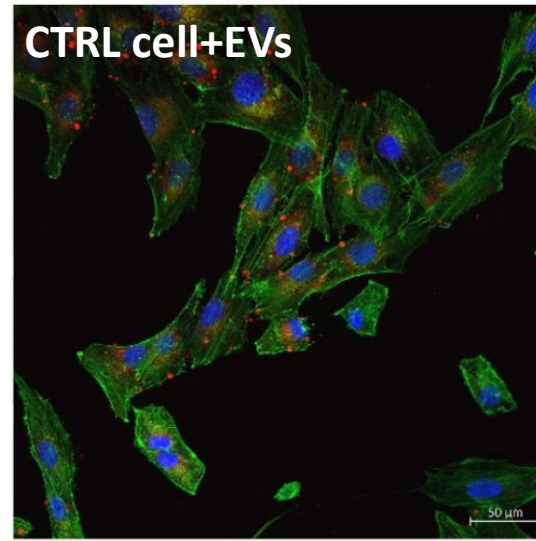
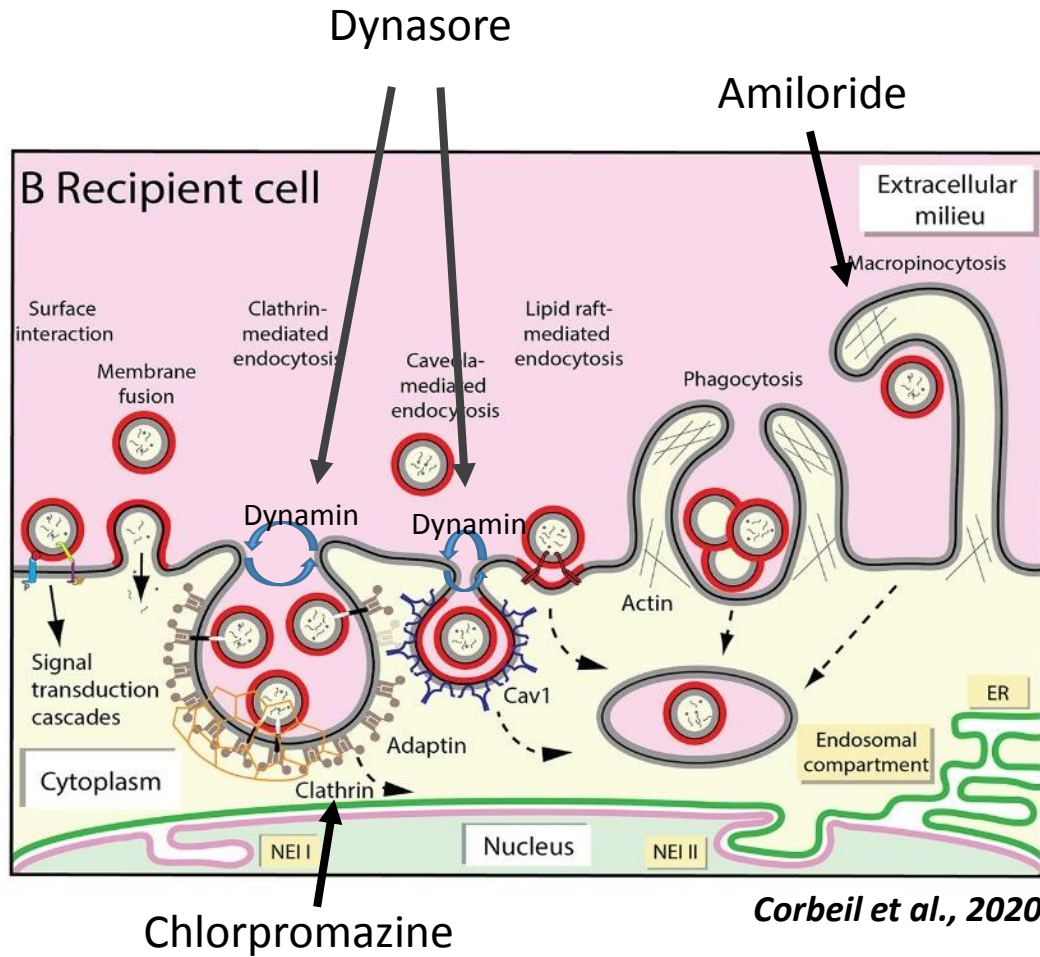
→ Several different pathways of internalization are possible



Dil-labelled Extracellular vesicles  
from N315 strain



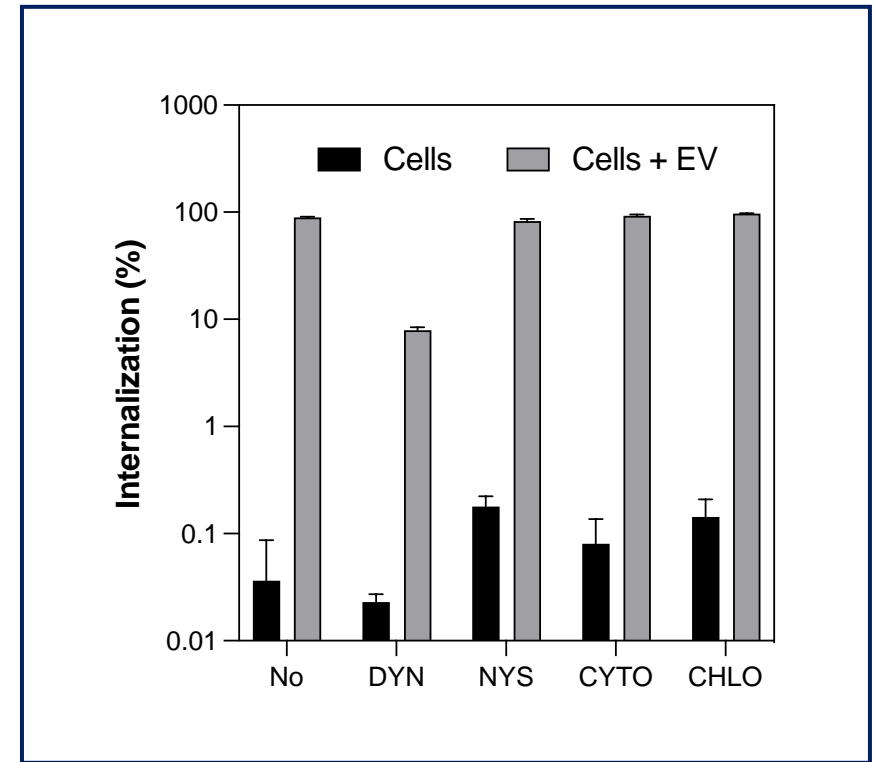
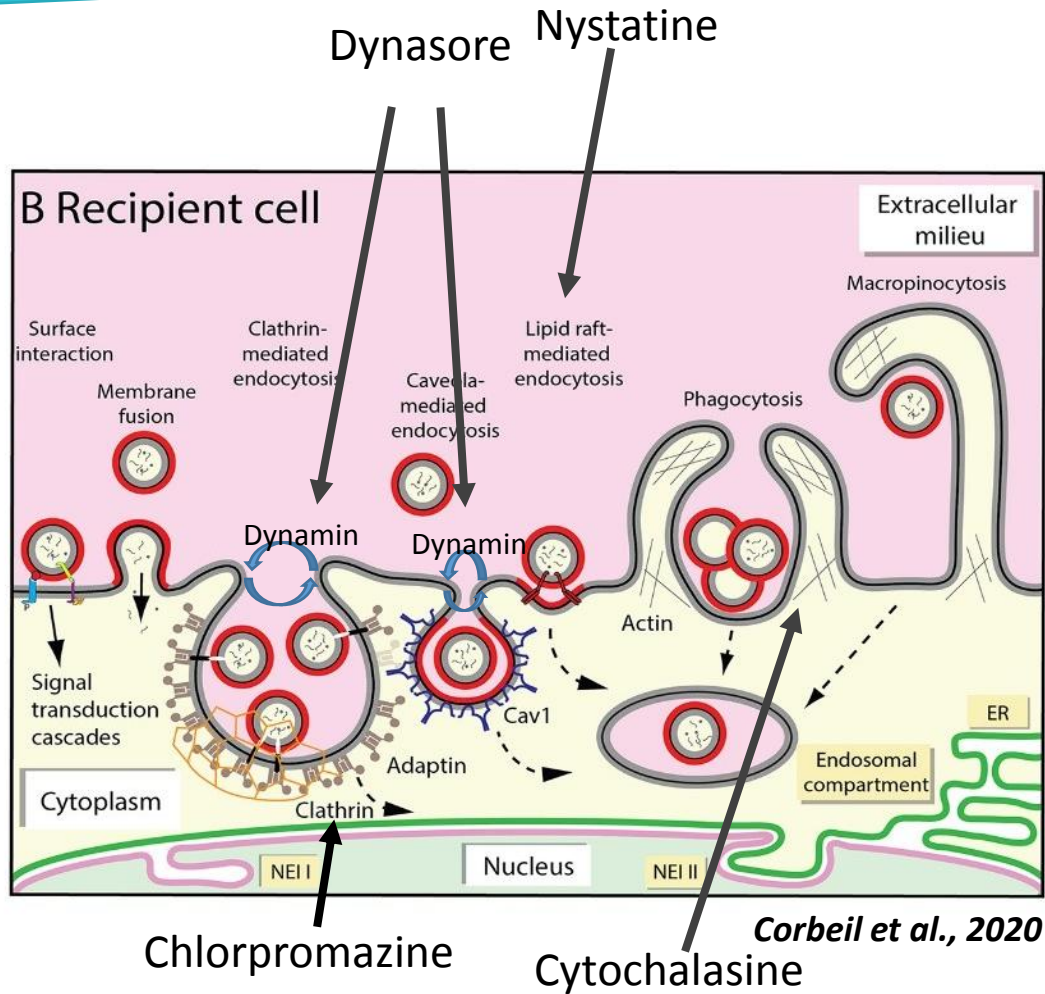
✓ Internalization of EVs by MG-63 cells



Unpublished results

→ Internalization of N315 EVs can depend upon dynamin-mediated endocytosis and macropinocytosis

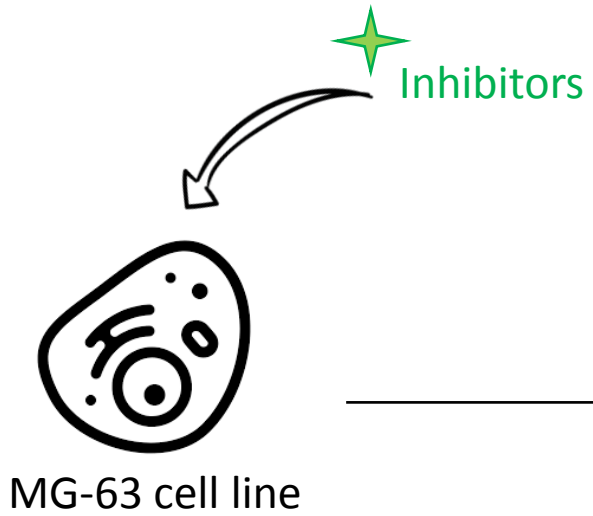
✓ Internalization of EVs by MG-63 cells



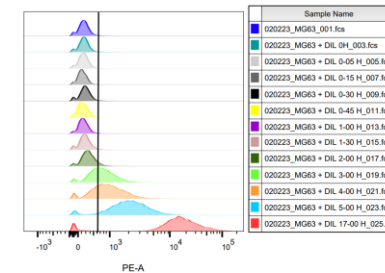
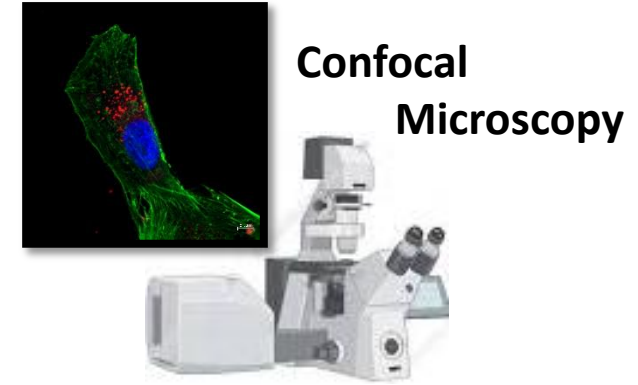
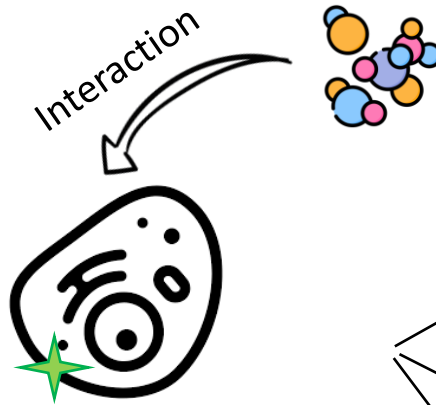
Unpublished results

→ Internalization of N315 EVs can depend upon dynamin-mediated endocytosis and macropinocytosis

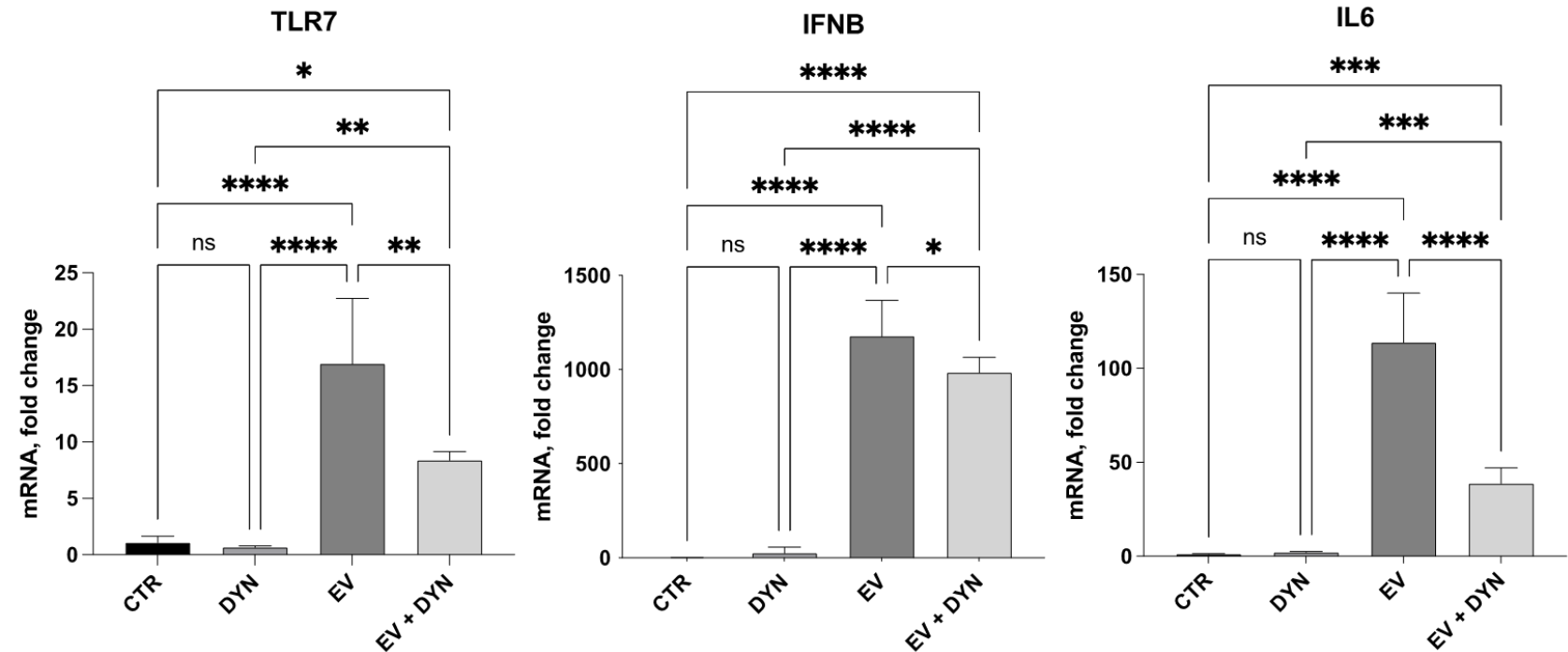




Dil-labelled Extracellular vesicles from N315 strain



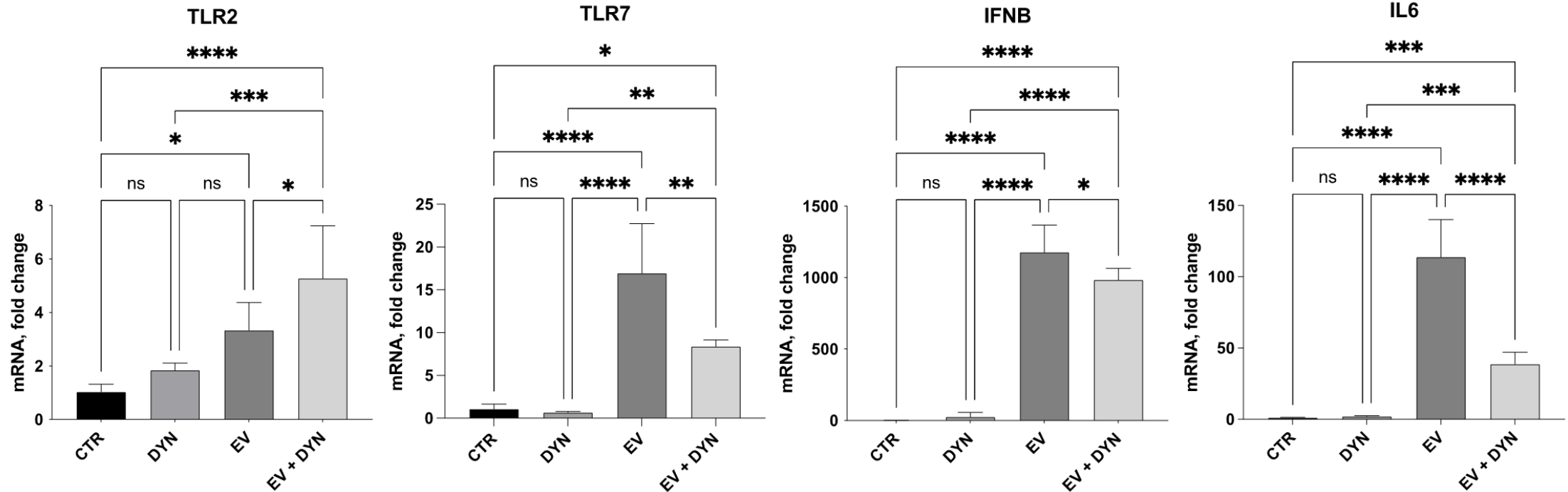
# ✓ Modulation of genes expression



→ The induced expression mediated by EVs of *TLR7*, *IFNβ* and *IL-6* genes is dependent on the internalization of EVs

→ Several pathways can be used by EVs to interact with host cells

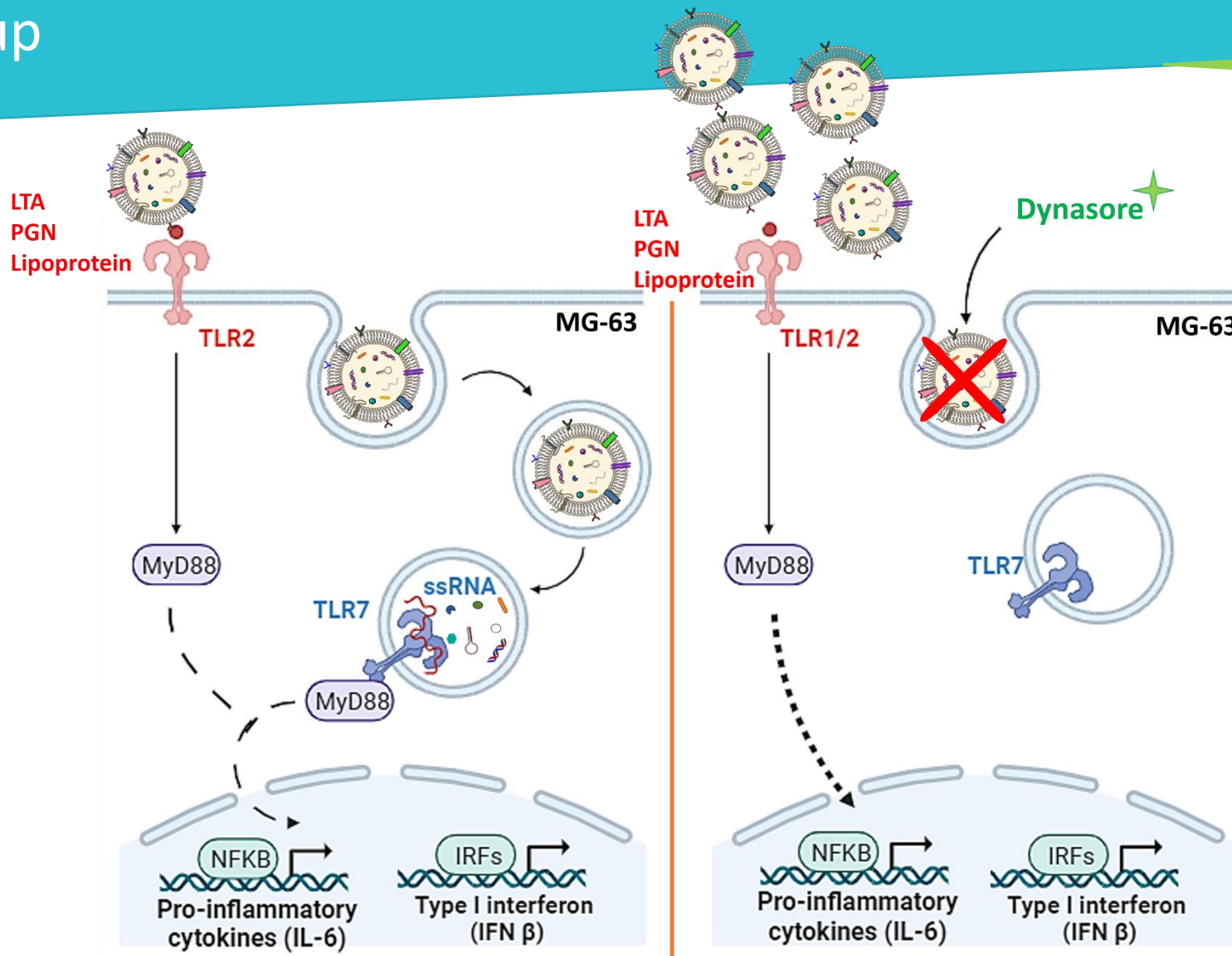
# ✓ Modulation of genes expression



→ The induced expression mediated by EVs of *TLR7*, *IFN $\beta$*  and *IL-6* genes is dependent on the internalization of EVs

→ Several pathways can be used by EVs to interact with host cells

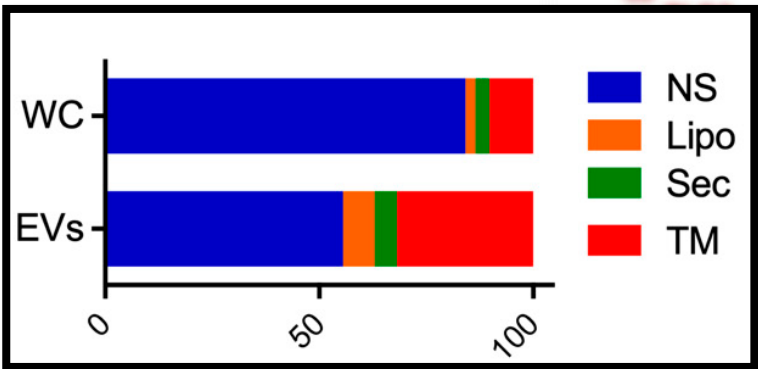
✓ To sum up



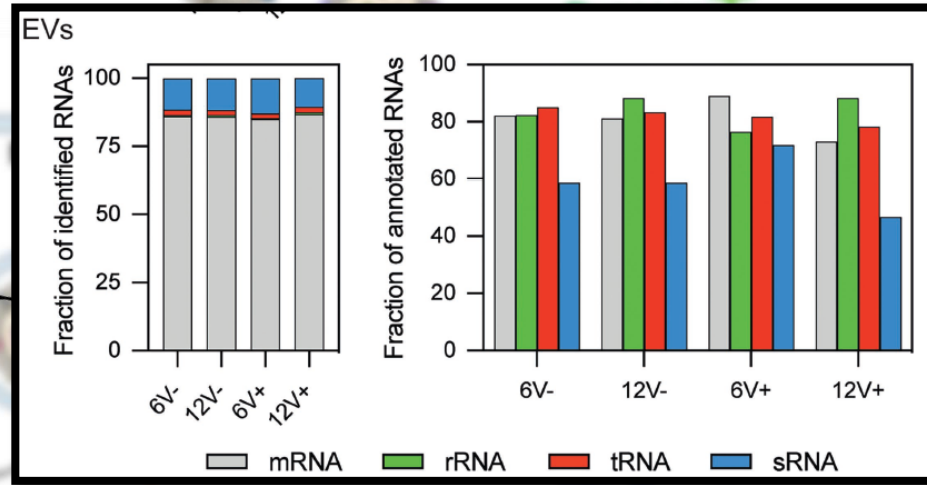
- N315-derived EVs can trigger both extracellular and intracellular signaling pathway in host cells
- Several EV components (proteins, RNA) can be involved in the interaction with host cells

✓ To sum up

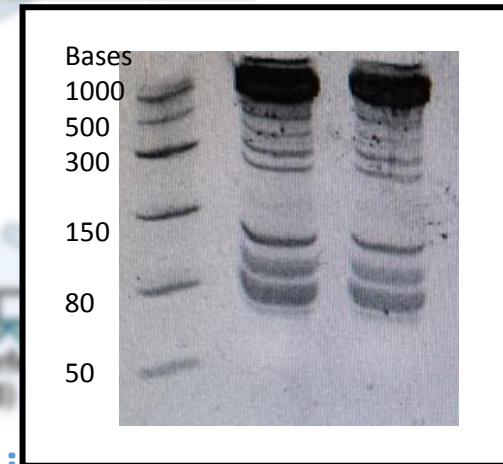
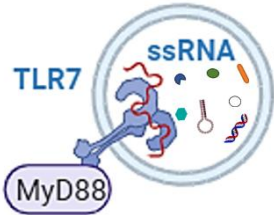
Lipoproteins



Luz and al., 2022

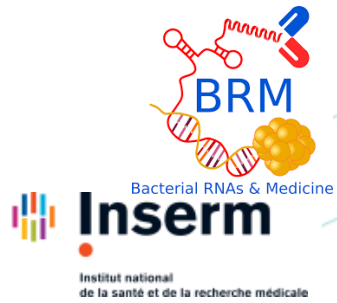


Luz and al., 2021



- N315-derived EVs can trigger both extracellular and intracellular signaling pathway in host cells
- Several EV components (proteins, RNA) can be involved in the interaction with host cells

# Thanks



**Ligia Prado, LIA**  
**Mathilde Lécot, Rennes**  
**Brenda Luz, LIA**

**Eric Guedon, STLO, Rennes**  
**Nathalie Daniel, STLO, Rennes**  
**Danièle Vassaux, STLO, Rennes**  
**Yves Le Loir, STLO, Rennes**  
**Nadejda Berkova, STLO, Rennes**  
**Yann Le Gouar, STLO, Rennes**  
**Jordane Ossemond, STLO, Rennes**

**Brice Felden, BRM, Rennes**  
**Svetlana Chabelskaia, BRM, Rennes**

**Vasco AZEVEDO, UFMG, Belo Horizonte, Brazil**

