

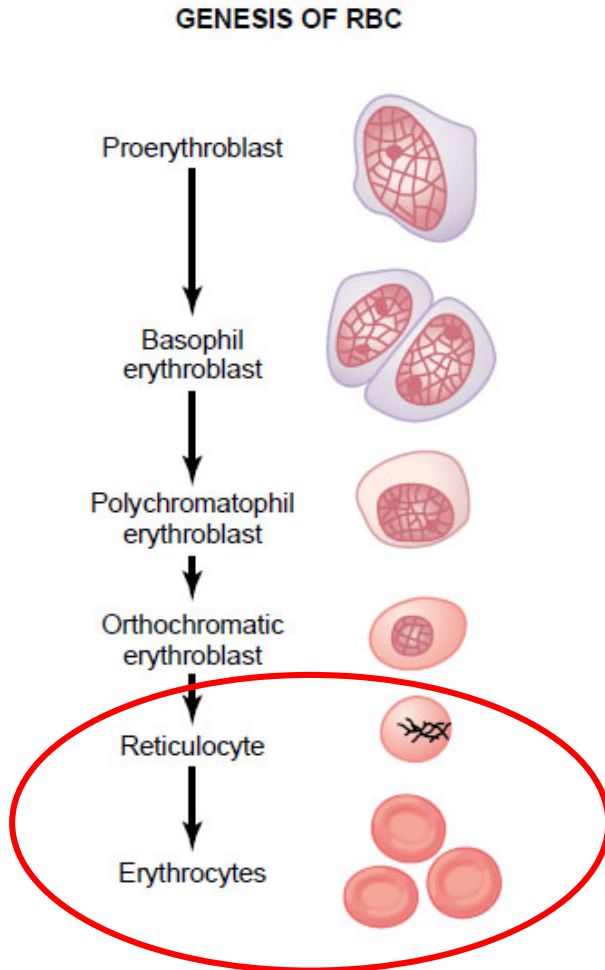
# **Pre-term infant transfusion support: adult or cord blood donation?**

A longitudinal study of CD71 expression in  
pre-term, cord and adult blood samples

**Dr Megan Forrester**

Infection, Immunity & Inflammation  
University of Aberdeen

# Circulating CD71+ Glycophorin A+ cells

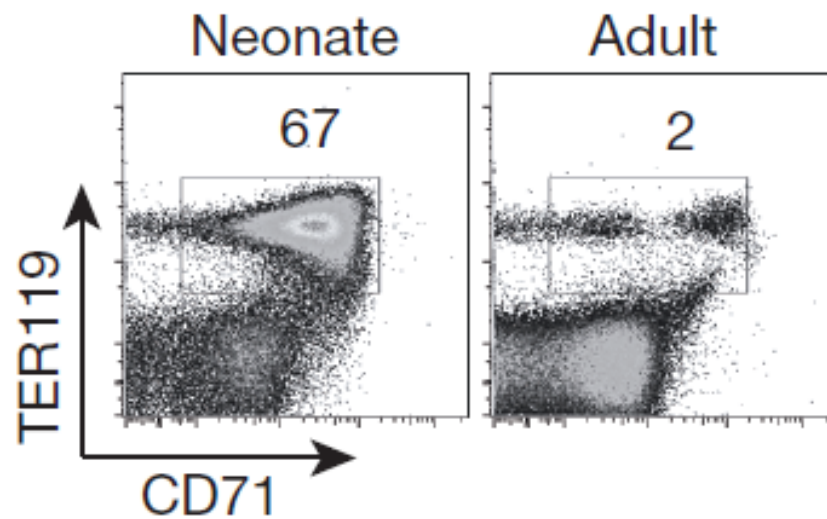


- **CD71** or Transferrin Receptor
  - Imports iron
  - Expressed during erythropoiesis
  - Not expressed on mature red blood cells
- **Glycophorin A** or GPA

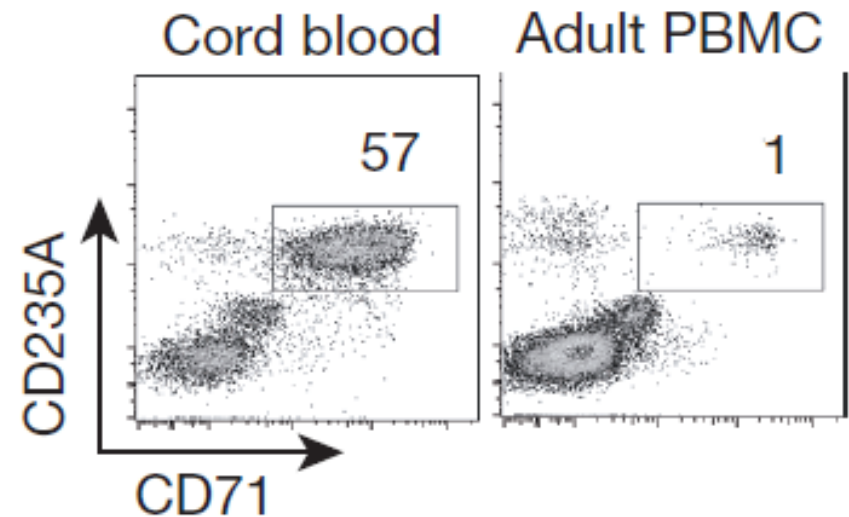
# Immunosuppressive CD71<sup>+</sup> erythroid cells compromise neonatal host defence against infection

Elahi *et al.* Nature Dec 2013

## Mouse



## Human



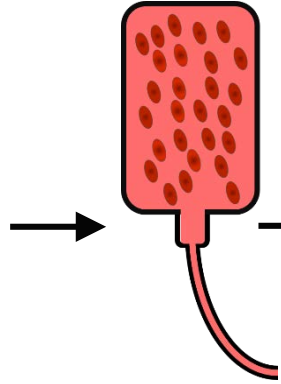
# Necrotising Enterocolitis

- Necrosis of the bowel caused by inflammation and ischaemic death of the gut
- Pathogenesis involves immature gut mucosal barrier, abnormalities of blood flow, abnormal bacterial colonisation and immune responses
- Risk factors include low birthweight, prematurity and **transfusion**

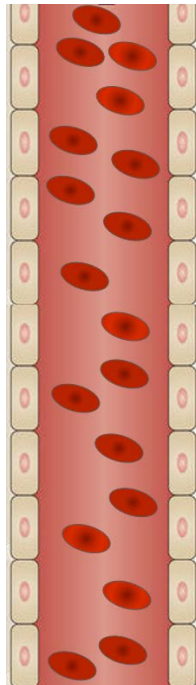
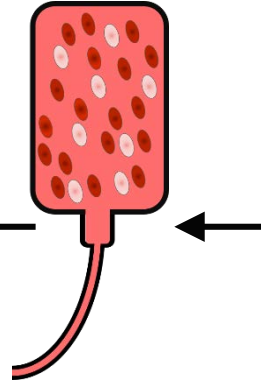


# Transfusion-associated NEC - Pathogenesis

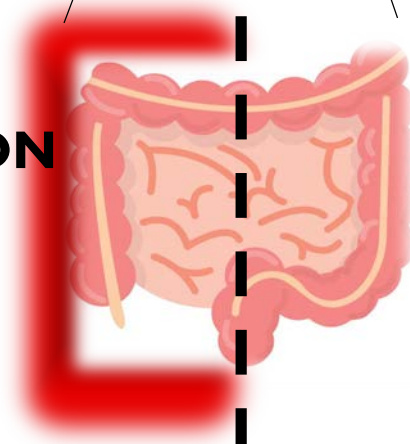
Adult Blood Transfusion



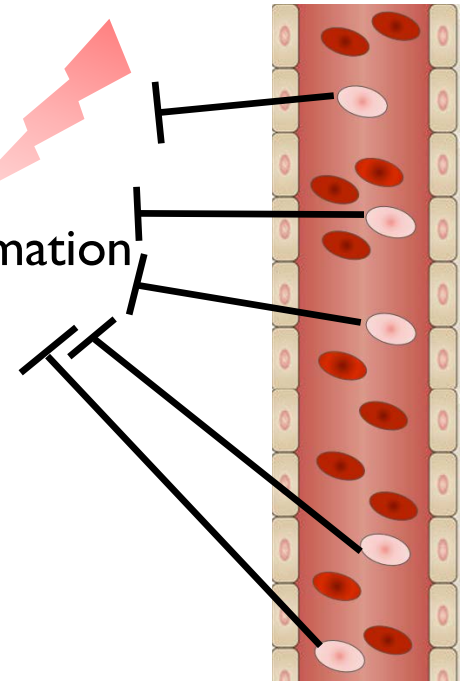
Cord Blood Transfusion



**INFLAMMATION**



Inflammation



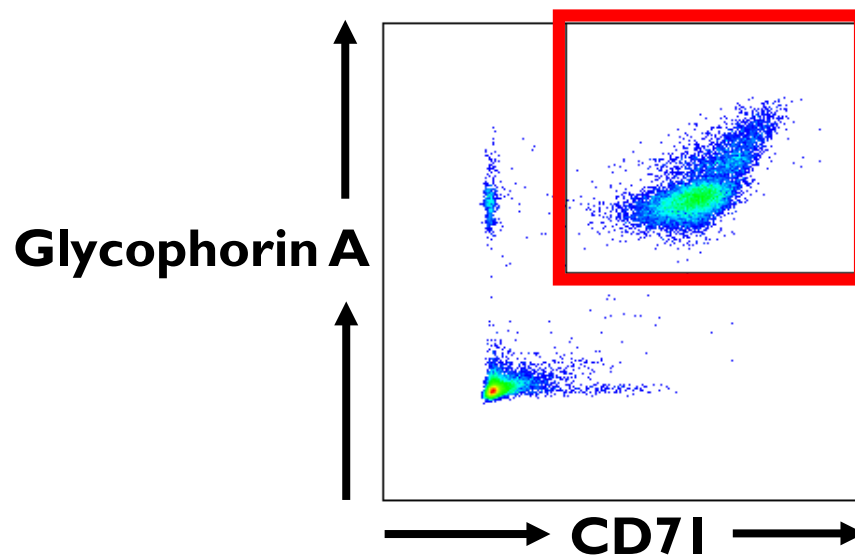
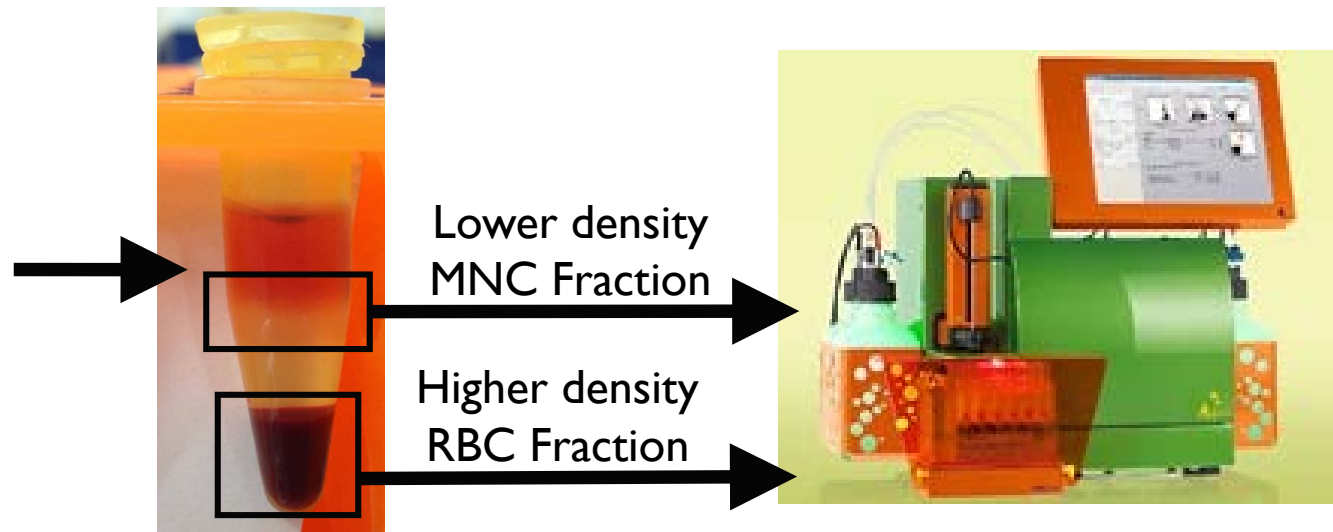
# Aims

- Identify in neonatal cord blood samples the early red cell population (CD71+ Glycophorin A+)
- Compare to adult blood donors
- Establish a time course of their development with respect to gestational age
- Assess their potential anti-inflammatory activity.

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# CD71 Expression Analysis

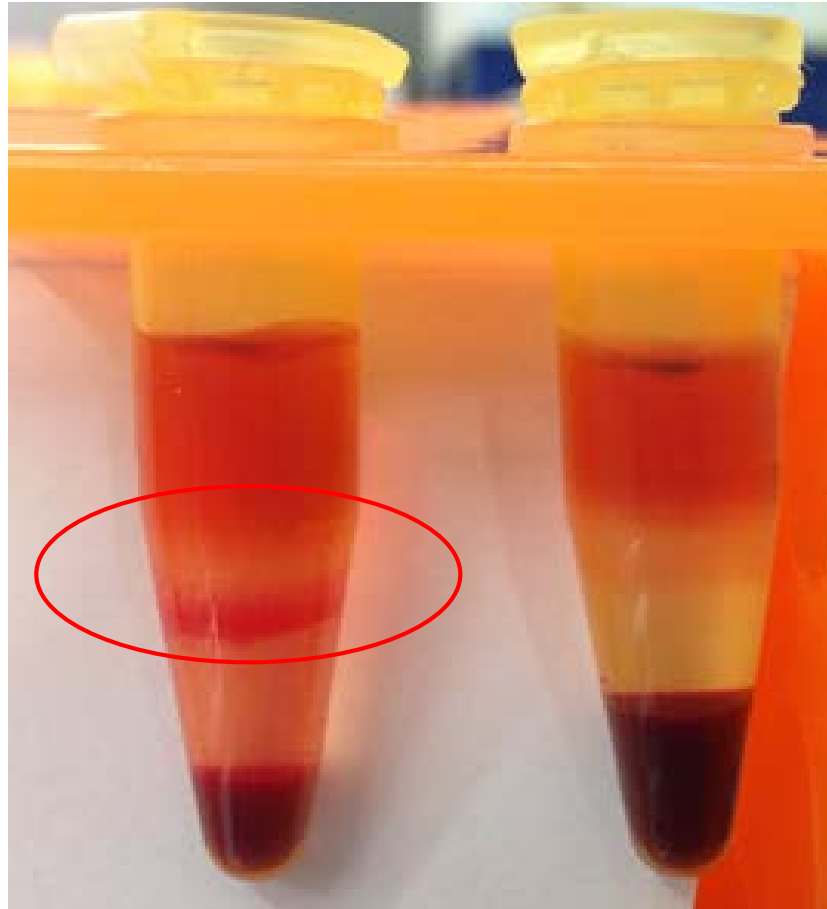




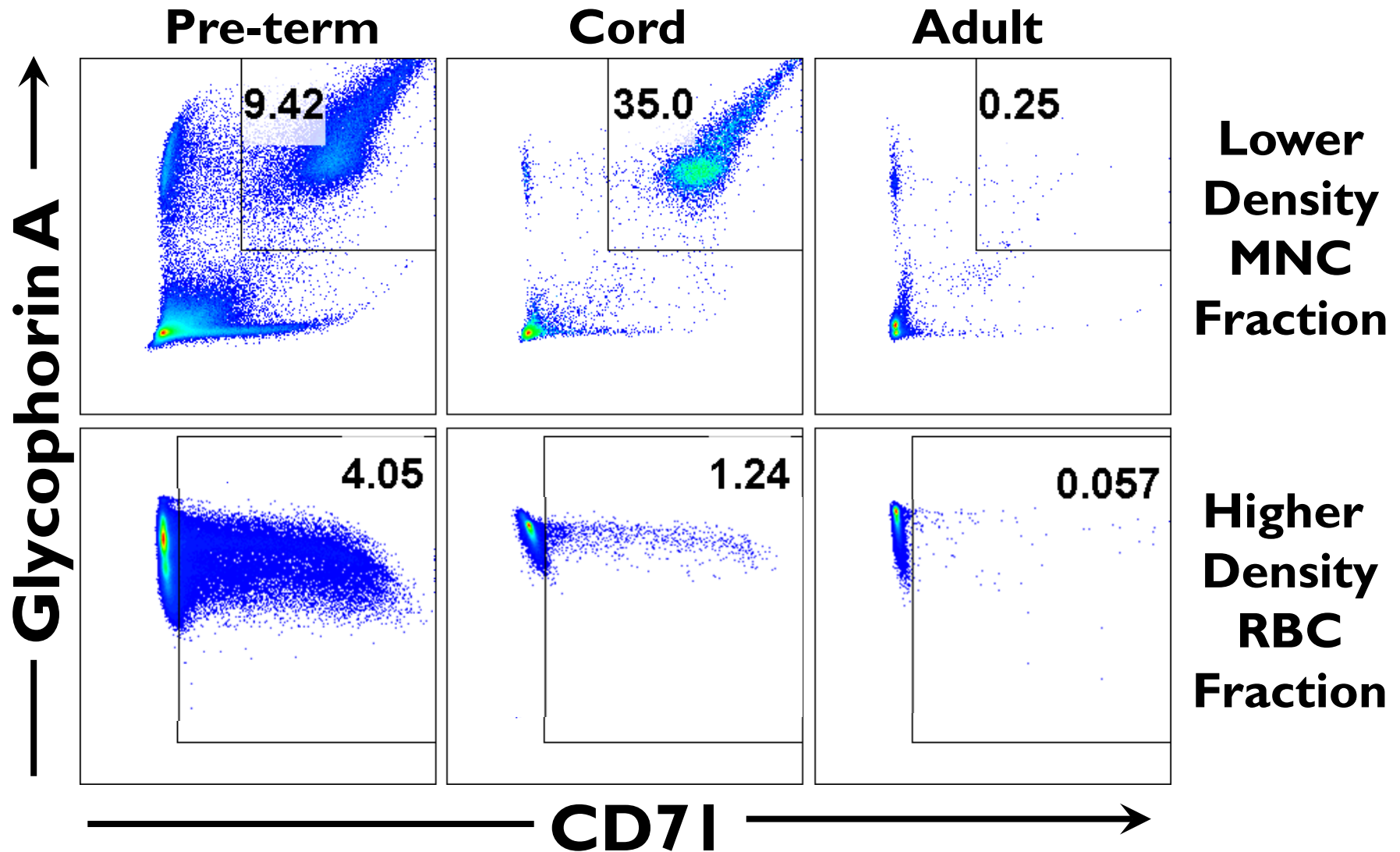
# CD71 Expression Analysis

Cord

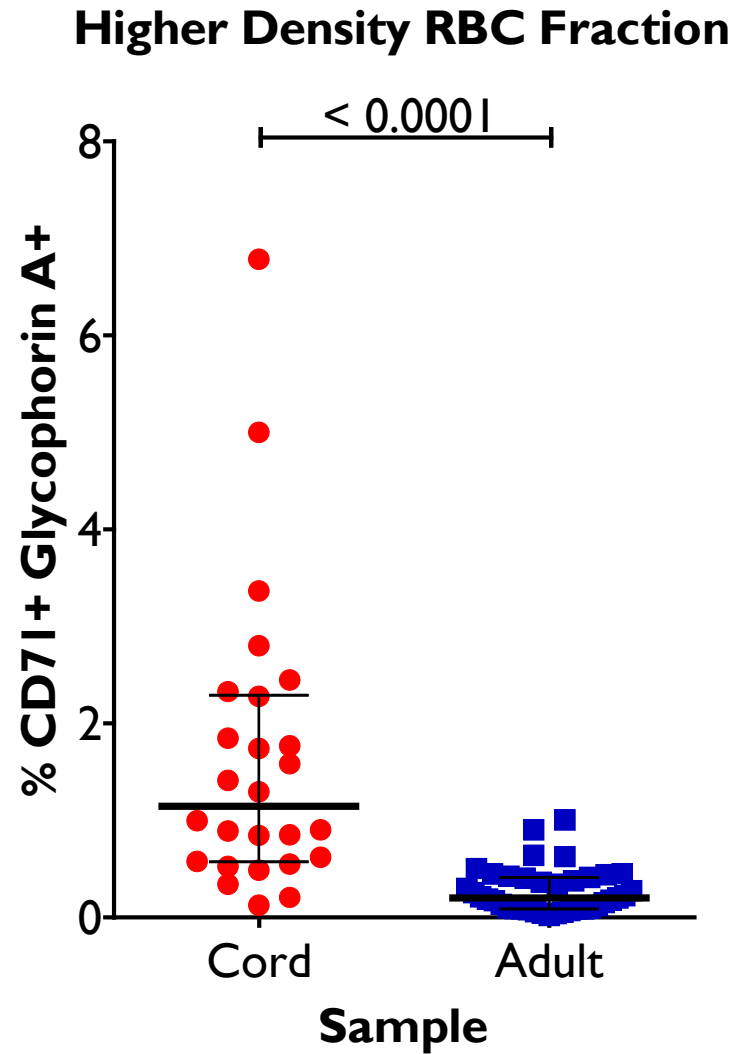
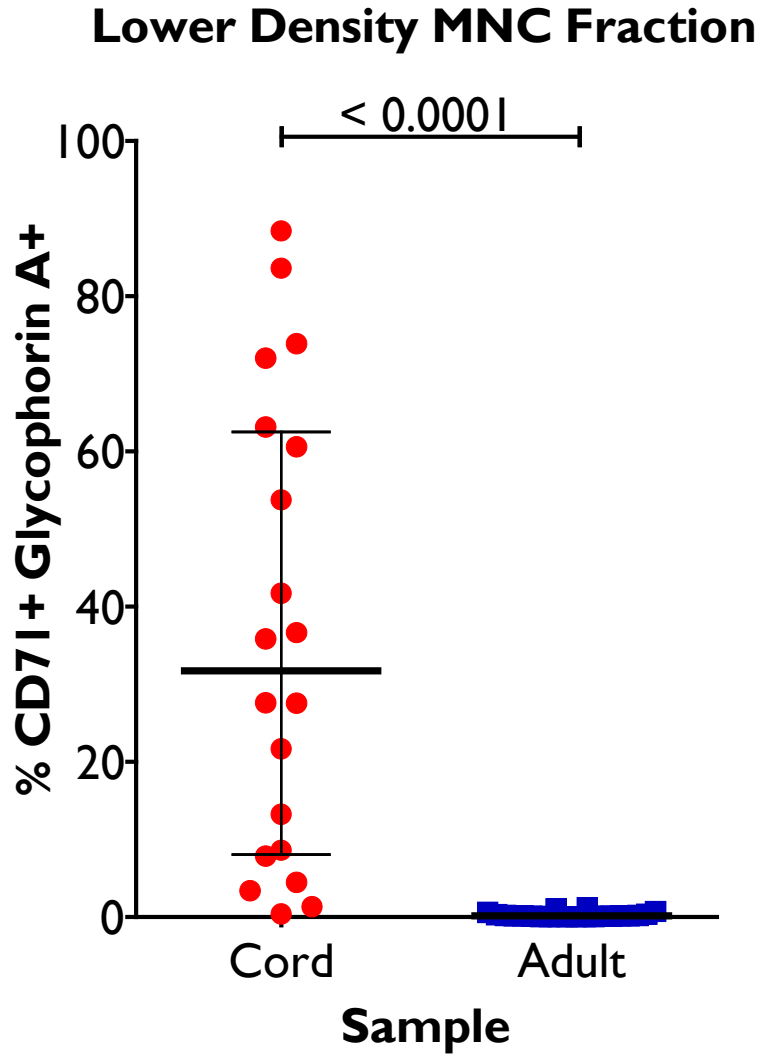
Adult



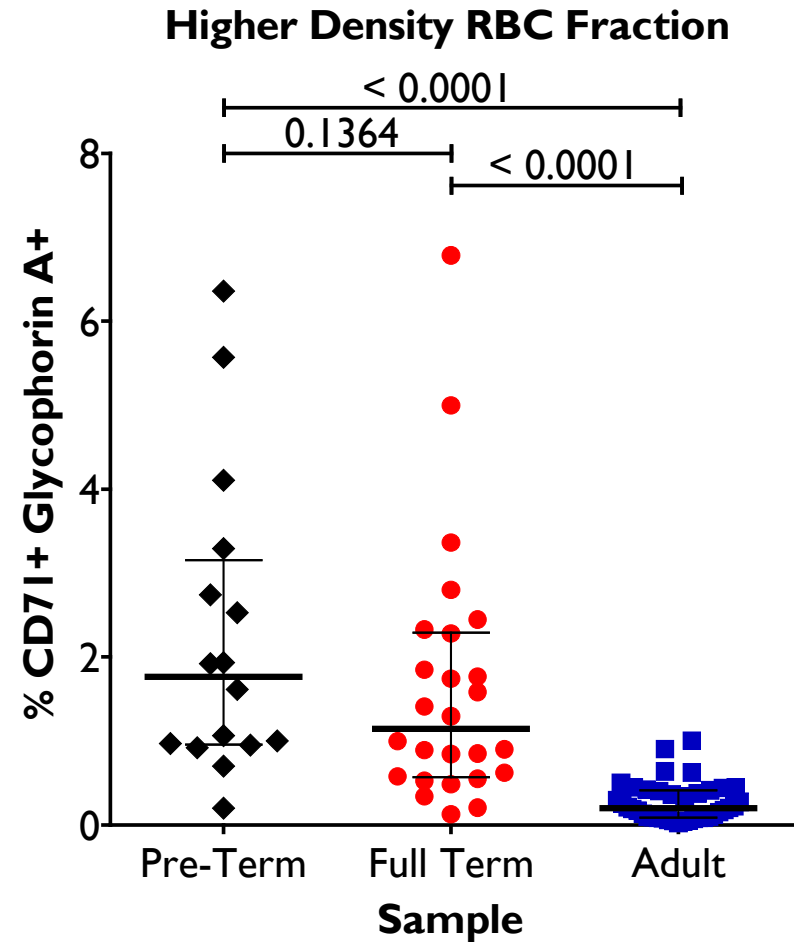
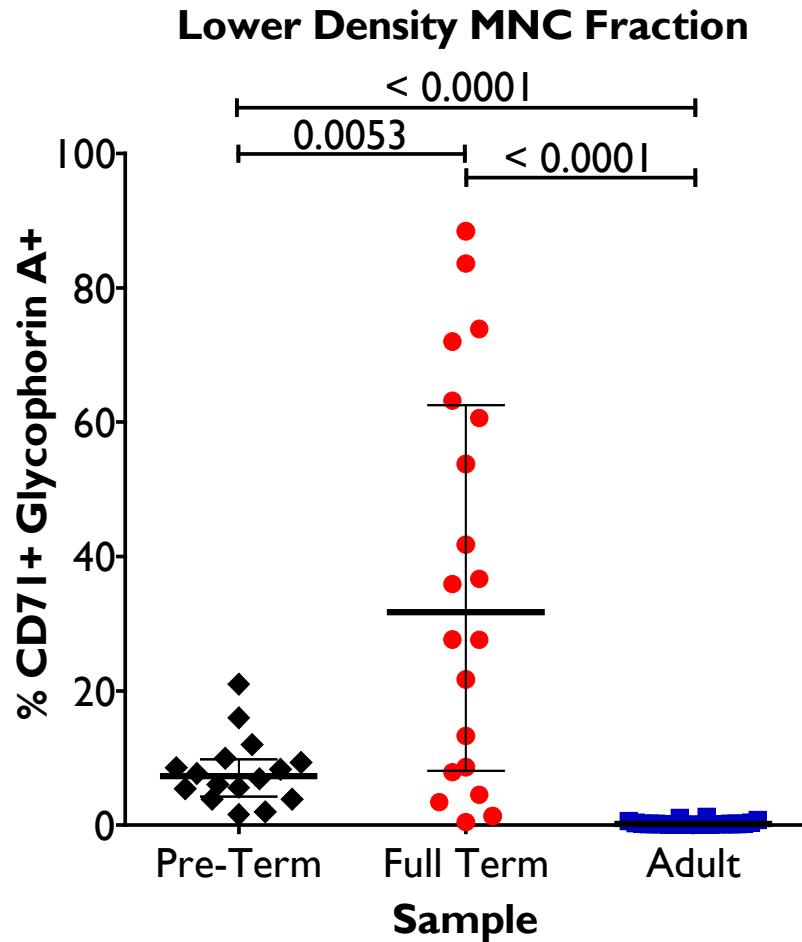
# Examples of flow cytometry plots of CD71 vs Glycophorin A from pre-term, cord and adult samples.



# Cord Blood Has A Higher Concentration of CD71+ Glycophorin A+ Cells Than Adult Blood

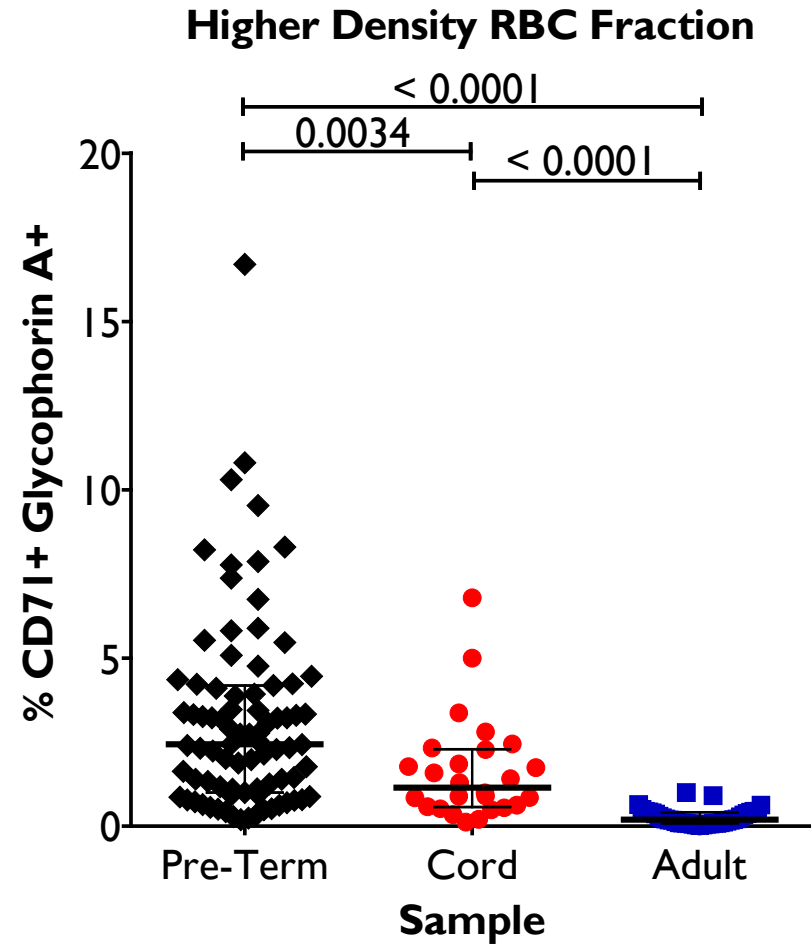
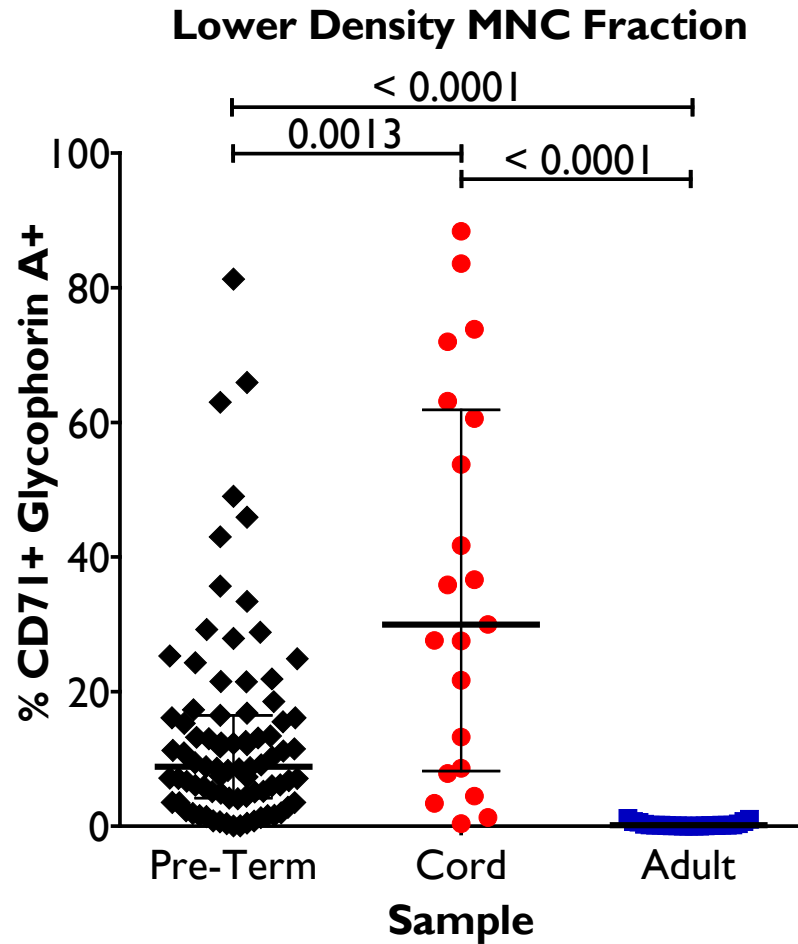


# Pre-Term Blood Has A Higher Concentration of CD71+ Glycophorin A+ Cells Than Adult Blood



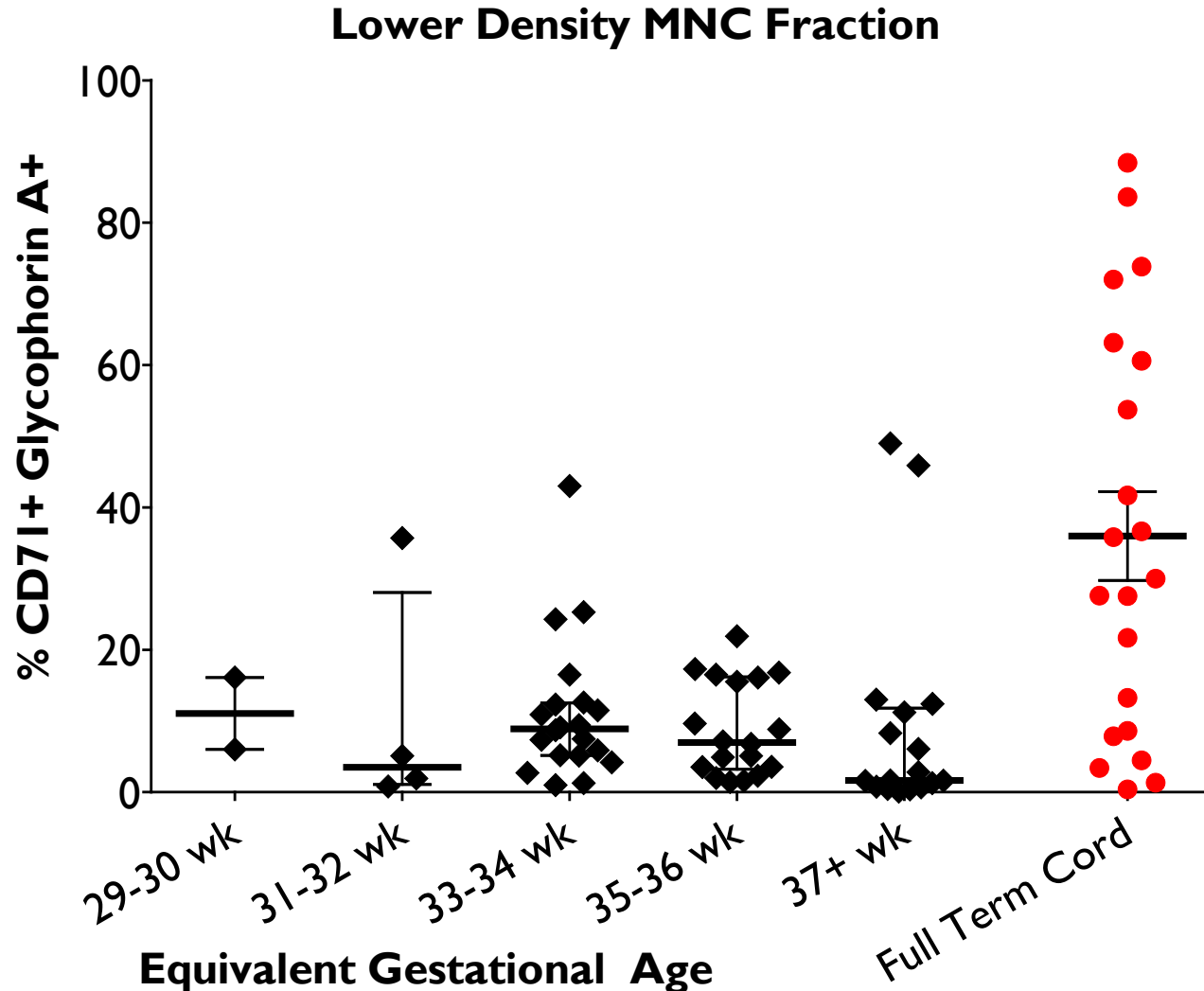
### Average of each Pre-Term infant

# Pre-Term Blood Has A Higher Concentration of CD71+ Glycophorin A+ Cells Than Adult Blood



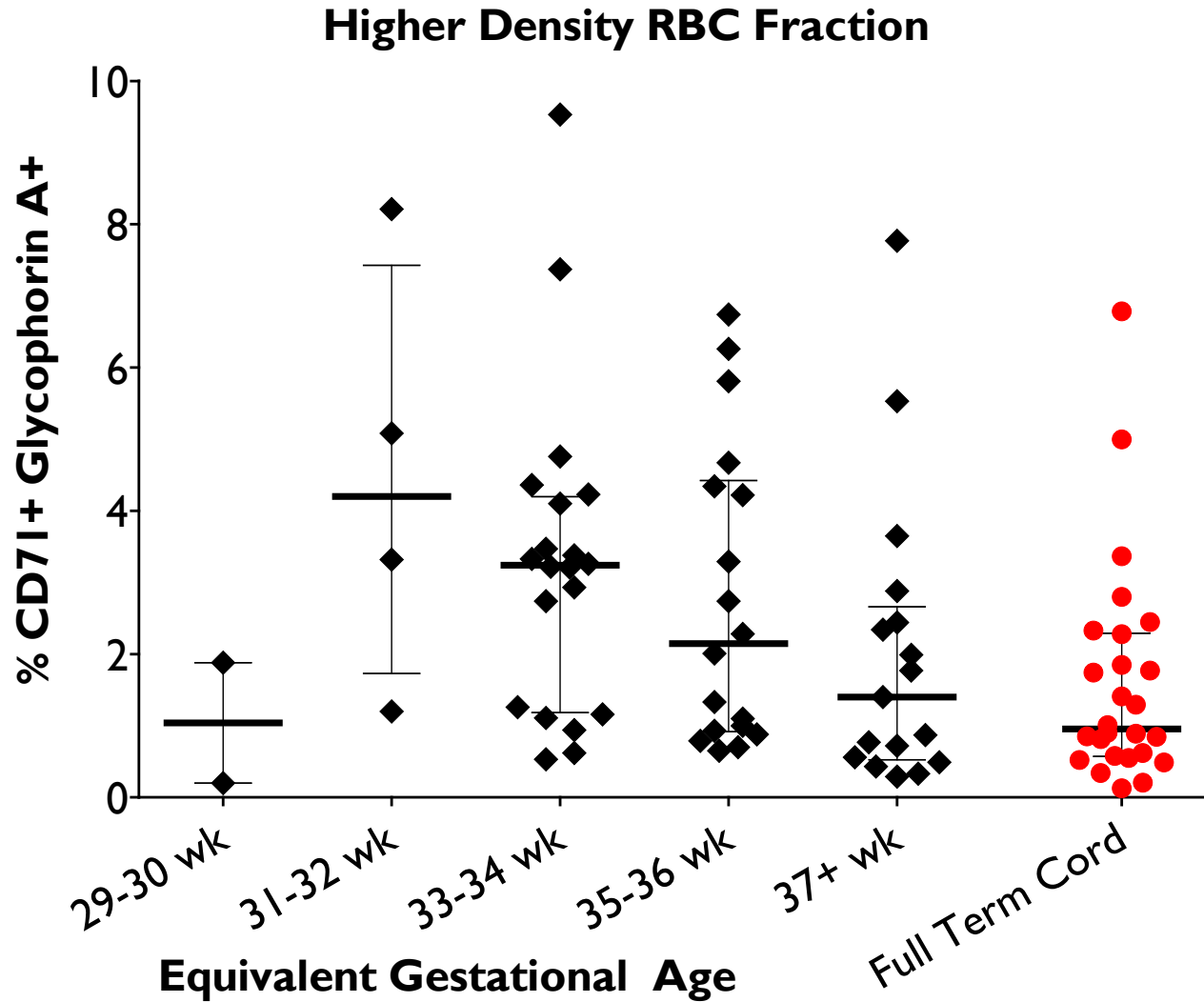
**All Pre-Term samples**

# CD71+ Glycophorin A+ cell concentration in the mononuclear cell fraction does not follow a pattern with equivalent gestational age



Equivalent gestational age = gestation age at birth + age

# CD71+ Glycophorin A+ cell concentration in the RBC fraction decreases according to equivalent gestational age until similar to full term cord



Equivalent gestational age = gestation age at birth + age

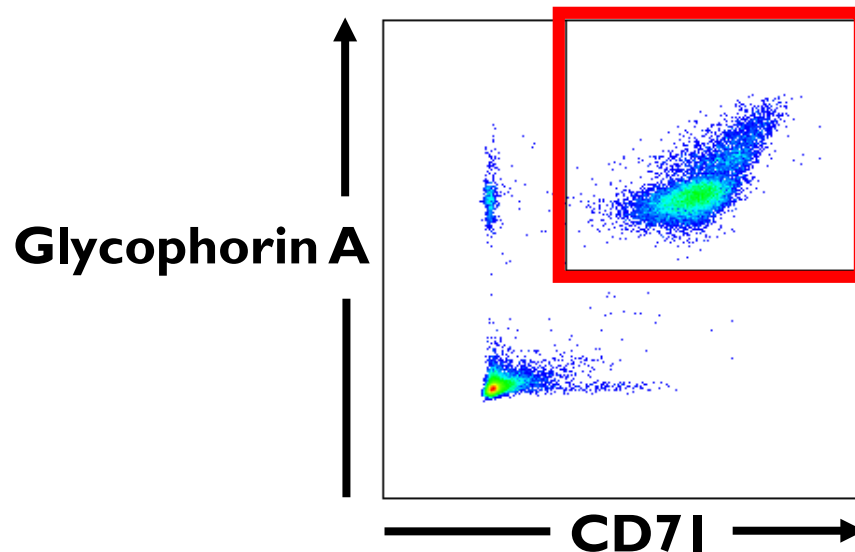
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- **Identify in neonatal cord blood samples the early red cell population (CD71+ Glycophorin A+)**
- **Compare to adult blood donors**
- **Establish a time course of their development with respect to gestational age**
- Assess their potential anti-inflammatory activity.



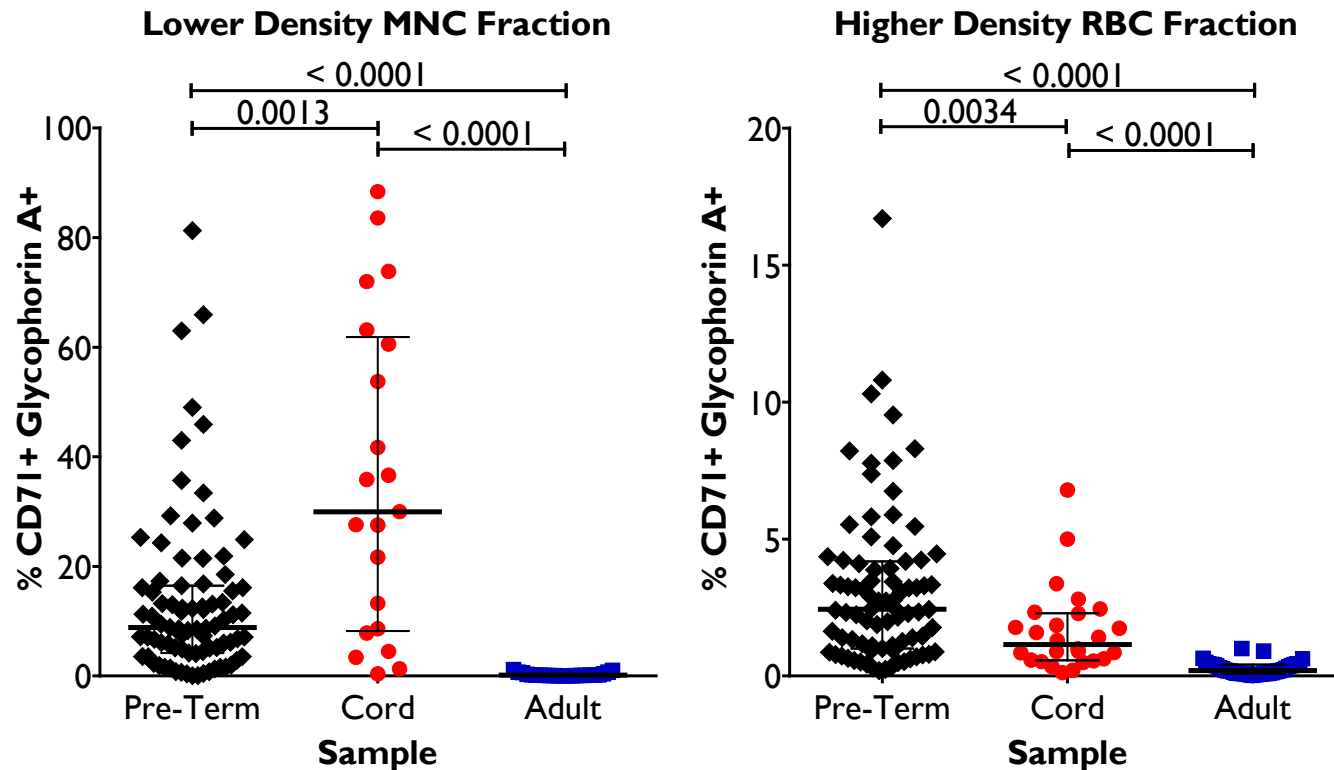
**Aim:- Identify in neonatal cord blood samples the early red cell population (CD71+ Glycophorin A+)**

✓ Identified CD71+ Glycophorin A+ cells in neonatal cord blood and pre-term samples



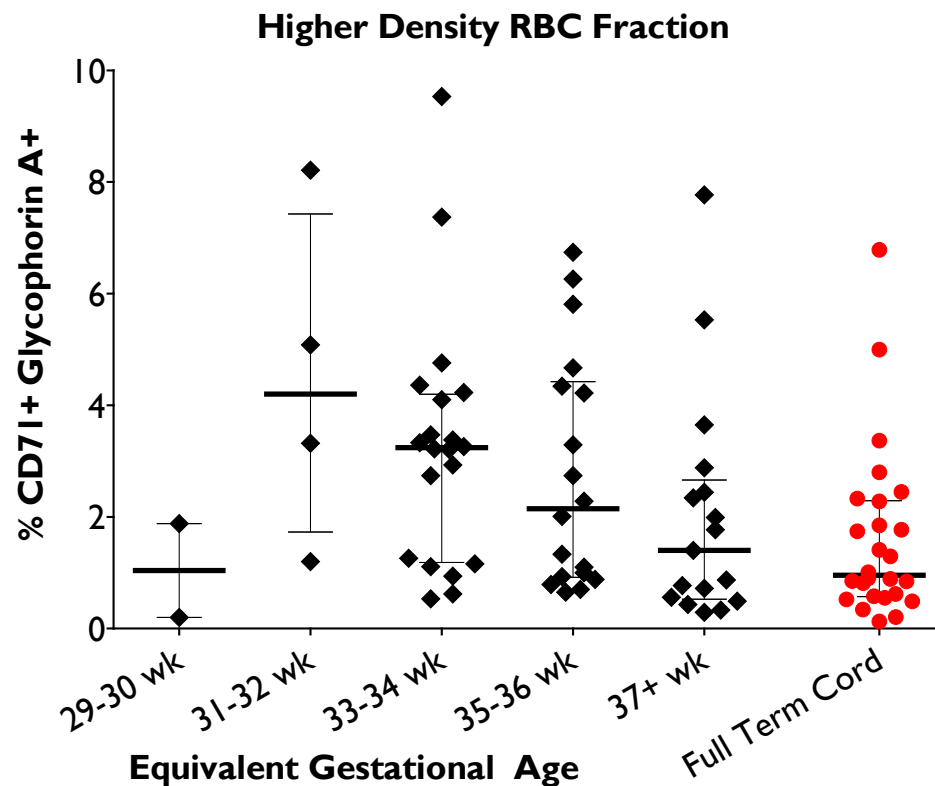
# Aim:- Compare to adult blood donors

- ✓ CD71+ Glycophorin A+ cells in cord and pre-term samples have a higher concentration compared to adult blood donors



# Aim:- Establish a time course of their development with respect to gestational age

- ✓ CD71+ Glycophorin A+ cells in the RBC fraction in pre-term samples decreases in concentration with increasing equivalent gestational age

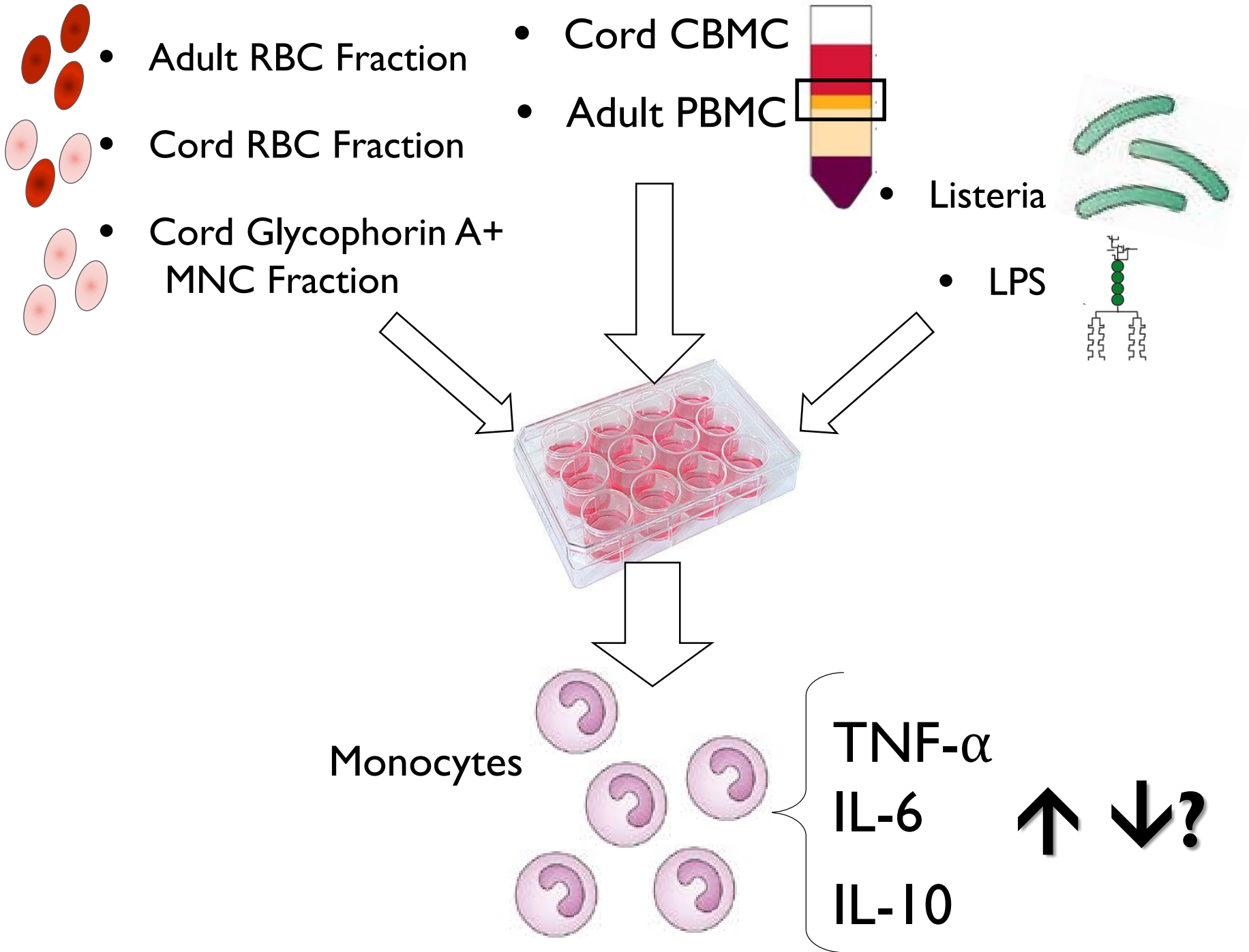


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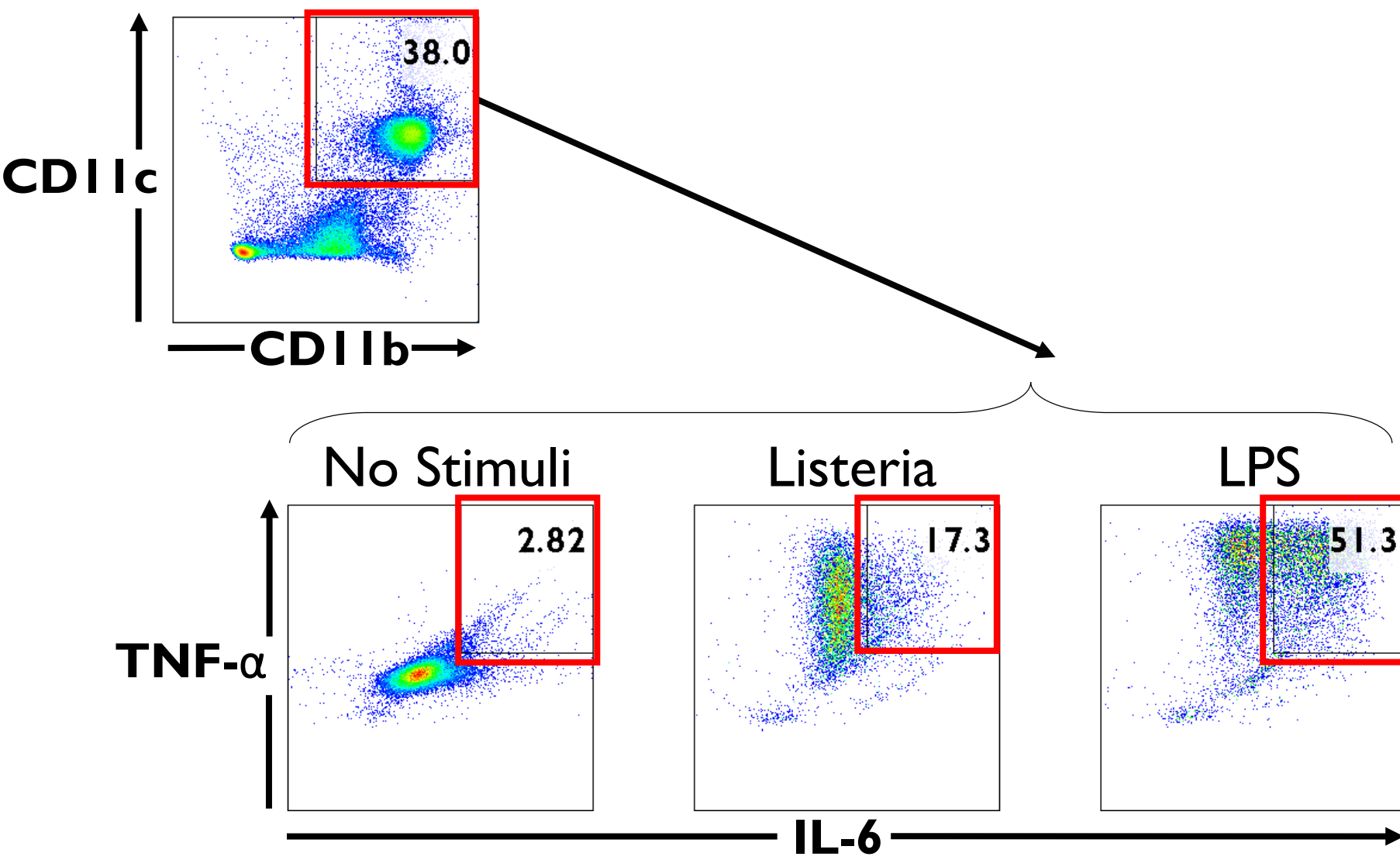
- ✓ Identified CD71+ Glycophorin A+ cells in neonatal cord blood and pre-term samples
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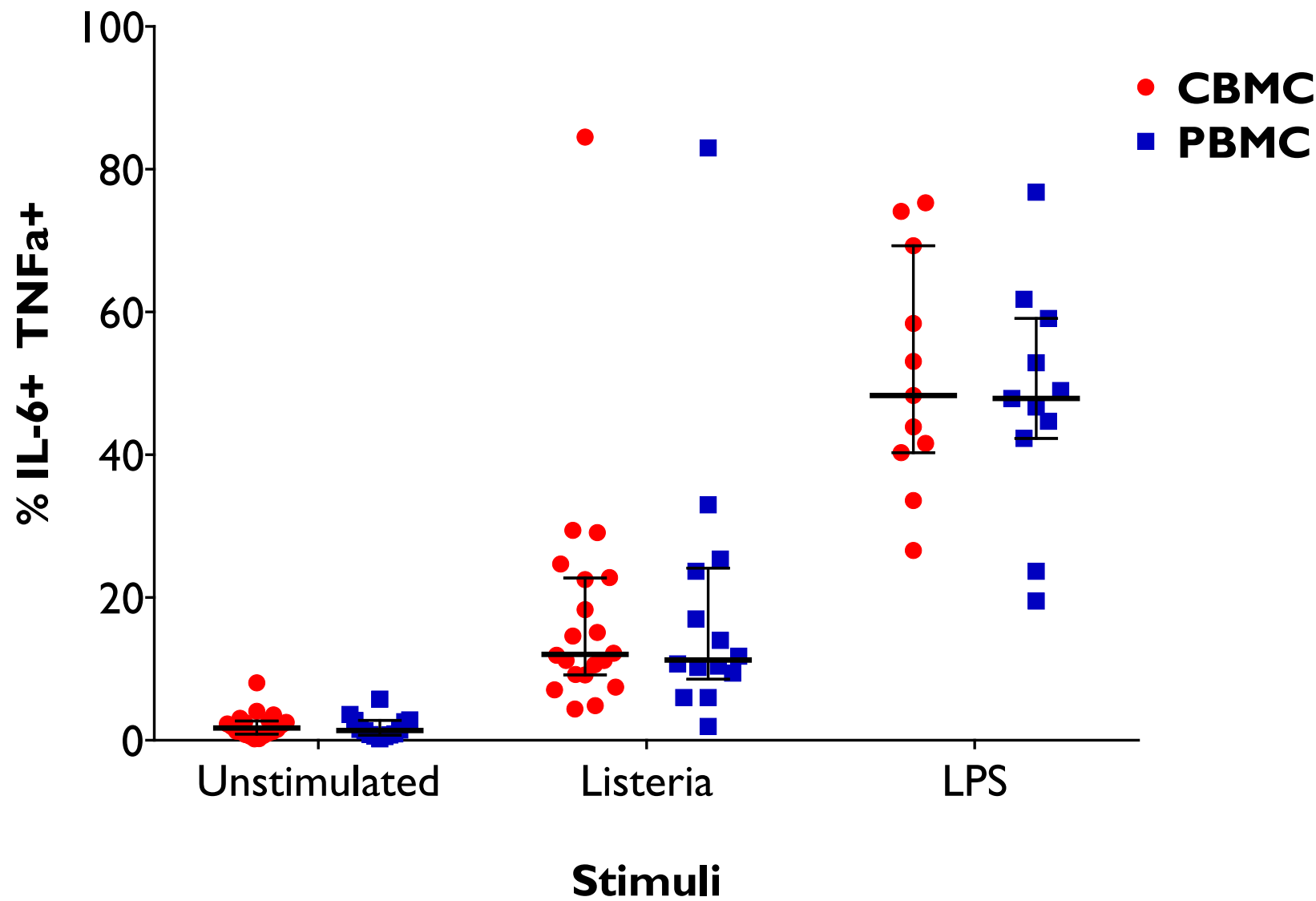
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# Examples of flow cytometry plots of inhibition experiments

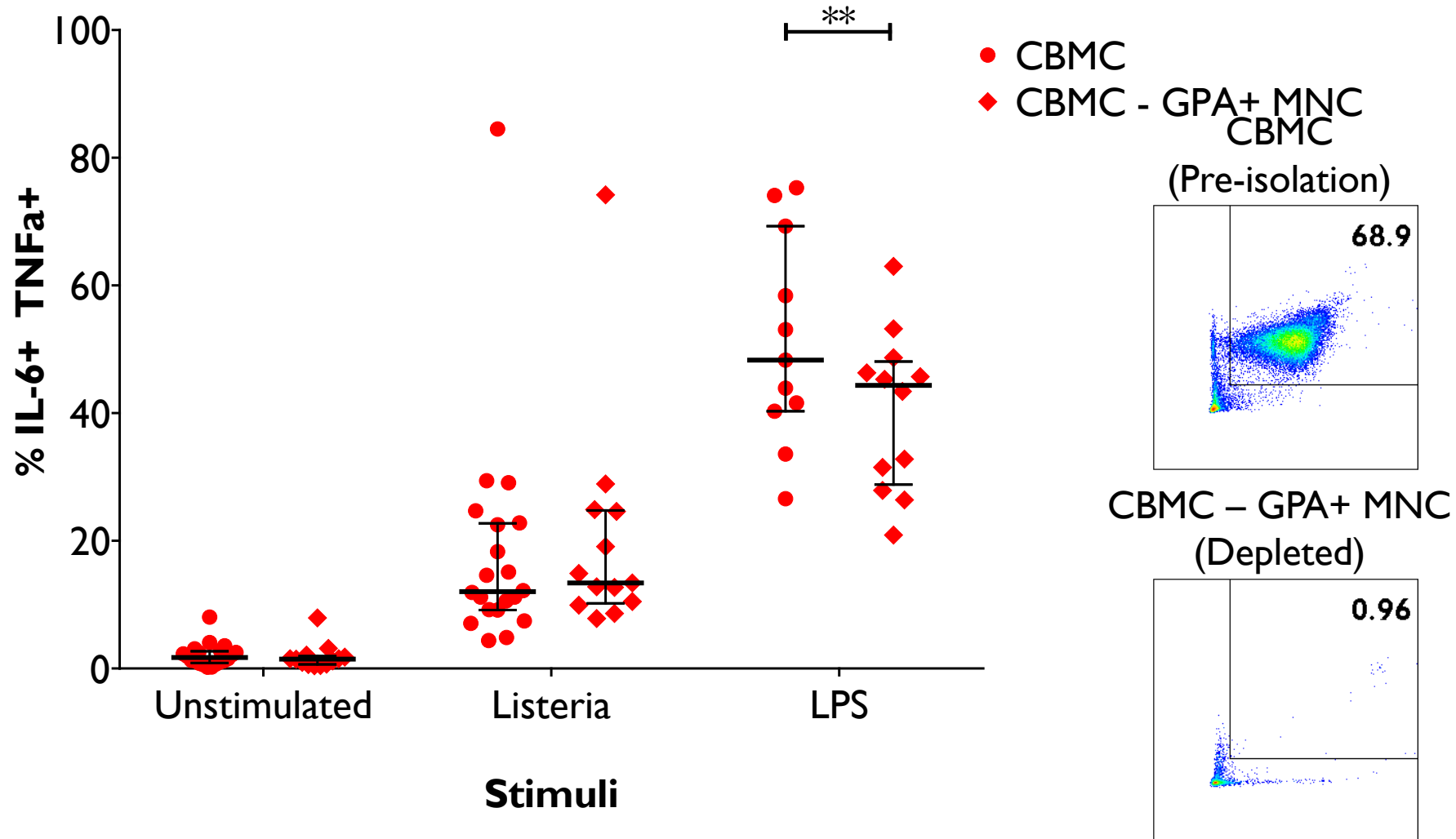


# No difference in CBMC and PBMC Response to Listeria or LPS

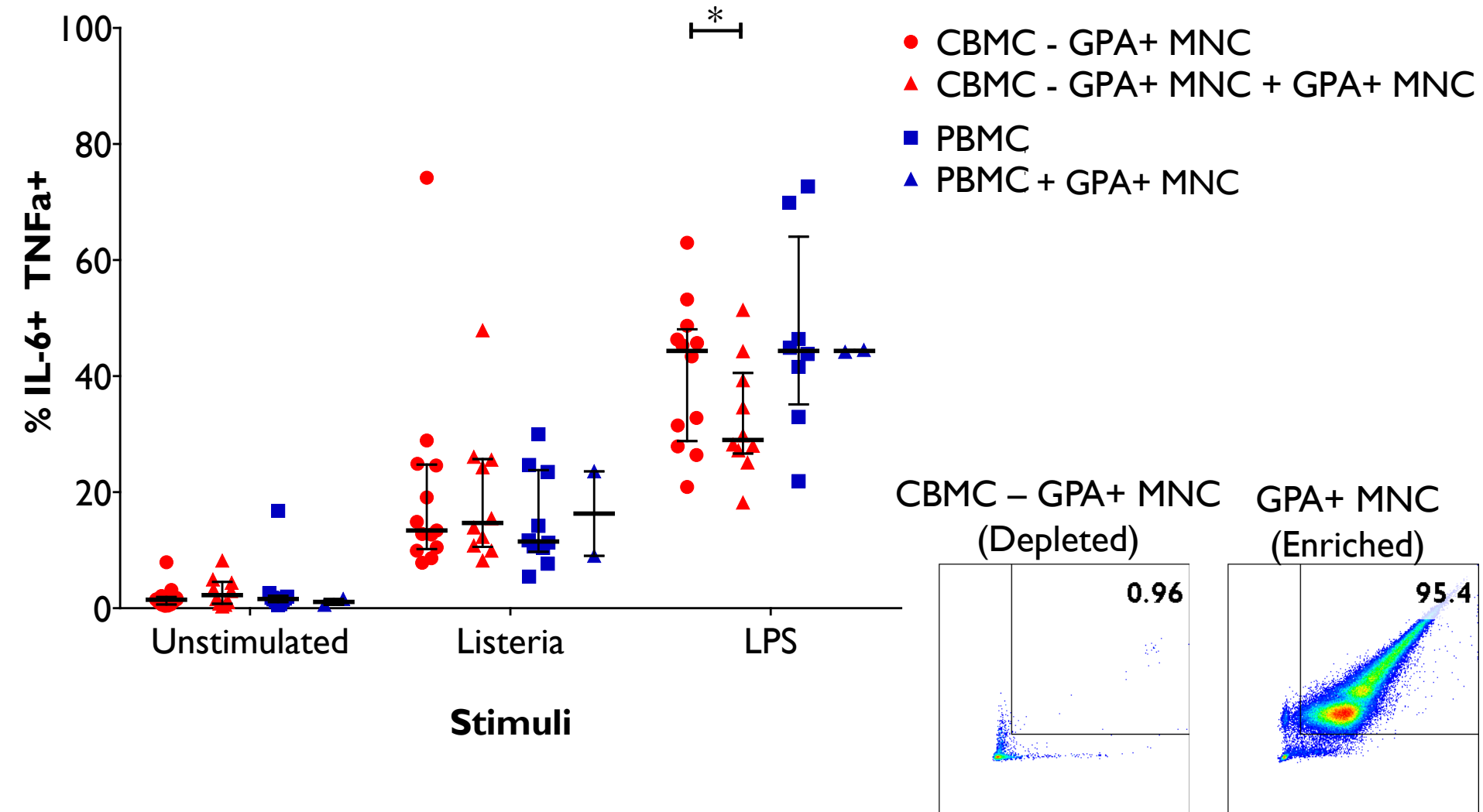




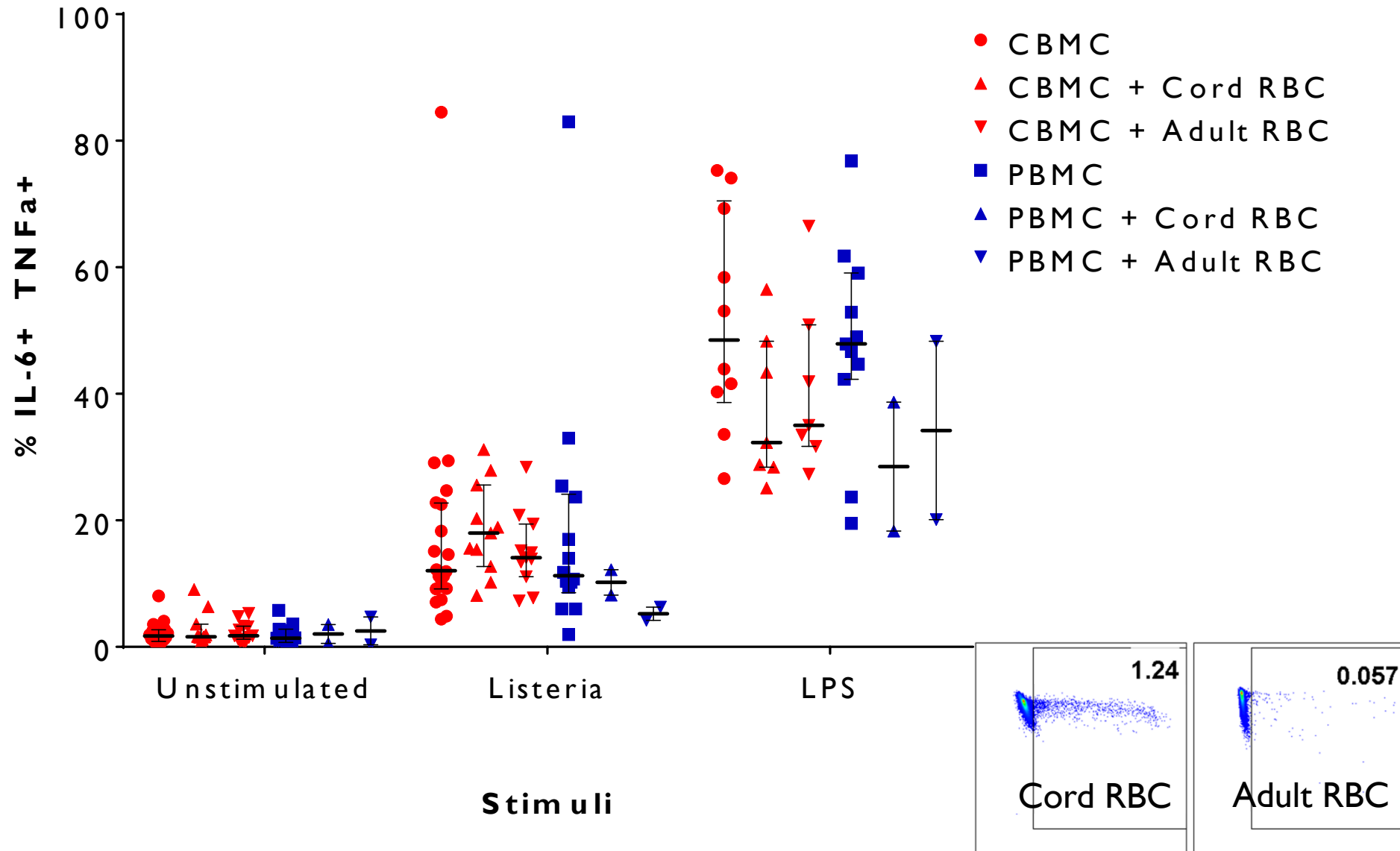
# Removing the glycophorin A<sup>+</sup> cells from the MNC fraction reduces the pro-inflammatory response to LPS by CBMC



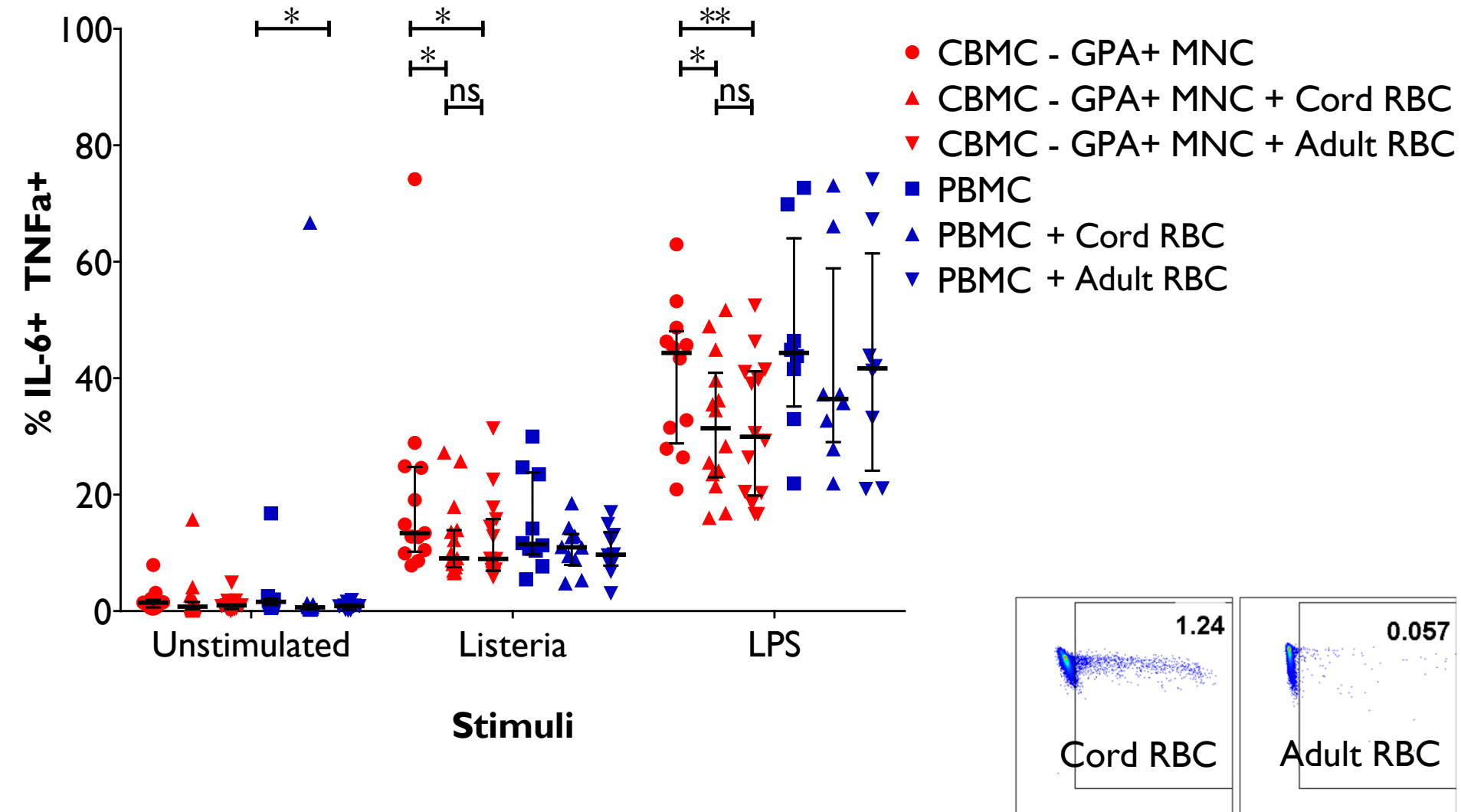
# Removing the glycophorin A<sup>+</sup> cells then adding them back reduces the pro-inflammatory response to LPS by CBMC



# Adding RBC did not inhibit pro-inflammatory cytokine production



# Adding RBC after removing GPA+ cells from the MNC fraction did inhibit pro-inflammatory cytokine production by CBMC

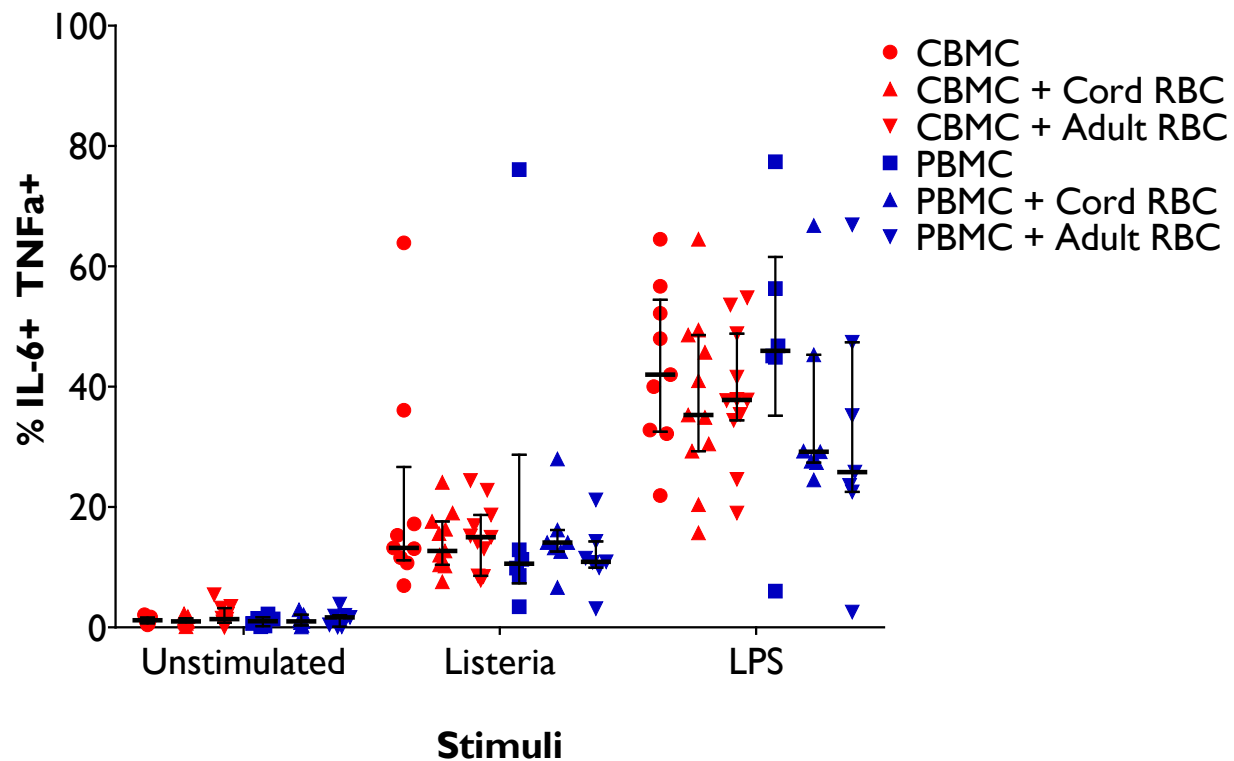


# Aims

- ✓ Identified CD71+ Glycophorin A+ cells in neonatal cord blood and pre-term samples
- ✓ CD71+ Glycophorin A+ cells in cord and pre-term samples have a higher concentration compared to adult blood donors
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- **Assess their potential anti-inflammatory activity.**

# Aim:- Assess their potential anti-inflammatory activity

- ✓ CD71+ Glycophorin A+ cells from either MNC or RBC fraction do not conclusively demonstrate anti-inflammatory properties

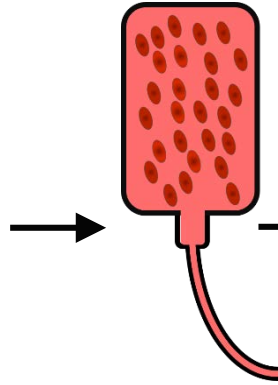


# Aims

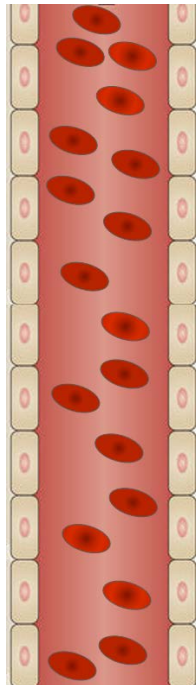
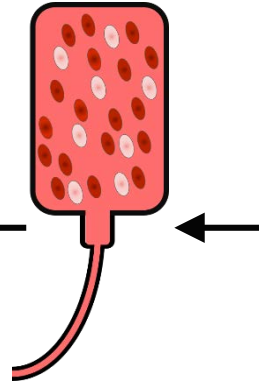
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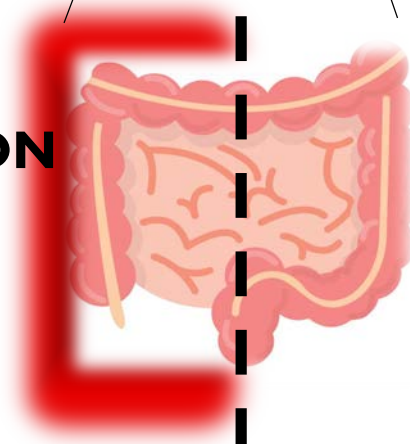
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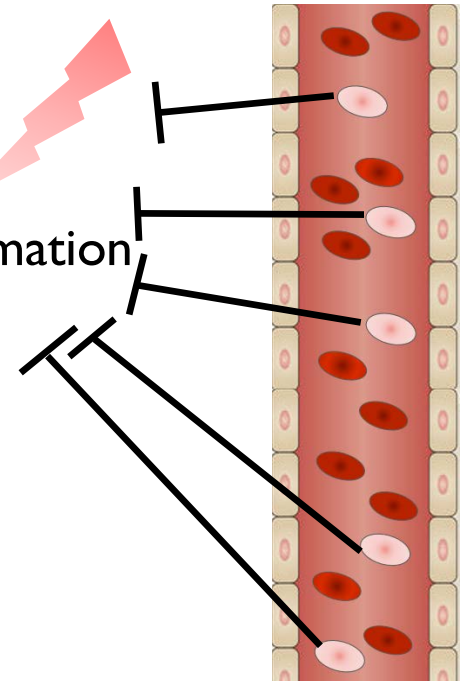
Cord Blood Transfusion



**INFLAMMATION**

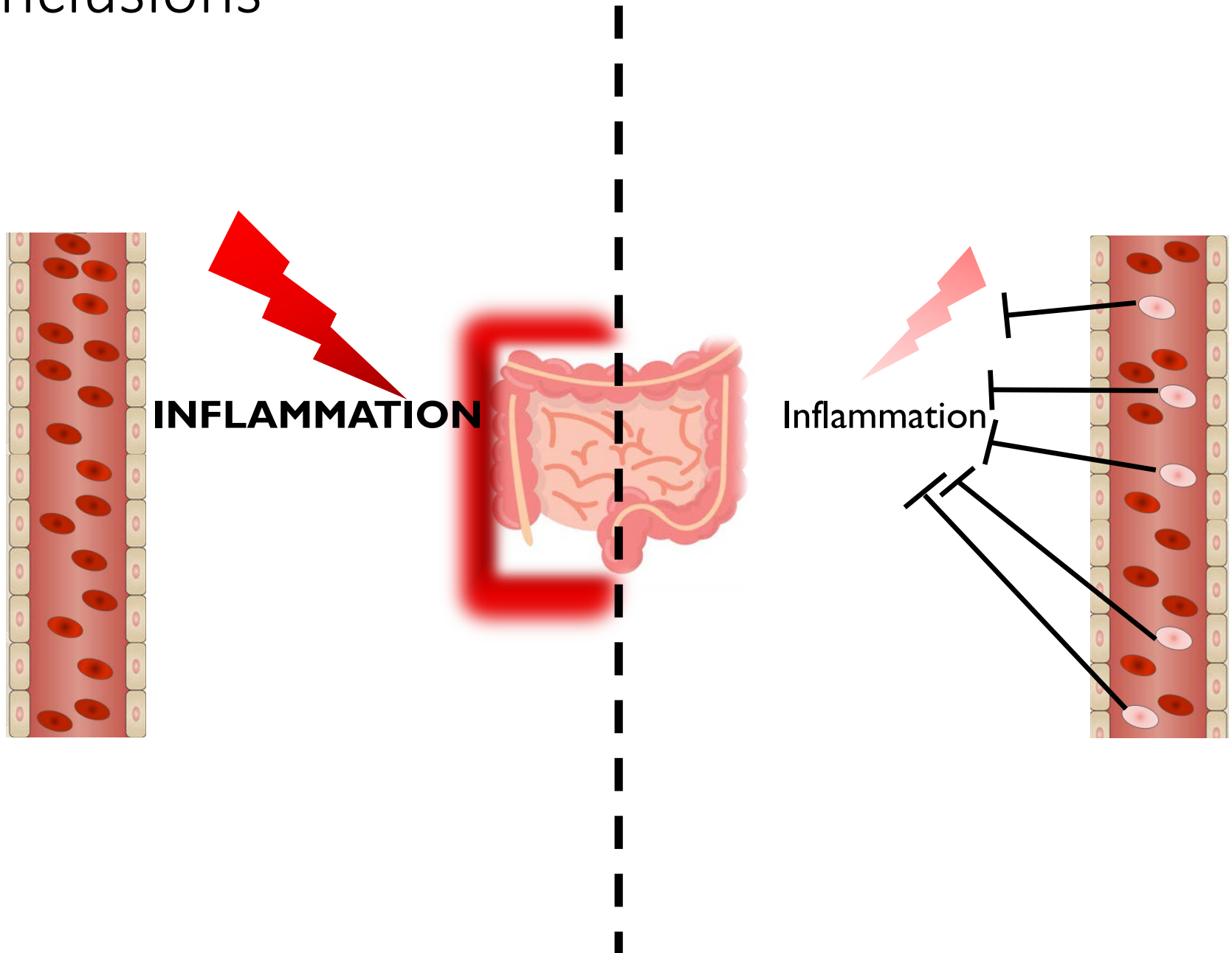


Inflammation

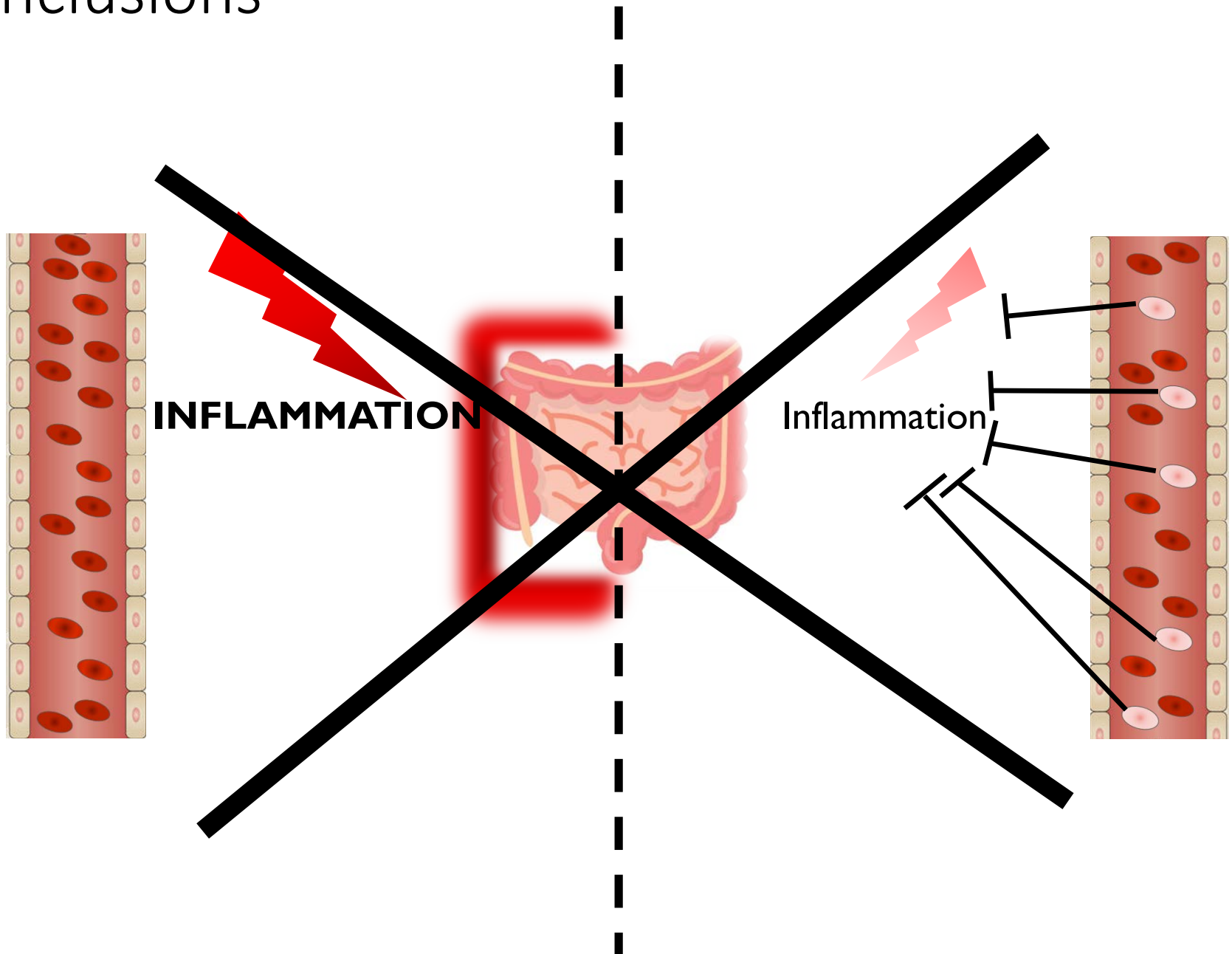




# Conclusions

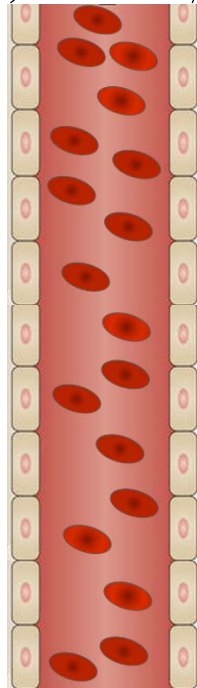
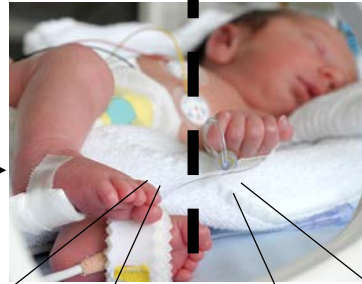
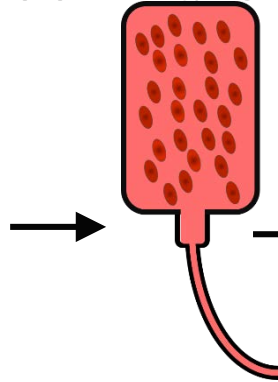


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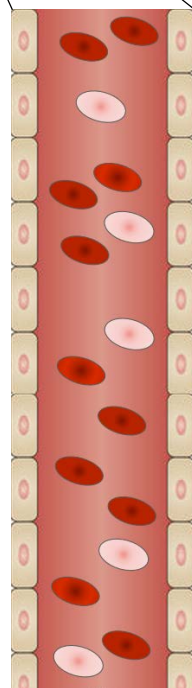
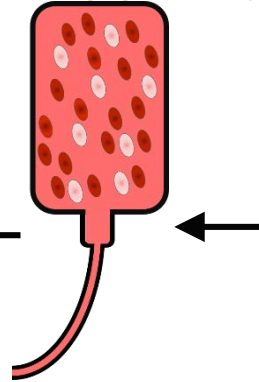


# Conclusions

Adult Blood Transfusion



Cord Blood Transfusion



# Acknowledgements



Dr Sylvia Armstrong-Fisher  
– Aberdeen SNBTS

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Professor Mark Vickers  
– University of Aberdeen and Aberdeen SNBTS