

# THE BEHAVIOR OF OUR IMMUNE SYSTEM CAN BE ALTERED UPON AN EXPOSURE TO GOLD NANOPARTICLES

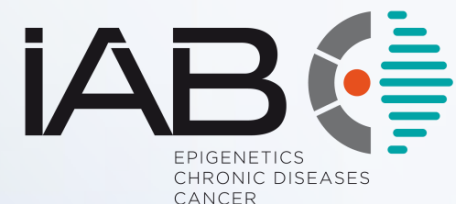
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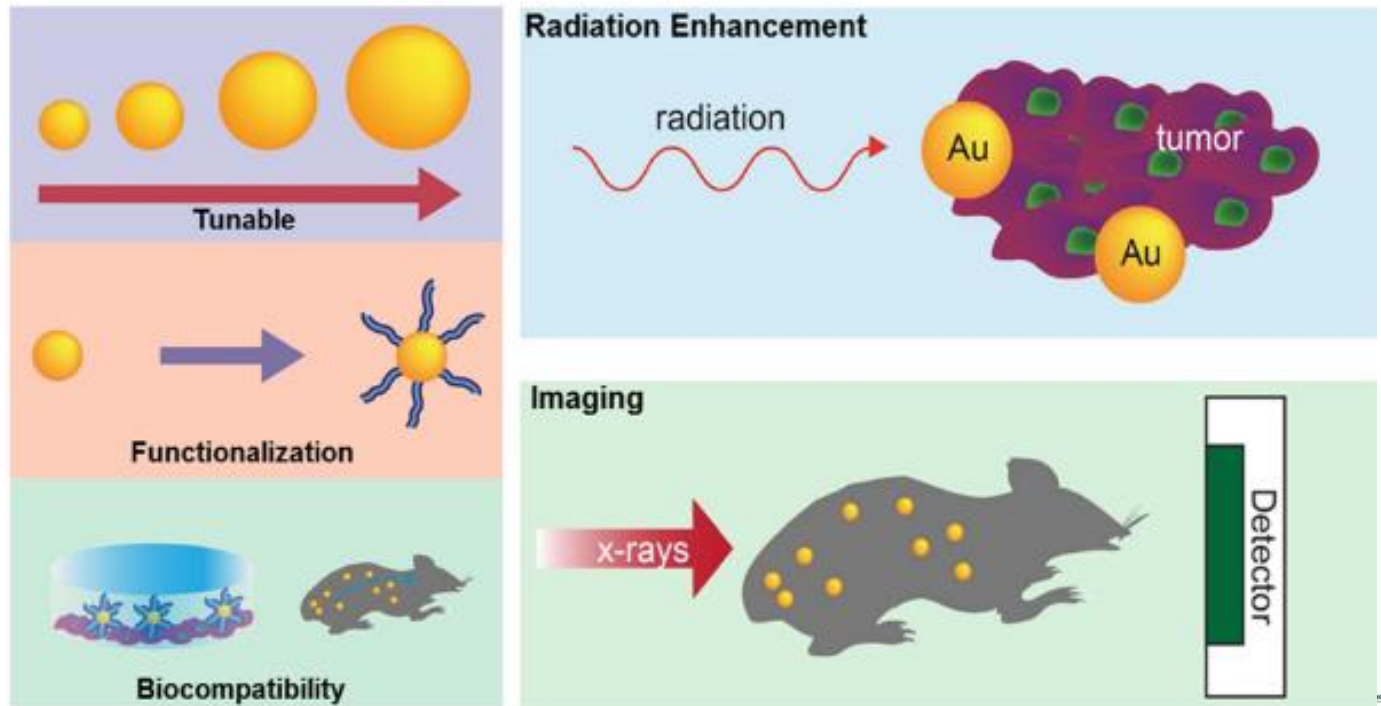
Supervisors : Patrice MARCHE & Michele COTTIER



# Gold Nanoparticles (AuNP)

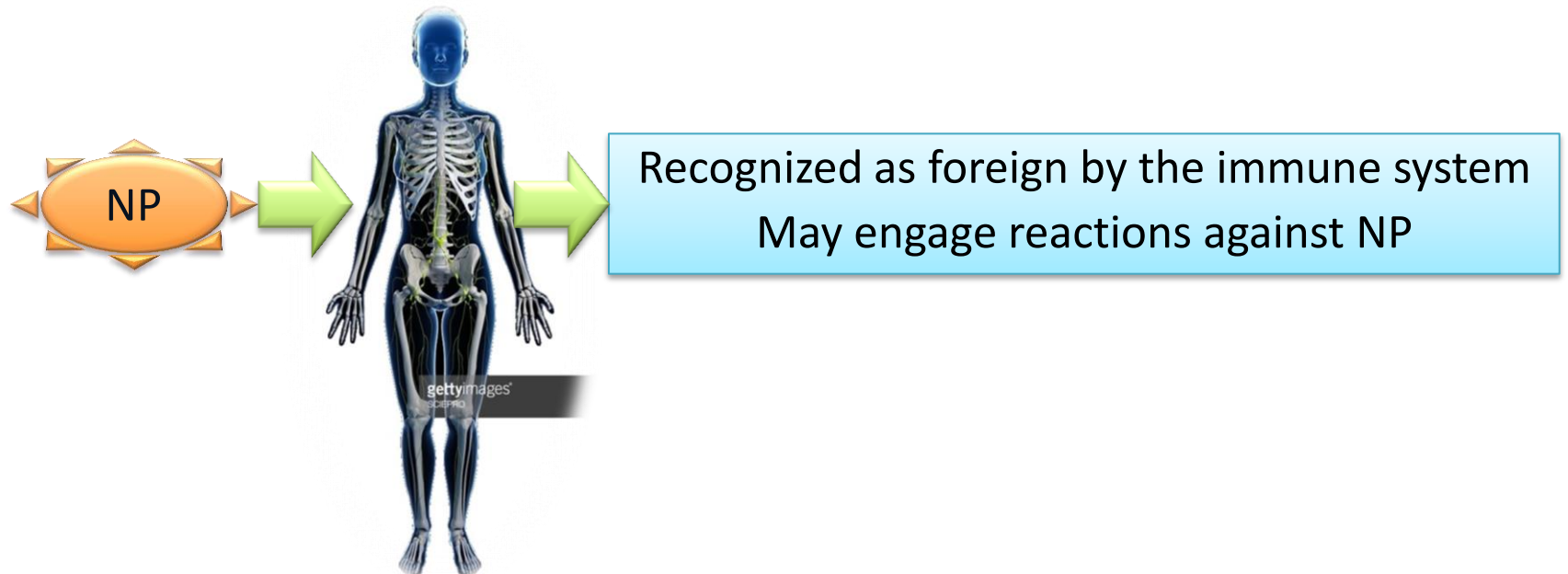
Key material introduced in nanomedicine as nanocarriers, theragnostic agents

- Ease of synthesis (*Aillon et al, 2009*)
- Facile surface modification (*Khlebtsov et al, 2011*)
- Ease of detection and imaging (*Fadeel et al, 2010*)
- Produce heat upon surface plasmon excitation used for cancer therapy (*Hwang et al, 2014*)



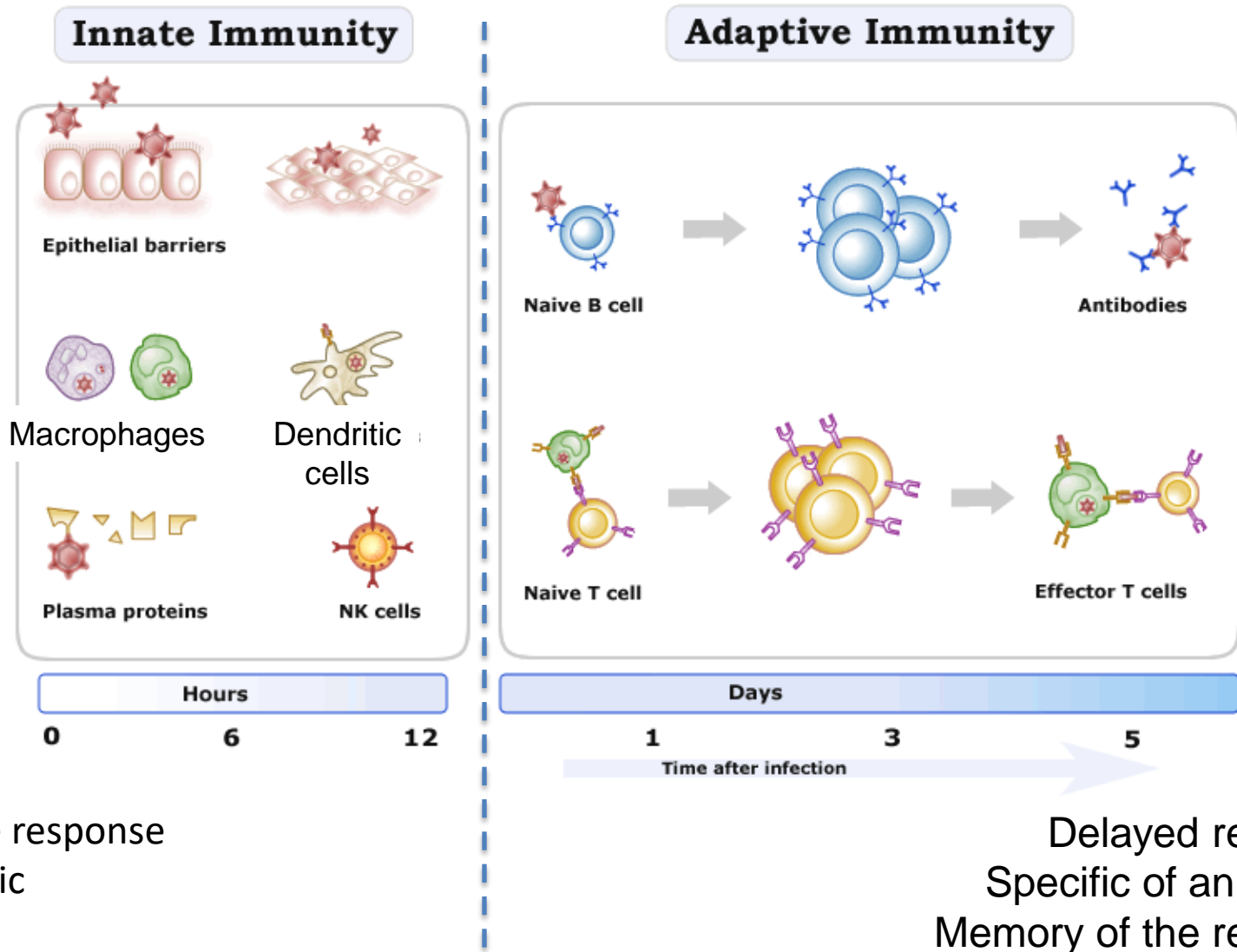
# Problematics

However  
toxicological effects of AuNP (after acute and chronic exposure)  
are not clearly understood



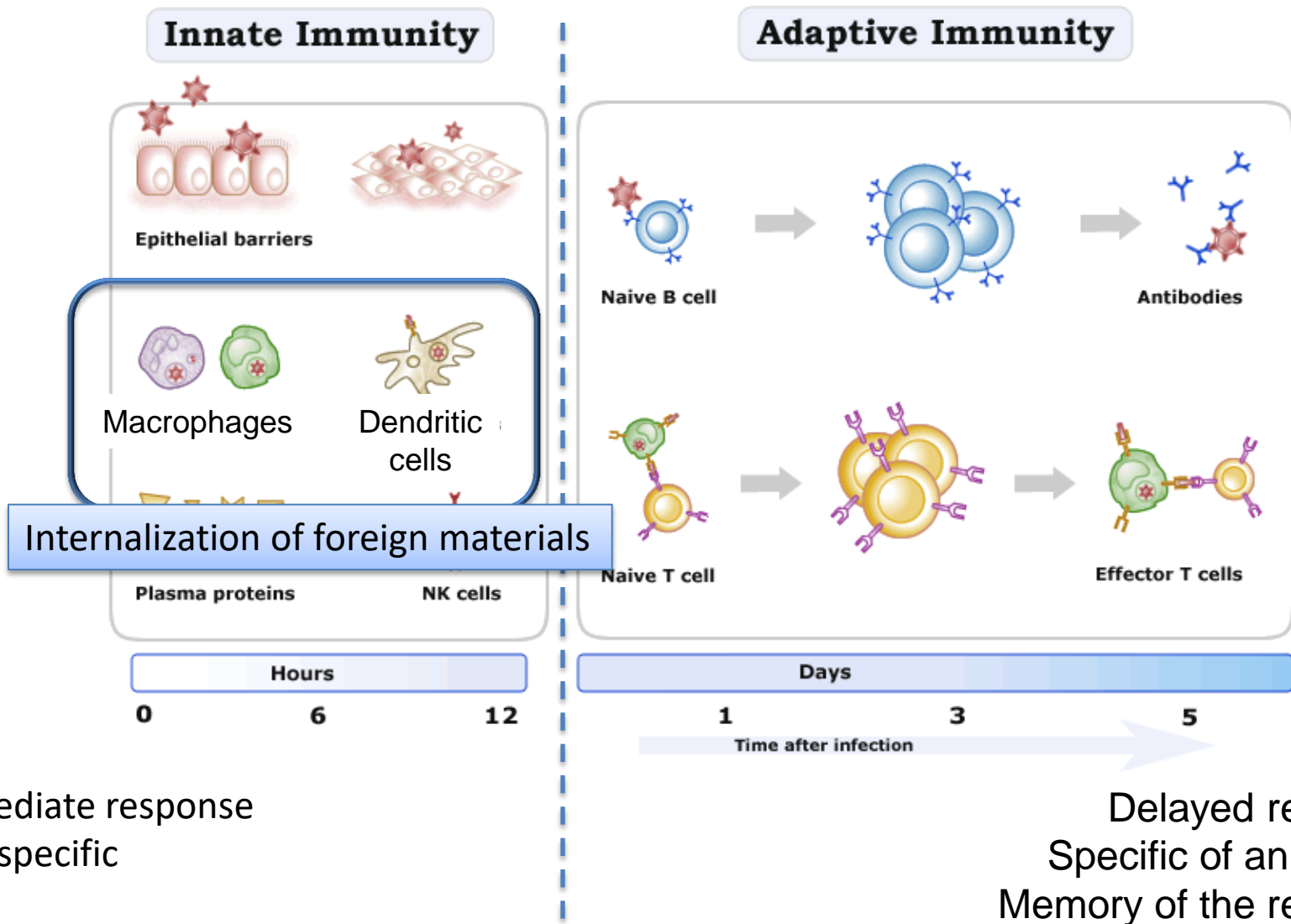
# Innate immune system

## the first defense against an intrusion

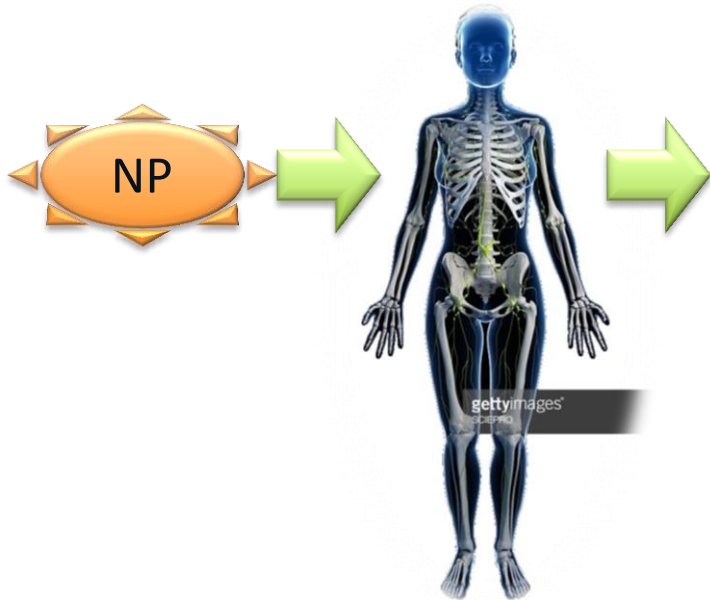


# Innate immune system

## the first defense against an intrusion

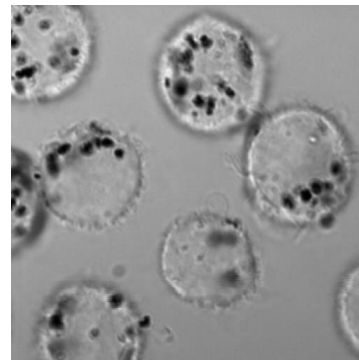


# Innate immune system the first defense against an intrusion

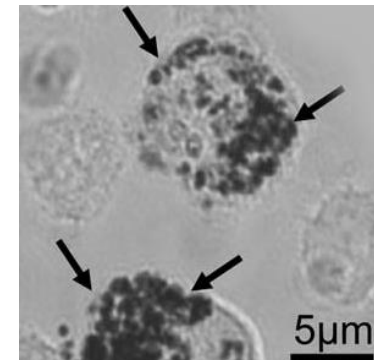


Gold NP in

Recognized as foreign and uptaken by immune system cells



Macrophages

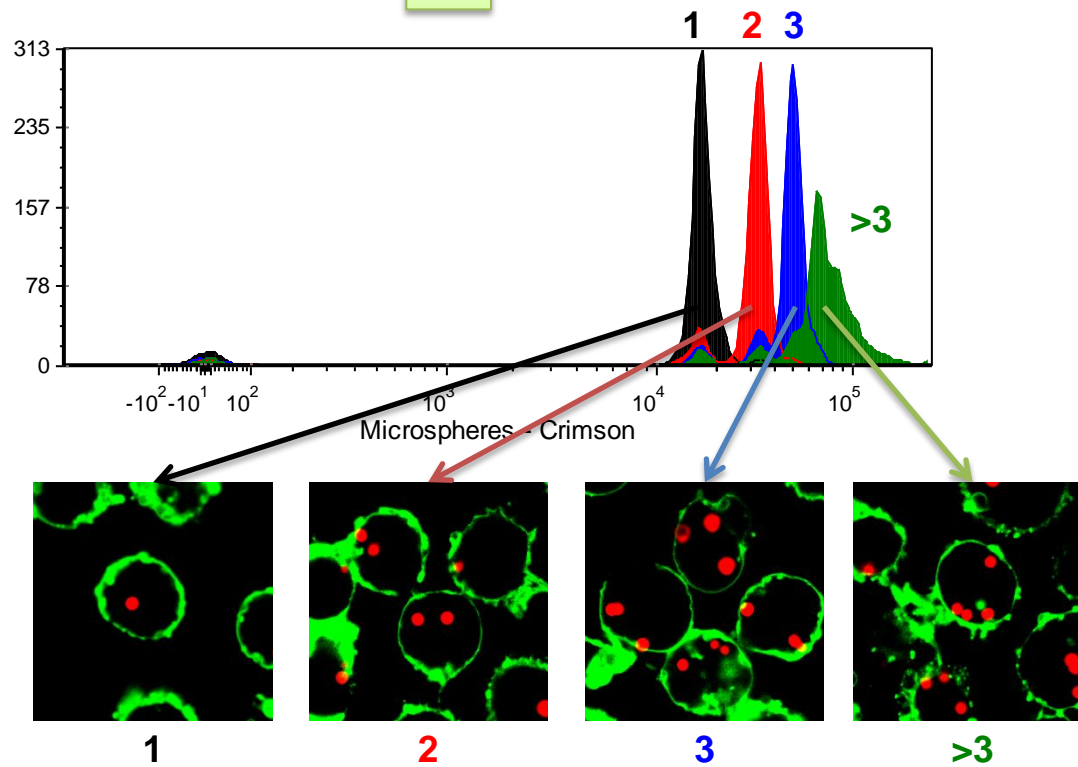
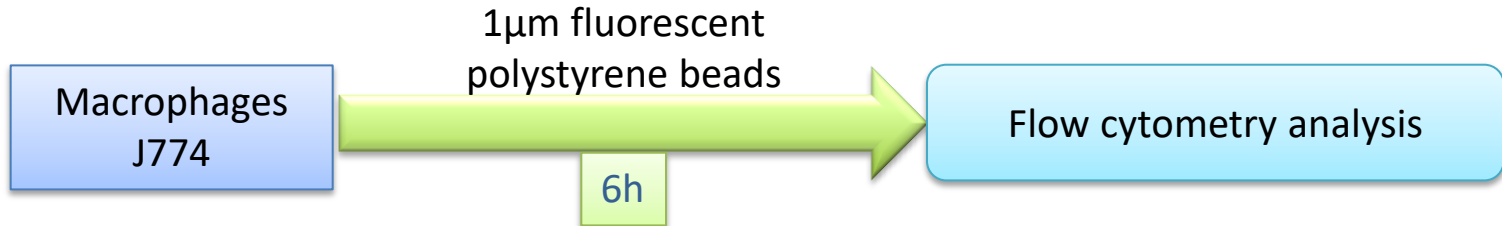
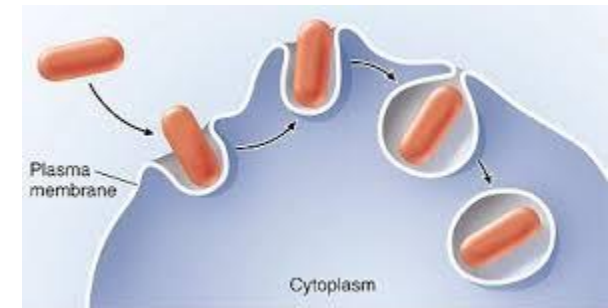


Dendritic Cells (DC)

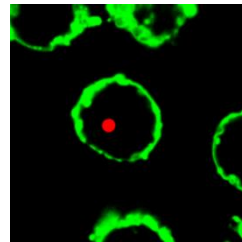
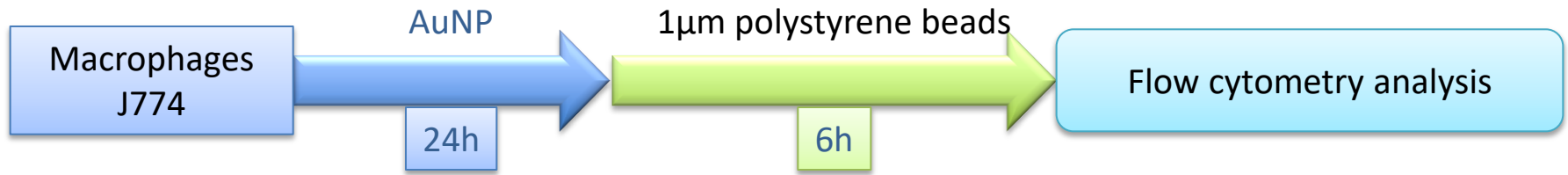
Study of the impact of an exposure to AuNP on cell functions

# phagocytosis of foreign materials

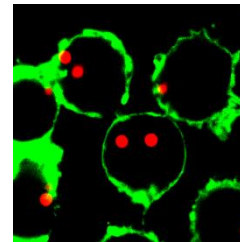
Phagocytosis = uptake of pathogens and foreign material larger than  $0,5\mu\text{m}$



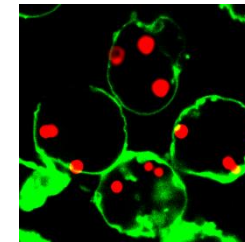
# AuNP do not impair phagocytosis of foreign materials



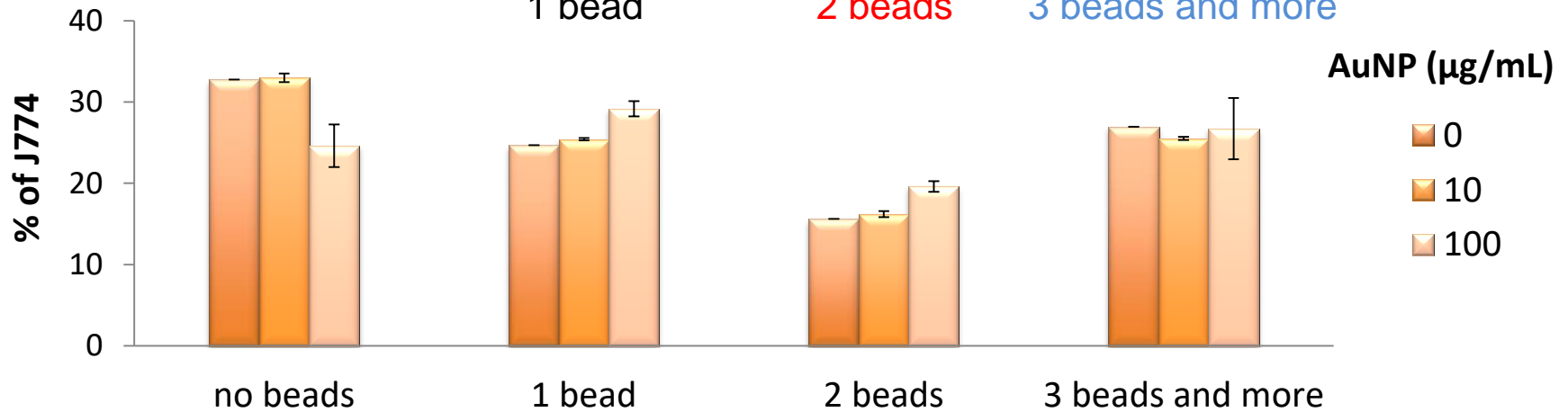
1 bead



2 beads

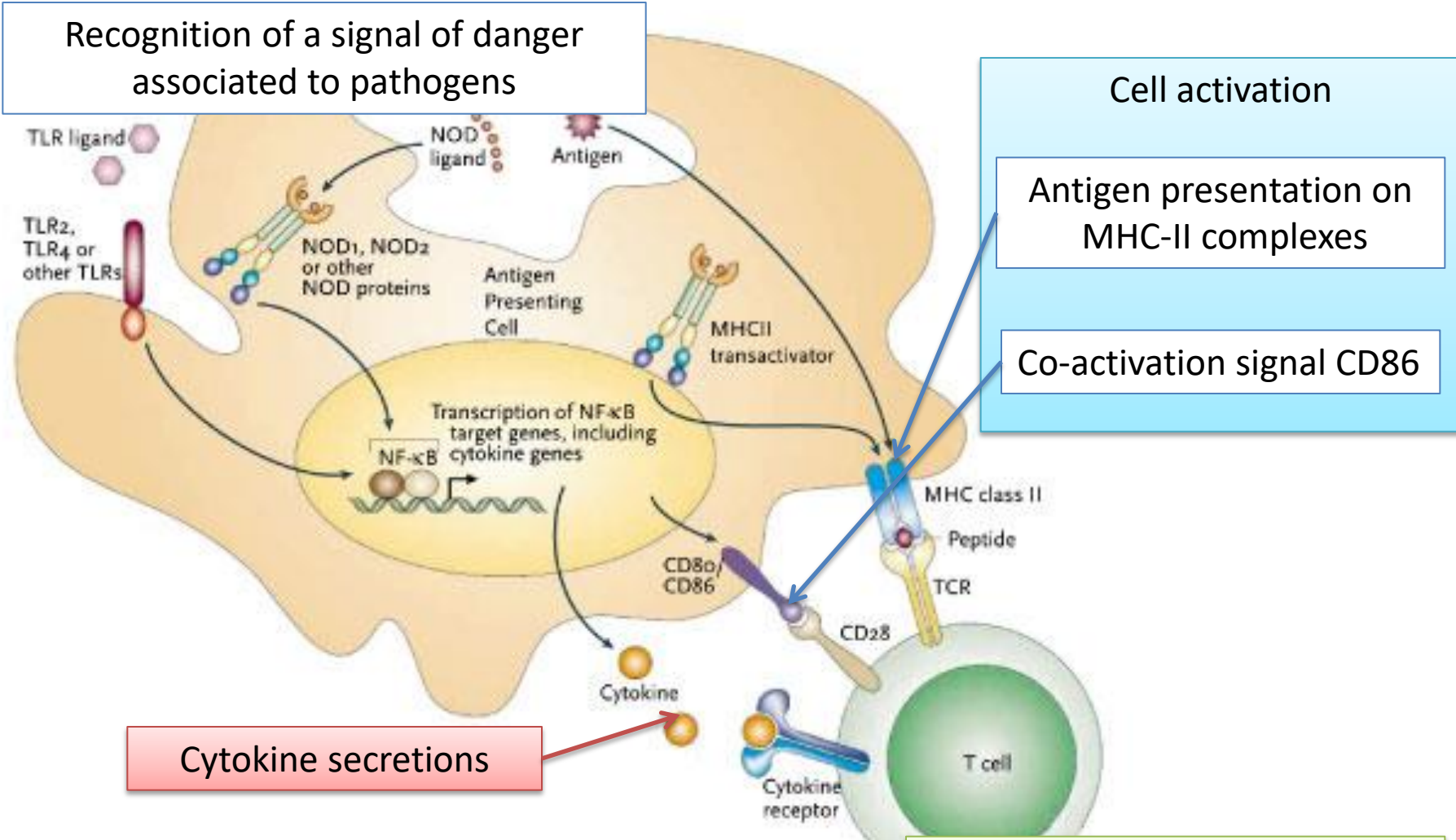


3 beads and more





# The initiation of adaptive immune response



Recognition of a signal of danger associated to pathogens

Cell activation

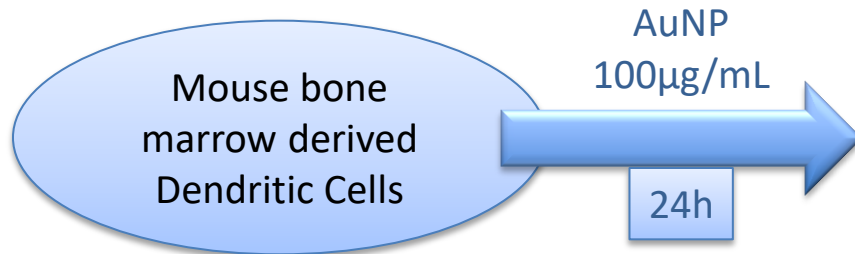
Antigen presentation on MHC-II complexes

Co-activation signal CD86

Cytokine secretions

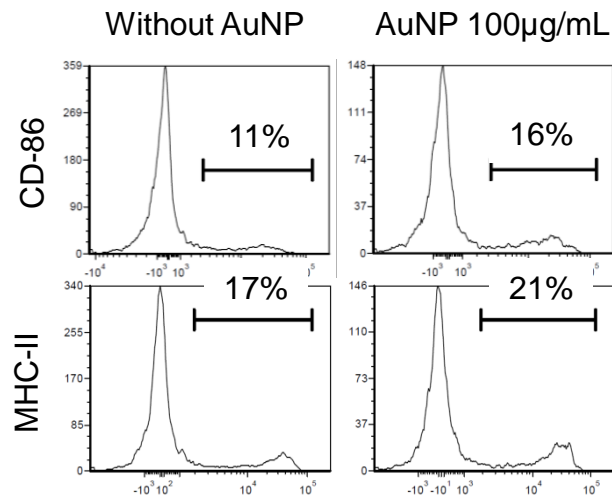
Two signals => initiation of adaptive immune response

# AuNP do not impact cell activation



Analysis of the expression of surface activation markers CD-86 and MHC-II

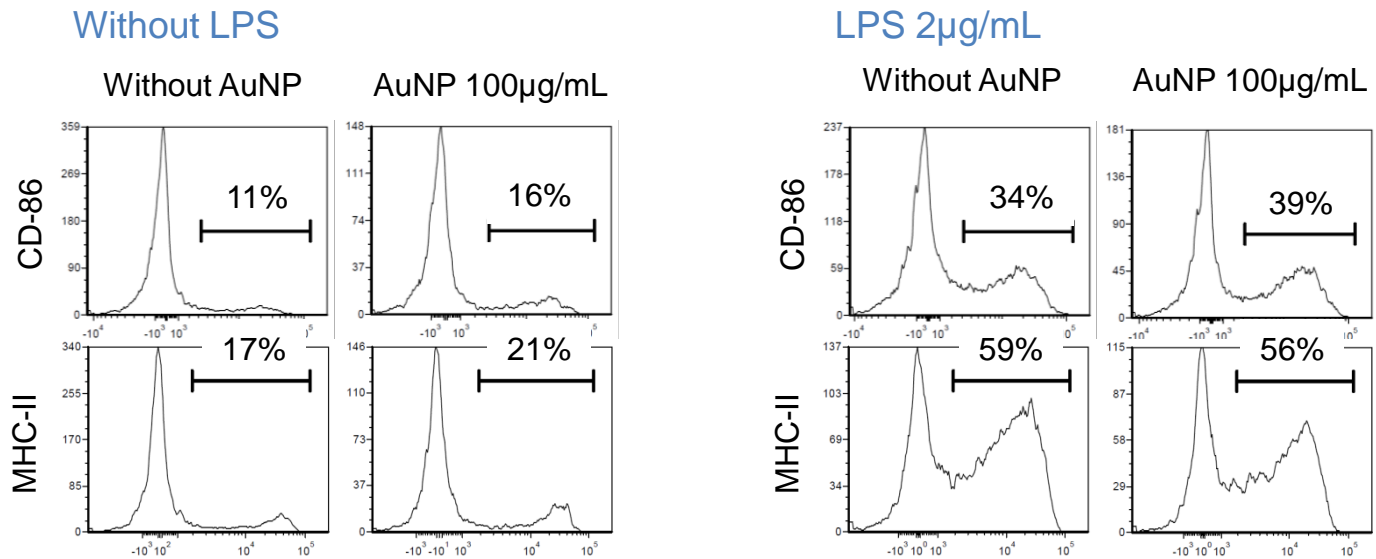
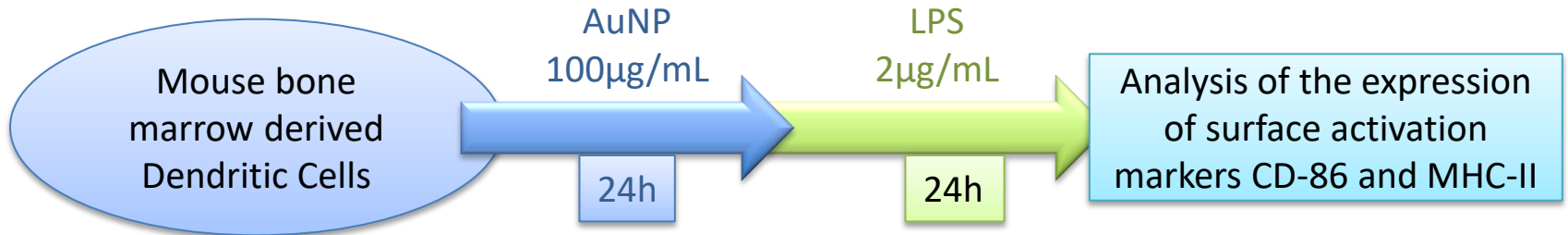
Without LPS



AuNP do not activate DC

Cell count ↑  
Log fluorescence intensity →

# AuNP do not impact cell activation

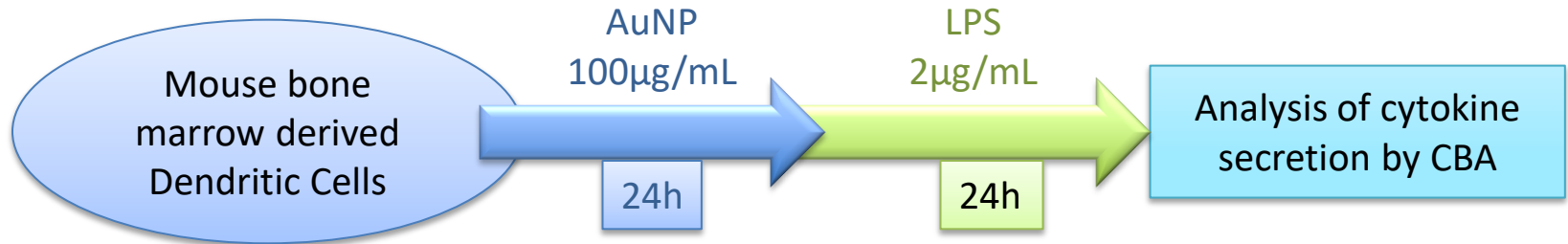


AuNP do not activate DC

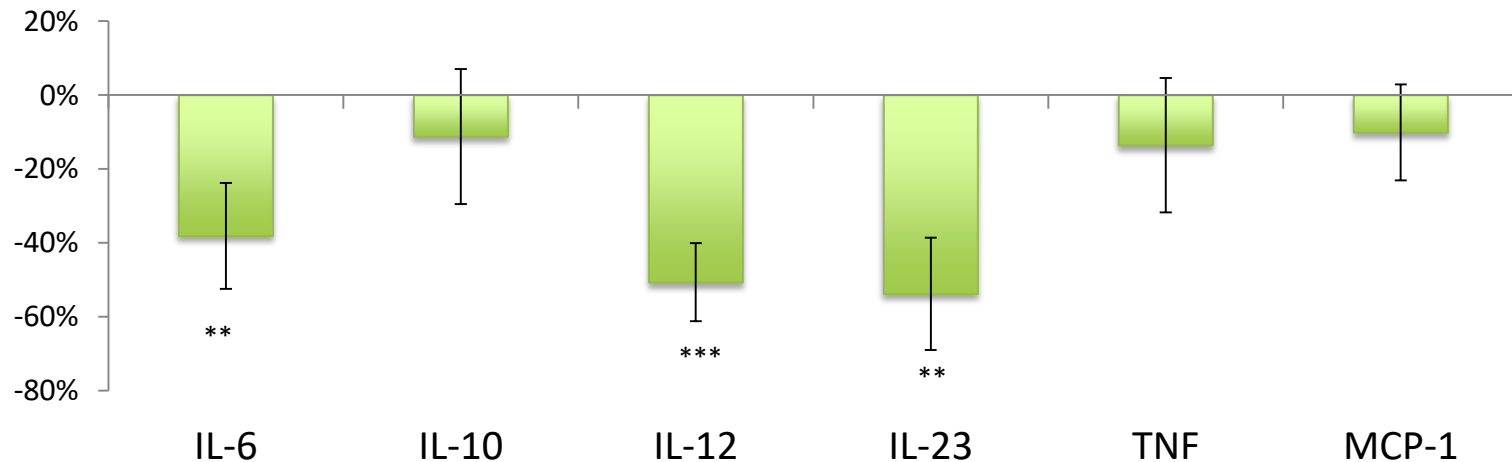
AuNP do not impair further activation by bacterial LPS

Cell count ↑  
Log fluorescence intensity →

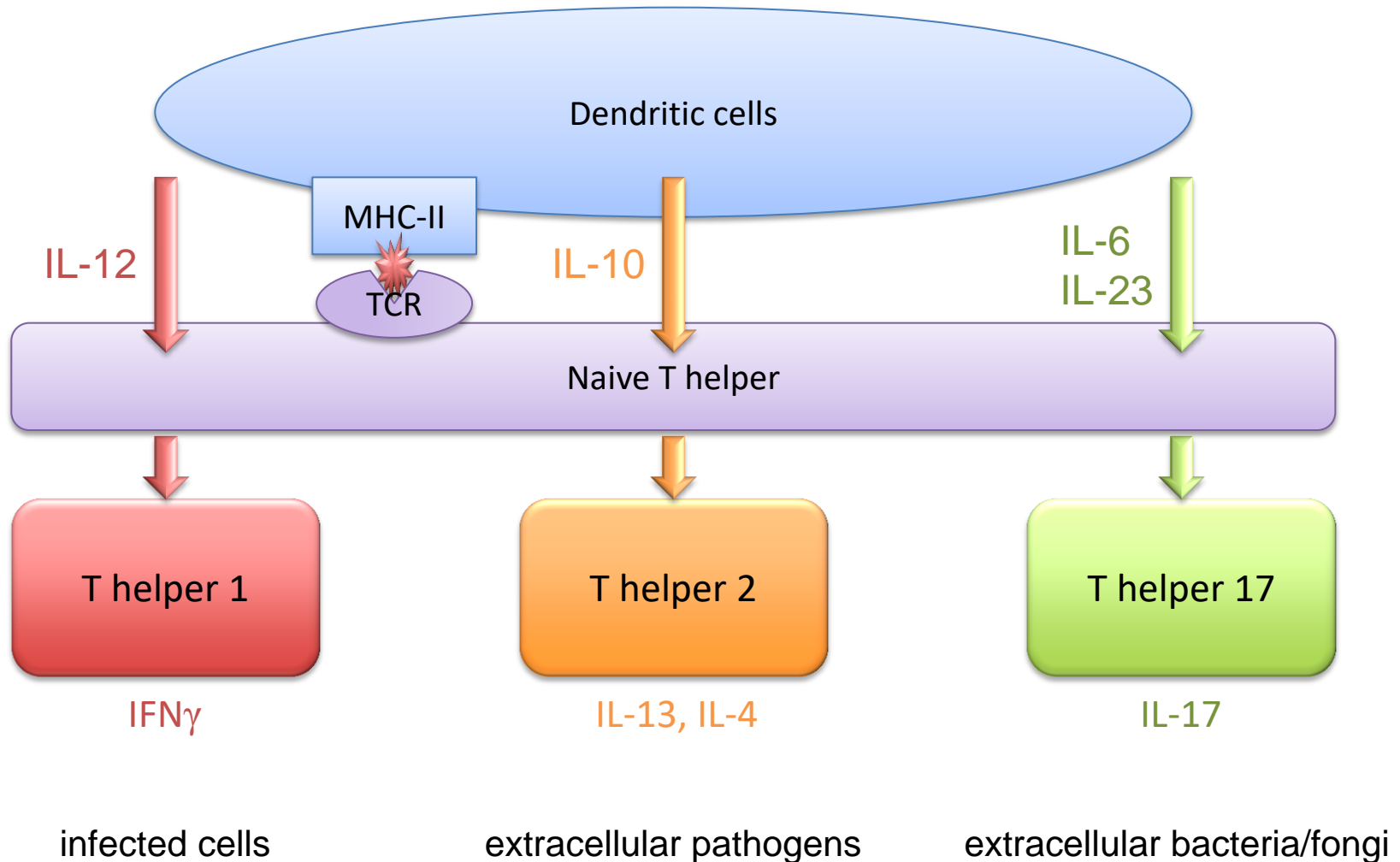
# AuNP impair cytokine response



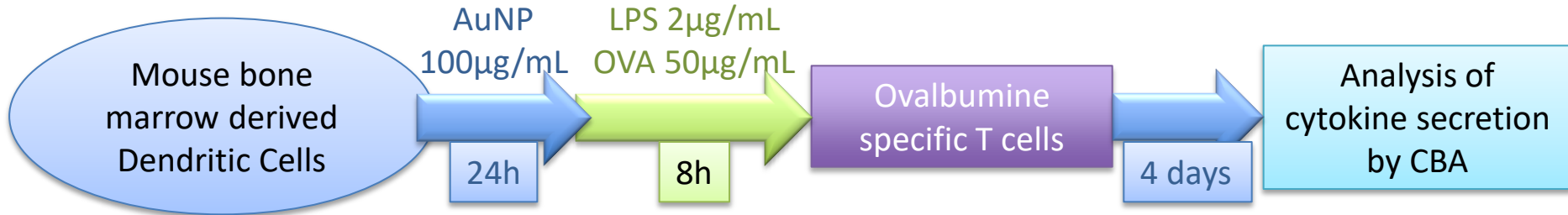
Compared to control without NP exposure



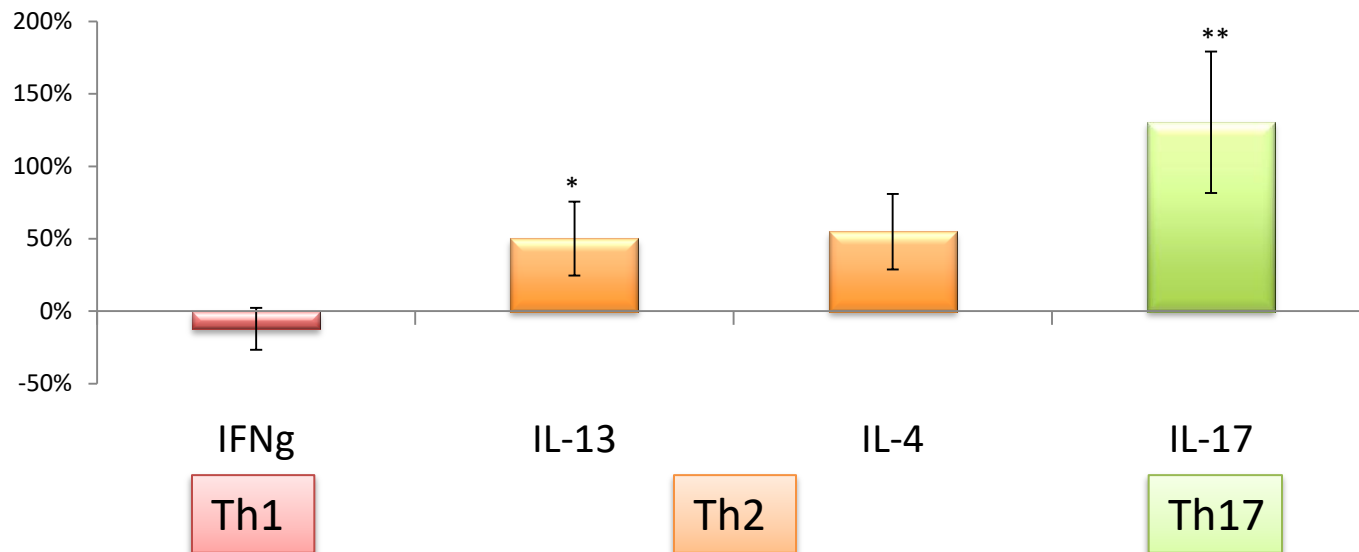
# Impact of this cytokine profile on T cell response



# Impact of this cytokine profile on T cell response



Compared to control without NP exposure



# Conclusion

- deregulation of Th17 response by AuNP could lead to autoimmune diseases (*Bailey et al, 2014*)
- Better understanding of the effects of NP on immune cells
- Side effects have to be taken into account to develop new NP
- This project gives systematic tools to characterize NP immunotoxicology



# Thanks for your attention

## Institute for Advanced Biosciences - Grenoble

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**L. Baert**



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