FACULTY OF
VETERINARY MEDICINE
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DEPARTMENT VIROLOGY, PARASITOLOGY AND IMMUNOLOGY
RESEARCH GROUP IMMUNOLOGY

THE EFFECTS OF β-1,3-1,6-GLUCANS ON INNATE IMMUNE RESPONSES IN PIGS.

Hermans L., Devriendt B., Favoreel H., Cox E.

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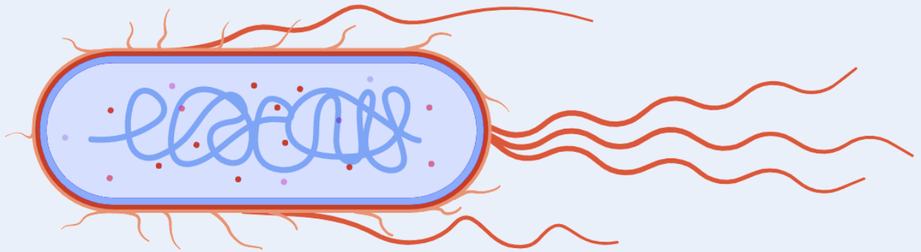
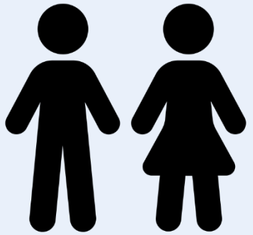


STEC infection

Haemolytic uremic syndrome



Renal failure

Haemolytic anaemia

Thrombocytopenia

Public health

Oedema

Ataxia

Death

Economic losses

Modulate
innate immune response
in pigs

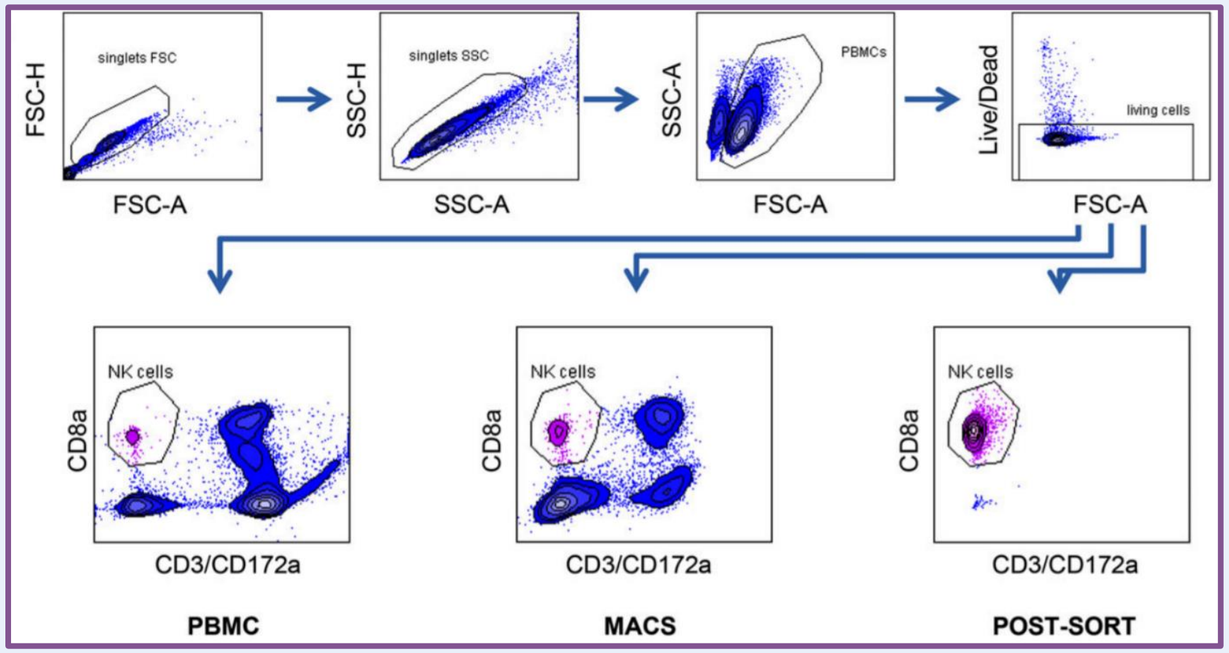
β-glucans

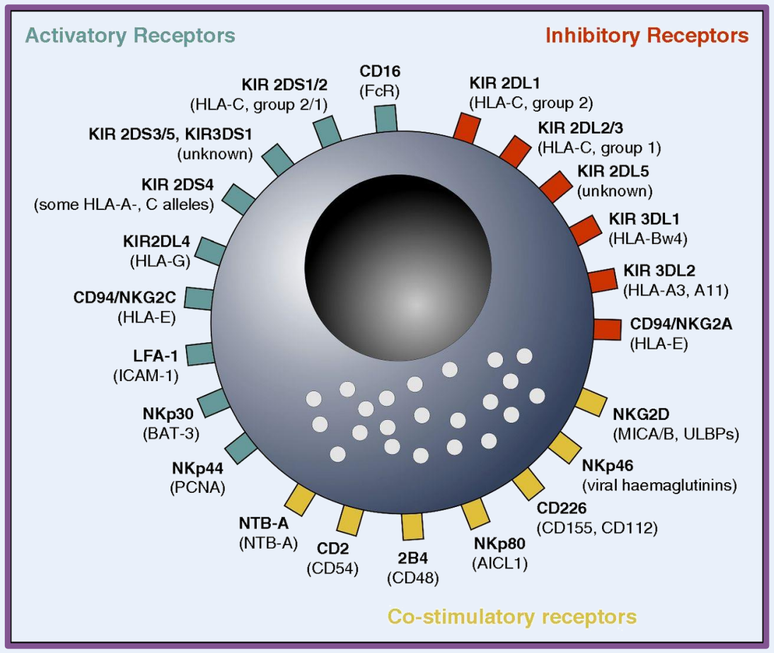
C.L. Gyles (Ed.), *Escherichia coli* in Domestic Animals and Humans, CAB International, Wallingford, Oxon, UK (1994), p. 337
Wöchtl B et al. Comparison of clinical and immunological findings in gnotobiotic piglets infected with Escherichia coli O104 : H4 outbreak strain and EHEC O157 : H7. Gut Pathog. BioMed Central; 2017;1–18.
Tseng M et al. Shiga toxin-producing Escherichia coli in swine: the public health perspective. Anim Health Res Rev. 2014;15(1):63–75.

β-glucans stimulate PBMC

➔ cytokine production

➔ **NK cell activation**





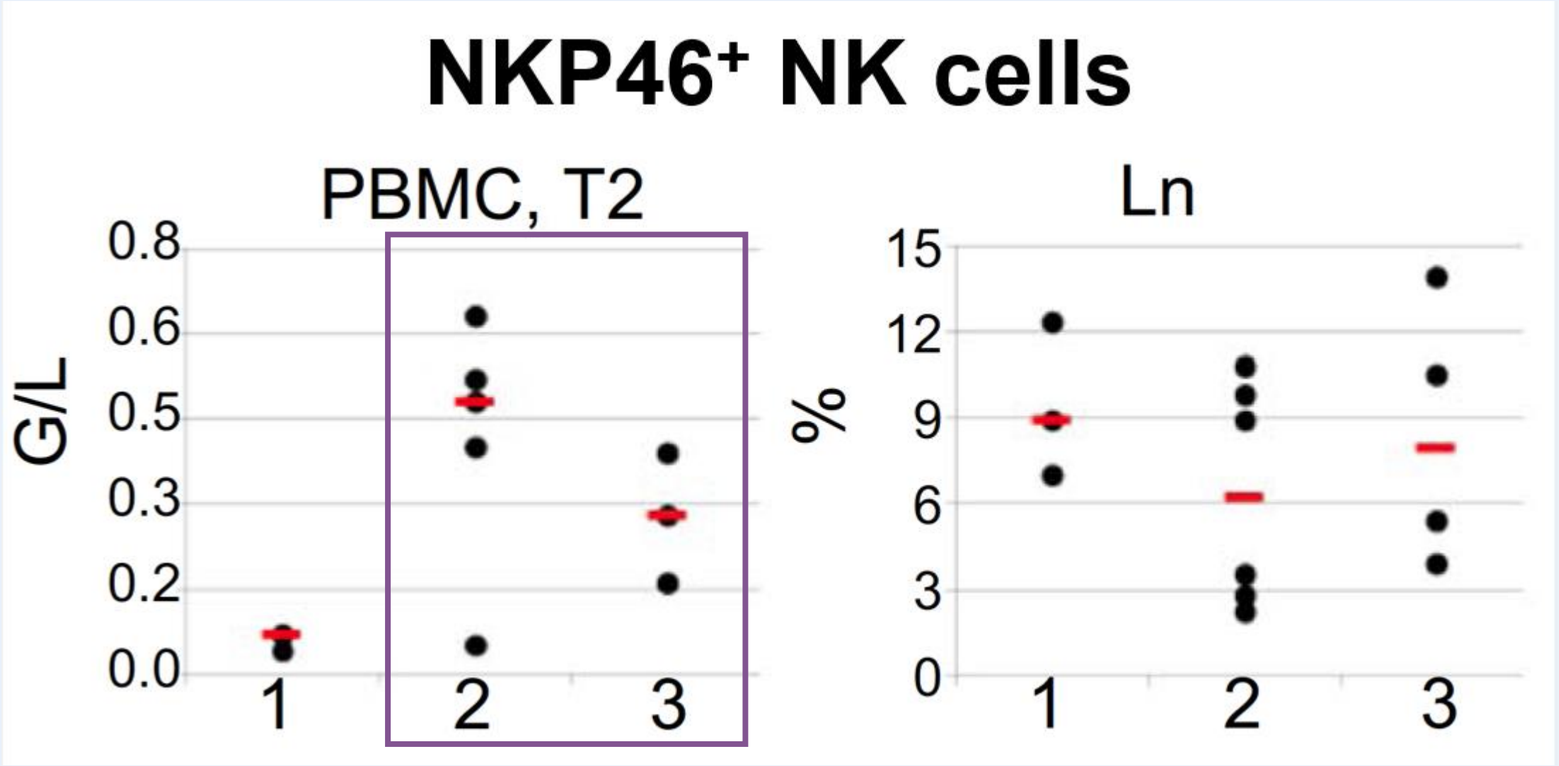
NK cells

$CD3^-$ $CD172a^-$ $CD8a^+$	Cytotoxicity	Shape immune responses	APC features Memory-like PT

Rupert Handgretinger et al. Blood 2016;127:3341-3349
De Pelsmaeker et al. , J. Leukoc. Biol., 2018; 103(1); 129-140
Gerner et al., J Allergy Clin Immunol. 2013 September ; 132(3): 536–544

STEC INFECTION IN GNOTOBIOTIC PIGLETS

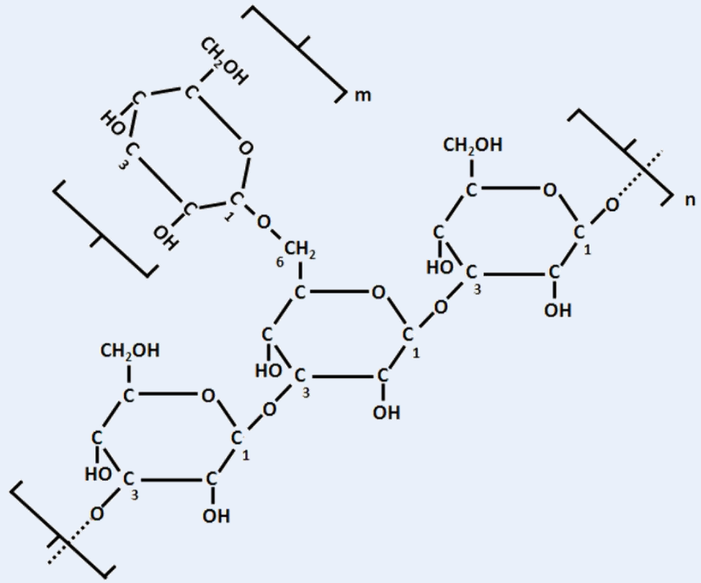
1. Control group
2. E. Coli O104:H4 infection
3. E. Coli O157:H7 infection



Increase of NKp46+ NK cells in PBMC:
IFN-γ production

Potential role for NK cells during STEC infection

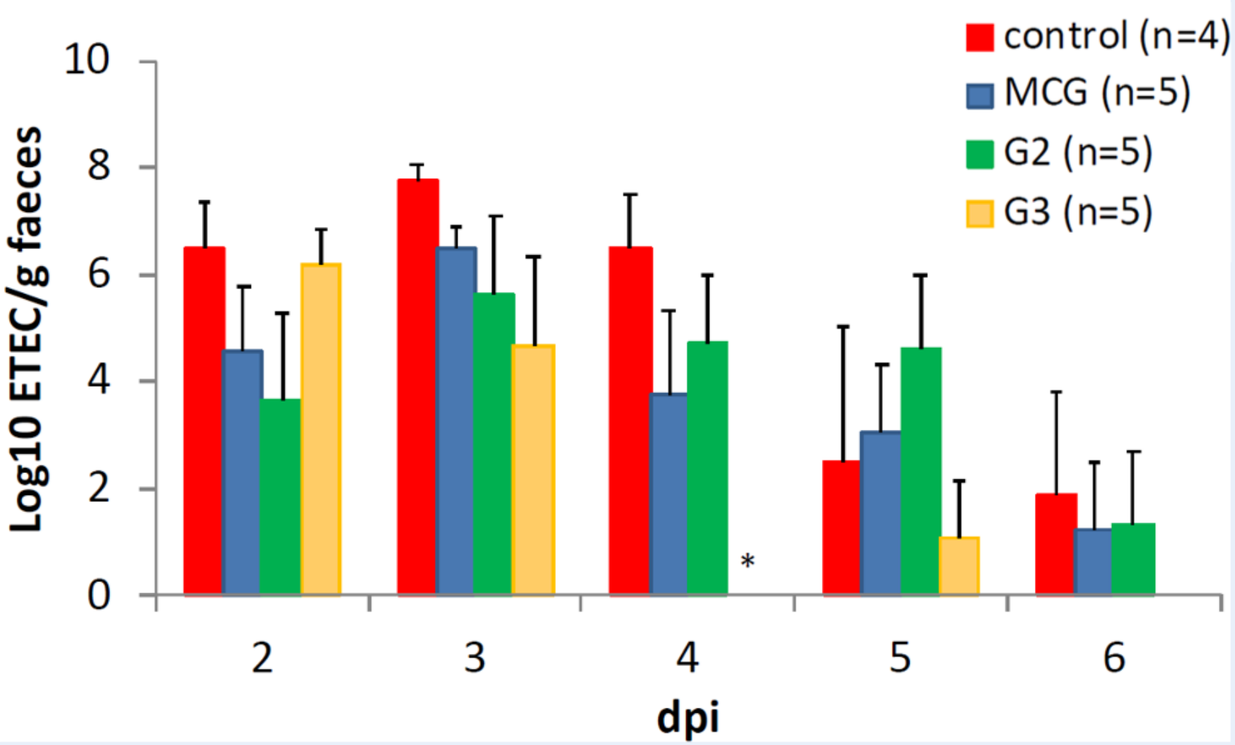
Wöchtl B et al. Comparison of clinical and immunological findings in gnotobiotic piglets infected with Escherichia coli O104 : H4 outbreak strain and EHEC O157 : H7. Gut Pathog. BioMed Central; 2017;1–18

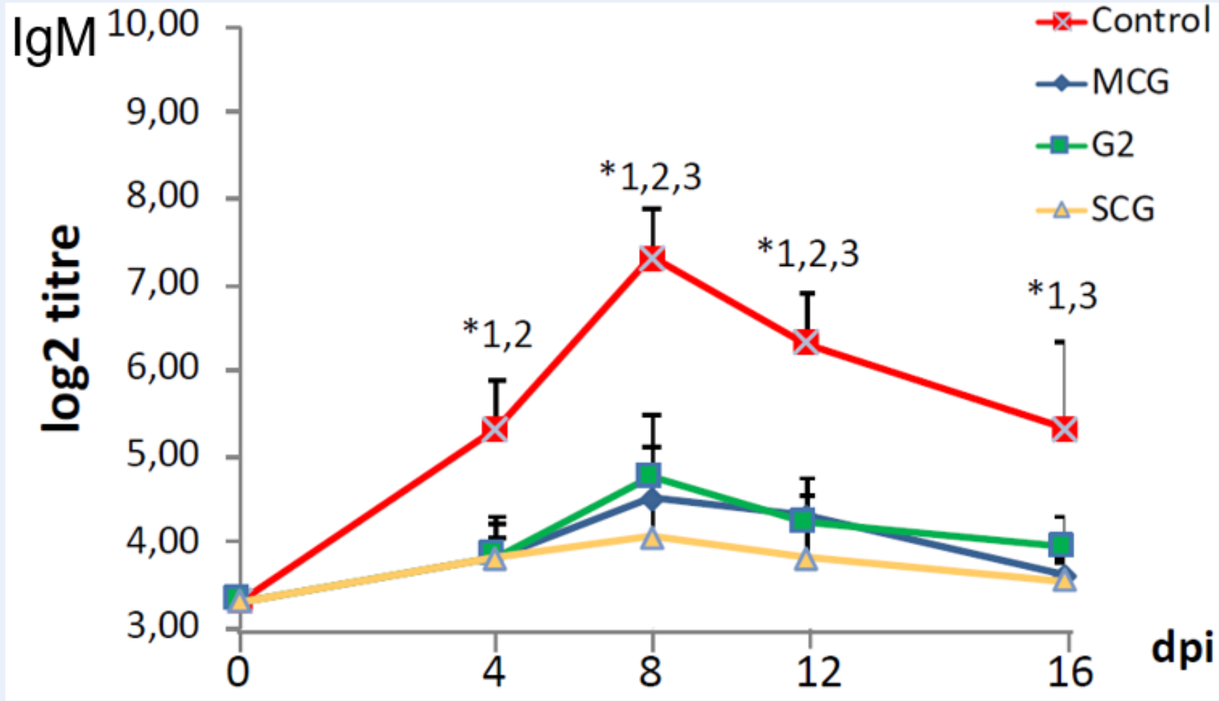


Beta-glucans?!

Carbohydrate polymers	MAMP	PRR ▪ Dectin-1 ▪ CR3	Proven to modulate immunity

FEED TRIAL WITH ETEC CHALLENGE





Decrease in faecal ETEC excretion

Lower antigen-specific IgM response

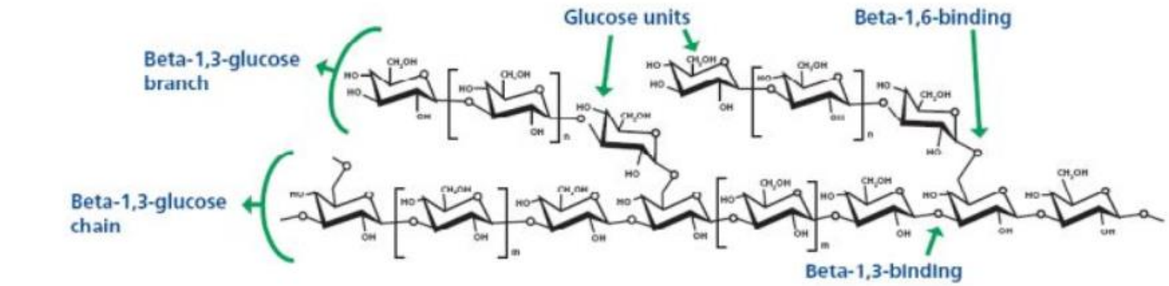
In-feed administered β-glucans can protect against ETEC infection

Stuyven et al., Vet Immunol Immunopathol, 2009; 128(1-3):60-6

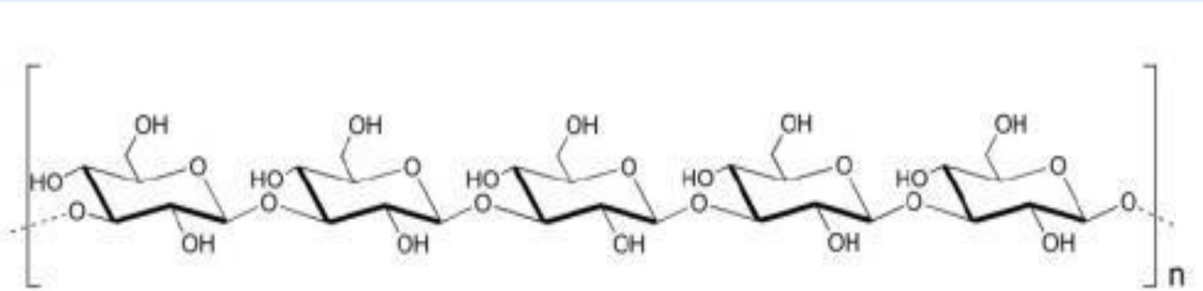
STRUCTURE?!

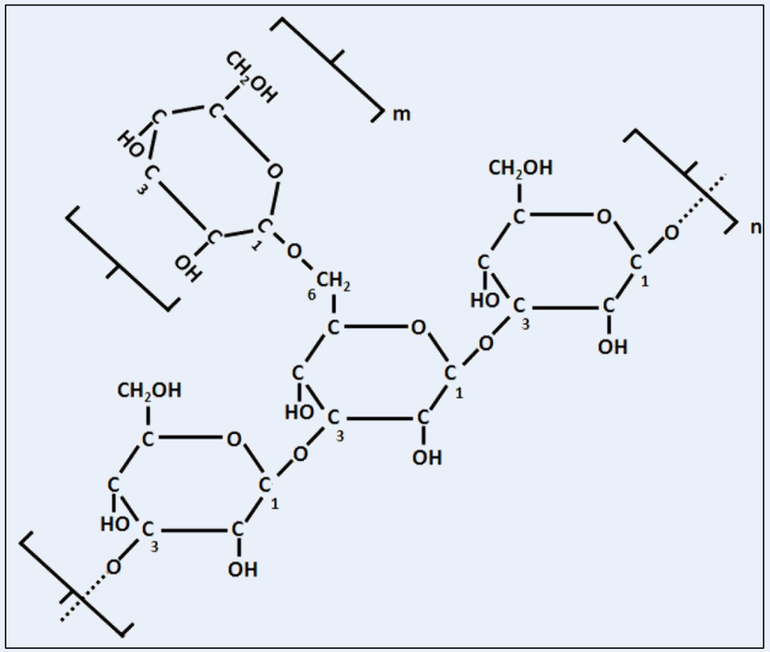
- Solubility
- Size
- Branching frequency
- Length of the branches
- Molecular conformation

Macrogard *(Saccharomyces cerevisiae)*

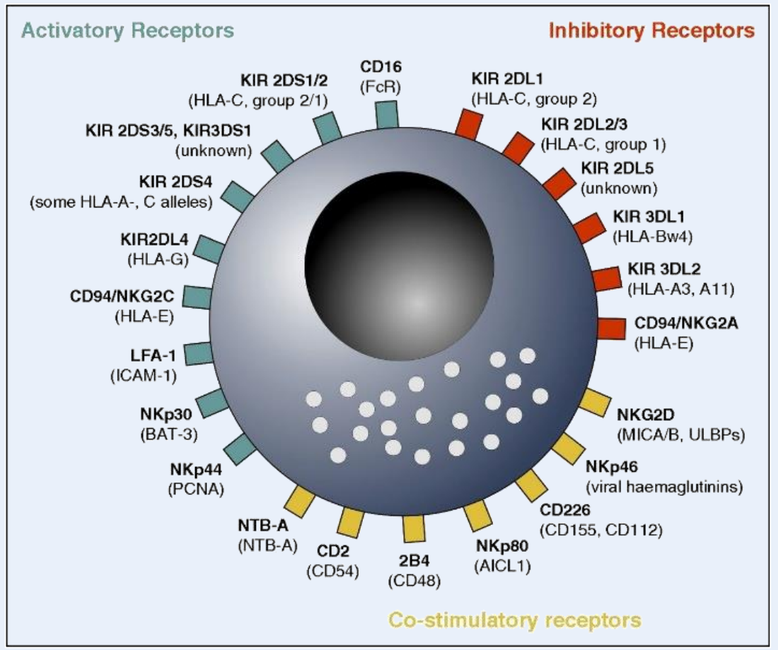


Curdlan *(Alcaligenes faecalis)*





Beta-glucans



NK cells

Activation

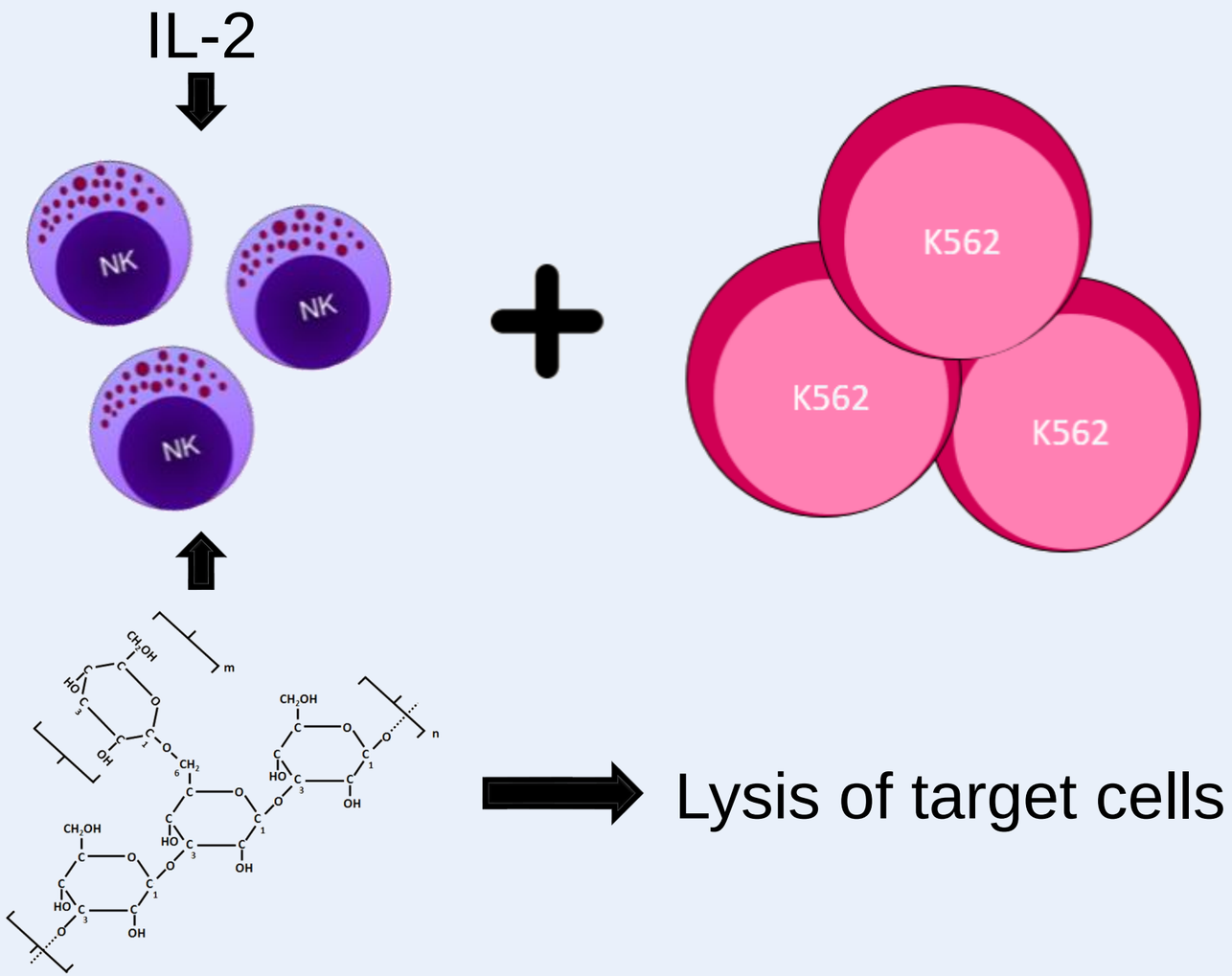
Effects on innate immune responses

EFFECTS OF β–GLUCANS ON PORCINE NK CELLS

Direct effects of β-glucans on pNK cells

- NK isolation
- IL-2 Priming (16-18h)

- Beta-glucan (50 µg/ml) (2h)
- CFSE-labelled K562 (4h)



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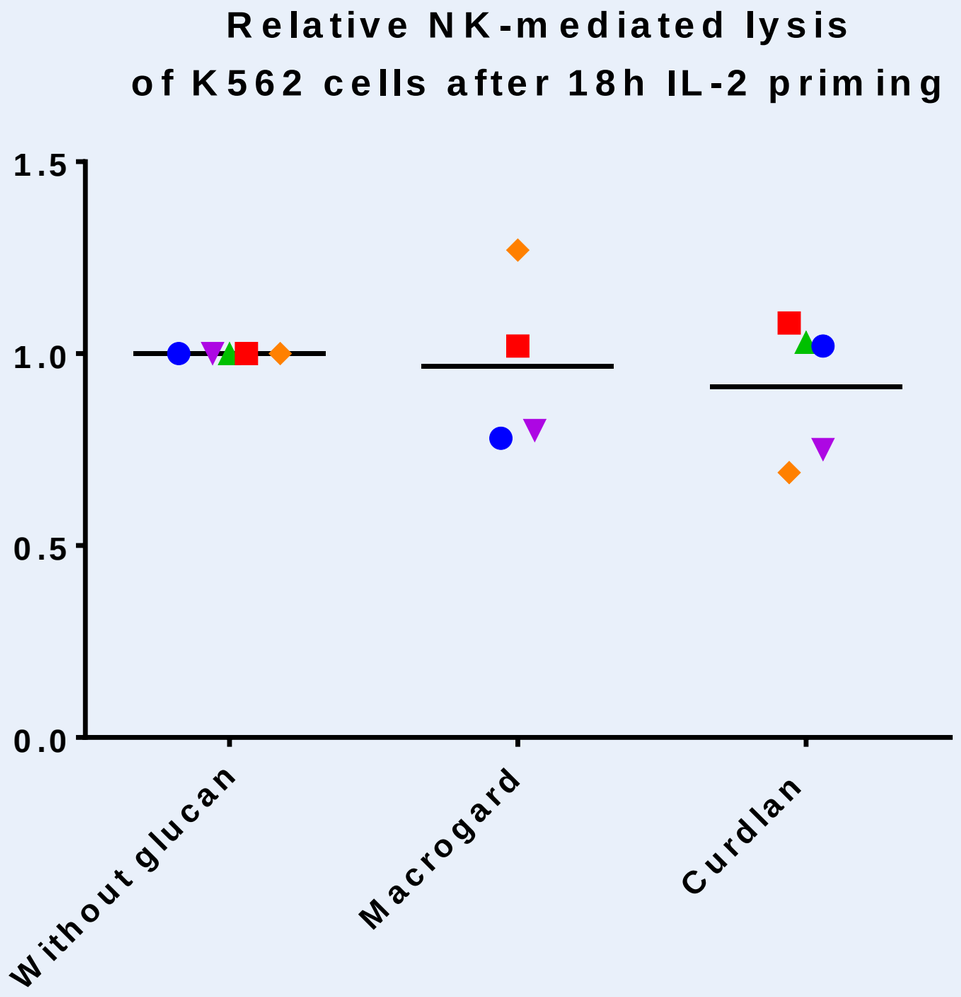


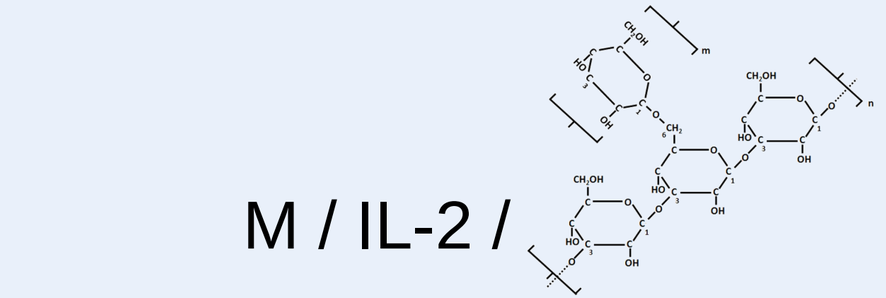
No direct effect of β-glucans on pNK cells

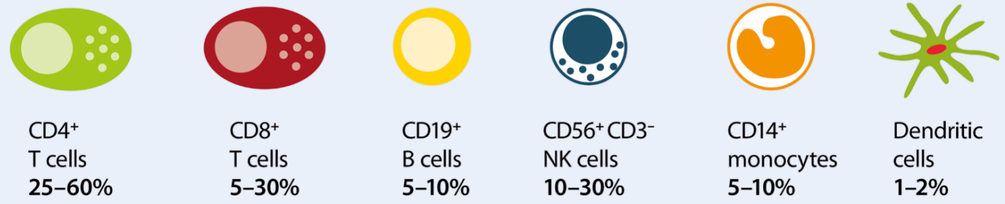
Indirect effects of β-glucans on pNK cells

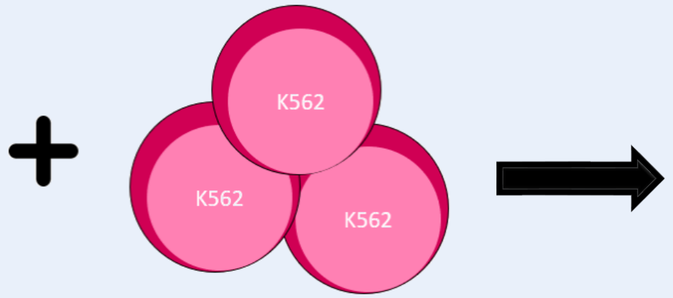
- PBMC isolation
- β-glucan priming (10 µg/ml)/
  IL-2 priming (50ng/ml) (18h)

- Medium (2h)
- CFSE-labelled K562 (4h)

M / IL-2 /







Lysis of target cells

Indirect effects of β-glucans on pNK cells

- PBMC isolation
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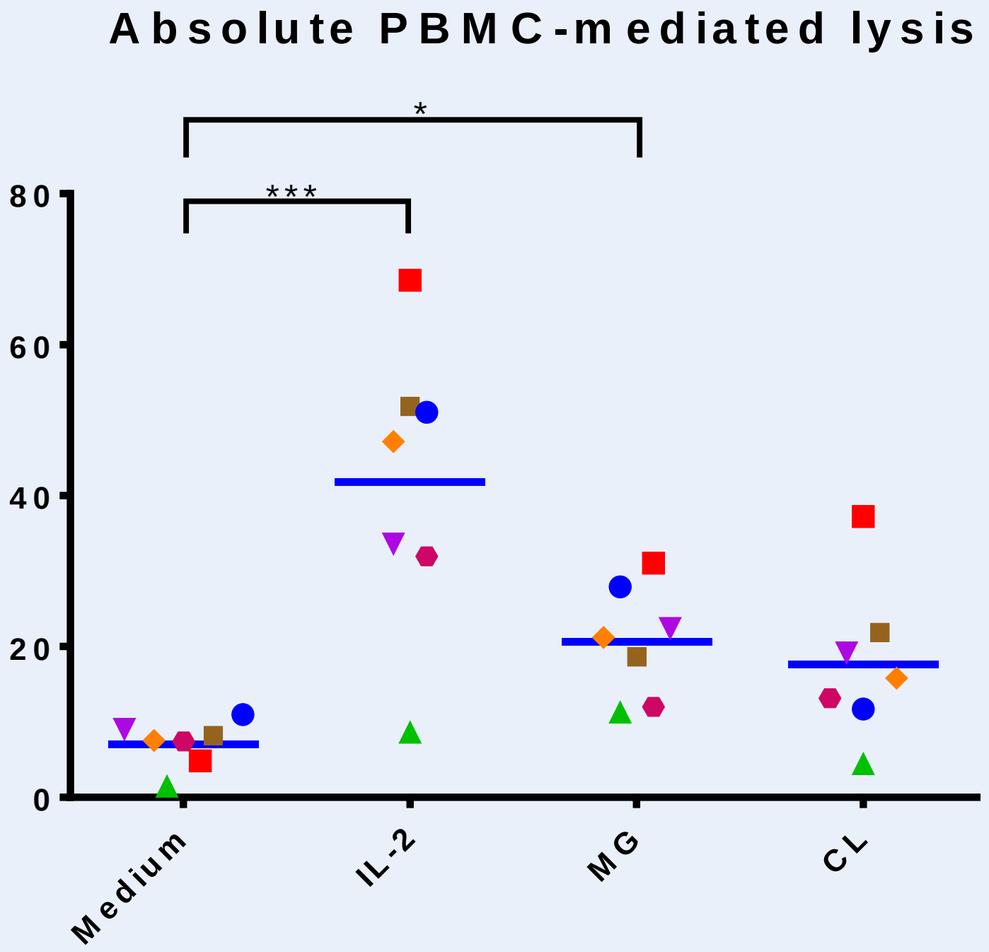
  IL-2 priming (50ng/ml) (18h)

- Medium (2h)
- CFSE-labelled K562 (4h)

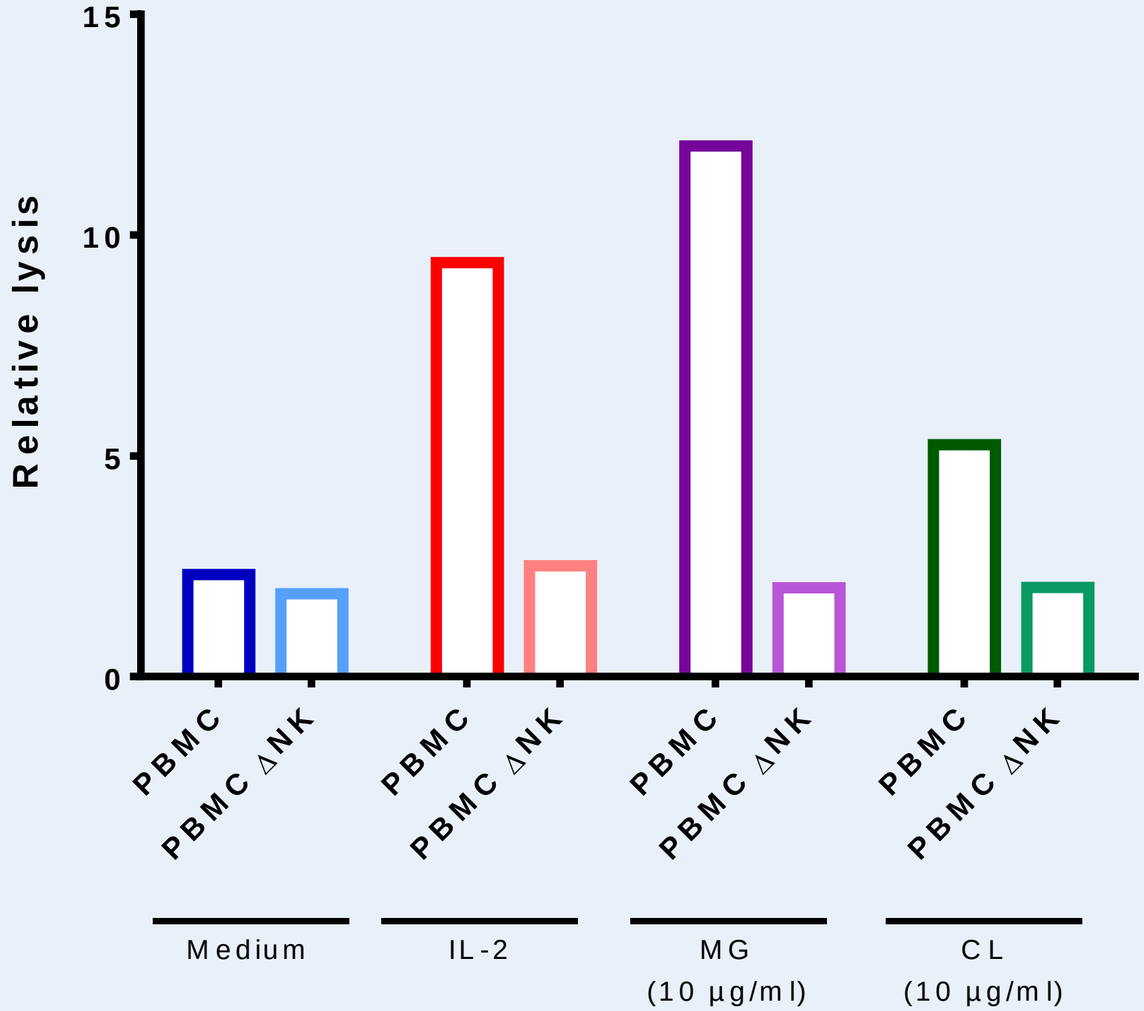


MG: Macrogard
CL: Curdlan

p<0,05: * ; p<0,001: ***

β-glucans do indirectly activate pNK cells

Are these effects NK-mediated?



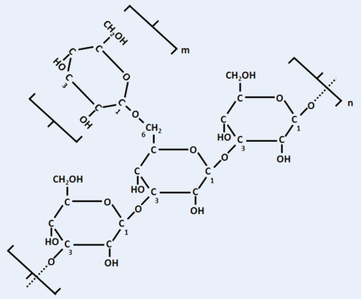
Yes

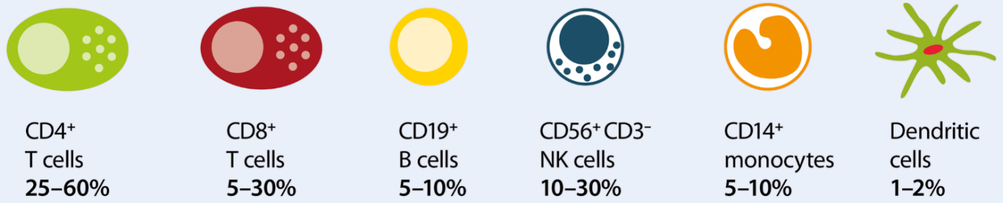
HOW DOES THIS WORK?

Effect of supernatant on pNK cells

- PBMC isolation
- β-glucan priming (10 µg/ml)/
  IL-2 priming (50ng/ml) (18h)

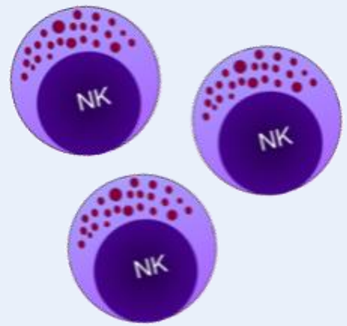
M / IL-2 /



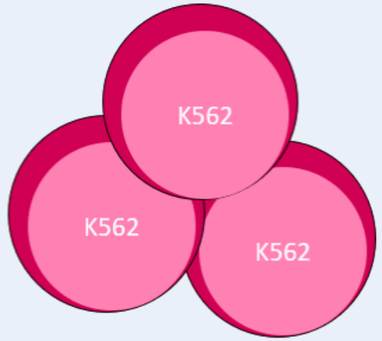


- Collecting culture SN
- FACS purified NK cells (18h)
- CFSE-labelled K562 cells (4h)

SN +



+



Effect of supernatant on pNK cells

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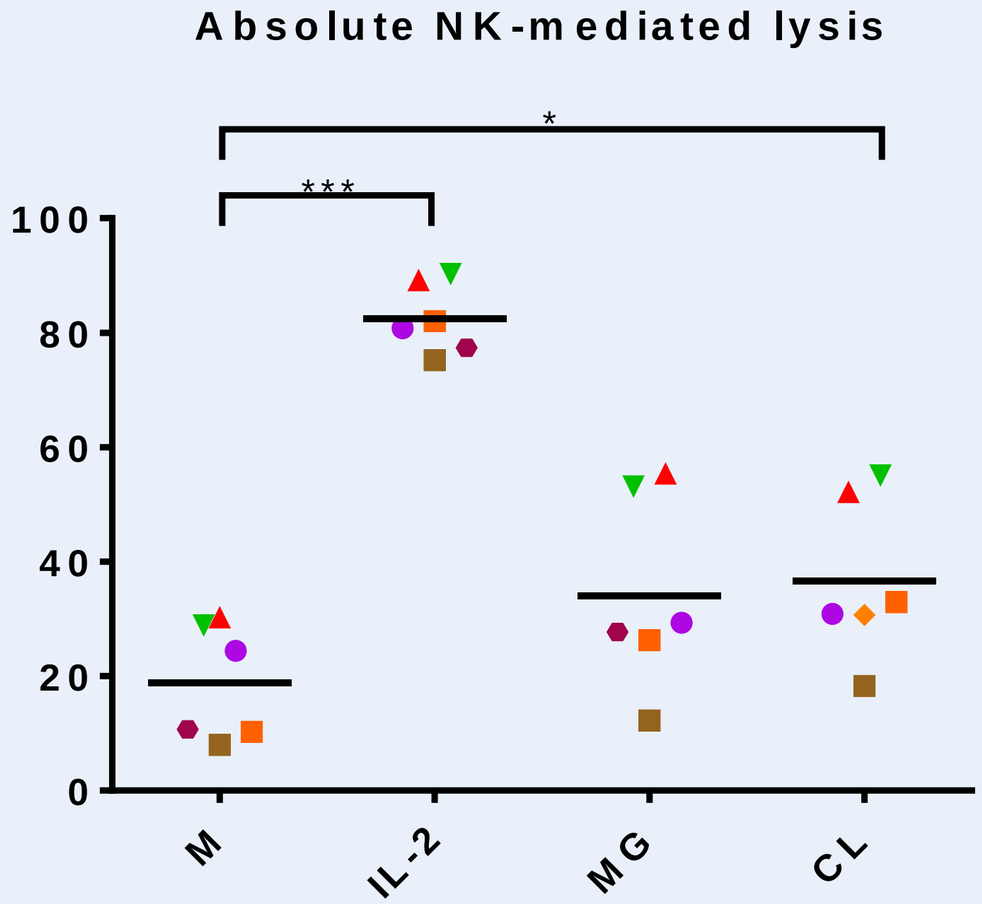
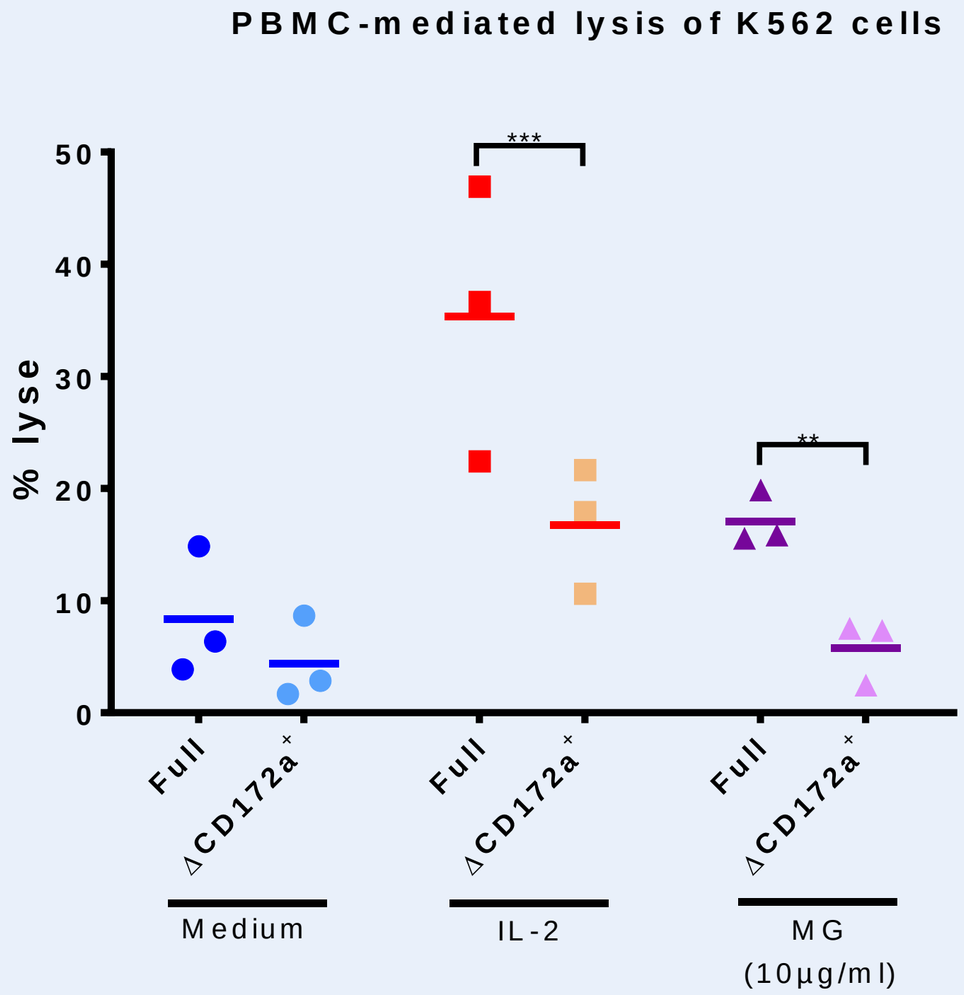


PBMC produce NK cell stimulating factors upon β-glucan priming

Effect of monocytes/DC



Role for CD172a+ cells: monocytes and/or DC

CONCLUSIONS

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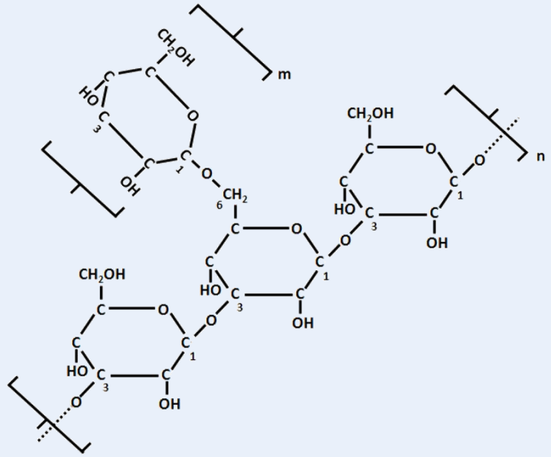
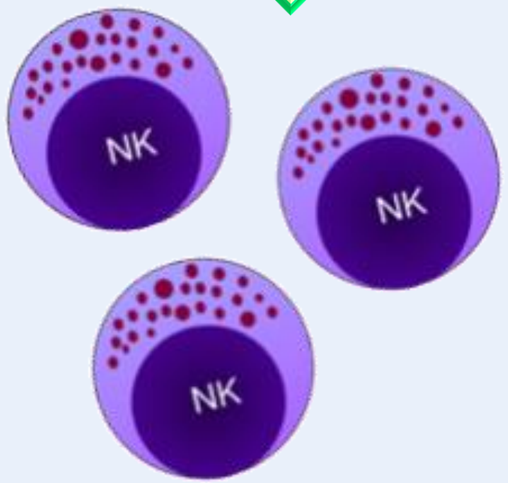


Beta-glucans

Monocytes / DC

Cytokines



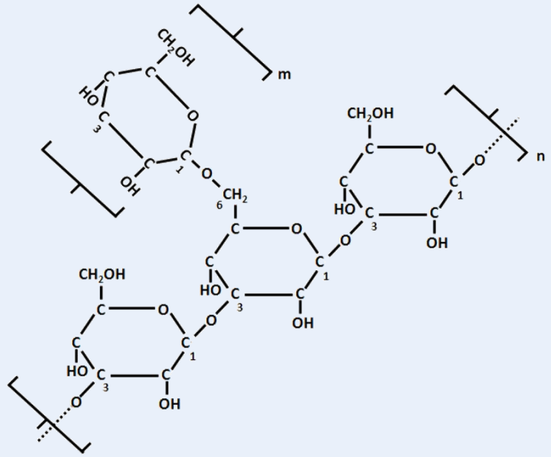
Cytotoxicity

Cytokines ???

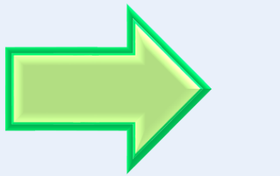
Maturation of DC

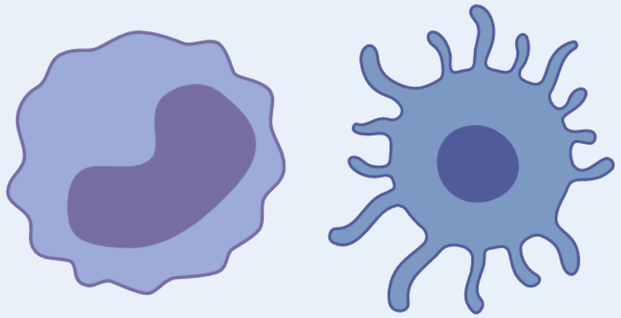
Activation of monocytes

Activation of Th1



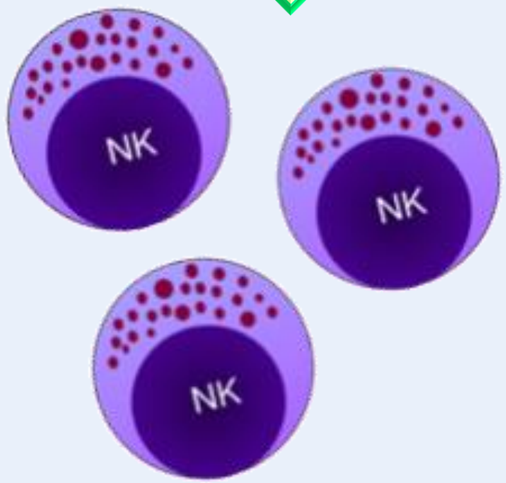
Beta-glucans





Monocytes / DC

Cytokines



Cytotoxicity

Cytokines ???

Shape innate immune response → Stronger resistance to infection

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Leen Hermans

DEPARTMENT VIROLOGY, PARASITOLOGY AND IMMUNOLOGY

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Co-promotor: Dr. Bert Devriendt

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BioRender

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