

Too much of a good thing: High T cell count can kill newborns

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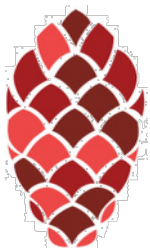
Abstract

Neonates have a weakened immune system that could be due to low exposure to pathogens resulting in low adaptive immunity and/or purposeful immune suppression to protect the weak neonate from a robust immune response. The purpose of this project is to find preliminary data to further investigate why the immune system of neonates are weaker, and to possibly improve neonatal immunity while protecting against a powerful immune response in the future. Using processed mice spleen cells that were stained for CD4 and CD8 to be subjected to flow cytometry, an increase in the percent of helper CD4 and killer CD8 T cells were observed as the mice aged. This indicates that neonates do have a weaker immune system. Between healthy mice and mice infected with either *Bordetella pertussis* or *Listeria*, a decrease in the percent of CD4 and CD8 T cells were found, which could be because not enough time had passed for an adaptive immune response.

Key words:

mouse, BALB/c, T cell, neonate, baby, immune system, adult, CD4, CD8

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Introduction

- ❖ T cells are a type of leukocyte (white blood cell), generated in the thymus, that form the majority of the body's adaptive immune response to pathogens and tumors.
- ❖ Helper T cells assist other immune cells and have the CD4 marker.
- ❖ Killer T cells can act to destroy pathogens and cancer cells. They have the CD8 marker.
- ❖ T cells become activated in the presence of foreign particles in the body called antigens.
- ❖ Infants are especially susceptible to infectious diseases.
- ❖ Common belief is that they have a naive immune system and have not yet been exposed to many pathogens and therefore cannot defend against them.
- ❖ This immune deficiency can be beneficial for newborns because it prevents too strong of an immune response that otherwise would be detrimental to the health of the newborn.

Purpose

- ❖ To find preliminary data in order to further investigate why the immune systems of infants are deficient.
- ❖ This can then help us to better understand the neonatal immune system for potential therapeutic interventions to protect infants from disease, while still protecting them from a robust immune response.

Methods

- ❖ The spleens of BALB/c strain mice were harvested at different age points from neonates to adults.
- ❖ The spleens were processed and stained for different markers and analyzed using flow cytometry.
- ❖ In some studies BALB/c mice were infected with *Bordetella pertussis* (whooping cough) at D6 and then euthanized at D9.
- ❖ In some studies, adult BALB/c were infected with *Listeria* and euthanized 2 days after.



Results

Fig. 1: A greater amount of T cells was observed in older mice.

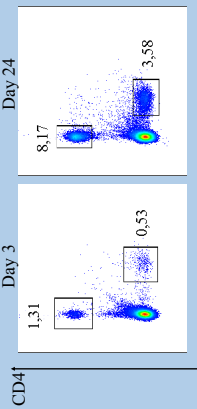


Fig. 2: An increase of T cells was observed as the mice age.

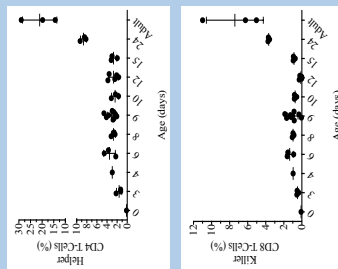
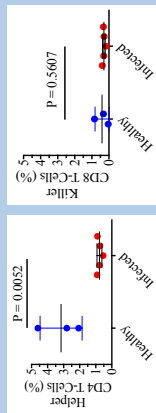


Fig. 3: A decreased amount of Helper CD4 T cells was found in the mice infected with *Bordetella pertussis*. No significant change was observed in the Killer CD8 T cell count.



Results

Fig. 4: A decreased amount of Helper CD4 and Killer CD8 T cells was found in the mice infected with *Listeria*.

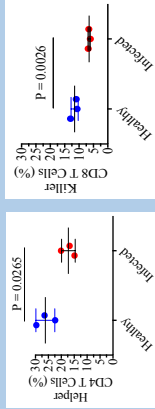


Fig. 5: Cultured *Bordetella pertussis* colonies.

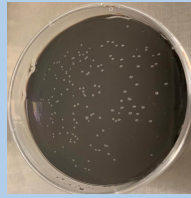


Fig. 6: Cultured *Listeria* colonies.

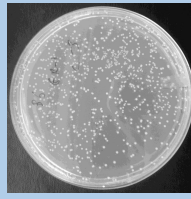
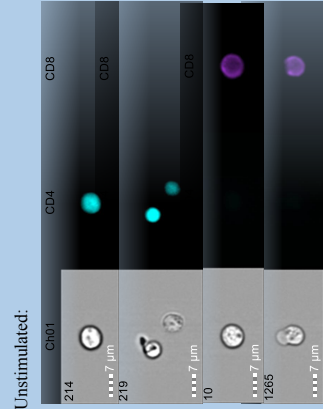
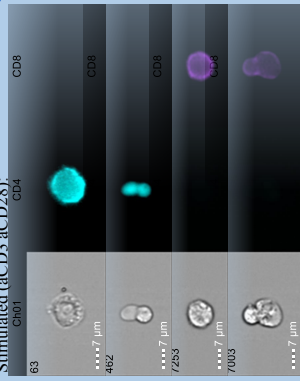


Fig. 7: In the cell imaging stream, cyan fluorescence indicates Helper CD4 markers and purple fluorescence indicates Killer CD8 markers. Larger cells are observed in the activated stream.



Results

Stimulated (aCD3, aCD28):



Conclusions

- ❖ The helper and killer T cell count increases as a baby ages, which could be accounted to increased exposure to antigens and pathogens that build up the baby's adaptive immunity.
- ❖ The helper and killer T cell count in healthy mice was greater than in infected mice, which could be a result of cell death after infection or too short of a time period post infection.
- ❖ That babies have a weaker immune system as compared to adults. Fewer T cells can indicate less ability to fight infections.
- ❖ This weaker immune response to pathogens can be beneficial for the survival of the newborn.
- ❖ The next step would be to investigate other factors that uniquely affect a baby's immune system, to then better understand why it is deficient and to find ways of protecting babies from disease while still protecting them from a powerful immune response.
- ❖ From here and onwards, new medicines, methods of care and treatments could stem that would help prevent unnecessary infant death.

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