Veterinary Immunology
Insights

Chris Chase
Department of Veterinary and Biomedical Sciences
South Dakota State University
Brookings SD
Credits

- Slides
  - Kuby Immunology
  - Immunobiology, 8th edition
  - David Topham, University of Rochester

- Movies/Animations
  - Heather Ambraska and Jennifer Gommerman, University of Toronto
  - Uwe von Andrian, Harvard University
  - Julian Kirk-Elleker and Alberto Martin, University of Toronto
Thank You

- CFSPH/IICAB
- Jim Roth
- GODFATHER OF VETERINARY VACCINOLOGY
Topics

- Vaccine Response
- Homeostasis
- Mucosal Response
Vaccine Response

- Antigen, Adjuvant and “Constituent” components - some Ag have all vaccine response properties or just one or two
  - Danger- DAMP PAMP
  - Signal 1-Antigen – T cell receptor
  - Signal 2-Co-stimulatory
In the Garden of Good and Evil
Vaccination is usually GOOD
Not Enough of A Good Thing

LEVEL

TIME

- Immune Response
- Disease Challenge
Immune responses

1\textsuperscript{st} Line of Defense
- Barriers
  - mucous, tears, gastric pH, saliva, skin

2\textsuperscript{nd} Line of Defense
- Cellular and humoral defenses
  - interferon, cytokines (pro-inflammatory and T stimulatory), complement proteins, phagocytosis, NK cells

3\textsuperscript{rd} Line of Defense
- Cellular and humoral defenses
  - Antibodies, cytokines, T helper cells, cytotoxic T cells
Inflammatory Response

IL-1 IL-6, TNF Proinflammatory cytokines
Immune Response - Animal

Doesn’t Lie

- Immune response
  - Proinflammatory response necessary
    - Expect Some Side effects
    - No side effects - no response
- Without response - Higher disease
  - Poorer immunity (active response)
Inflammatory Response
- Out of Control Response

Neutrophil Fungal Killing
Summary

- Recruitment
- Activation
- Acute Inflammation
Activation of Receptors and Antigen Presentation
Building Block of Adaptive Immunity
Dendritic Cell-T cell
Lymphocyte Trafficking and Inflammation
T cells and Dendritic Cells - Delicate Dance
Linking Innate and Adaptive Immunity

Danger Signal 0

LPS
PGN

dsRNA
Glycolipids
Mannans
flagellins

Antigen Presentation Signal 1

Cytokine-IL-1,
IL-6, IL-12, TNF,
IFN-a/b

Costimulatory Molecules-
B-7, CD40

Co-Stimulation Signal 2

Activated T cells

T/B cell conjugate

Antigen Presentation
Timing and the Adaptive Immune Response:

- **Lymphocyte proliferation to Ag A**:
  - 1° response to antigen A
  - 2° response to antigen A

- **Lymphocyte proliferation to Ag B**:
  - 1° response to antigen B

- **Lymphocyte apoptosis**

Magnitude of specific response

Days:
- 4
- 8
- 12
- 16
- 20
- 64
- 68
- 72

A
B
Maturation of the Response
Affinity and Levels of Antigen

- Lower levels of antigen enhance affinity
Too Much of A Good Thing

LEVEL

TIME

- Immune Response
- Disease Challenge
Tissue Damage - Overactive Immune System
Homeostasis

- Immune response that stays in the middle
- Proinflammatory and antiinflammatory are not mutually exclusive
Mucosal Immunity- Anti-inflammatory
Summary

- Proinflammatory response needed - what balance
- Levels of antigen influence cellular vs humoral
  - More antigen more humoral - more avidity - IgM
  - Less being better for higher affinity
- Co-stimulatory how can manage the type of response
Th2
IL-4
IL-13
Th1
IFNγ
Innate
IL-1β
IL-6
TNFα
IFNα/β
DCs

Humoral response

Cell mediated response

B cell

T helper cell

Antigen

Plasma cell

Cytokine production

Antibodies

Cytokine production

Humoral response

Cell mediated response

T helper cell

B cell

Antigen
Summary

- Mucosal immunity - needs a little proinflammatory response - while maintaining anti-inflammatory response
Final Thoughts

- Workshop - Disappointed - Naïve - Discussion
- Contention has been problem - Line in Sand
- Hopeful - White Paper
- GODFATHER - Will Come up with “AN OFFER THAT WE Can’t REFUSE”
Harvey Dunn (1884-1952) Prairie is My Garden, South Dakota Art Museum