Pasturella and its Impact on Stocker Health

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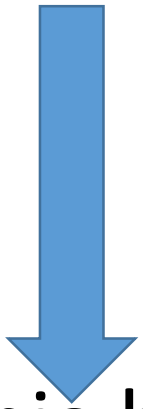
VMCVM

Goals

- Gain a better understanding of the role of Pasturella in Bovine Respiratory Disease Complex (BRDC)
- Understand the factors that make Pasturella unique

Pasturella

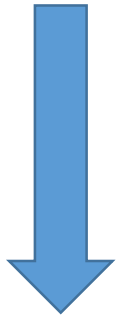
Pasturella hemolytica



Mannheimia hemolytica

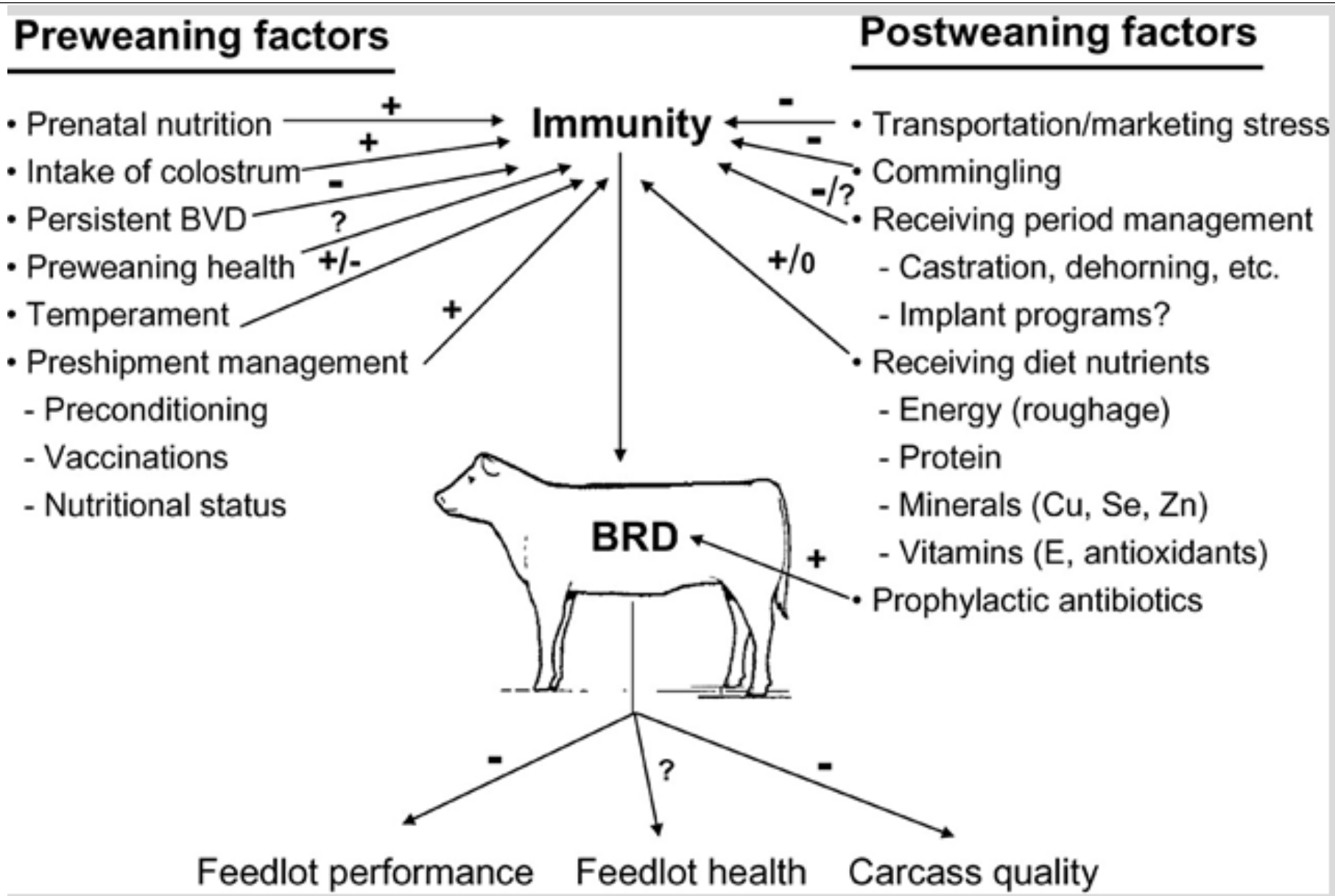
Understanding BRDC

Stressor(s)



Bacterial Pneumonia


BRDC
Other Disease
Maternal Immunity
Source
Genetics
Time of Year
Age & Weight
TX Drug
Weaning
Processing
Vaccines
Clean Water
Weather
Social Stress
Shipping
Size of Operation
Environment
Sex
Nutrition
Herd History
Detection of Disease



Pre- and post-weaning factors affecting bovine respiratory disease (BRD) in beef cattle and resulting outcomes of the disease. + = ↓ incidence or consequence; – = ↑ increased incidence or consequence; ? = effects not fully understood based on the available data. BVD = bovine viral diarrhea virus. Source: J. Anim Sci. 2007. 85:823-840

Respiratory Viruses

- Antibiotics do not work on viruses because viruses are not alive
- A virus injects its DNA into a living cell and has that cell reproduce more of the viral DNA. With a virus there is nothing to "kill," so antibiotics don't work on it.
- Viruses take over living cells … make the cell do what the virus demands … then leaves … cell is weak or dead

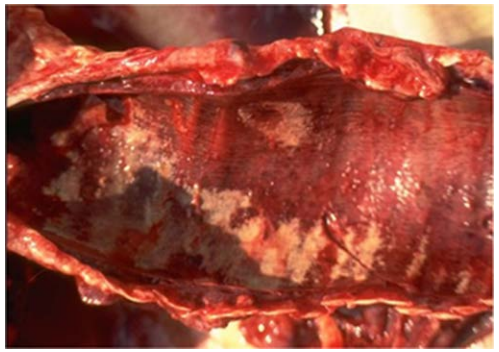
Disease sequence of events:

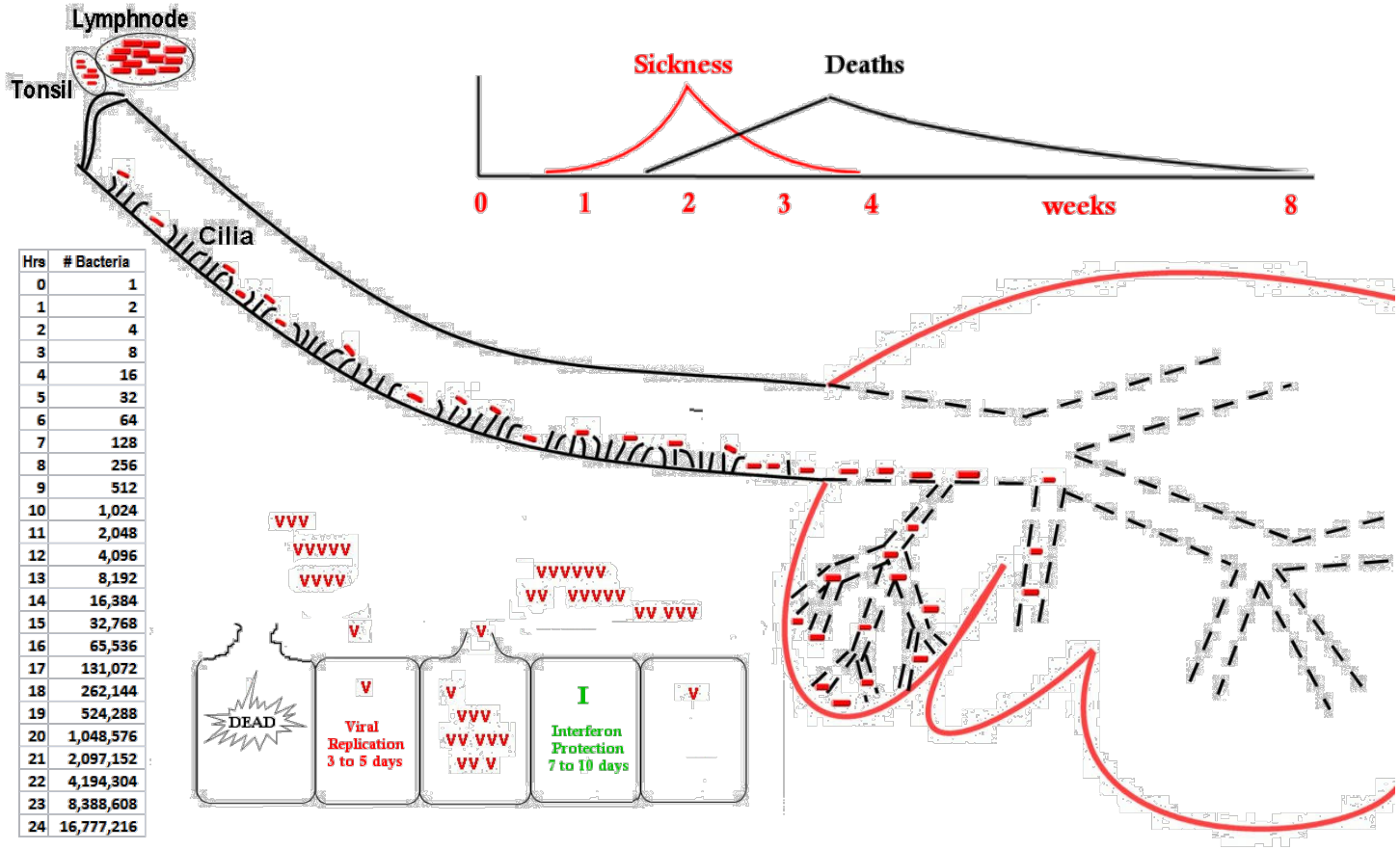
- Susceptible animal exposed.
- Incubation is the period (time) from the first replication of the disease causing biological agent until sufficient compromise of the target organ(s) occurs causing loss of function of the target organ(s).
- Primary viral BRD this averages 3 days.
- Secondary bacterial BRD averages 3 to 5 days behind the initial viral infection.

What makes Mannheimia unique?

- Presence in all cattle’s tonsils
- Production of leukotoxin

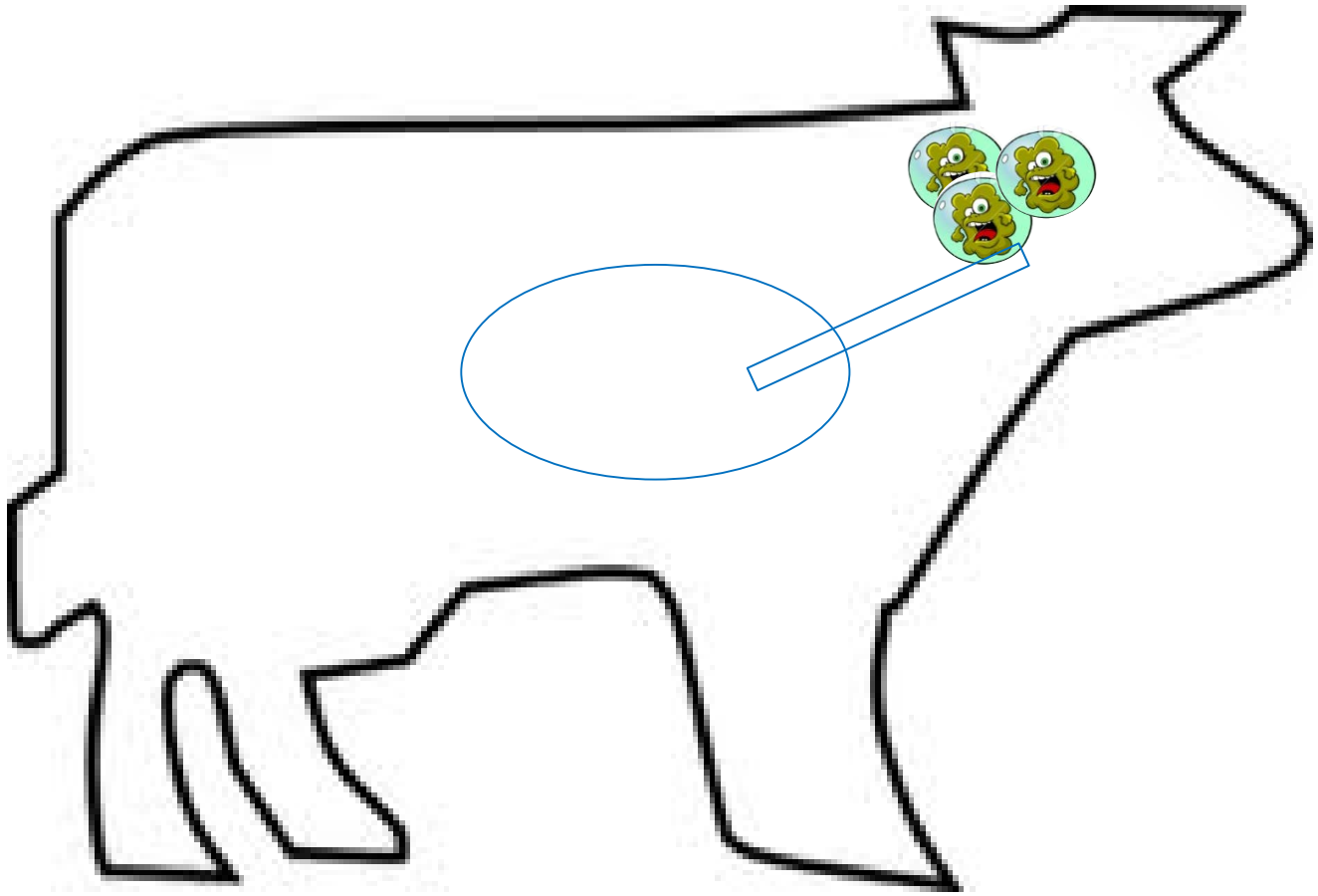
Present in the Tonsils of all cattle





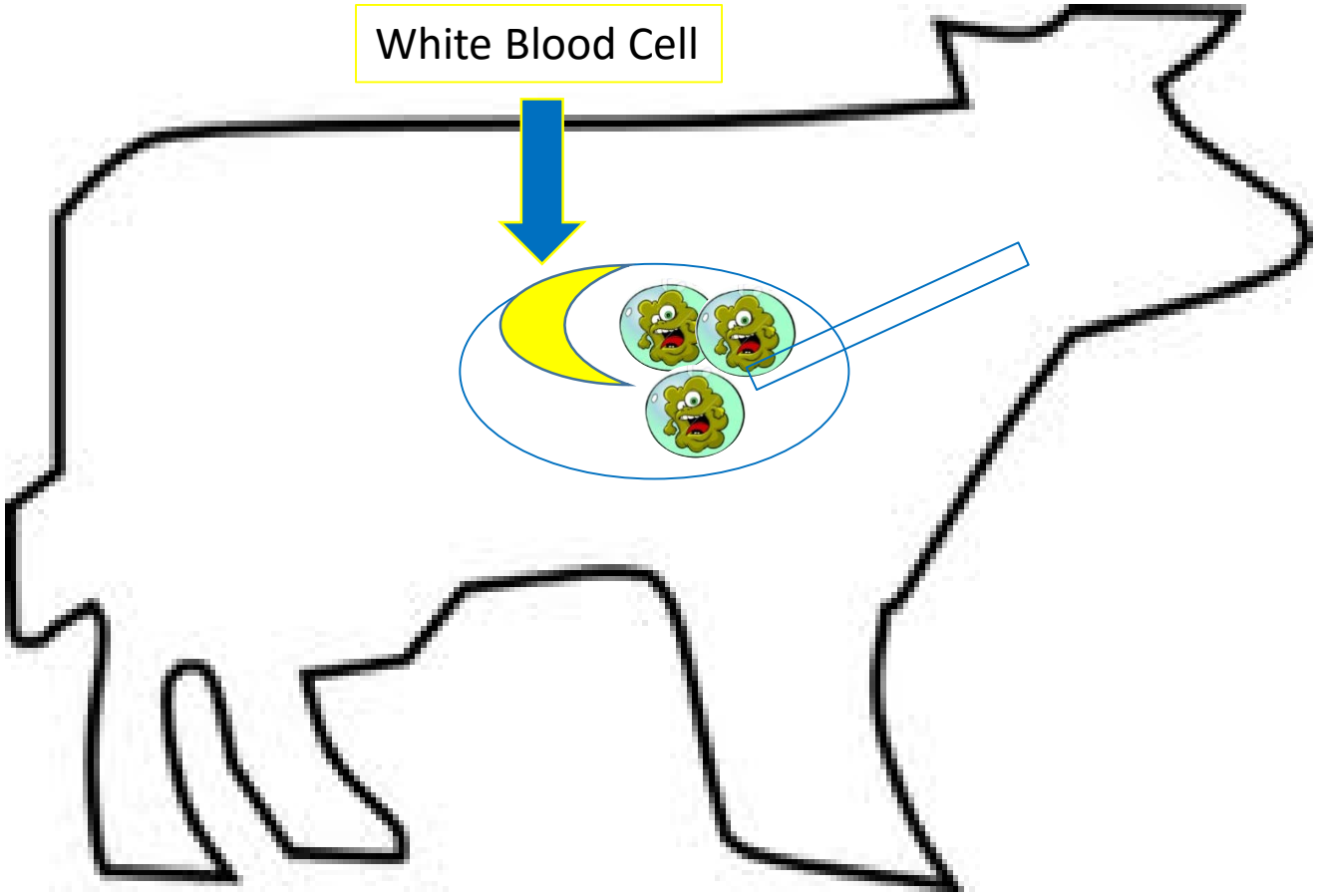
Hrs	# Bacteria
0	1
1	2
2	4
3	8
4	16
5	32
6	64
7	128
8	256
9	512
10	1,024
11	2,048
12	4,096
13	8,192
14	16,384
15	32,768
16	65,536
17	131,072
18	262,144
19	524,288
20	1,048,576
21	2,097,152
22	4,194,304
23	8,388,608
24	16,777,216

Mannhemia present in the tonsil of a normal calf

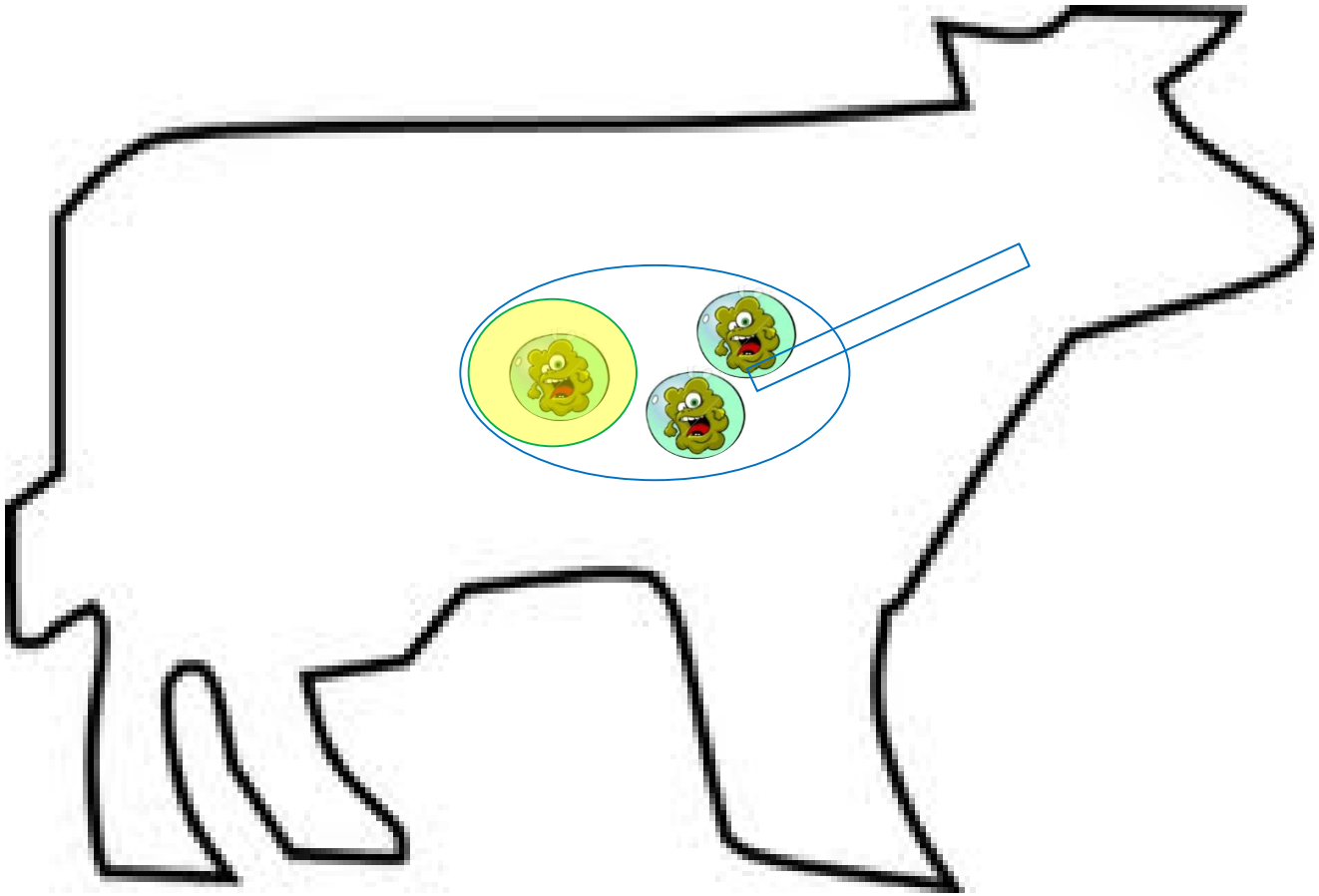


After stressors occur Manheimia moves from tonsils down to the lungs

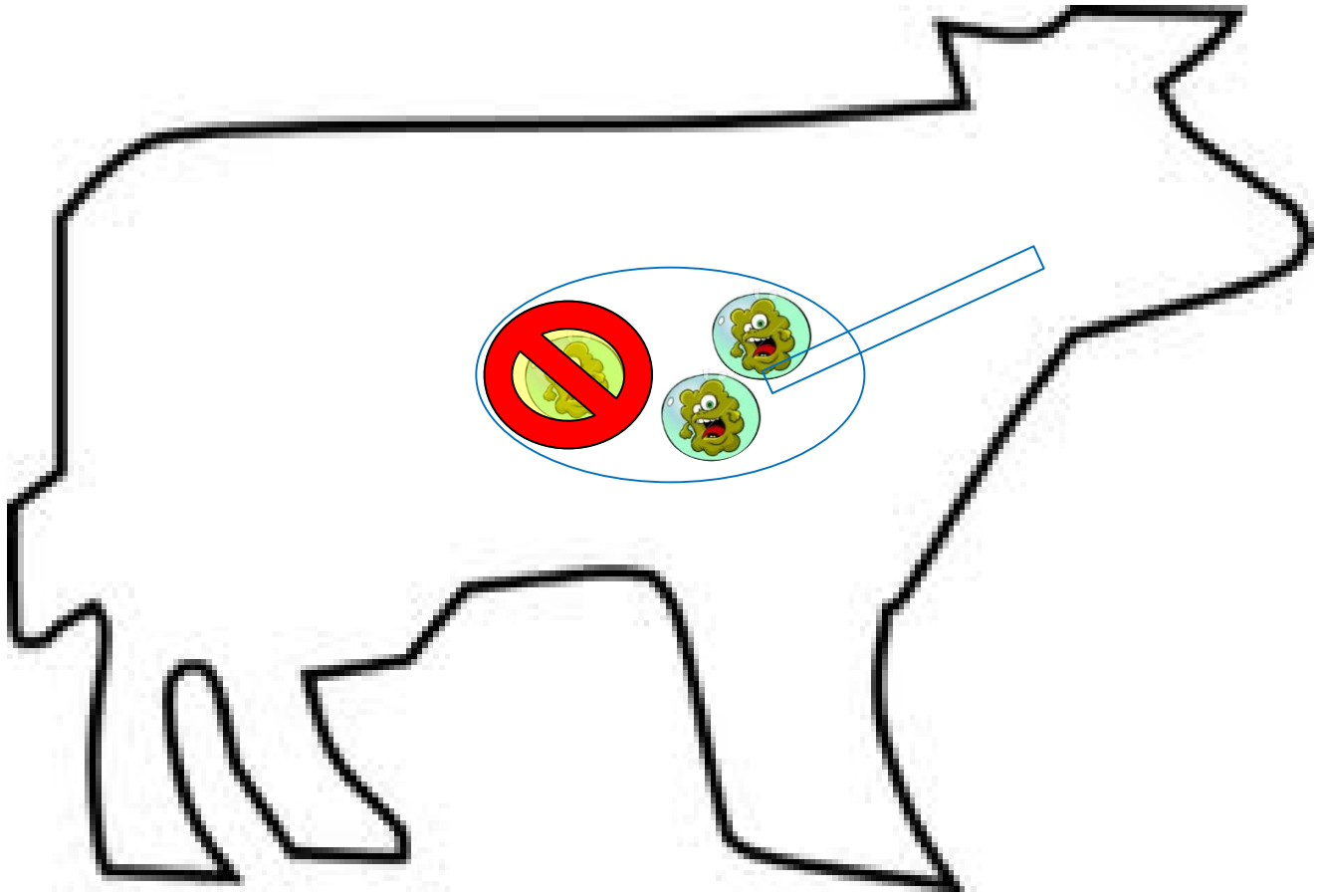
Immune cells in the lung move to attack the Mannheimia



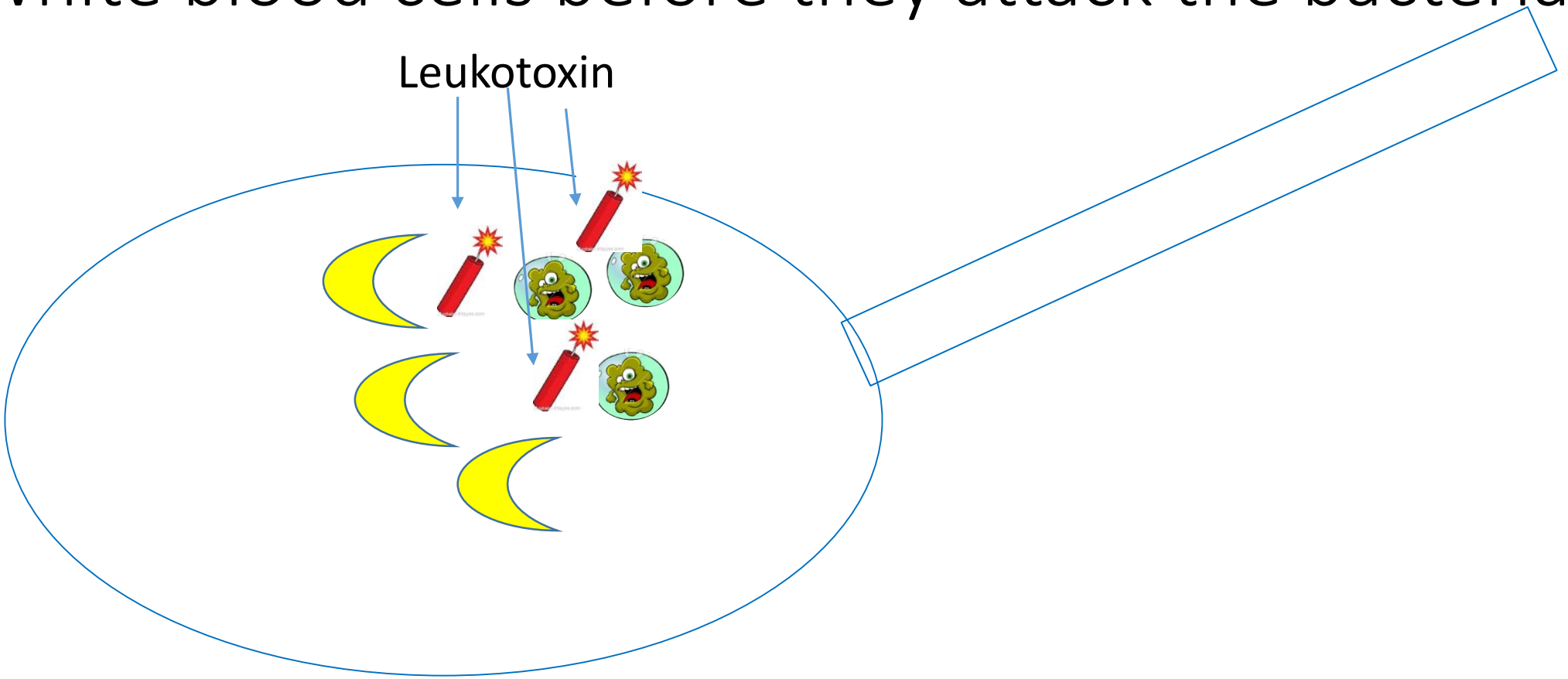
White Blood cell engulfs bacteria



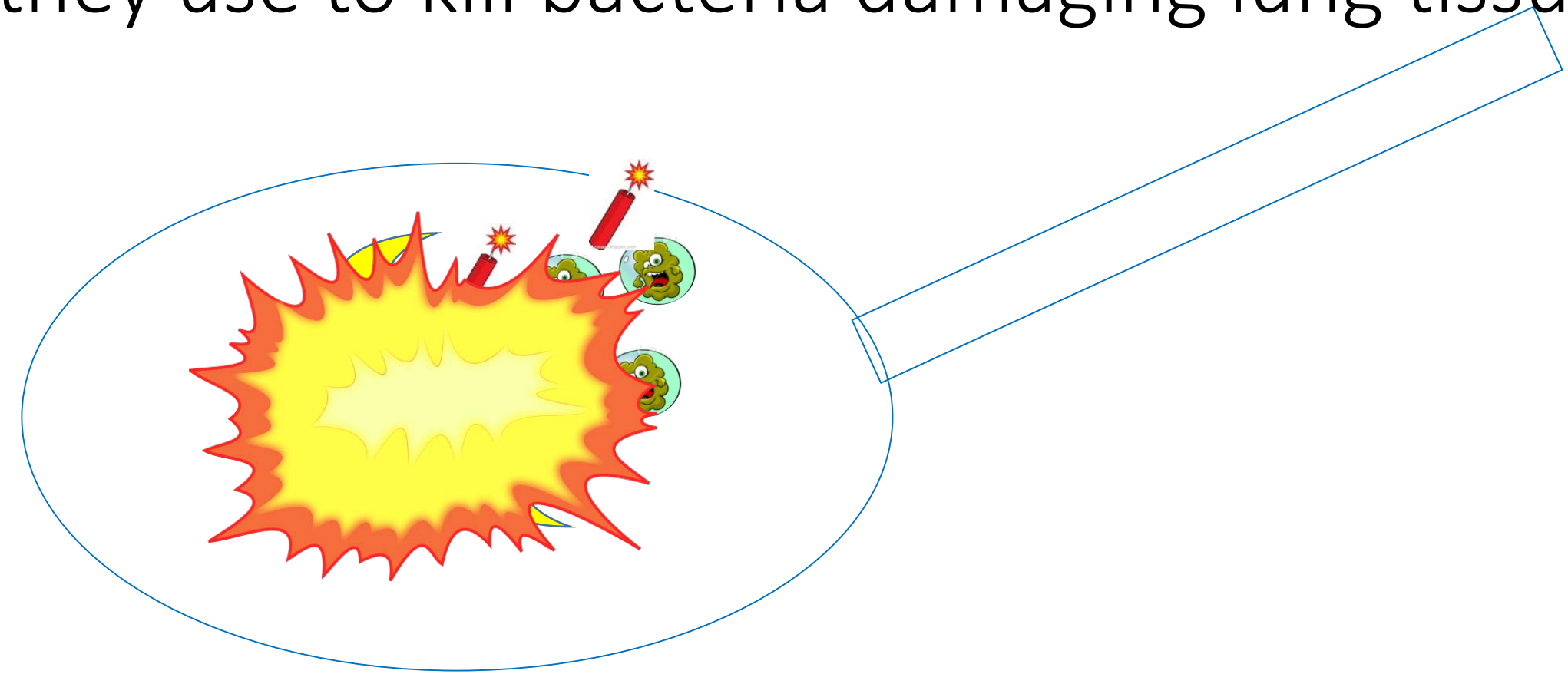
White blood cell carefully implodes killing it and the bacteria



Mannheimia produces Leukotoxin that attacks white blood cells before they attack the bacteria



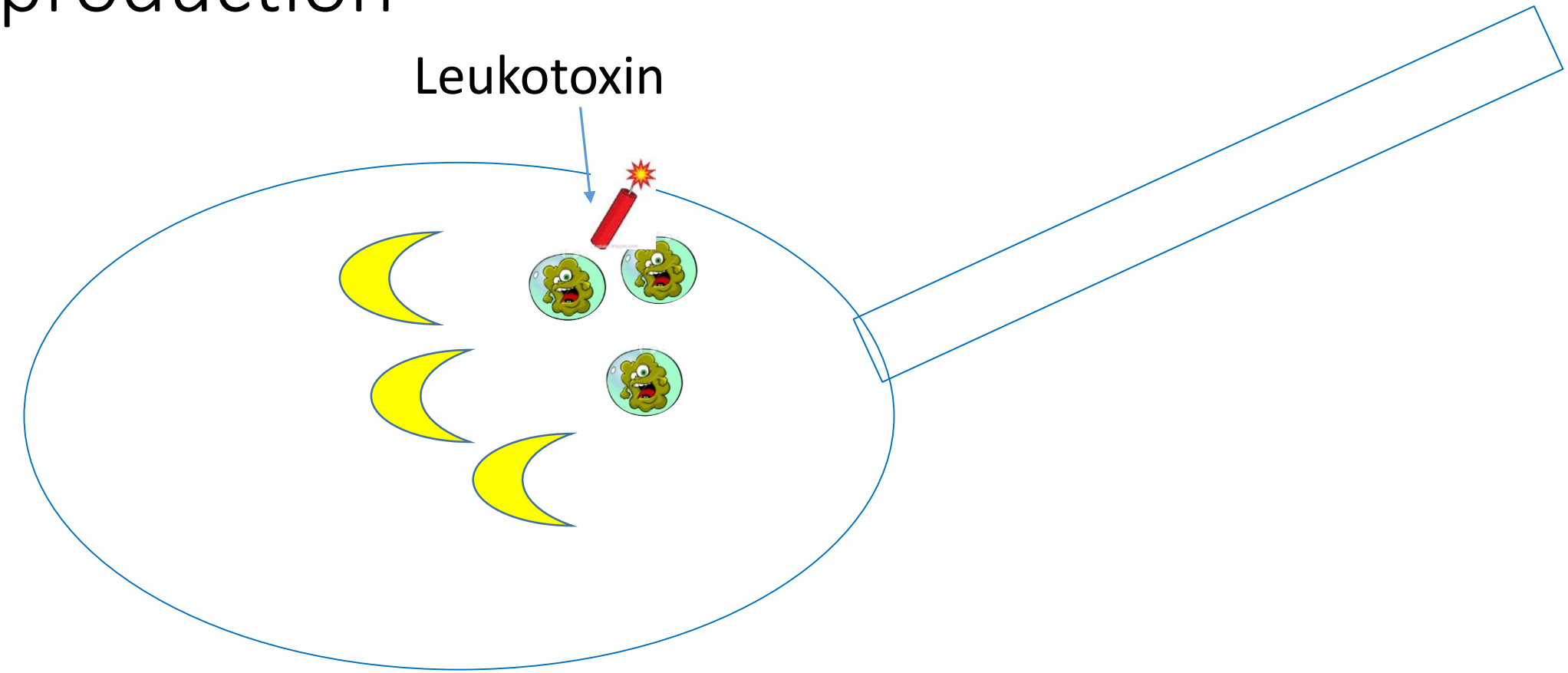
White blood cells die releasing the substances they use to kill bacteria damaging lung tissue



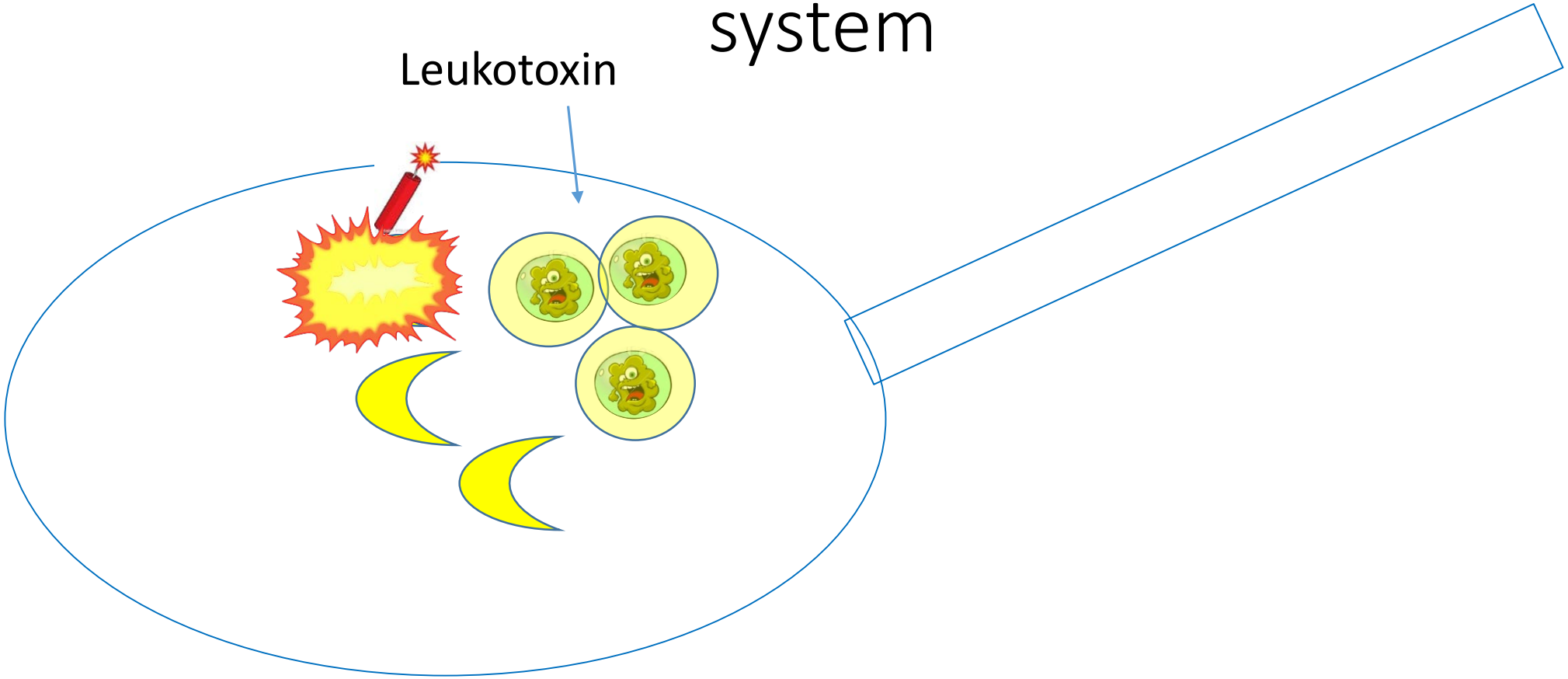
Mannheimia Leukotoxin

- The effects of the leukotoxin are what causes the calf to run a fever and look sick
- Different strains of Mannheimia bacteria produce different amounts of leukotoxin
- The amount of leukotoxin produced explains much of the severity and quickness of the lung damage in cases of BRDC

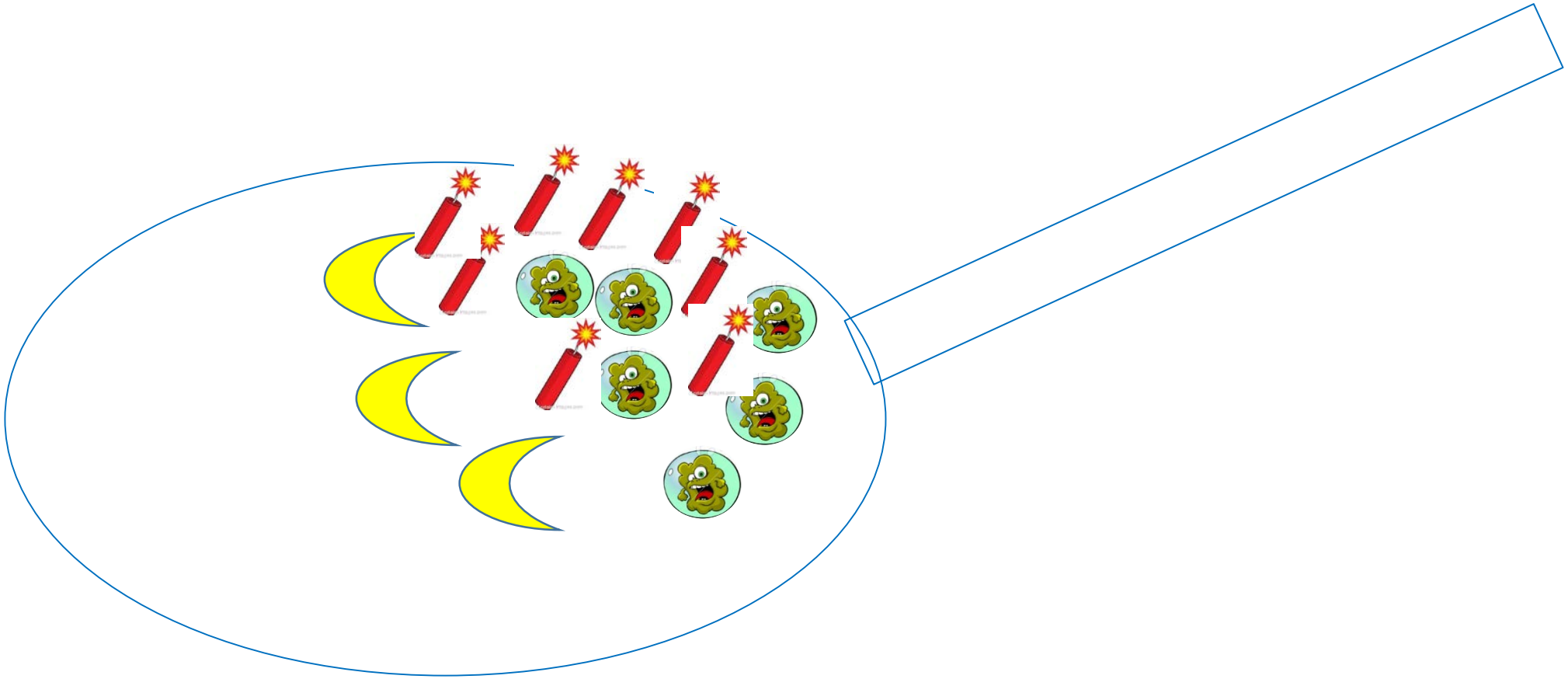
Mannheimia with minimal leukotoxin production



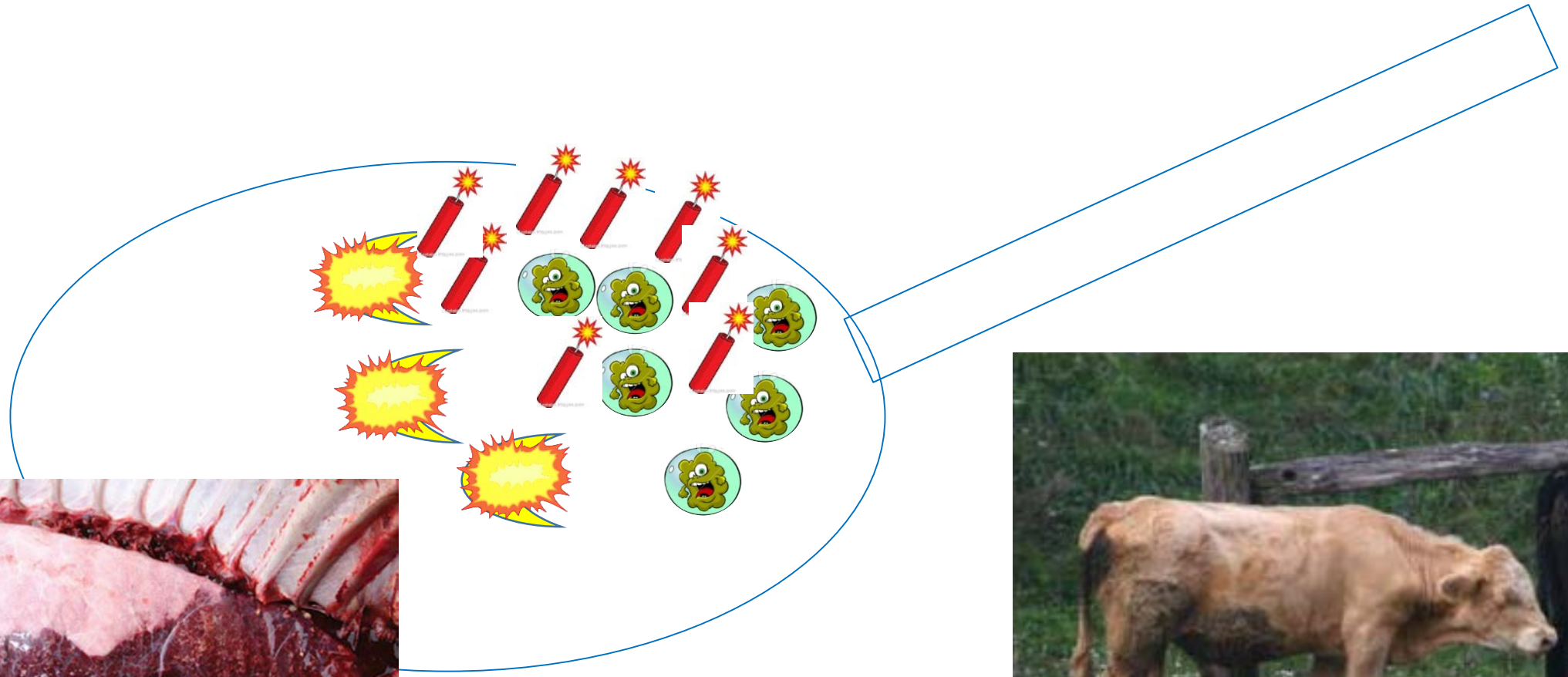
Mannheimia with minimal leukotoxin production = Less severe disease and controlled by the immune system



Mannheimia that produces lots of leukotoxin

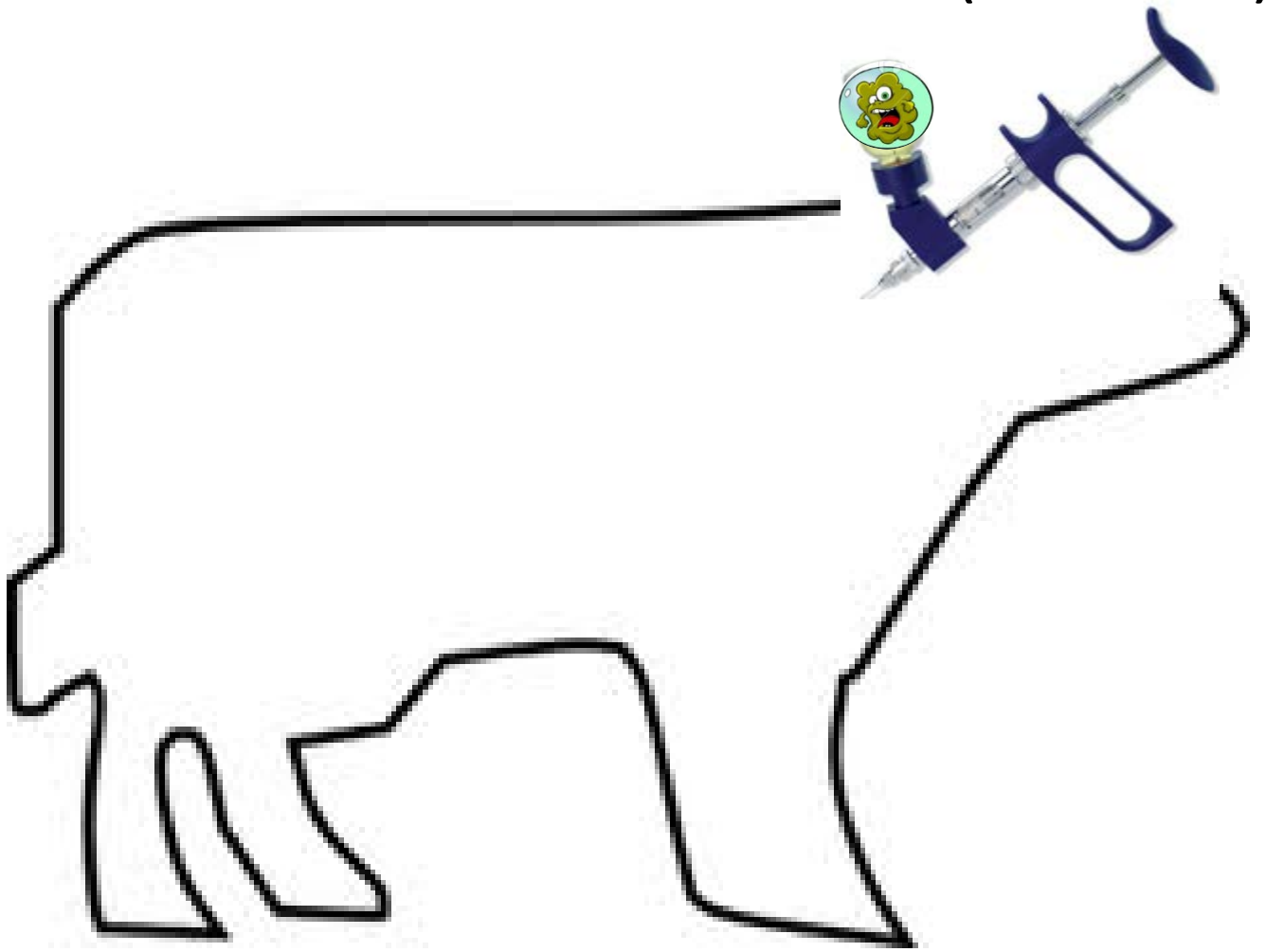


Severe disease and lots of lung damage+

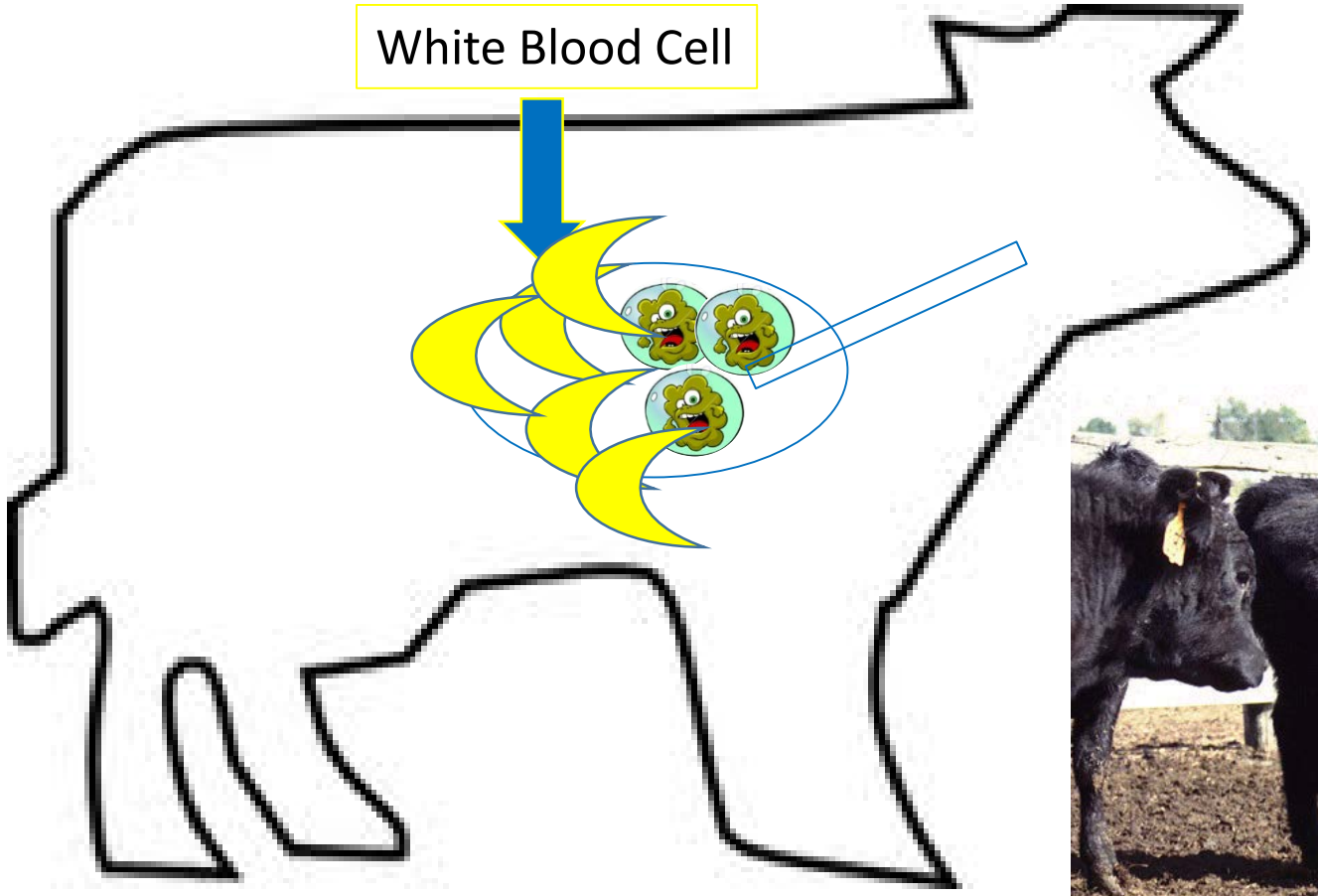


Mannheimia bacterin Vaccines (1980s)

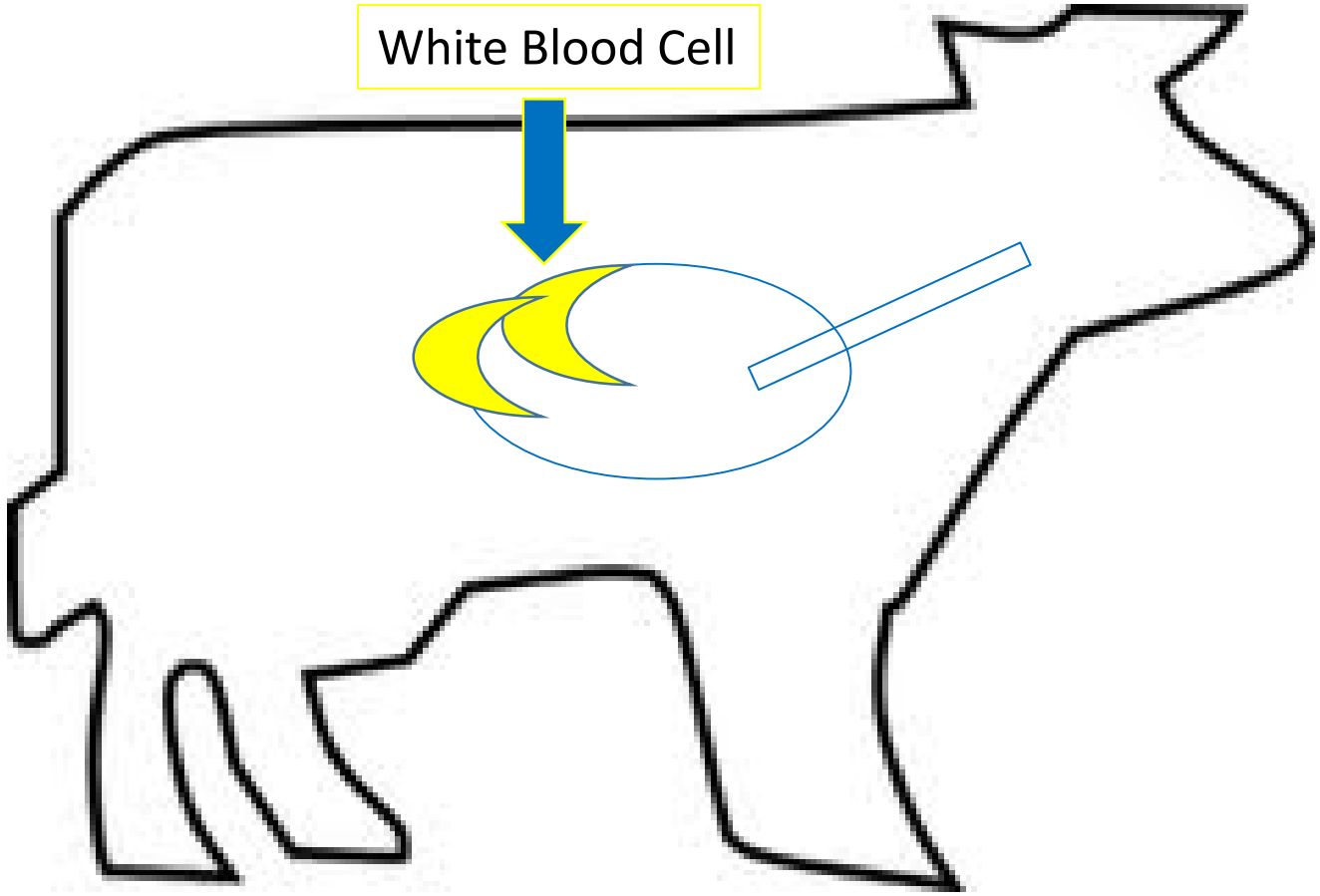
- Bacterial culture grown
- Bacteria chosen produced no leukotoxin
- Immune response was only to the bacteria



Increased #’s of immune cells waiting in the lung to attack the Mannheimia



Infection cleared



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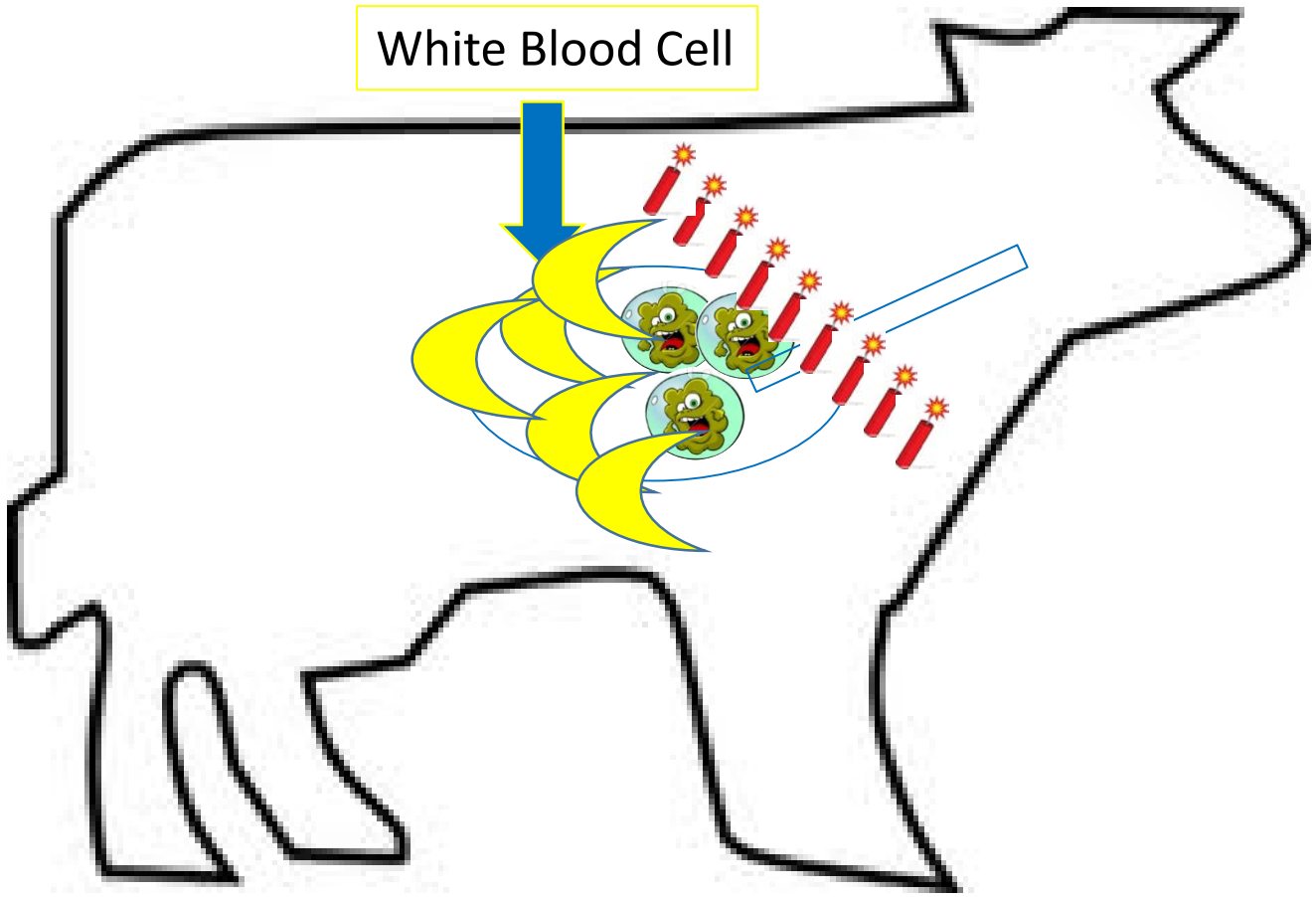
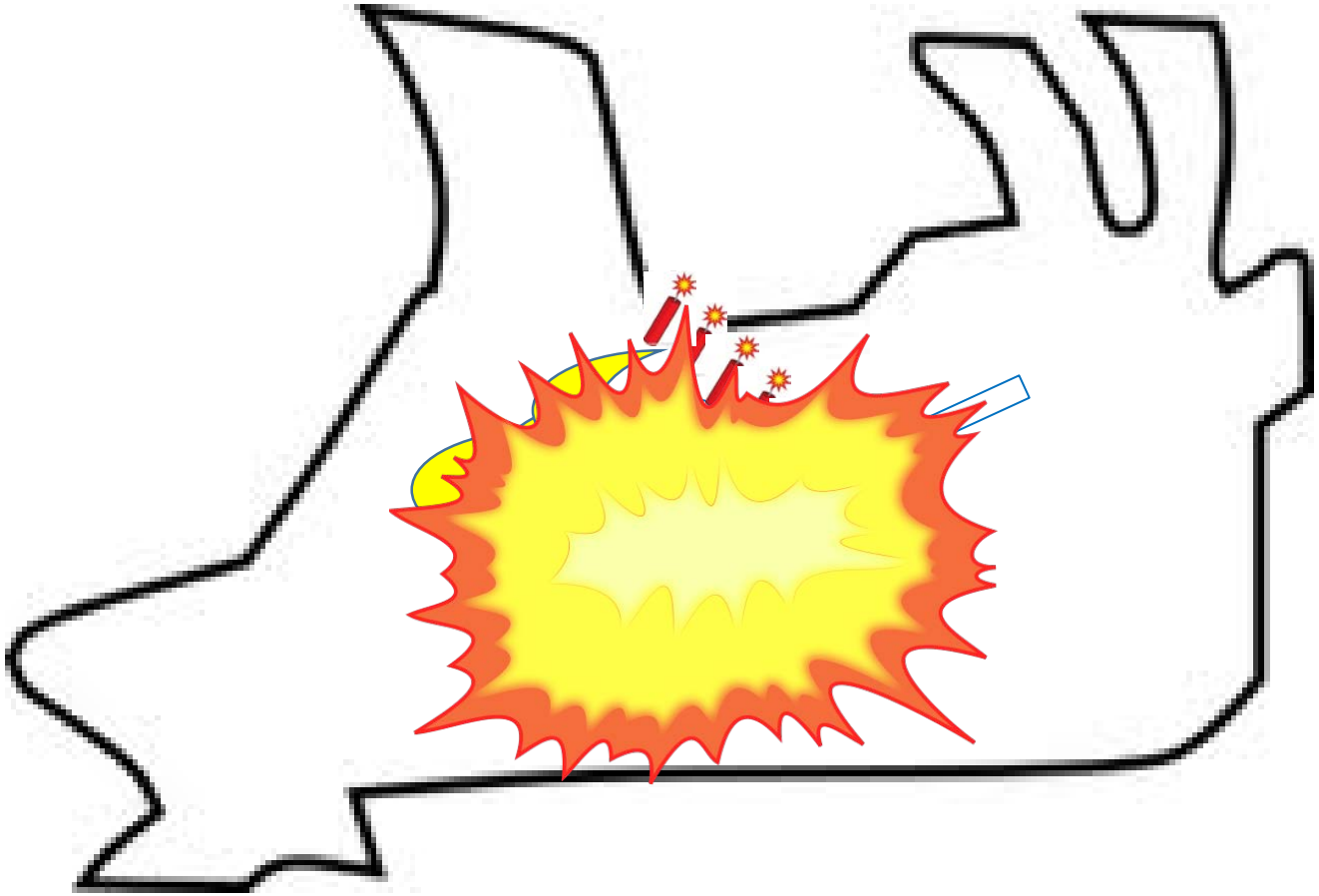
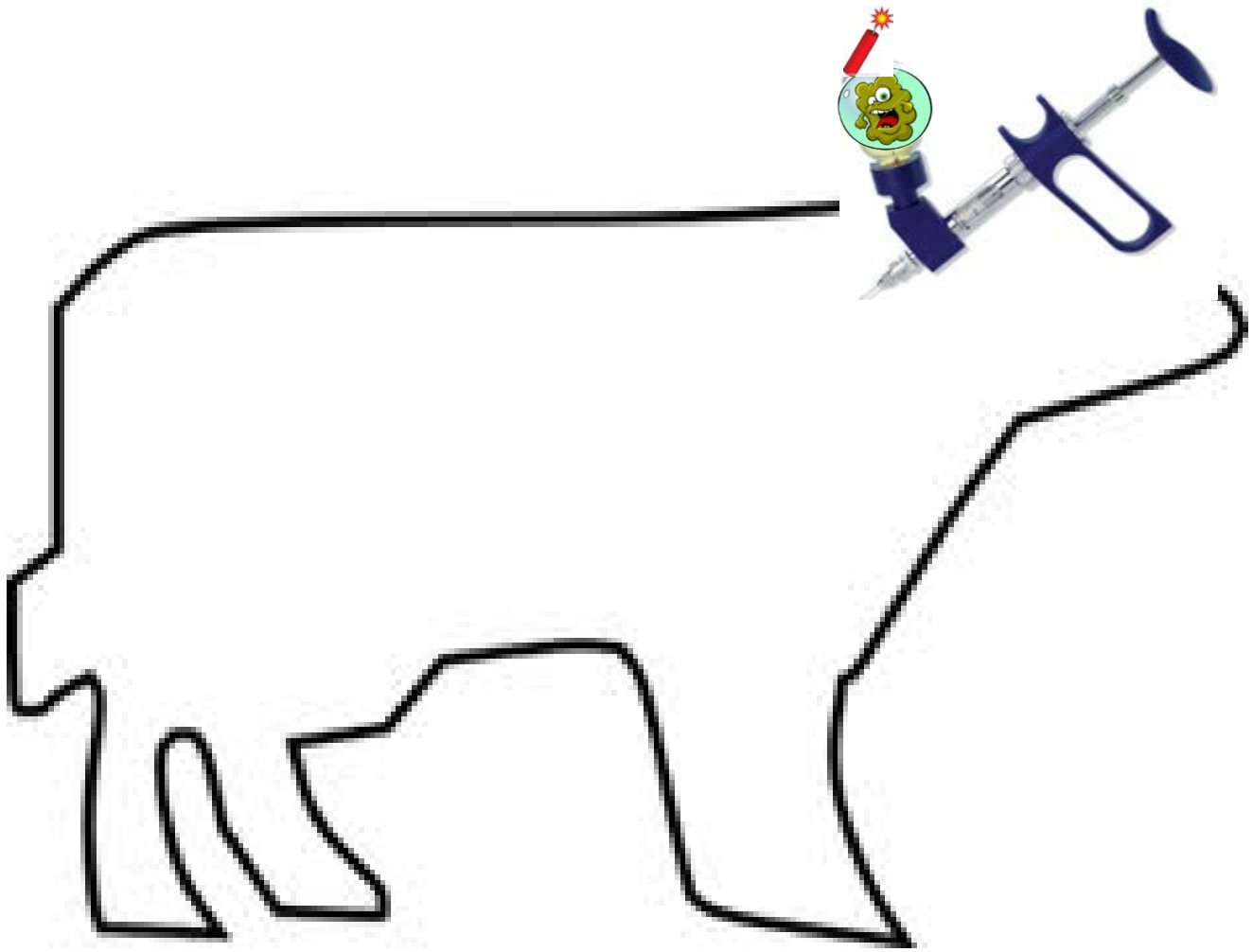


Increased #’s of immune cells waiting in the lung to attack the Mannheimia MORE LUNG DAMAGE

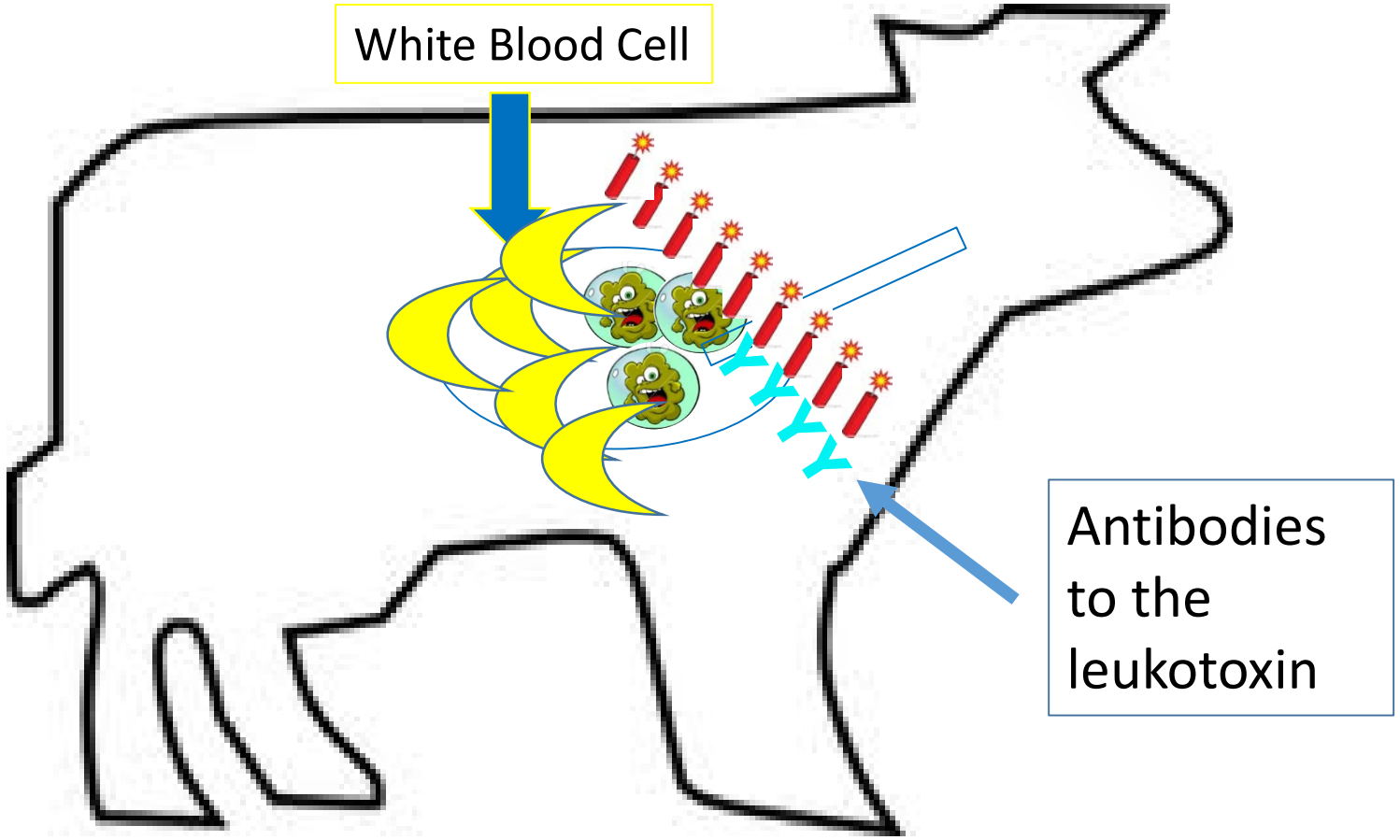


Current Mannheimia toxoid/bacterin Vaccines (2000s)

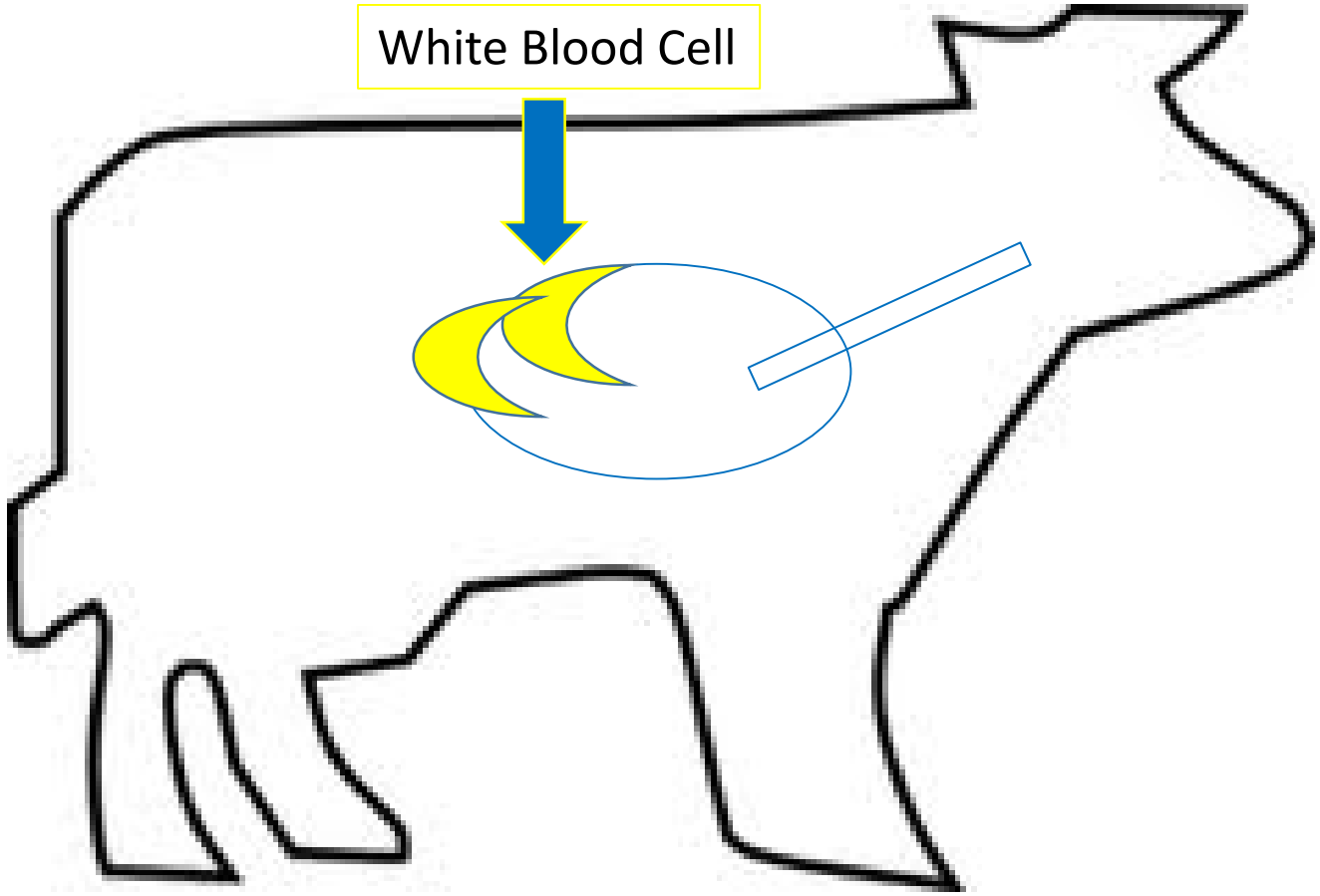
- Bacterial culture grown and leukotoxin isolated
- Immune response to the bacteria and the lukotoxin



Increased #’s of immune cells waiting in the lung to attack the Mannheimia



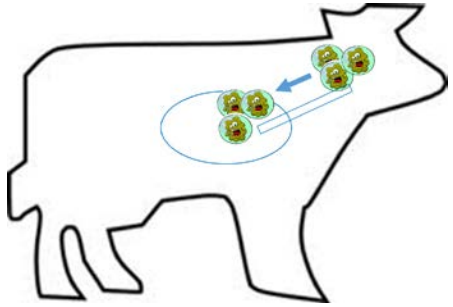
Infection cleared



Importance of Spread of Mannheimia in a group of calves

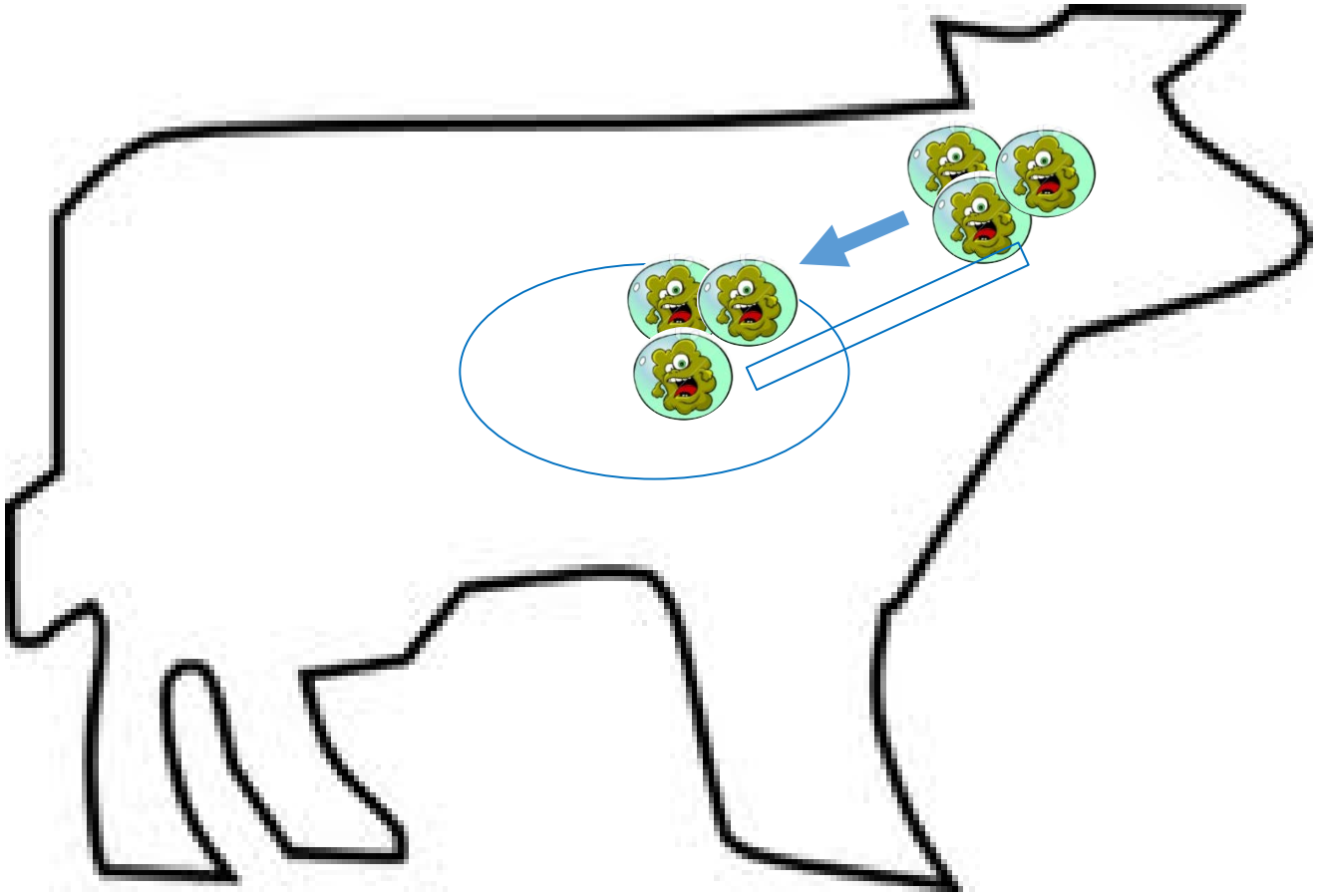
Mannheimia Spread (most common)

- Most infections in the lungs of calves come from the tonsils of that calf



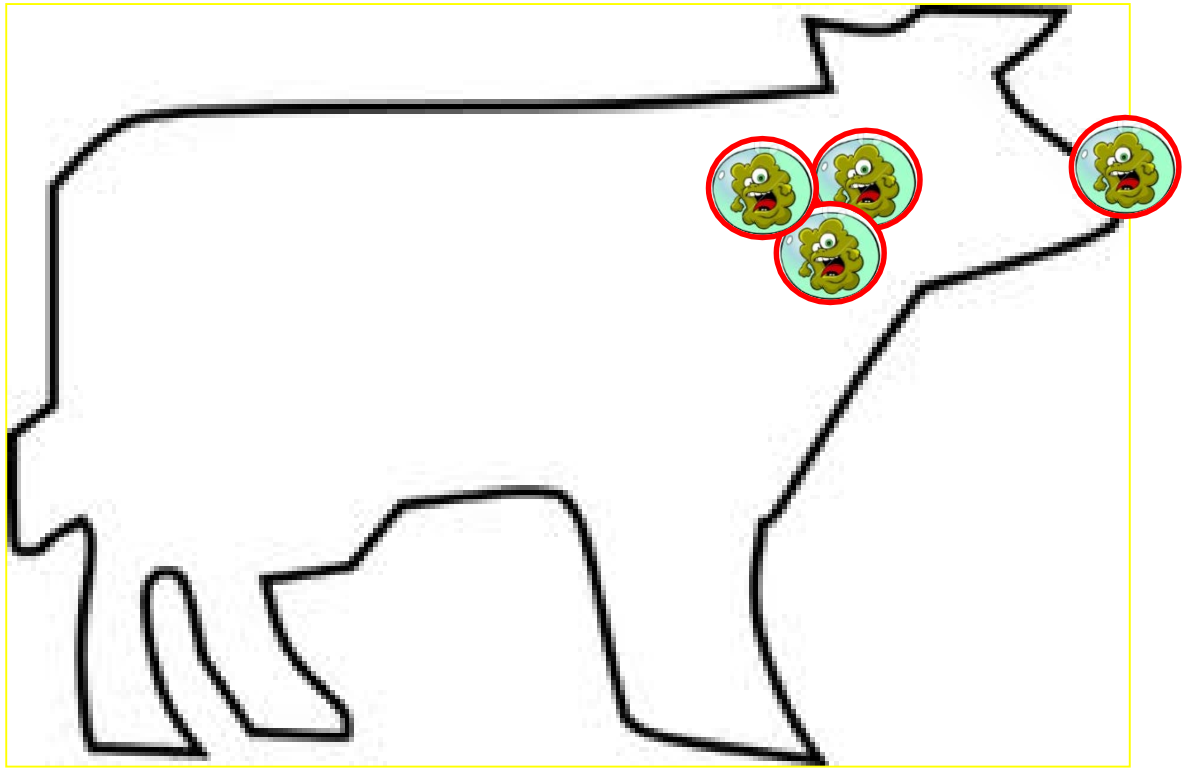
- Most emphasis should be on preventing disease not biosecurity

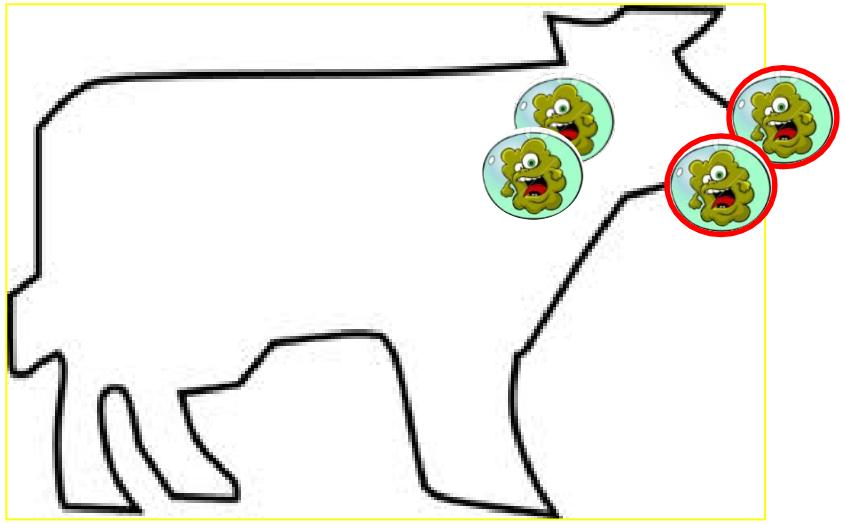
Mannhemia present in the tonsil of a normal calf

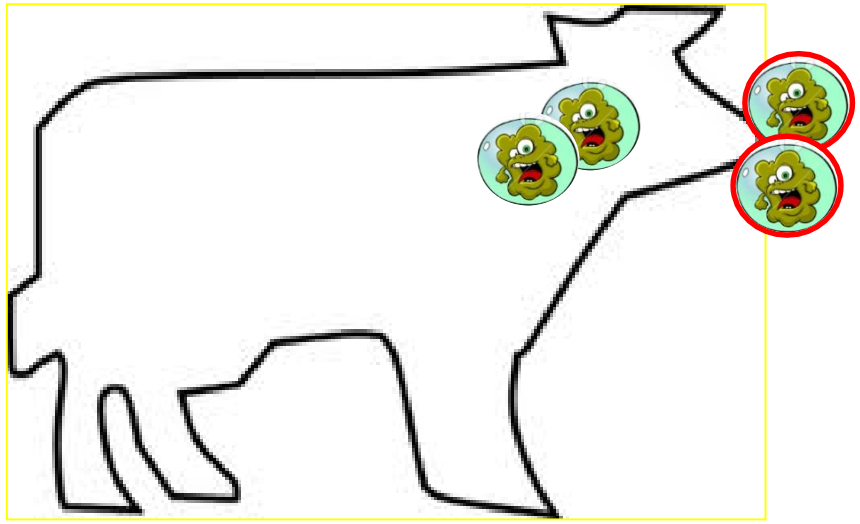


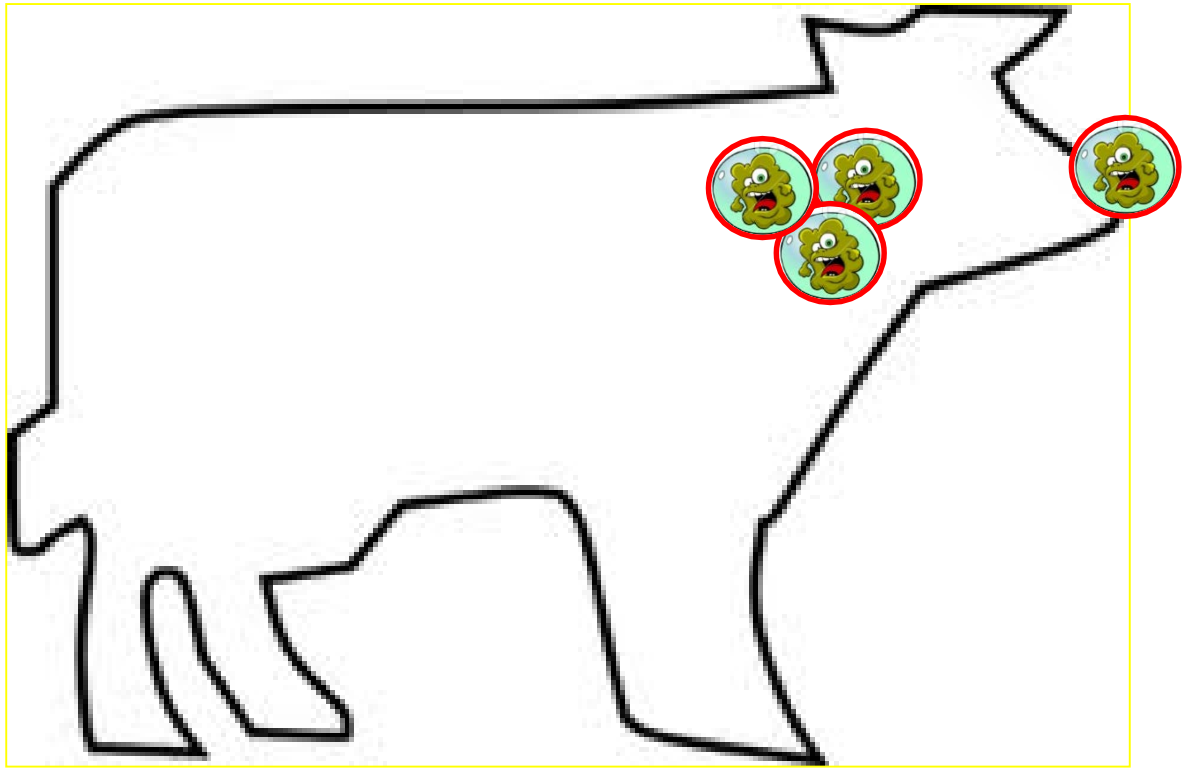
Mannheimia Spread (occasionally)

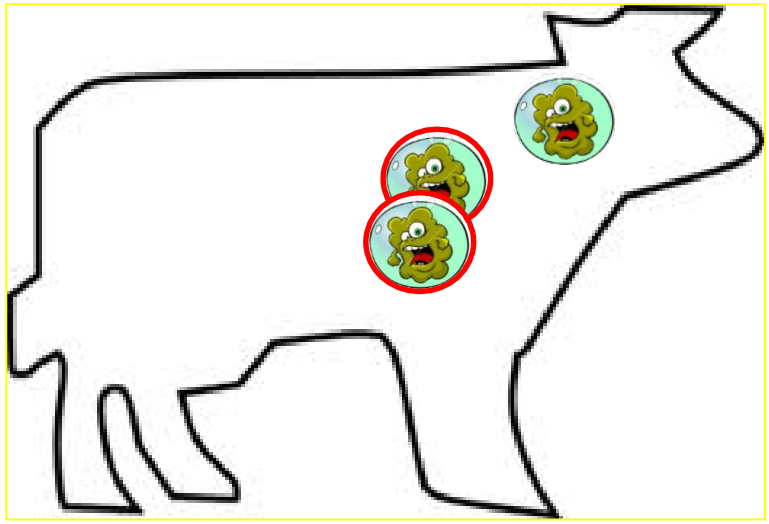
- One calf with a very bad Mannheimia (either production of lots of leukotoxin or resistant to multiple antibiotics spreads from one calf to others

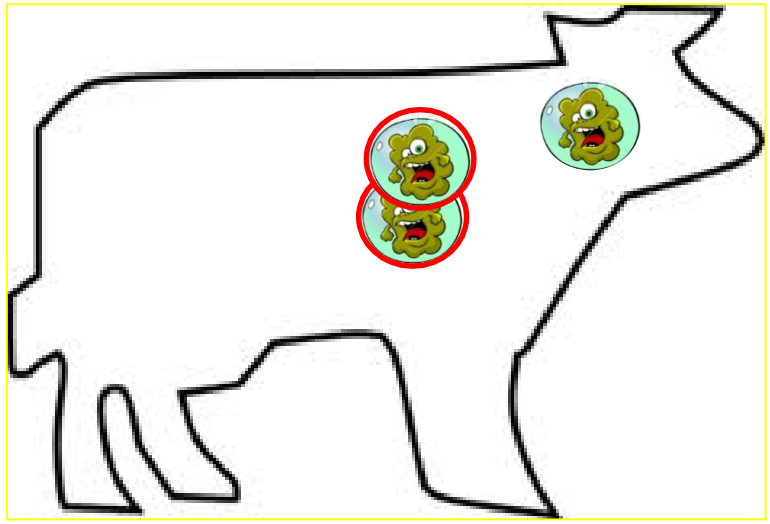












Questions