The Best Way to Fight Disease

Exclusive Patented Technology

Immunity+™

Disease Resistant Genetics

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Immunity+™ won

Innovation Award

Dr. Bonnie Mallard

Department of Pathobiology,

University of Guelph

Almost 100 research papers in referred journals on immune response

Several thousand animals tested in research, beta test & commercial herds

Genetic regulation of the immune system of livestock

22-YR RESEARCH PROGRAM
SEMEX SUPPORTED

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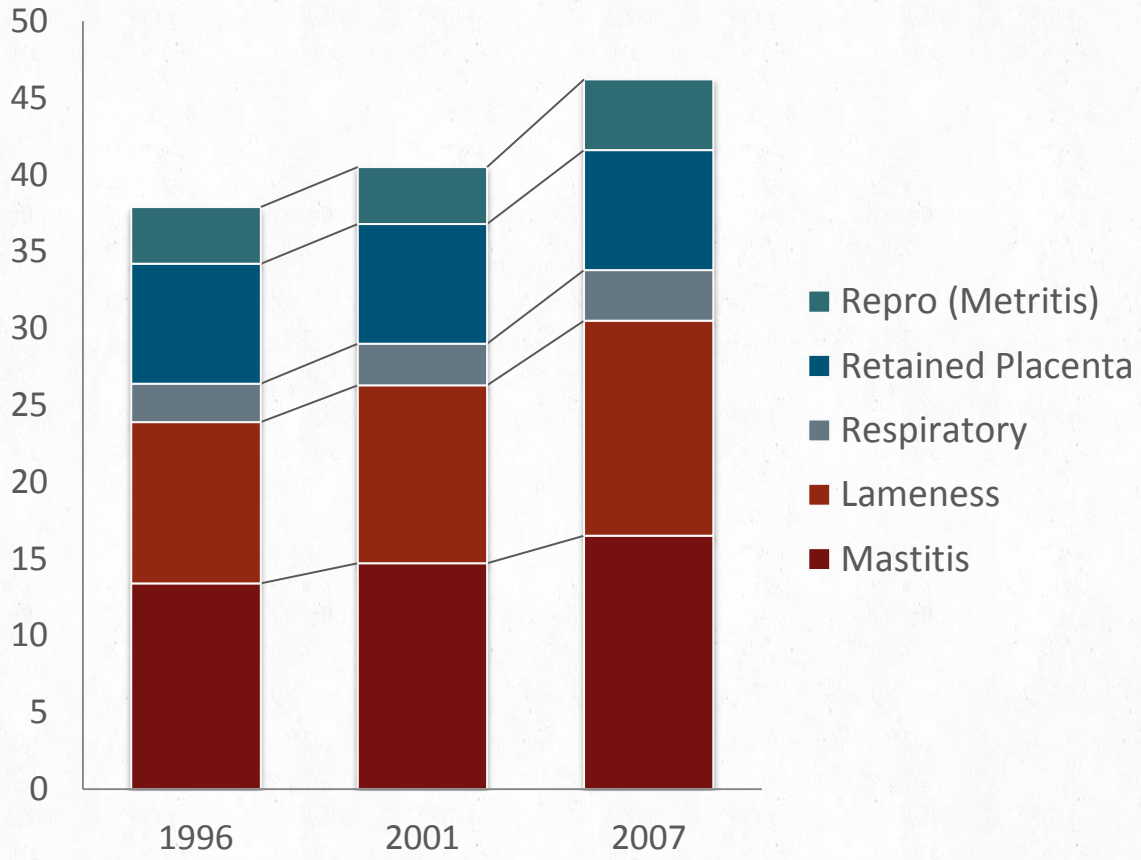
Disease Trends



NAHMS Dairy 2007 Part II: Changes in the Dairy Cattle Industry 1991-2007

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Past Genetic Selection for Health

Few “true” direct health traits

Hope it achieves better health

Selecting an end result

- Productive Life
- Daughter Pregnancy Rate
- Daughter Calving Ease
- SCS

Low heritability traits

Need a Better Approach

Selection for Higher Immunity

It is the ultimate goal.

Even better than direct selection for individual diseases.

A starting point for a healthier dairy

Changes the way dairies will select for health

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What is Immunity?

Bacterial infections

- mastitis, listerosis, brucellosis, E. coli scours, bacterial pneumonia, metritis, digital dermatitis

Others diseases

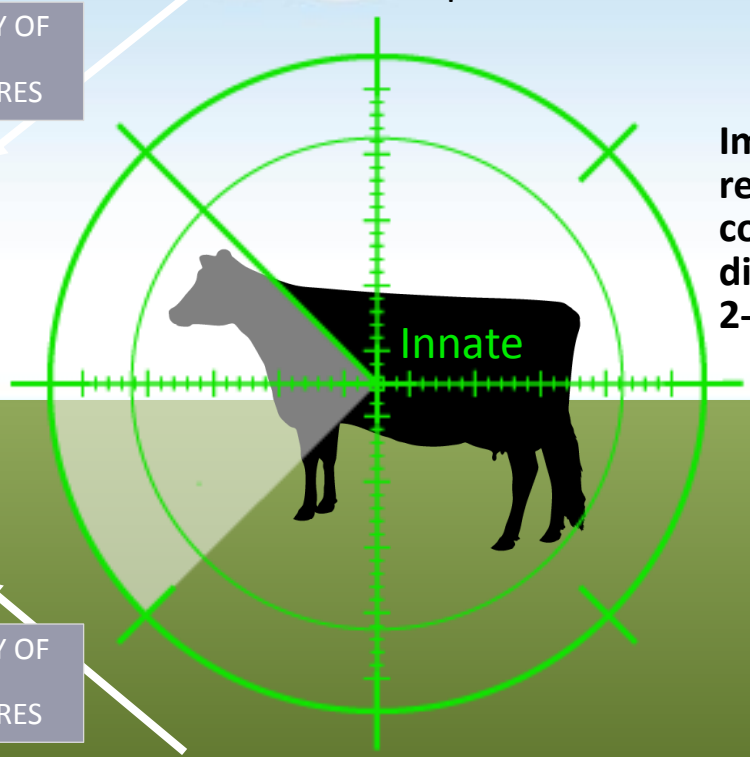
- Parasitic, prion & fungal diseases

Viral & mycobacterial infections

- -viral pneumonia, BVD, IBR, leucosis, foot & mouth, tb, retained placenta, Johne's

MEMORY OF PAST EXPOSURES

Antibody-mediated adaptive immune response



Immune response is controlled & directed by 2-3,000 genes

MEMORY OF PAST EXPOSURES

Cell-mediated adaptive immune response

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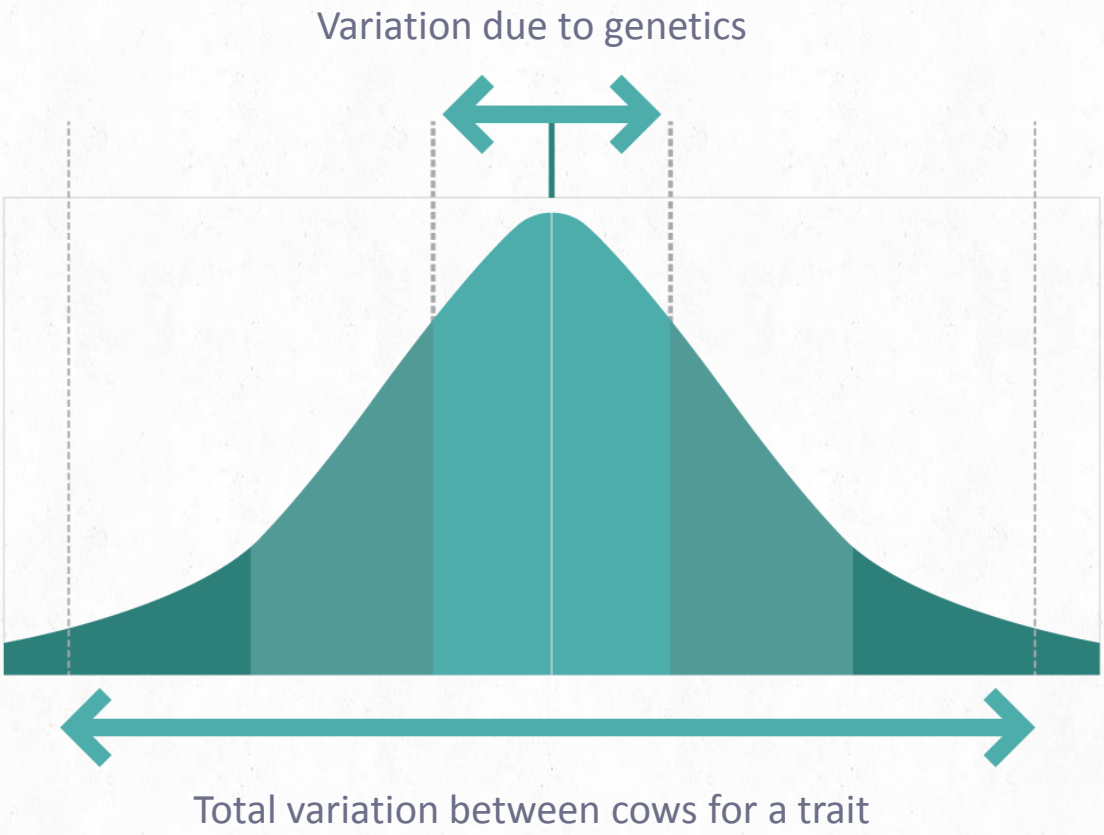
Immunity Genetics

Emerging technology

Immuno-genetics research programs are being initiated at institutions around the world

Heritability

% of total variation that's explained by genetics



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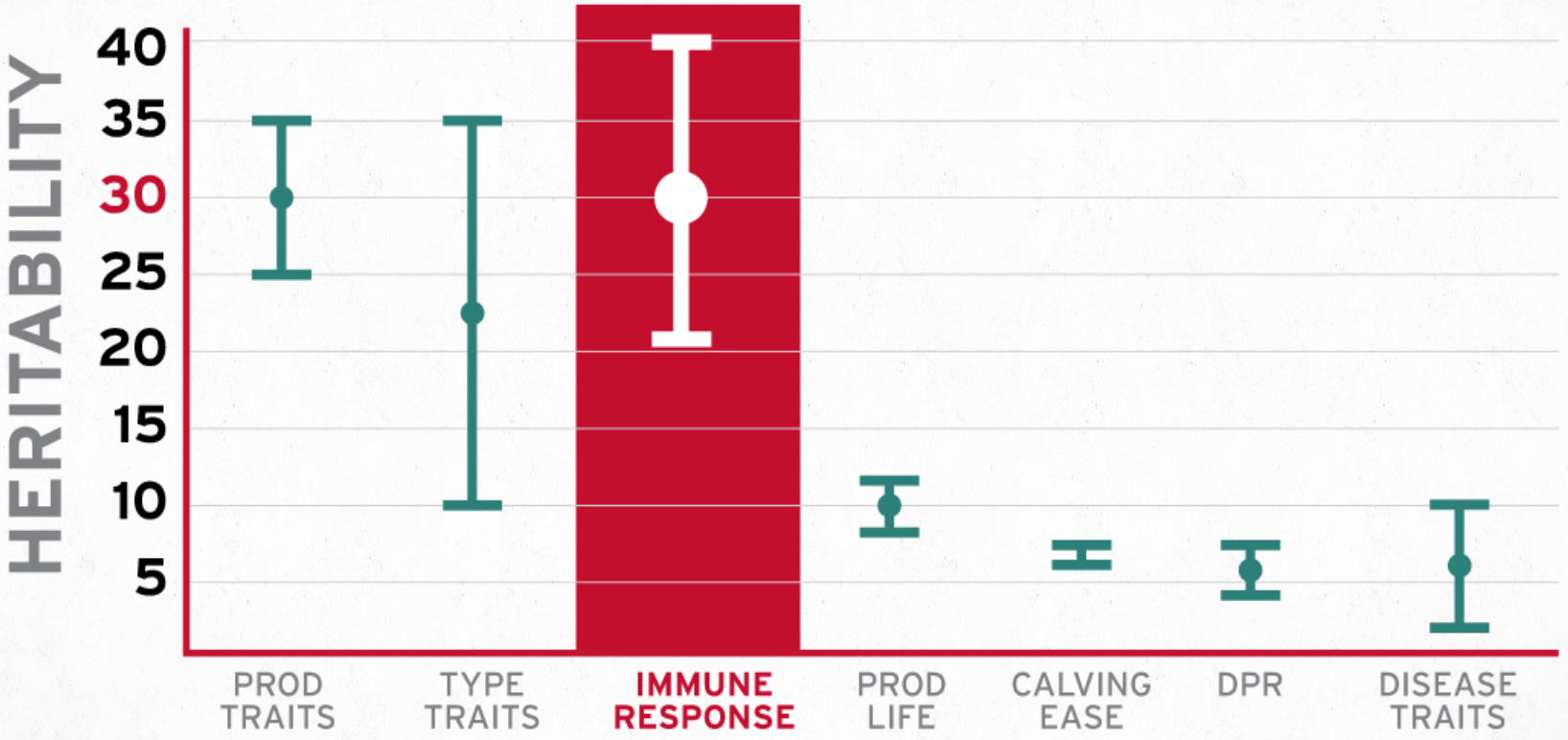
IMMUNE RESPONSE HERITABILITY IS NOW 30%



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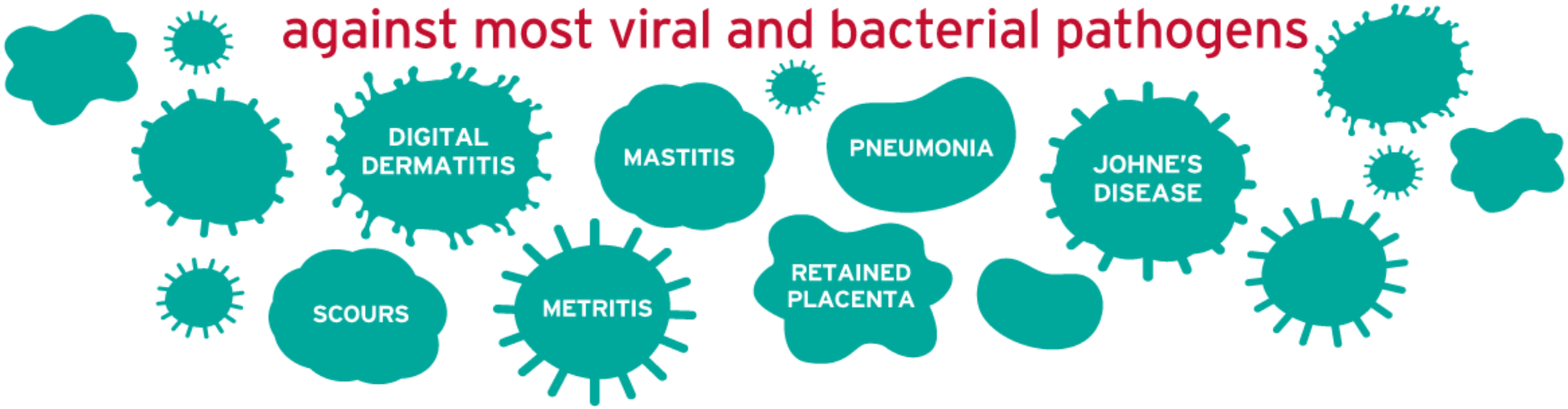
Broad-based Defence Against
Most Viral & Bacterial Infections

High Immune Response Technology

Immunity+™

BROAD-BASED DEFENSE



...and healthier cows have

- LESS METABOLIC DISEASE ie. Ketosis
- FEWER REPRODUCTIVE PROBLEMS
- LESS CHANCE OF CULLING

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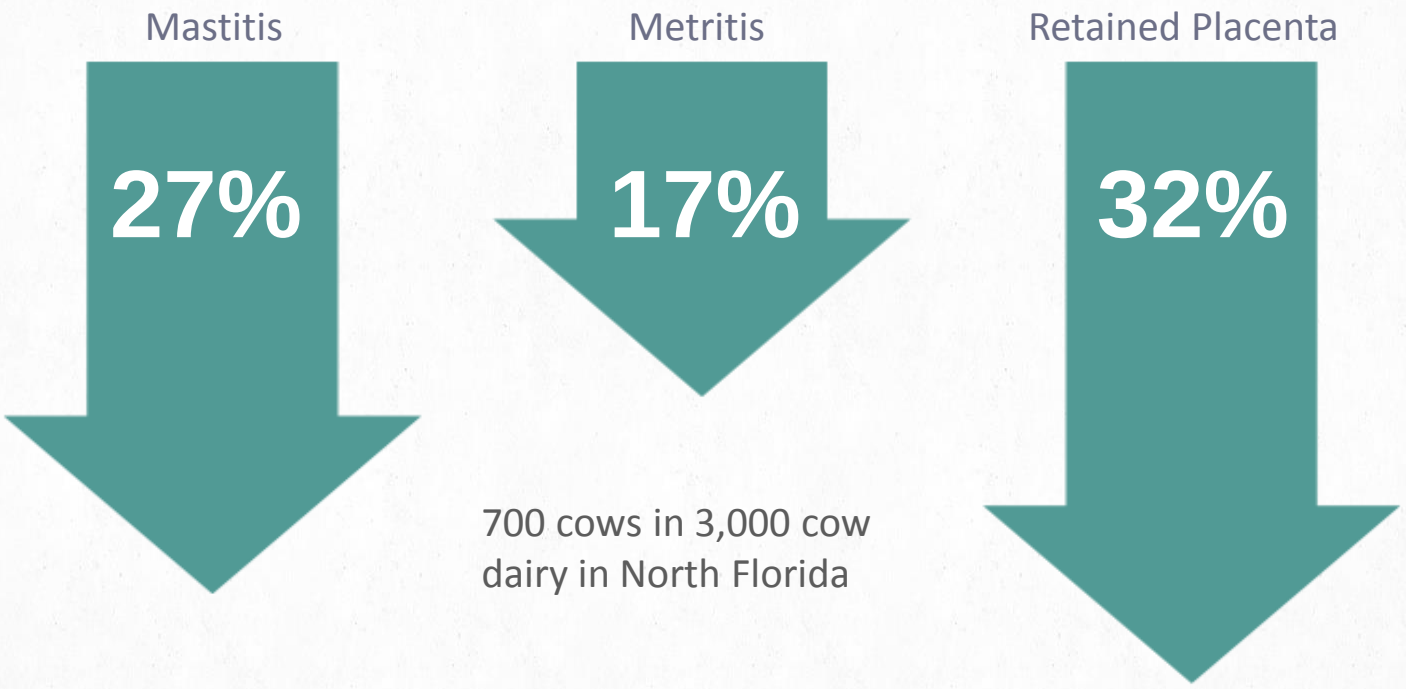
Less Disease

High Immune Responders have Less Disease

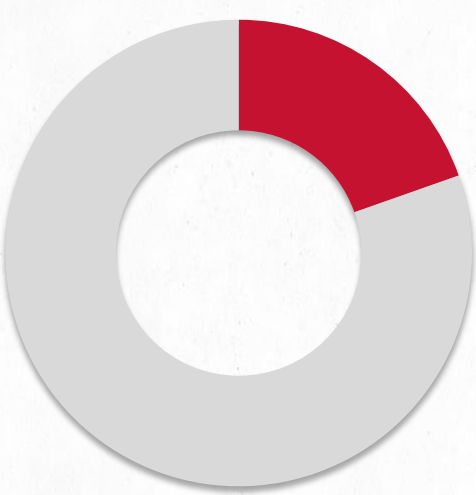


Range in all herds was 19–30% less incidence of disease

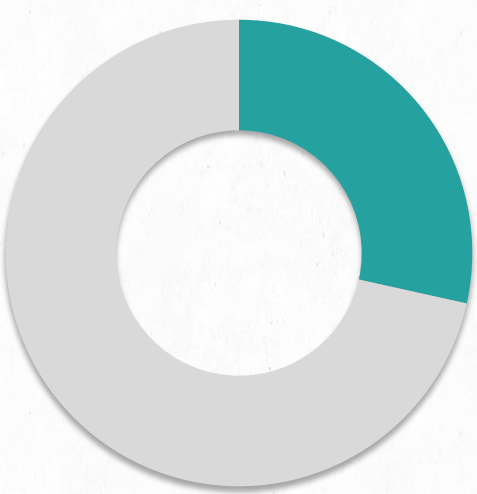
(High responders vs. herd average)

Disease Incidence

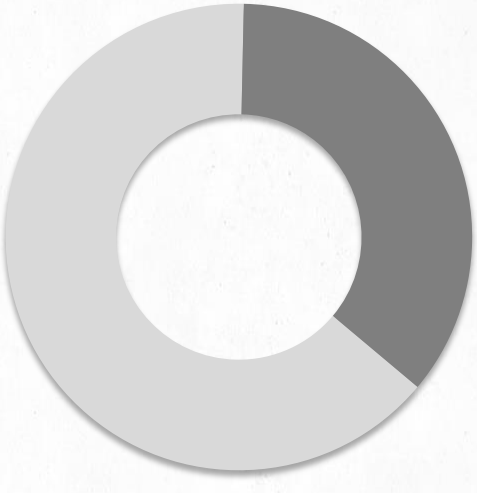
Incidence Rate of Clinical Mastitis in Cows



High Antibody Immune Responders
17.1%



Average Antibody Immune Responders
27.9%



Low Antibody Immune Responders
30.7%

Reference: Thompson-Crispi et al Clin Vaccine Immunol 2012

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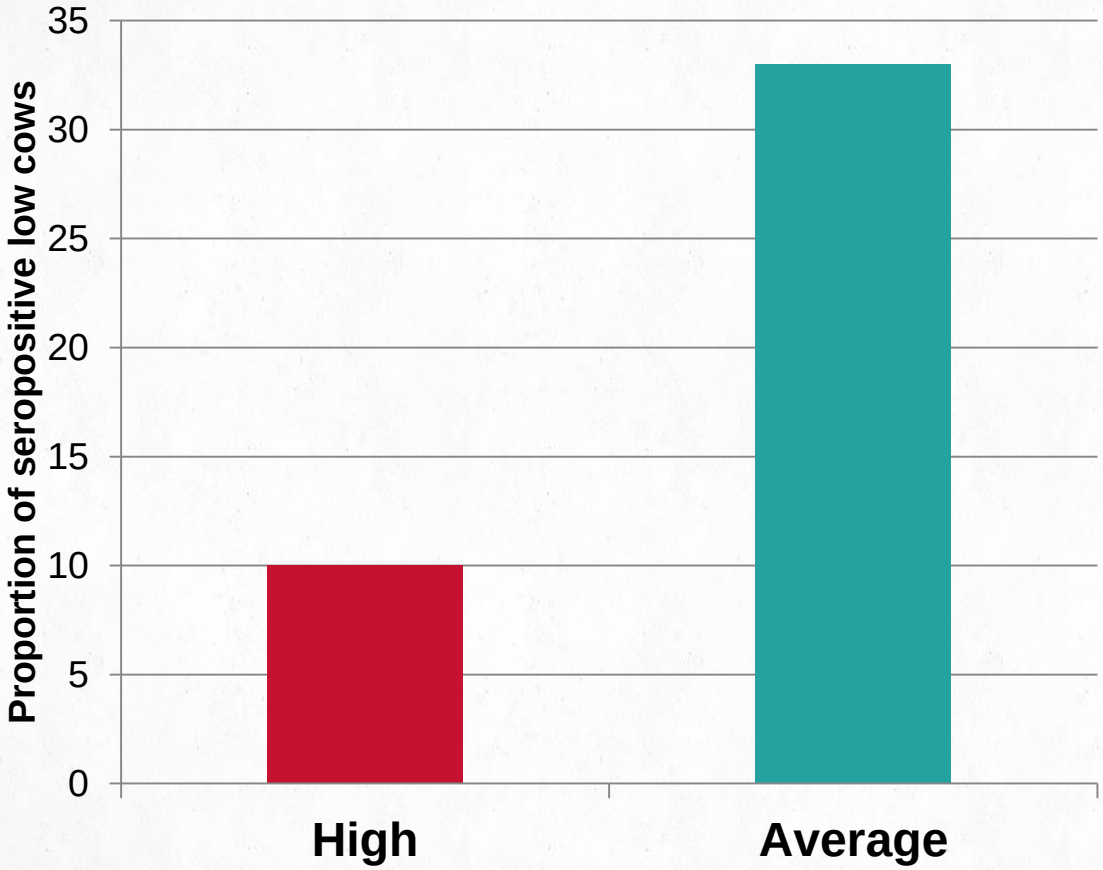
High CMIR = Less Johne's Sero-positive Cows



Categories:

Negative (OD=0- 0.49)

Inconclusive (OD 0.5-0.99)

Positive (OD 1.0-3.49)

Strong Positive (OD>3.5)

P.J. Pinedo, A. Donovan, O. Rae and De la Paz, Proc. Int. Colloq. Paratb., Mn, Aug 9-14, 2009

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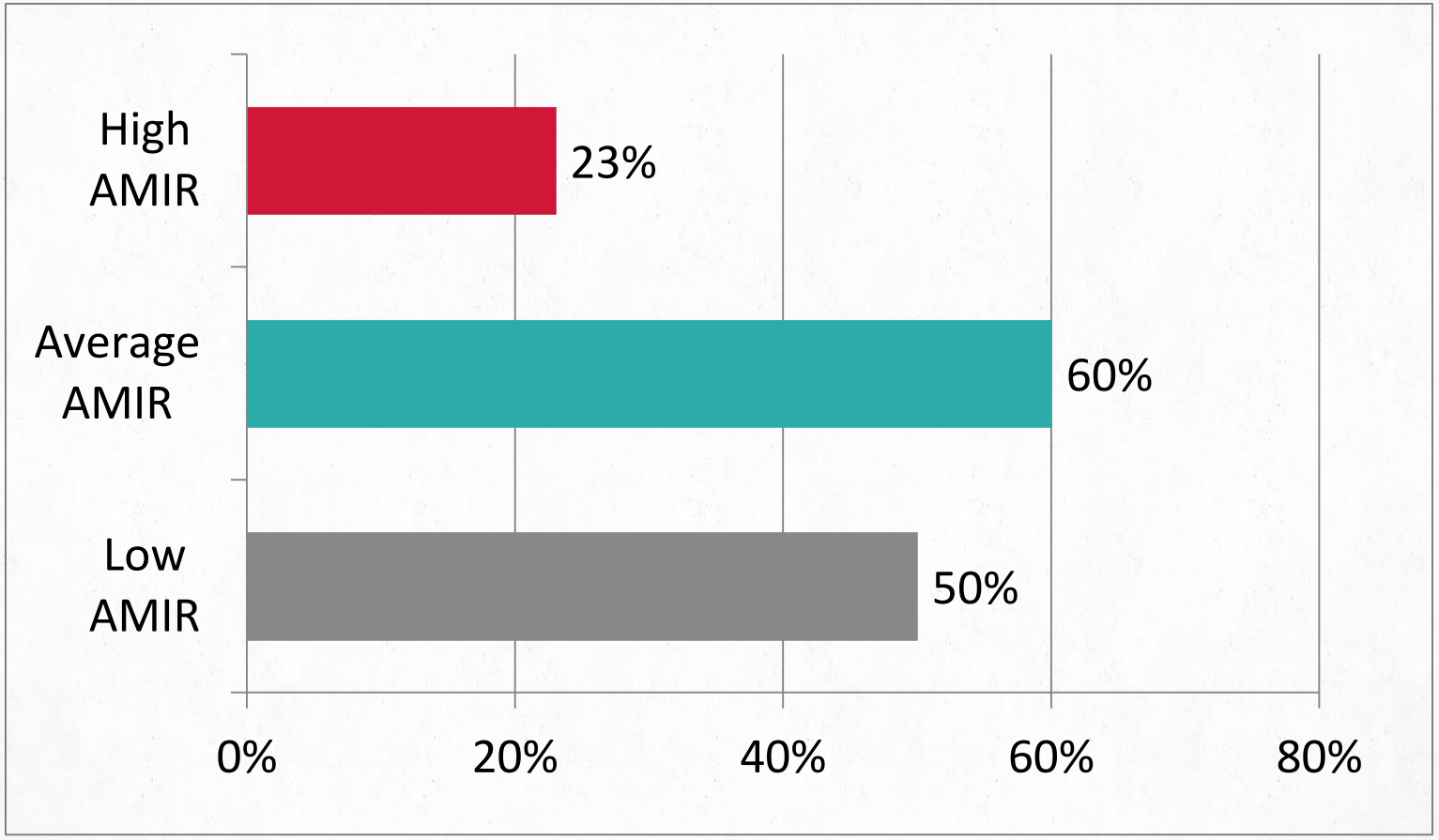
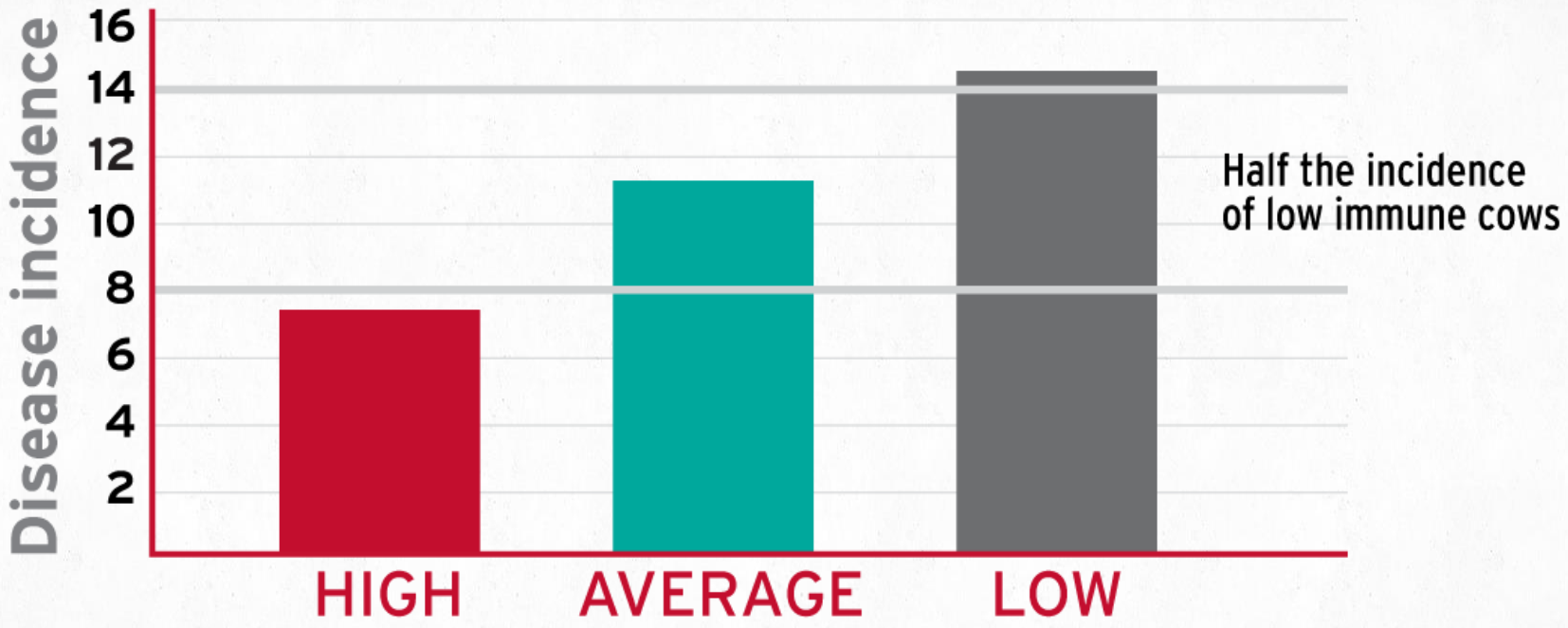
Infectious Digital Dermatitis



Cartwright, S.L. et al 2014

RESEARCH SHOWS
HIGH IMMUNE RESPONSE COWS HAVE LESS DISEASE



Studies across 64 herds in North America.

Wagter, et al. 2000 J. Dairy Sci. 83:488-498; Thompson-Crispi, et al. 2012. J. Dairy Sci. 95:3888-3893; Thompson-Crispi, et al. 2013. Clin Vacc Immuno. 20:106-112.

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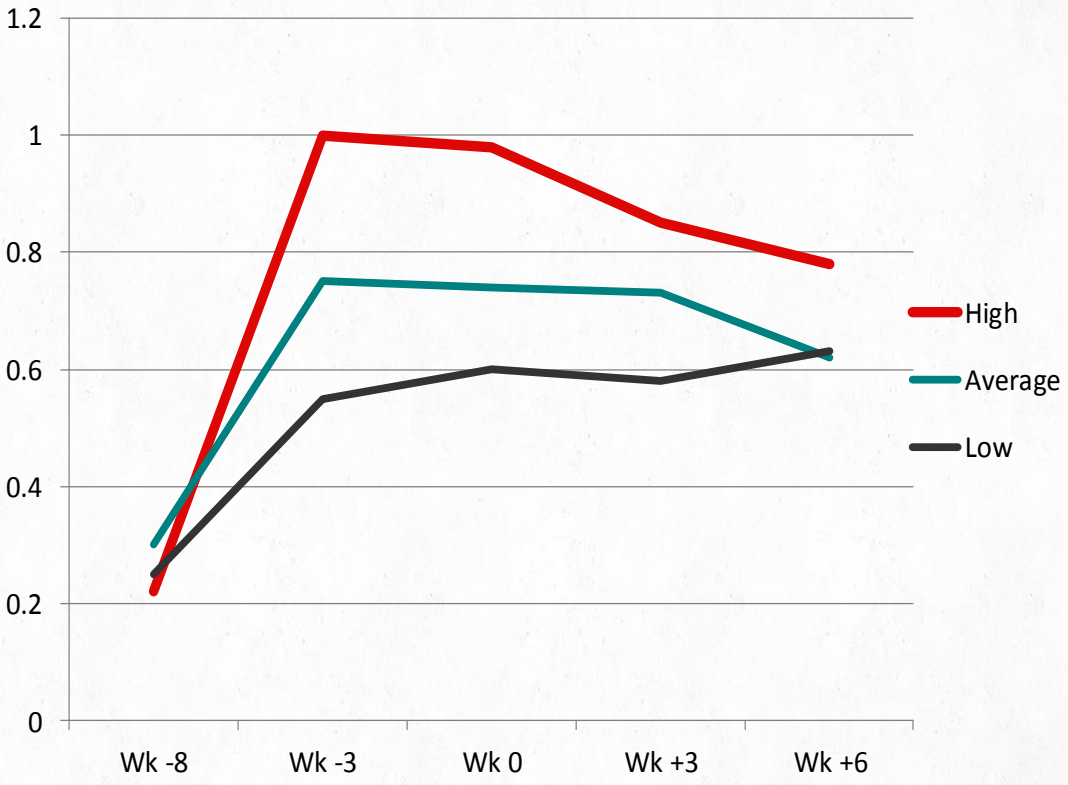
Vaccine Response

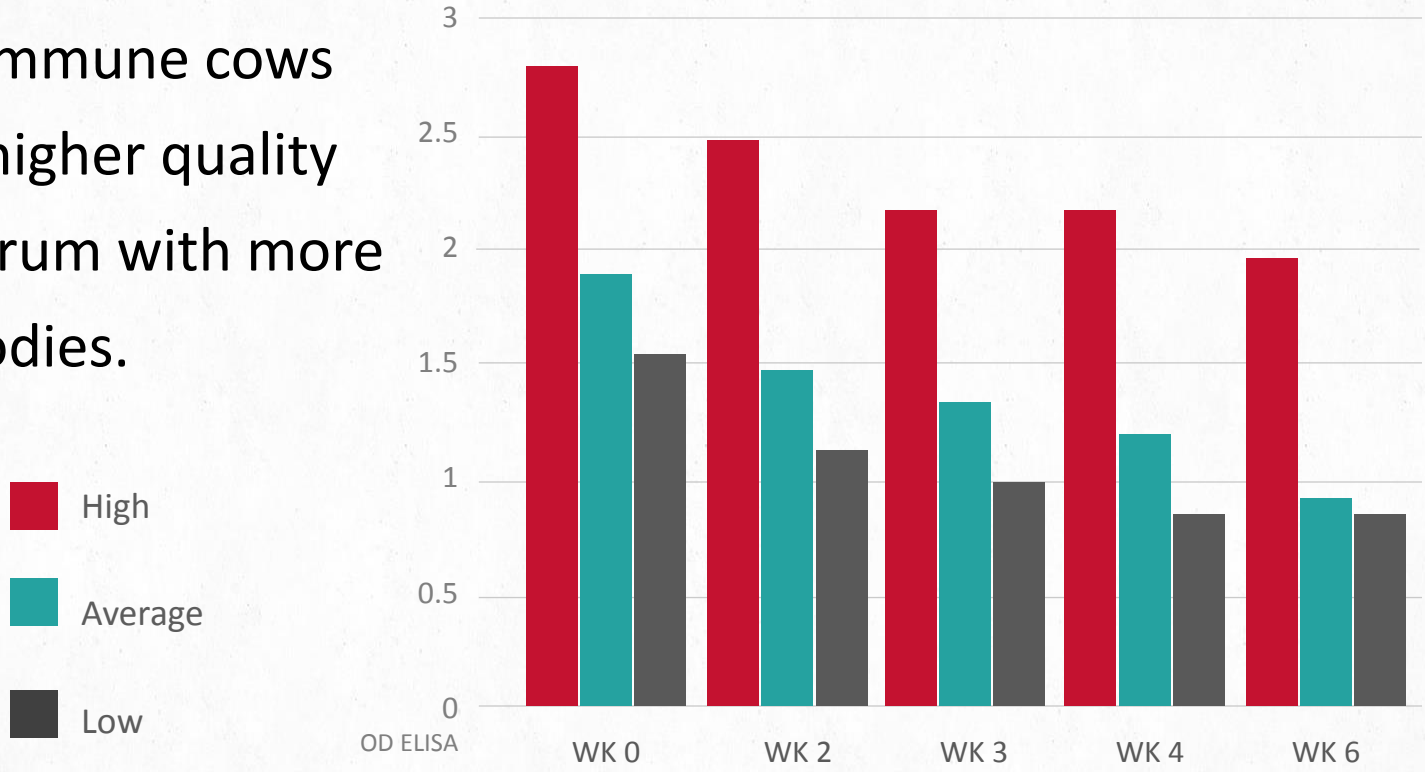
High immune cows respond better to commercial vaccines.



Reference: Wagter & Mallard et al 2000 JDS 83:488

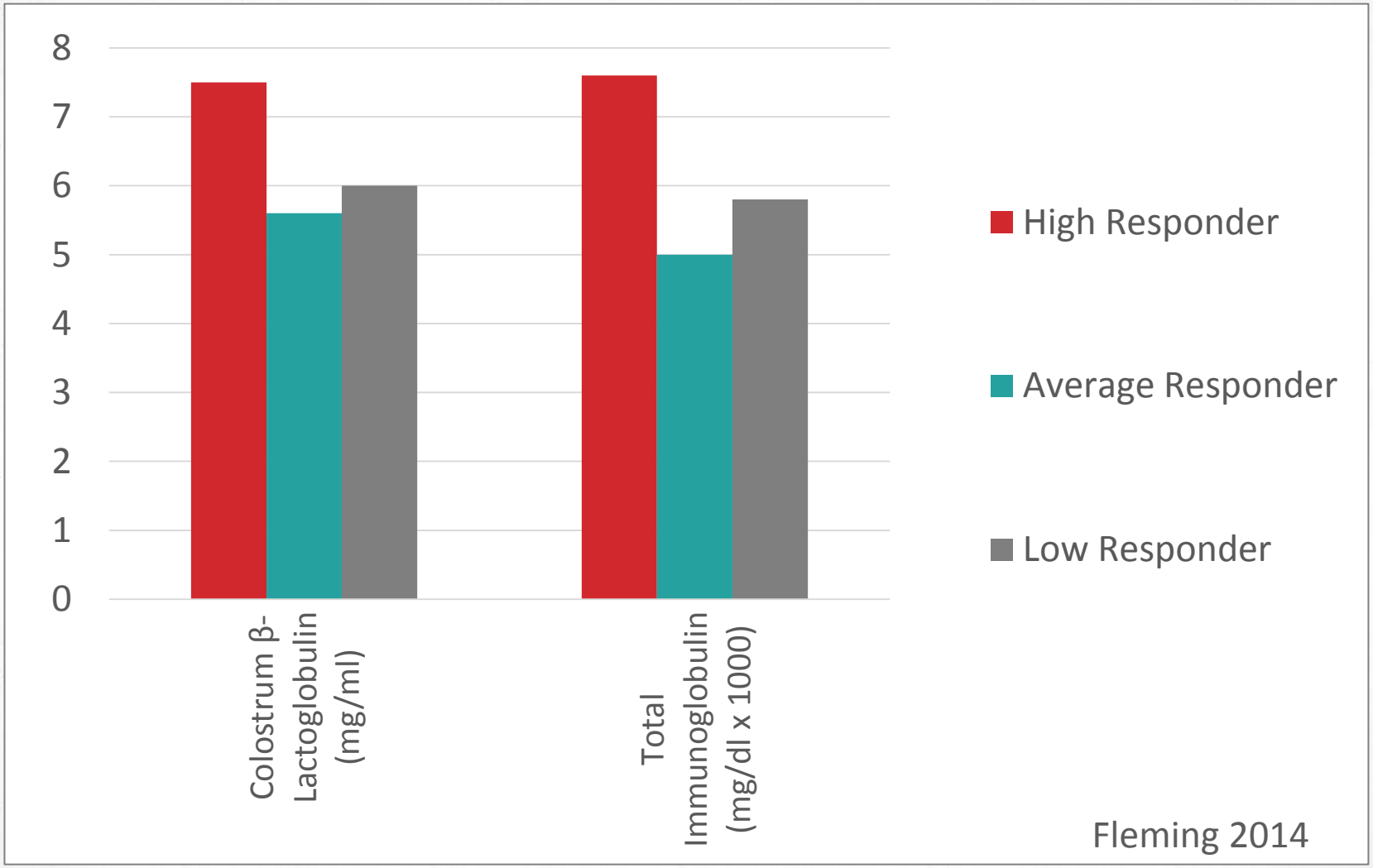
Quality Colostrum

High immune cows have higher quality colostrum with more antibodies.



Wagter & Mallard et al 2000 JDS 83:488

Components of Colostrum



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Economic Value of High Response Cows

HIGH IMMUNE COW

- less disease
- higher quality colostrum
- improved vaccine response
- lower cull rates

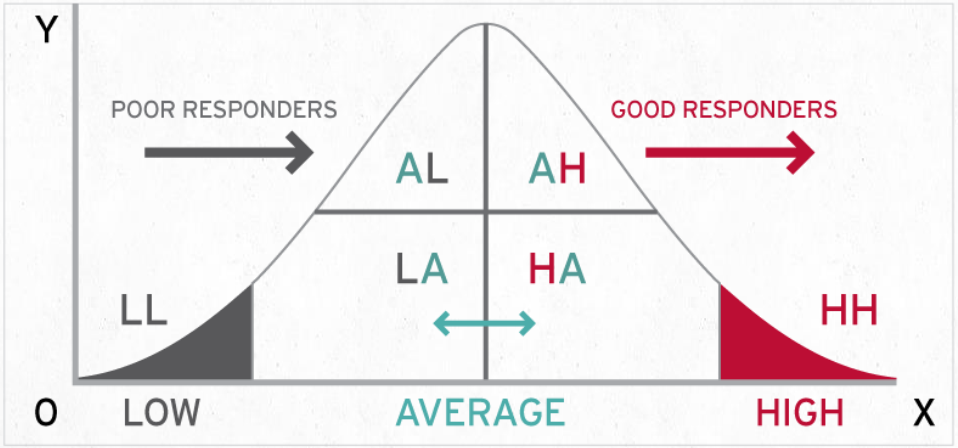
vs.

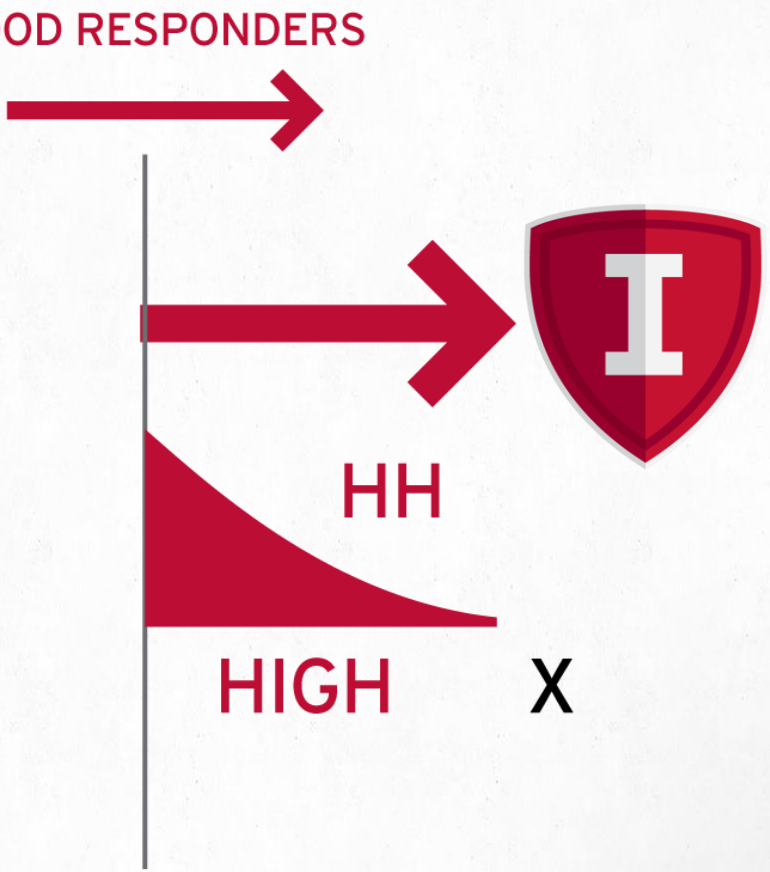
HERD AVERAGE COW

$124 PER COW PER YEAR

Bulls Designated as Immunity+

Approximately 10% of sires





Transmission to Daughters

25%

Heritability of immune response

50%

Proportion of genes that sire passes on to his daughters

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Breeding to an Immunity+ Sire

Dairies Using Immunity+ Sires

Compare disease incidence of daughters of Immunity+ bulls vs. daughters of other bulls

Herd 1	
1,509 cows	1,267 heifers

Herd 2	
1,682 cows	2,031 heifers (no disease data)

Herd 3	
2,450 cows (few Immunity+ daus)	2,724 heifers

Immunity+ Daughters vs. Daughters of Other Sires

Recorded Condition	Herd	Cattle	Immunity+ Daughters	All Other Daughters	Disease Reduction
Pneumonia	Herd 1	Heifers	6.8% 160 heifers	9.1% 1107 heifers	25.3%
Pulm. Treatment (reg./intensive)	Herd 3	Heifers	19.5%/0.9% 231 heifers	27.4%/1.6% 2493 heifers	28.8% / 43.8%
Pneumonia	Middle East Large Dairy	Heifers	0.3% 350 heifers	1.4% 17k heifers	84.6%
Scours	Middle East	Heifers	9.6% 350 heifers	13.6% 17k heifers	29.4%
Pink Eye	Middle East	Heifers	0.3% 350 heifers	3.2% 17k heifers	90.6%

Middle East Dairy: Early indications from their first group of Immunity+ heifers

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Immunity+ Daughters vs. Daughters of Other Sires

Recorded Condition	Herd	Cattle	Immunity+ Daughters	All Other Daughters	Disease Reduction
Mastitis	Herd 1	Lact 1	8.8% 34 cows	15.8% 632 cows	<44.3%
	Herd 2	Lact 1 & 2	11.7% 120 cows	14.5% 988 cows	<19.3%
Metritis	Herd 2	Lact 1 & 2	4.2% 120 cows	5.6% 988 cows	<25.0%
Retained Placenta	Herd 2	Lact 1 & 2	0.0% 120 cows	0.7% 988 cows	<100%

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REAL WORLD DATA, IOWA DAIRY (2015)

1200 MILKING COWS
9% FROM IMMUNITY+ SIRES

DAUGHTERS OF IMMUNITY+ SIRES VS. HERD AVERAGE

- **49%** less cow mortality
- **31%** less cows with disease
  - **41%** less lame cows
  - **57%** less mastitis
  - **57%** less retained placenta

1100 HEIFERS
40% FROM IMMUNITY+ SIRES

DAUGHTERS OF IMMUNITY+ SIRES VS. HERD AVERAGE

- **31%** less heifer mortality
- **20%** less heifer with disease
  - **2%** less diarhea
  - **17%** less pneumonia
  - **57%** less scours

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Immunity Genetics

It is the future of health genetic selection

Researchers are currently developing a genomic test for immunity

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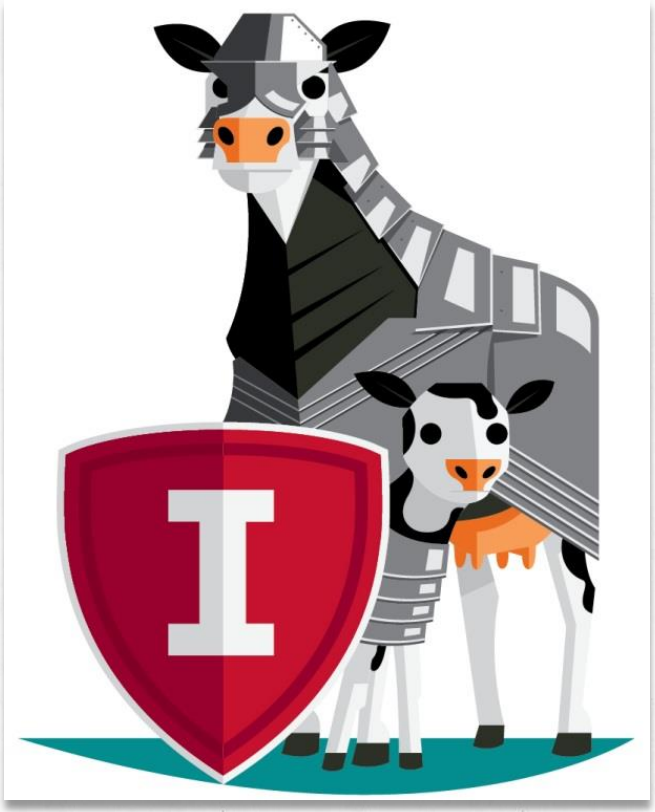
Immunity+ Sires



Immunity+ sires help accentuate disease resistance genes in the population for healthier cows and more profitable dairies.


Immunity+™
Disease Resistant Genetics
A BETTER, MORE NATURAL WAY TO FIGHT DISEASE.
Less disease
Greater response to vaccines
Higher quality colostrum
Longer, healthier lives
More profit for you
SEMEX®
Genetics for Life®