# MAKING THE BEST EVEN BETTER!

Peter van Beek MSc, Director Global Key Accounts


Euroopa Maaelu Arengu Põllumajandusfond: Euroopa investeeringud maapiirkondadesse

# How We Built the Best Health Index

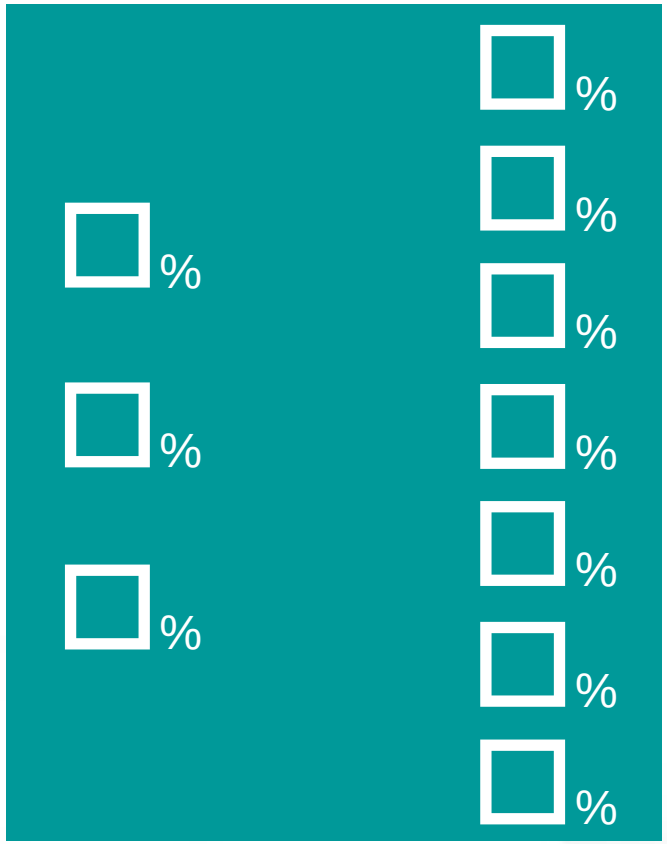
**Optimized for Maximum Reduction in Disease Cost** (using farm data)

## Immunity

**AMIR**
(Antibody-Mediated Immune Response)

**CMIR**
(Cell-Mediated Immune Response)

***New Nitric Oxide**
(Innate Immunity)




## Health Traits

**Mastitis**
- CDCB, Lactanet, Zoetis

**Lameness**
- Lactanet, Zoetis

**Metritis**
- CDCB, Lactanet, Zoetis

**Retained Placenta**
- CDCB, Lactanet, Zoetis

**Ketosis**
- CDCB, Lactanet, Zoetis

**Calf Resp & Scours**
- Zoetis

**Other Health Related Traits**
- CDCB, Lactanet, Zoetis

SEMEX®
Genetics for Life®

# Research Data & Methods

- 100 Herds – 333,618 animals; 67,757 genotyped; 168,661 health events
  - Mastitis, Lameness, RP, Ketosis, DA, Metritis, Fertility Disorder, Pneumonia, Diarrhea, Other
- Calculated total disease cost for each cow (Liang et al., 2017)
- **Optimal Index** derived from a combination of sire's AMIR, CMIR, Nitric Oxide & publicly available proofs for health traits (blend CDCB, Lactanet & Zoetis)
- **Optimal Index** predicts bulls having daughters with lowest disease cost

For comparison purposes:

1. **Current Immunity**
2. **Wellness Traits (WT$)**
3. **Health Trait Index (HTH$)**

4. **Optimal Immunity+** – Optimal prediction from Immunity + health traits

SEMEX® Genetics for Life®

# Immunity/Disease Index Weightings

| HEALTH INDEX | AMIR | CMIR | NO | MAST | LAME | RETP | KETO | METR | DA | RESP | MFEV |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Current Immunity | 63% | 34% | 3% | - | - | - | - | - | - | - | - |
| Wellness (WT$) [1] | - | - | - | 48% | 23% | 5% | 1% | 14% | 6% | 3% | - |
| Health Trait Index (HTH$) [2] | - | - | - | 33% | - | 10% | 5% | 27% | 23% | - | 2% |
| Optimal Immunity+ [3] | 34% | 17% | 3% | 23% | 2% | 4% | 2% | 15% | - | - | - |

[1] Clarifide Plus – Profit Index Fact Sheet https://www.zoetisus.com/animal-genetics/media/documents/clarifide-resources/clarifide-plus-wellness-product-detailer.pdf

[2] CDCB Net Merit 2021 Revision - https://www.ars.usda.gov/ARSUserFiles/80420530/Publications/ARR/nmcalc-2021_ARR-NM8.pdf

[3] Optimal Immunity Index – PL, DPR, Milk Fever, DA included but received no weighting in optimal index

SEMEX® Genetics for Life®

# Disease Reduction

## Daughters of Immunity+ Sires vs Whole Herd

| Health Index | MAST | LAME | RETP | KETO | DA | METR | TOTAL |
|---|---|---|---|---|---|---|---|
| Current Immunity+ | -18% | -31% | -22% | -23% | +6% | +13% | -22% |
| Wellness (WT$) | -11% | -25% | -28% | -21% | -25% | 0% | -15% |
| Health Trait Index (HTH$) | -11% | -30% | -33% | -39% | -36% | -8% | -21% |
| **Optimal Immunity+** | **-26%** | **-31%** | **-25%** | **-42%** | **-15%** | **-6%** | **-29%** |

## High Immunity Genomic Females vs Whole Herd

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Optimal Immunity+** | **-43%** | **-41%** | **-25%** | **-33%** | **-38%** | **-9%** | **-33%** |

SEMEX® Genetics for Life®

# Sire Proof Correlations

| Traits | Current Immunity | Optimal |
|---|---|---|
| LPI | +0.24 | +0.56 |
| Pro$ | +0.24 | +0.58 |
| TPI | +0.26 | +0.59 |
| NM$ | +0.24 | +0.56 |
| DWP$ | +0.12 | +0.50 |
| Wellness (WT$) | -0.01 | +0.53 |
| Milk | +0.05 | +0.10 |
| Fat | +0.19 | +0.38 |
| Protein | +0.15 | +0.31 |
| Conf/PTAT | +0.13 | +0.11 |
| MS/UDC | +0.21 | +0.42 |
| F&L/FLC | +0.04 | -0.01 |
| DS/DC | -0.02 | -0.19 |
| HL/PL | +0.21 | +0.64 |
| DF/DPR | +0.12 | +0.38 |

| Traits | Current Immunity | Optimal |
|---|---|---|
| AMIR | +0.86 | +0.66 |
| CMIR | +0.34 | +0.20 |
| Nitric Oxide (NO) | -0.04 | +0.02 |
| Mastitis | +0.12 | +0.58 |
| Hoof Health | +0.12 | +0.52 |
| Metritis | +0.13 | +0.47 |
| Ketosis | +0.11 | +0.44 |
| RP | +0.09 | +0.35 |
| SCS | +0.16 | +0.63 |
| Mast Resist (MR) | +0.12 | +0.61 |
| Metr Resist (MDR) | +0.09 | +0.38 |
| SCE | +0.08 | +0.27 |
| DCE | +0.21 | +0.50 |
| SSB (reversed) | +0.07 | +0.23 |
| DSB (reversed) | +0.25 | +0.49 |

SEMEX®
Genetics for Life®

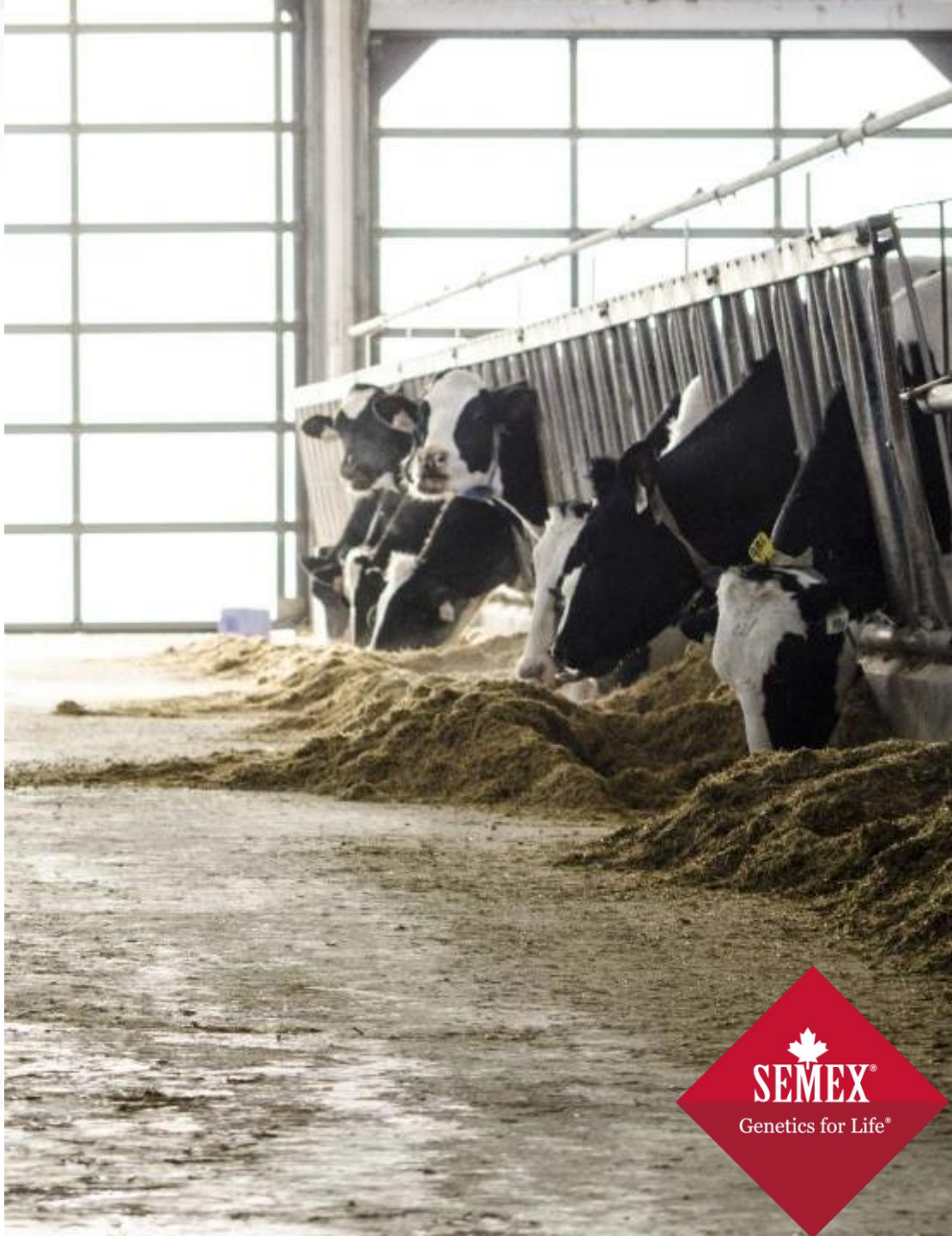
# 3 Types of Immunity

- Adaptive Immunity
- Innate Immunity
- Passive Immunity


SEMEX®
Genetics for Life®

# Adaptive Immunity

- Primed by the Innate component
- Recognizes broad range of microbes & remembers them on subsequent exposure
  - responses become more rapid & stronger
- Specific & long-lasting
- Core of Immunity+ since 2012

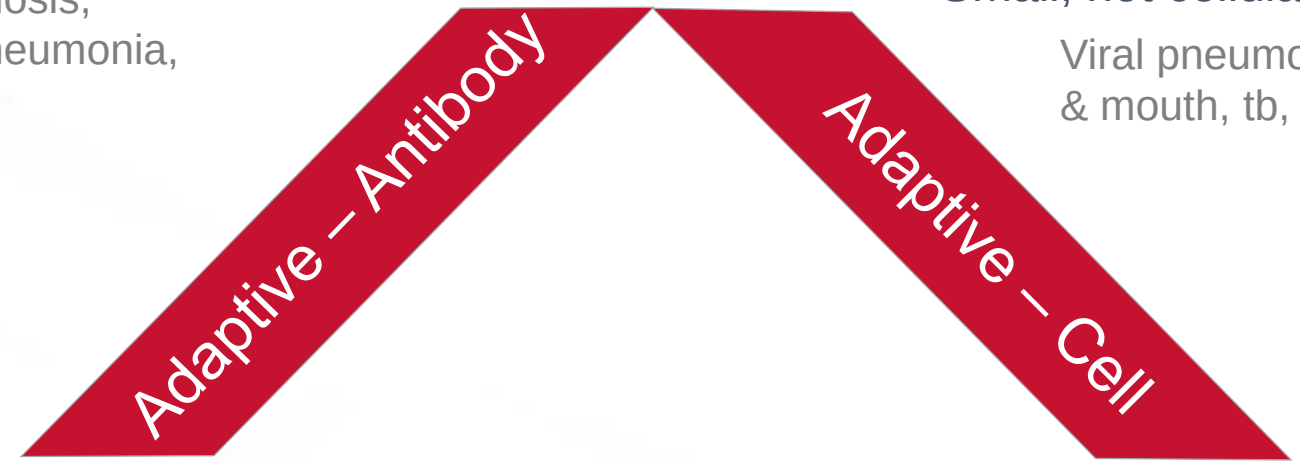


# Adaptive Immunity

## AMIR (Antibody-mediated IR)

- Fights bacterial infections outside the cells
- Attacked primarily by antibodies
- Large, living creatures

Mastitis, listeriosis, brucellosis, e. coli scours, bacterial pneumonia, metritis, digital dermatitis




## CMIR (Cell-mediated IR)

- Fights viral and mycobacterial infections inside the cells
- Attacked primarily by macrophages
- Small, not cellular

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

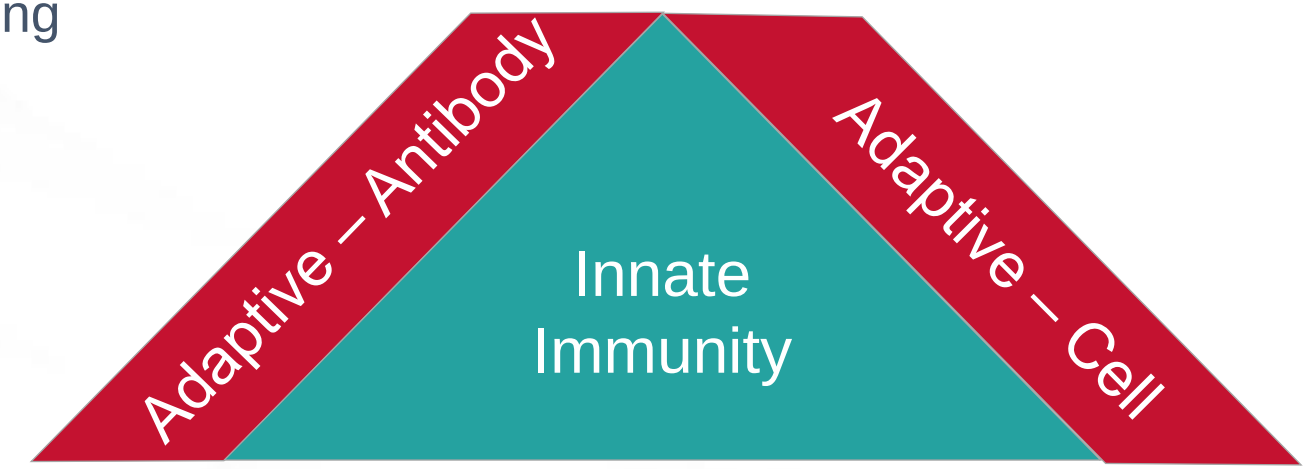
SEMEX® Genetics for Life®

# Innate Immunity

## First line of defense against harmful invading microbes

- No memory of past exposure to pathogen
- Non-specific responses
- Not long-lasting

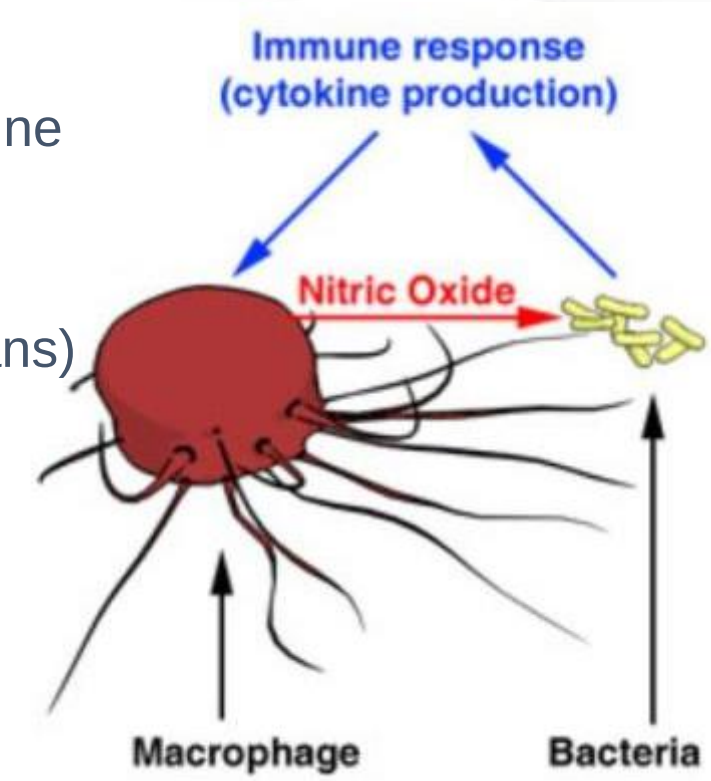
- Initiation of immune response
- Primes an adaptive immune response




SEMEX®
Genetics for Life®

# Nitric Oxide (NO) Response

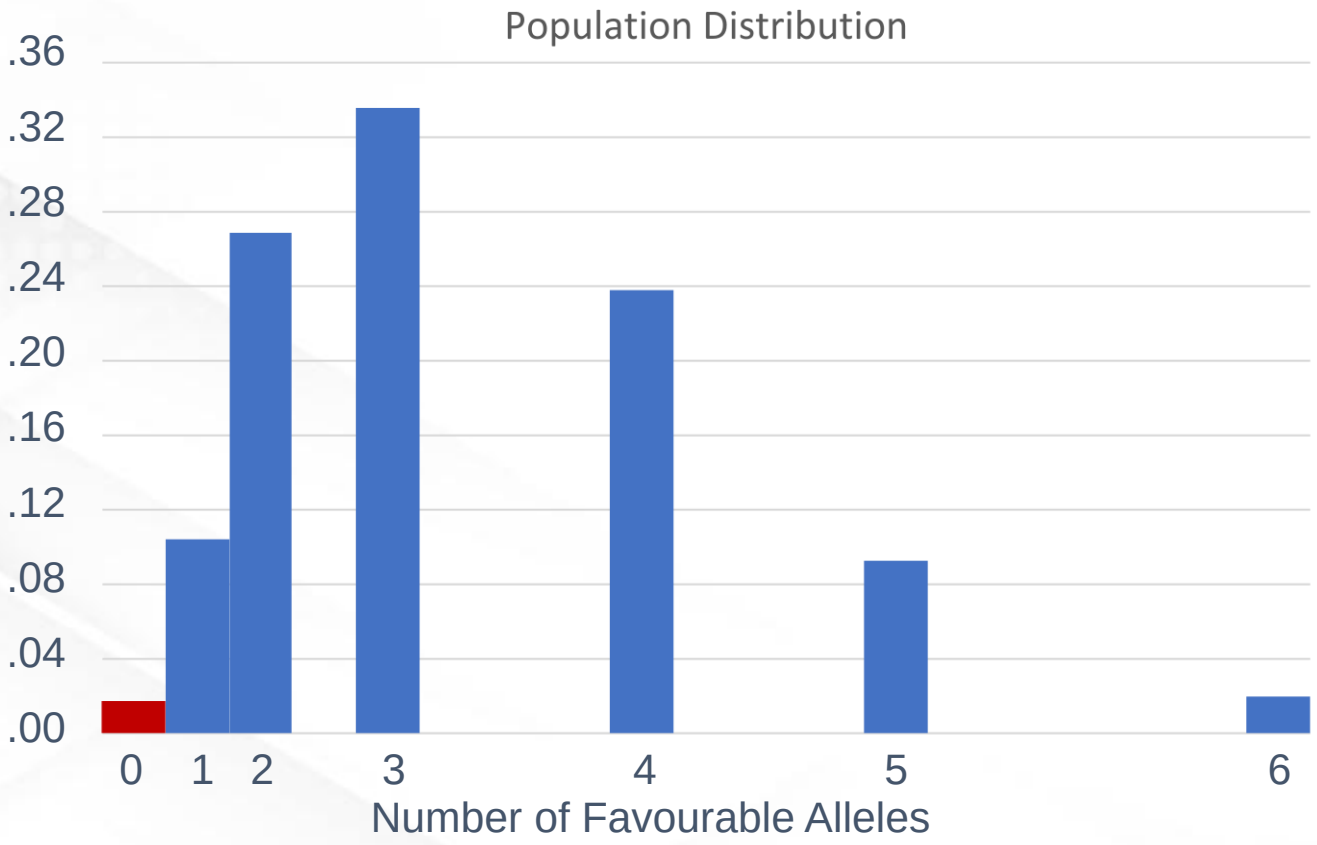
- Nitric oxide (NO) has been shown to be a critical component of immune response, especially the first line of defense known as the innate immune response.
- Nitric Oxide also helps control tumors, autoimmune processes & chronic degenerative diseases (in humans)
- University of Guelph has a patent pending method of measuring Nitic Oxide response in vitro
- Nitric Oxide is very highly heritable (h2 = 0.7)
- Semex has licensed a series of SNPs that identify animals with Nitric Oxide Deficiency (NO-)




Nitric Oxide Research Group, University of Reading

SEMEX
Genetics for Life®

# Nitric Oxide (NO) Response



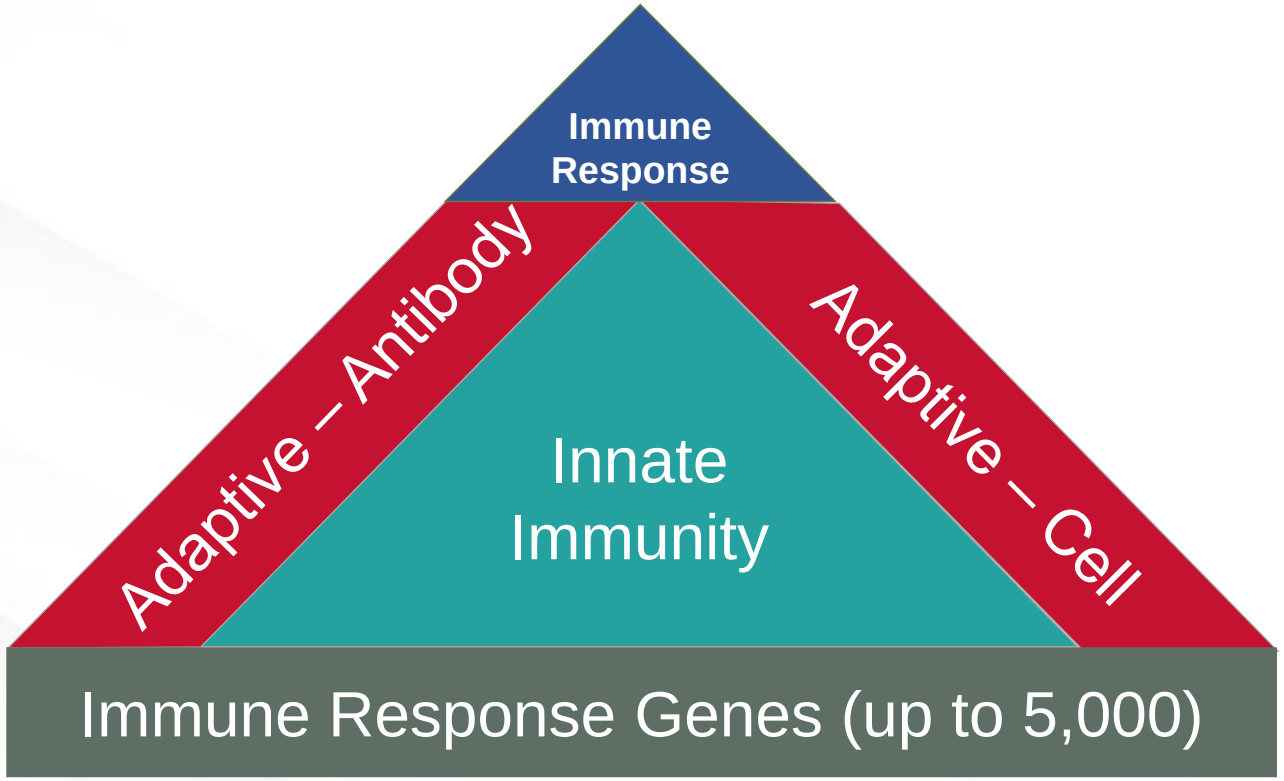

No significant difference was found among animals with at least one favourable allele for Nitric Oxide

| Disease | Lowest Category (~2%) vs Rest |
|---|---|
| Mastitis | +46% |
| Metritis | +41% |
| Lameness | +78% |
| Ketosis | +89% |
| Total | +21% |

Clear association showing that animals who are Nitric Oxide deficient have a significant immune disadvantage.

SEMEX® Genetics for Life®

# Overall Immune Response – Highly Heritable





SEMEX
Genetics for Life®

# Passive Immunity

- Initial and temporary
- Passed through colostrum
- Contains protective features from the dam
- Fades as own immune system matures


CALF HEALTH ≠ COW HEALTH
SEMEX
Genetics for Life®

# Calf Immunity Index Weightings

| Calf Immunity Index | AMIR | CMIR | Resp | Scours | HLIV |
|---|---|---|---|---|---|
| Current Immunity+ | 65% | 35% | - | - | - |
| Optimal Immunity+ Only* | 55% | 45% | - | - | - |
| Optimal Calf Immunity | 48% | 37% | 11% | 4% | - |

* To be used for Elevate females

SEMEX®
Genetics for Life®

# Calf Disease Reduction

## Daughters of Sires 105 or higher vs Whole Herd (calves)

| Calf Immunity Index | Pneumonia | Diarrhea | Total |
|---|---|---|---|
| Current Immunity+ | -25% | -30% | -27% |
| Optimal Immunity Only* | -34% | -29% | -32% |
| Optimal Calf Immunity | -33% | -31% | -32% |

* To be used for Elevate females

SEMEX® Genetics for Life®

# Economic Impact (in USD$)

## Daughters of Immunity+ Sires vs. Whole Herd

| | MAST | LAME | RETP | KETO | DA | METR | OTHER* | Total |
|---|---|---|---|---|---|---|---|---|
| Disease Reduction (>=105) | -25.6% | -31.4% | -24.9% | -42.4% | -15.2% | -6.4% | | |
| Population Frequency (NAHMS) | 24.8% | 16.8% | 4.5% | 4.2% | 2.2% | 6.9% | | |
| Cost of Disease 1st Lact (Liang et al., 2017) | $325.76 | $185.10 | $150.41 | $77.00 | $432.48 | $171.69 | | |
| Cost of Disease 2nd+ Lacts (Liang et al., 2017) | $426.50 | $333.17 | $313.49 | $180.91 | $639.51 | $262.65 | | |
| Savings 1st Lact | $20.68 | $9.76 | $1.69 | $1.37 | $1.45 | $0.76 | | |
| Savings/Lact: 2nd+ Lacts | $27.08 | $17.58 | $3.51 | $3.22 | $2.14 | $1.16 | | |
| **Savings Lifetime (2.8 Lacts)** | **$69.42** | **$41.40** | **$8.01** | **$7.17** | **$5.30** | **$2.85** | **$13.30** | **$147.45**<br>**$23/pt(-100)** |

* Includes calf diseases, vaccine response effectiveness and higher quality colostrum

SEMEX® Genetics for Life®

# Economic Impact (in USD$)

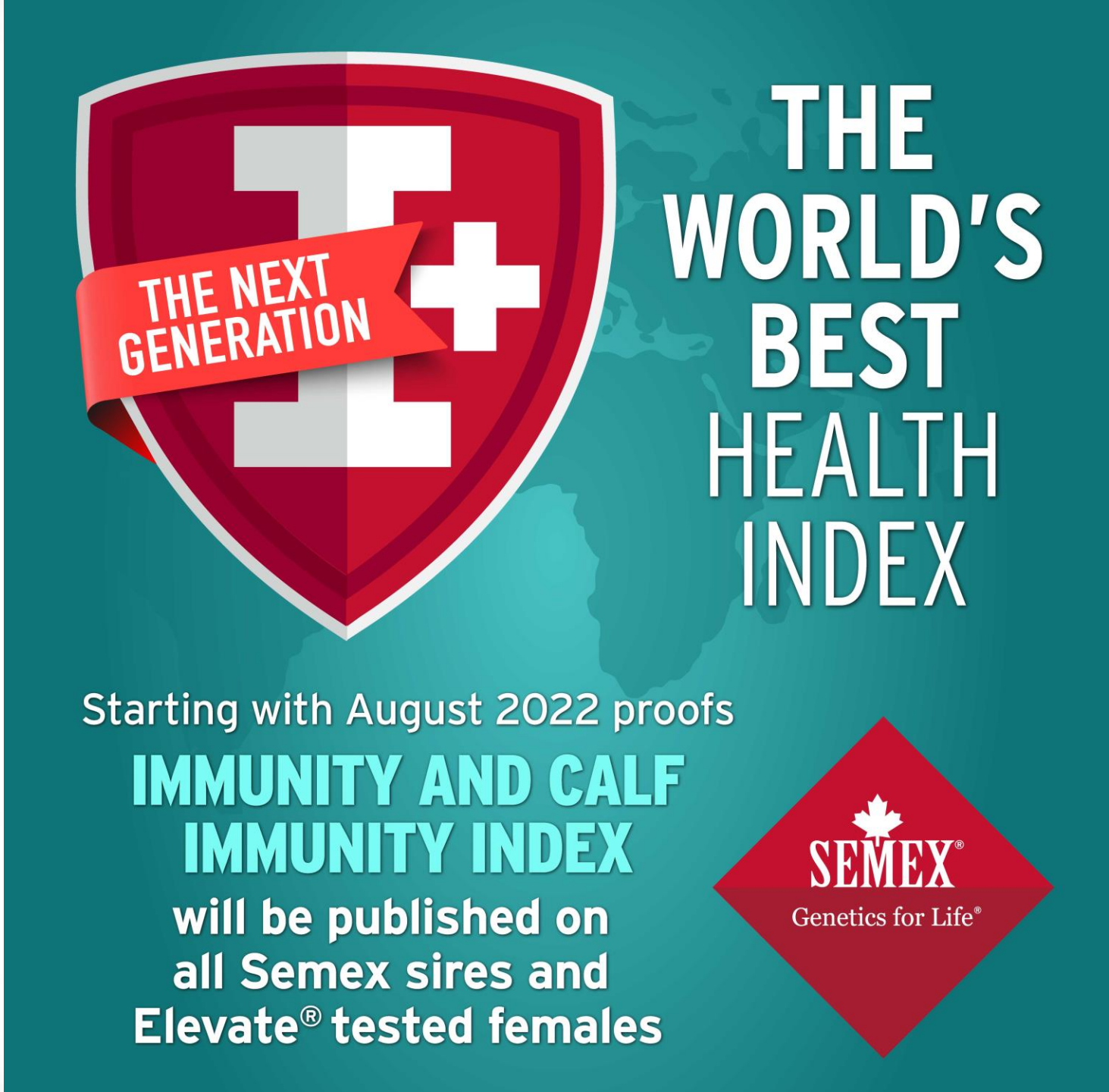
## High Immunity Genomic Females vs. Whole Herd

| | MAST | LAME | RETP | KETO | DA | METR | OTHER* | Total |
|---|---|---|---|---|---|---|---|---|
| Reduction in females 105+ | -42.6% | -41.2% | -25.3% | -33.4% | -38.2% | -8.9% | | |
| Population Frequency (NAHMS) | 24.8% | 16.8% | 4.5% | 4.2% | 2.2% | 6.9% | | |
| Cost of Disease 1st Lact (Liang et al., 2017) | $325.76 | $185.10 | $150.41 | $77.00 | $432.48 | $171.69 | | |
| Cost of Disease 2nd+ Lacts (Liang et al., 2017) | $426.50 | $333.17 | $313.49 | $180.91 | $639.51 | $262.65 | | |
| Savings 1st Lact | $34.42 | $12.81 | $1.71 | $1.08 | $3.63 | $1.05 | | |
| Savings/Lact: 2nd+ Lacts | $45.06 | $23.06 | $3.57 | $2.54 | $5.37 | $1.61 | | |
| **Savings Lifetime (2.8 Lacts)** | **$115.52** | **$54.32** | **$8.14** | **$5.65** | **$13.31** | **$3.96** | **$16.09** | **$216.99**<br>**$33/pt(-100)** |

* Includes calf diseases, vaccine response effectiveness and higher quality colostrum

SEMEX® Genetics for Life®

- **Immunity Index** published on all males & Elevate females
- **Calf Immunity Index** published on all males & Elevate females
- Fixed base starting with bulls born 2014 to 2016
  - Published on RBV scale (100 mean – 5 standard deviation)
  - Change base when U.S. changes their base (next change in 2025)
- Bulls receive Immunity+ when Immunity Index >= 105 and Calf Immunity Index >= 100
- Bulls must requalify for Immunity+ each proof run



# Sire Proofs for Immunity & Calf Immunity

## Pursuit PINE-TREE-I PURSUIT

**0200HO11186 IMAX x PROFIT x SUPERSIRE**

ROBOTREADY

SILVERRIDGE V IMAX
PINE-TREE 9882 PROF 7019 VG-86-4YR-USA
S-S-I PARTYROCK PROFIT
OCD SUPERSIRE 9882 VG-86-2YR-USA DOM
SEAGULL-BAY SUPERSIRE
OCD ROBUST SHIMMER EX-90-2E-USA DOM

WESTCOAST PSUIT LAUMAB 8996
DAUGHTER

**GMACE LPI +3548 PRO$ 3061**

DPF RDF BLF CNF BYF CVF HH1F HH2F HH3F HH4F HH5F HH6F HCDF

Reg. #: HOCANM12857690 aAa: 243156 DMS: 234
Born: 08/03/2017 Kappa Casein: AA Beta Casein: A1A2

**PRODUCTION** 62 Herds 217 Daughters 87% Rel GMACE 22*APR

| Milk kg | Fat kg | Fat % | Protein kg | Protein % |
|---|---|---|---|---|
| **1499** | **97** | **+0.32** | **74** | **+0.21** |

| HEALTH & REPRODUCTION | | IMMUNITY | 107 |
|---|---|---|---|
| Herd Life | 106 | Calf Immunity | 103 |
| Somatic Cell Score | 104 | Calving Ability | 102 |
| Daughter Fertility | 103 | Daughter Calving Ability | 110 |
| Body Condition Score | 100 | Milking Speed | 105 |
| Mastitis Resistance | 105 | Milking Temperament | 103 |
| Feed Efficiency | 105 | Metabolic Disease Resistance | 97 |

**CONFORMATION** 12 Herds 20 Daughters 87% Rel GEBV 22*APR

| | | | |
|---|---|---|---|
| Conformation | 7 | Dairy Strength | 6 |
| Mammary System | 3 | Rump | 2 |
| Feet & Legs | 9 | | |

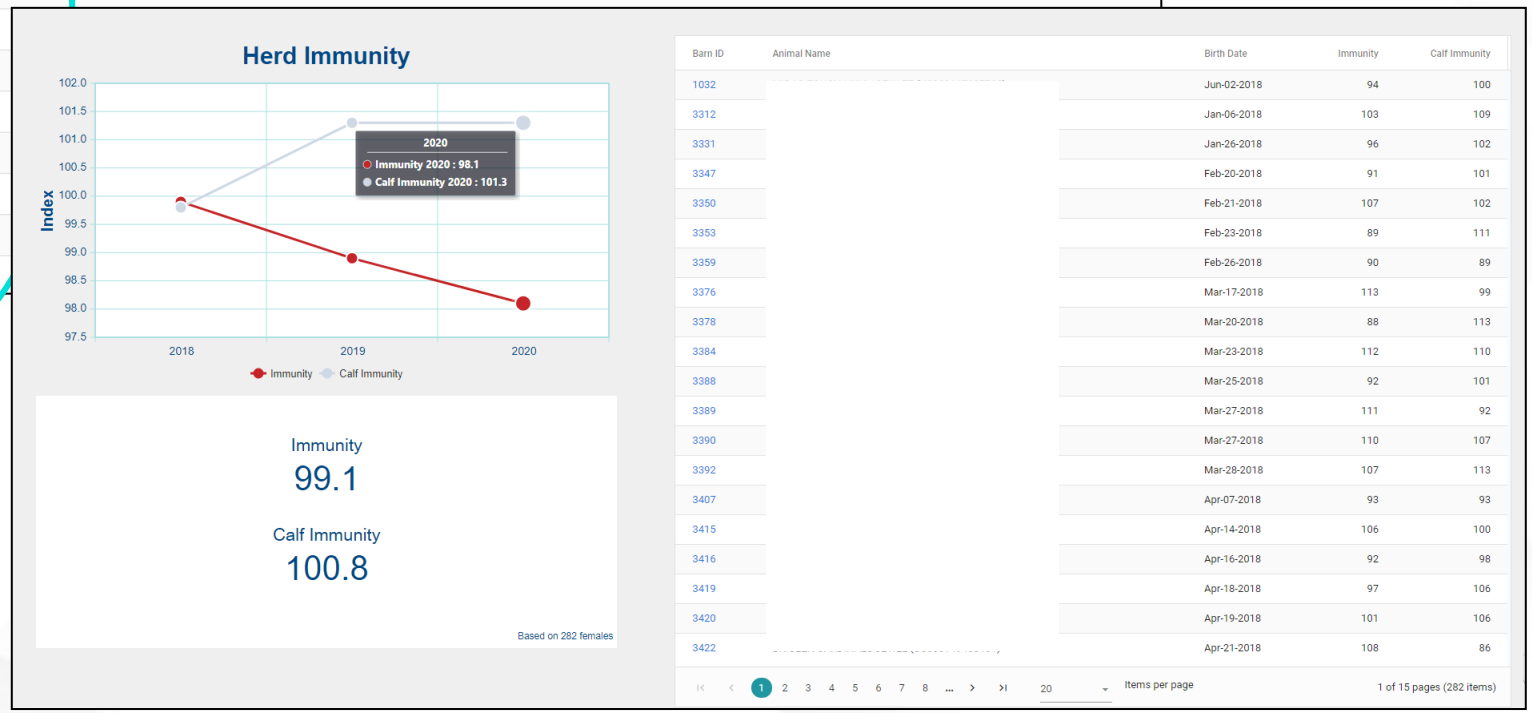
| | | | |
|---|---|---|---|
| Udder Depth | | Deep | 1D |
| Udder Texture | | Fleshy | -1 |

SEMEX® Genetics for Life®

# Elevate – Immunity & Calf Immunity Genomics

To Excel

| Barn ID | Birth Date | Immunity | Calf | TPI | Client Ind... | NM$ | Curre... | MILK | FAT | %F | PROT | %P | SCS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1420 | 09/10/2020 | 113 | 92 | 2774 | 2,587 | 653 | Sexed | 1,122 | 80 | 0.13 | 42 | 0.02 | 2.95 |
| 3942 | 03/01/2020 | 110 | 115 | 2516 | 2,433 | 481 | Sexed | 924 | 42 | 0.02 | 37 | 0.03 | 2.90 |
| 3950 | 03/11/2020 | 114 | 112 | 2174 | 2,170 | 41 | Cull | -377 | 36 | 0.18 | 4 | 0.06 | 2.97 |
| 3956 | 03/21/2020 | 111 | 113 | 2217 | 2,163 | 187 | Cull | 437 | 27 | 0.04 | 19 | 0.02 | 3.10 |
| 3958 | 03/27/2020 | 99 | 106 | 2301 | 2,232 | 253 | Sexed | 130 | 8 | 0.01 | 14 | 0.04 | 2.95 |
| 3968 | 04/10/2020 | 98 | 86 | | | | | | | | | | |
| 3977 | 04/23/2020 | 93 | 101 | | | | | | | | | | |
| 3979 | 04/27/2020 | 96 | 113 | | | | | | | | | | |
| 3980 | 04/28/2020 | 115 | 114 | | | | | | | | | | |
| 3981 | 04/29/2020 | 105 | 92 | | | | | | | | | | |
| 3982 | 05/03/2020 | 89 | 96 | | | | | | | | | | |
| 3984 | 05/05/2020 | 90 | 93 | | | | | | | | | | |




| Barn ID | Animal Name | Birth Date | Immunity | Calf Immunity |
|---|---|---|---|---|
| 1032 | | Jun-02-2018 | 94 | 100 |
| 3312 | | Jan-06-2018 | 103 | 109 |
| 3331 | | Jan-26-2018 | 96 | 102 |
| 3347 | | Feb-20-2018 | 91 | 101 |
| 3350 | | Feb-21-2018 | 107 | 102 |
| 3353 | | Feb-23-2018 | 89 | 111 |
| 3359 | | Feb-26-2018 | 90 | 89 |
| 3376 | | Mar-17-2018 | 113 | 99 |
| 3378 | | Mar-20-2018 | 88 | 113 |
| 3384 | | Mar-23-2018 | 112 | 110 |
| 3388 | | Mar-25-2018 | 92 | 101 |
| 3389 | | Mar-27-2018 | 111 | 92 |
| 3390 | | Mar-27-2018 | 110 | 107 |
| 3392 | | Mar-28-2018 | 107 | 113 |
| 3407 | | Apr-07-2018 | 93 | 93 |
| 3415 | | Apr-14-2018 | 106 | 100 |
| 3416 | | Apr-16-2018 | 92 | 98 |
| 3419 | | Apr-18-2018 | 97 | 106 |
| 3420 | | Apr-19-2018 | 101 | 106 |
| 3422 | | Apr-21-2018 | 108 | 86 |

1 2 3 4 5 6 7 8 ... 20 Items per page 1 of 15 pages (282 items)

SEMEX® Genetics for Life®

# Impact Immunity on Cow Health 1st Lactation

| Event | Mastitis | Metritis | Endometritis | Ketosis | IBR |
|---|---|---|---|---|---|
| High | 19.2% | 10.1% | 28.3% | 20.2% | 11.1% |
| Low | 36.6% | 19.5% | 41.5% | 24.4% | 14.6% |
| **High vs. Low** | **-48%** | **-48%** | **-32%** | **-17%** | **-24%** |

**Large Dairy in Central Europe, 486 genomic tested 1st lactation cows included, from which #99 High (Immunity ≥105) and #41 Low (≤96)*

SEMEX® Genetics for Life®

# Impact Immunity on Cow Health 2nd Lactation

| Event | Mastitis | Retained Placenta | Metritis | Endometritis | Ketosis | IBR |
|---|---|---|---|---|---|---|
| High | 12.4% | 5.3% | 8.0% | 35.4% | 4.4% | 10.6% |
| Low | 36.2% | 6.9% | 19.0% | 50.0% | 8.6% | 20.7% |
| **High vs. Low** | **-66%** | **-23%** | **-58%** | **-29%** | **-49%** | **-49%** |

**Large Dairy in Central Europe, 540 genomic tested 2nd lactation cows included, from which #113 High (Immunity ≥105) and #58 Low (≤96)*

SEMEX® Genetics for Life®

# Impact Immunity on Ketosis Test result in 1st Lactation cows

| Immunity Level | # | # BHBA 1.2+ | % BHBA 1.2+ |
|---|---|---|---|
| ≥100 | 99 | 2 | 1.6% |
| <100 | 129 | 7 | 7.1% |


**Results from large dairy in Central Europe who use a standard protocol Subclinical fresh cow test 8 – 14 DIM. BHBA Levels of 1.2 mmol/L or more are considered cows suffering from subclinical ketosis.*

SEMEX® Genetics for Life®

# Impact Immunity on colostrum quality in 1st Lactation cows

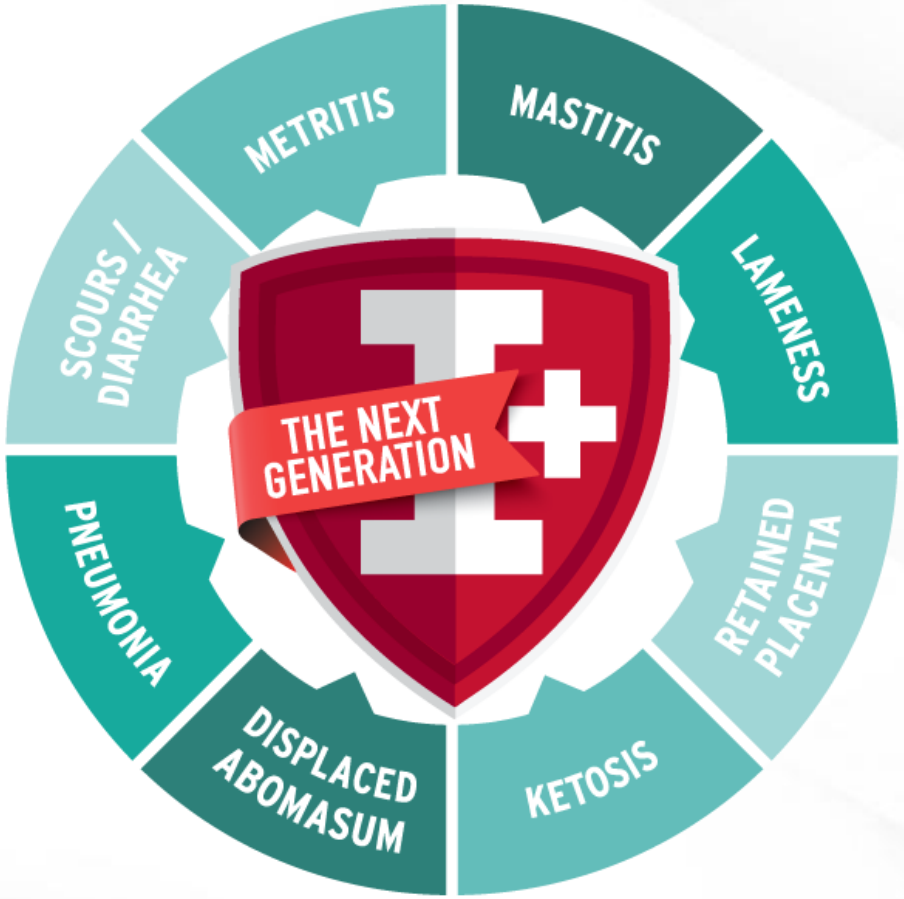
| Immunity Level | # | # Brix 22%+ | % Brix <22% |
|---|---|---|---|
| ≥100 | 99 | 87 | 6% |
| <100 | 133 | 125 | 12% |

**Testing the first colostrum in order evaluation quality for feeding to calves. The brix score of 22% is equivalent to an IgG concentration of 50 mg/ml. This is data from large dairy in central Europe which is testing all its cows colostrum.*

SEMEX® Genetics for Life®

# The Complete Health Package

- Ultimate power to minimize disease incidence via genetic selection
- Defence that's robust & broad-based (cows & calves; viral, bacterial & mycobacterial)
- Covers innate (nitric oxide) & adaptive immunity components
- Plus enhanced passive immunity from higher quality colostrum
- Stronger responses to commercial vaccines




SEMEX®
Genetics for Life®


# THE WORLD'S BEST HEALTH INDEX

SEMEX®
Genetics for Life®

# Thank you