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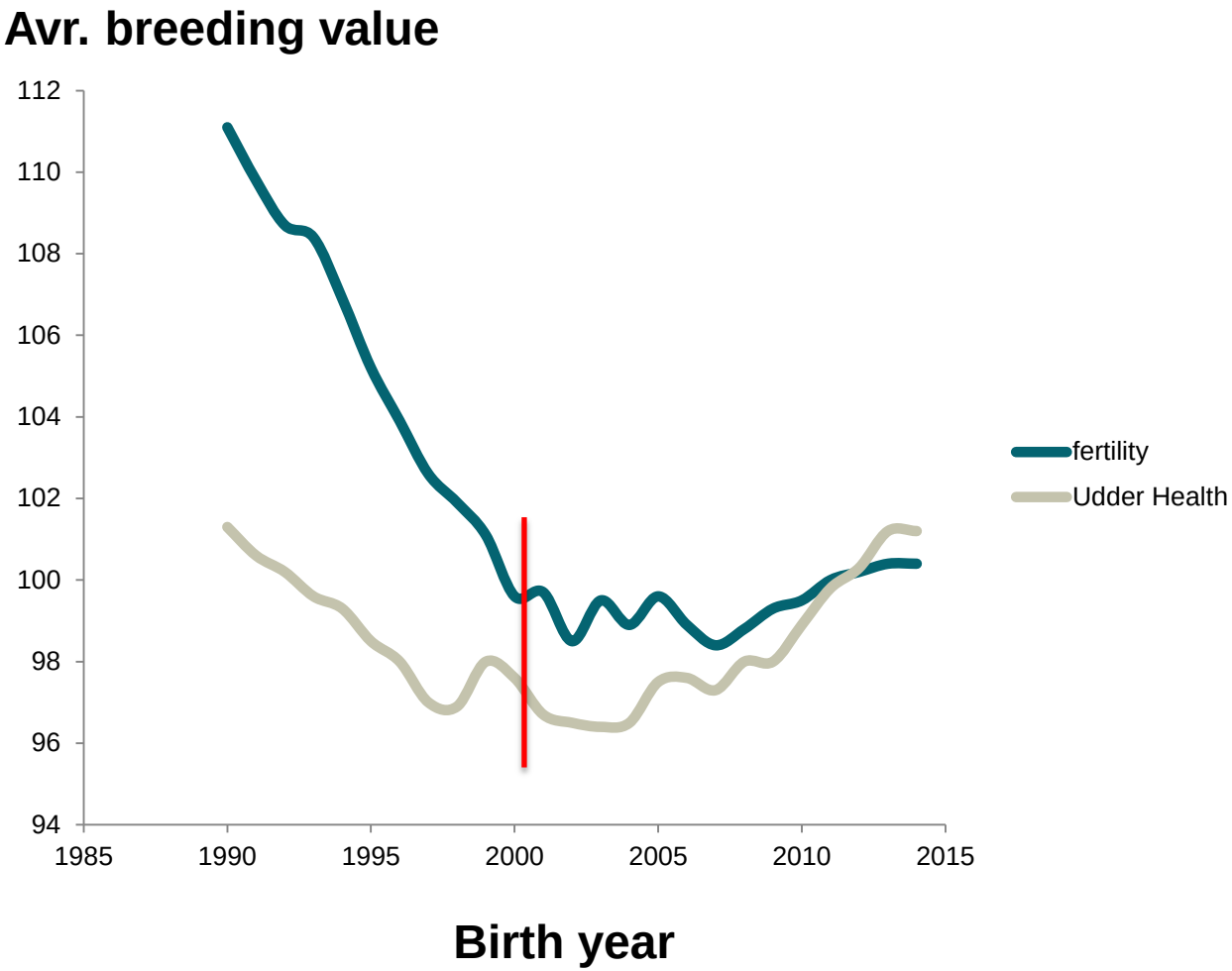
BREEDING FOR IMPROVED FERTILITY AND UDDER HEALTH - REQUIREMENTS

REGISTRATIONS ARE KING

BUT LESS VALUABLE WITHOUT BEING MARRIED TO THE QUEEN – THE PROPER BREEDING GOAL

NORDIC COW TRENDS



IMPROVEMENTS

Improvement of fertility and udder health can be reached by:

- **Management**
- **Genetic improvement**

A good registration system is essential for both management and genetic improvements

TRUE TRAITS

- Fertility
  - The ability to reproduce
    - The ability to come in heat and show heat
    - The ability to get pregnant
    - The ability to keep the pregnancy
- Udder health
  - The ability to produce milk from a healthy udder
    - Mastitis infectious (clinical and subclinical)
    - Mastitis environmental (clinical and subclinical)

Can we define these traits properly?

INFORMATION TRAITS

- The co-heritability
  - $r_g * h_{\text{information trait}} * h_{\text{true trait}}$
- To be compared with the heritability of the true trait

Challenge:

Do we know these parameters except for $h_{\text{information trait}}$?

POSSIBLE INDICATOR TRAITS FOR FERTILITY

- AI registrations, eg.:
  - Days from calving to first insemination
  - Days from first to last insemination
- Progesterone measurements
  - Golden standard (Egger-Danner, 2014)
- Activity measurement
- Causative mutations
- BCS

POSSIBLE INDICATOR TRAITS FOR UDDER HEALTH

- Mastitis treatments:
  - In different lactation stages
  - In different lactations
- Conformation
  - Udder conformation traits
  - Dairy character/BCS
- Somatic Cell Score
- Electronic conductivity
- IR spectroscopy
- Pathogen information

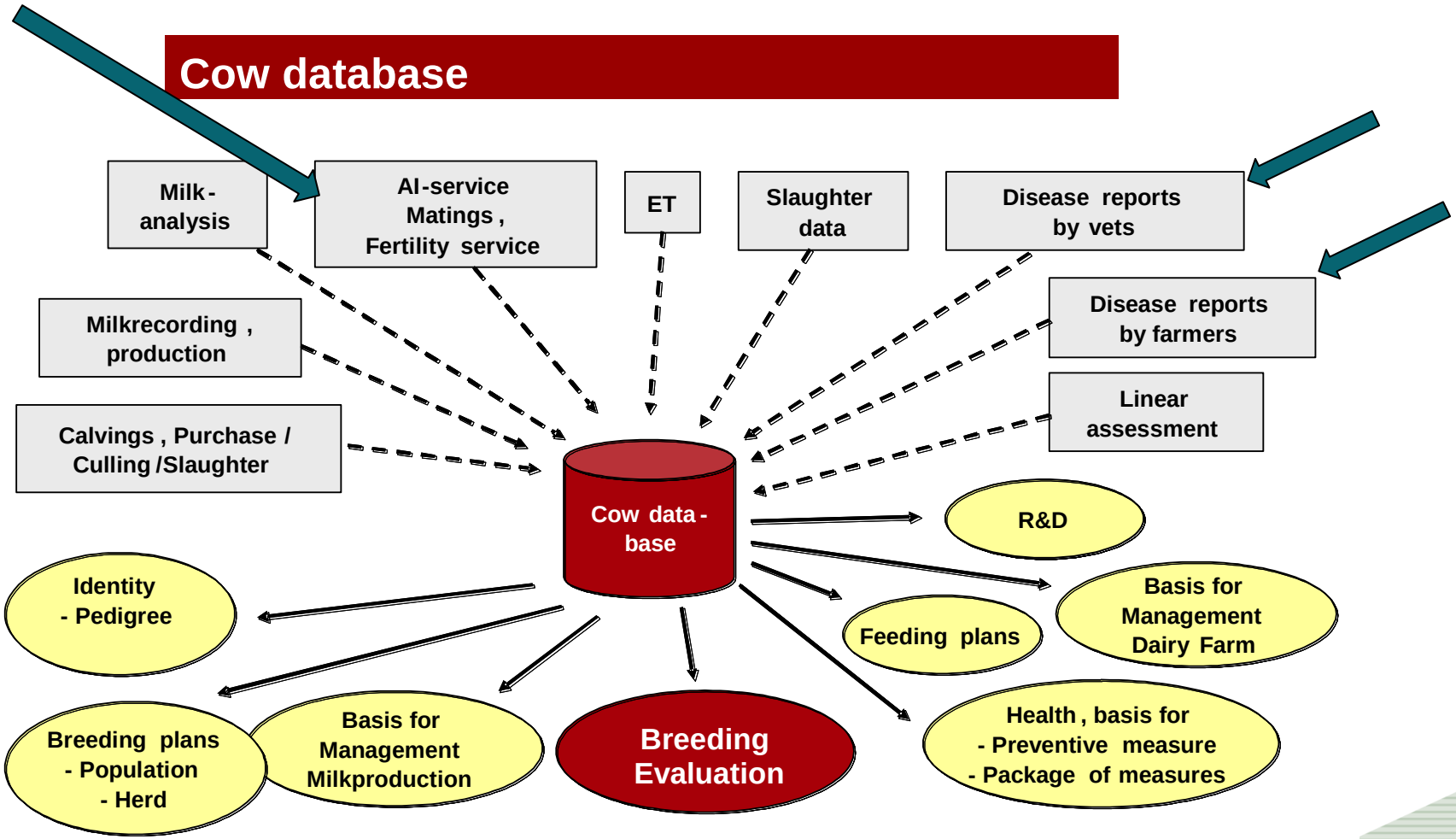
SYSTEMATIC DISEASE RECORDING

- Started before 1985 in Norway, Sweden and Finland
- Started in Denmark in 1990 in cooperation between Danish Cattle Federation and the Danish Veterinary Society
- Within last decade in many more countries

Registrations need to be valuable for management purposes

– If not cost for breeding purposes are too high

SYSTEMATIC DISEASE RECORDING –
DATA ORGANISATION IMPORTANT



BREEDING FOR FERTILITY AND UDDER HEALTH?

- Low heritability
- Expensive registration system

However:

- Large genetic variability
- Reasonable reliability (large daughter groups, genomic selection)

GENETIC CORRELATIONS

Production – Fertility	- 0.35
Production – Udder Health	- 0.35
Health – Fertility	0.25

THE PRESENT NORDIC FERTILITY INDEX IS BASED ON

Non return rate at day 56 (H+C)

Days from first to last insemination (H+C)

Number of inseminations (H+C)

Days from calving to first insemination (H + C)

Heat strength (H + C, Sweden)

THE PRESENT NORDIC UDDER HEALTH INDEX IS BASED ON

Mastitis treatment first lactation

- -15 to 50 days from first calving
- 51 to 305 days from first calving

Mastitis treatments second and third lactation

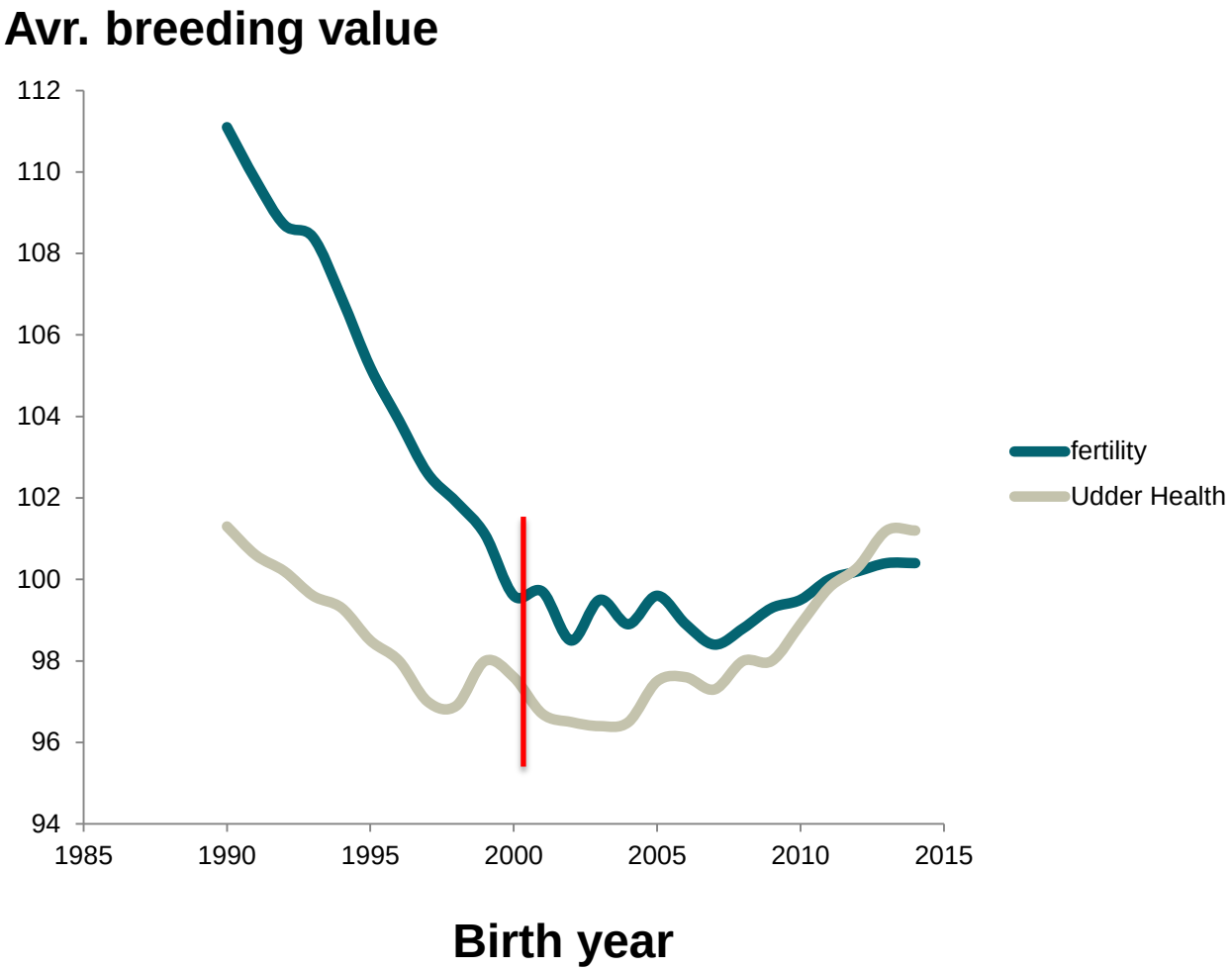
- - 15 to 150 days from calving

Somatic cell score first, second and third lactation

Udder conformation

- Fore udder attachment
- Udder depth

NORDIC COW TRENDS



MAYBE NOT PERFECT BUT IT WORKS

- The value of 10 index units for fertility on:
  - - 6 days from calving to first insemination
  - -12 days from first insemination to last insemination

- The value of 10 index units for udder health on:
  - - 4.5 treatments per 100 cows in first lactation
  - - 6 treatments per 100 cows in later lactations

Even though it works we still have to work on finding the true trait

THE BREEDING GOAL

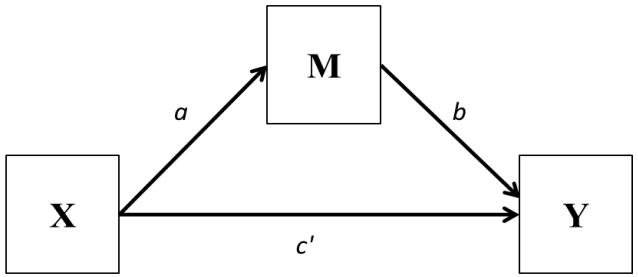
- The traits need to be included in the breeding goal with proper economic values.
  - Meaning avoiding double counting while keeping the structural effects of the traits in the economic values
  - This appeared to be a challenge in the derivation of ev's to be used in the Nordic total merit index.
- Can be handled using Stochastic Dairy Herd Simulation followed by multiple regressions and the use of mediator variables in the derivation of economic values

THE BREEDING GOAL

First to last AI **€**

(Total Effect of X on Y)

Yield



First to last AI **€**

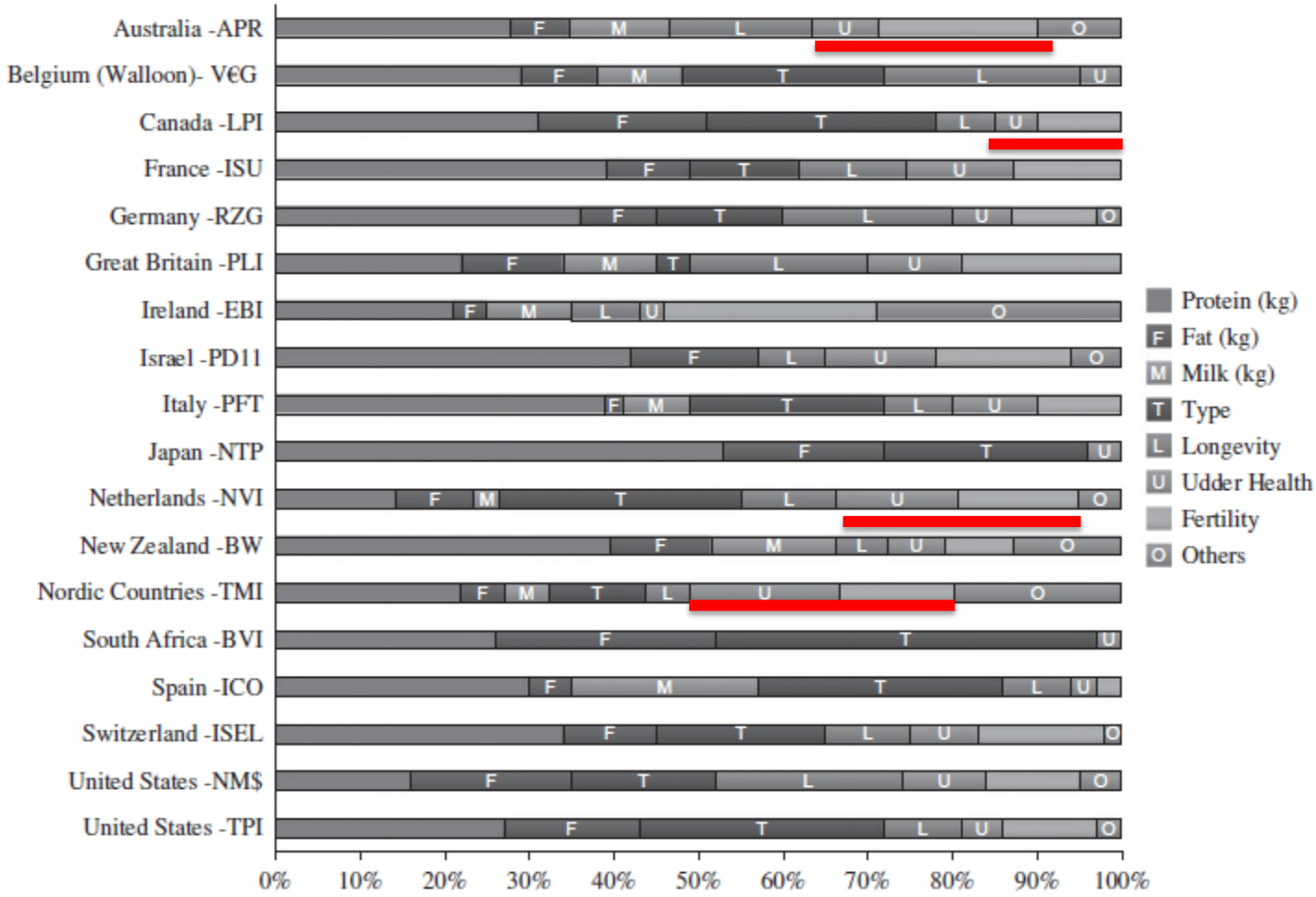
- direct effect of X on Y = c

- indirect effect of X on Y = a * b
- direct effect of X on Y **with the effect of the mediator removed** = c'

Fairchild and MacKinnon, 2009

HOLSTEIN BREEDING GOALS

EGGER DANNER ET AL,2014 (DATA PROVIDED BY F. MIGLIOR



CORRELATION BETWEEN NTM AND:
BULLS BORN 2007-2009

	Holstein	Red	Jersey
Fertility	34	20	29
Udder health	51	32	50

FOR HOLSTEIN AN IMPROVEMENT OF +25 NTM UNITS RESULTS IN

+ 10.8 fertility index units

Fertility traits	days
Interval calving first ins	- 4.5
Interval first to last ins	- 12.0

Without NTM fertility would have been worse!!

FOR RDC AN IMPROVEMENT OF +25 NTM UNITS RESULTS IN

+ 7.5 udder health index units

Trait	Mastitis cases
CM- until day 50 1st lact	- 2.7
CM- day 50-305 1st lact	- 1.8
CM- 2nd lact	- 3.5
CM – 3rd lact	- 3.9

THE RESULTS ARE OBSERVED IN 39 HOLSTEIN HERDS

BEST HALF COMPARED TO POOREST HALF BASED ON HEIFER NTM

Trait	Difference
Days from calving to first insemination, first parity	- 1.9
Days from first to last insemination, first parity	- 5.0
# of inseminations, first parity	- 0.03
# of mastitis treatments, first parity	- 2.7
# of mastitis treatments, second parity	- 4.7

GENOMIC SELECTION WILL INCREASE THE GENETIC PROGRESS FOR FERTILITY AND UDDER HEALTH

Reliabilities EBV/GEBV:

- Traditional
  - **Bulls:** **protein >> health traits**
  - **Females:** **protein >>> health traits**
- Genomic Selection
  - **Bulls:** **protein > health traits**
  - **Females:** **protein > health traits**

GENOMIC SELECTION WILL INCREASE THE GENETIC PROGRESS FOR FERTILITY AND UDDER HEALTH

Breeding scheme	Total response	Response protein	Functional traits
Progeny test	100	100	100
GS + Progeny test	129	113	161
GS	201	169	273

Buch et al 2011

CONCLUSION

- Good registration a must
- Work towards a better definition of the true traits (ICAR issue)
- Find the best indicator traits (ICAR issue)
- Be aware of double counting in the derivation of economic values
- Breeding for fertility and udder health works
- But it can be improved
- Genomic selection is in favour of fertility and udder health