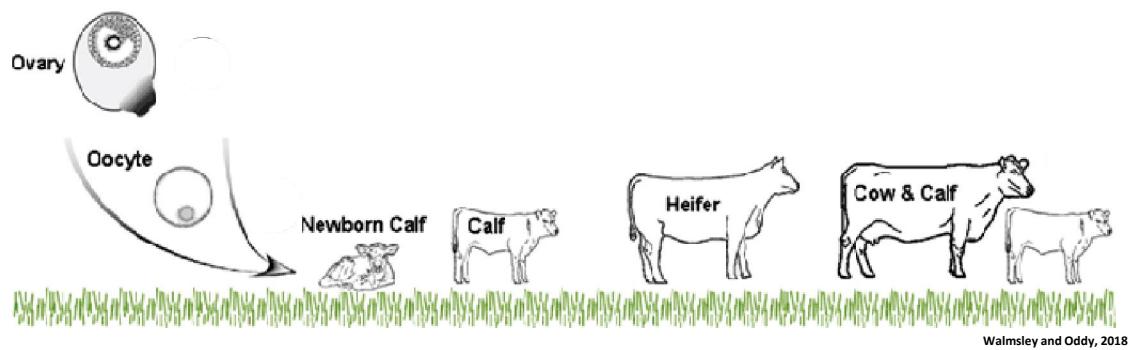


The Inside-Outside Approach

Rik Hendriks, January 30th
VEERkracht Dairy Congress 2019



Timeline of a cow



Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Retrospective versus prospective



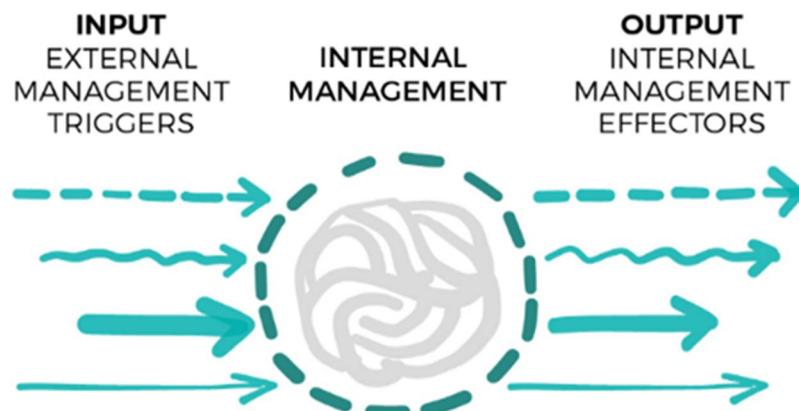
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Associative versus causative



Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

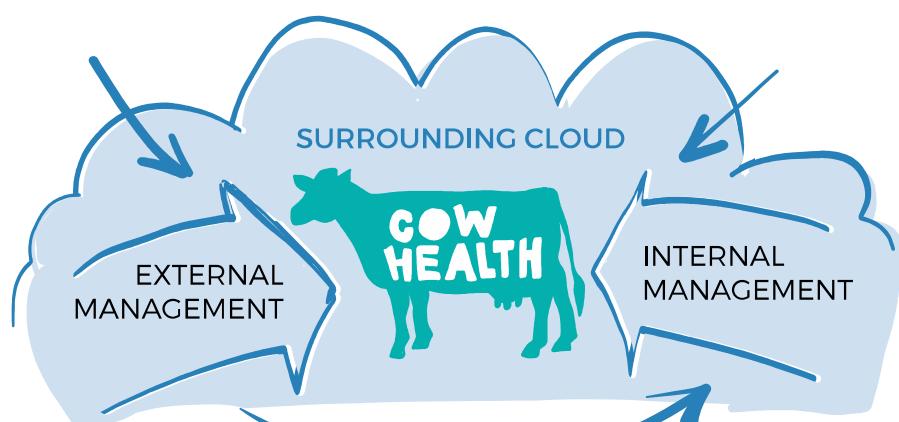
Concept: The outside-in-Inside-out model



Brand and Hendriks, 2019

Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

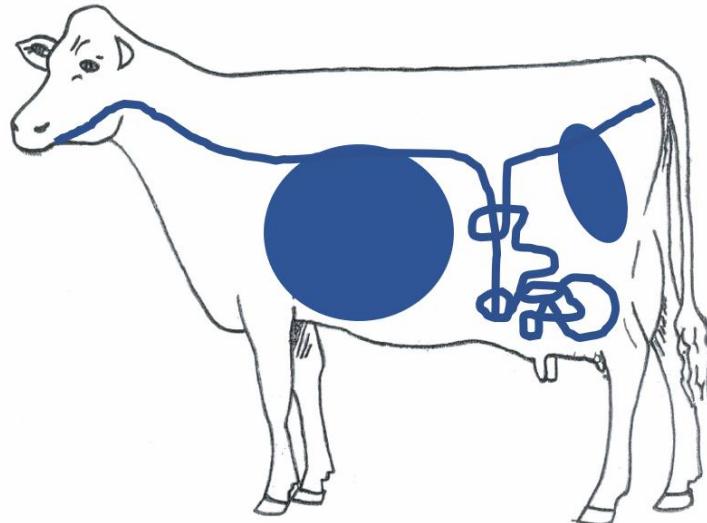
External environment versus internal environment



Brand and Hendriks, 2019

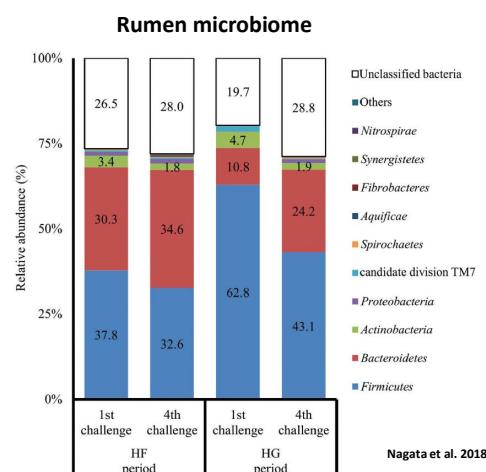
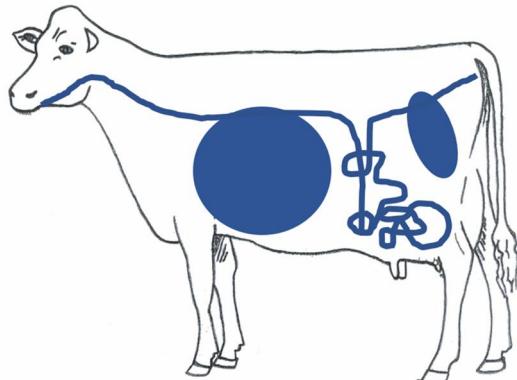
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

External environment versus internal environment



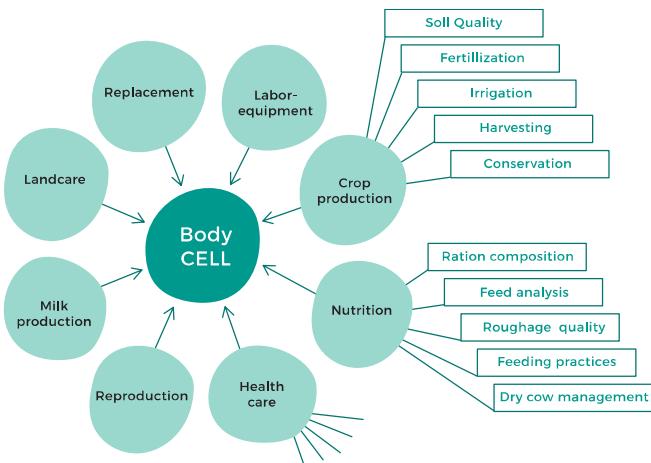
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

External environment versus internal environment



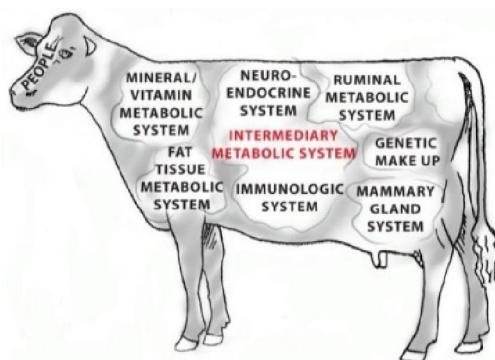
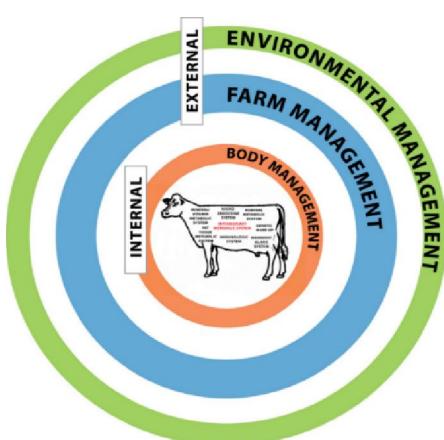
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

External environmental (managerial) factors



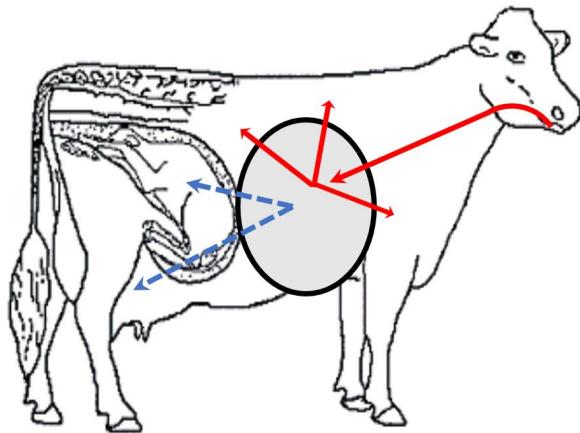
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Interacting and interconnecting multi-systems



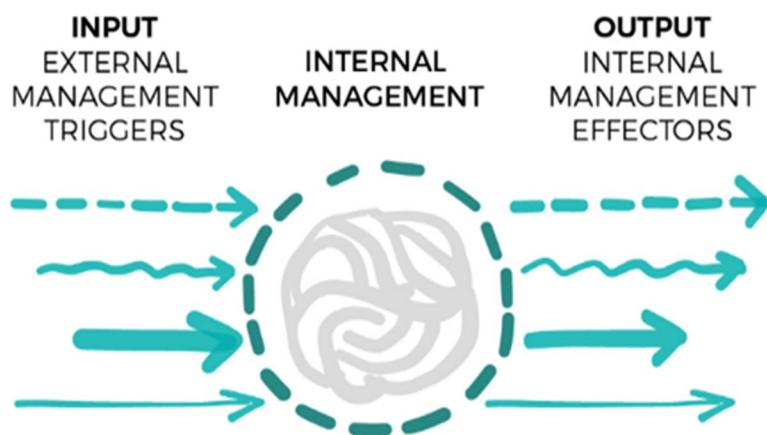
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

External environment, internal environment, and metabolic programming



Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

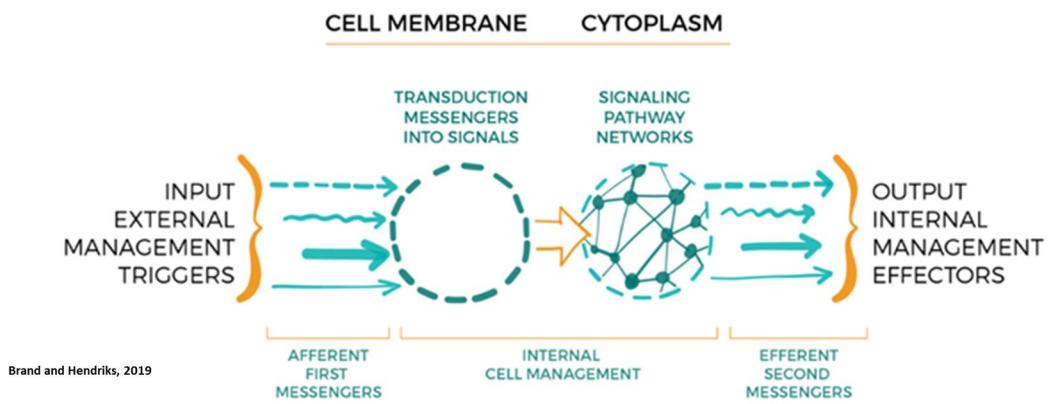
Multiple input and multiple output



Brand and Hendriks, 2019

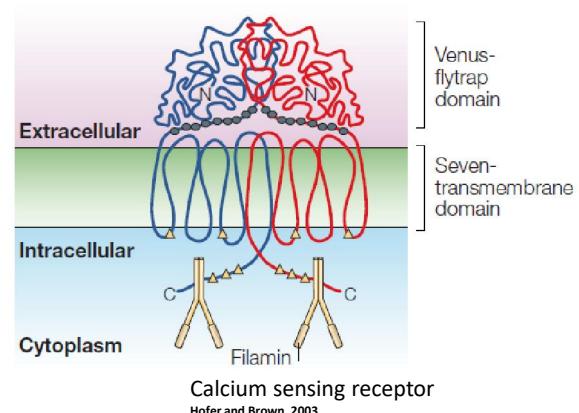
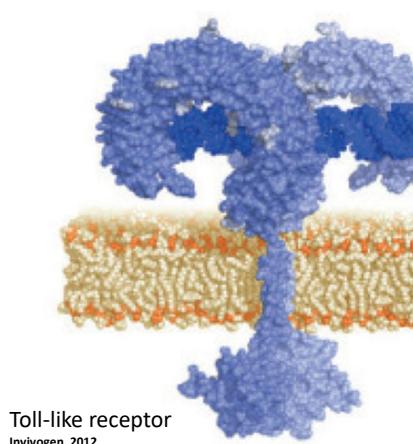
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Transduction of signals across membranes



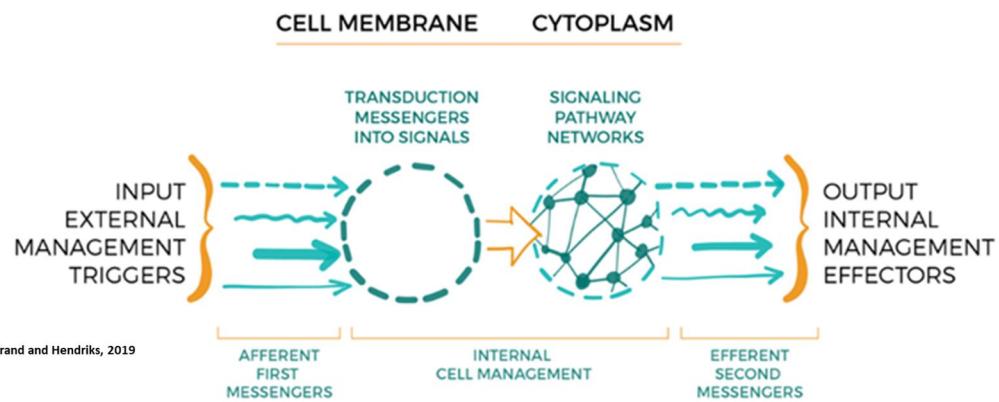
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Sensing and transducing signals across membranes



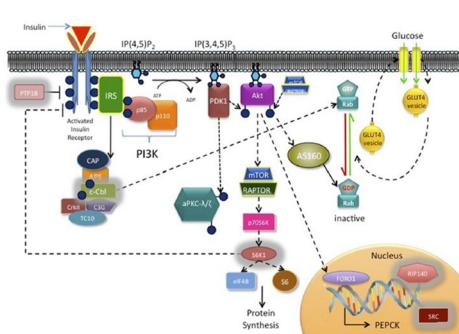
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Translation into an intracellular response and output



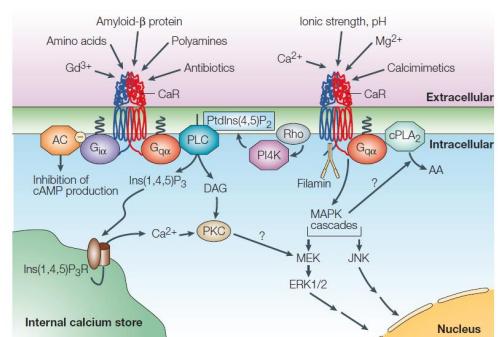
Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Intracellular response



Downstream molecular signals of the insulin receptor pathway.

Gilliam and Neufer, 2012

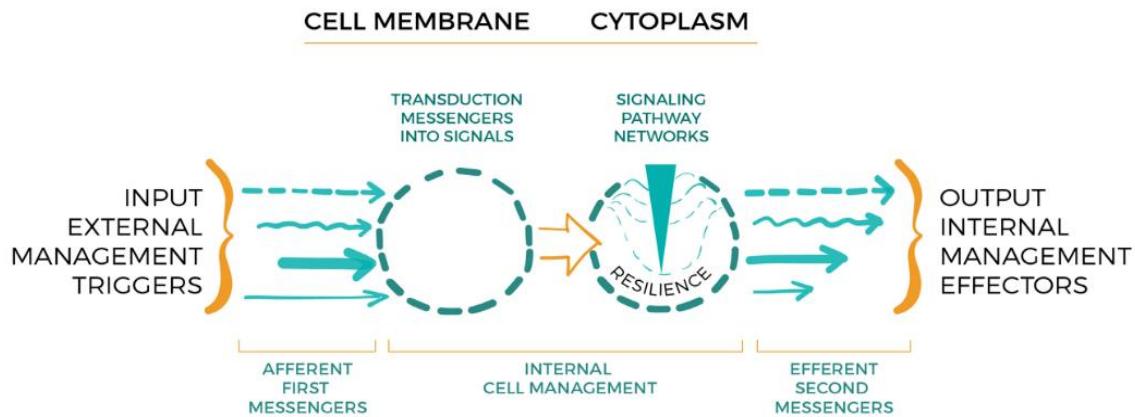


Intracellular signal transduction cascade after activation of the CaSR

Hofer and Brown, 2003

Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

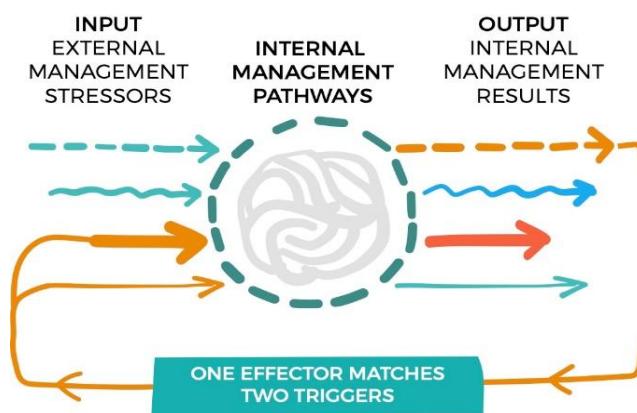
Resilience



Brand and Hendriks, 2019

Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

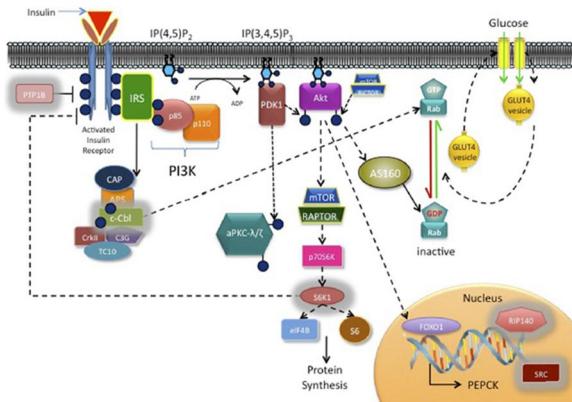
Cause-and-effect



Brand and Hendriks, 2019

Rik Hendriks, VEERkracht Dairy Congress, the Netherlands,
2019

Pathways and flows

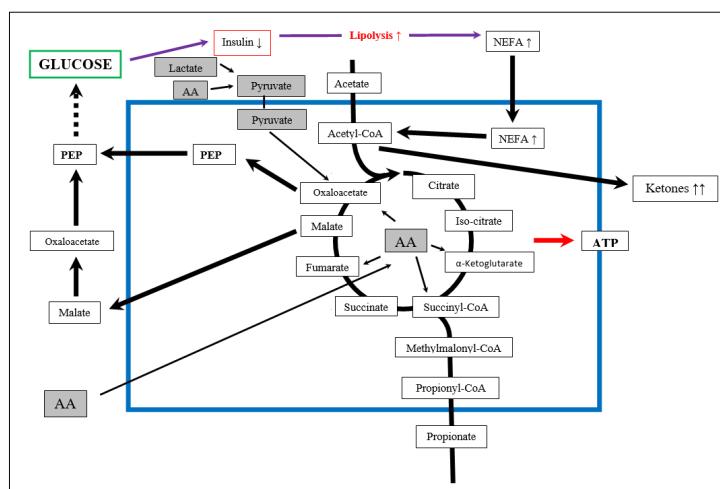


Gilliam and Neufer, 2012



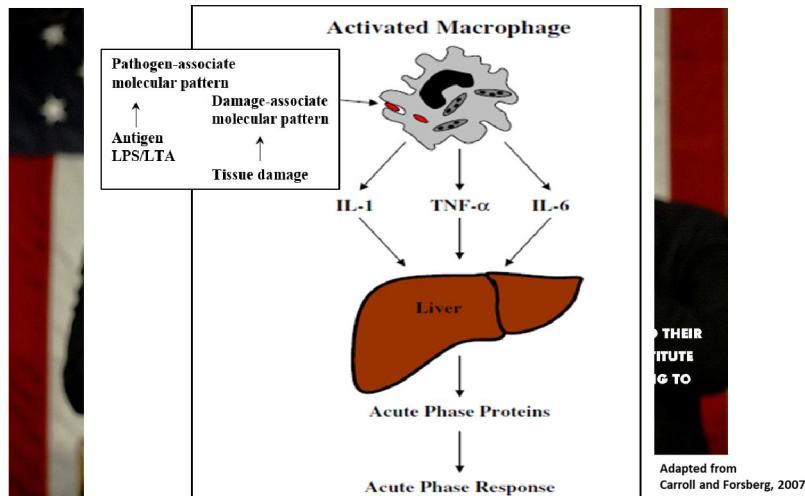
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2019

Pathways and flows



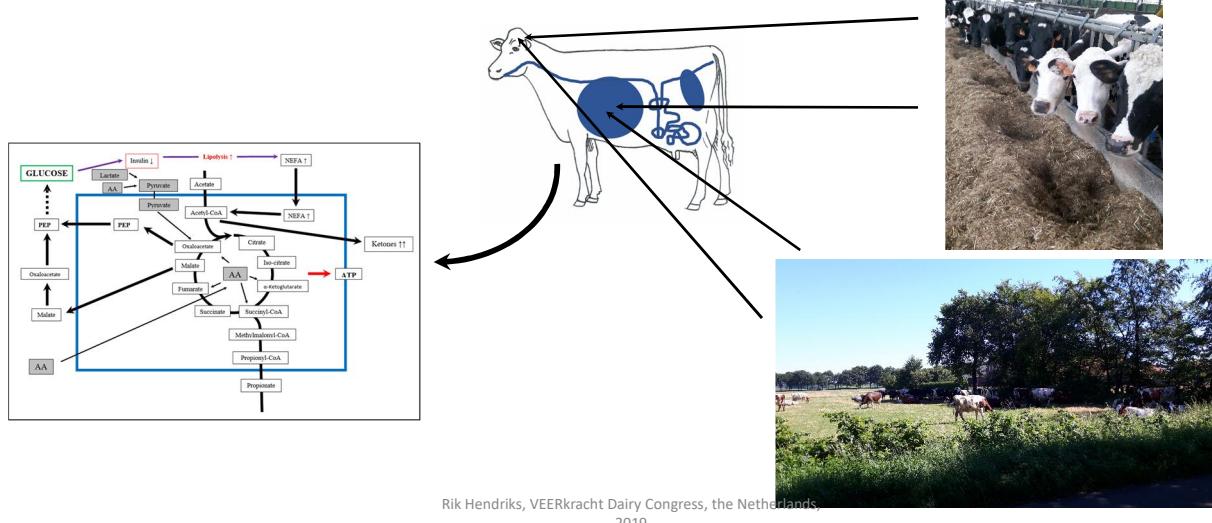
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2019

Pathways and flows: “the axis of evil”

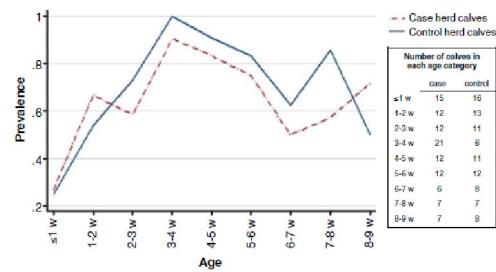


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2019

Translation to practice: monofactorial versus multifactorial



Translation to practice

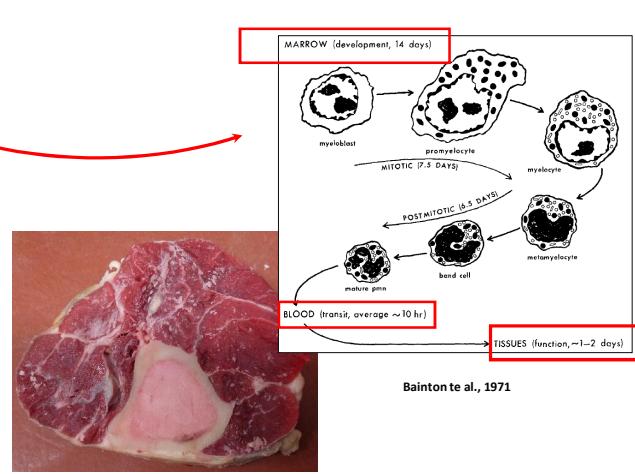
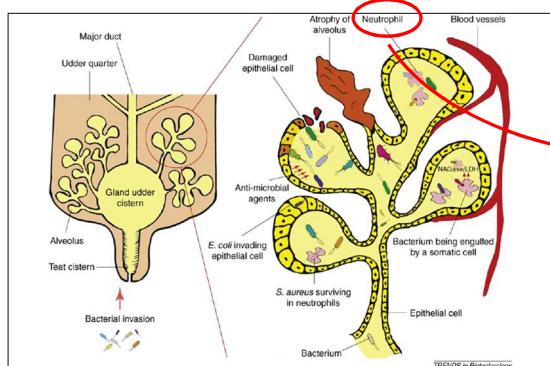


Prevalence of *Cryptosporidium* positive calves in case and control herds.

Silverlas et al., 2010

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2019

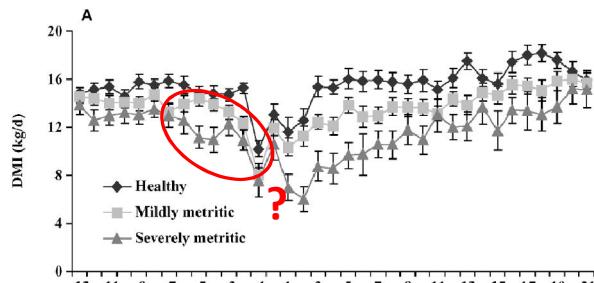
Translation to practice



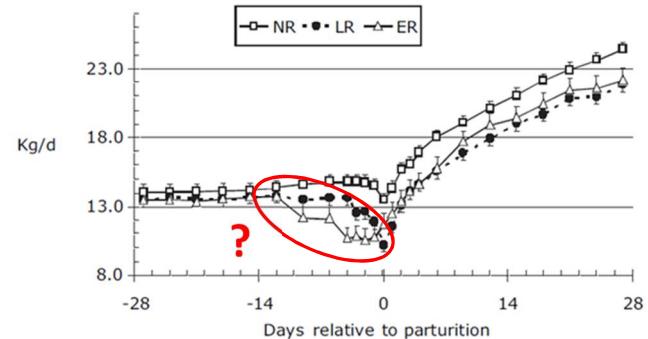
Viguier et al. 2009

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2019

Translation towards science



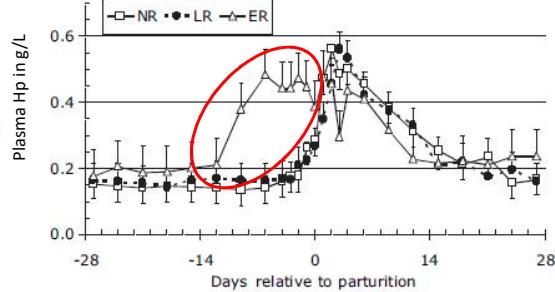
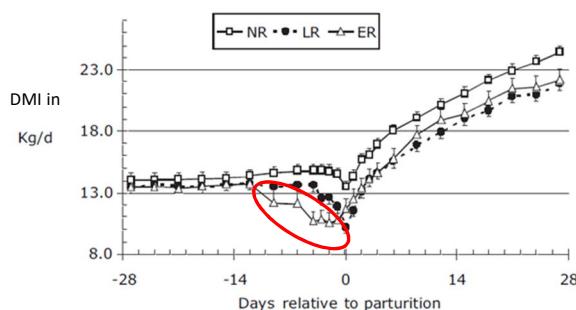
Huzzey et al., 2007



Trevisi et al., 2002 IN Bertoni et al., 2009

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2019

Translation towards science



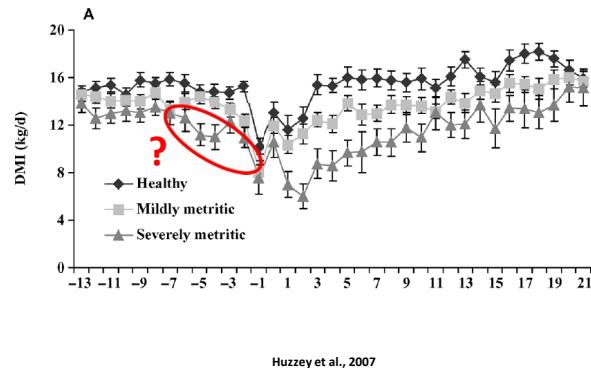
Prepartum conditions: Housing in tie stall, diet corn silage + hay
NR: No (NR), late (LR), or early (ER) reduction in prepartum DMI

Trevisi et al., 2002 IN Bertoni et al., 2009

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2019

Translation towards science

- Van Dixhoorn et al. 2018
 - Total Deficit Score (TDS)
 - High TDS indicative for
 - Low resilience in transition period
 - Predictive for disease severity p.p.
 - High TDS:
 - low average eating time,
 - non-periodicity in number of steps (indicative of disturbance of daily patterns)
 - variance in ear temperature



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Translation towards science

Dry cow diet composition in gr/kg DM	Murondoti et al. 2004	Diehoo et al. 2016
Grass silage	-	273
Corn silage	523	270
Wheat straw	-	349
Soybean meal	172	108
Beet pulp	218	-
Canola meal	77	-
Diet characteristics		
NEL in MJ / in Mcal / in VEM	6.6 / 1,58 / 957	5,3 / 1,27 / 768
CP	74	109
Starch	361	90

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Translation towards science

Diet composition in g/kg DM	Drackley et al. 2014 (OVE)	Salin et al. 2018 (OVE)
Grass silage	-	1000
Corn silage	499	
Alfalfa silage	179	
Alfalfa hay	60	
Whole cottonseed	50	
Soybean meal	43	
Urea	2	
Diet characteristics		
NEL in MJ / Mcal / VEM	6,9 / 1,62 / 1000	
ME in MJ / Mcal	9,1 / 2.18	10.1 / 2.6
CP	146	129
MP	88,6	62,4

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Translation towards science

P.p. disease	Diehoo et al. 2016	Martinez et al. 2018
Morbidity	8/12	36/79
Endometritis	7/12	
Metritis		27/78
Retained placenta		13/79
Abomasal displacement		4/79
Mastitis	1/12	10/78
Milk fever		9/79

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2019



Conclusions:

We need the new Outside-in-Inside-out approach:

- to gain progress in advisory work at dairy farms resulting in a sustained improvement of animal performance
- to offer new insights for experimental designs in dairy research

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2019