

Value of cooperative phenotypic databases in the genomics era

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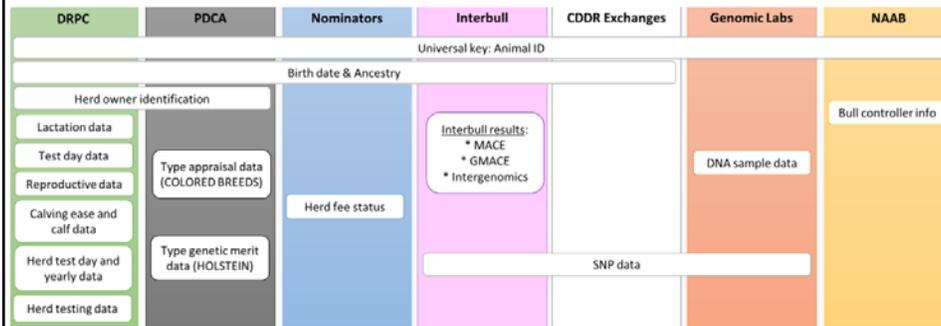


Future of Phenotyping
Council on Dairy Cattle Breeding Industry Meeting, Madison, WI. October 2, 2018

How important will it be to continue having consolidated data available for universities and USDA, in order to supply the dairy sector with the necessary technologies?



CDCB hosts cooperator' phenotypic and genomic databases



- Management and performance benchmarks (e.g. DHI reports)
- Genetic and genomic evaluations
- Data for research

<https://www.uscdcb.com/what-we-do/cooperator-database/>

Arguments for cooperation

- National data
- Cleaned, vetted, standardized, unbiased
- Free data for research
- Federal grant funded research benefits everybody
- What is the alternative?
- ...



Challenges

- Every genetics provider has their own PTAs
- Are the data still representative for the industry? (who provides data?)
- Should be easily accessible for research
- Data frequency (month, day, hour, second)
- Many new phenotypes
- Where does new data go? (sensors)
- ...

 <p>J. Dairy Sci. 93:968–977 doi:10.3168/jds.2009-2408 © American Dairy Science Association®, 2010.</p> <p>Effect of days to conception in the previous lactation on the risk of death and live culling around calving</p> <p>P. J. Pinedo and A. De Vries¹ Department of Animal Sciences, University of Florida, Gainesville 32611</p>	<p>Selected papers based on DHIA data. Journal of Dairy Science</p>
 <p>J. Dairy Sci. 93:2250–2261 doi:10.3168/jds.2009-2572 © American Dairy Science Association®, 2010.</p> <p>Dynamics of culling risk with disposal codes reported by Dairy Herd Improvement dairy herds</p> <p>P. J. Pinedo, A. De Vries,¹ and D. W. Webb Department of Animal Sciences, University of Florida, Gainesville 32611</p>	
 <p>J. Dairy Sci. 93:613–623 doi:10.3168/jds.2009-2573 © American Dairy Science Association®, 2010.</p> <p>Reproductive risk factors for culling and productive life in large dairy herds in the eastern United States between 2001 and 2006</p> <p>A. De Vries,¹ J. D. Olson,[†] and P. J. Pinedo[*] [*]Department of Animal Sciences, University of Florida, Gainesville 32611 [†]Pfizer Animal Health, Ft. Collins, CO 80526</p>	
 <p>J. Dairy Sci. 97:2896–2908 http://dx.doi.org/10.3168/jds.2013-7690 © American Dairy Science Association®, 2014.</p> <p>Agreement between milk fat, protein, and lactose observations collected from the Dairy Herd Improvement Association (DHIA) and a real-time milk analyzer</p> <p>K. Kaniyamattam and A. De Vries¹ Department of Animal Sciences, University of Florida, Gainesville 32611</p>	
<p>M219 Seasonality of calving on dairy farms across the United States. F. C. Ferreira*^{1,2} and A. De Vries¹, ¹University of Florida, Gainesville, FL, ²Embrapa Gado de Leite, Juiz de Fora, MG, Brazil.</p>	

Benchmarking: DRMS Dairy Metrics

Welcome back: Albert De Vries [\[Log Off\]](#)

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[Graphs](#)
[Save Report](#)
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Compare Herd
 You may specify a compare to herd here, but you do not have to.

Herdcode:
 RAC:

[Display to Screen](#)

File Output Options

Send To:
 Orientation:

[Output to File](#)

General
 Production

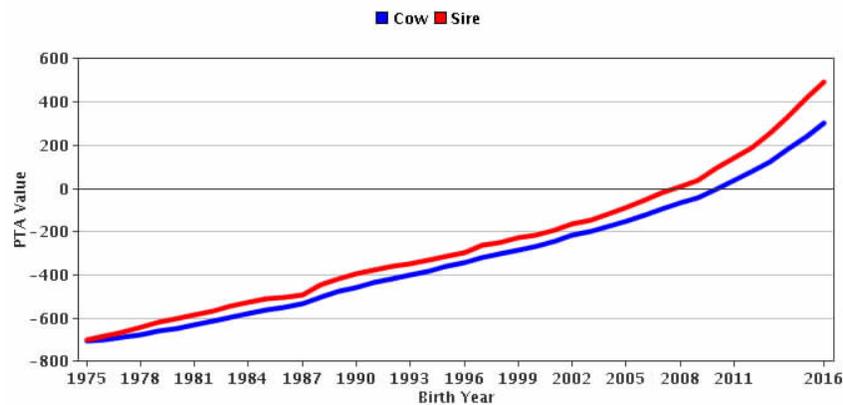
DM Data Value	58010029	Perc	Number of Herds	Average	Std Dev	Minimum	Maximum
Rolling Milk	24165	78%	20	22016.8	4286.5	9688.0	28700.0
Rolling Milk-Year Change	1344.5	84%	20	926.5	4988.7	-1840.0	21592.0
Rolling Fat	903	84%	16	790.3	170.2	313.0	1077.0
Rolling Protein	747	78%	16	671.9	129.0	291.0	889.0
Daily Milk 1-40 D-1st Lact	79	100%	20	53.2	13.5	27.0	79.0
Daily Milk 1-40 D-2nd Lact	89	94%	20	69.8	15.1	36.0	90.0
Daily Milk 1-40 D-3rd+ Lact	83	73%	19	70.6	19.3	39.0	99.0
Daily Milk-Milk cows	70.9	73%	20	63.2	12.9	35.9	88.8
Daily Milk-All Cows	59.8	68%	20	52.5	12.8	24.6	78.3
Daily Fat %	4.1	89%	18	3.7	0.2	3.3	4.1

<http://retro.drms.org/DairyMetricsRun.aspx>

Independent: Net Merit\$



Net Merit PTA Values for Holstein or Red & White



https://queries.uscdcb.com/eval/summary/trend.cfm?R_Menu=HO.nm#StartBody

Example: Other traits offered in North America

CLARIFIDE® PLUS... PROVIDES MORE OPPORTUNITY FOR COW AND CALF WELLNESS AND PROFIT

CDCB Evaluation	Wellness Traits	Genetic Conditions	
<ul style="list-style-type: none"> • Parentage • Production • Fertility • Longevity, Milk Quality & Calving • Functional Type 	<ul style="list-style-type: none"> • Mastitis • Lameness • Metritis • Retained Placenta • Displaced Abomasum • Ketosis <div style="background-color: #4a5568; color: white; padding: 2px; text-align: center; font-weight: bold; margin-top: 5px;">Calf Wellness</div> <ul style="list-style-type: none"> • Calf Livability • Calf Respiratory • Calf Scours 	<ul style="list-style-type: none"> • Polled (no fee) • Milk Components • Genetic conditions* • Infertility Haplotypes 	

DWP\$® Animal Ranking




* CVM, Brachyspina and Beta Casein A2 available with add-on fee.

Example: Other traits offered in North America



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DISEASE RESISTANT GENETICS



IMMUNITY+

High immunity passed from parent to progeny at rates exceeding all health/fitness traits

30%

heritable

DOWNLOAD INFOGRAPHIC

?

FIND OUT MORE

Immunity+ FAQ's and testimonials

CLICK HERE

Example: Other traits offered in North America



The screenshot shows the Select Sires website interface. At the top, there is a search bar and navigation links for News, Contact Us, Careers, About Us, and Employee Login. Below this is a main menu with categories like HOME, DAIRY, BEEF, DESIGNATIONS, PROGRAMS, PRODUCTS, STORE, RESOURCES, and GENERATIONS. A secondary menu lists various programs such as FeedPRO, WellnessPRO, Superior Setters, Showcase Selections, CalvingPRO, gender SELECTed, Fertility PRO, and RobotPRO. The RobotPRO section is highlighted, featuring a sub-header "RobotPRO™" and a sub-section "Your Solution for Automated Milking Systems". This section includes a photograph of a robotic milking system and a paragraph explaining that Select Sires identifies sires with desirable traits for automated milking, such as component and milk yield, milk quality, longevity, and durability. Social media sharing icons for Facebook, Twitter, LinkedIn, Pinterest, Google+, and Email are located at the bottom of the section.

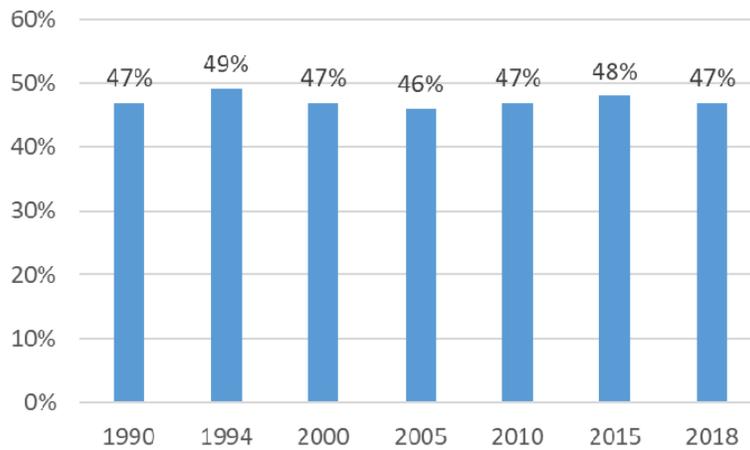
Direction: Robot data used for genetic evaluations

Does traditional milk testing have a future?



University of Florida Dairy Unit

Percentage of cow population in DHI



<https://queries.uscdcb.com/publish/dhi/part.html>



J. Dairy Sci. 99:9782–9795
<http://dx.doi.org/10.3168/jds.2016-11155>
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EXAMPLE

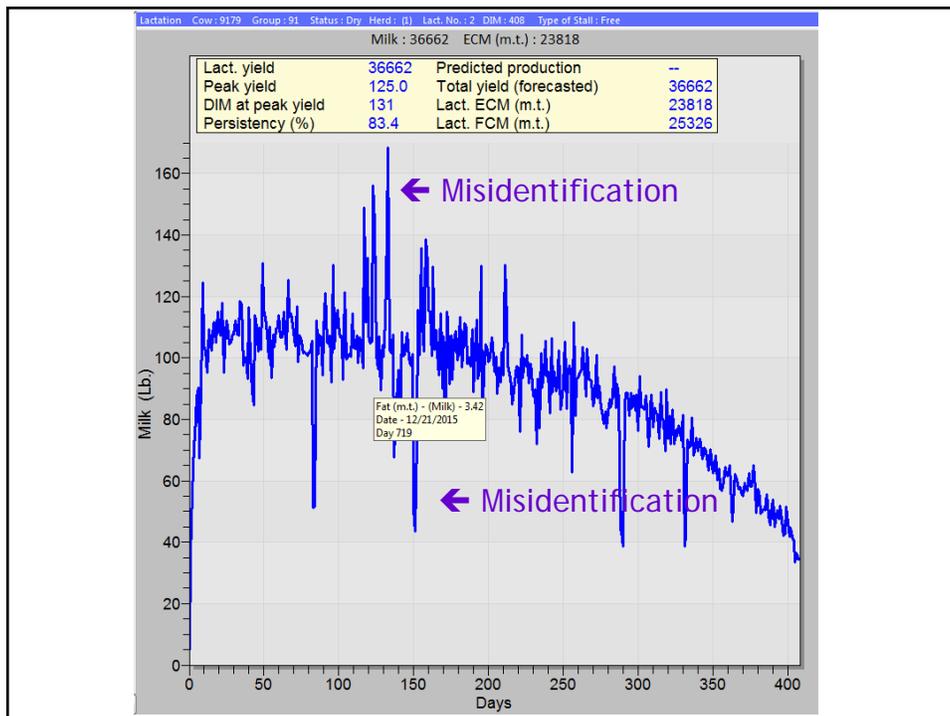
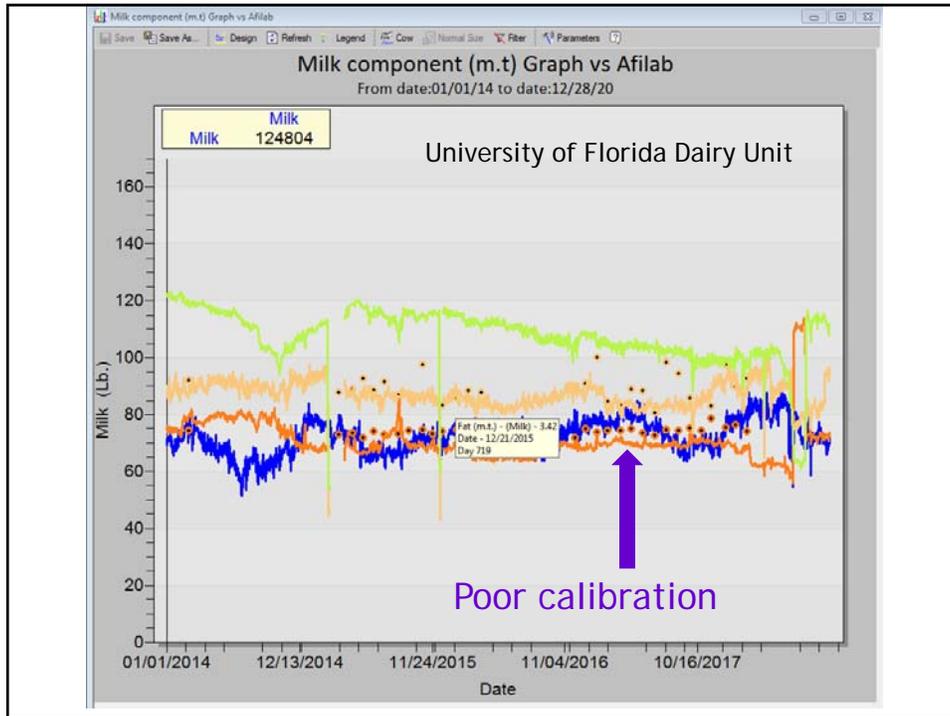
Genetic and phenotypic analysis of daily Israeli Holstein milk, fat, and protein production as determined by a real-time milk analyzer

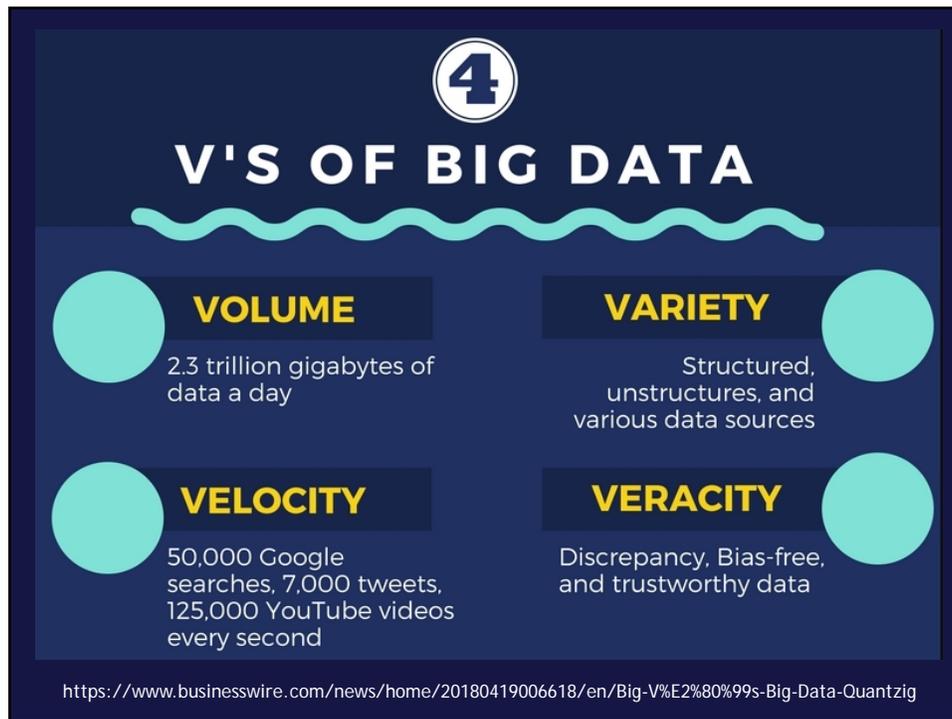
J. I. Weller^{*†} and E. Ezra[†]

^{*}Institute of Animal Sciences, Agricultural Research Organization, The Volcani Center, Bet Dagan 50250, Israel
[†]Israel Cattle Breeders Association, Caesaria Industrial Park 38900, Israel



Conclusion: “Real-time daily recording of fat and protein concentration by the daily recording system may be preferable to monthly analysis for herd-management decisions and genetic evaluation.”





Novel traits with heritability estimates

Egger-Danner et al. *Animal* 9:191 (2015). Table 2

Udder health

- Clinical mastitis, improved SCC, electrical conductivity, pathogen information, lactoferrin, minerals, near-IR spectroscopy, PCR, IR thermography

Reproduction

- Fertility related diseases, luteal activity, multiple ovulation, ovary cycle health

Metabolism

- Ketosis, milk fever, displaced abomasum, fat/protein ratio

Feed and legs

- Lameness, disorders based on veterinary or hoof trim data

Feed efficiency and methane

- Residual feed intake, methane prediction

Other novel traits

- Temperament, suckling behavior, milkability, AMS behavior traits, activity data, fatty acids



J. Dairy Sci. 100:8205–8219
<https://doi.org/10.3168/jds.2016-11865>
 © American Dairy Science Association®, 2017.

EXAMPLE

Genetic analysis of new progesterone-based fertility traits in dairy cows measured on-farm

Diana Sorg,* Monika Wensch-Dorendorf,* Kati Schöpke,*¹ Gunter Martin,* Renate Schafberg,*
 Nicole Reinhold,† Steffen Pache,‡ and Hermann Swalve*²

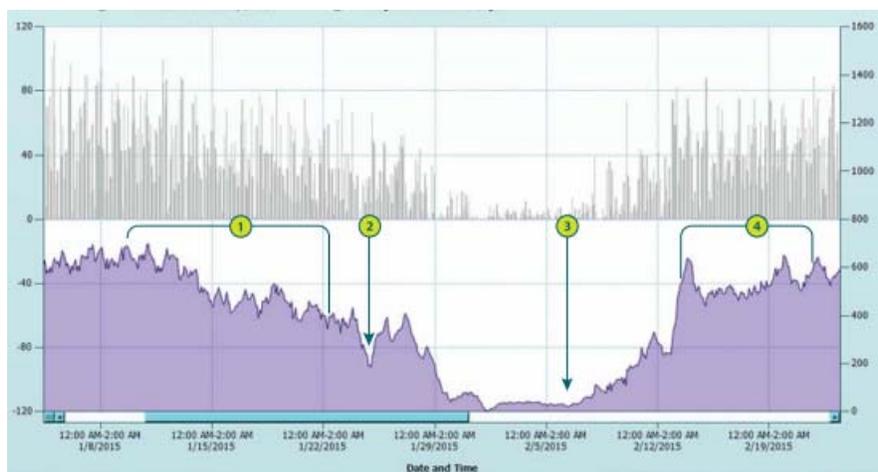
*Animal Breeding, Institute of Agricultural and Nutritional Sciences, Martin Luther University Halle-Wittenberg, Theodor-Lieser-Str. 11, 06120 Halle (Saale), Germany

†LKV Agro-Tier-Service GmbH, Angerstraße 6, 06118 Halle (Saale), Germany

‡State Office for the Environment, Agriculture and Geology of Saxony, 01311 Dresden-Pillnitz, Germany

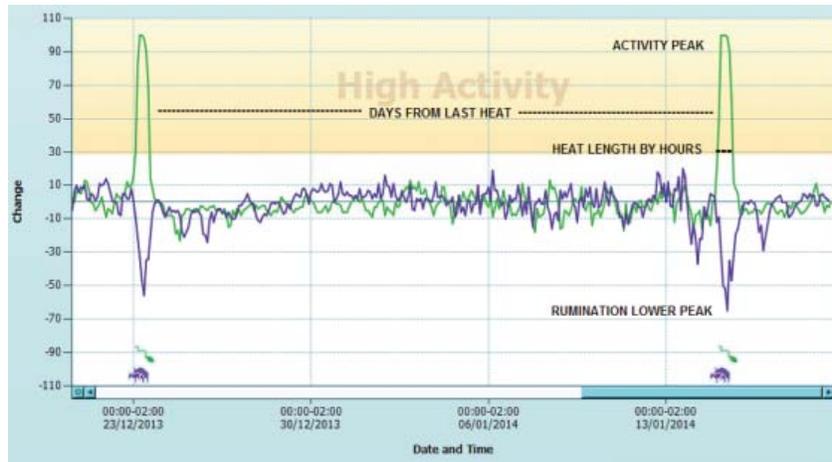
“In the future, biosensors for progesterone, integrated with inline milking systems, will probably facilitate phenotyping of a large population of cows for these novel fertility traits”

Rumination monitoring



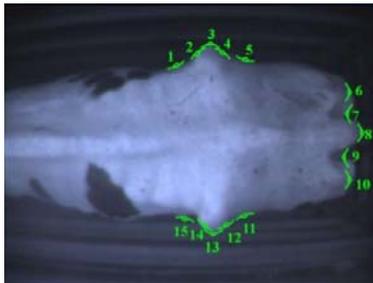
http://www.scrdairy.com/images/PDF/broshures_24_6/Rum_12_A4_Eng_May14_low.pdf

Heat detection



http://www.scrdairy.com/images/PDF/broshures_24_6/Rum_12_A4_Eng_May14_low.pdf

Automatic body condition scoring

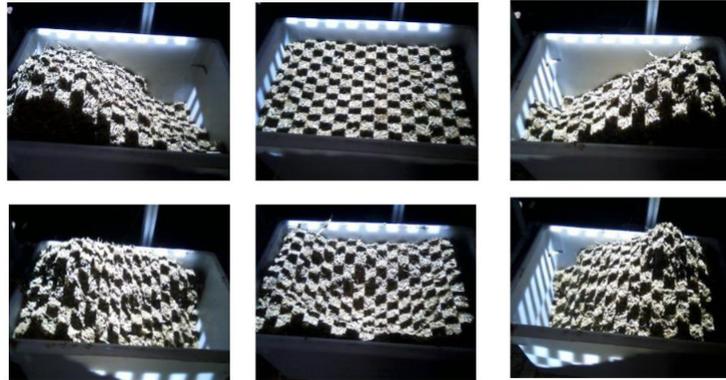


Picture: Jeffrey Bewley



Picture: DeLaval

Feed intake: 3 dimensional imaging



Lau, Shelley, Sterrett, and Bewley, 2013

Automatic calf feeders

Measure:

- Drinking speed
- Milk consumption
- Visit frequency
- Unrewarded visits



Research Report

A Face Only an Investor Could Love: CEOs' Facial Structure Predicts Their Firms' Financial Performance

Elaine M. Wong¹, Margaret E. Ormiston²,
and Michael P. Haselhuhn³

¹Department of Communication, University of Wisconsin–Milwaukee; ²Department of Organisational Behaviour, London Business School; and ³Sheldon B. Lubar School of Business, University of Wisconsin–Milwaukee



Psychological Science
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DOI: 10.1177/0956797611418838
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THE ROYAL
SOCIETY **B**

Proc. R. Soc. B (2008) 275, 2651–2656
doi:10.1098/rspb.2008.0873
Published online 19 August 2008

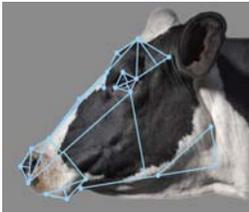
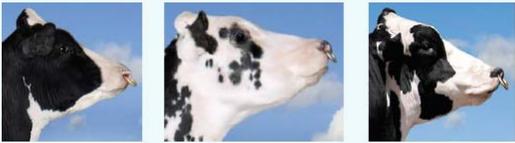
In your face: facial metrics predict aggressive behaviour in the laboratory and in varsity and professional hockey players

Justin M. Carré¹ and Cheryl M. McCormick^{1,2,*}

¹Department of Psychology, and ²Centre for Neuroscience, Brock University,
500 Glenridge Avenue, St Catharines, Ontario, Canada L2S 3A1

356 Facial biometrics as predictors of productivity, fertility, and health traits in elite dairy sires. C. McVey* and P. Pinedo,
Colorado State University, Fort Collins, CO.

ADSA 2017

1. Pictures from sire catalogue, 62 bulls
2. gEstimated Breeding Values: productivity, health, longevity, fertility
3. Use facial recognition software → facial biometrics
4. Predictors: gPTA type traits + facial biometrics

Conclusion:
"All traits demonstrated significant correlations with facial biometrics. Productivity, longevity, and fertility traits were particularly well predicted."

WORLD ECONOMIC FORUM

The artificial intelligence revolution is here

Marc Benioff says it will change your life

<https://www.youtube.com/watch?v=zSNIRmFNGAO>

Chinese lecturer to use facial-recognition technology to check boredom levels among his students

share | | Save

<https://www.telegraph.co.uk/news/2016/09/12/facial-recognition-technology-used-in-chinese-classroom-to-check/>



Chinese police with facial recognition glasses



NEWS

Finally, Facial Recognition for Cows Is Here



Sidney Fussell

2/01/18 10:40am • Filed to: LIVESTOCK IS TECH

... software uses images to identify individual animals based on hide patterns and facial recognition, and tracks key data such as food and water intake, heat detection and behavior patterns ...



<https://gizmodo.com/finally-facial-recognition-for-cows-is-here-1822609005>

SCIENTIFIC
AMERICAN

English ▾ Cart Sign In |

BIOLOGY

Fowl Language: AI Decodes the Nuances of Chicken “Speech”

How machine learning can translate chicken chatter and improve farming

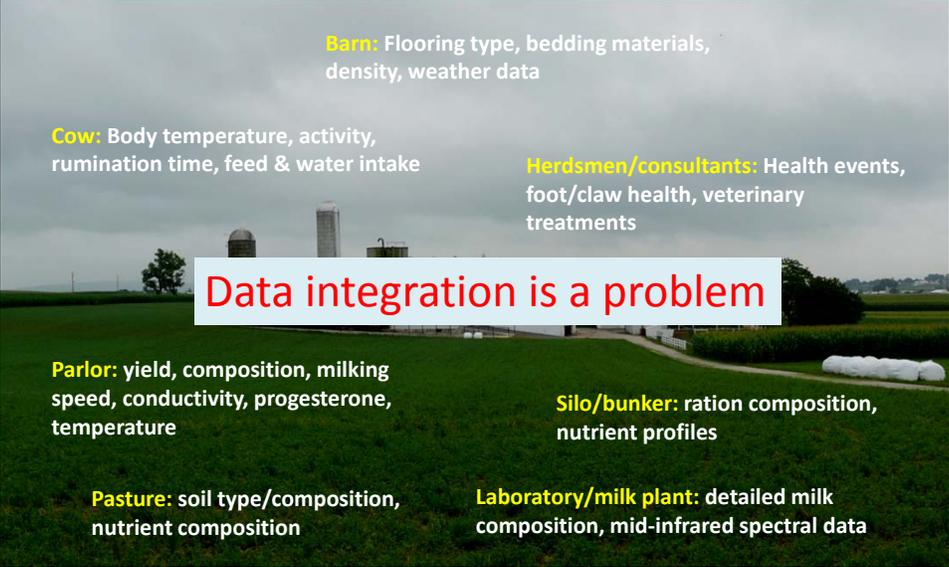
By Ferris Jabr on December 11, 2017



“... the birds have “patterns of speech” that reveal a lot about their well-being.”



Where do new phenotypes come from?



Barn: Flooring type, bedding materials, density, weather data

Cow: Body temperature, activity, rumination time, feed & water intake

Herdsmen/consultants: Health events, foot/claw health, veterinary treatments

Data integration is a problem

Parlor: yield, composition, milking speed, conductivity, progesterone, temperature

Silo/bunker: ration composition, nutrient profiles

Pasture: soil type/composition, nutrient composition

Laboratory/milk plant: detailed milk composition, mid-infrared spectral data

Source: http://commons.wikimedia.org/wiki/File:Amish_dairy_farm_3.jpg



Council on Dairy Cattle Breeding 2017 Industry Meeting, Madison, WI, 3 October 2017 (35)

Cole

University of Wisconsin virtual dairy farm uses AI to improve farm management

By [Mary Ellen Shoup](#)
22-Aug-2017 - Last updated on 23-Aug-2017 at 08:12 GMT







J. Dairy Sci. 97:731–742
<http://dx.doi.org/10.3168/jds.2013-6693>
© American Dairy Science Association[®], 2014.

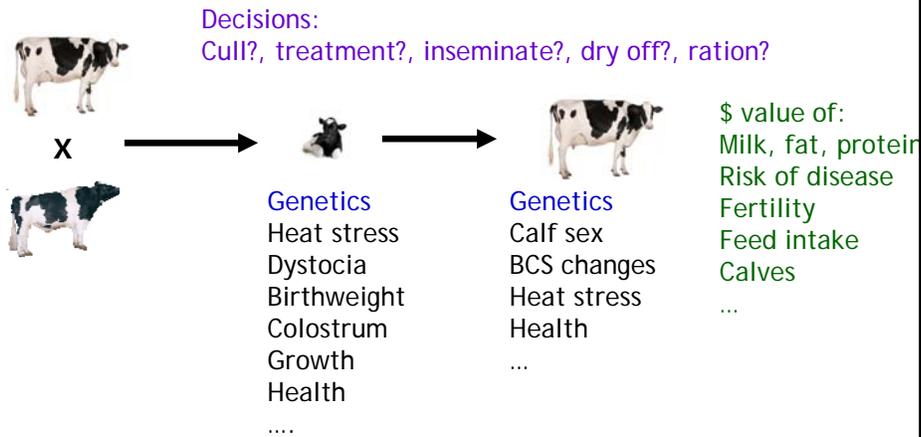
Prediction of insemination outcomes in Holstein dairy cattle using alternative machine learning algorithms

Saleh Shahinfar,*† David Page,† Jerry Guenther,* Victor Cabrera,* Paul Fricke,* and Kent Weigel*
*Department of Dairy Science, and †Department of Biostatistics and Medical Informatics and Department of Computer Science, University of Wisconsin, Madison 53706

The multidisciplinary management opti

<https://www.dairyreporter.com/Article/2017/08/23/University-of-Wisconsin-starts-virtual-dairy-farm-project-using-AI>

Prediction from birth to culling



Summary

- Value in large data sets for research: cleaned, representative, complete, unbiased, high frequency, novel phenotypes
- Trends towards image analysis, artificial intelligence, combining data from various sources
- New BIG data: where does it go?
- Data integration is a problem in the USA

Thank you
devries@ufl.edu