

Challenges in Reproduction

Matt Lucy

Animal Reproductive Biology Group

Division of Animal Sciences

University of Missouri-Columbia, USA

Dairy Reproduction 2013



Ever-Green-View My 1326-ET

Waldo, Wisconsin USA February 2010



32,805 kg of milk*

1,267 kg fat

974 kg protein

365 d lactation

***3-times average US
cow in 2010**

Ever-Green-View My 1326-ET

Waldo, Wisconsin USA February 2010



32,805 kg of milk per year

134,000 cups of milk

Nutritionally equal to (calories):

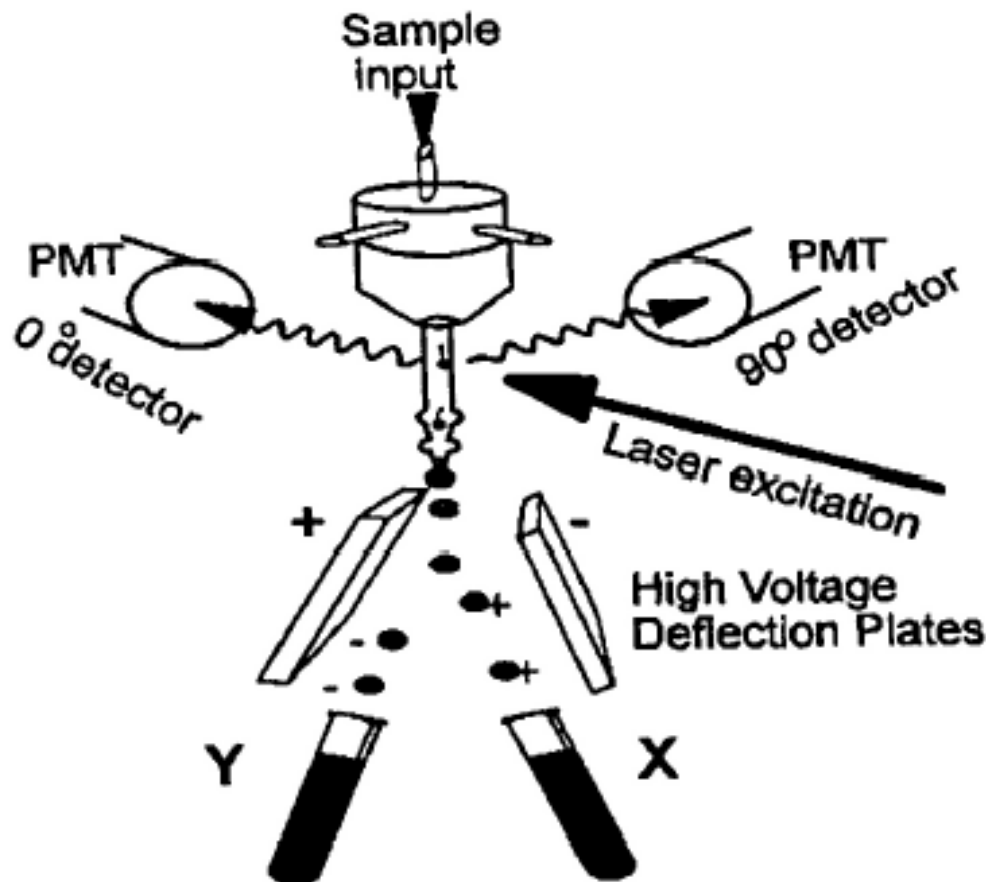
- **22,000 dozen eggs**
- **5000 roasting chickens**
- **250 whole hogs**
- **100 sides of beef**

ONE COW

Innovations of the past decade

- **Highly Effective Synch Programs for Cows**
 - Presynch Ovsynch
 - G6G
 - 5 day Cosynch 72
 - Double Ovsynch
- **Highly effective Resynch Programs for COWS**

Innovations of the past decade: Gender selected semen



Genex
Cooperative, Inc.

A Subsidiary of Cooperative Resources International

Innovations of the past decade: Improved systems for automated estrus detection



Innovations of the past decade: Better and more portable ultrasounds

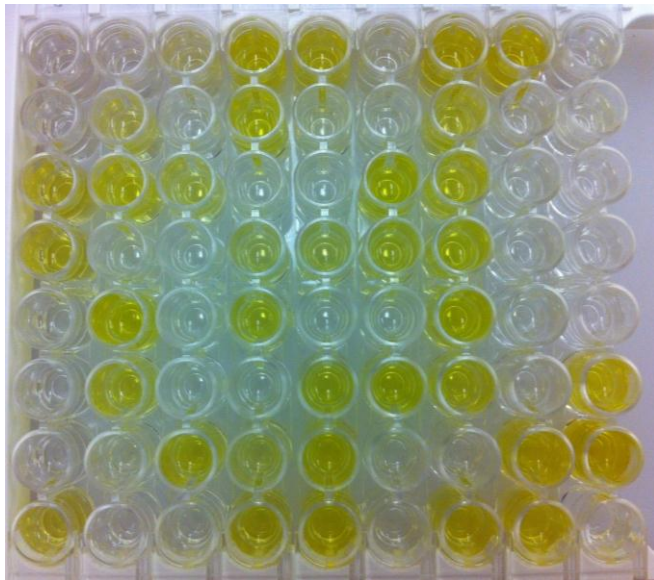


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FOOD AND NATURAL RESOURCES

Innovations of the past decade: Blood pregnancy tests



bioTRACKING

TESTING

for DAIRY CATTLE

for BEEF CATTLE

for GOATS

for SHEEP

for WILDLIFE

for BISON

for HORSES

Welcome to E

Based in Mosc

help improve

BioPRYN®, a t

other ruminar

convenient B

its own labora

country quick

Submission

Genex Cooperative, Inc.
A subsidiary of Cooperative Resources International

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DG29™
Bovine Pregnancy Results on Demand



DG29 is an easy-to-use bovine blood pregnancy test. Blood samples are drawn from cattle on the farm or ranch, forwarded to a certified laboratory, and pregnancy diagnosis is determined by the presence of a pregnancy-related protein. Results are returned to the farm quickly and accurately.

IDEXX

Test With Confidence™

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Livestock/Poultry Diagnostics

Ruminant

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Poultry

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Home > Livestock/Poultry Diagnostics > Ruminant



The Point



Milk Pregnancy Test Now Available

Is she pregnant? Is she still pregnant? These are some of the most important questions asked on the dairy farm. Managing the reproductive cycle on your farm—from timely breeding to pregnancy confirmation to successful calving — is a critical component on today's dairy farms.

Traditionally, producers have had limited options for pregnancy detection. The most common and most effective in early detection is palpation or ultrasonography by a veterinarian to identify the presence of a fetus. More recently blood testing has been used to confirm pregnancy. Today, NorthStar Cooperative is making available a new tool for producers in the management of the reproduction cycle. Working with IDEXX Laboratories, AntelBio now offers

on the farm is reproductive status. Being able to gather that type of information noninvasively, without additional labor or stress on the cow is a win for both the producer and the animal."

How it works

The new Milk Pregnancy Test is based on ELISA technology, a rapid and trusted diagnostic method. The test detects the presence of Pregnancy Associated Glycoproteins (PAGs) in the milk sample. These proteins are released by the placenta during pregnancy and are specific to pregnancy, unlike some other chemical indicators of pregnancy such as progesterone. PAGs can be detected in milk from 35 days post-breeding and testing can be implemented anytime after traditional voluntary waiting periods

Stockowner notices

Stockowner meetings are fast approaching and all stockowners are encouraged to attend to cast a vote for the election of directors and resolutions and advisory committee members. To be eligible to vote at the 2013 stockowner meetings you must be sign-up as a common stockowner by December 31, 2012.

For more information on how to become a NorthStar stockowner, talk to your area NorthStar Specialist.

Pre-pay and earn 3%

Earn an extra 3 percent on your money when you make a pre-payment towards your 2013 purchases at NorthStar Cooperative. To take advantage of this

Innovations of the past decade: Automated Milk Progesterone Testing

Förster Technik: FT Multilyser

DeLaval: Herd Navigator



Herd Navigator™ 

[About Herd Navigator](#)

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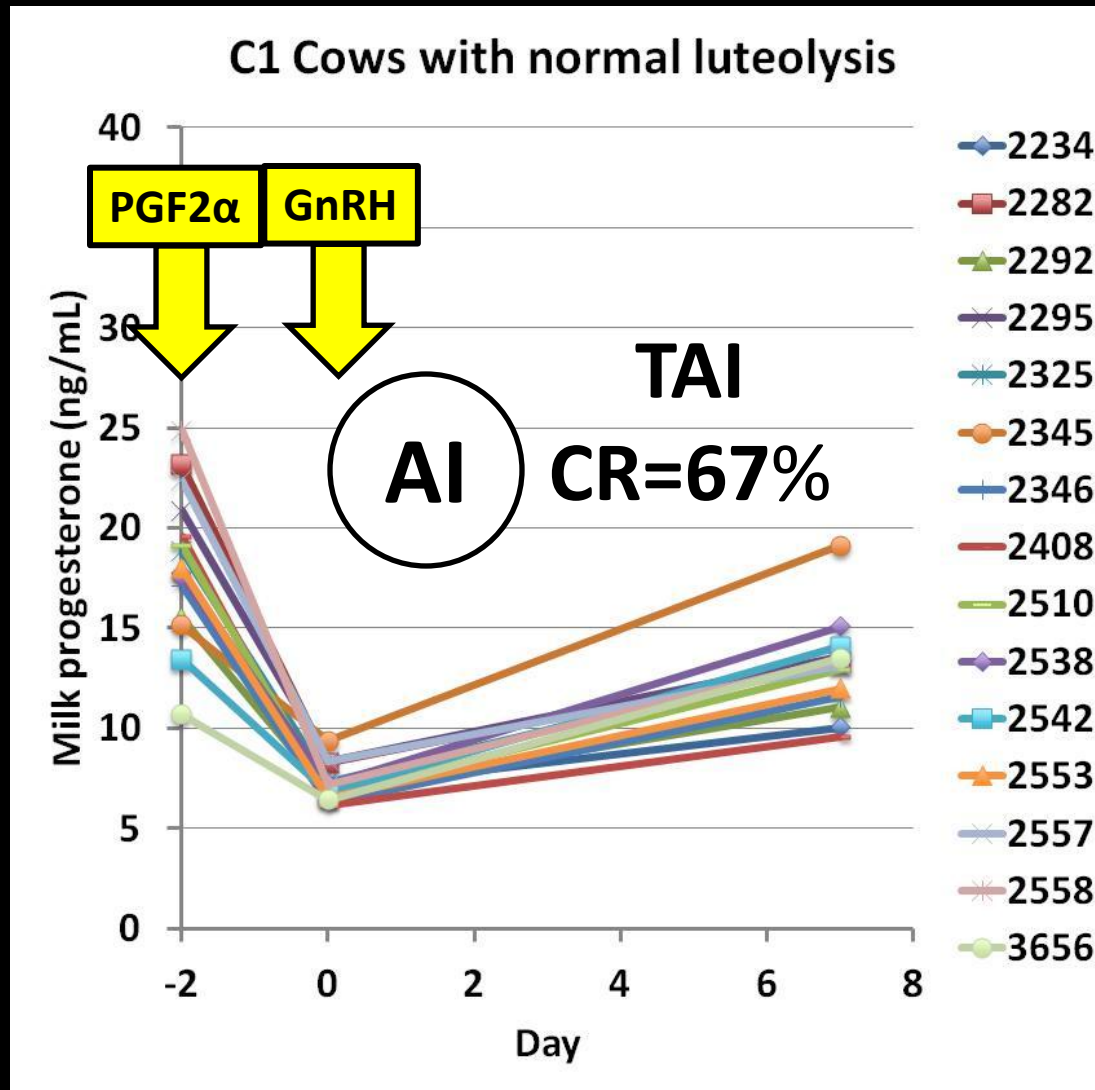
Herd Navigator™ is the future solution for the professional farmer who wants proactive herd management.

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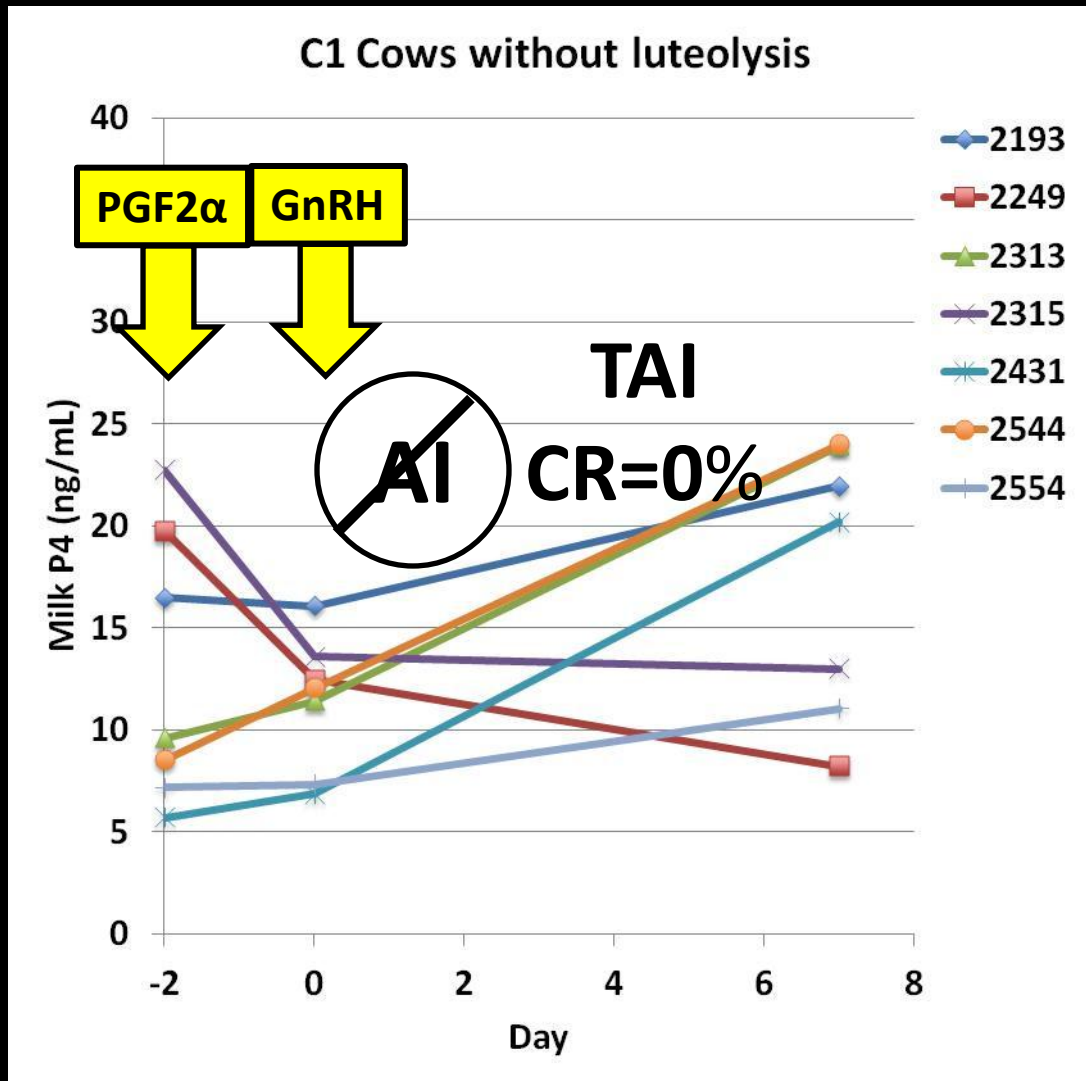


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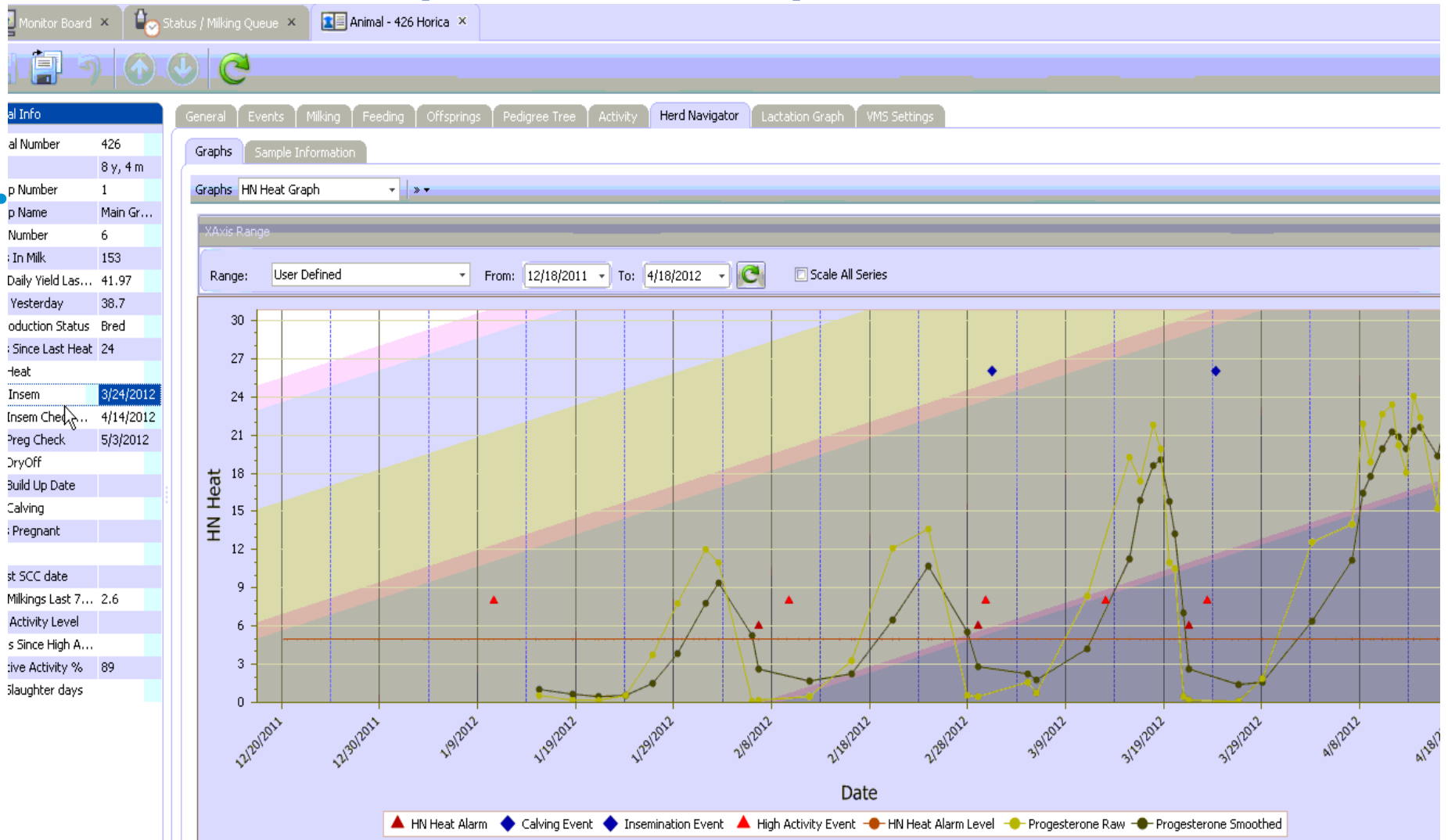
Milk progesterone around TAI



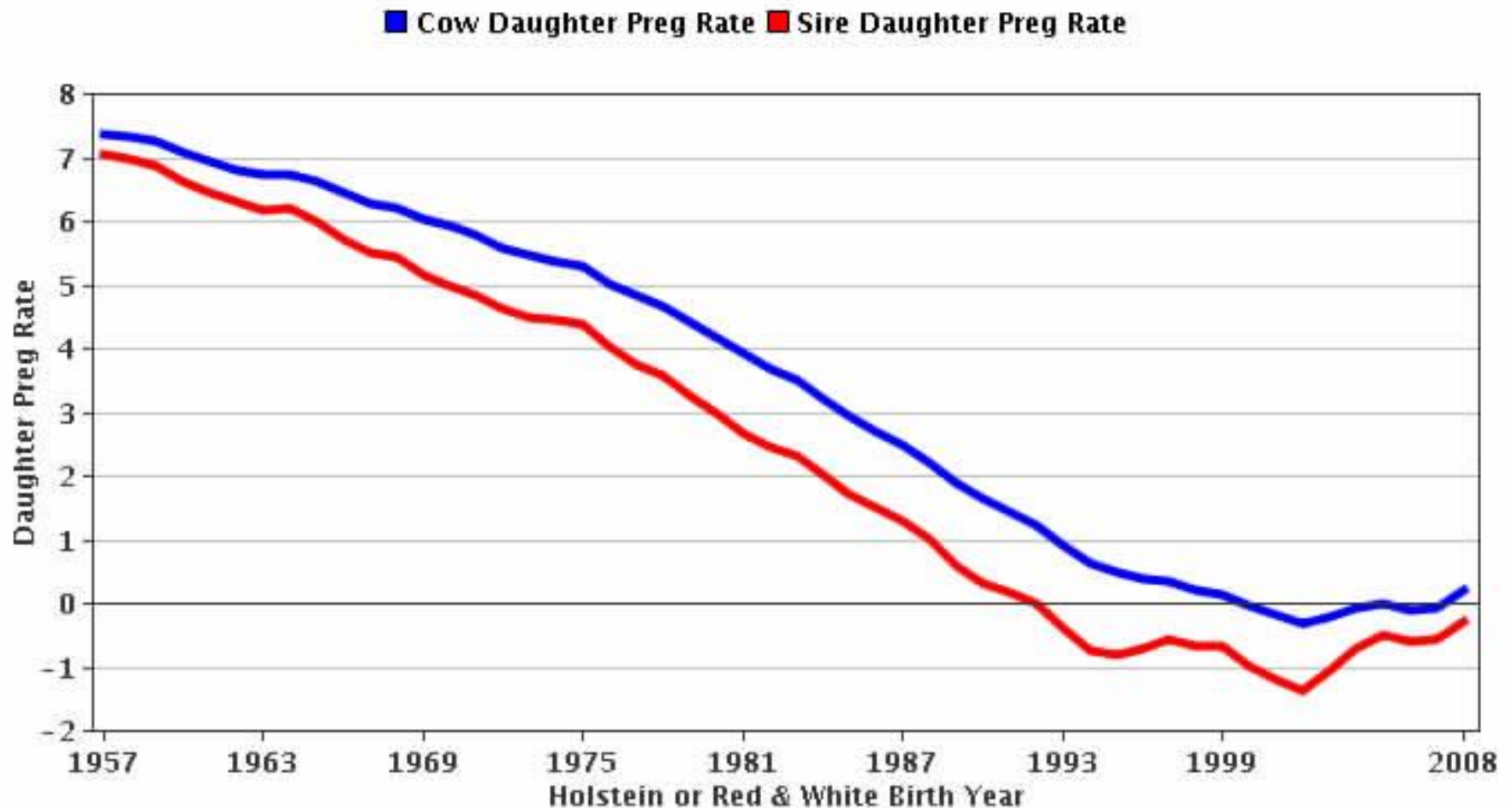
Milk progesterone around TAI



Cow 426 – Reproductive Graph



Innovations of the past decade: Introduction of Daughter Pregnancy Rate



75th Annual Hoard's Dairyman Cow Judging Contest

1st Contest 1931 Winner



First Holstein Winner

25th Contest 1956 Winner



Inka Pietje Veeman, EX

50th Contest 1981 Winner



Jan Com Fond Matt Matilda, EX 97 5E
Pinehurst Farm, Sheboygan Falls, Wis.

74th Contest 2004 Winner



VanDyk-K Charles Pandora-ET, EX 91 2E
VanDyk-K Holsteins, Lynden, Wash.



Ever-Green-View
My 1326-ET

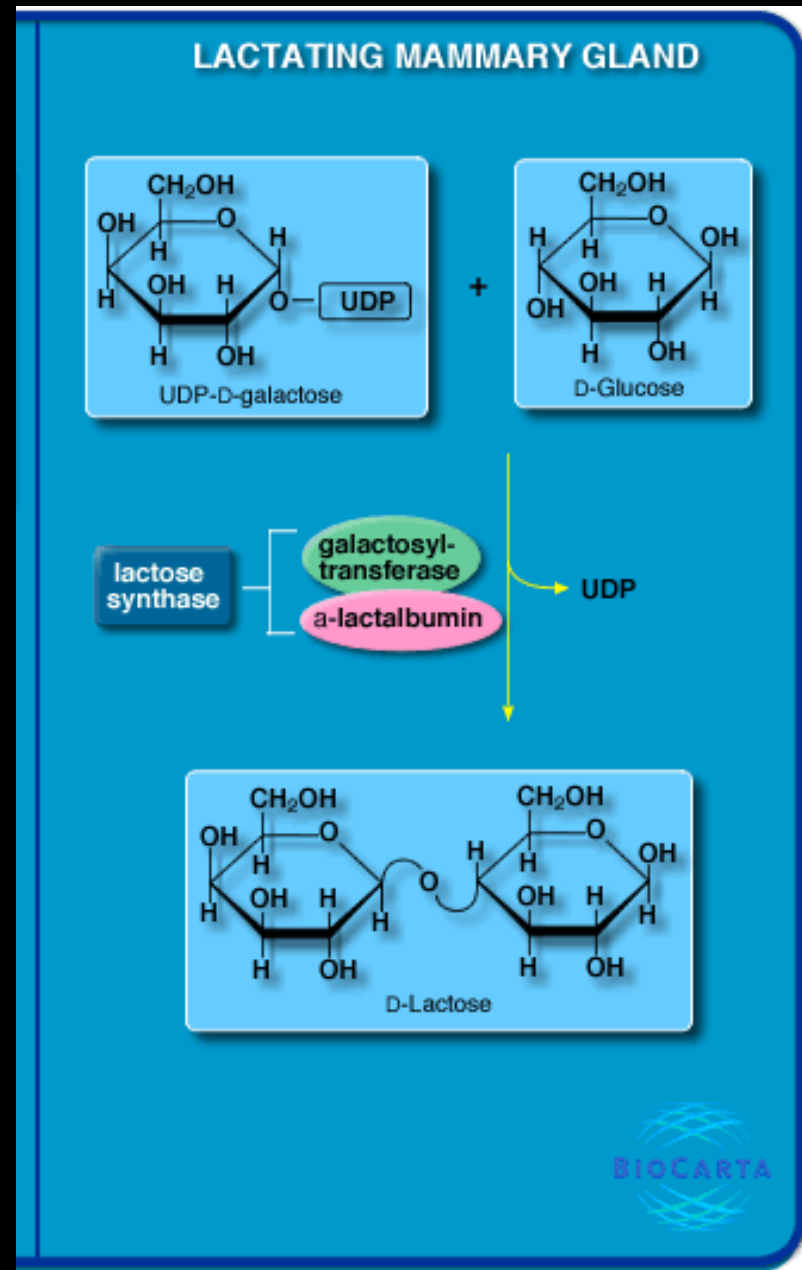
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Lactose (milk sugar)

Two molecules of
glucose are used in
the production of
one molecule of
lactose



How much glucose per day?

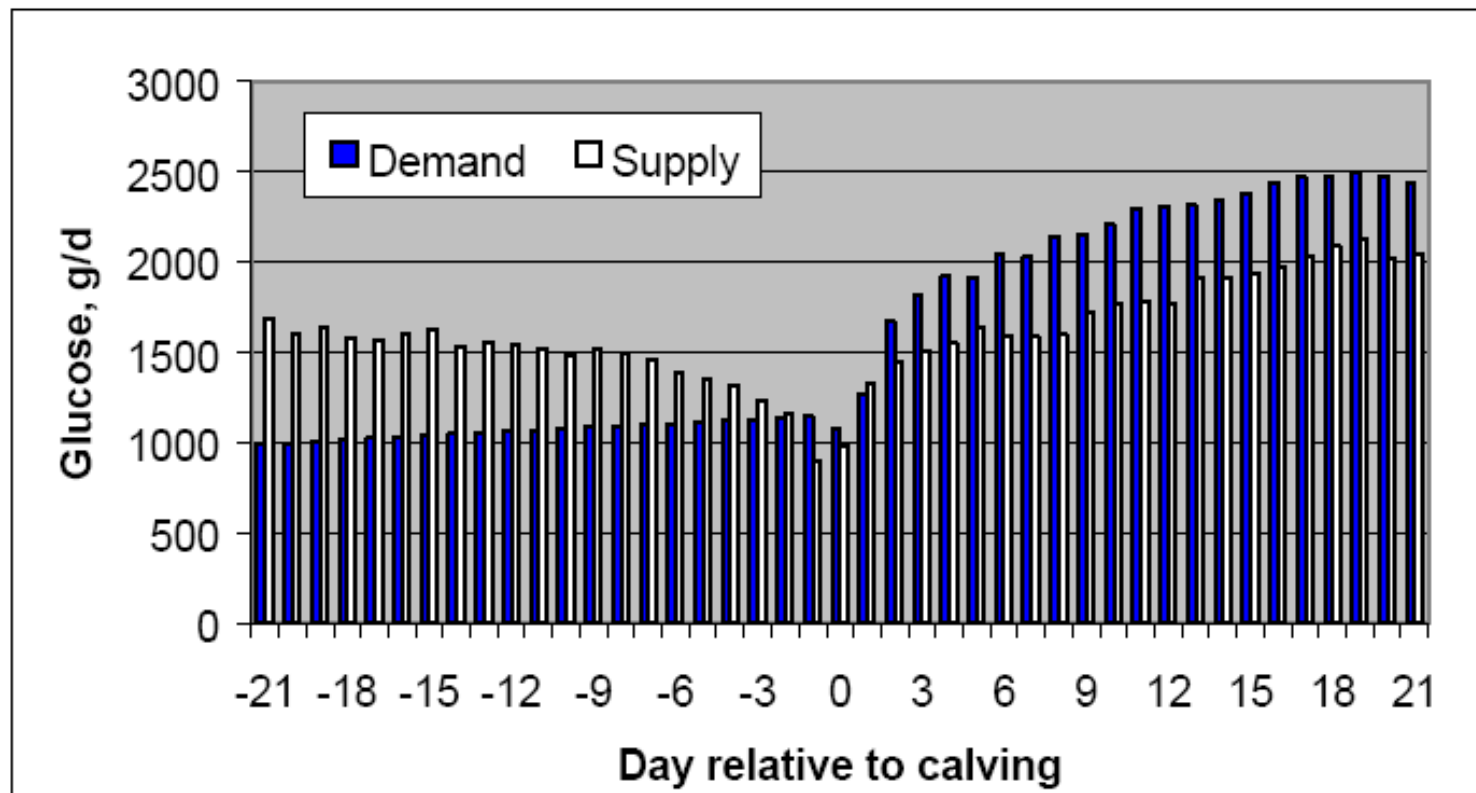
72 g of glucose to produce 1 kg milk

100 kg milk per day

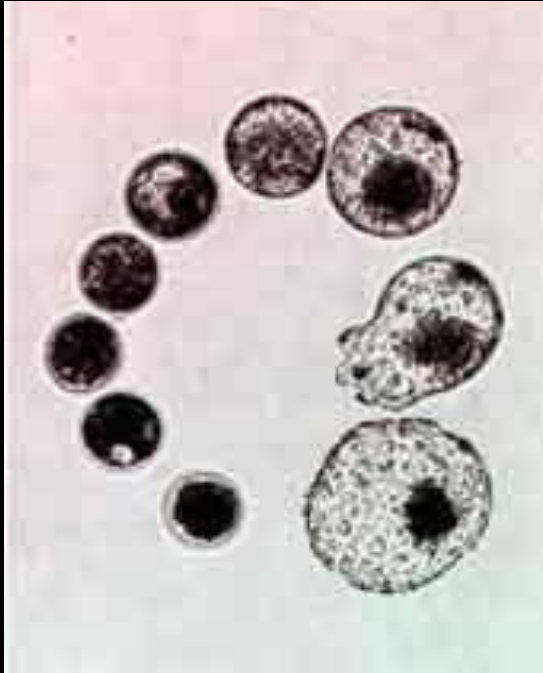
7.2 kg glucose per day



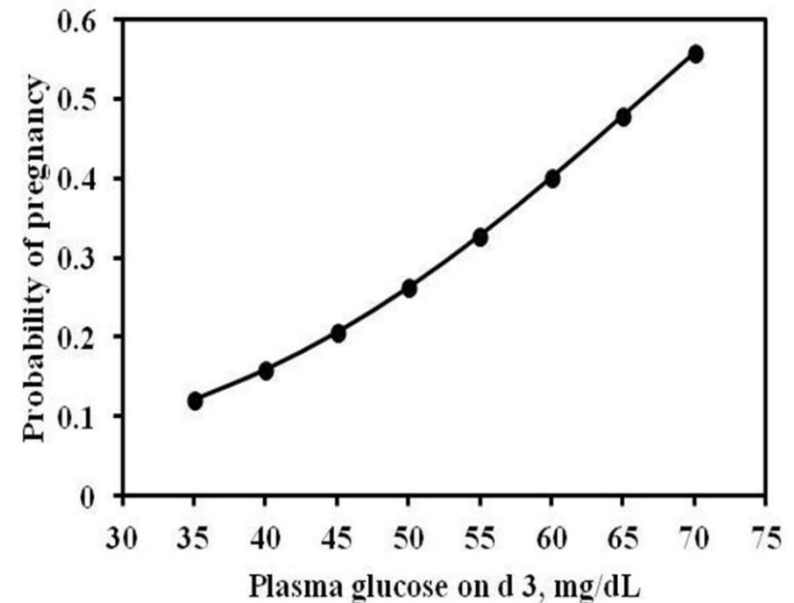
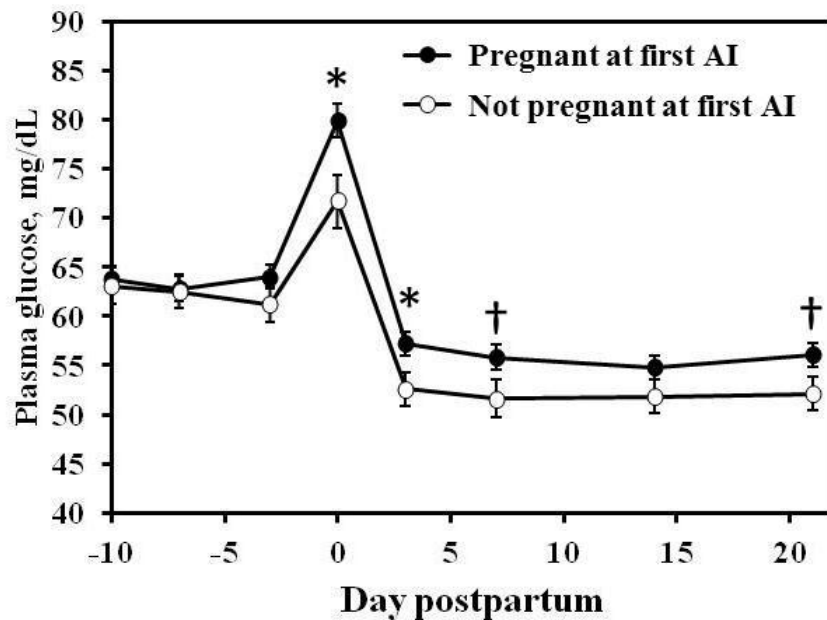
Glucose supply and demand: Prepartum and early lactation



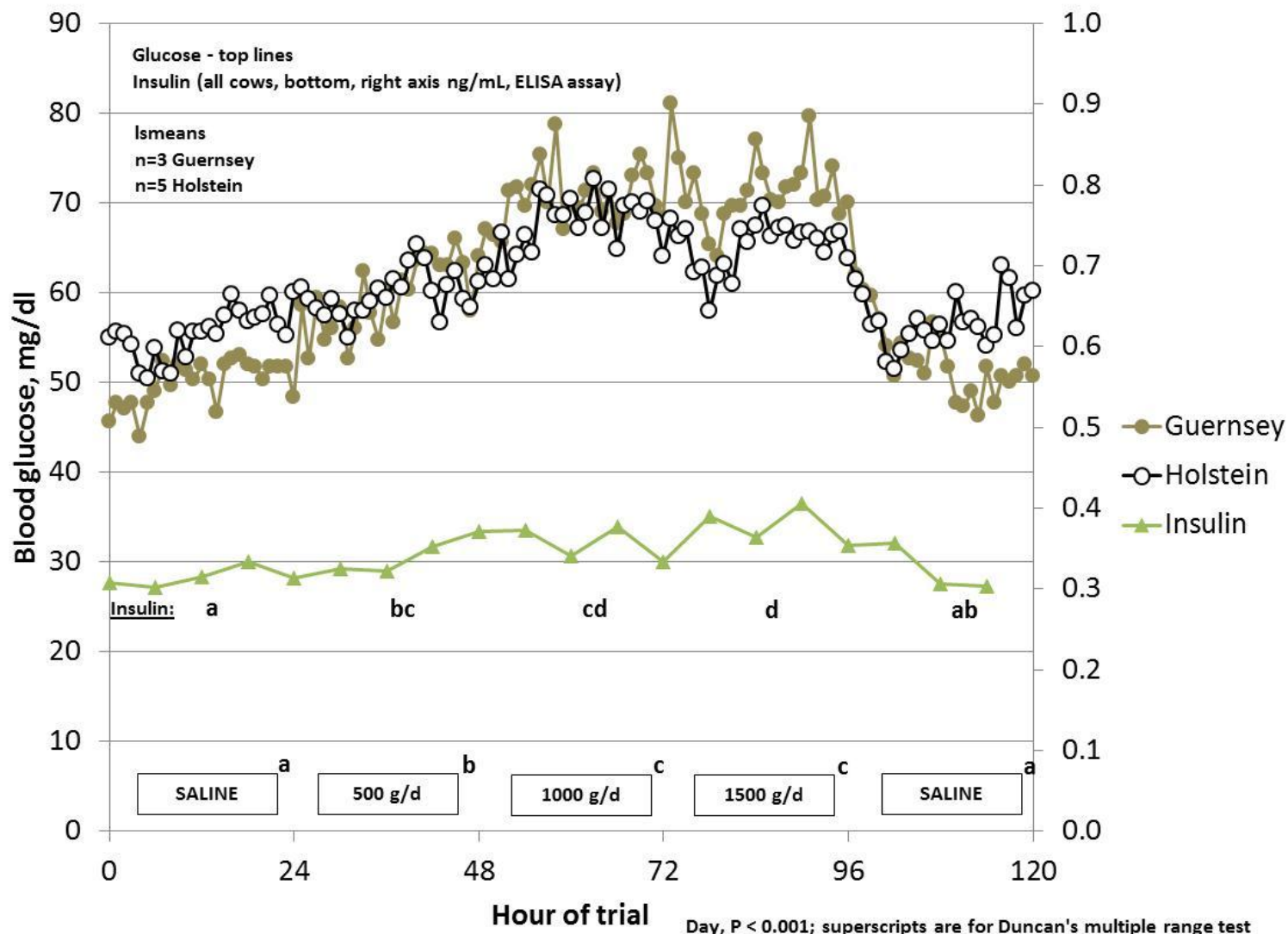
Bovine embryonic and fetal development depends on glucose



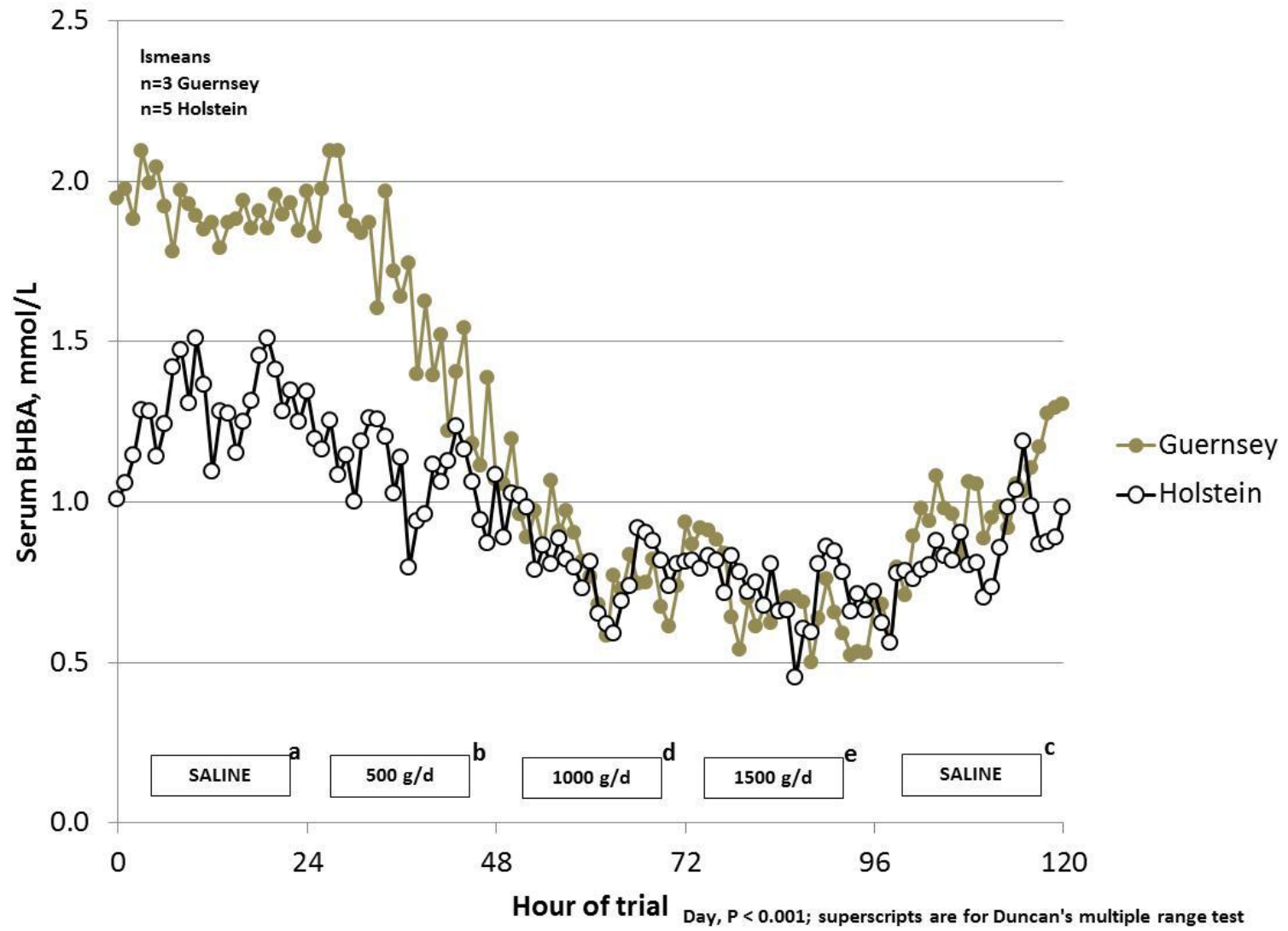
Early postpartum glucose and pregnancy later postpartum



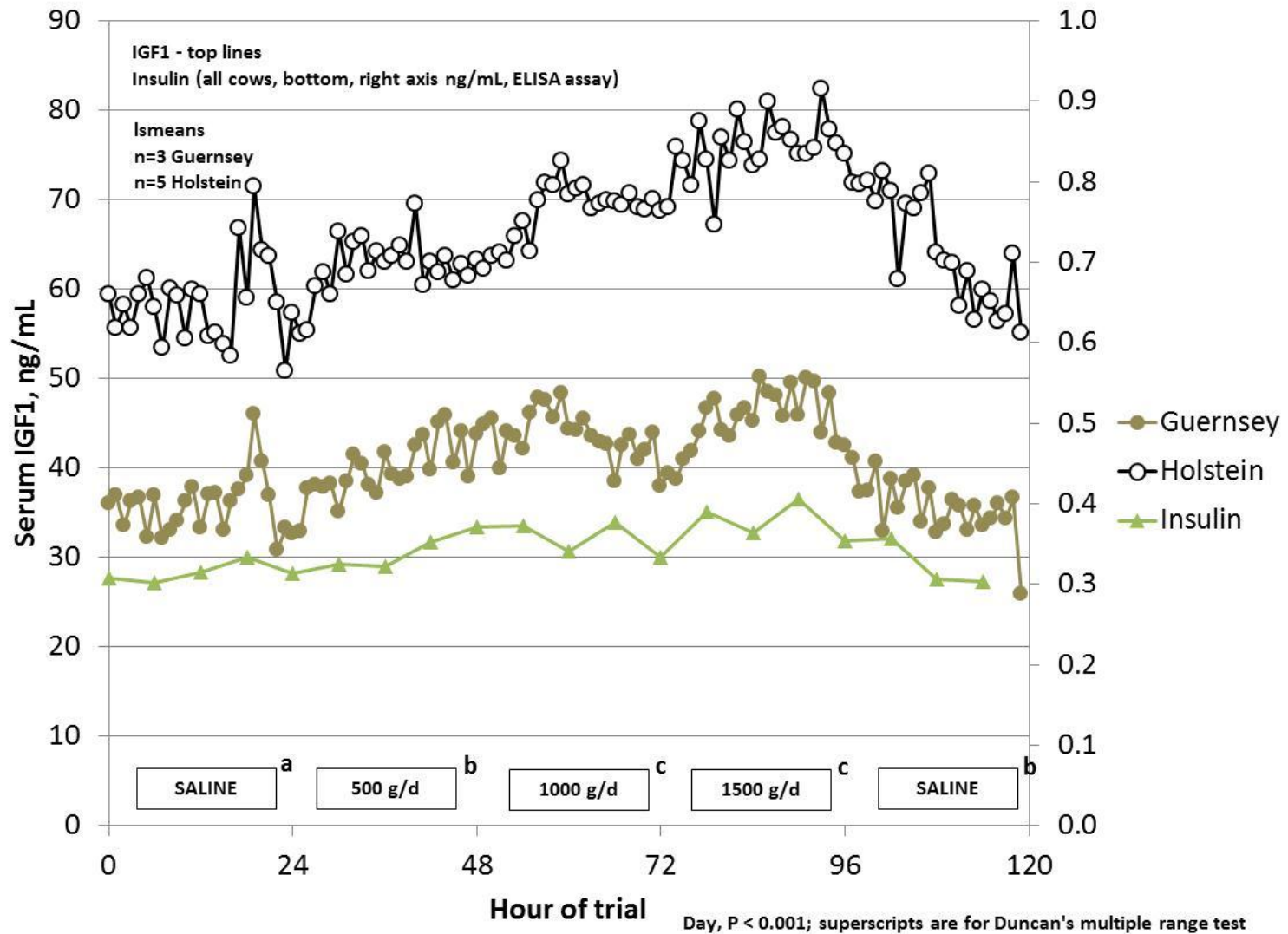
Blood glucose and serum insulin



Serum BHBA



Serum IGF1 (Keisler lab)



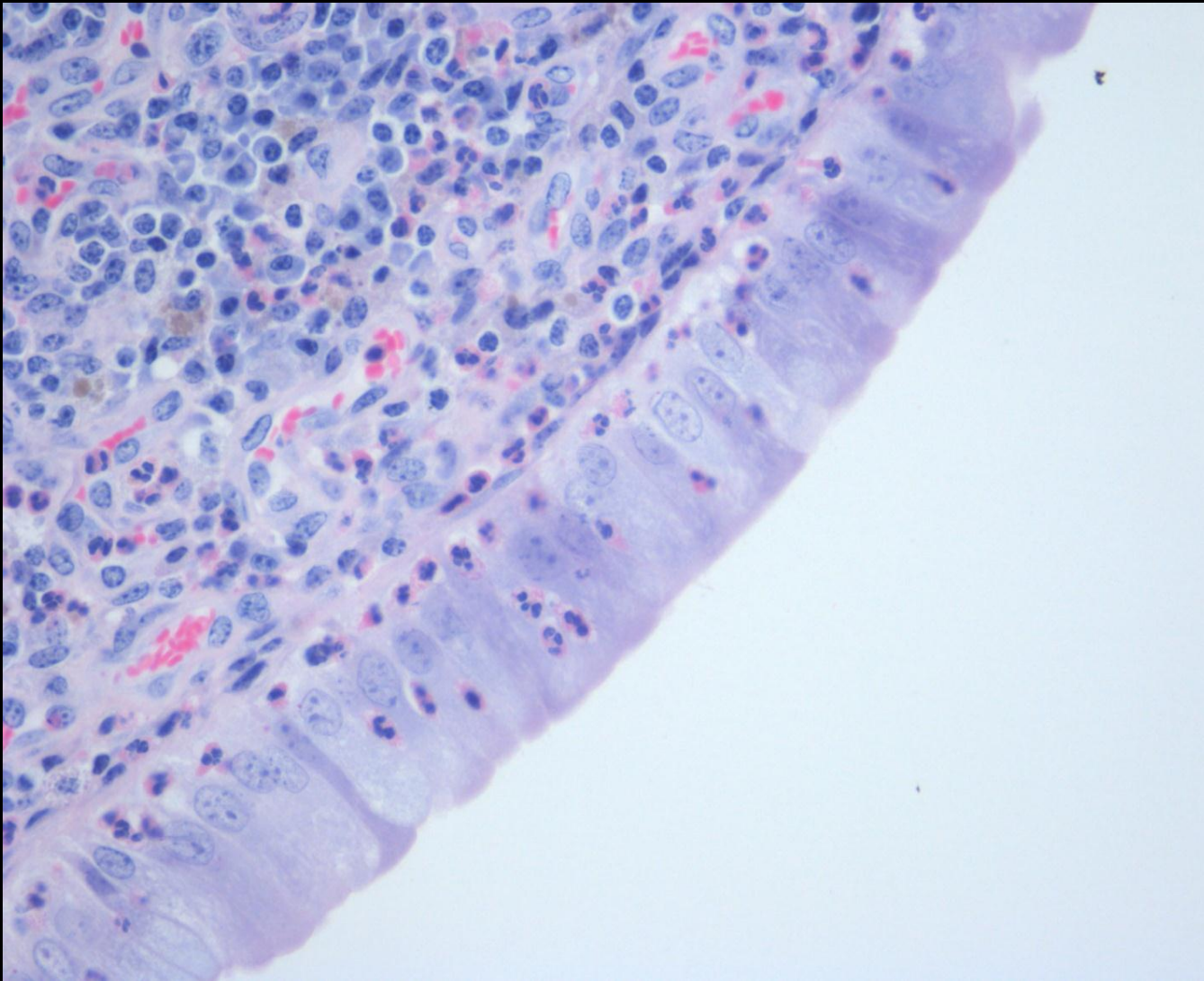


Day 3

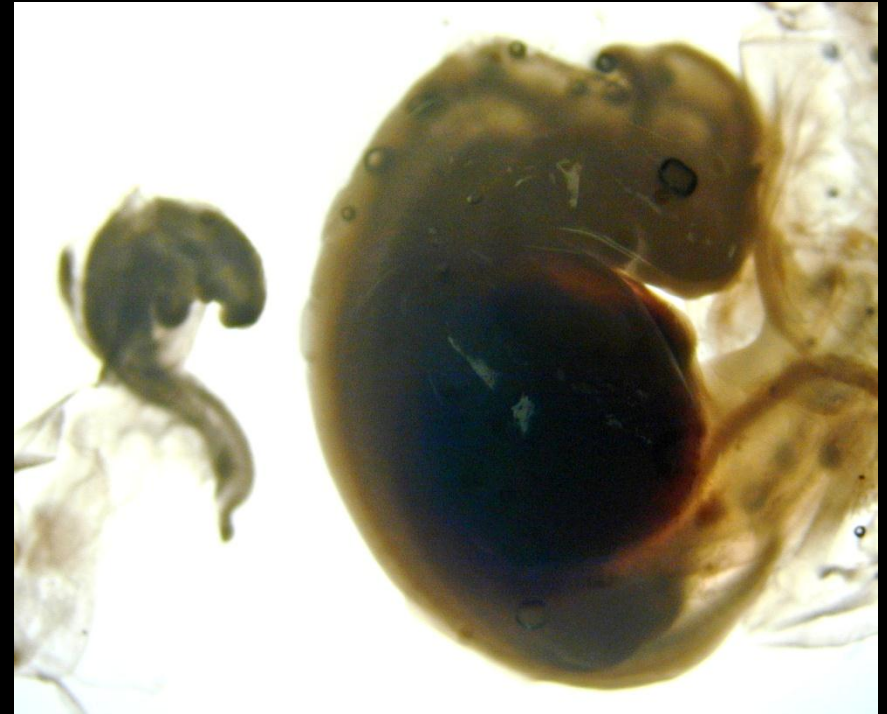
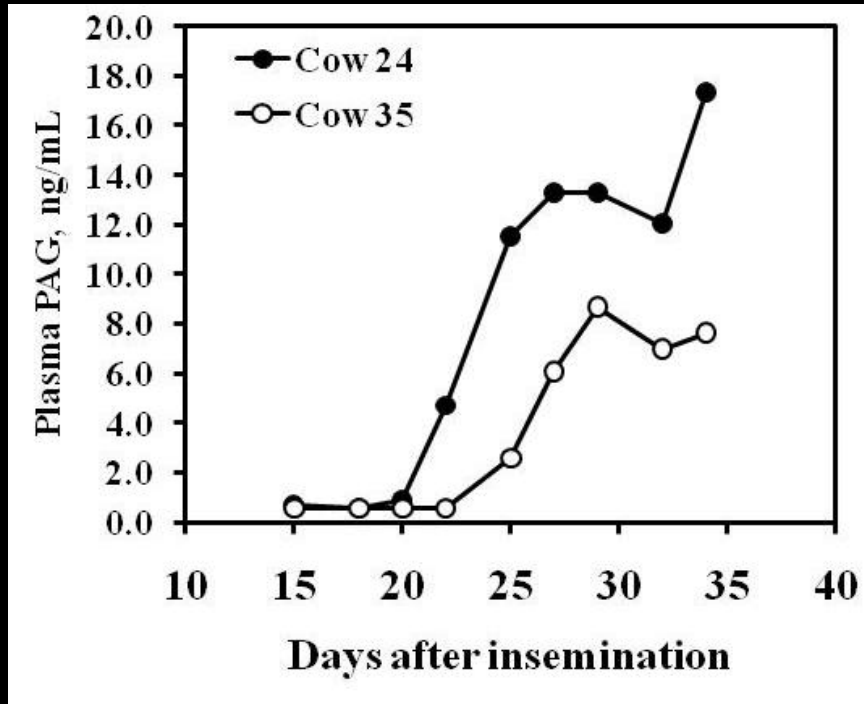


Day 25

Luminal Epithelium of the bovine uterus at 25 dpp



Day 35 bovine fetuses



**Lactating;
Pregnant at
2nd AI**

**Not lactating;
Pregnant at
1st AI**



Ann. Rev. Biochem. 1988. 57:1-28
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SEQUENCES, SEQUENCES, AND SEQUENCES

Frederick Sanger

Retired from Medical Research Council Laboratory of Molecular Biology, Hills Road, Cambridge. CB2 2QH, England

Table 1 The progress in sequencing

Year	Protein	RNA	DNA	Number of residues	Ref.
1935	Insulin			1	4
1945	Insulin			2	3
1947	Gramicidin S			5	16
1949	Insulin			9	12
1955	Insulin			51	22
1960	Ribonuclease			120	25
1965		tRNA _{Ala}		75	32
1967		5S RNA		120	35
1968			Bacteriophage λ	12	45
1978			Bacteriophage ϕ X 174	5,386	61
1981			Mitochondria	16,569	58
1982			Bacteriophage λ	48,502	54
1984			Epstein-Barr virus	172,282	64

Human Genome Project 10th anniversary – 2011

- 3 billion base pairs
- 10 years draft sequence
- 13 years completed sequence
- \$2.7 billion



Innovations of the past decade: Sequencing of the bovine genome

connection
information
discovery

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Search for

Display Show Send to

All: 1 Environmental: 0 Eukaryotes: 1 Prokaryotes: 0

[Links](#)

Genome Project > ***Bos taurus*** (bovine)

Resource Links

NCBI Resources

- MapViewer
- BLAST genome
- TaxPlot
- Cow Genome Resources

Organism data in GenBank

- EST
- Genomic
- mRNA
- Protein
- WGS

Sequencing Centers

- Bovine Genome Project - Baylor
- Cattle Genome Sequencing Consortium

Sequencing Projects

- Sequencing Proposal

Related Resources

- ArKDB - cow
- CSIRO Livestock Genomics -

An agriculturally important animal for beef and milk production.

Lineage: *Eukaryota; Metazoa; Chordata; Craniata; Vertebrata; Euteleostomi; Mammalia; Eutheria; Laurasiatheria; Cetartiodactyla; Ruminantia; Pecora; Bovidae; Bovinae; Bos; Bos taurus*

Photo: courtesy of Terri Hobbs (www.crazyforcows.com)

1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25 26
27 X Y MT

— unknown chromosome size

Search Map Viewer for

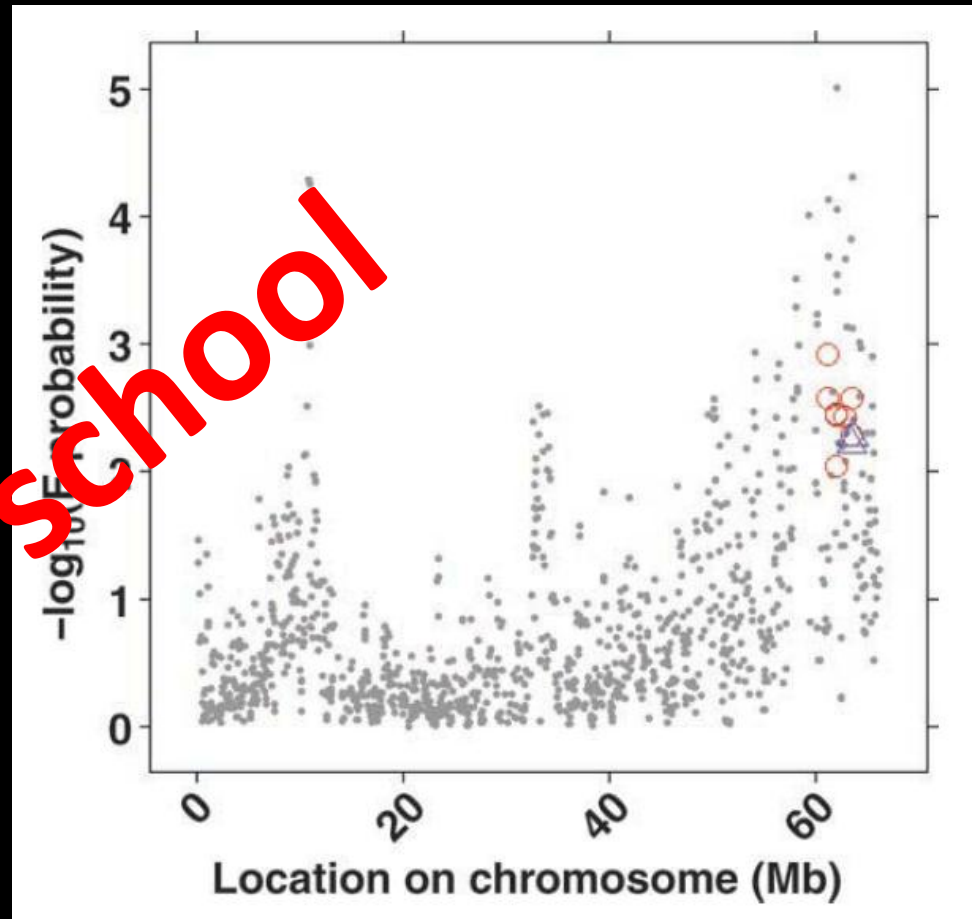
Available maps:

Sequence Maps	Genetic maps	RH maps
15 maps	MARC	ILTX

Genome Projects

- Bos taurus overview** (Project ID: 10708)

Innovations of the past decade: Bovine SNP chips and the identification of fertility markers



Fertility markers on chromosome 18
Price et al. (2010)

One Run, Eight Bacterial Genomes: The Potential of the MiSeq® Personal Sequencer

With 10-fold higher output than other small-scale next-generation sequencing platforms, the MiSeq system will enable Tim Stinear, Ph.D. to spend less time generating data and more time analyzing it.

Systems / **MiSeq Personal Sequencer**

Follow us: 



Sequencing at the touch of a button.

MiSeq is the only fully integrated personal sequencer, delivering a streamlined solution that takes you from rapid sample prep through automated data analysis and storage in the BaseSpace cloud. Sequencing doesn't get any easier than this.

[See what's possible »](#)

**15 trillion bp in a single 48 h run = complete sequence of 500 cows at 10 x coverage
Fits on a 2 sq ft surface; \$400 to \$750 per run.**



ORIGINAL ARTICLE

Use of haplotypes to estimate Mendelian sampling effects and selection limits

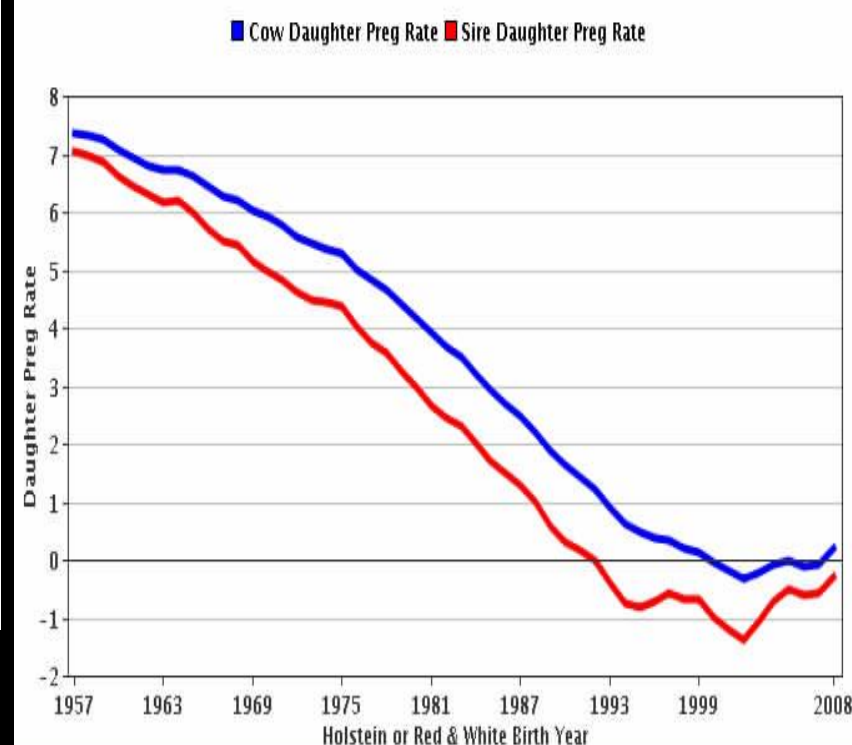
J.B. Cole & P.M. VanRaden

Animal Improvement Programs Laboratory, ARS, USDA, Beltsville, MD, USA

J. Anim. Breed. Genet. 128 (2011) 446–455

Table 3 Predicted upper and lower bounds of selection limits and largest observed direct genomic values (DGV) for daughter pregnancy rate (DPR), milk yield, lifetime net merit (NM\$) and protein yield for US Brown Swiss (BS), Holstein (HO) and Jersey (JE) cattle

Trait	Breed	Lower bound	Upper bound	Largest DGV ^a
DPR (%)	BS	20	53	8
	HO	40	139	8
	JE	19	53	5



Mentally prepare yourself for the first synthetic cow genome



RNA-Guided Human Genome Engineering via Cas9

Prashant Mali,^{1*} Luhan Yang,^{1,3*} Kevin M. Esvelt,² John Aach,¹ Marc Guell,¹ James E. DiCarlo,⁴ Julie E. Norville,¹ George M. Church^{1,2†}

Bacteria and archaea have evolved adaptive immune defenses, termed clustered regularly interspaced short palindromic repeats (CRISPR)/CRISPR-associated (Cas) systems, that use short RNA to direct degradation of foreign nucleic acids. Here, we engineer the type II bacterial CRISPR system to function with custom guide RNA (gRNA) in human cells. For the endogenous AAVS1 locus, we obtained targeting rates of 10 to 25% in 293T cells, 13 to 8% in K562 cells, and 2 to 4% in induced pluripotent stem cells. We show that this process relies on CRISPR components; is sequence-specific; and, upon simultaneous introduction of multiple gRNAs, can effect multiplex editing of target loci. We also compute a genome-wide resource of ~190 K unique gRNAs targeting ~40.5% of human exons. Our results establish an RNA-guided editing tool for facile, robust, and multiplexable human genome engineering.

“We expect that RNA-guided genome targeting will have broad implications for synthetic biology . . . and targeted ex vivo and in vivo gene therapy.

Redefining high fertility



www.keelobach.com

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Now is the time to define “high fertility”!



**Pregnant after an observed
in estrus and AI**



Pregnant after a timed AI

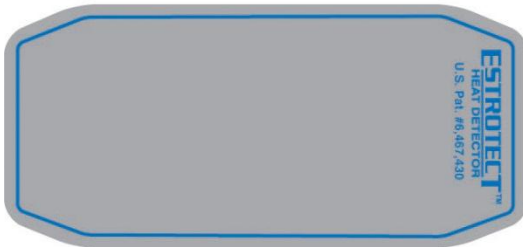
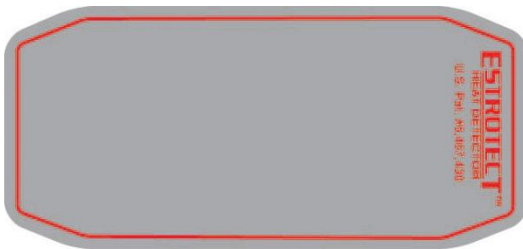
Now is the time to define “high fertility”!



**Pregnant after an observed
in estrus and AI**

- Cycling before breeding period
- Uterus released PGF2 α
- Follicle grew; produced adequate estradiol
- Behavioral centers responded to estradiol and cow expressed detectable estrus.
- Pituitary released an LH surge.
- Artificial insemination
- Follicle ovulated, CL formed.
- Pregnancy!

Estroprotect Patches



ESTROTECT after single mounting

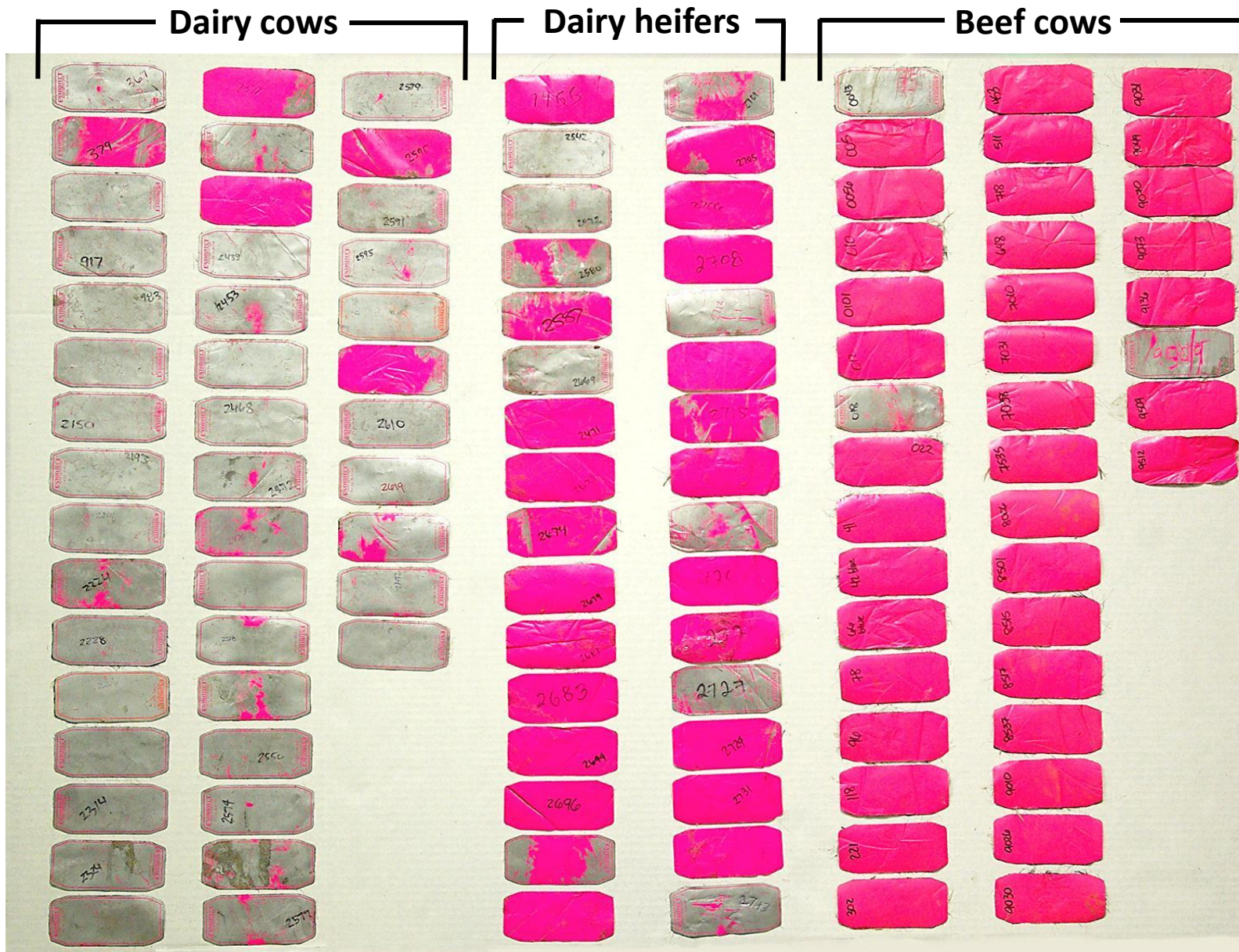


ESTROTECT after 3-5 mountings



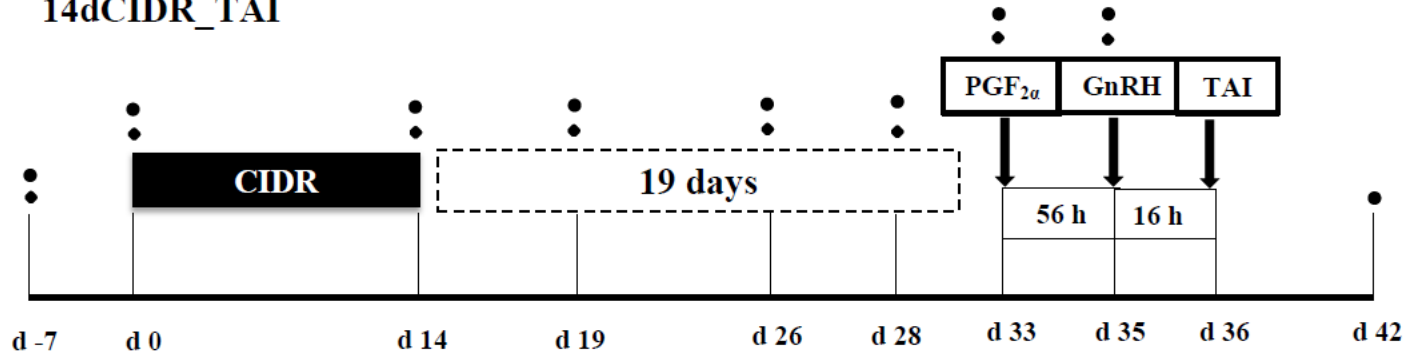
ESTROTECT after more than 5 mountings

Estroprotect Patches removed from cattle after the same synch treatment

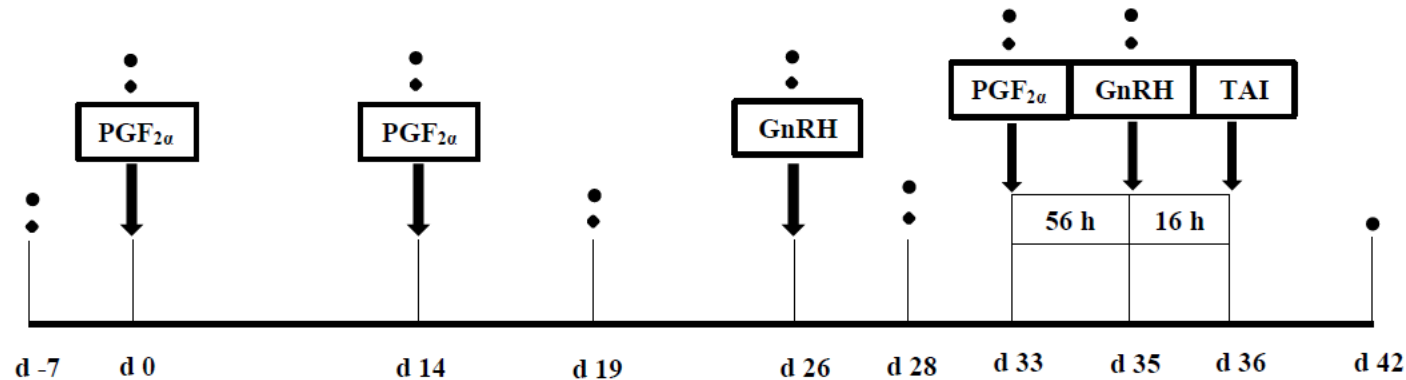


Synchronization programs

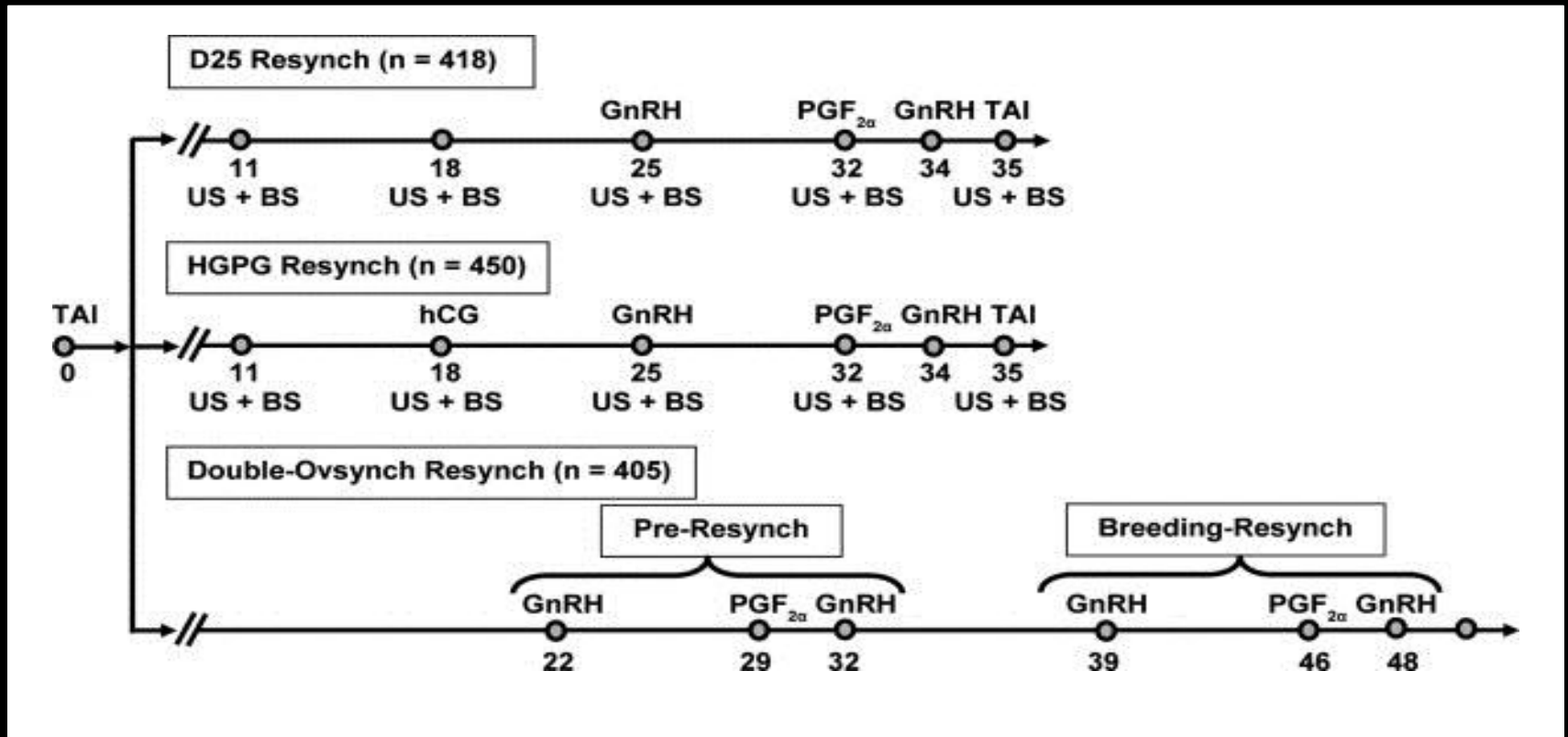
14dCIDR_TAI



Presynch-Ovsynch56



Resynchronization programs





**“The more you tighten your grip,
Tarkin, the more star systems will
slip through your fingers.”**

Now is the time to define “high fertility”!

- ~~• Cycling before breeding period~~
- ~~• Uterus released PGF2 α~~
- ~~• Follicle grew, produced adequate estradiol~~
- ~~• Behavioral centers responded to estradiol and cow expressed detectable estrus.~~
- ~~• Pituitary released an LH surge.~~
- Artificial insemination
- Follicle ovulated, CL formed.
- Pregnancy!



Pregnant after a timed AI

Which cow scores better for DPR?



**Pregnant after an observed
in estrus and AI**



Pregnant after a timed AI

Which cow is the best cow for the future?

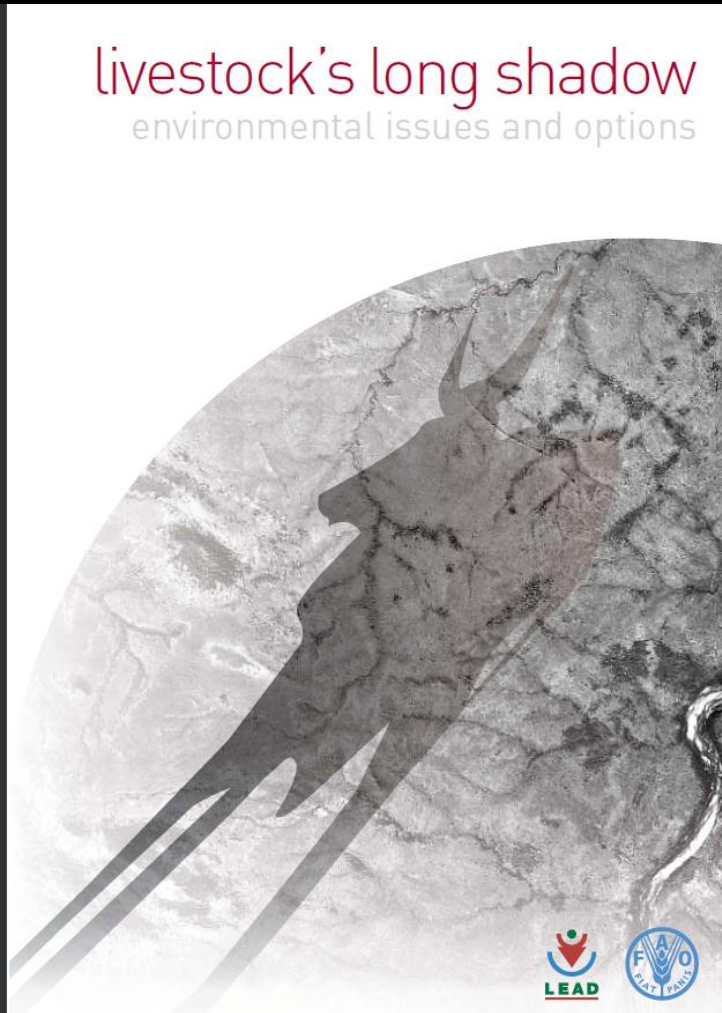


**Pregnant after an observed
in estrus and AI**



Pregnant after a timed AI

What about the future?



- **Climate change and air pollution**
- **Water depletion and pollution**
- **Biodiversity**

**Food and Agriculture Organization of
the United Nations**



Thank you!