

Pregnancy diagnosis in cattle: when, why and how



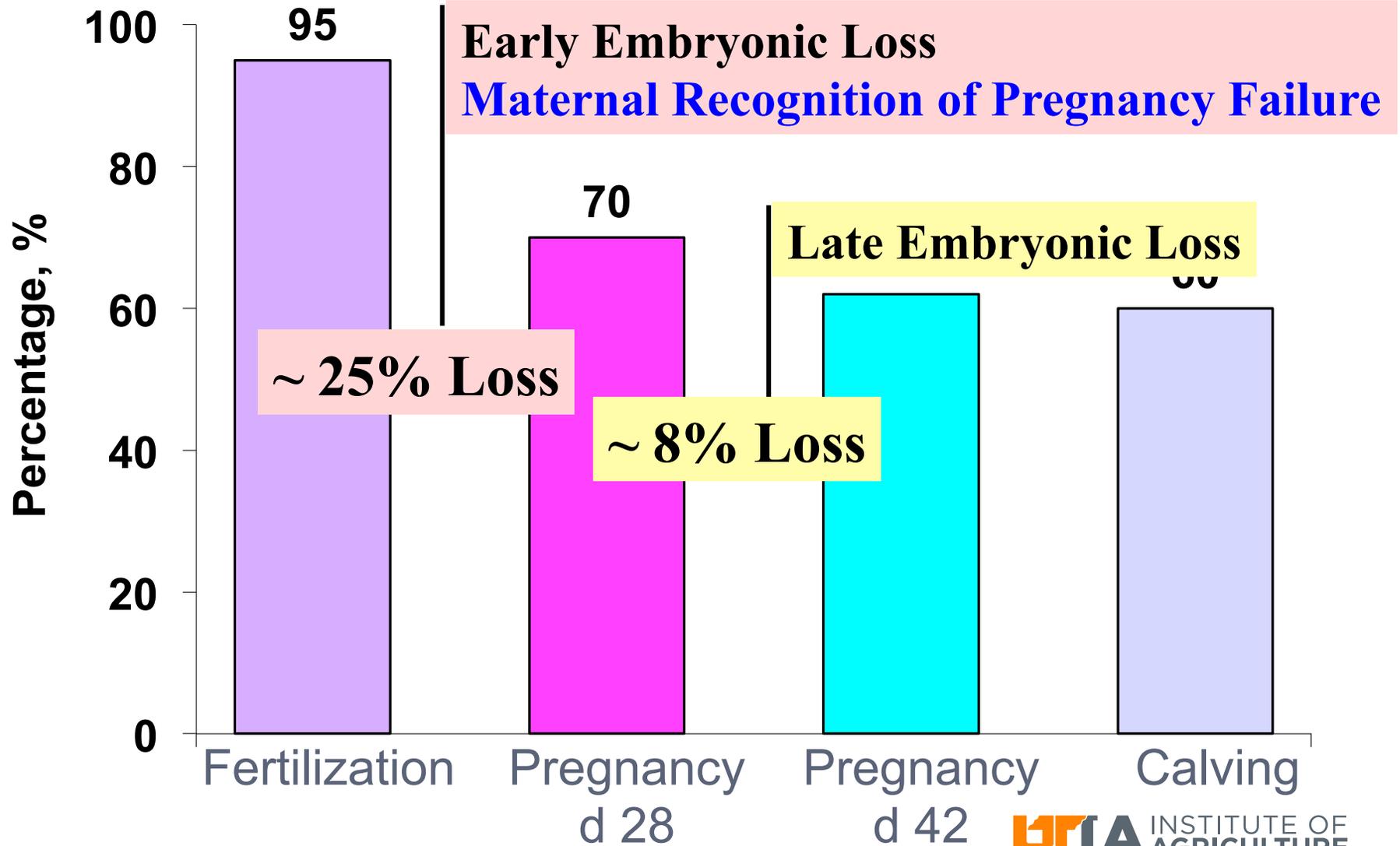
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Department of Animal Science, University of Tennessee, Knoxville, TN

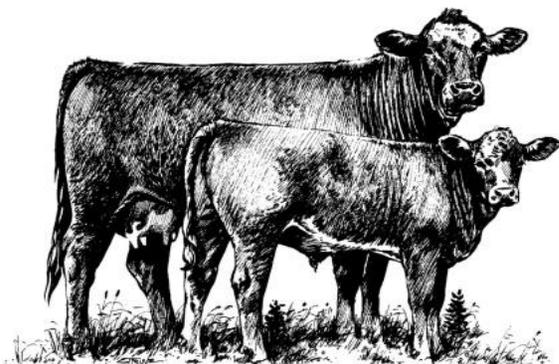
Herd Size (Number of Beef Cows)

Reproduction Technology	1-49		50-99		100-199		200 or More		All Operations	
	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Estrus synchronization	5.7	(0.9)	10.5	(1.8)	14.9	(2.1)	19.3	(1.9)	7.9	(0.7)
Artificial insemination	5.6	(0.8)	8.4	(1.6)	16.3	(2.1)	19.8	(2.0)	7.6	(0.7)
Palpation for pregnancy	10.8	(1.2)	25.8	(2.6)	41.2	(2.8)	58.3	(2.6)	18.0	(1.0)
Ultrasound	0.5	(0.2)	4.4	(1.1)	6.5	(1.3)	13.4	(1.6)	2.2	(0.3)
Pelvic measurement	1.5	(0.4)	4.8	(1.2)	15.4	(2.0)	15.9	(2.0)	3.9	(0.4)
Body condition scoring	10.5	(1.1)	19.1	(2.3)	26.8	(2.5)	34.4	(2.5)	14.3	(0.9)
Semen evaluation	10.9	(1.1)	33.2	(2.7)	45.9	(2.8)	56.8	(2.5)	19.5	(1.0)
Embryo transfer	0.7	(0.3)	4.3	(1.2)	2.6	(1.0)	5.0	(1.0)	1.6	(0.3)
Any of the above	25.3	(1.6)	49.7	(2.9)	65.8	(2.8)	78.5	(2.0)	35.0	(1.3)

Fertility of a single service in beef cattle



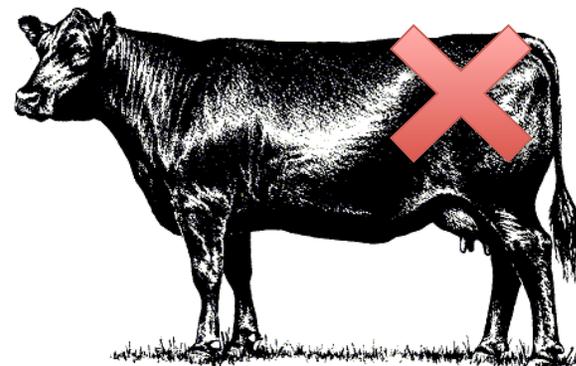
Why check for pregnancy? The math is simple



Average cow cost – breeding
to weaning: \$600

Weaned 450 lb. calf value:
\$760

\$165 profit



Average cow cost – breeding
to weaning: \$600

Weaned 450 ~~lb.~~ calf value:
\$760

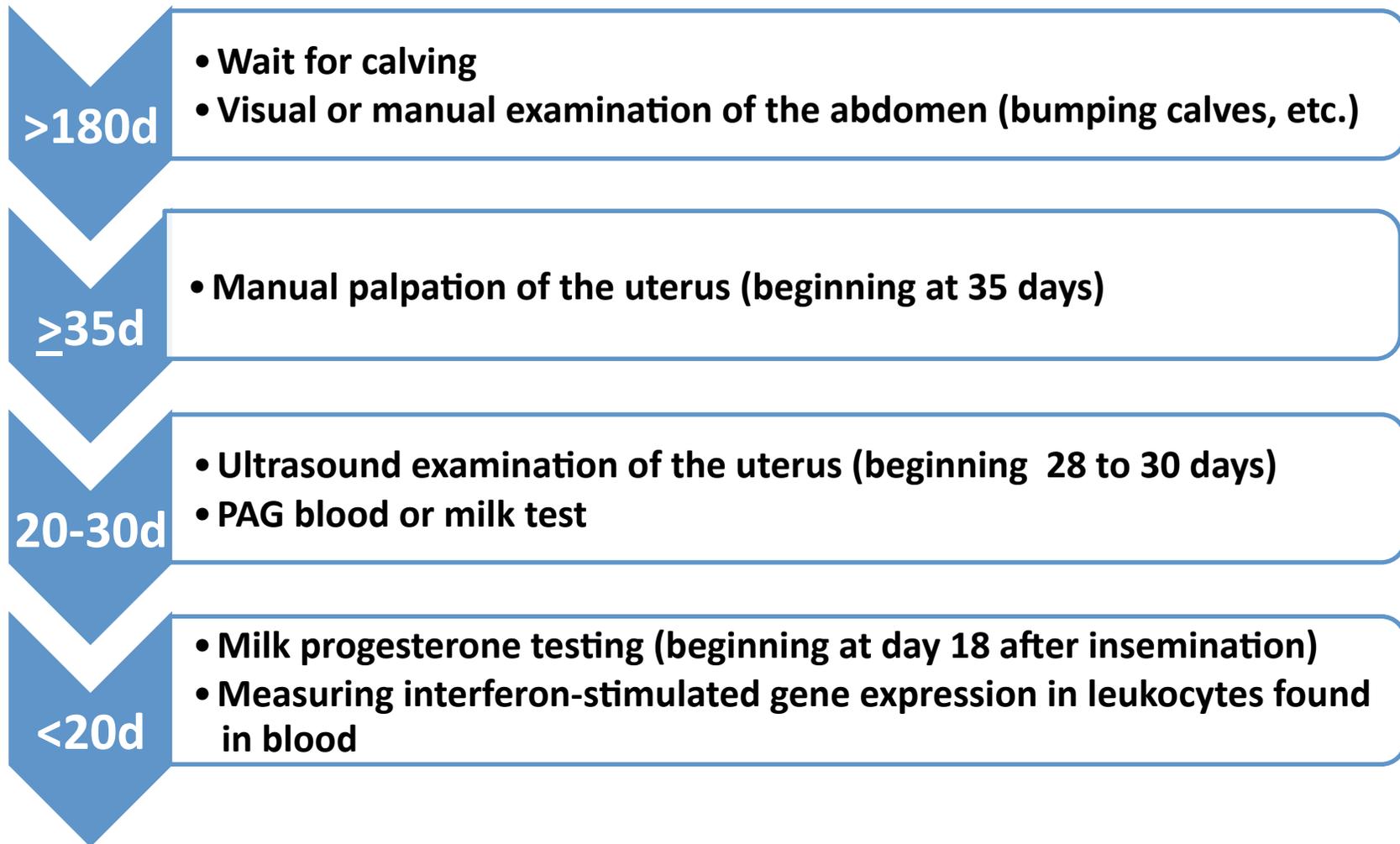
Knowing the pregnancy status of the herd

- Help make management decisions
 - Nutrition
 - Marketing plans
- Evaluate reproductive efficiency
 - Bull/semen quality
 - Synchronization or resynchronization protocols efficiency
- Identify how much pregnancy loss is happening and when

What is the Ideal Pregnancy Test?

- Key features
 - High sensitivity
 - Correctly ID pregnant animals
 - High specificity
 - Correctly ID non-pregnant animals
 - Embryonic Viability
 - Simple
 - Inexpensive

Evolution of pregnancy detection



Methods of Pregnancy Evaluation

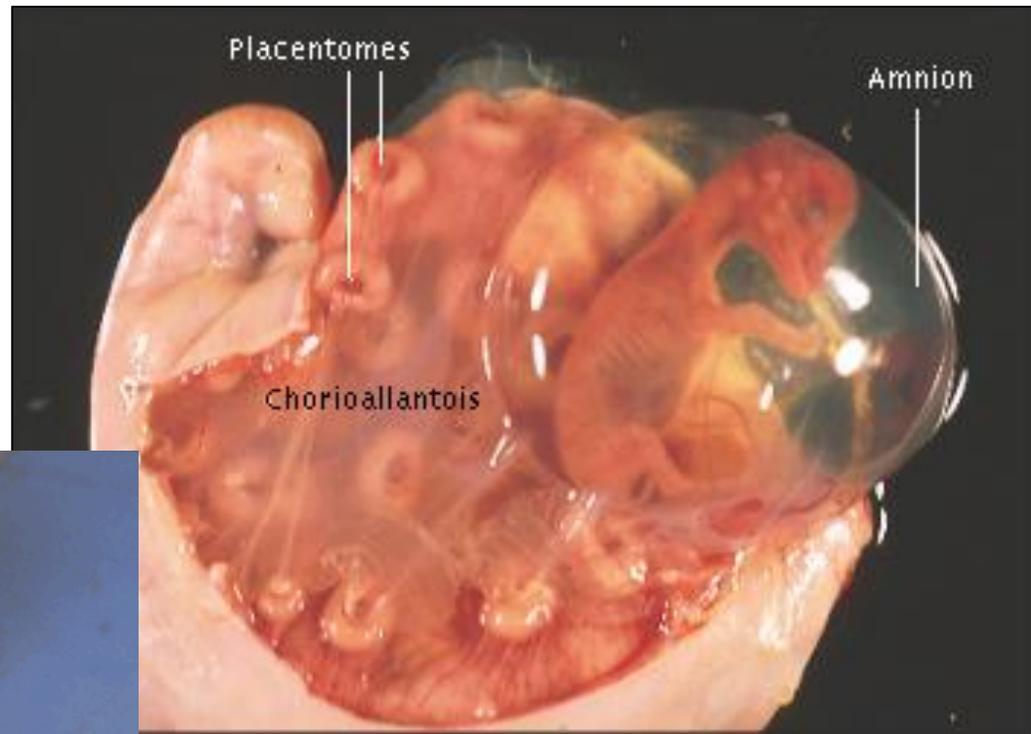
- Rectal Palpation
- Ultrasonography
- Chemical

Sometimes limited
by facilities



Rectal Palpation of Pregnancy

- **MUST HAVE FLUID!!!!!!!** Plus:
 - Amnion
 - Fetus
 - Placentomes
 - Membrane slip



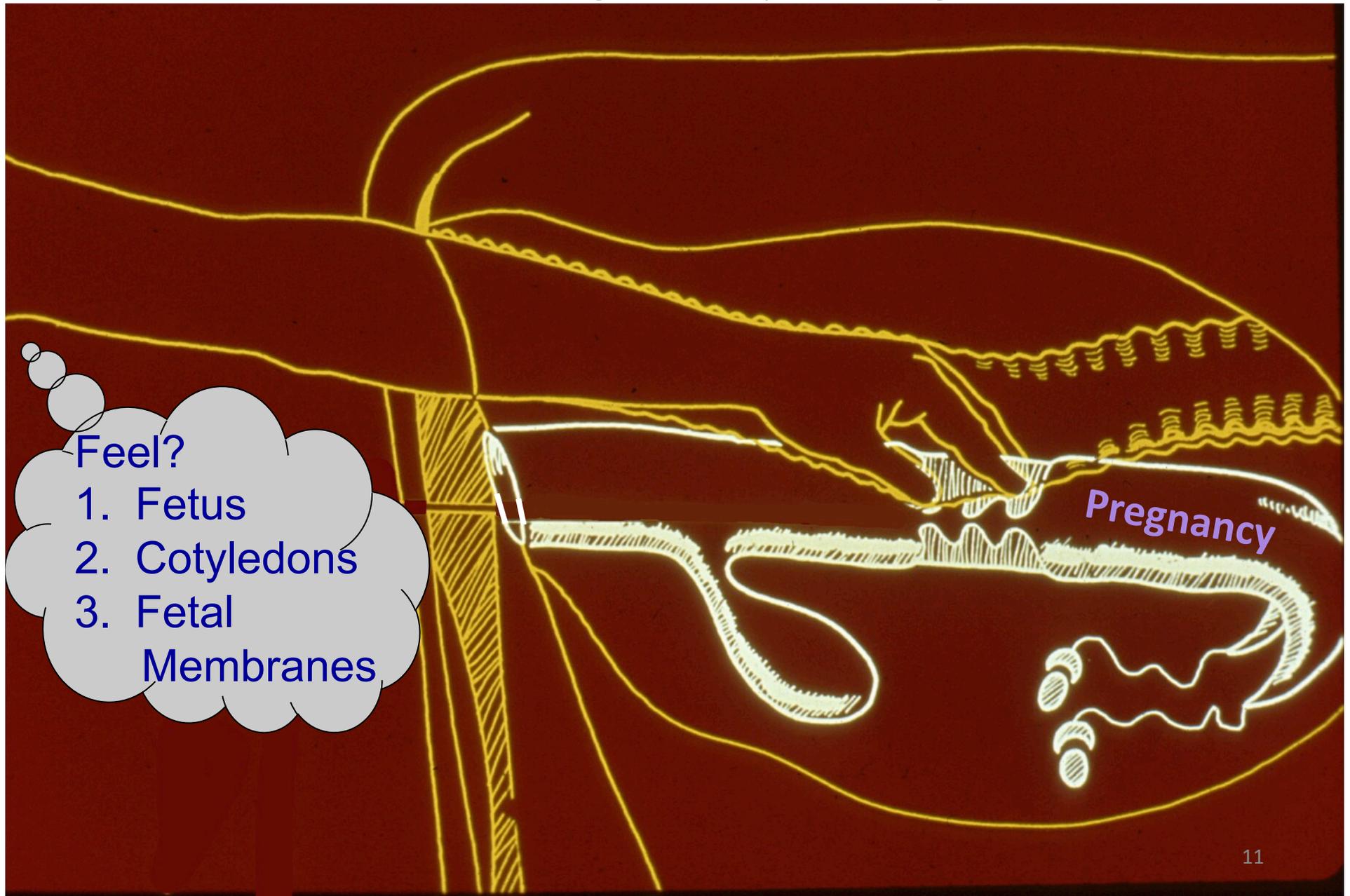
Membrane Slip

Ultrasound Pregnancy Diagnosis

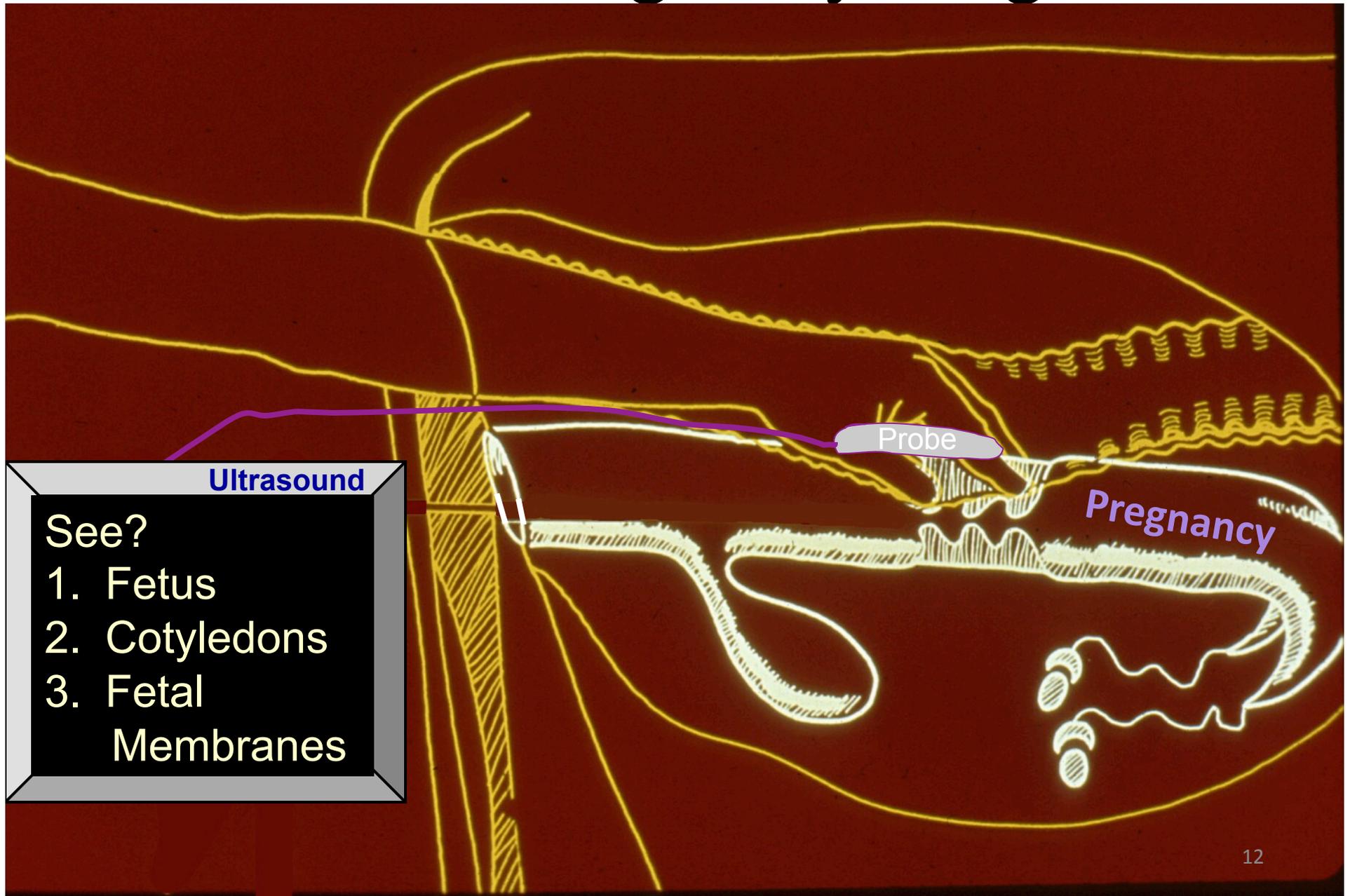
- Earlier Diagnosis of OPEN cows
 - Most studies show near 100% accuracy > 27 days of gestation
 - “Provides a Witness”



Manual Pregnancy Diagnosis



Ultrasound Pregnancy Diagnosis



Ultrasound

See?

1. Fetus
2. Cotyledons
3. Fetal Membranes

Other Advantages with Ultrasound

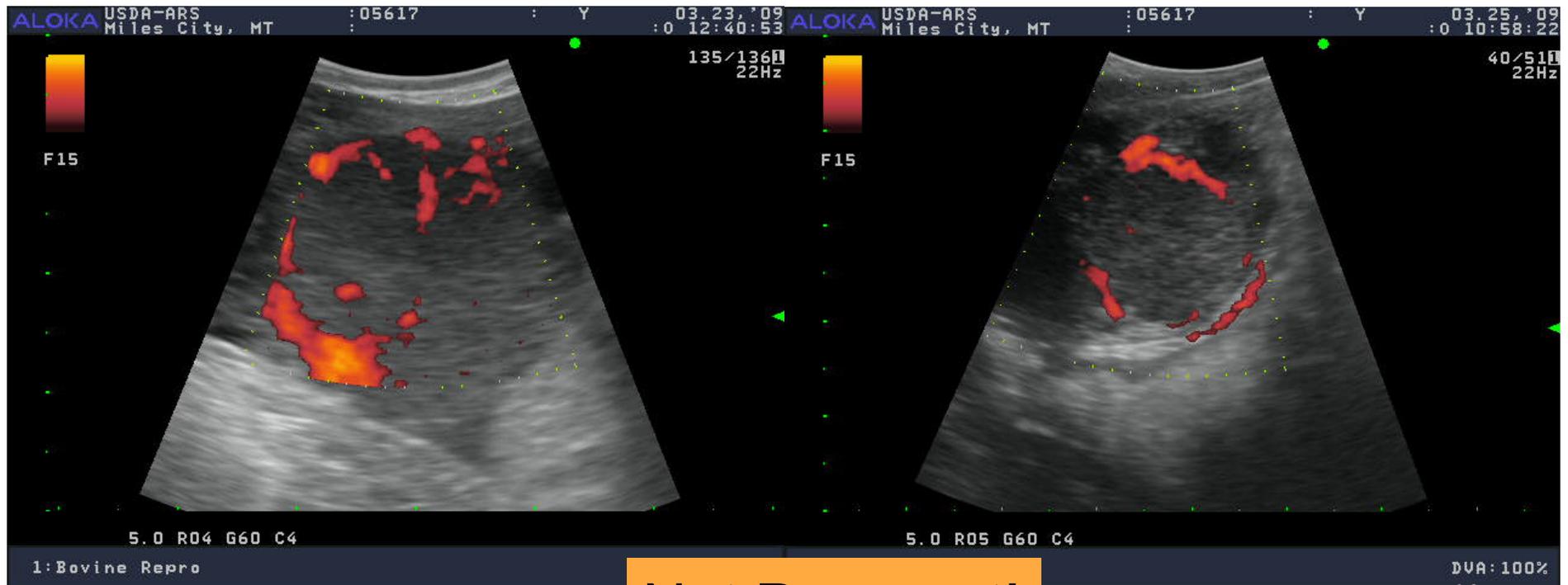
- Better diagnosis of twins
- More accurate gestational aging before 100 days
- Diagnosing fetal death/anomalies
- Fetal sexing

Sequential CL Vasculature for Pregnancy Diagnosis

05617

■ d 18

■ d 20



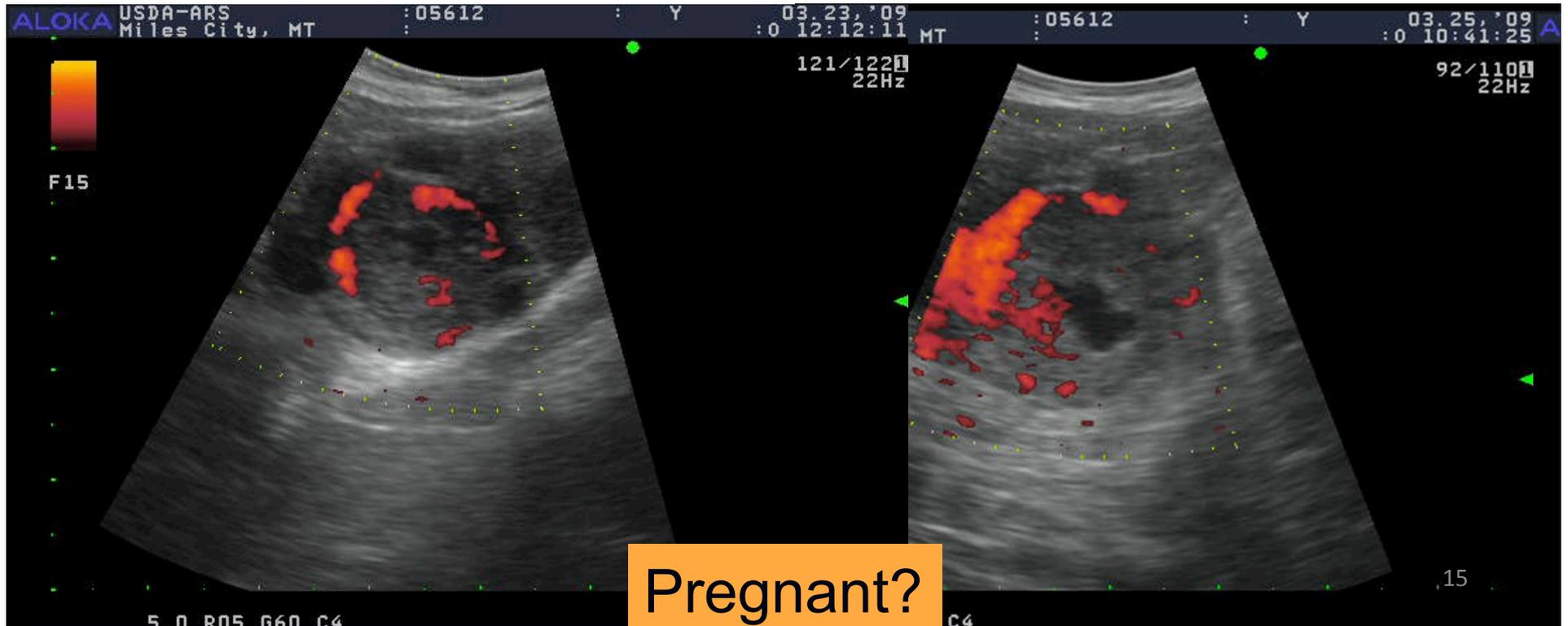
Not Pregnant!

Sequential CL Vasculature for Pregnancy Diagnosis

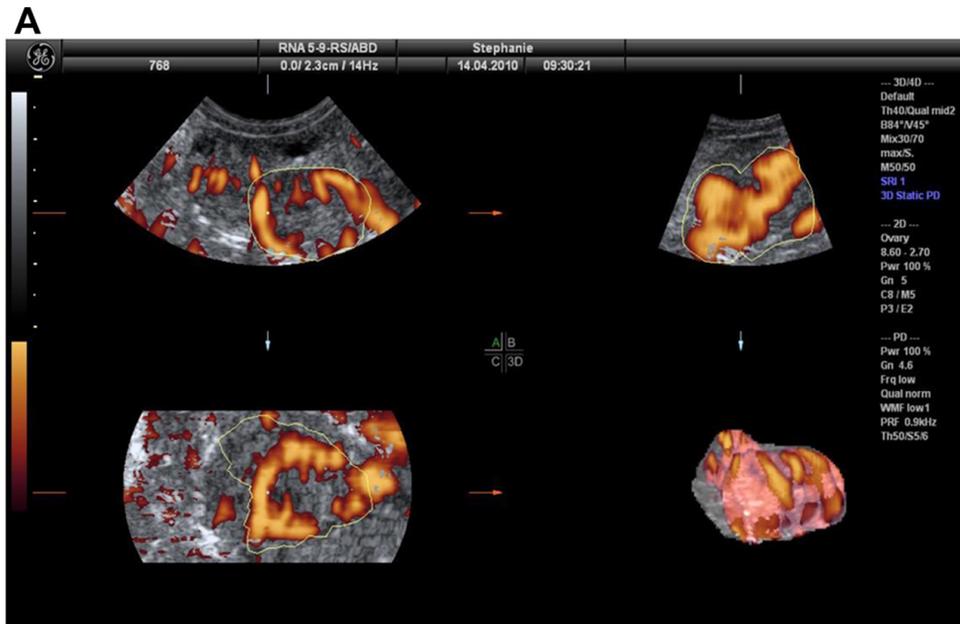
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■ d 18

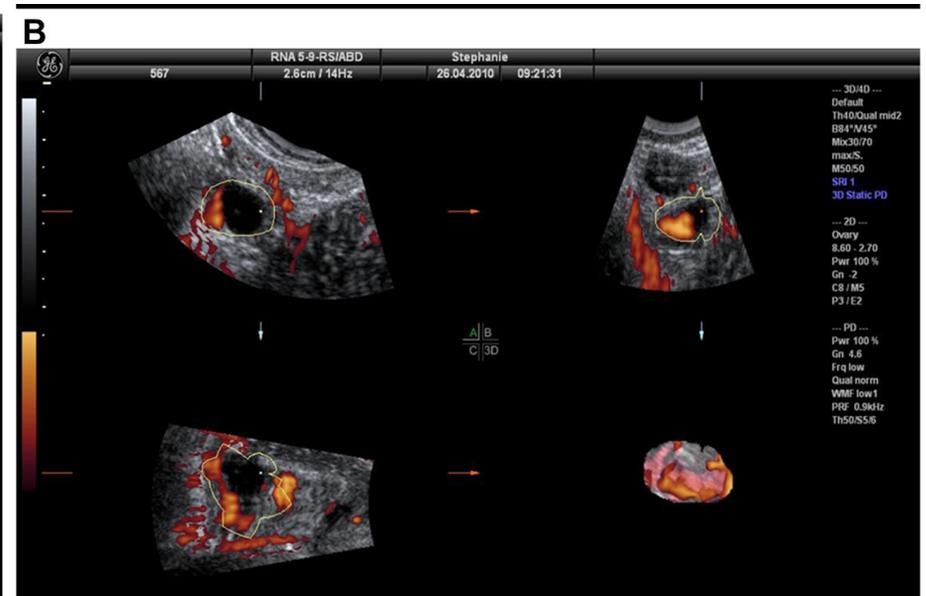
■ d 20



3D/4D Ultrasound



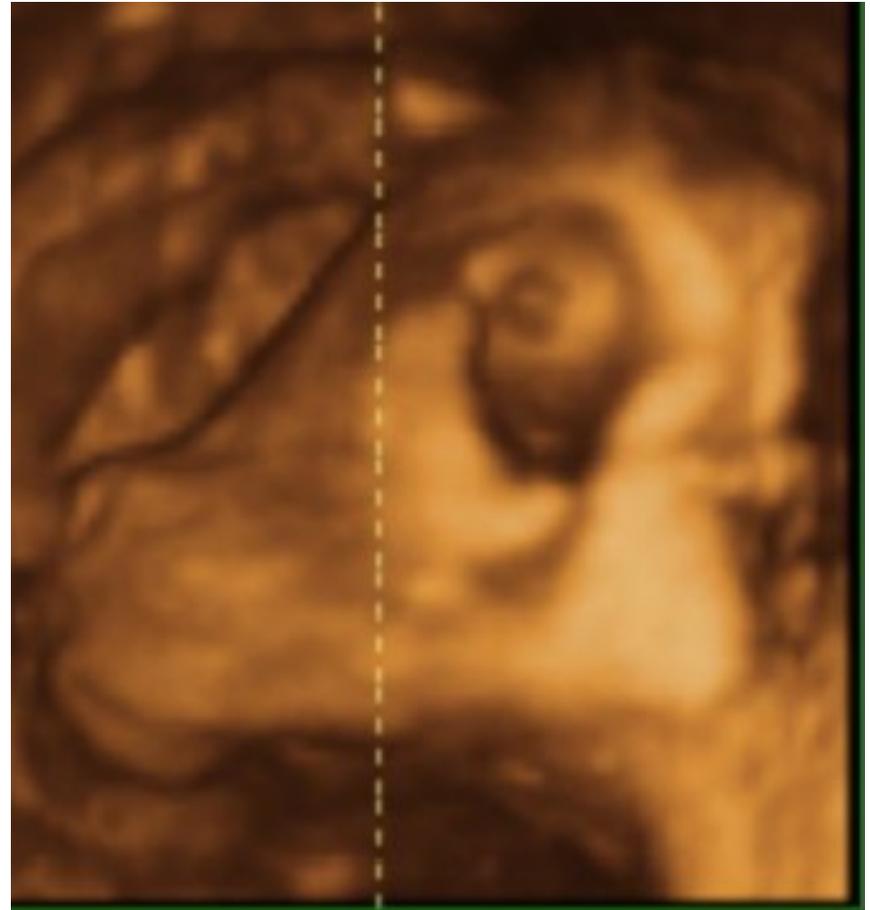
CL 4 days after ovulation



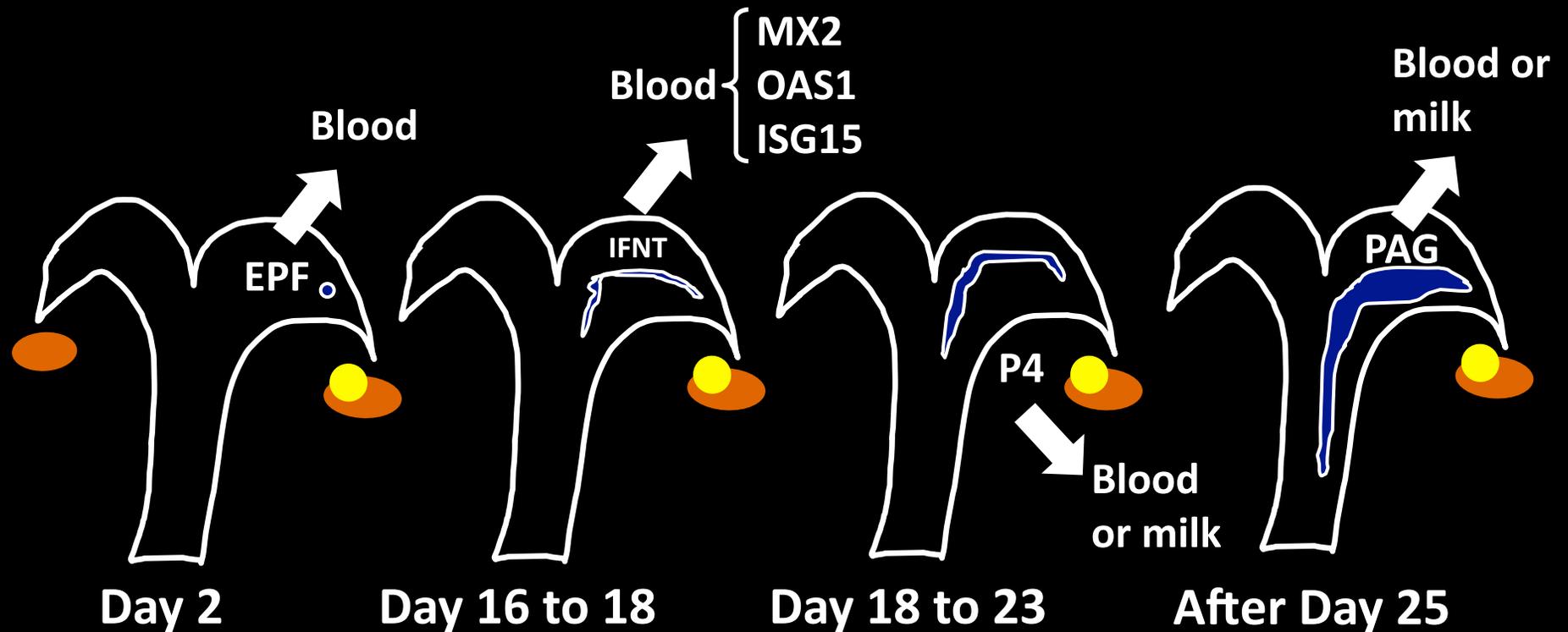
DF 1 day before ovulation

Scully et al., 2013

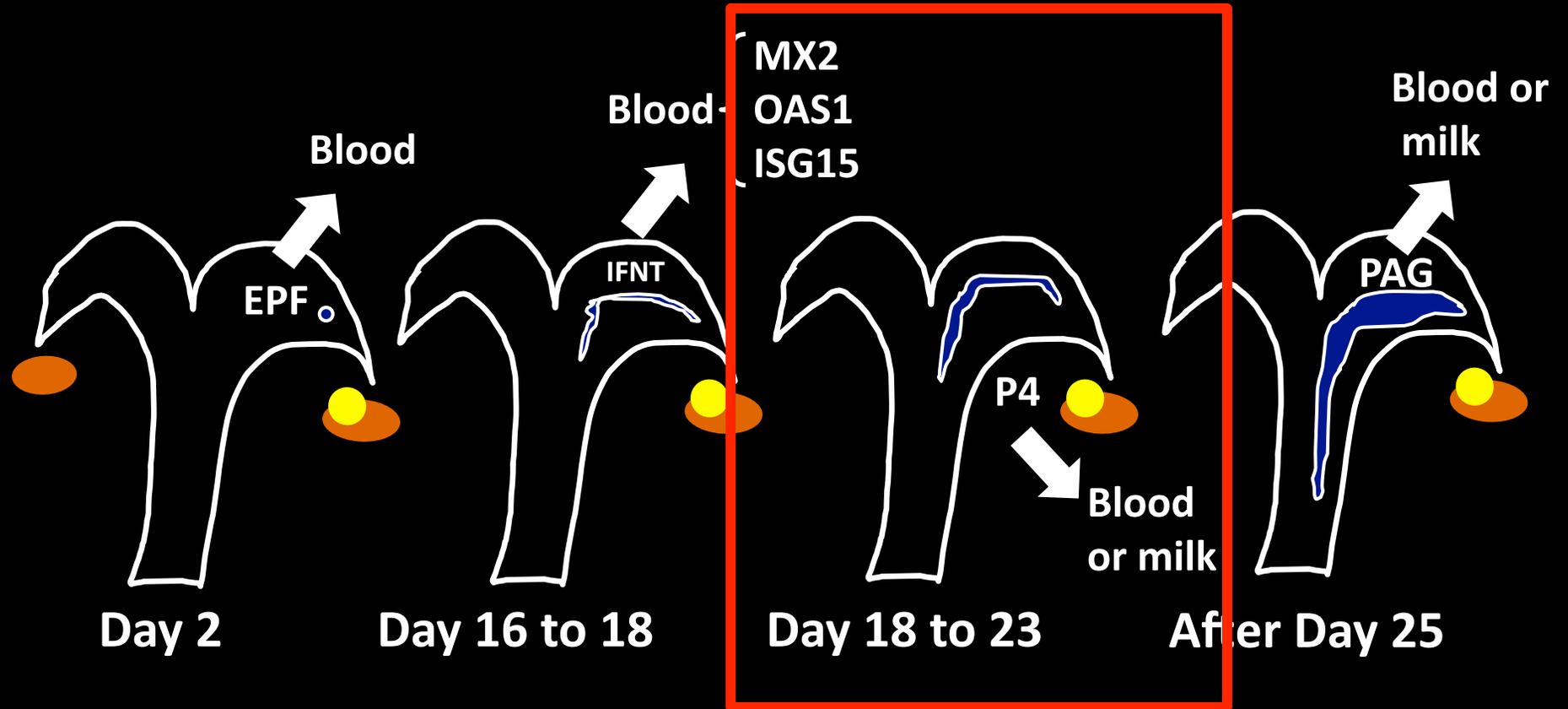
3D/4D Ultrasound



Chemical Pregnancy Tests in the Bovine

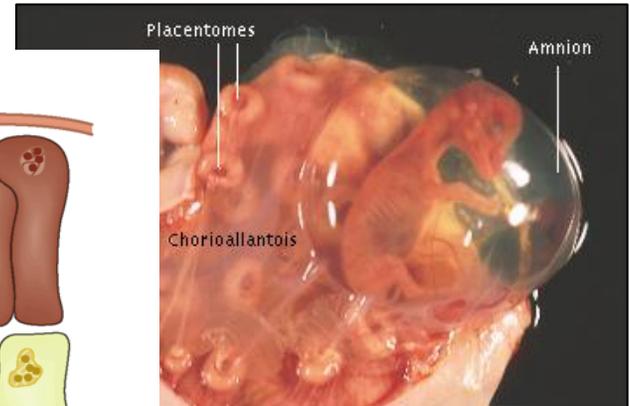
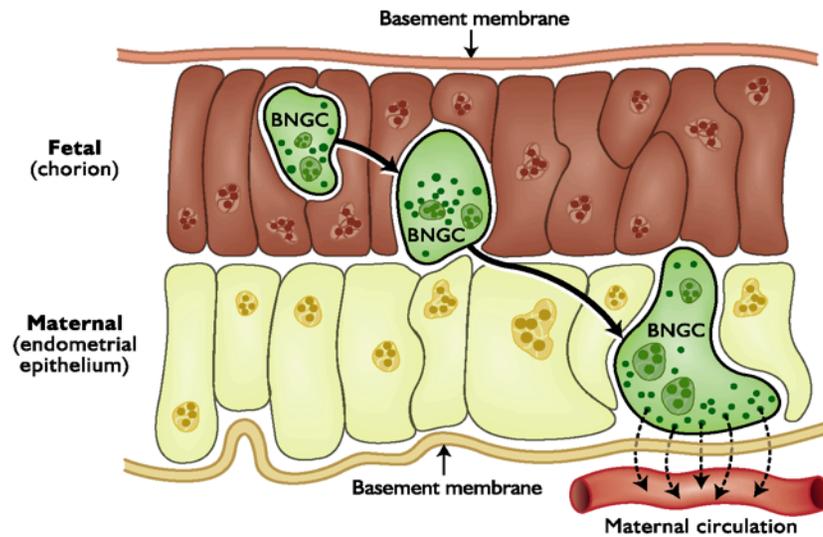
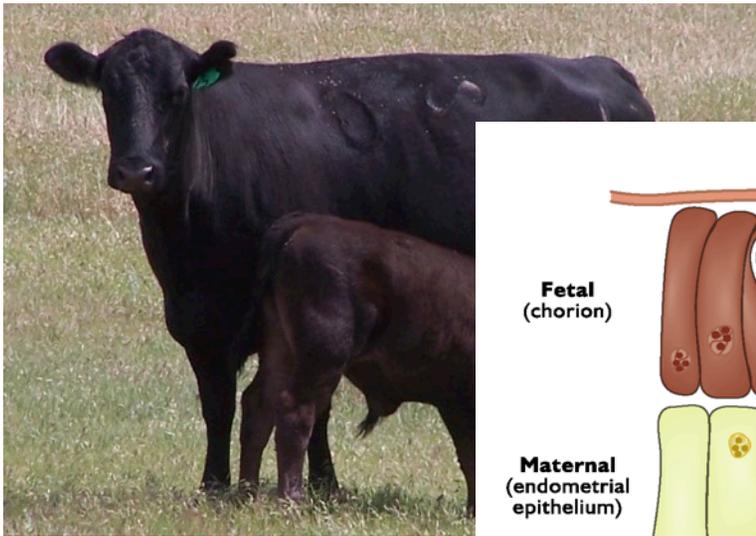


Chemical Pregnancy Tests in the Bovine

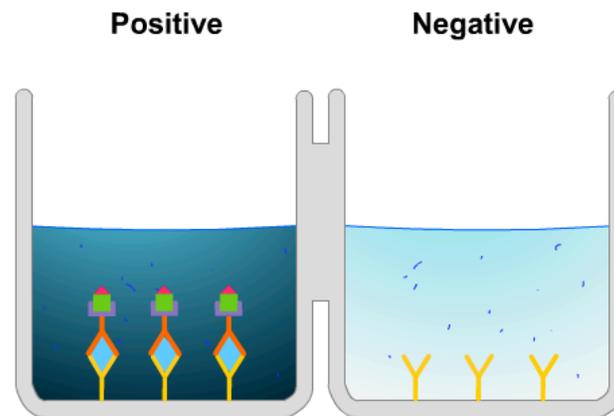


What are PAGs

- Pregnancy Associated Glycoproteins

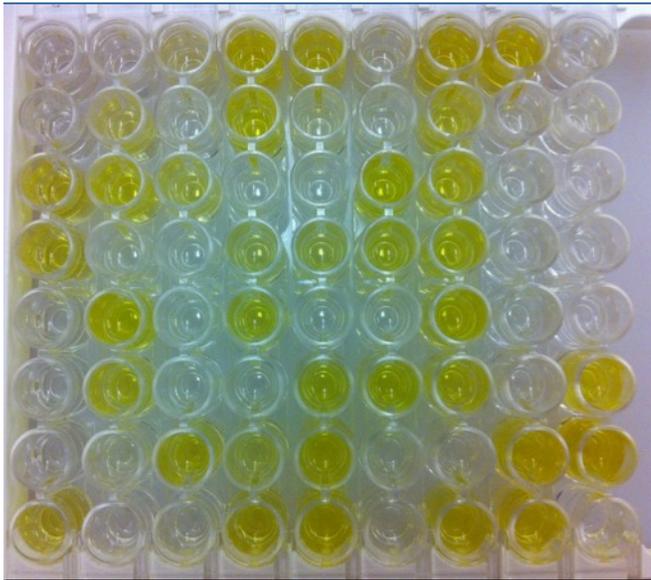


How does PAG testing work?



Innovations of the past decade:

Blood pregnancy tests



bio TRACKING

- For DAIRY CATTLE
- For BEEF CATTLE
- For GOATS
- For SHEEP
- For WILDLIFE
- For BISON
- For HORSES

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Know pregnancy status as early as 29 days post breeding with DG29™ blood pregnancy testing!

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Rapid Visual Pregnancy Test



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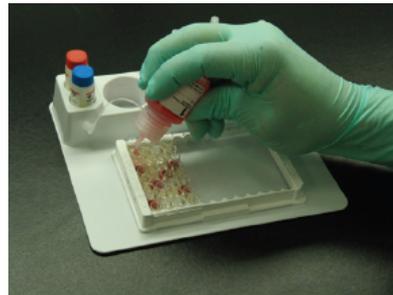
Simple and Fast Protocol Steps Enable a Visual Read

Dispense Samples



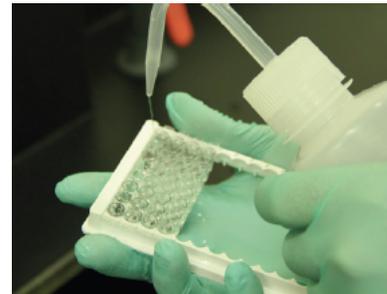
Dispense samples and controls with the calibrated precision pipette provided

Dispense Reagents



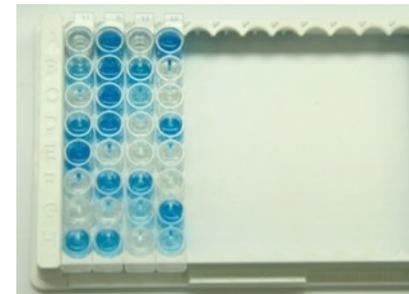
Dispense all reagents labeled 1-4 following protocol steps using convenient dropper caps

Wash



Wash with distilled or deionized water by hand using a wash bottle over your sink (or liquid disposal receptacle)

Read Visually



Pregnant
Wells appear blue.



Not Pregnant
Wells do not appear blue.



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UTIA INSTITUTE OF
AGRICULTURE
THE UNIVERSITY OF TENNESSEE

Pregnancy Detection: Beef Cattle

Real-time ultrasonography

- 720 beef cows
 - 54% pregnancy rate
 - 386 pregnancies



bPAG ELISA

- 720 beef cows
 - 52.08 % pregnancy rate
 - 375 pregnancies
 - 97 % accurate



Pohler et al ., 2016

Pregnancy Detection

Table 2

Indices for pregnancy diagnosis in dairy cows by PSP-B ELISA compared with contemporaneous transrectal ultrasonography (TRUS).

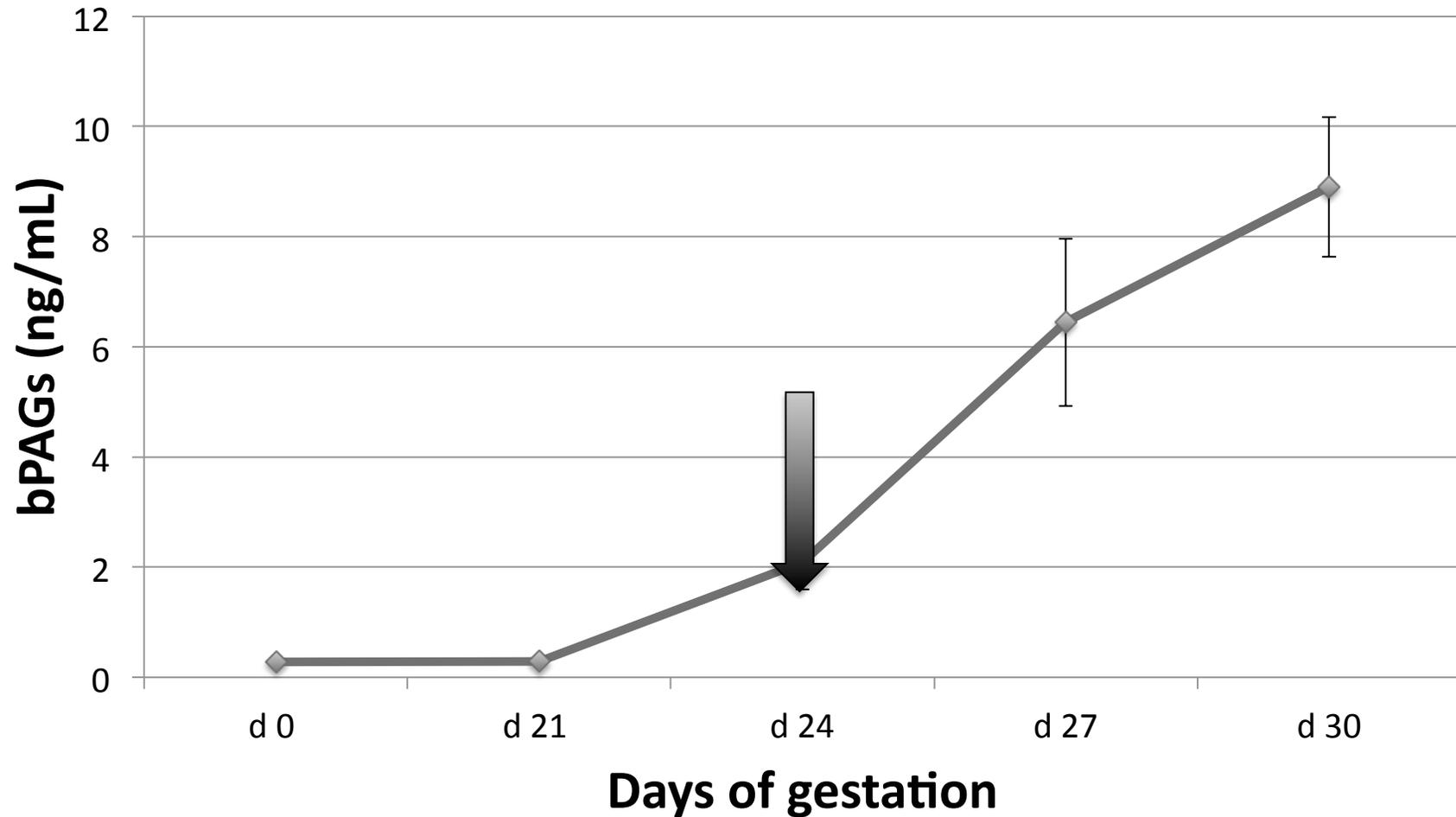
	Evaluation		
	Day 28	Day 30	Day 35
TRUS (No.)	246	246	246
PSP-B (No.)	246	229*	246
Pregnant (%) ¹	46.3	44.7	43.1
Sensitivity (%) [95% CI ²]	93.9 ^a [87.3 – 97.3]	96.0 ^a [89.4 – 98.7]	97.2 ^a [91.4 – 99.3]
Specificity (%) [range]	95.5 ^a [89.9–98.1]	93.9 ^a [87.8 – 97.1]	93.6 ^a [87.8 – 96.8]
Positive predictive value (%)	94.7 ^a [88.3 – 97.8]	92.2 ^a [84.8 – 96.3]	92.0 ^a [84.9 – 96.0]
Negative predictive value (%)	94.7 ^a [89.1 – 97.7]	96.8 ^a [91.6 – 98.9]	97.8 ^a [93.1 – 99.4]
Accuracy (%)	94.7 ^a [92.0 – 97.6]	94.8 ^a [91.9 – 97.7]	95.1 ^a [92.5 – 97.9]

Table 6. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy of transrectal ultrasonography (TU) for determining pregnancy status 27 d after timed AI (TAI) by TAI number

TAI	Sensitivity, ¹ % (no./no.)	Specificity, ² % (no./no.)	PPV, ³ % (no./no.)	NPV, ⁴ % (no./no.)	Accuracy, ⁵ % (no./no.)	Kappa
1	96.8 (367/379)	91.7 (461/503)	89.7 (367/409)	97.5 (461/473)	93.9 (828/882)	0.87
2	94.2 (145/154)	93.5 (303/324)	87.3 (145/166)	97.1 (303/312)	93.7 (448/478)	0.85
3	98.9 (91/92)	97.3 (215/221)	93.8 (91/97)	99.5 (215/216)	97.8 (306/313)	0.94

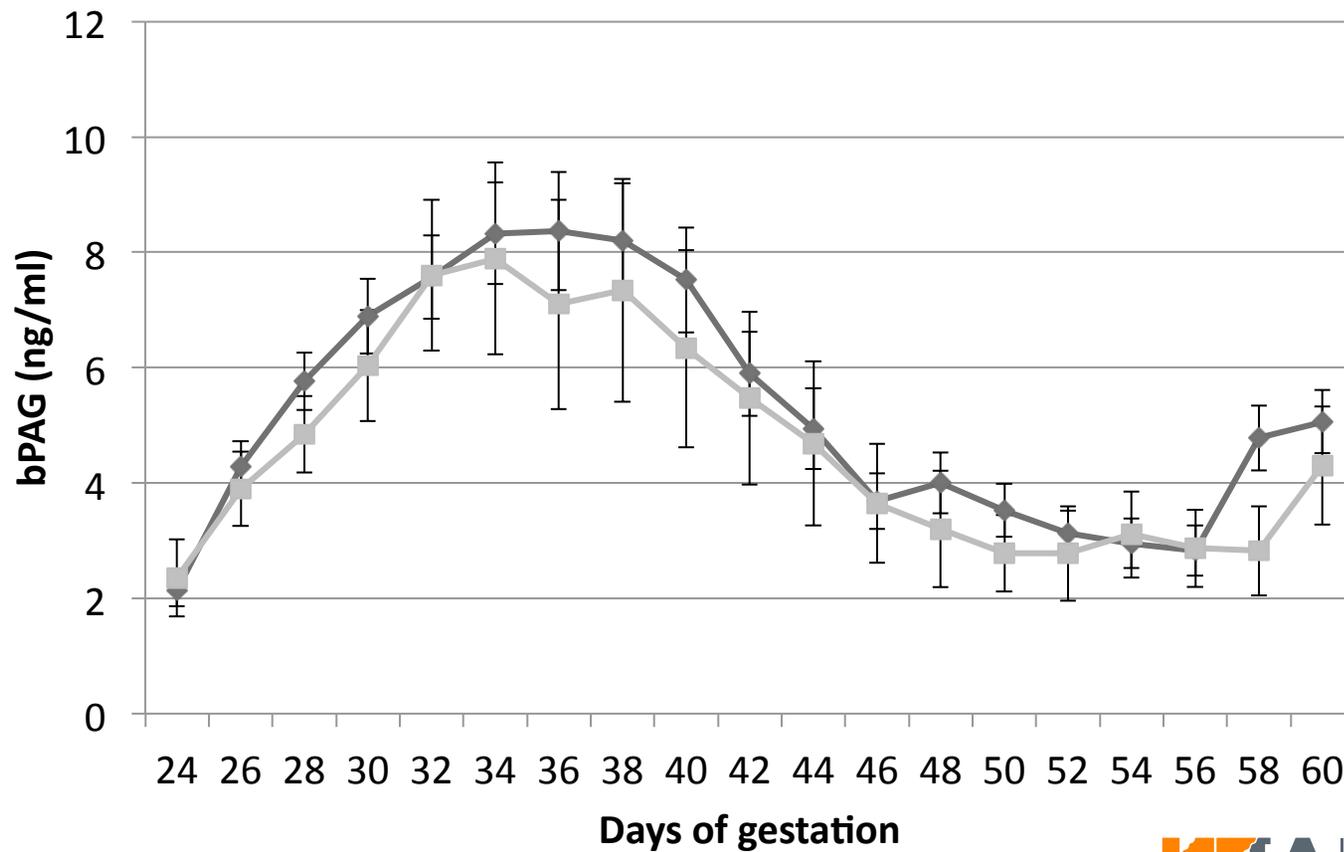
What do PAG profiles look like during pregnancy?

First significant increase in bPAGs

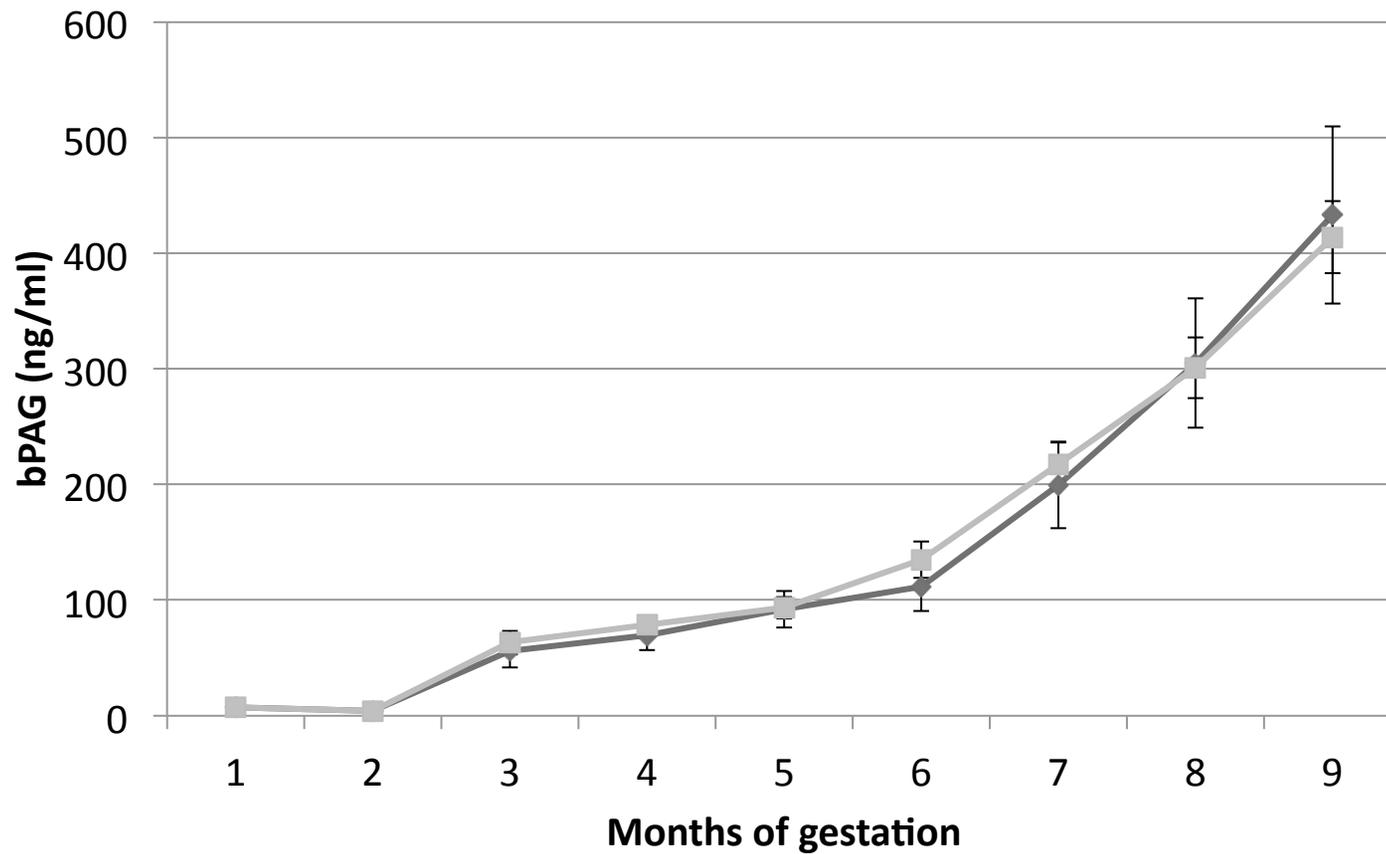


$P < 0.0001$

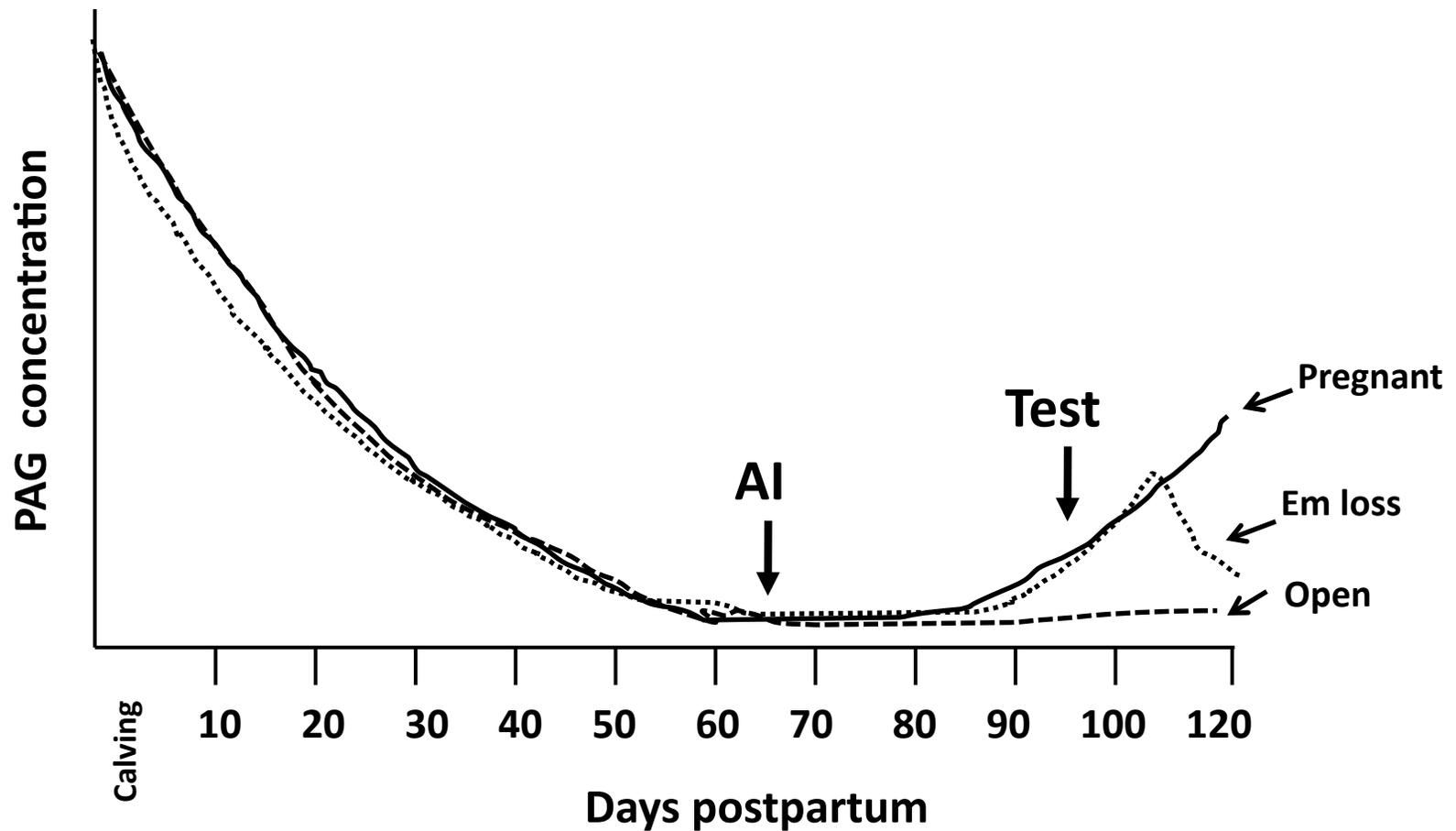
PAGs During Early Gestation



PAGs During Gestation



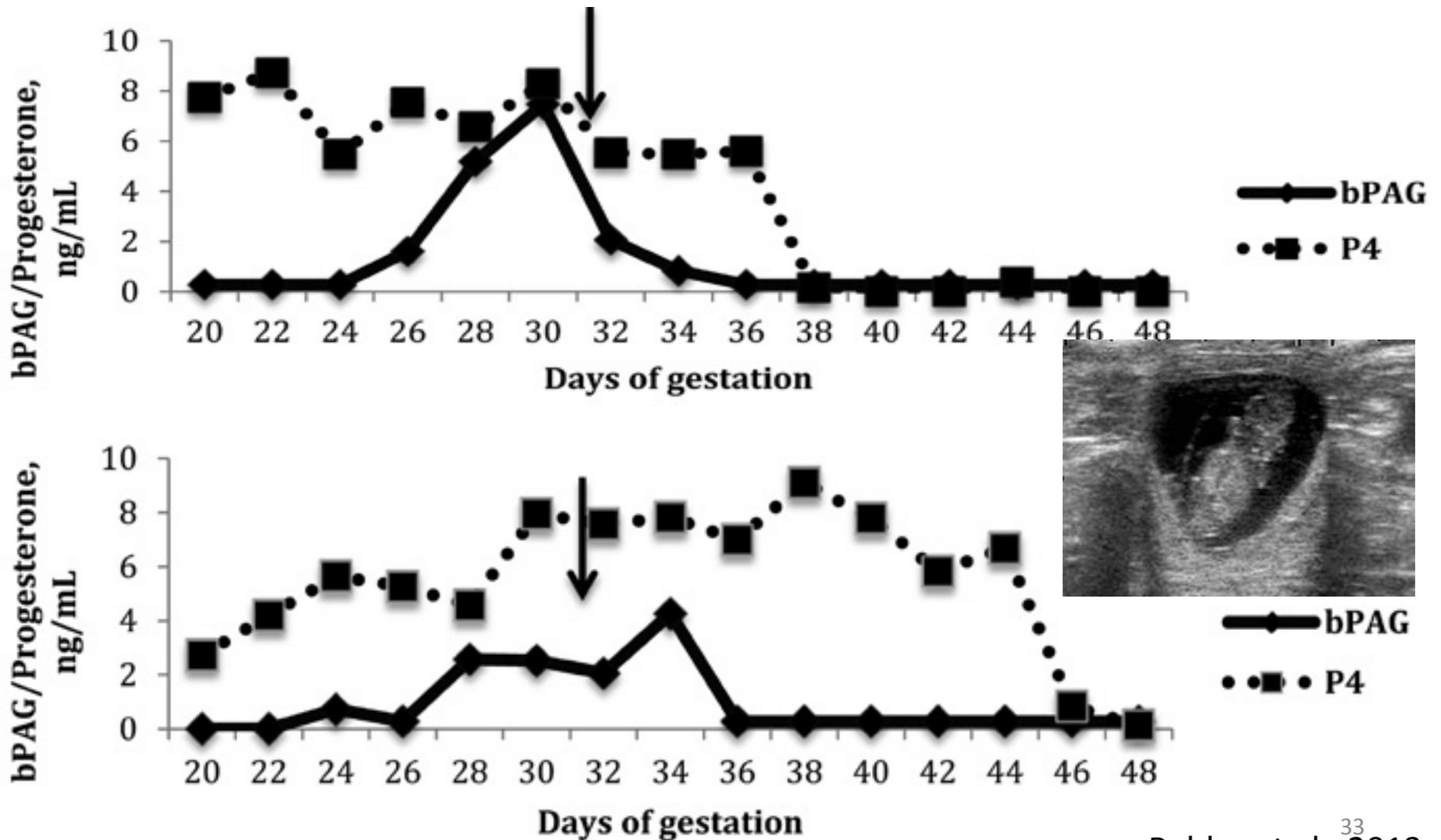
Blood PAG concentrations over time



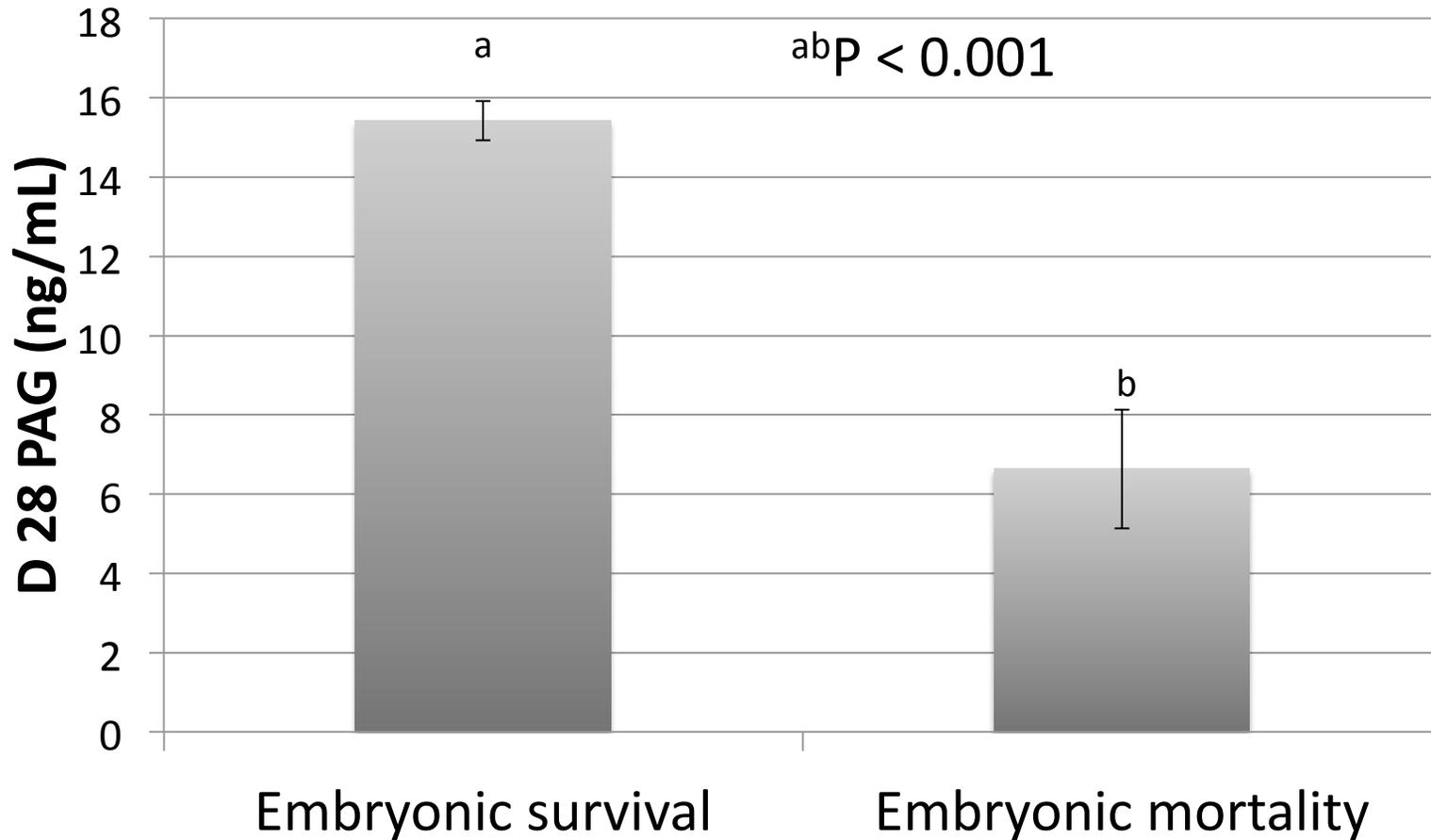
Future of Pregnancy Diagnosis in Cattle



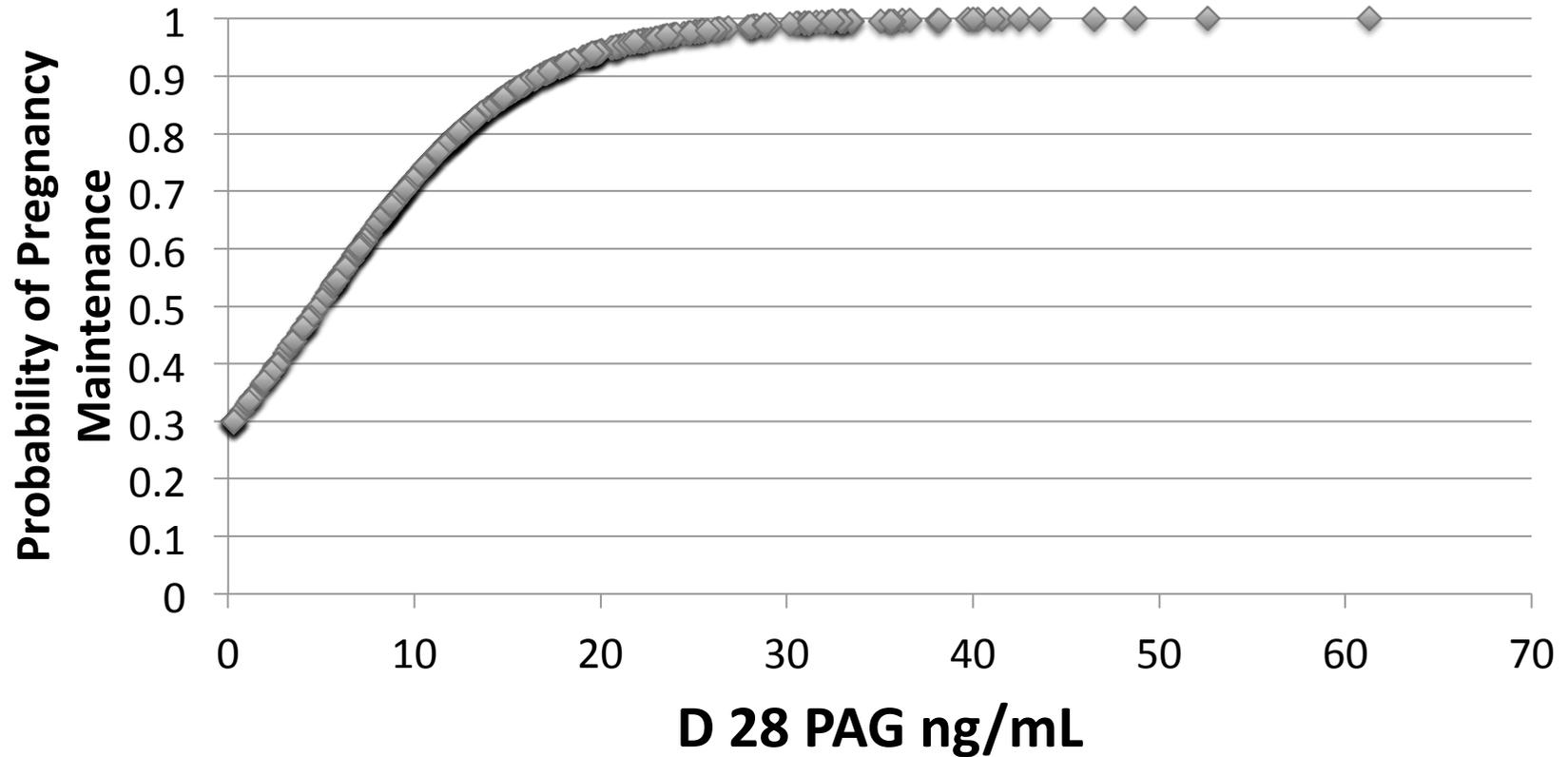
Pregnancy Loss



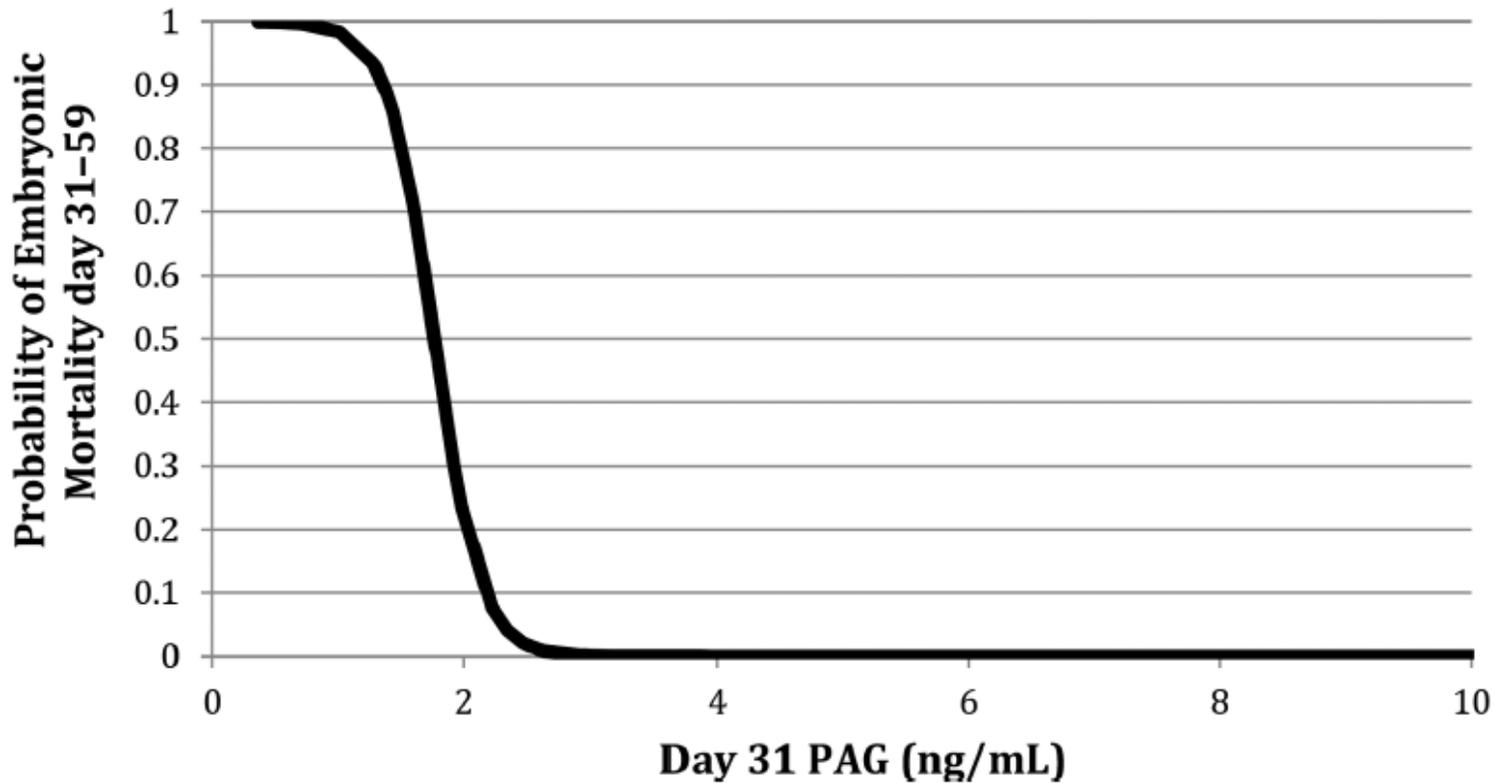
Pregnancy Success and PAGs



Pregnancy Success and PAGs



Pregnancy Success and PAGs

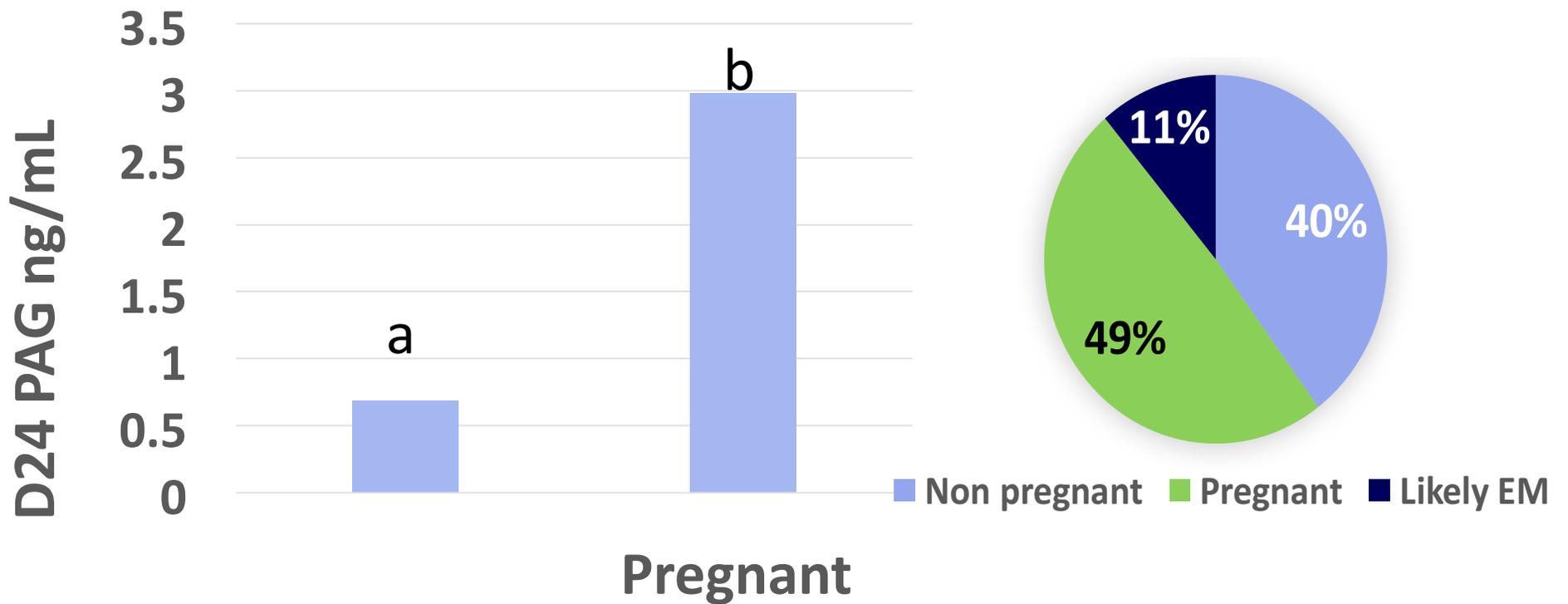


How early can we detect PAG and successfully diagnosis pregnancy?

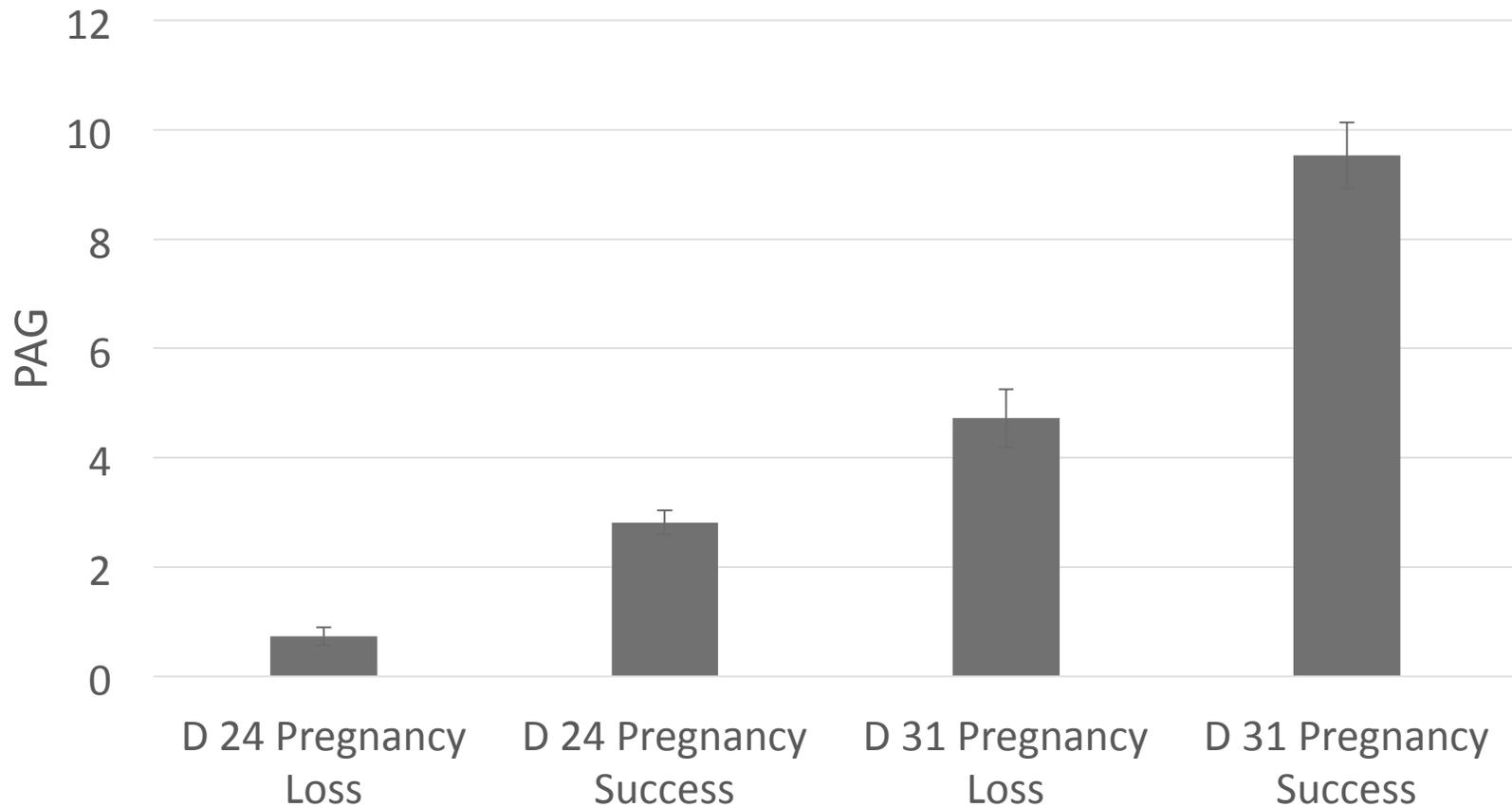
Materials and Methods

- 400 heifers undergoing FTET on day 7
- Blood Samples collected on day 17, 24 and 31
- Day 17 samples used as a baseline for each heifer
- Pregnancy status confirmed on day 31 and 60 via ultrasound

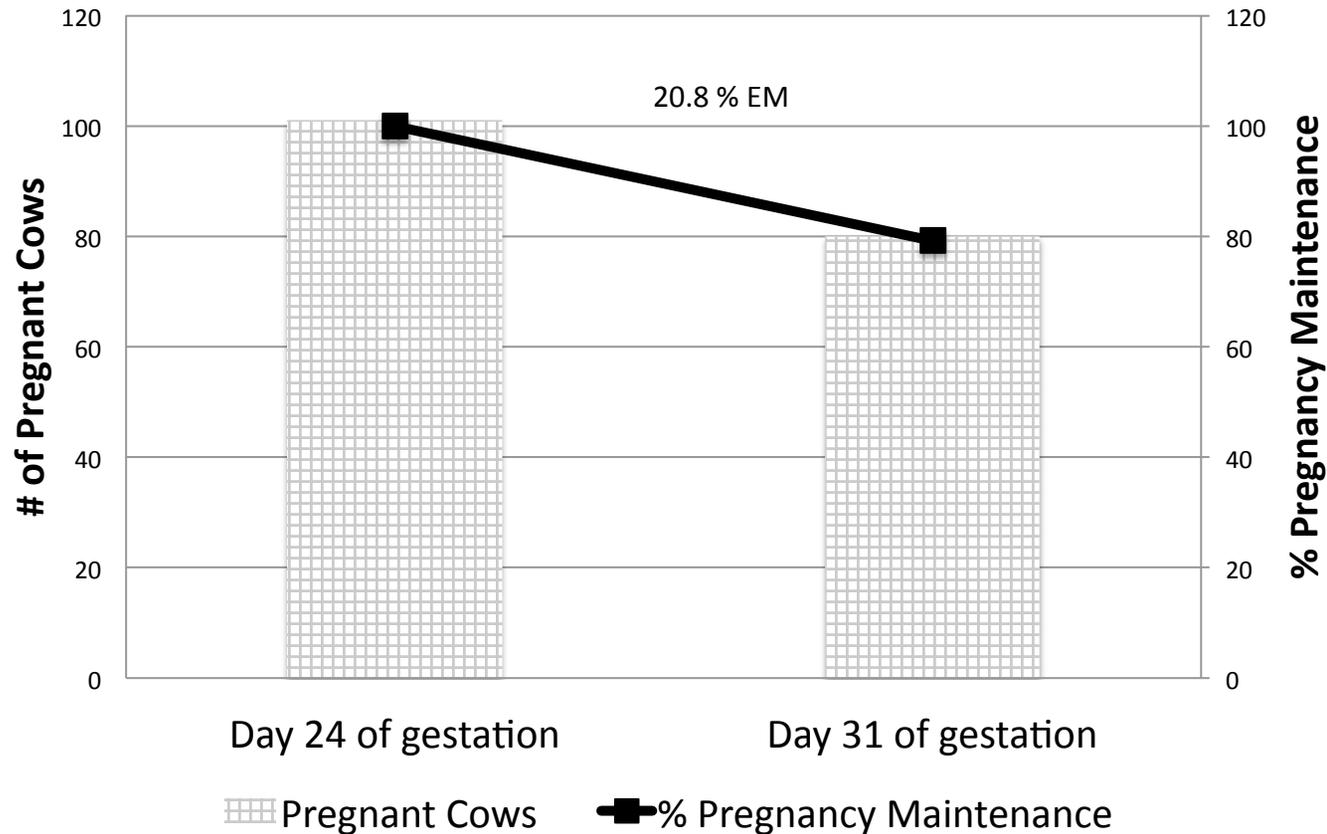
D 24 Pregnancy Diagnosis in Heifers Following ET



Day 24 PAG and Pregnancy Success



Pregnancy Loss between d 24 - 31



Beef Data: 7 to 12 % in Angus Cows

Conclusions

- Rectal Palpation, Ultrasound and PAG testing are effective methods of pregnancy diagnosis in cattle
- Embryonic mortality between day 17 and 31 of gestation provides a major challenge for early pregnancy diagnosis
- Investigating markers specific to embryonic viability instead of pregnancy provide the most promise
- No matter what....Use a proven method of pregnancy diagnosis!

Thank You!



Real. Life. Solutions.