Grazing Sheep Nutrition – Focus on Feeding Ewes in Breeding and Gestation

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Overview

- There are key factors in sheep that influence nutrition

- Genetics
- Feed Intake
- Environment - Stress

Nutrition – Seedstock / Show Sheep

- What makes these sheep different?

- Genotype/phenotype
  - Differences in body composition, feed intake, etc.

Spectrum of Feed Sources

Drylot/Barn

- Grains
- Hay
- Supplemented minerals

Pasture/Feedlot

- Grains
- Hay
- Supplemented minerals

Pasture/Range

- Forages
- Supplemented minerals

Ewe Nutritional Management

- **Traditional Thinking – There are basically three periods of critical importance when feeding ewes**

  1. Breeding

  2. Late gestation

  3. Early lactation

Influences of Breeding Success

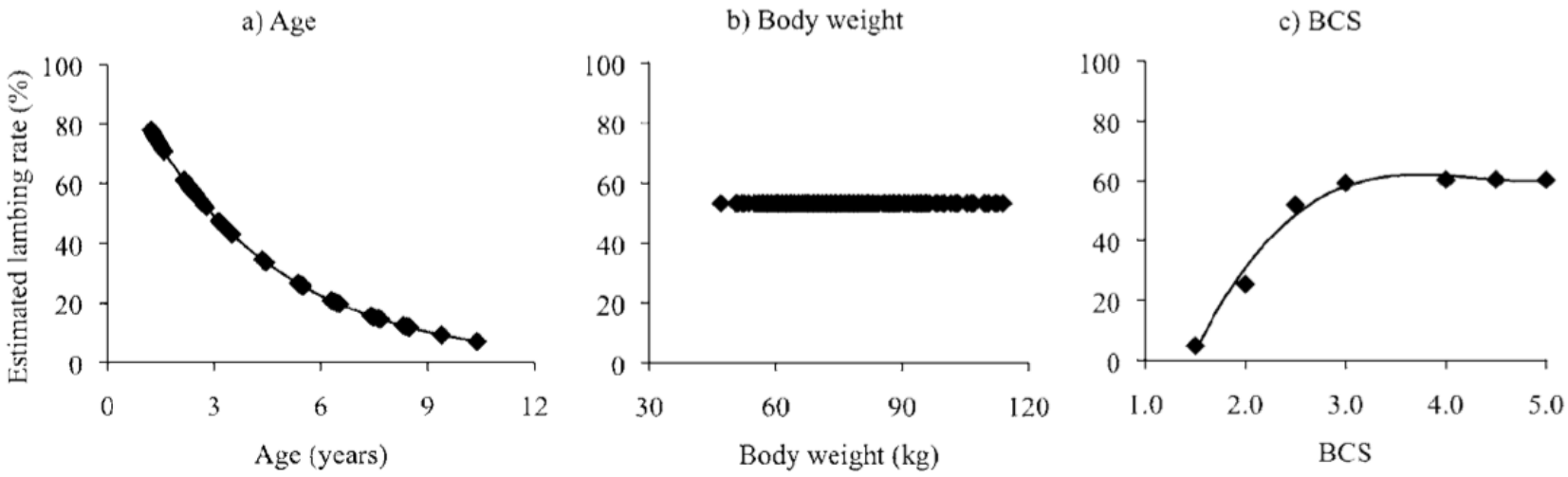
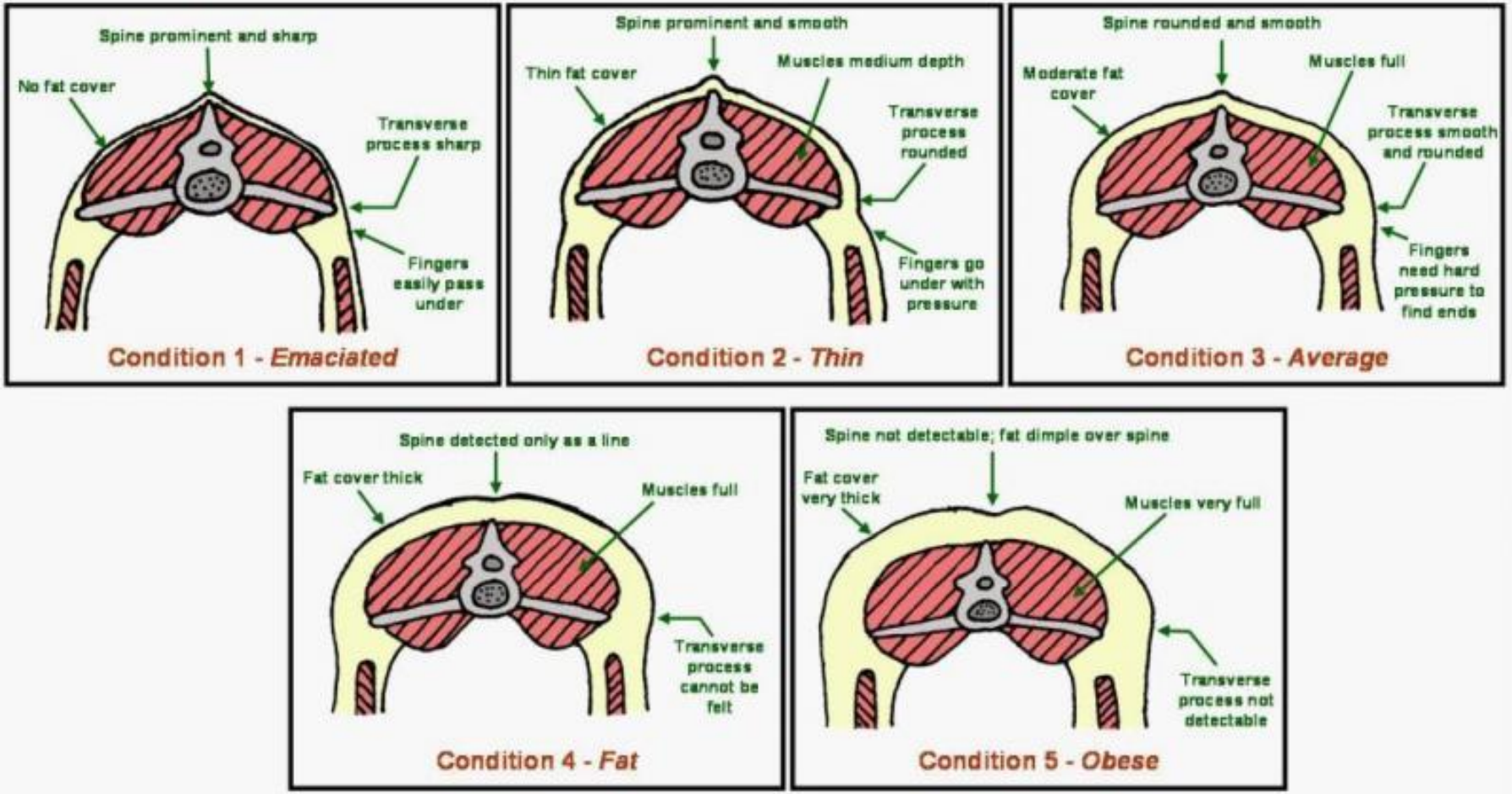


Fig. 1. Estimated lambing rates of the inseminated ewes (n=231) in Experiment 2 according to age (a), body weight (b) and BCS (c).

Fukui, 2010

Body Condition Scores – Sheep/Goats



Adapted from "Body Condition Scoring of Sheep" by J.M. Thompson and H. Meyer (Oregon State University)

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Body Condition Score

1 or 1.5

3 or 3.5

4 or 5.5

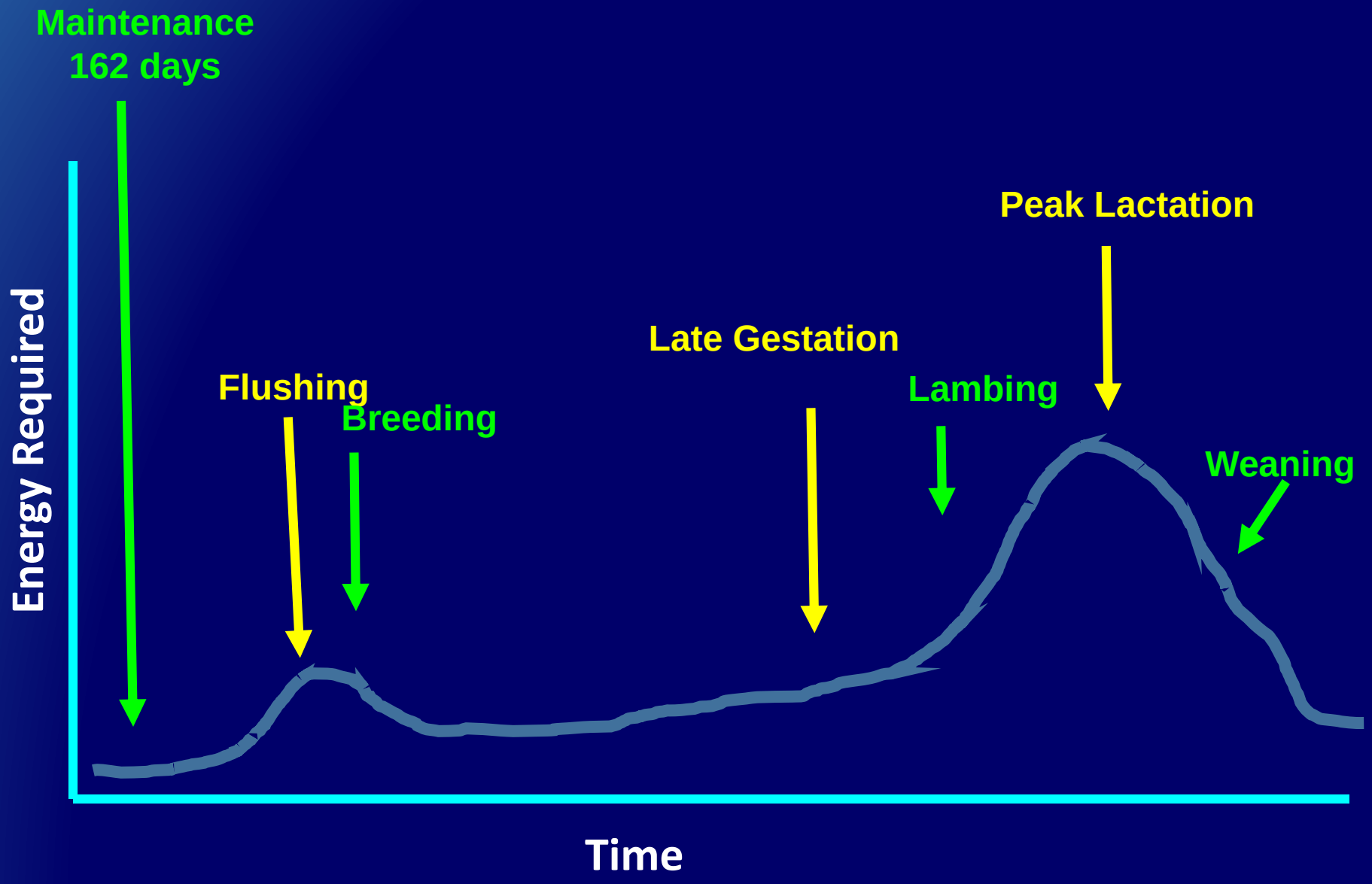
BCS – one of the most critical factors influencing reproductive success

Nutrient Requirements - 154 lb. ewe

Production Stage	DM	TDN	CP	DE
	lb/d	lb/d	lb/d	Kcal/d
Maint	2.6	1.5	0.25	3,000
Flush/Breed	4.0	2.3	0.36	4,600
Early Gest	3.1	1.7	0.29	3,400
Late Gest	4.2	2.8	0.47	5,600
Lactation	6.2	4.0	0.92	8,000

Total Digestible Nutrients (TDN) - old system of measuring energy of feeds
Digestible Energy – energy digested and absorbed by the animal
Metabolizable Energy – energy used by the organs and is available for use
Net Energy – energy actually used for body functions – maintenance, growth, lactation

Ewe Management: Relative Energy Demands



Ewe Management: ‘Pre’ Pre-breeding

- Starts as early as ewe lambs in the creep !

- Underfed ewe lambs (pre-weaning) have delayed first estrus and lower ovulation rates

Ewe Management: Pre-breeding

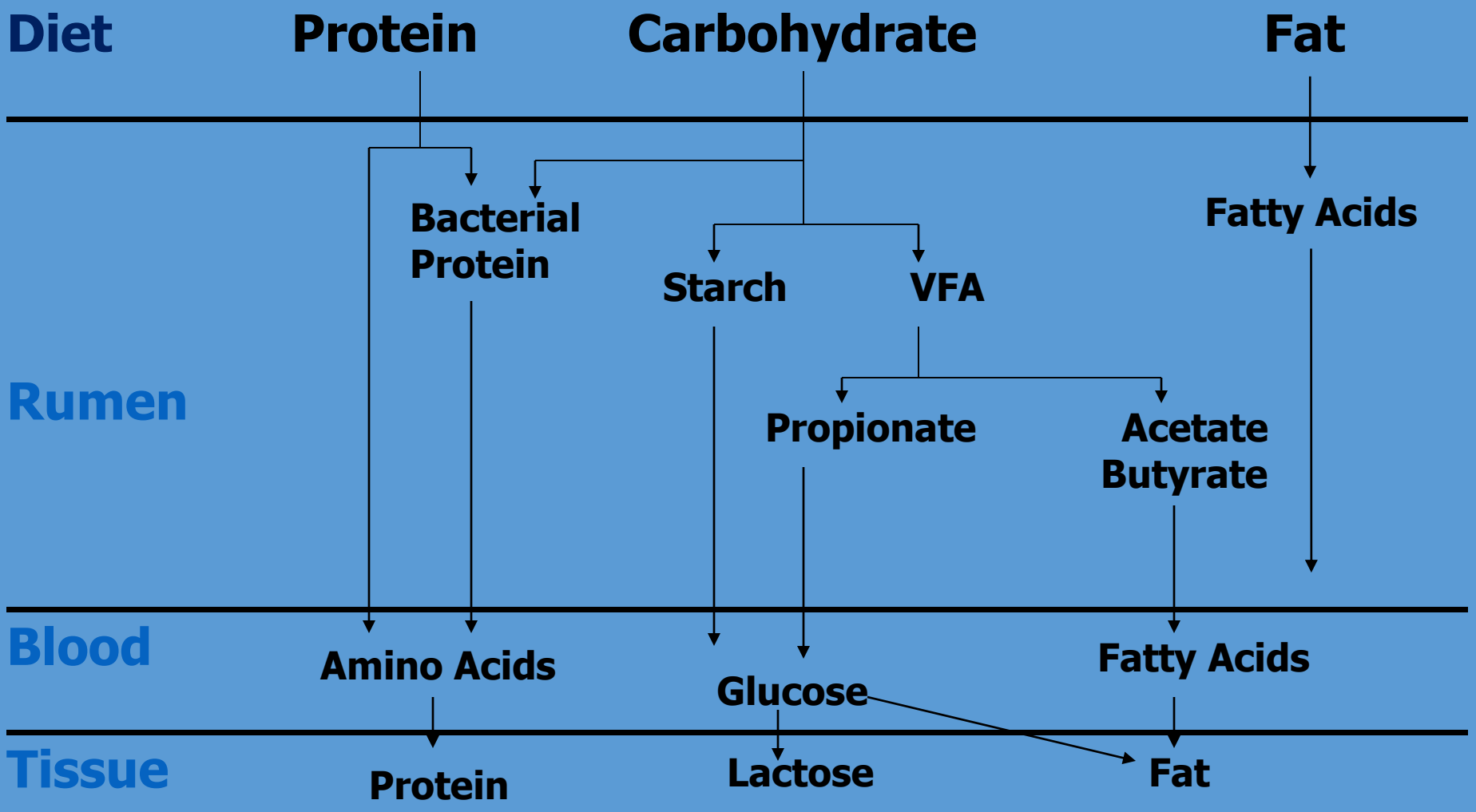
- Flushing
  - Increasing dietary energy levels
    - Start 2-3 weeks before breeding
    - Continue through breeding interval
      - Need optimum nutrition when egg attaches to uterine wall
  - Results of flushing
    - Increased ovulation rate

Increasing Ovulation Rate

- Driven by positive energy balance
- Effects include –
  - Weight gain
  - Increasing BCS
  - Increased growth hormone production
  - Increased IGF-1 and leptin production
  - Increased insulin response

- Insulin increases FSH → follicular development

Ruminant Digestion



Nutrients Capable of Flushing

- Starch and Glucose – yes *IDEAL*
- Hay and Forages – not effective alone
- Protein Feeds – not when fed in excess

Excess N from protein can impair oocyte viability

- Fat Supplements – effective with starch

Guiding Principles in Feeding Ewes During Breeding

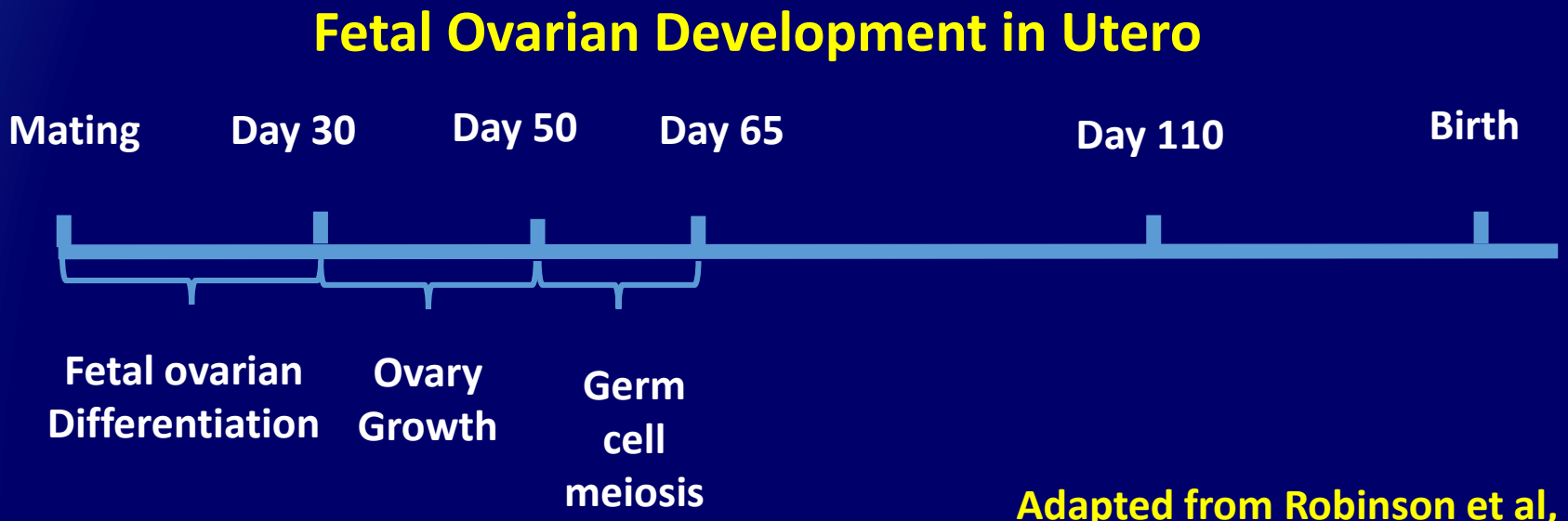
- Select a clean, high quality grain source or complete feed supplement
- Provide access to a high quality forage source
- Consistent Feeding Practices
- Focused use of micronutrient supplements

Transitioning from Flush Ration

- Maintain flush feeding 2-3 weeks after ewes are marked
  - Embryos are implanting
- Drastically increasing feed energy = lower progesterone
- Added unsaturated fatty acids can enhance progesterone
- Reduce energy gradually to maintenance levels

Early-Mid Gestation Feeding

- Fertility of progeny starts in the uterus !
- Underfed ewe lamb fetuses have delayed first estrus and lower ovulation rates



Adapted from Robinson et al, 2006

Early-Mid Gestation Feeding

- Reduced early fetal growth = ↓ time to puberty

- Fetal programming
  - Reproductive success of progeny
  - Day 0-30 gestation – ovary development in lambs
  - Day 50-65 – follicle development

Treatment group	*n*	Live weight (kg)	BCS	No. of ovulations
Females				
H	28	48.6 ± 0.96	2.5 ± 0.03	1.46 ± 0.10 a
L	21	48.2 ± 1.03	2.5 ± 0.03	1.17 ± 0.09 b

Rae, 2002

Forage Choices

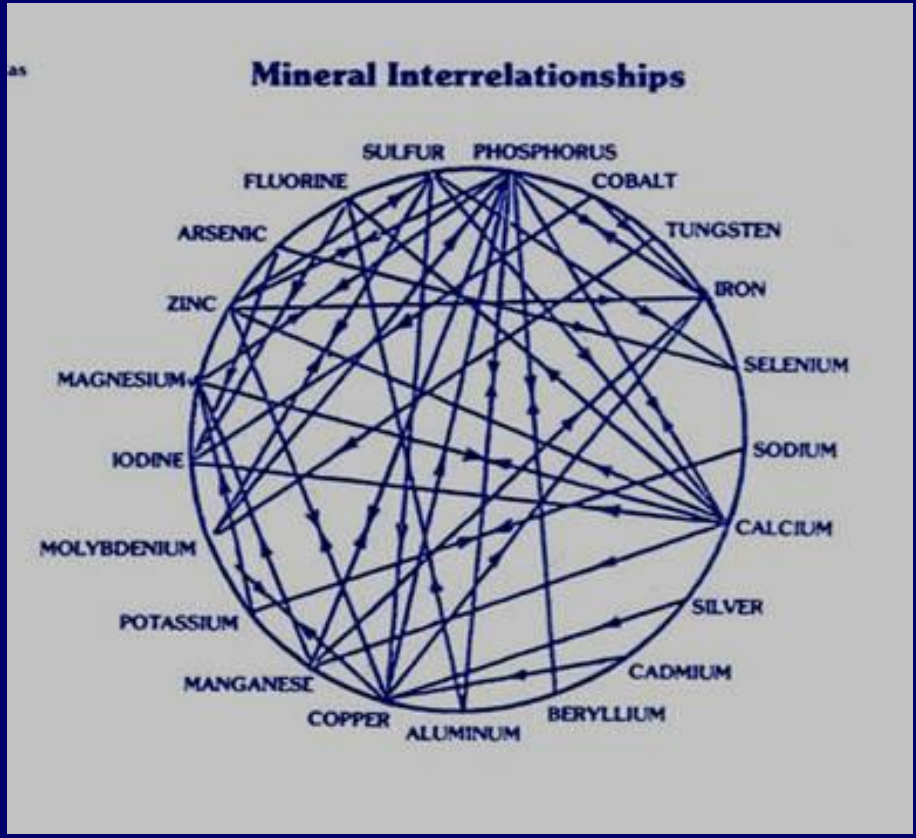
- Alfalfa Hay
- Grass Hay
- Oat/Grain Hay

Minerals Required by Sheep

- Calcium and Phosphorus
- Sodium and Chloride
- Electrolytes – Mg, K, S
- Iron
- Iodine
- Copper and Molybdenum
- Zinc
- Manganese
- Selenium
- Cobalt

Complexities of Mineral Nutrition

- Variation in requirements
  - Ca (grams) v. Se (ppm)
- Sources vary in absorption
  - Oxide forms are generally low
- Interactions/antagonism
- Requirements change with age



Calcium and Phosphorus

- **Ratio of Ca:P is still critical**
  - **2:1 or at least more Ca than P**
- **Calcium easy to supplement**
- **Legume hays are high in Ca**

Phosphorus Concerns - Urolithiasis

- Struvite crystal formation in urinary tract
- High risk – mature males on high P diet

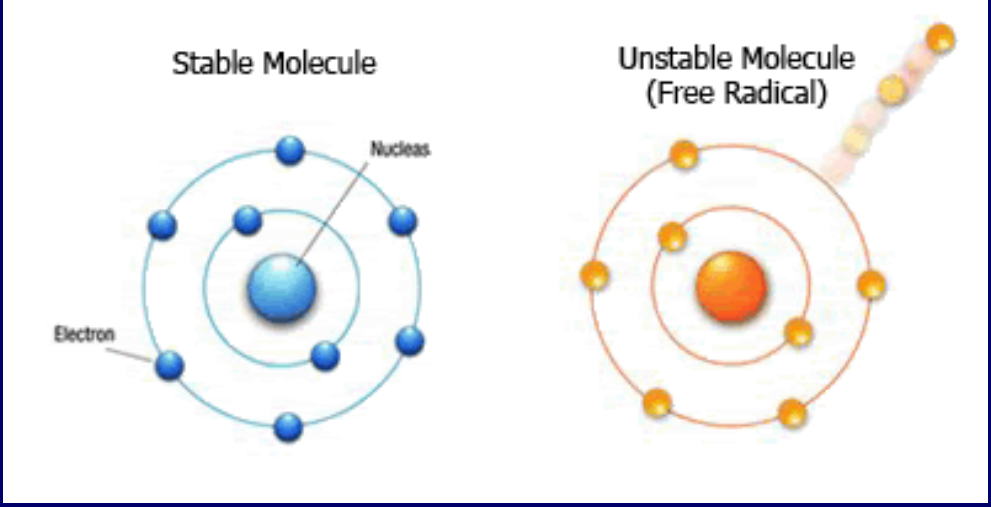
Mitigating Risks of Urinary Calculi

- Use mineral supplements with no added P to mature rams

- Feed ammonium chloride when feeding grain to rams

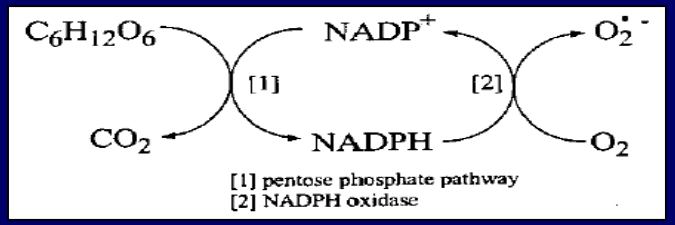
Oxidative Stress in Livestock

- **Formation of free radicals during normal metabolism**



Causes of Oxidative Stress in Livestock

- Disease (parasites)
- Rapid growth
- Activation of Immune System
  - Temperature change
  - Environmental changes



Where Do Minerals Fit In?

- Antioxidants
  - Chemicals capable of removing oxidizing compounds (i.e. free radicals)
  - Some are enzymes – some are specific molecules

- Primary antioxidant enzymes used by cells
  - Super oxide dismutase – (Cu, Zn, Mn, Fe, Ni)
  - Catalase (Iron)
  - Glutathione peroxidase – (Se, Vitamin E)

Selenium

- Only nutrient currently regulated by FDA (0.3 ppm in feed)
- Sheep can tolerate more in their diet – depending on source
- Toxicity arises when consuming organic form or when injected

Range of Safety Margins

Trace Mineral	Requirement[a]	Maximum Tolerable Level[b]	Requirement to Tolerable level
Cobalt	0.2[c]	10	50
Copper	10	100	10
Iodine	0.50	50	100
Iron	50	1000	20
Manganese	20	1000	50
Selenium	0.1	10	100
Zinc	30	500	16.7

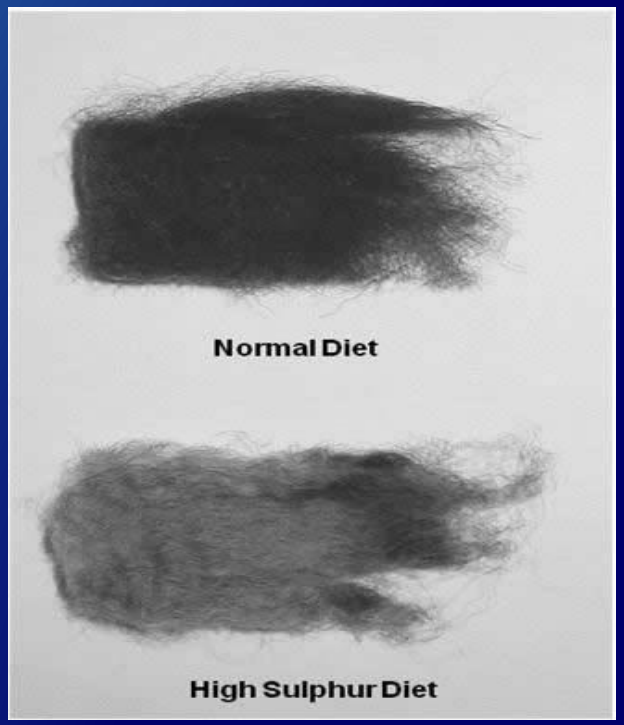
[a] NRC (1996)-Requirements are for gestating and early lactating beef cows.
[b] NRC (1980)
[c] Stangl et al (2000)-Requirement suggested to be 0.2-0.3 ppm

Adapted from Davis et al., 2006. Tolerance of inorganic selenium by range type ewes during gestation and lactation. J. Anim. Sci. 84:660-668

Copper and Molybdenum

- Susceptibility of sheep to Cu toxicity is well described
- Copper absorption reduced by Molybdenum and/or Sulfur

Sulfur and Molybdenum Induced Copper Deficiency



Copper

- Required by sheep in many areas of metabolism
- Sheep store copper well in liver, but no bile excretion
- Stress can release stored copper – immune response

Zinc

- Zinc is critical for cell replication – growth and reproduction
- Oxide form is poorly used by sheep
- Too much Zn reduces absorption of Fe and Cu

Al-Saad et al. 2010. Clinical, Hematological, Biochemical and Pathological Studies on Zinc Deficiency (Hypozincemia) in Sheep

Manganese

- Critical for normal reproduction – especially ewes
- Involved in proper collagen formation in fetal lambs
- Grazing animals get plenty of Mn from forage and soil
- However - high Ca, P, or Iron may induce a Mn deficiency

Summary

Drylot/Barn

- Supplement carefully
- Add Mn, Se, Zn to ewe & ram diets
- No P in mix

Pasture/Feedlot

- Be selective in supplementation
- Test pasture forage
- Supplement rams

Pasture/Range

- Test forages
- Salt, iodine
- Ca, P when ewes are on dry grass

General Considerations

- Keep ewes in positive energy balance
- Use Consistent Feeding Practices
- Use Probiotics to maintain gut health
- Provide loose salt/mineral w/ Se and Vit. E
- Vitamin supplement

Thank you