Fetal Programming in Beef Cattle

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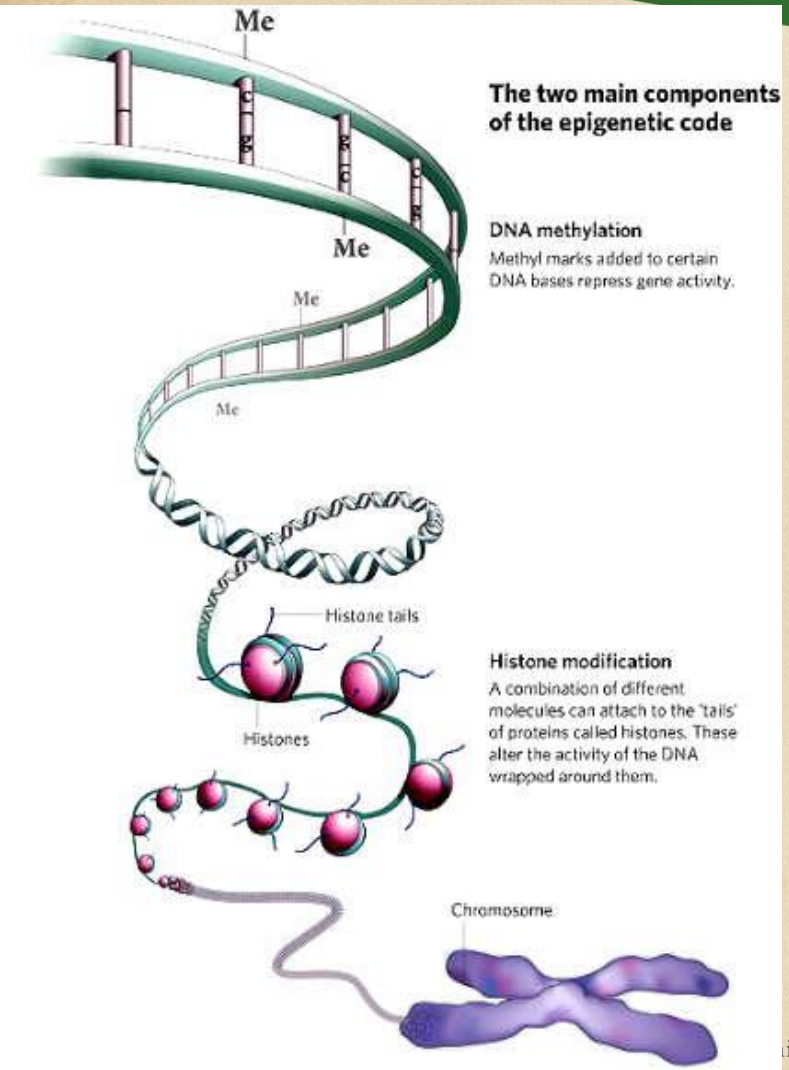
What is fetal programming?

Fetal Programming

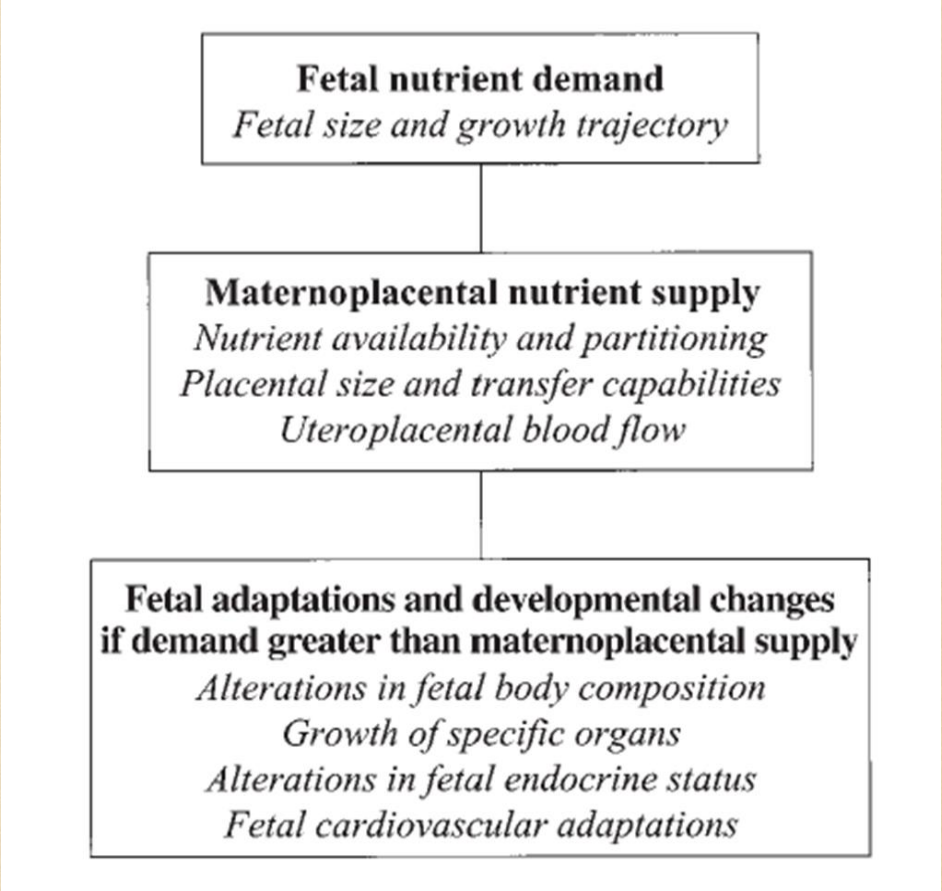


- **The idea that a fetus is developmentally plastic and can adapt to its predicted postnatal surroundings**
- Occurs through epigenetic modifications
- Alters an animal's performance in postnatal life
- Causes:
  - **Nutrient restriction**
  - Twinning
  - Heifer pregnancy
  - Heat/Cold stress
  - High altitude

Thrifty Type Cattle

In a nutrient restricted environment,

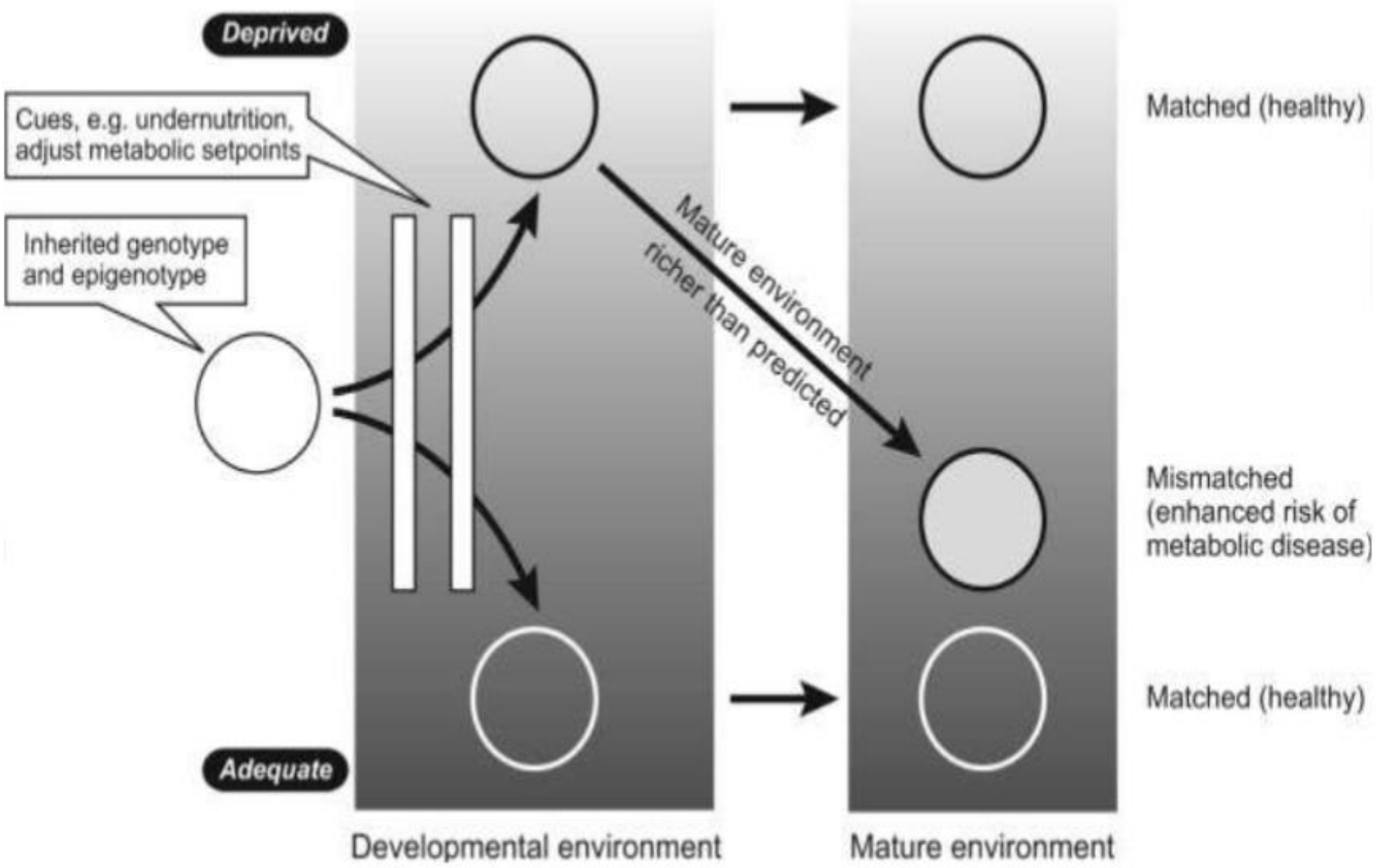
- The **fetus programs it's metabolism** to partition more calories to the storage of fat than to lean muscle
- Development of insulin producing cells in the pancreas is impaired
  - Decreased insulin production



Intrauterine growth restriction (IUGR)

- IUGR = Excessively low birth weights
- Significantly increases chance of sickness or death of calves

Matching and mismatching environments



Sectors of the Beef Industry



Forage based diet
Extensively managed
Variable management
Geographically variable

Grain based diet
Intensively managed
Uniform management
Regional location

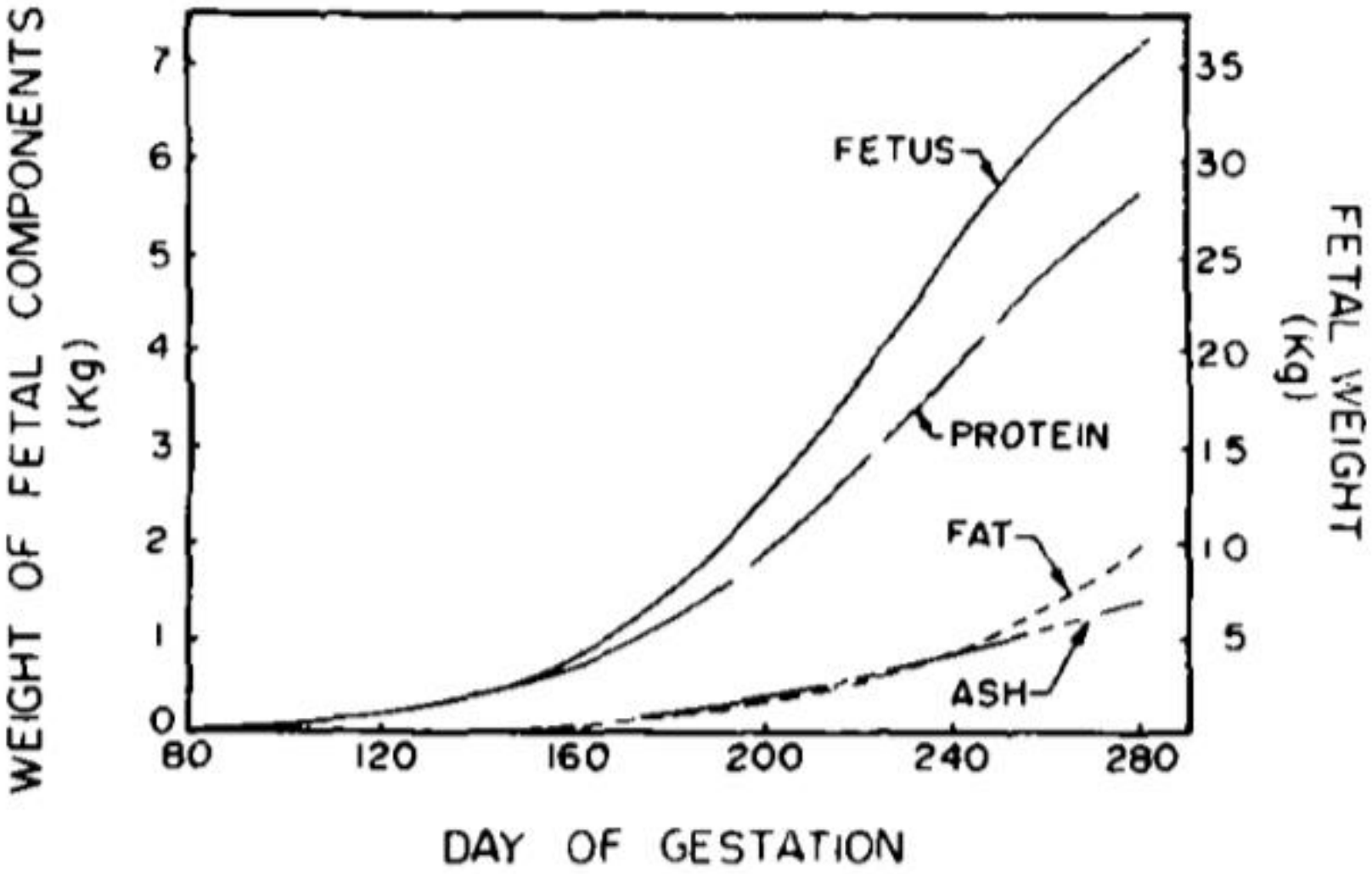
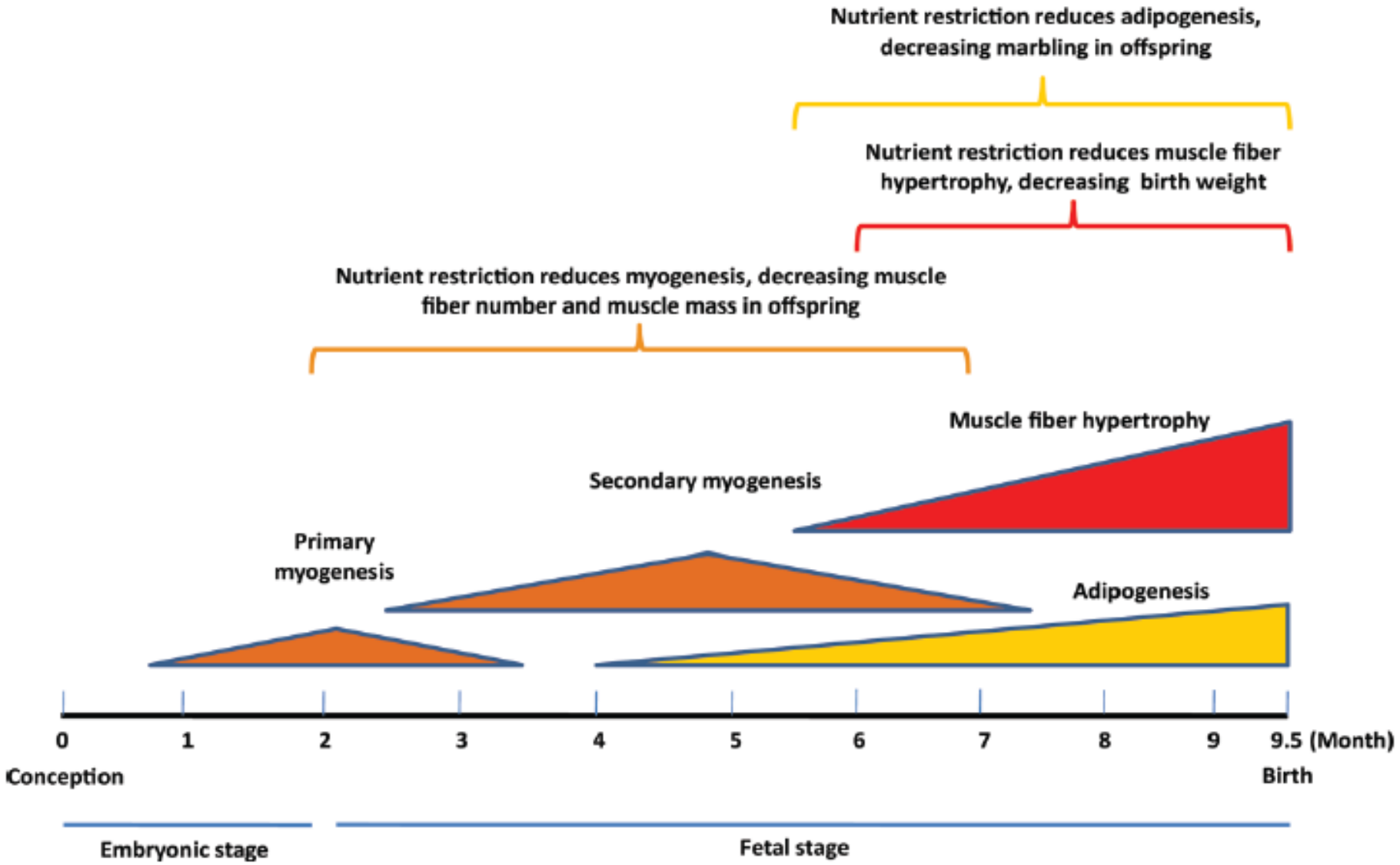


Figure 1. Fetal weight, and protein, fat and ash content of the bovine fetus by day of gestation.

Organ Development

- Fetal organs develop early in gestation
  - Fetal calf heart beat: 21-22 days post-ovulation
  - 25 days post ovulation: Limbs, Pancreas, liver, adrenals, lungs, thyroid, spleen, brain, thymus, and kidneys start to develop
  - Reproductive organ development starts: 60 days post ovulation
    - Heifer calf's future fertility and stayability can be affected

Muscle and Fat Development

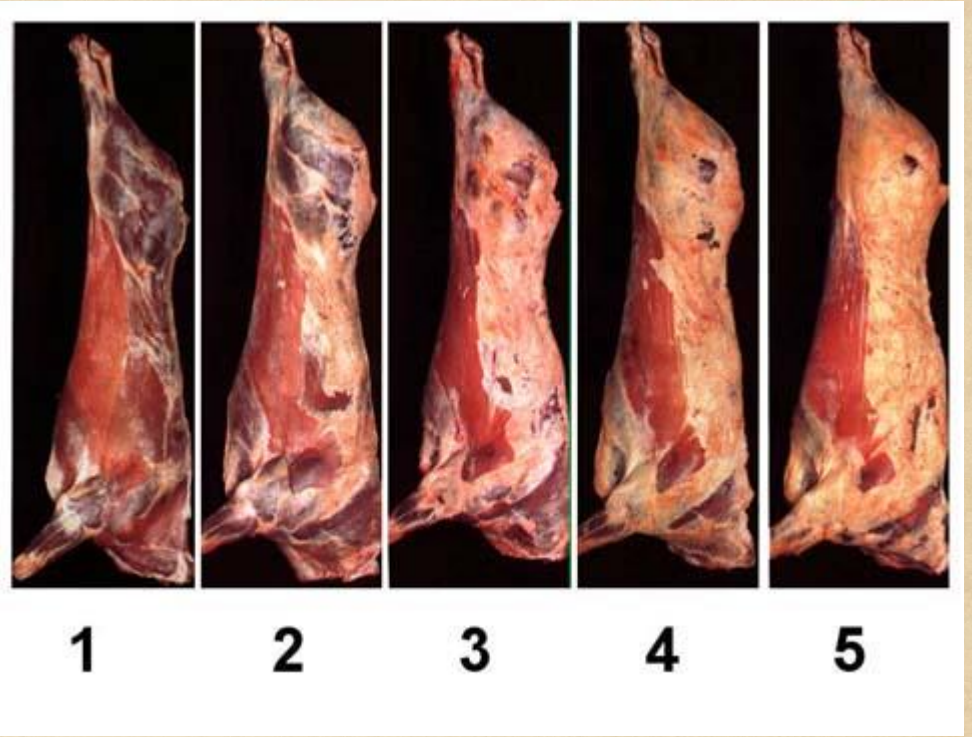


Negative programming on growth

- **Decreased weaning weight**
- Decreased live weight at slaughter
- Decreased growth of the respiratory system
  - Cattle are more susceptible to respiratory illness

Negative programming on carcass traits

- Nutrient restriction of cows can cause offspring to have:
  - Reduced hot carcass weight (HCW)
  - Reduced muscle tenderness
  - Decreased 12th rib fat thickness
  - Decreased carcass yield grade
  - Increased size of fat cells
  - Decreased marbling
  - Reduced % grading choice



Negative impacts on replacement heifers

- Heifers born to nutrient restricted dams may have:
  - Later onset of puberty
  - Decreased Follicle stimulating hormone (FSH) production
    - Decreased follicular size
  - **Delayed pregnancy achievement**

Avoiding Negative Programming

- Keep Records
- Know your actual mature cow weight
  - Figure out her nutritional requirements
- Run suitable cattle to your environmental conditions/production goals
- Have a controlled breeding season (60-90 days)
- Have cows at a BCS 5-6 at calving
  - Allows for some loss due to lactation
- Don’t cut back heifer’s diets in late pregnancy
- Determine whether to keep replacements/retain ownership from a drought year

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