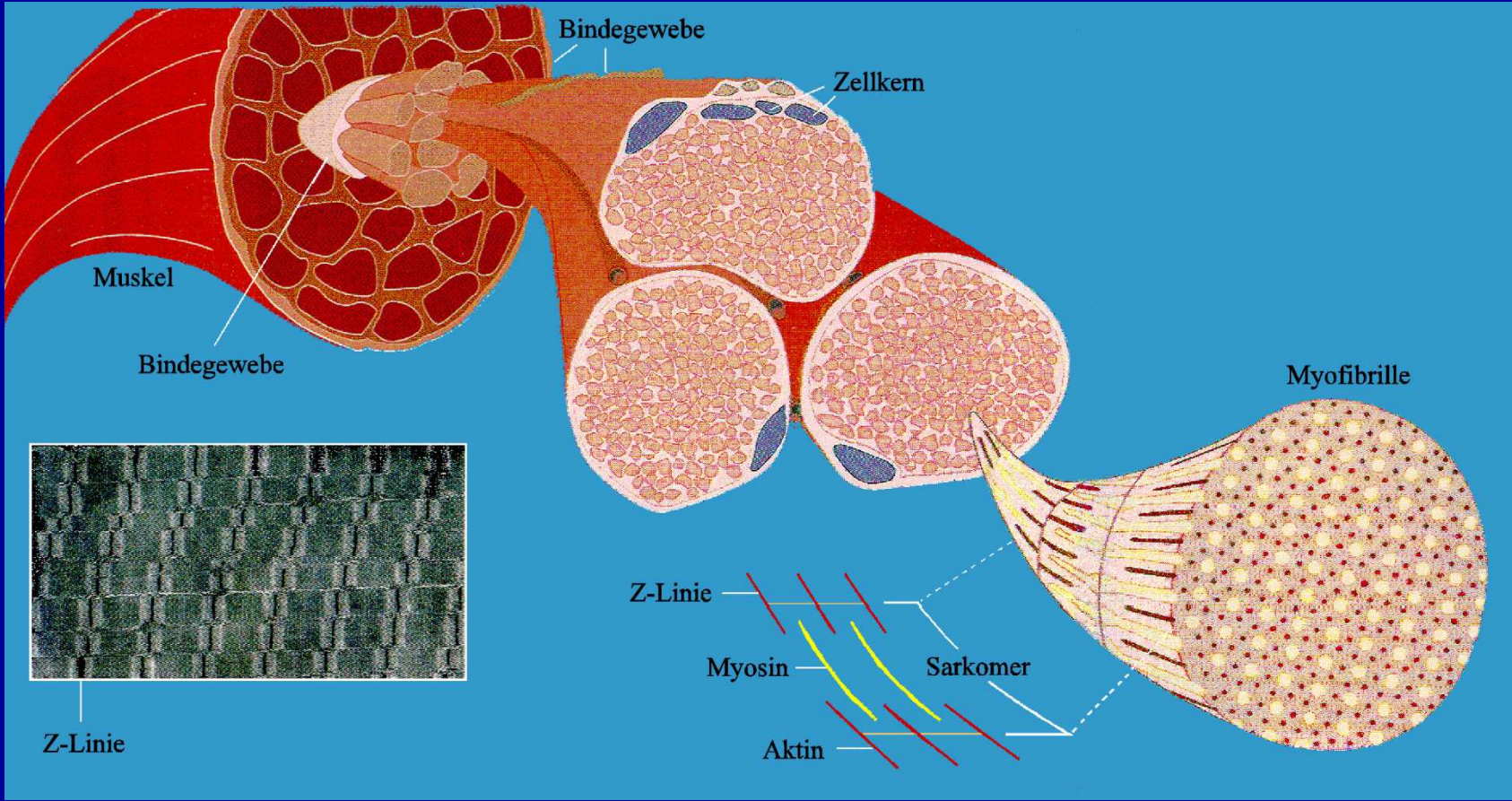


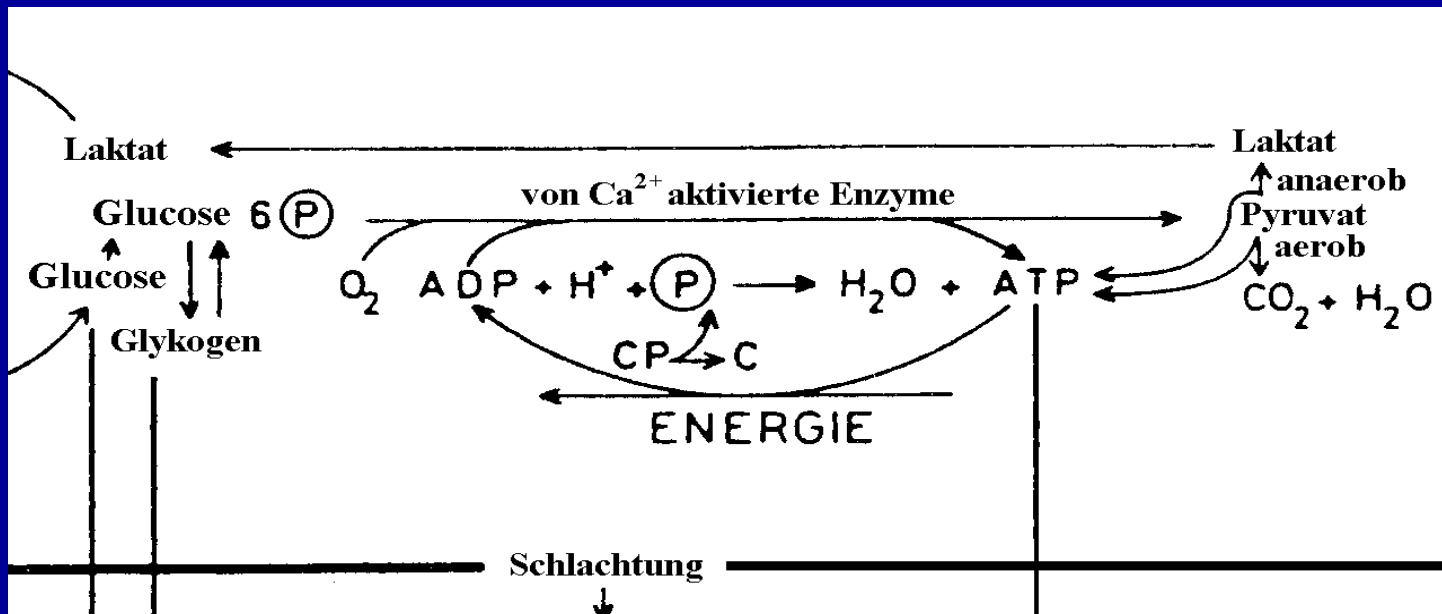
Muscle Biology and Meat Quality

Frans J.M. Smulders

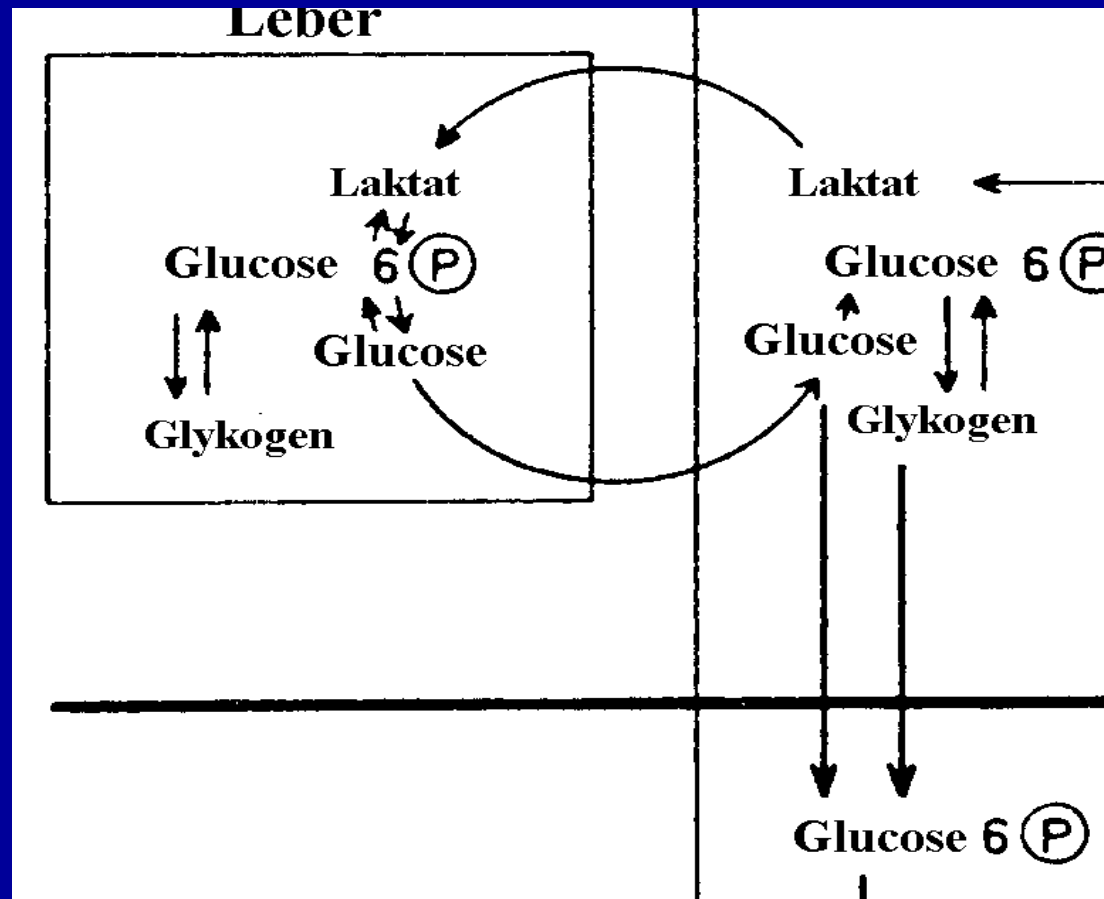
Muscle Structure and Light Microscopy



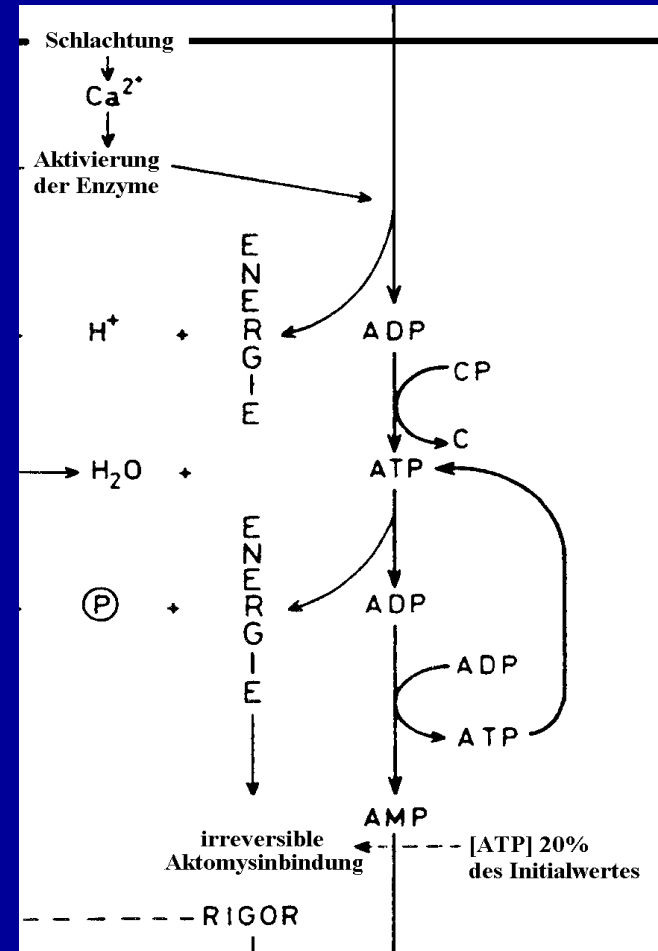
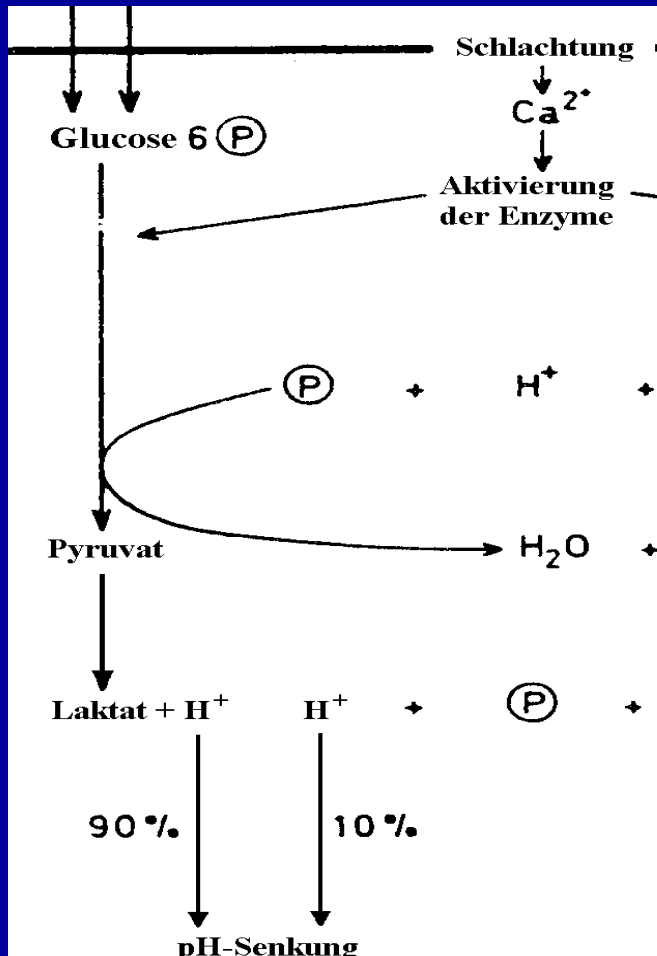
Energy Generation for Muscle Contraction *in vivo*



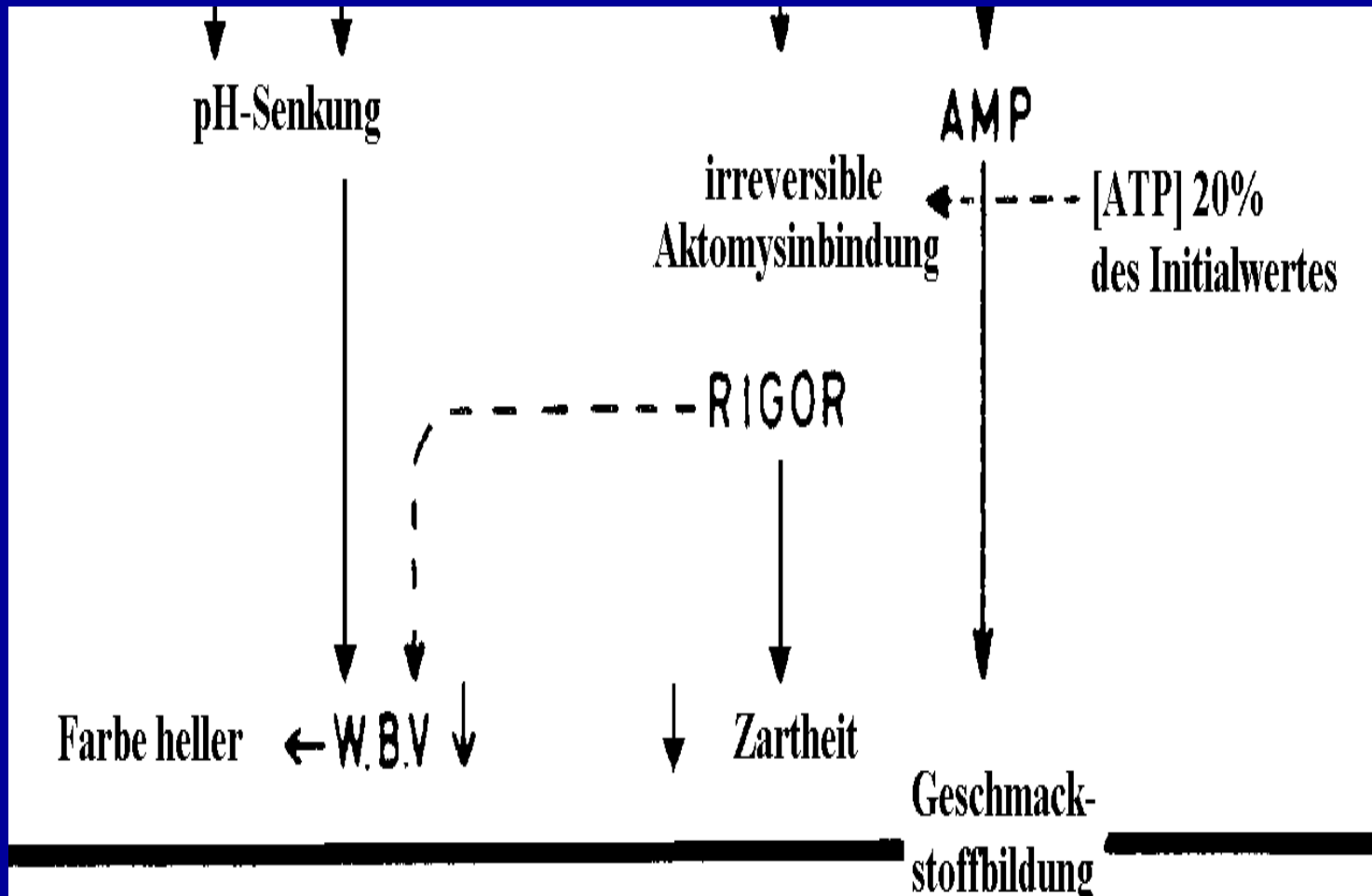
Cori cycle for regenerating glucose



Post mortem muscle physiology ("conditioning" = period before rigor onset) [1]

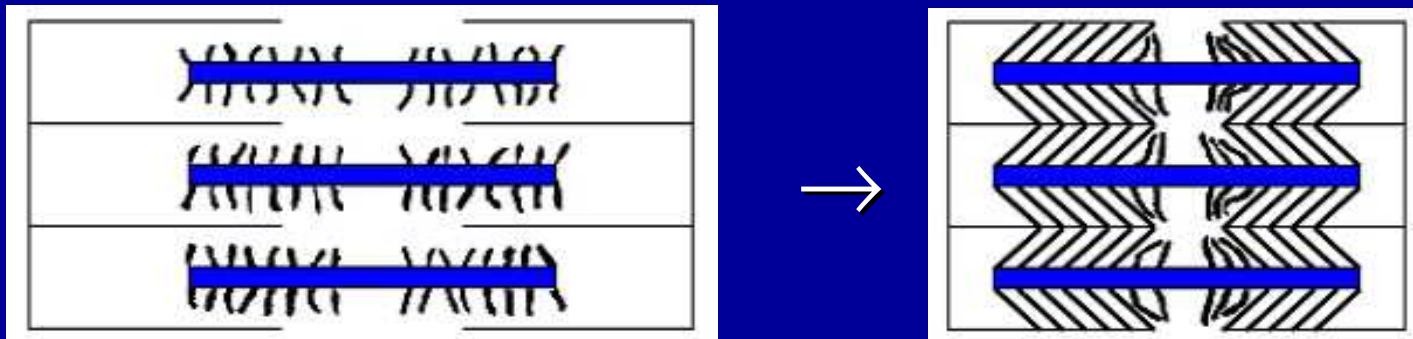


Post mortem muscle physiology ("conditioning") [2]



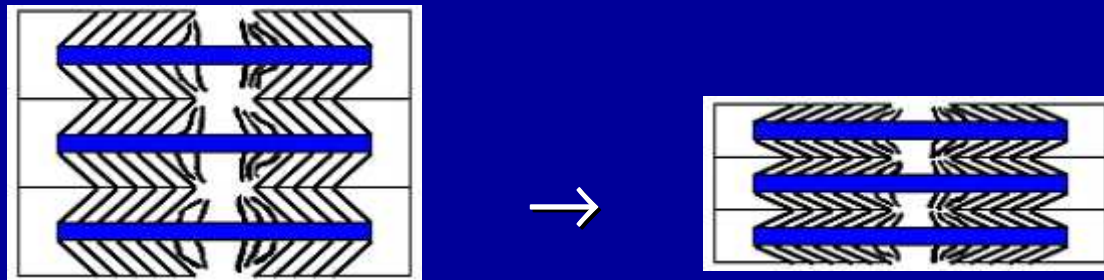
Onset of *rigor mortis*

When [ATP] is depleted in 80 or more % of the fibres: irreversible "interdigitation" of actin and myosin, increased myofibrillar density

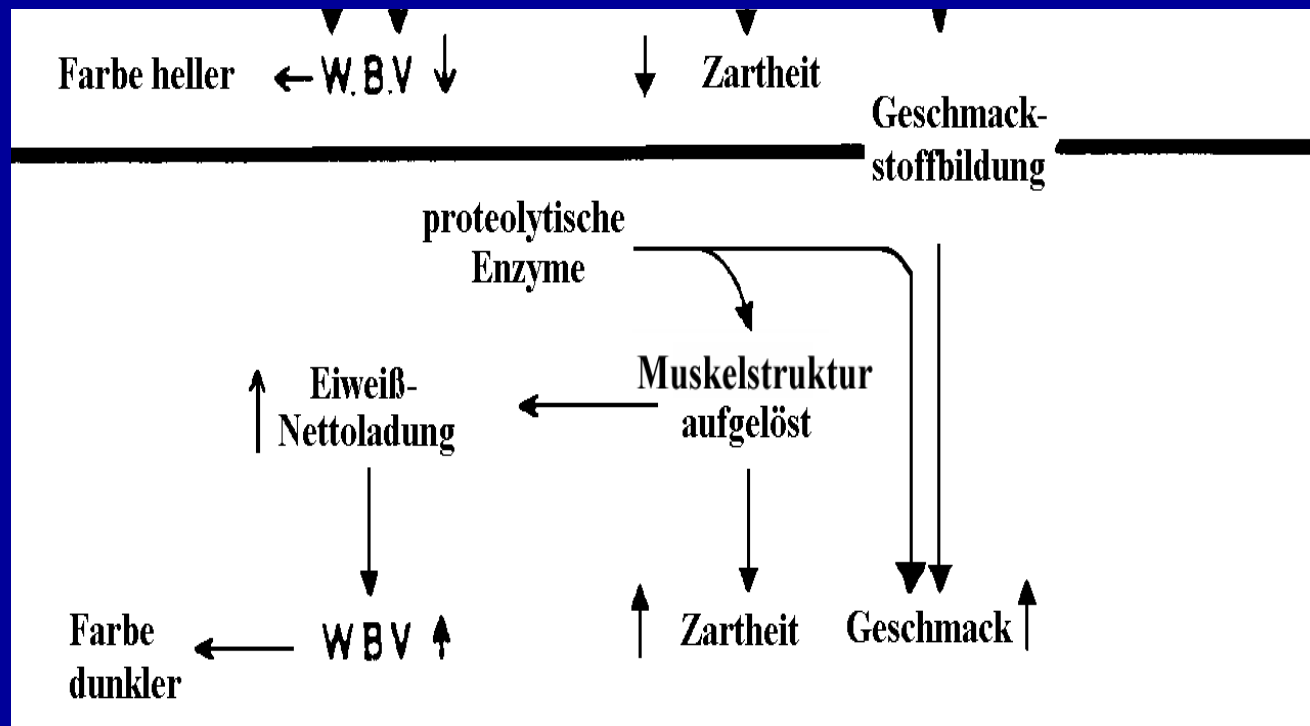


Crucial role of pH decline

1. Approach of isoelectric point
 - decreased electric charge of proteins
 - loss of the (bipolar) water molecules
2. "lateral shrinkage" → density of myofibrillar matrix increases



Post mortem muscle physiology ("ageing" = period after rigor onset)



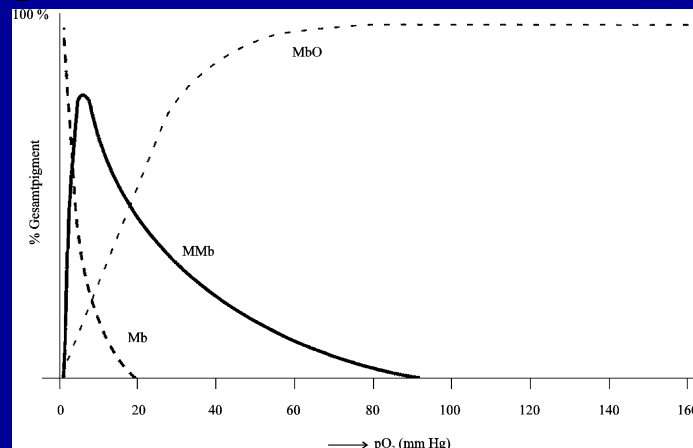
proteolysis, weakening of myofibrillar matrix

Sensory properties of meat (waterholding)

- Water immobilised by molecular binding
- electrostatically bound water (reduced with lower pH)
- structurally bound water (reduced with shrinkage of the myofibrils)

Sensory properties of meat (colour)

- cytochrome
- muscle pigments: myoglobin (~ Hb) [light absorption]
- state of oxygenation/oxidation (Mb, MbO₂, MMb)



- water on the muscle surface (light reflection)

Sensory properties of meat (flavour)

- lactic acid
- ATP metabolites
- fat soluble aroma components (e.g. carbonyl compounds)
- glycogen residuals
- compounds released upon decomposition (spoilage): e.g. NH_3 , H_2S
- Compounds formed upon heating (e.g. pyrazins)

Sensory properties of meat (tenderness)

- fibre size
- connective tissue (solubility)
- fat?
- myofibrillar density
- proteolysis (μ -calpain, cathepsins)
- (technological manipulation, e.g. electrical stimulation, boning techniques, pelvic suspension etc.)

Differences between animal genera and species - examples

- speed of glycolysis (slow and fast glycolysing muscle: birds/pigs vs. ruminants)
- species differences (e.g. increasing tendency for MMb formation: beef → pork → lamb, or, calpain activity or, DFD prevalence)
- breed differences (Hampshire effect)
- age differences: collagen solubility
- sex differences: boar taint