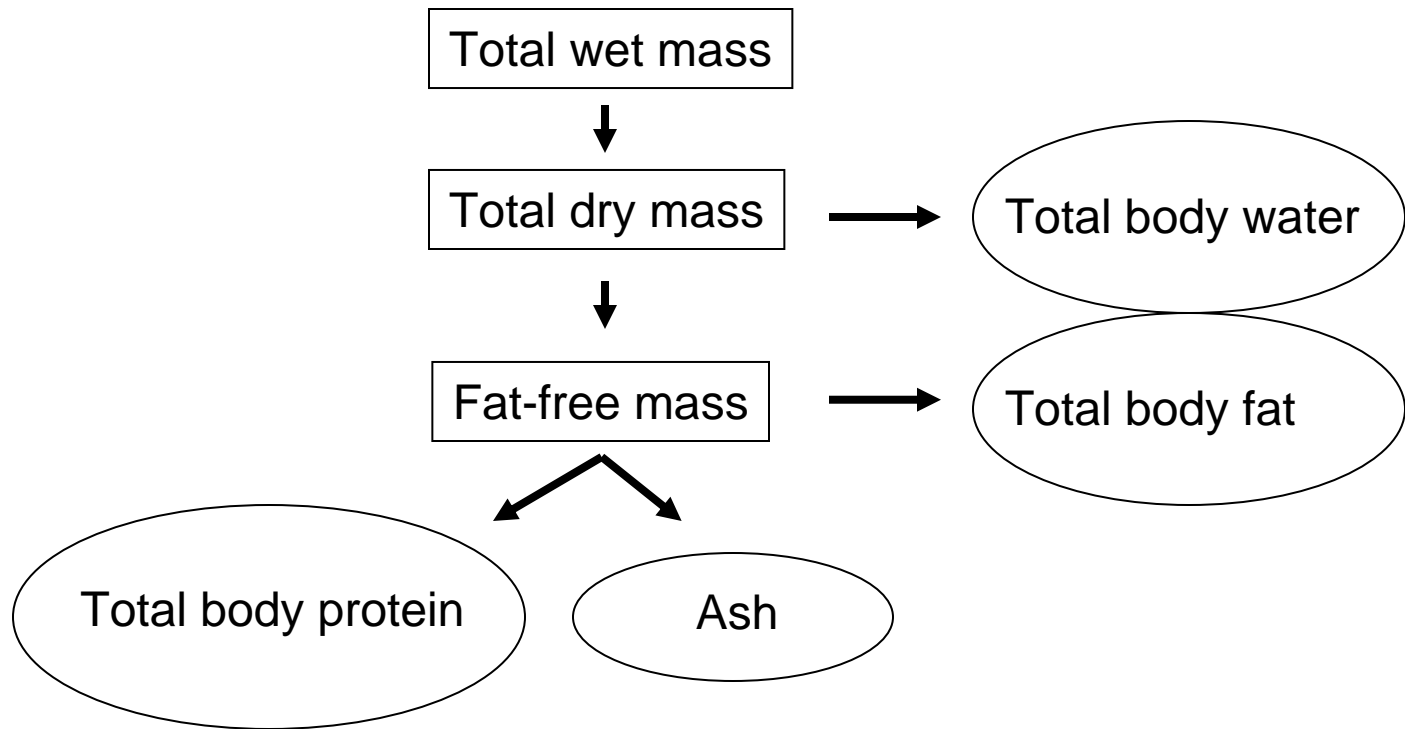


Estimating body condition

Body components



$\text{LBM} - \text{Ash} = \text{ash-free mass}$

$\text{ash-free mass} - \text{TBP} = \text{total body carbohydrates}$

Models of body composition

Methods

- Marker dilution
 - inject small, known amount of deuterium (^2H) or tritium (^3H)
 - let it equilibrate with body water pool (minutes to hours)
 - take blood sample
 - dilution of marker indicates size of body water pool
 - water pool size inversely related to fat

Methods

- Bioelectrical impedance analysis
 - hydrated tissues conduct electricity
 - fat does not conduct electricity
 - impedance to an electrical current allows estimation of body water pool
 - subtract water mass from total body mass to get fat mass

Indices

- Fat depots
 - Kidney fat index
 - Marrow fat index
 - Subcutaneous fat

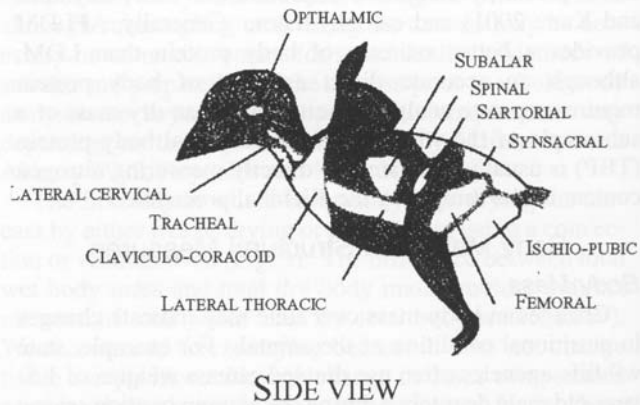
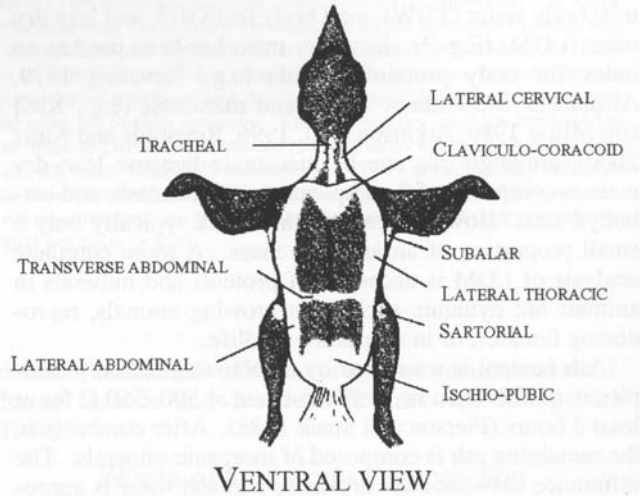


Fig. 4. Distribution of subcutaneous fat in the white-crowned sparrow (*Zonotrichia leucophrys*) (copied with permission from King and Farner 1965).

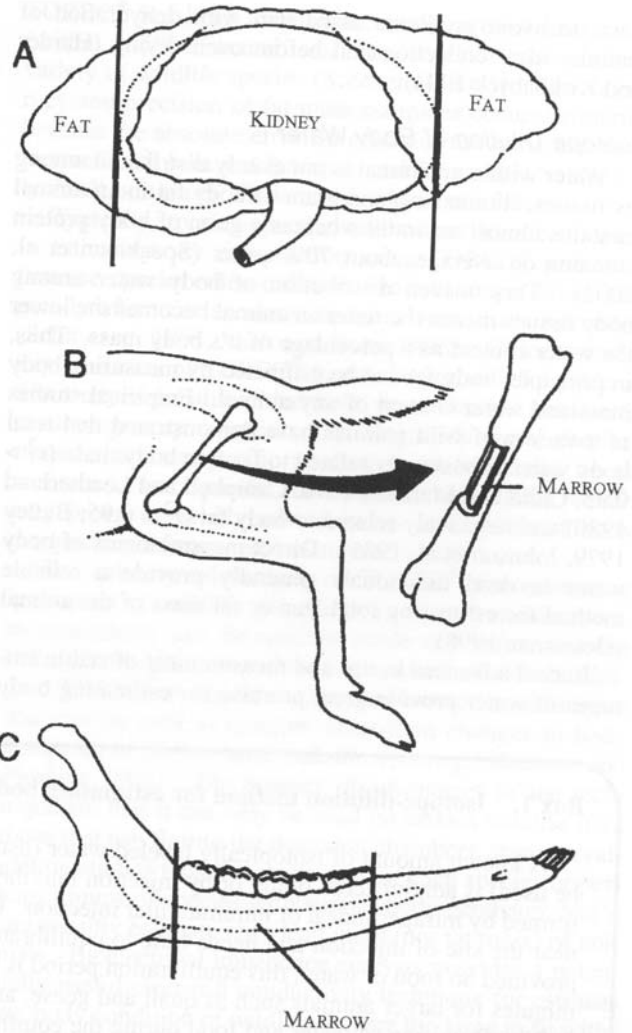


Fig. 5. The amount of fat surrounding the kidney (A) provides an index to visceral fat (adapted from Riney 1955). The amount of fat in the marrow of mammalian long bones such as the femur (B) (adapted from Cheatum 1949) or the mandible (C) (adapted from Nichols and Pelton 1974) provides a measure of energy in this depot of last resort. Fat (in A) or bone (in C) lateral to the vertical lines is trimmed and discarded.

Urine

- Collect yellow snow
- Correct for dilution as ratio to creatinine
- Urea
 - indicative of protein status
- Allantoin
 - indicative of rate of microbial fermentation
- Cortisol
 - indicative of energy balance

Blood

- Blood urea nitrogen
 - indicative of protein status
 - positively correlated with protein intake
 - also increases with protein catabolism

Ptilochronology

- Growth bars on tail feathers
- Capture bird and pull out feather
- Recapture weeks later and examine growth bars on re-grown feather
- Growth bar spacing related to nutritional status
- Also related to gender, age, and season

Dynamics of Lipid Reserves in Moose

Kris J. Hundertmark

Charles C. Schwartz

Thomas R. Stephenson



Order of fat mobilization/deposition

“Harris (1945) and Riney (1955) have described the order of fat catabolism as follows:

- (1) subcutaneous fat over the rump and saddle disappears;
- (2) abdominal cavity fat is used; and
- (3) bone marrow fat stores decline.”

Wildlife Management Techniques Manual
4th edition, 1980, p. 106

Fat Depots as Indices of Body Condition

First the fat over the rump and the saddle disappears, and then gradually the fat between the hide and body cavity is absorbed. The next step of fat absorption occurs within the body cavity proper.

Harris (1945, J. Wildl. Manage. 9:319-322) p. 320

The order of deposition of fat is fundamental to the use of the amount of fat in various depots as an index of total fat reserved, or to condition.

Riney (1955, NZ J. Sci. Tech.36:429-463) p. 435

Objective

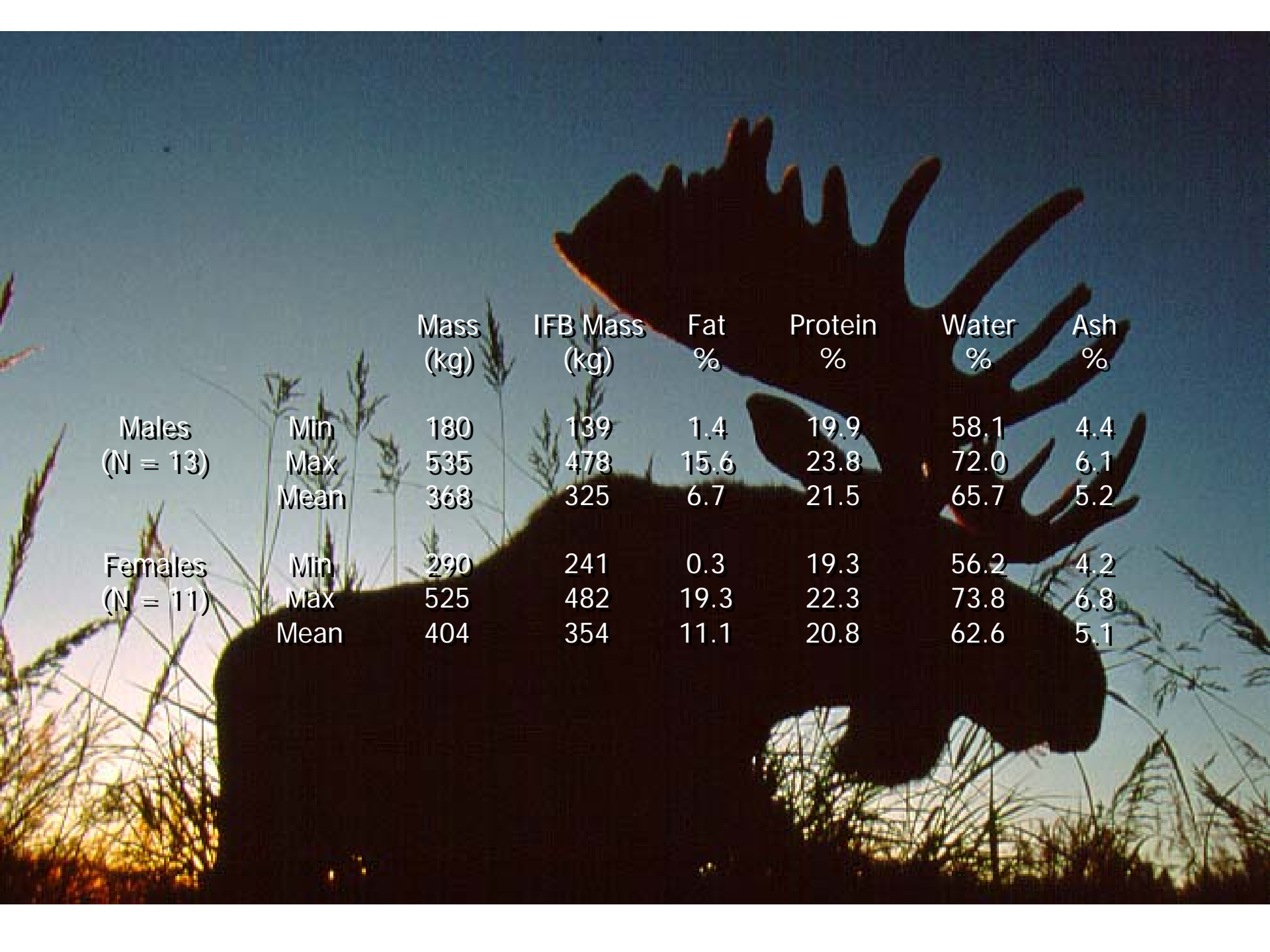
As part of a comprehensive study of body composition of moose, we set out to determine whether fat stores in the carcass and viscera are mobilized independently as body condition declines.



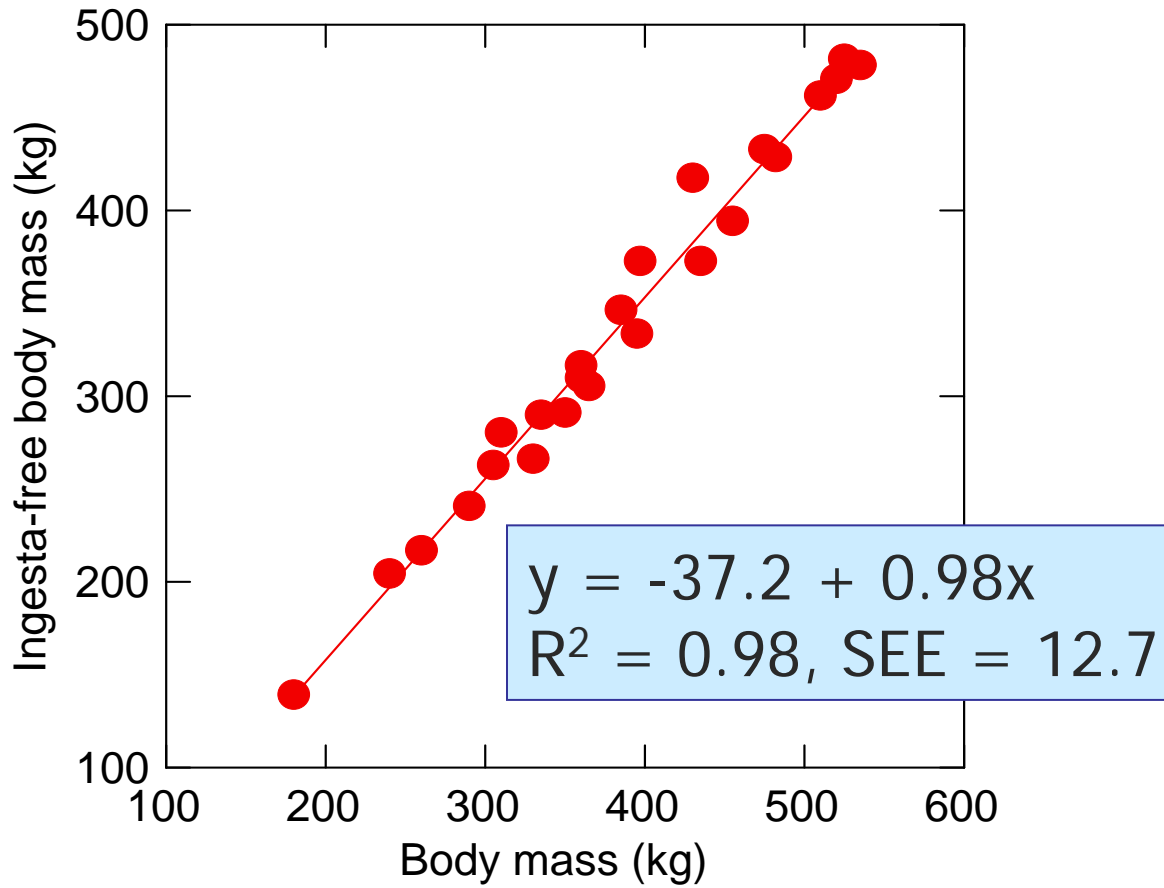
Methods

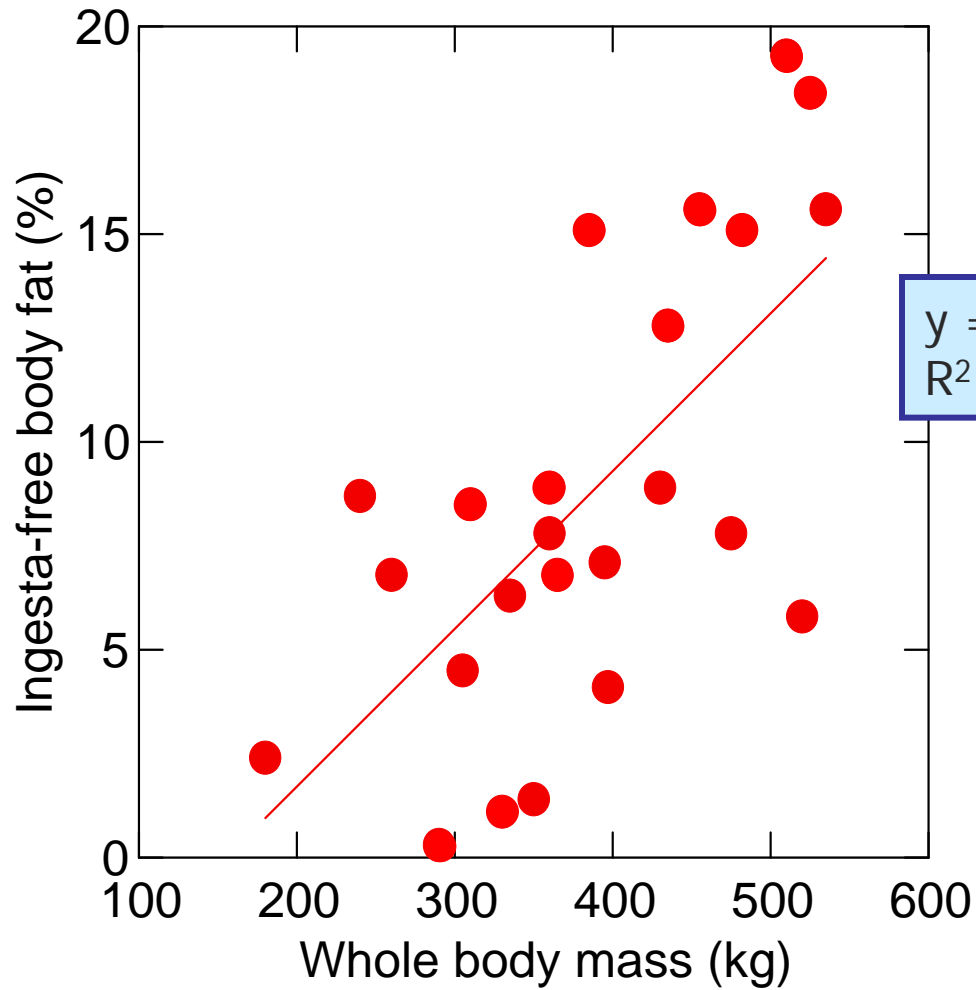
- 11 females and 13 males included in the study
- Animals divided into hide, carcass, and viscera components
- Subcutaneous fat kept on carcass, all fat within the body cavity kept with viscera
- Digestive tract emptied, carcass split along spine
- Viscera and half carcass frozen separately and subjected to band saw sampling technique (Huot)
- Shaved hide samples freeze-dried and ground
- Total body composition computed from proximate analysis of components

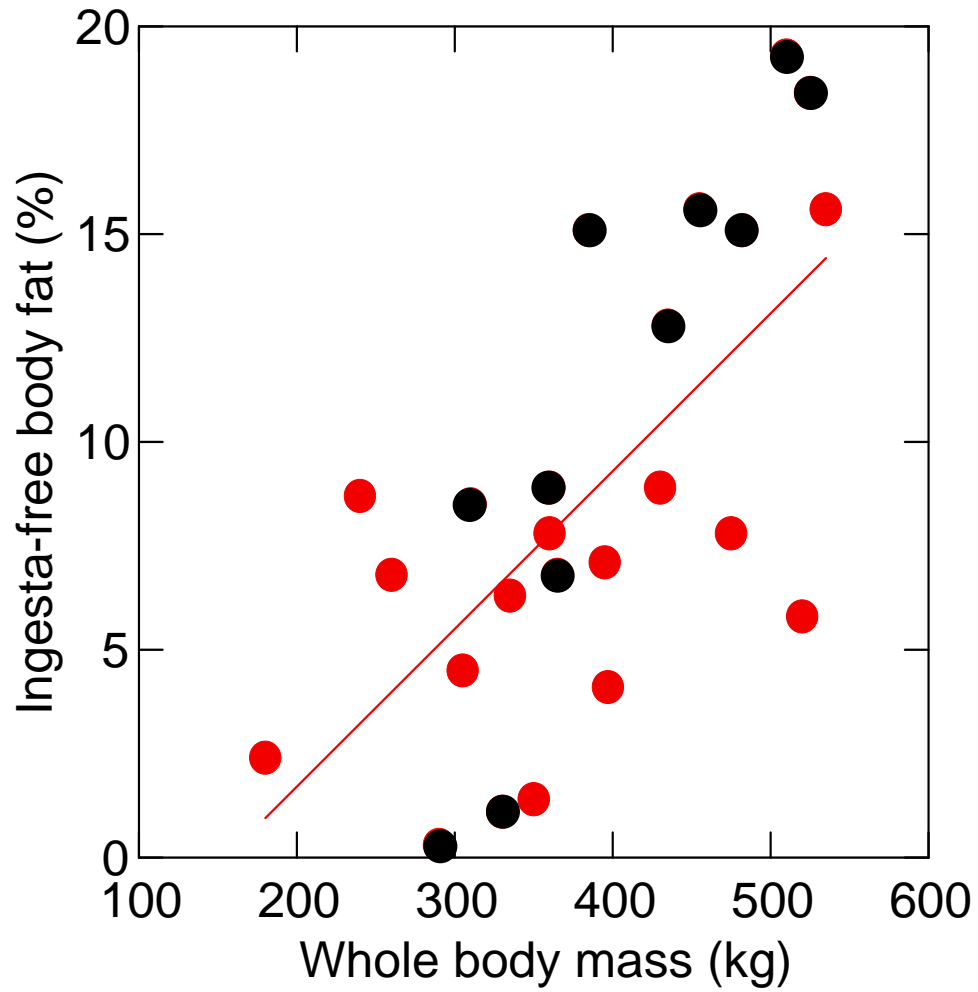


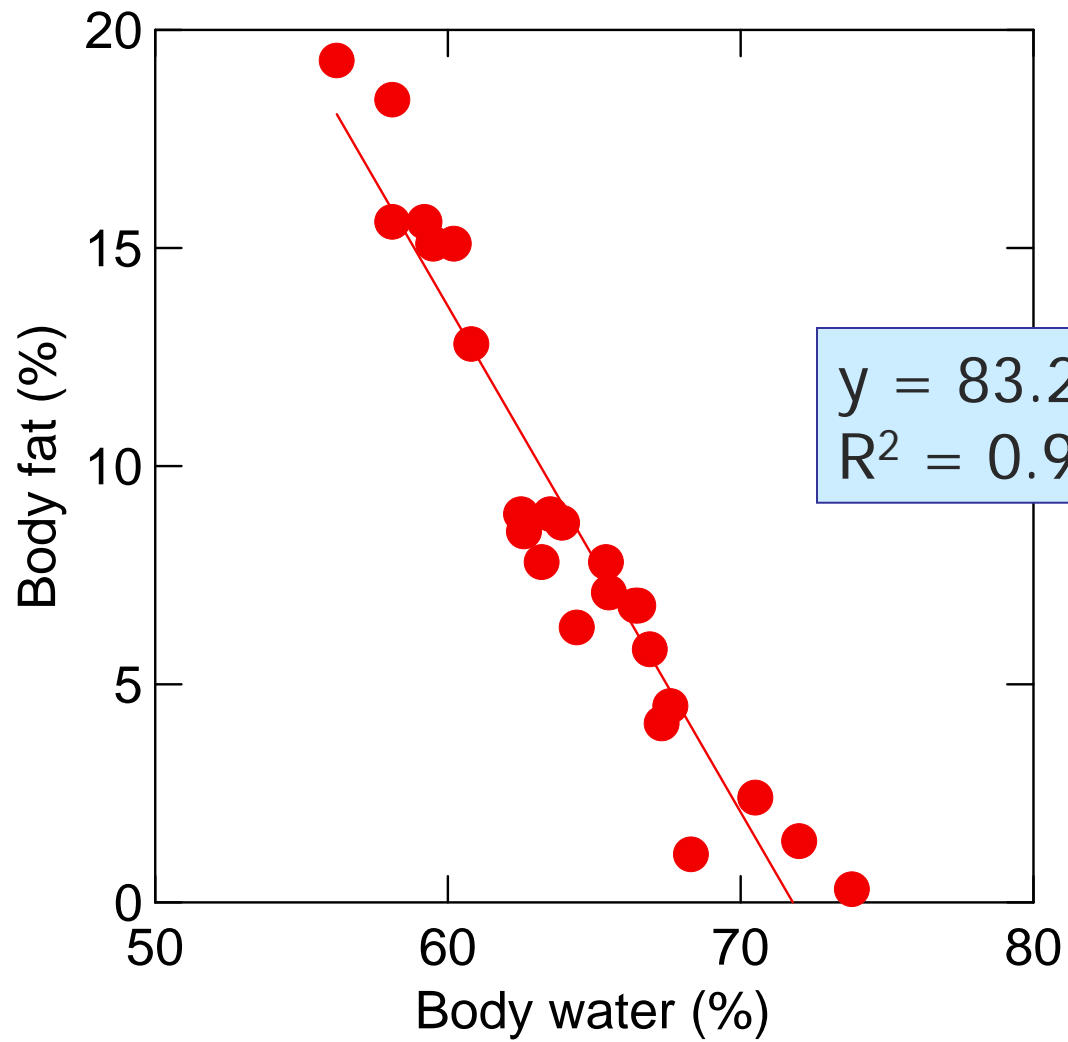


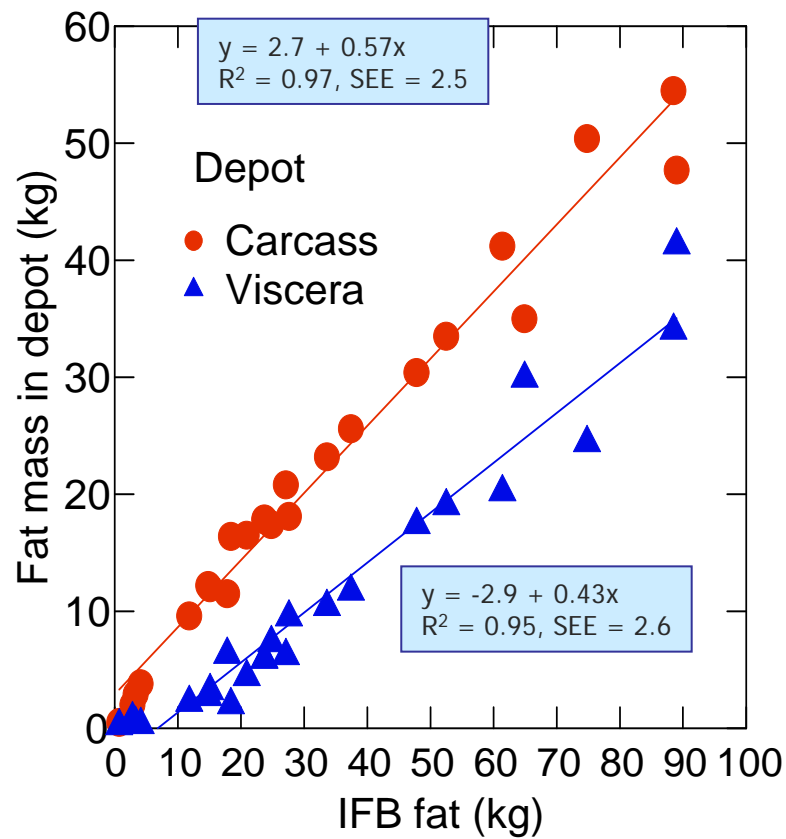
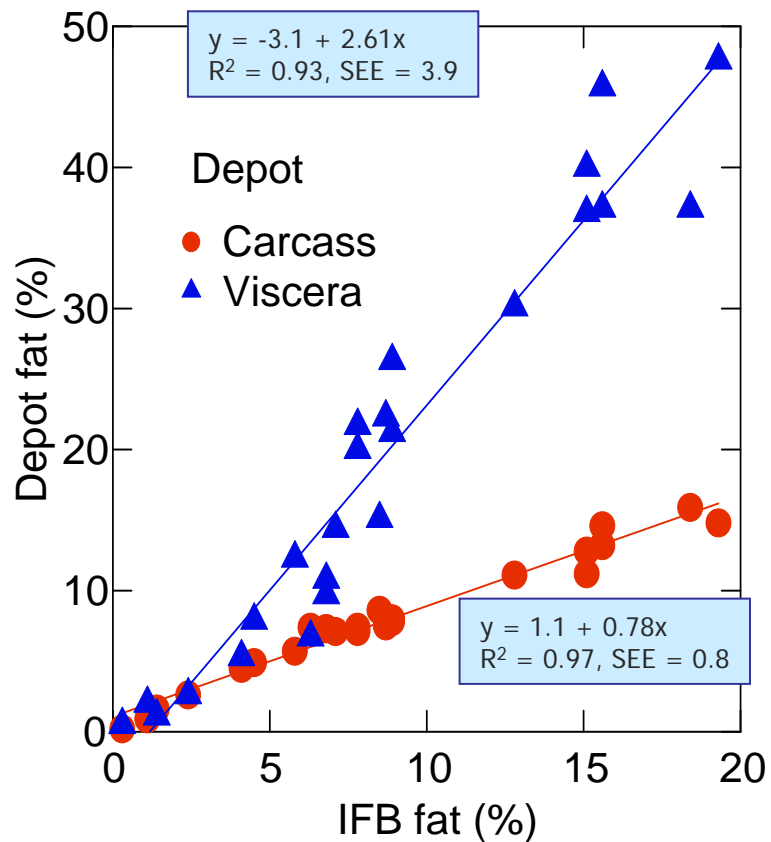
		Mass (kg)	IFB Mass (kg)	Fat %	Protein %	Water %	Ash %
Males (N = 13)	Min	180	139	1.4	19.9	58.1	4.4
	Max	535	478	15.6	23.8	72.0	6.1
	Mean	368	325	6.7	21.5	65.7	5.2
Females (N = 11)	Min	290	241	0.3	19.3	56.2	4.2
	Max	525	482	19.3	22.3	73.8	6.8
	Mean	404	354	11.1	20.8	62.6	5.1

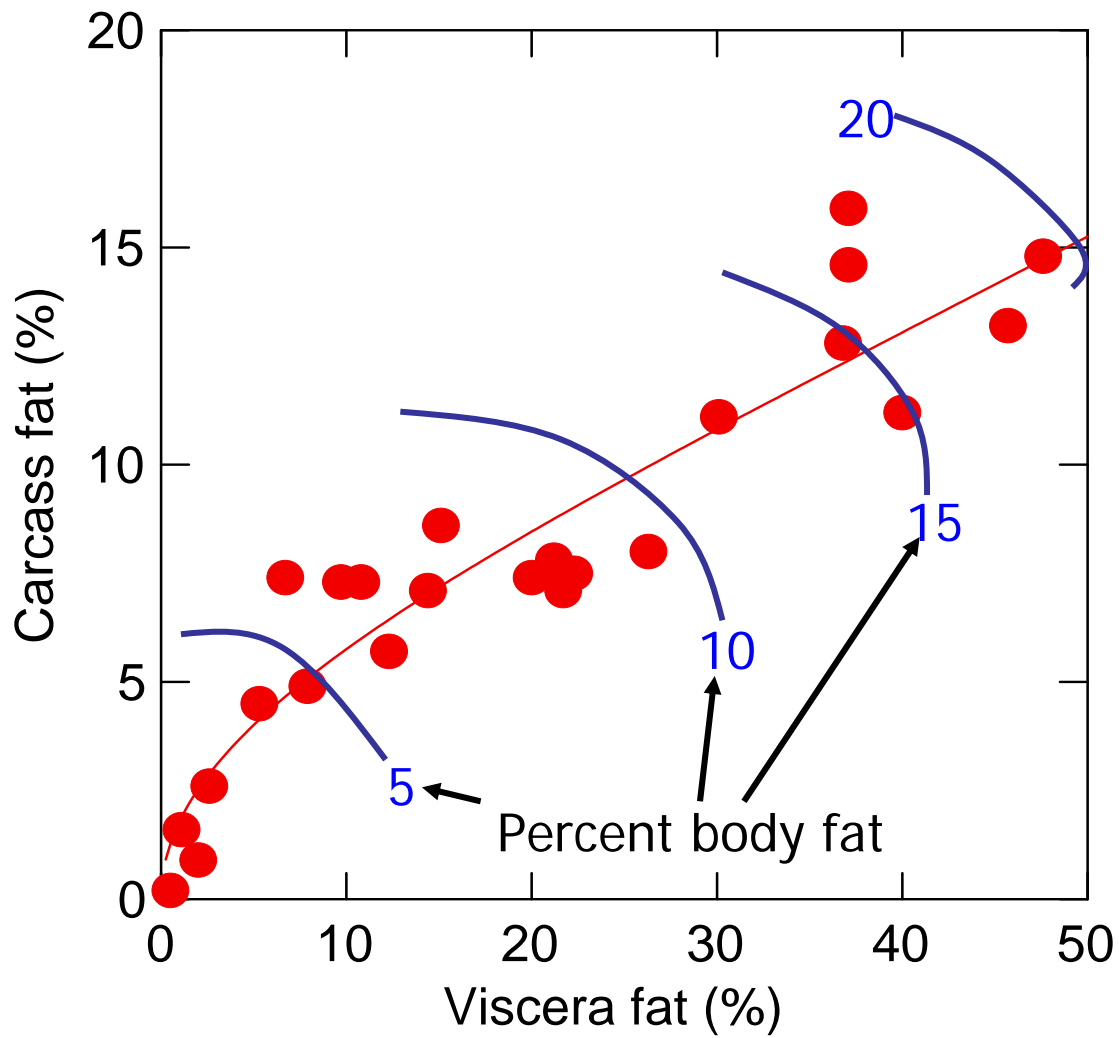








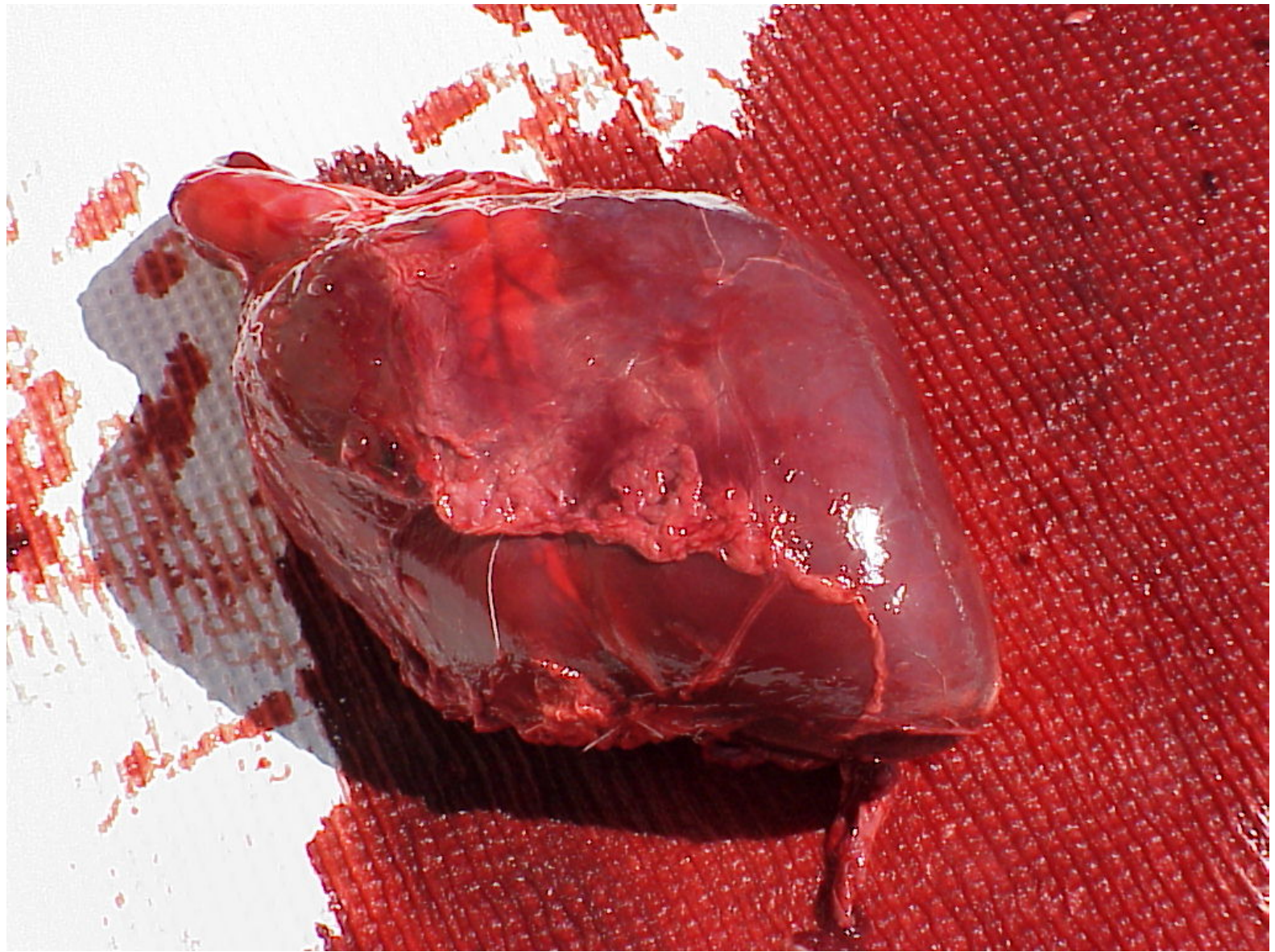




What Riney (1955) Really Said

The order of deposition of fat is fundamental to the use of the amount of fat in various depots as an index of total fat reserved, or to condition. At any given time of change, fat is being laid on or taken off most of the depots at the same time. The order of deposition refers only to the start and finish of the process.”

Riney (1955, NZ J. Sci. Tech.36:429-463) p. 435





Indices of Body Condition

- Ideal characteristics
 - Valid over the entire range of condition
 - Linear relationship, or nearly so
 - Easy to measure, repeatable
- Pericardium:heart ratio
 - Pericardium mass \div heart mass
 - Pericardium is a site of fat storage, easily definable
 - Heart mass does not vary seasonally, unlike kidney

