Digestive physiology of carnivores

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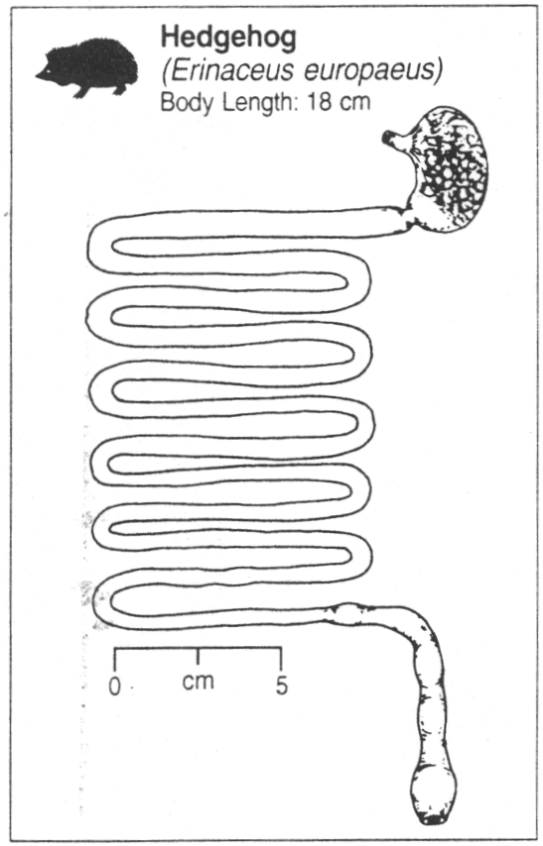
Clinic of Zoo Animals, Exotic Pets and Wildlife

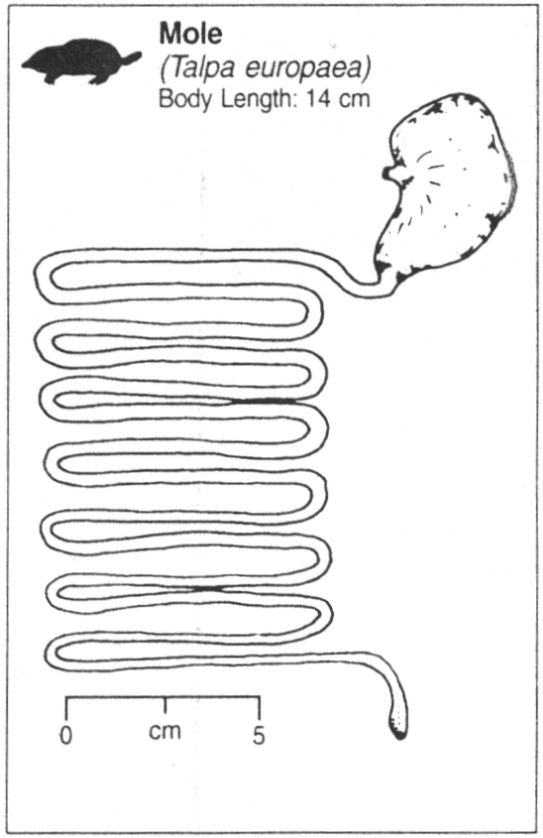
Carnivory ...

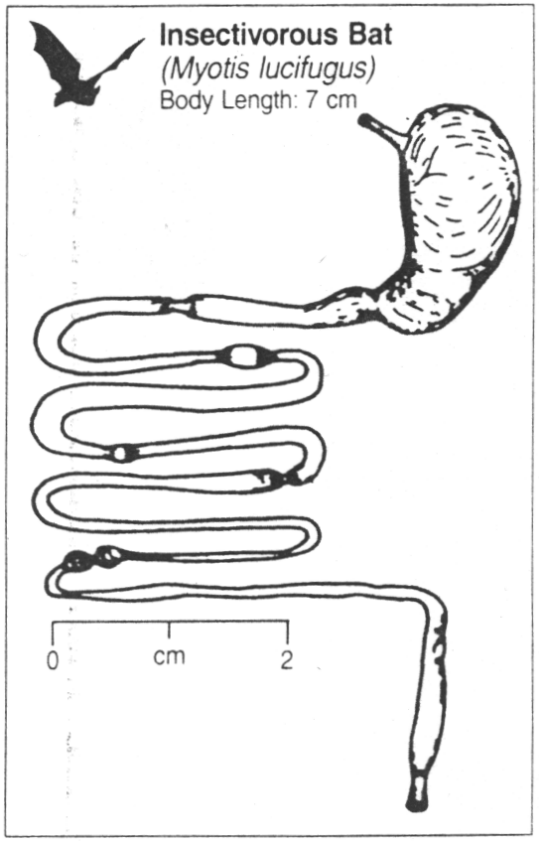
- *... is no physiological challenge*
- *... but a biomechanical and logistical one!*

- ***Digesting prey is easy - catching prey is the hard part!***

Insectivores

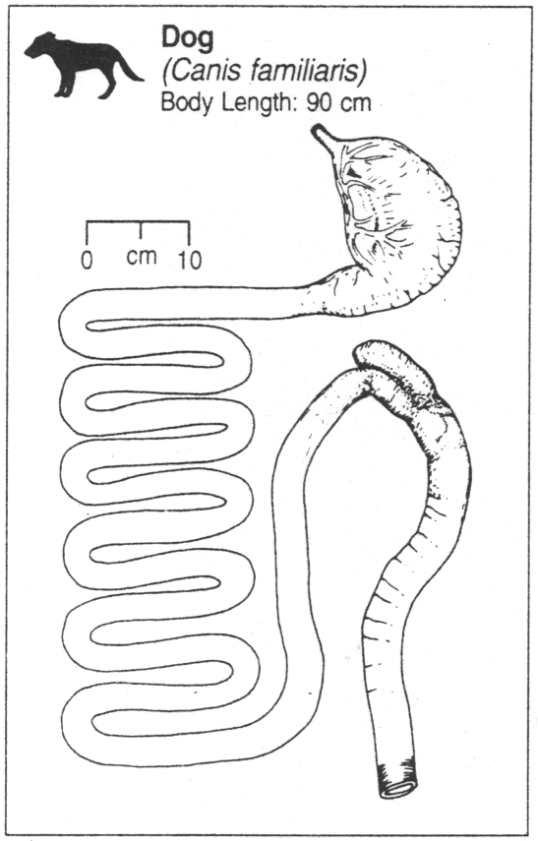


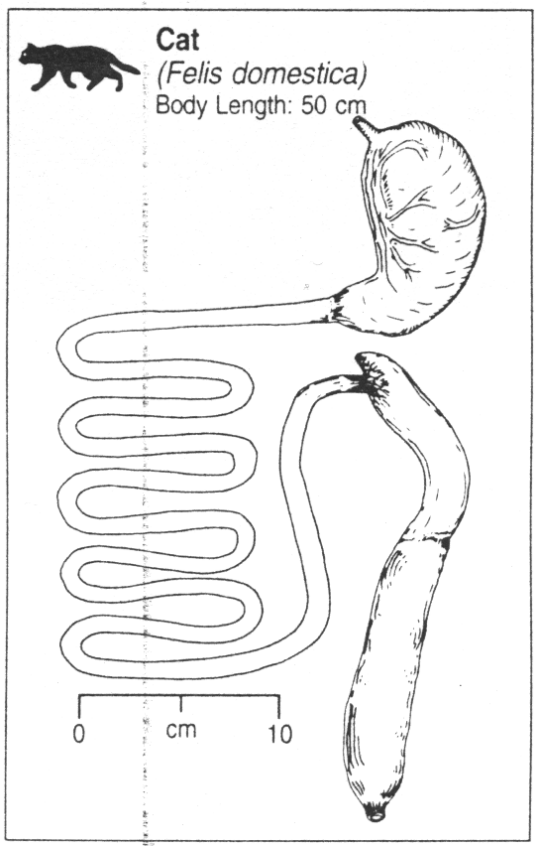


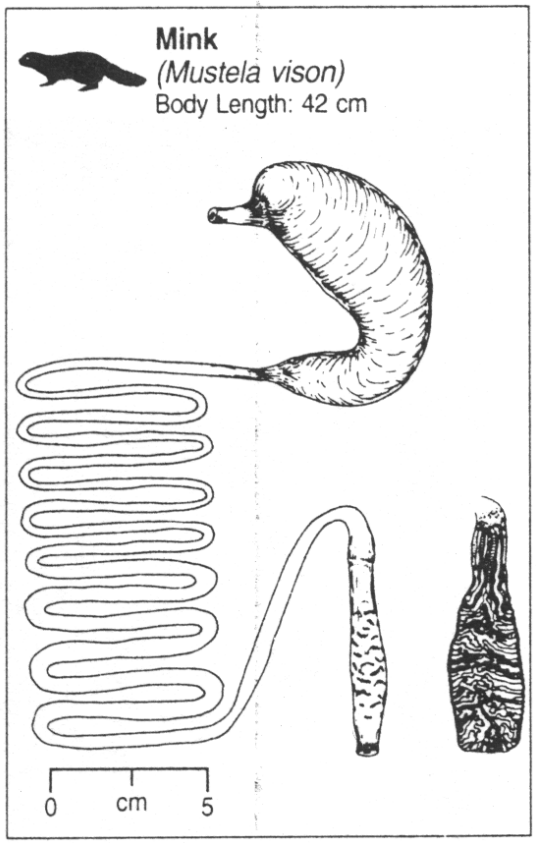


from Stevens und Hume (1995)

Carnivores

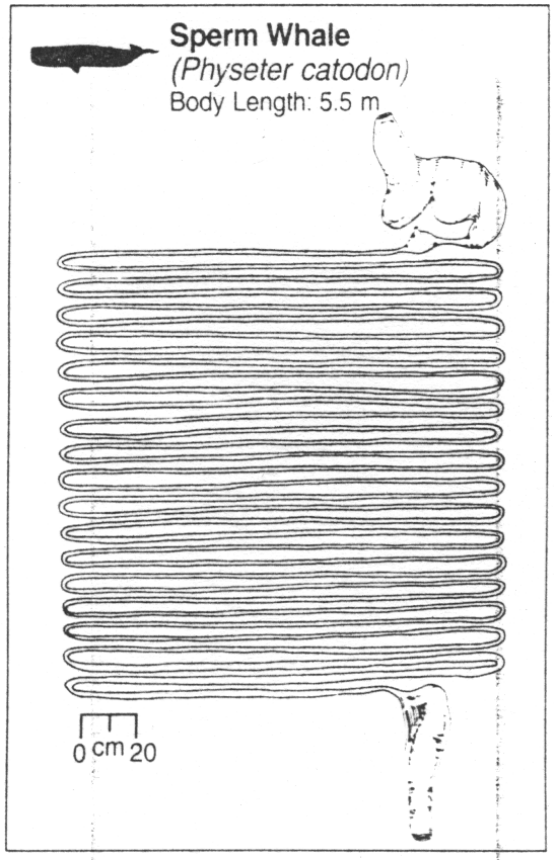


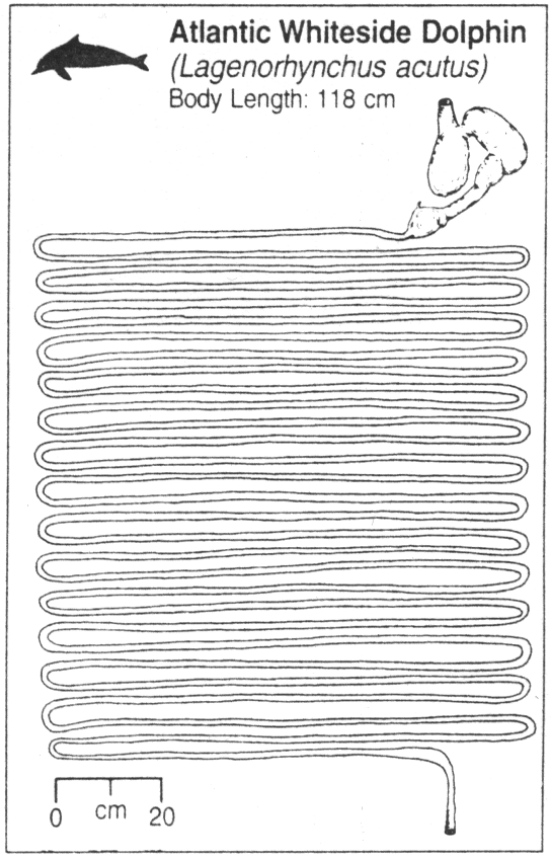


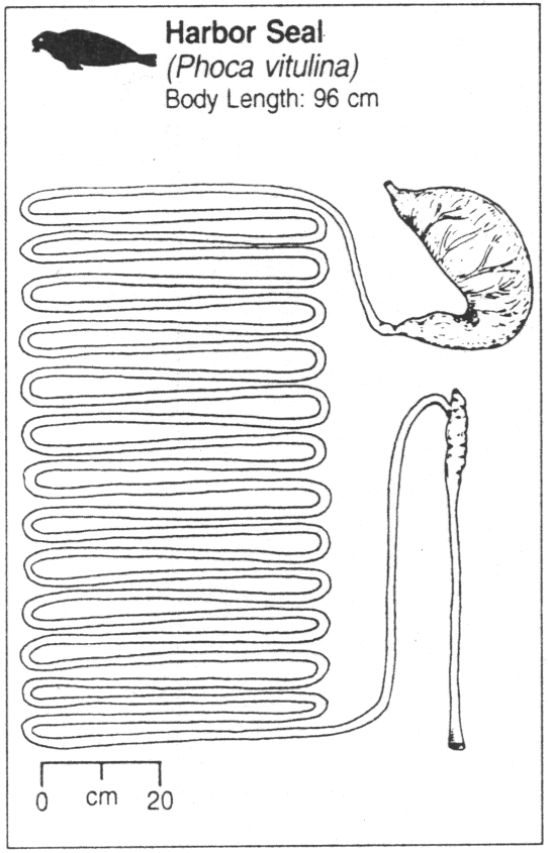


from Stevens und Hume (1995)

Piscivores

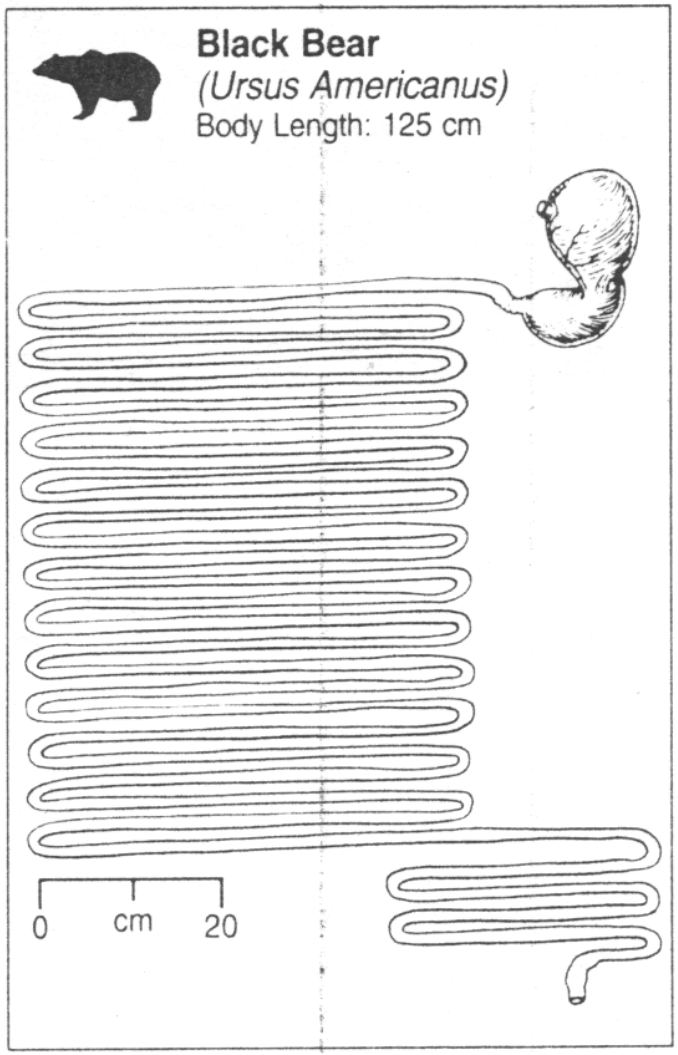




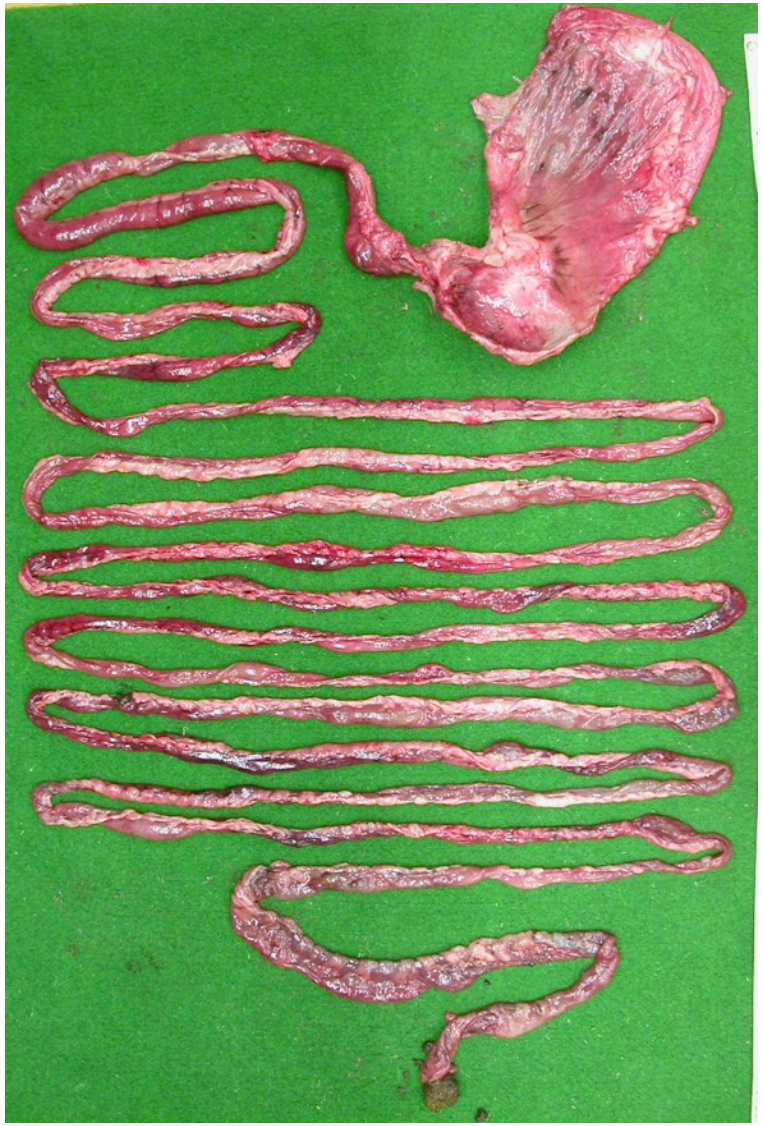


from Stevens und Hume (1995)

Bears



from Stevens und Hume (1995)



Zoo Biology 29 : 687–704 (2010)

RESEARCH ARTICLE

Carnivorous Mammals: Nutrient Digestibility and Energy Evaluation

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Estimating the energy content is the first step in diet formulation, as it determines the amount of food eaten and hence the concentration of nutrients required to meet the animal's requirements. Additionally, being able to estimate the energy content of a diet empirically known to maintain body condition in an animal will facilitate an estimation of maintenance energy requirements. We collated data on nutrient composition of diets fed to captive wild canids, felids, hyenids, mustelids, pinnipeds, and ursids and the digestibility coefficients from the literature (45 species, 74 publications) to test whether differences in protein and fat digestibility could be detected between species groups, and whether approaches suggested for the estimation of dietary metabolizable energy (ME) content in domestic carnivores (NRC [2006] Nutrient requirements of dogs and cats. Washington, DC: National Academy Press.) can be applied to wild carnivores as well. Regressions of digestible protein or fat content vs. the crude protein (CP) or fat content indicated no relevant differences in the digestive physiology between the carnivore groups. For diets based on raw meat, fish, or whole prey, applying the calculation of ME using "Atwater factors" (16.7 kJ/g CP; 16.7 kJ/g nitrogen-free extracts; 37.7 kJ/g crude fat) provided estimates that compared well to experimental results. This study suggests that ME estimation in such diets is feasible without additional digestion trials. For comparative nutrition research, the study implicates that highly digestible diets typically fed in zoos offer little potential to elucidate differences between species or carnivore groups, but research on diets with higher proportions of difficult-to-digest components (fiber, connective tissues) is lacking. Zoo Biol 29:687–704, 2010. © 2010 Wiley-Liss, Inc.

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Comparison of carnivores

Literature research

publications / species

Canids	(15	/	7)
Felids	(15	/	17)
Hyenids	(1	/	2)
Mustelids	(25	/	9)
Pinnipeds	(11	/	8)
Ursids	(10	/	4)
Viverrids	(1	/	2)

control data: domestic cats/dogs

from Clauss et al. (2010)

Material and Methods

Data collection in EXCEL spreadsheet

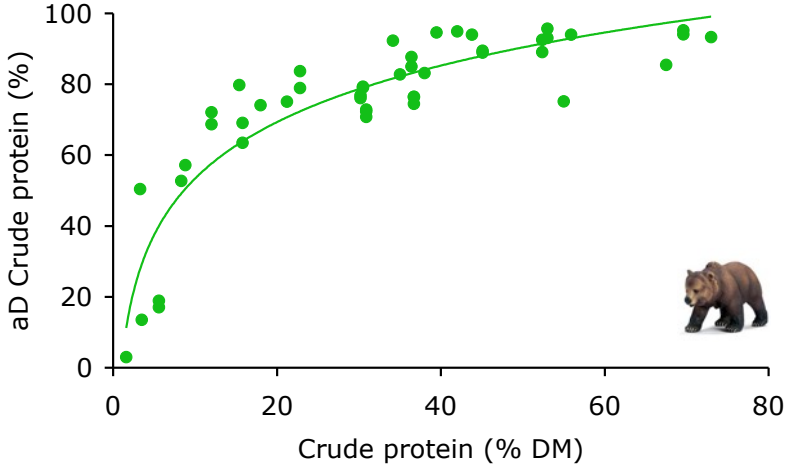
- Species
- Body mass
- Food
- Nutrient composition
  - Crude protein CP
  - Ether extracts EE
  - Crude fibre CF / Total dietary fibre TDF (Prosky)
  - Gross energy GE
  - Nitrogen-free extracts NfE
- ... and the corresponding intake and apparent digestibility (aD) data

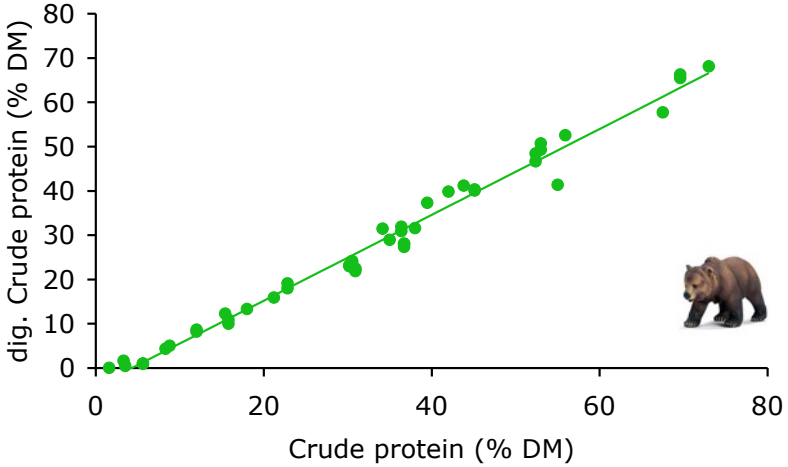
from Clauss et al. (2010)

Material and Methods

Evaluation of physiological differences

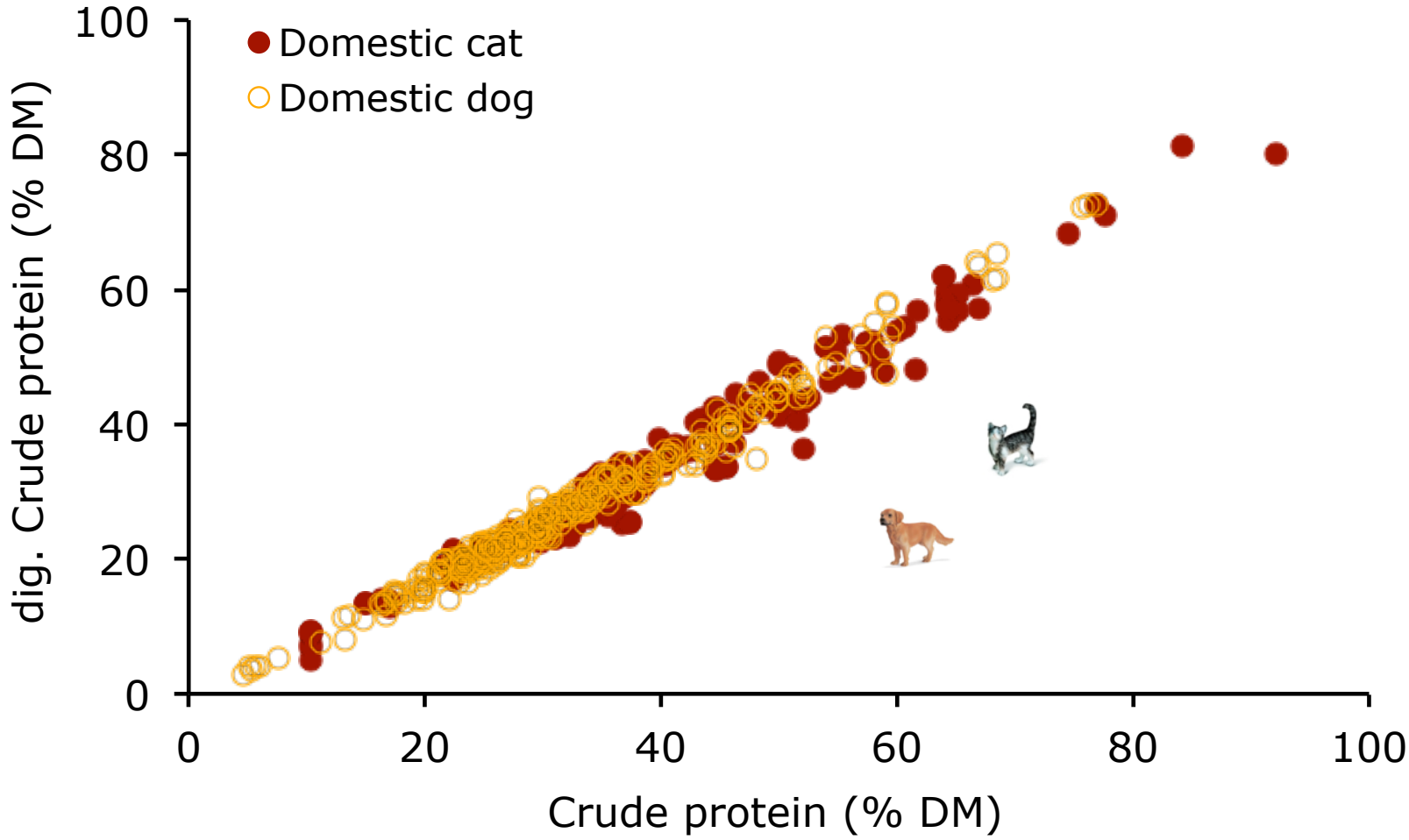
'Lucas-Test' :
plotting of digestible nutrient content vs. nutrient content





from Clauss et al. (2010)

Protein digestion



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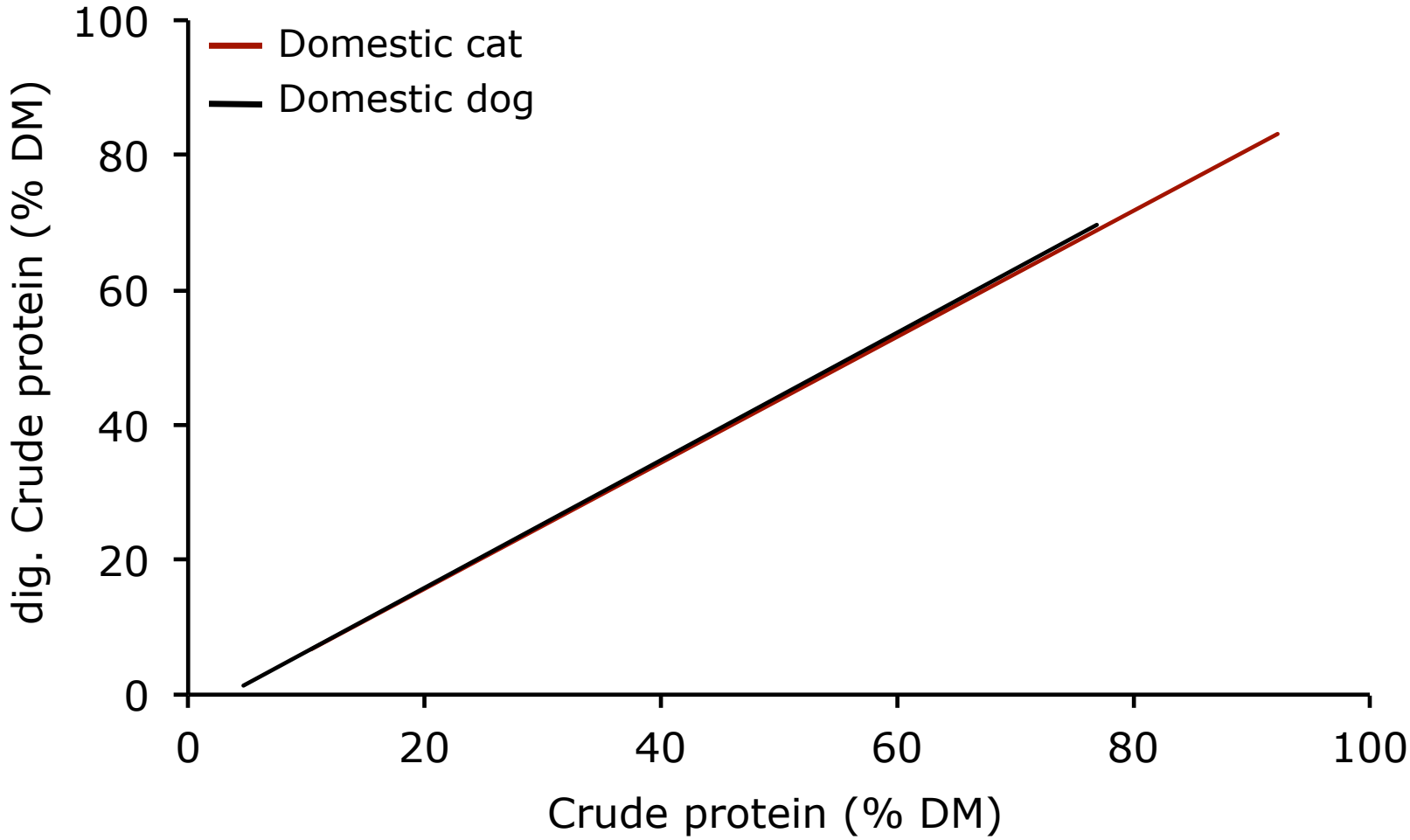
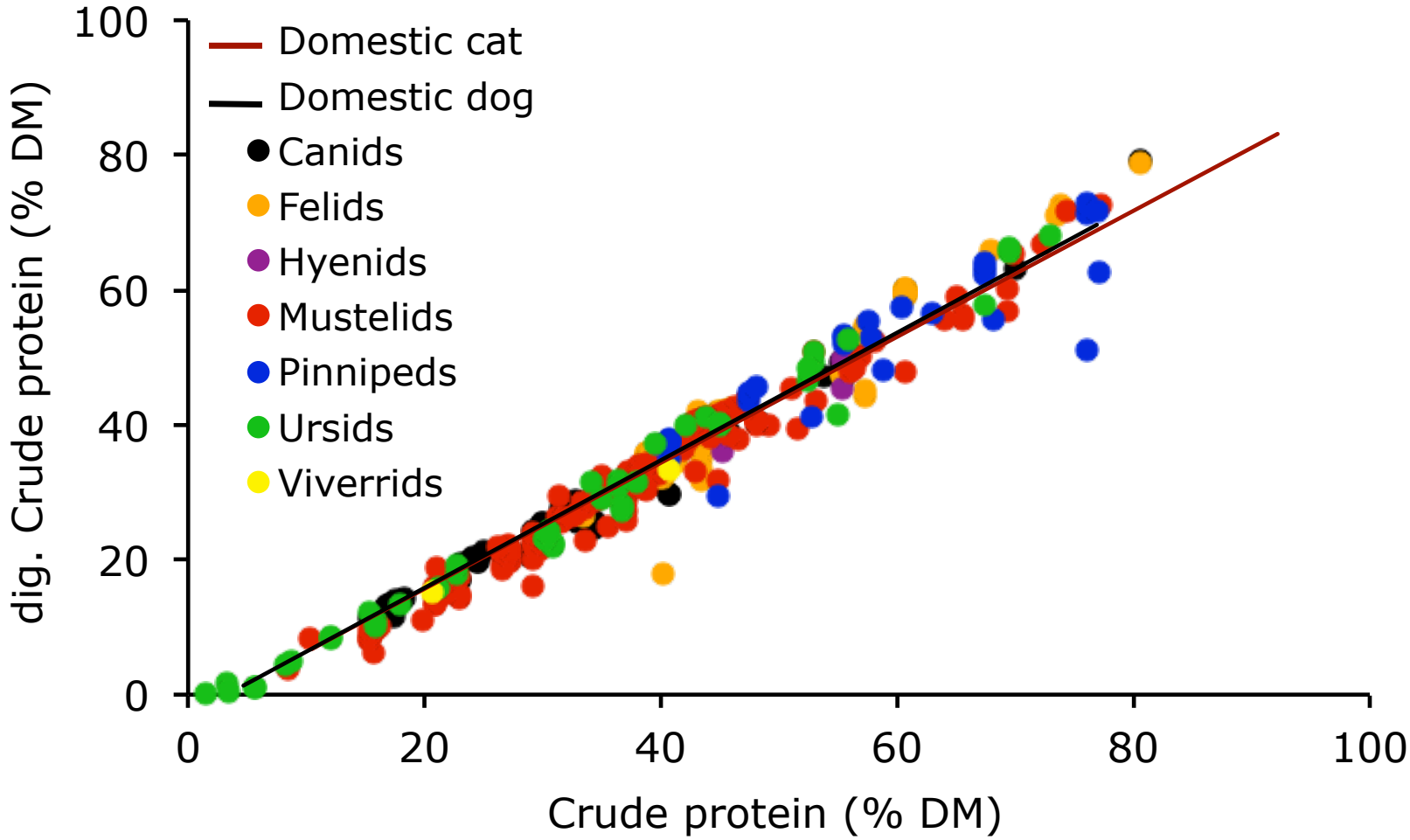
Protein digestion



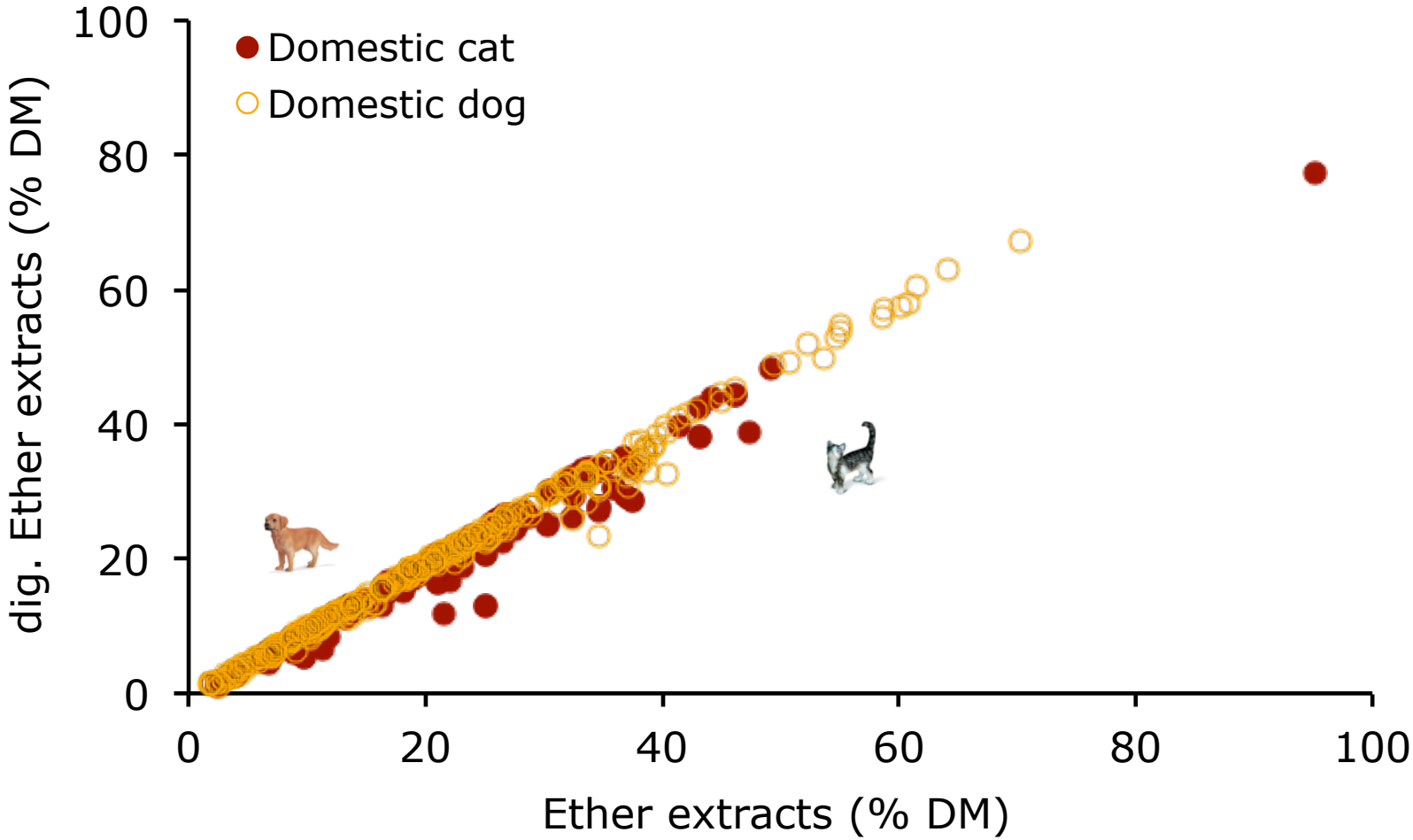
from Clauss et al. (2010)

Protein digestion



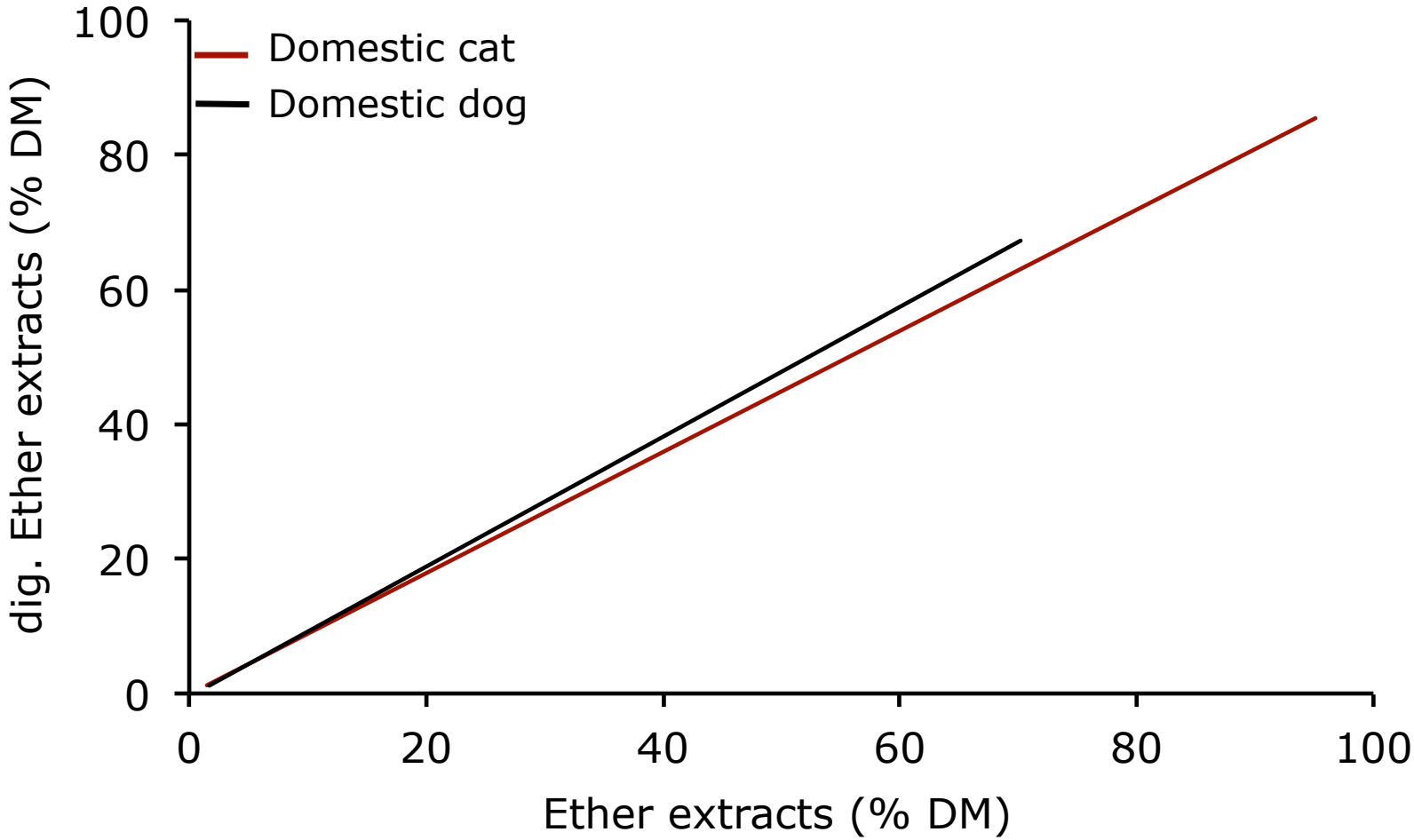
from Clauss et al. (2010)

Fat digestion



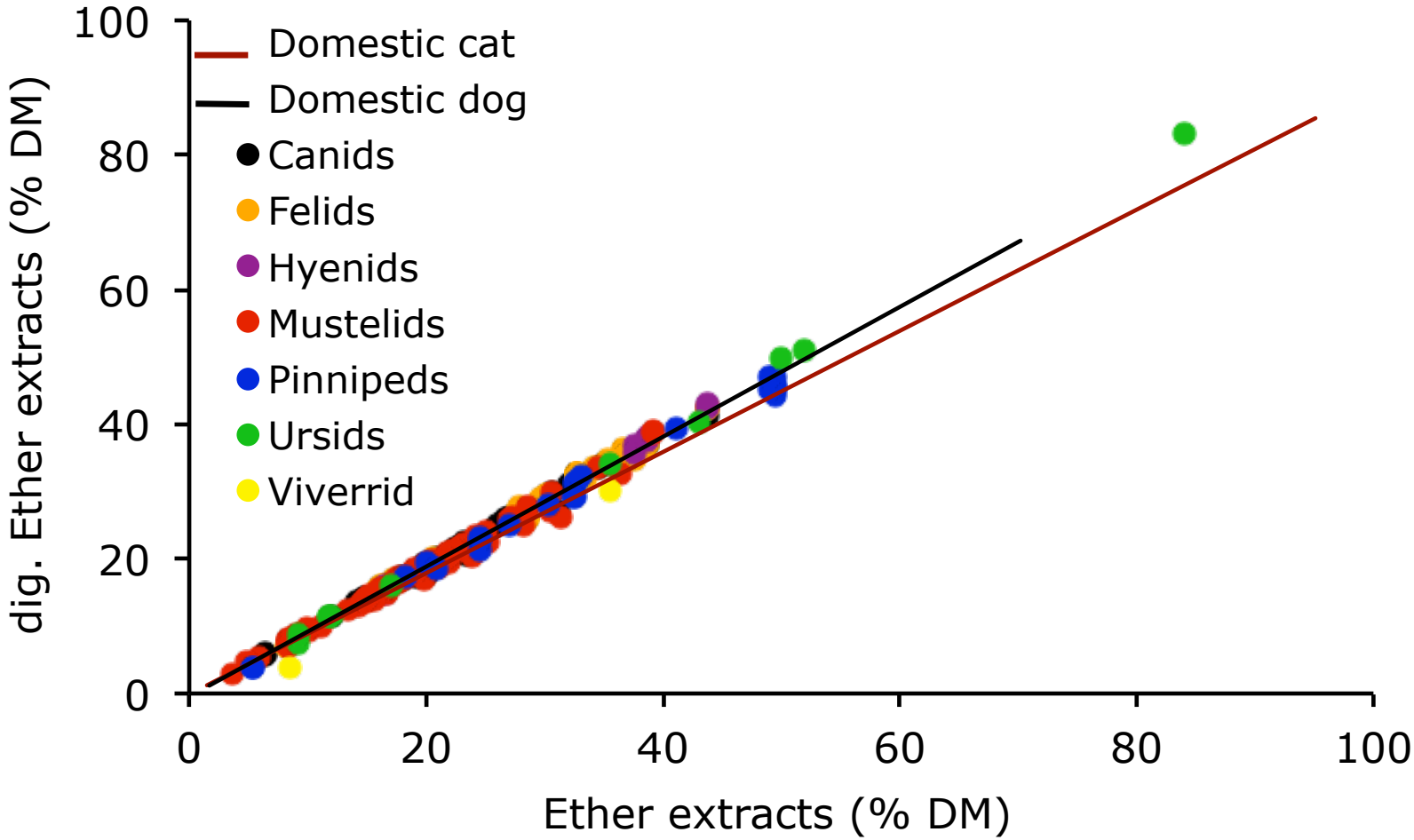
from Clauss et al. (2010)

Fat digestion



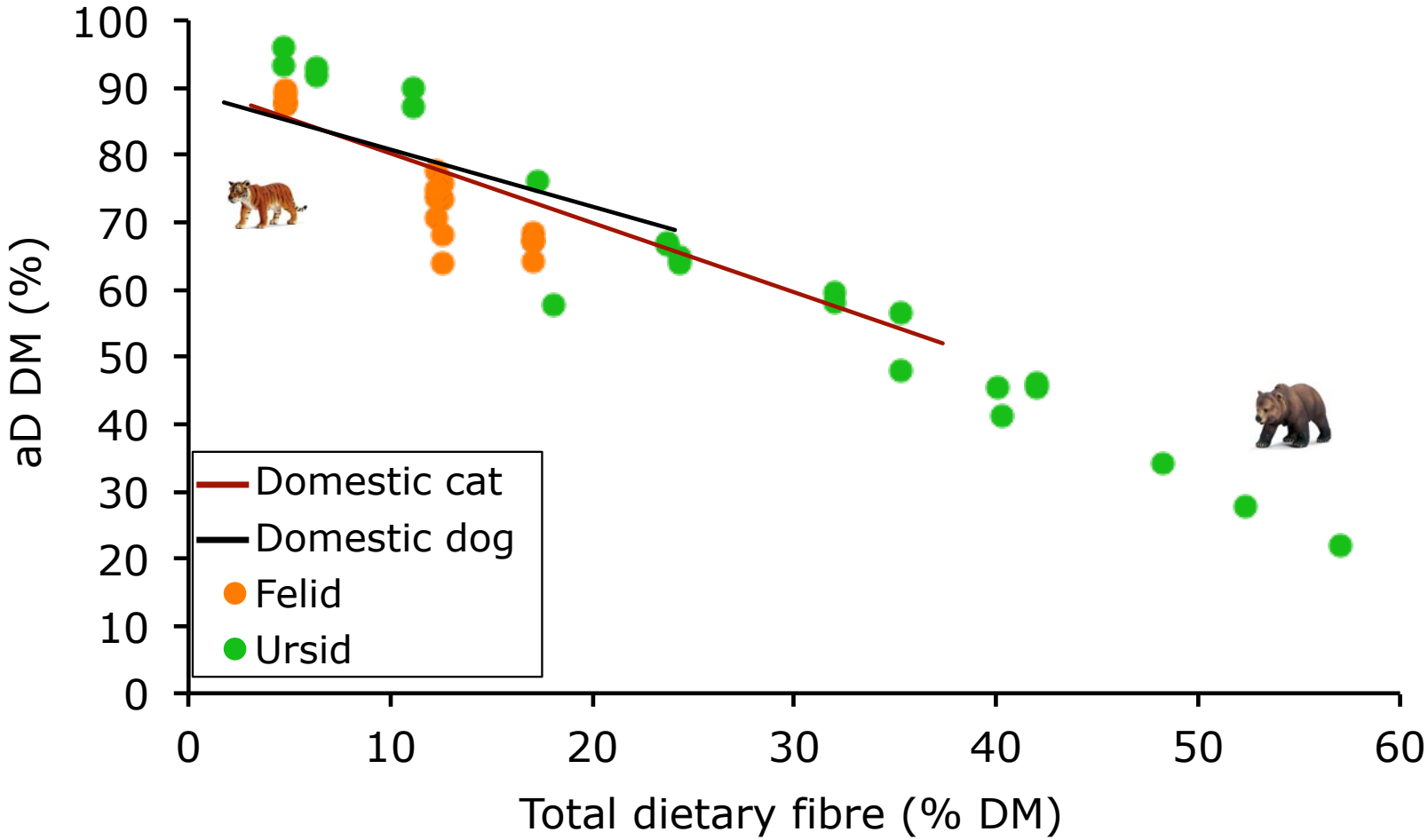
from Clauss et al. (2010)

Fat digestion



from Clauss et al. (2010)

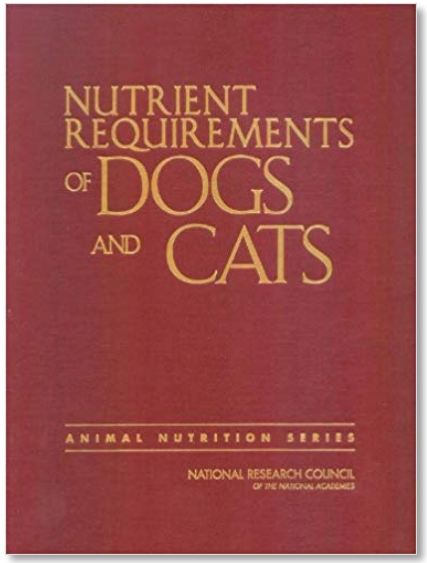
Effect of fibre on digestion



from Clauss et al. (2010)

Conclusion

- Carnivores do not differ much in terms of 'digestive physiology'
- You can use dog/cat equations to estimate digestibility and energy content in wild carnivores



… and more data

Digestive physiology of captive giant anteaters (*Myrmecophaga tridactyla*): determinants of faecal dry matter content

J. M. Gull[1], M. Stahl[1,2], C. Osmann[2], S. Ortmann[3], M. Kreuzer[4], J.-M. Hatt[1] and M. Clauss[1]

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