# COMPARATIVE GASTROENTEROLOGY/NUTRITION

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As zoo nutritionists and comparative gastroenterologists, we have embarked upon a field of immense diversity, major uncertainties, and prominent controversy. Yet, our task can be made easier with some basic understandings and with some redirection of these understandings.

While comparative gastroenterology is the study of the varied digestive systems of animals and their numerous different structural systems, the gastroenterologist typically divides the digestive system into three main segments: the foregut which includes the mouth, esophagus and stomach; the midgut which includes only the small intestine and the hindgut which includes the cecum, colon and rectum. Comparative gastroenterology becomes quite simple once the gastrointestinal tract is divided as such. For example, if an animal eats fast it has a big stomach and if it eats slow it has a small stomach. If the animal consumes plant material rapidly it has a complex stomach and if it consumes flesh it has a simple stomach. The foregut of an animal functions simply as a retaining vat for ingested material. It represents the animals feeding behavior and not its nutritional needs.

It is the small intestine that performs 80 to 90% of the digestion and assimilation of nutrients whether that animal is herbivorous, omnivorous, or carnivorous. The small intestine is the most important of all digestive parts and is remarkably similar across all species. Furthermore, the small bowel and its related organs, the liver and pancreas, are remarkably adaptive. In feeding a herbivorous animal flesh, the system adapts to digesting and assimilating flesh. In feeding a carnivorous animal plants, the system adapts to assimilating plants.

It' 80 to 90% of the digestive process of the animal has occurred within the small intestine, and before the digesta reach the large bowel, the cecum and colon like the forgut is of limited digestive and nutritional importance. The large bowel serves primarily as a refining unit for the digestive process. If the small intestine has accomplished 90% of the digestive process, the large bowel needs to do very little. And if the small intestine has accomplished only 80% of the digestive process, the large bowel may need to do a hit more. However, if we are not trying to fatten the animal, as in the zoo environment, 80 to 90% nutrient assimilation is most certainly adequate.

Recognizing that the small intestine accomplishes the vast majority of the digestive process and that it is very adaptive to either the herbivorous, omnivorous, or carnivorous diet, it becomes apparent that nutrition is equally and easily comparable across varied species.

Nutrients of prominent concern are in order of importance; water, energy, protein, fats, and vitamins and minerals. The average zoo nutritionist pays little attention to water. If the water is accessible, free choice and clean, typically the animal will manage its own fluid needs. Energy nutrition is generally the manipulation of available or resistant sources. Since energy is derived via several sources such as plants, grains, fruits and flesh, it is most often provided in more than one source in the diet. Protein is quite often fed in excess of the animals needs and is the nutrient most frequently influenced by tradition and belief, more so than nutrition. Vitamins and minerals are the principle source of stimuli for the nutritionist. Because they are offered in small quantities, a small alteration in their amounts can create measurable differences. Remembering that water, energy, protein, fats, vitamins and minerals are assimilated into the body via the small intestine, and that the small intestine functions quite similarly in all species, comparative nutrition is not difficult.

What has been overlooked in the efforts of both the gastroenterologist and zoo nutritionist is the prehensile mechanics of the animal. It is the prehensile mechanics that define how the animal eats whether it be rapidly or slowly and what the animal eats such as plants, fruits or flesh. Understanding the prehensile mechanics of the varied species will enable the nutritionist to accomplish much in their efforts to control the diets of varied species.