Functional foods aren't just growing in popularity with health-conscious people. Prebiotics may also prove to be beneficial to our pets, according to **Bob Rastall**.

Prebiotics for pets

Functional foods to improve human health are increasing in popularity with more and more products in the supermarkets. The science behind their development is also accumulating rapidly. One of the most important areas of application of functional foods in humans is gut health. Gut disorders are a very common cause of visits to the GP. The success of such products for human nutrition has inevitably led to them being considered for application in companion animals, most commonly in dogs, but with some developing interest in cats and fish.

Probiotics vs prebiotics

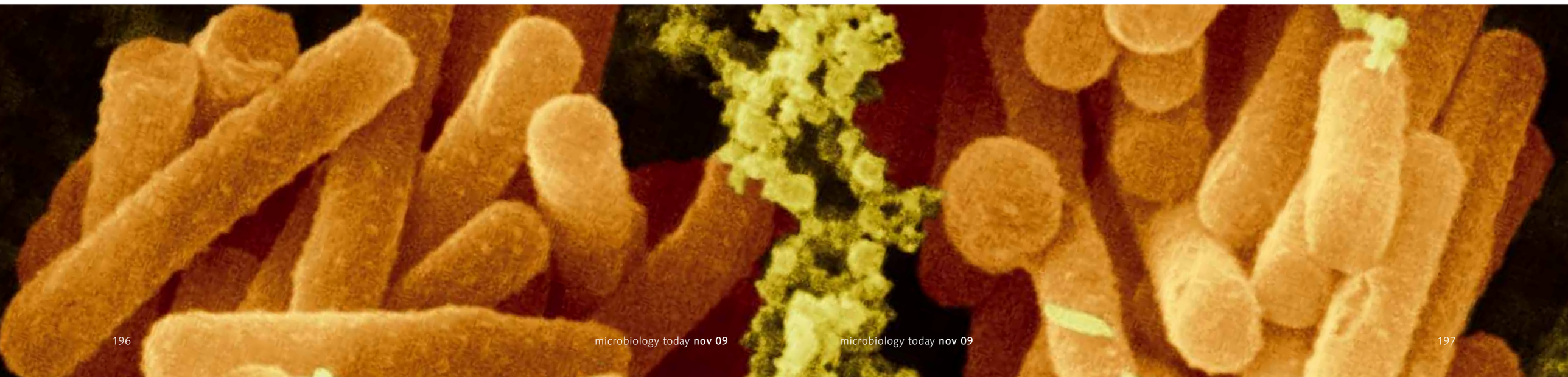
Traditionally, human functional foods for gut health have been based on the probiotic concept. Probiotics are live bacterial supplements or food ingredients which, when taken in sufficient numbers, confer health benefits to the host. There are very many well-designed studies showing positive effects with probiotics, although some have not shown an effect. Probiotics have also been applied to pets, and bacterial species from the lactobacilli, bifidobacteria and enterococci are finding their way into pet foods. One big disadvantage with probiotics, however, is the need to keep the organisms viable in order to produce the full range of potential benefits. This is overcome in the human food industry by the use of chilled, usually dairy, products as delivery vehicles, an approach that is not very practical for pet food.

Prebiotics are an alternative to the use of probiotics which is gaining currency at the moment. The concept of prebiotics was originally described in 1995, and they have recently been redefined by the International Scientific Association of Probiotics and Prebiotics as follows: '*A dietary prebiotic is a selectively fermented ingredient that results in specific changes, in the composition and/or activity of the gastrointestinal microbiota, thus conferring benefit(s) upon host health*'. The stress on the words dietary and gastrointestinal is to facilitate the use of the term, with a suitably modified wording for extra-intestinal application. To date, all known prebiotics are carbohydrates. They have the great advantage of being resistant to processing in cooked food products – a particular advantage to the pet food industry. The most common prebiotics are the inulin, derived from chicory, and fructo-oligosaccharides (FOS), derived from inulin by hydrolysis or from sucrose by synthesis. Galacto-oligosaccharides (GOS) made from lactose are also prebiotic and mainly used in formula infant foods.

The most important attribute of a prebiotic is that it is selectively fermented by certain members of the gastrointestinal microbiota which are regarded as having health-positive attributes. Most attention so far has been on increasing the population levels of bifidobacteria and lactobacilli, and on increasing the levels of short-chain fatty acids at the expense of phenolic toxins and genotoxic compounds and enzymes which may predispose towards development of gastrointestinal cancers. Inhibition of exogenous pathogens is a frequent target *in vitro*, but this is very difficult to demonstrate in humans or animals.

▶ *Where's my prebiotic snack? … Photos.com / Jupiter Images*

▼ *Lactobacillus bulgaricus* in yoghurt. *Scimat / Science Photo Library*



▲ Dry cat food. *Stockxpert / Jupiter Images*

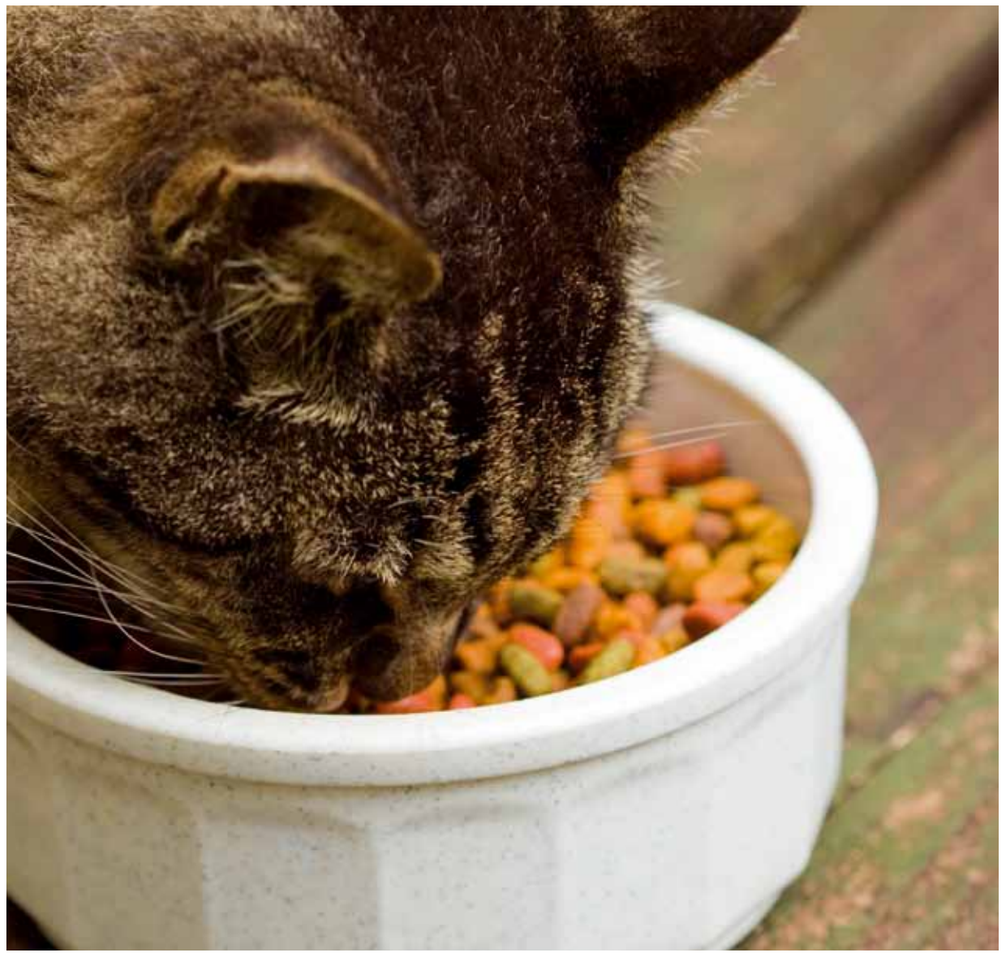
▼ *... I've got it! Stockxpert / Jupiter Images*

Cats and dogs

Although giving prebiotics to companion animals such as dogs and cats is being proposed, there is some concern over the basis for applying the concept in non-human species. The problem is that we actually know very little of the functional ecology of the gut microbiota in companion animals. Are bifidobacteria and lactobacilli health-positive in the context of dogs and cats?

Most studies on the gut microbiota of such species have been carried out using traditional culture-based methods with selective media which are known to be inadequate for enumeration of bacteria from such complex ecosystems. Molecular microbiological methods are giving us a much more reliable picture of the gut microbiota of dogs and cats. Results of studies using techniques such as denaturing gradient gel electrophoresis (DGGE) and clone libraries have shown that the major taxonomic groups in the gut microbiota of canines are *Clostridiales*, *Fusobacteriales*, *Bacteroidales*, *Enterobacteriales* and *Lactobacillales*. In cats the major groups are *Clostridiales*, *Lactobacillales*, *Bacteroidales*, *Campylobacterales*, *Actinomycetales* and *Fusobacteriales*.

Whilst lactobacilli have been found in the guts of these companion animals, their function is unknown. There is a much bigger question over the status of bifidobacteria. These bacteria have been only inconsistently isolated from culture-based studies and inconsistently identified in molecular microbiological studies of canines. This suggests that, if they are indeed a normal member of the gut microbiota, they are present at or below the detection limits of the methods used.



The picture is even more inconsistent in felines. Many studies have failed to show bifidobacteria, but some have shown very high levels. Clearly, much more research is required to clarify the status of bifidobacteria in dogs and cats. These microbiota studies raise the question of what the target for prebiotic intervention should be in dogs and cats.

Studies on prebiotics in pets

Currently, most research and development utilizes prebiotics developed around the properties of the human colonic microbiota. The most widely studied prebiotic in pets is FOS. Many studies have shown that feeding FOS results in changes in the microbiota of dogs. The range of carbohydrates that are currently marketed as prebiotics for animal application includes some that are not considered to be prebiotics in humans. For example, manno-oligosaccharides (MOS), derived from yeast cell walls, are poorly supported as prebiotics by experimental data.

Many experiments on prebiotics in pets have looked at functional outcomes in terms of animal health and nutrition, such as immune function markers, nutrient digestibility, faecal and urinary nitrogen excretion, faecal short-chain fatty acid concentration (mainly acetate, propionate and butyrate) and elimination of pathogens. It has not been firmly established, however, that these effects are a result of prebiotic-induced modification of the gut microbiota, as in many cases these modifications were not characterized. However, the available data do support the effectiveness of FOS as a prebiotic in dogs with respect to outcomes of pathogen removal and immune status.

The few studies that have been carried out in cats have shown that FOS results in increases in bifidobacteria and lactobacilli with a decrease in clostridia, *Escherichia coli* and staphylococci. Faecal levels of putrefactive metabolites, such as phenol, indole and ammonia, decrease and short-chain fatty acids increase after prebiotic feeding. Studies have been rather small, involving few animals, and the health consequences of increasing saccharolytic bifidobacteria in a carnivorous animal is still open to question.

Whilst it is apparent that pet owners will pay for functional pet foods aimed at improving the gut health of their animals, there is a need for much more research on the health consequences and, perhaps, a rethink of what we mean by a prebiotic in companion animals.

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Further reading

Barry, K.A., Vester, B.M. & Fahey, G.C. (2009). Prebiotics in companion and livestock animal nutrition, In *Prebiotics and Probiotics Science and Technology*. Edited by D. Charalampopoulos & R.A. Rastall. Springer.