

## CHANGING THE ANIMAL WORLD WITH NIR : SMALL STEPS OR GIANT LEAPS?

Peter C. Flinn

*Agriculture Victoria, Pastoral and Veterinary Institute, Private Bag 105, Hamilton, Victoria 3300, Australia*

The concept of "precision agriculture" or "site-specific farming" is usually confined to the fields of soil science, crop science and agronomy. However, because plants grow in soil, animals eat plants, and humans eat animal products, it could be argued (perhaps with some poetic licence) that the fields of feed quality, animal nutrition and animal production should also be considered in this context. NIR spectroscopy has proved over the last 20 years that it can provide a firm foundation for quality measurement across all of these fields, and with the continuing developments in instrumentation, computer capacity and software, is now a major cog in the wheel of precision agriculture.

There have been a few giant leaps and a lot of small steps in the impact of NIR on the animal world. These have not been confined to the amazing advances in hardware and software, although would not have occurred without them. Rapid testing of forages, grains and mixed feeds by NIR for nutritional value to livestock is now commonplace in commercial laboratories world-wide. This would never have been possible without the pioneering work done by the USDA NIR Forage Research Network in the 1980's, following the landmark paper of Norris *et al.* in 1976. The advent of calibration transfer between instruments, algorithms which utilise huge databases for calibration and prediction, and the ability to directly scan whole grains and fresh forages can also be considered as major steps, if not leaps. More adventurous NIR applications have emerged in animal nutrition, with emphasis on estimating the functional properties of feeds, such as *in vivo* digestibility, voluntary intake, protein degradability and *in vitro* assays to simulate starch digestion. The potential to monitor the diets of grazing animals by using faecal NIR spectra is also now being realised. NIR measurements on animal carcasses and even live animals have also been attempted, with varying degrees of success. The use of discriminant analysis in these fields is proving a useful tool.

The latest giant leap is likely to be the advent of relatively low-cost, portable and ultra-fast diode array NIR instruments, which can be used "on-site" and also be fitted to forage or grain harvesters. The fodder and livestock industries are no longer satisfied with what we once thought was revolutionary: a 2-3 day laboratory turnaround for feed quality testing. This means that the instrument needs to be taken to the samples rather than vice versa. Considerable research is underway in this area, but the challenge of calibration transfer and maintenance of instrument networks of this type remains.

The animal world is currently facing its biggest challenges ever; animal welfare, alleged effects of animal products on human health, environmental and economic issues are difficult enough, but the current calamities of BSE and foot and mouth disease are "the last straw". NIR will not of course solve all these problems, but is already proving useful in some of these areas and will continue to do so.