Background
Animal and horticultural products provide a range of essential nutrients and also contain health active compounds. The concentrations of some of these compounds in animal and plant products can be manipulated (either increased or reduced) through genetics, fertiliser regime or by nutritional management. Consumers in some markets prefer ‘natural’ as opposed to fortified products offering on-farm rather than post-farm gate opportunities. Successful on-farm manipulation of the concentrations of physiologically functional compounds to improve the food supply requires systems that produce consistent concentrations in animal and plant products. Opportunities to increase the concentrations of protein-bound organic selenium (Se) and zinc (Zn) provide examples of on-farm practices to improve food supply.

Selenium
In Australia, there are Se-deficient soils along the coasts of mainland and the interior of Tasmania. Due to these relatively low concentrations of Se, many primary products sourced from these areas can contain relatively low Se concentrations. Fortunately, Se deficiency has largely been eliminated through intervention programs such as Se supplementation to farm animals. The major food source of Se for humans in Australia such as bread, cereals and meat products exhibit a wide range in Se contents largely because of differences in soil Se and fertiliser or feed supplementation practices. However, regional differences have been reduced through consolidation of primary products from across Australia and the globe. While it is generally accepted that Se intakes of Australian and New Zealand consumers are sufficient to ensure no overt signs of deficiency, there is a feeling that the relatively low intakes may contribute to elevated risk for some cancers (eg. bowel and prostate). However, Se supplementation is problematic, since high Se intakes can be toxic, particularly if the source is inorganic. Protein-bound Se is more bioactive and less toxic than inorganic forms of Se and there is interest in delivering Se in organic forms in food products we consume. Products where the Se contents have been successfully increased include cereal grains, dairy products, milk and horticultural products such as broccoli and mushrooms. Some of these products have also been evaluated in animal models of cancers or oxidative stress and occasionally in human studies.

The concentration of Se in horticultural products such as broccoli and mushrooms as well as in yeast has been increased through the provision of fertilisers or growth media that have been supplemented with inorganic Se. Selenium can substitute for sulphur in methionine and cysteine and these newly synthesised amino acids can be incorporated into proteins by the plant or fungi. Or, the plant or fungi can assimilate the inorganic Se into their own amino acids and proteins. On the other hand, inorganic Se is poorly incorporated into mammalian proteins and so protein or amino acid bound Se, such as Se-methionine or selenised yeast, need to be fed to animals to achieve significant incorporation in food products such as meat or milk. The efficacy and safety of protein bound Se is much better than that of inorganic Se and so these are the preferred forms of delivering Se via the food supply. Horticultural and animal products have containing elevated levels of Se have been shown to improve oxidative status and reduce the risk of some cancers, viral infections and neurological disease in animal models. Also, feeding supra-physiological levels of selenised yeast to animals has been shown to improve the ability to handle stressors such as heat stress or disease challenge.

There is also growing interest in the Zn status of the population and whether this can be manipulated through nutritional supplementation or fortification through the food supply. Zinc is an important component of many enzyme systems and is essential for a variety of functions. Red meat is an important source of Zn for many humans as it is generally more bioavailable than plant sources. On the other hand, plant Zn is often unavailable because of antinutritional factors such as phytate and phenolic compounds which bind with divalent cations such as iron and zinc leading to the formation of insoluble complexes that precipitate during intestinal digestion. Although there is a wide variation in Zn concentrations in various animal products, particularly meat, efforts to increase the incorporation of Zn into animal products through dietary manipulation have been largely unsuccessful tissue Zn is refractory to dietary level. However, plasma and tissue Zn concentrations are moderately heritable suggesting opportunities for selection of animals with higher concentrations of Zn in their food products. Efforts to improve the availability of Zn from plant foods are largely reliant on plant breeding for lower concentrations of antinutritional compounds such as phytates, through activation of endogenous phytases or supplementation with exogenous phytases.

Conclusion
Animal and horticultural products are already important sources of dietary Se and Zn for the general population. The opportunity to change farming practices to increase their bioavailability offers more targeted nutrigenomic or personalised nutrition approaches. Since Se is incorporated into amino acid and proteins it is relatively easy to manipulate. Opportunities to alter Zn concentrations in primary products are more likely going to involve genetic selection or activation of endogenous phytases in plant foods.