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<td>Authors(s)</td>
<td>Gormley, T. R. (Thomas Ronan)</td>
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<tr>
<td>Publication date</td>
<td>2006</td>
</tr>
<tr>
<td>Publication information</td>
<td>Functional Food News, (1):</td>
</tr>
<tr>
<td>Link to online version</td>
<td><a href="http://www.eu-research.com/sme/functional-food-net-ffnet/2010/03/07/">http://www.eu-research.com/sme/functional-food-net-ffnet/2010/03/07/</a></td>
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<td>Item record/more information</td>
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Inherent functionality:--a useful term for consumer information?

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Functional foods are broadly defined as those that offer ‘something extra’ in terms of health benefits than the basic food item, e.g. probiotic-enriched yoghurt versus ordinary yoghurt. The term functional food, by its very nature, tends to suggest that other foods are not functional and have less health benefit relative to functional foods. This is far from fact as many animal and plant foods are highly beneficial for health ‘as consumed’ and possess inherent functionality. The term inherent functionality is stronger than the term naturally present used to describe health-promoting constituents occurring naturally in foods such as conjugated linoleic acid (CLA) in dairy or meat products. The author suggests, therefore, that inherent functionality is a term needed for consumer information in that foods of the same type may differ in their inherent functionality and scientists/technologists/consumers should be aware of this. This can be demonstrated using many examples such as taurine in fish, antioxidants and dietary fibre in fruit and vegetables, antioxidants in olive oil, CLA in animal products, and phytosterols in grains; some of these are discussed below. These naturally-present substances are in addition to the traditional nutrients, i.e. carbohydrates, proteins, fats, vitamins and minerals.

Taurine in fish

A number of recent medical studies have shown that taurine (circa 1.5g/day) is beneficial for cardiovascular health and helps to restore suppleness of human arteries [Fennessy et al., Circulation, 2003, 107 (3): 410-415]. Fish is a good taurine source
and tests for taurine content were conducted recently at Ashtown Food Research Centre, Dublin. The content in four species purchased in supermarkets (eight test dates) was in the order plaice (126), cod (93), mackerel (69) and farmed salmon (53 mg/100g wet weight). Values for spot samples of a number of other species were albacore tuna (155), ray wing (128), wild salmon (53), siki shark (44), whiting (35), Greenland halibut (28), roundnose grenadier (6) and Baird's smoothhead (5mg/100g wet weight). These data indicate that fish species have different levels of inherent functionality (in terms of taurine status) with albacore tuna having the highest level.

**Dietary fibre in apples**

The alcohol insoluble solids (AIS) (largely dietary fibre) fraction in apples is beneficial in controlling late maturity diabetes and level of dietary lipids [Mayne et al., *Irish Journal of Medical Science*, 1982, 151 (2): 36-41]. Tests have shown that Golden Delicious apples (3.64%) are more inherently functional than Red Jonathan (3.28%) or Cox's Orange Pippin (2.89%) in terms of AIS content (Gormley, *Journal of the Science of Food & Agriculture*, 1981, 32: 392-398) and hence their likely effect on diabetic control. This study followed an earlier one with 76 human volunteers which showed that eating two Golden Delicious apples per day significantly reduced serum cholesterol levels and raised the high density lipoprotein fraction (HDL) thus demonstrating efficacy and the inherent functionality of apples in terms of cholesterol reduction (Gormley et al., *Irish Journal of Food Science & Technology*, 1: 117-128).

**Antioxidants in olive oil**

Olive oil is a key contributor to the health-giving attributes associated with the Mediterranean diet, since the health-related properties (e.g. contributing to the prevention of thrombosis-related diseases) of olive oil are 'added' to those foods (e.g. vegetables and fish) which are served with olive oil [Serra, *Pathophysiology of Haemostasis & Thrombosis*, 2003, 33(5-6): 461-465]. The inherent functionality of olive oil varies considerably depending on variety, cultural practices, and on extraction and processing procedures. For example, extra virgin olive oil would be expected to be more inherently functional than virgin olive oil than non-virgin oil. The most abundant antioxidants in virgin olive oil are hydrophilic phenols; however, tocopherols and carotenes also contribute to antioxidant capacity. The influence of olive variety has been demonstrated by Servili and Montedoro (*European Journal of*...
Lipid Science & Technology, 2002, 104: 602-613) who showed secoiridoid (the dialdehydic form of eienolic acid linked to 3,4-dihydroxyphenylethanol) contents of 558, 61 and 68 mg/kg in the varieties Moraiolo, Frantoio and Leccion, respectively. The negative effect of fruit ripening on the phenolic content of virgin olive oil has also been demonstrated with lowest hydrophilic phenolic contents in over-ripened olives.

CLA in ruminant animal products
Meat and dairy products are inherently functional foods via their content of conjugated linoleic acid (CLA), bioactive peptides and other agents. CLA has gained considerable attention in recent years because of its many beneficial effects on human health including anti-carcinogenic and anti-atherogenic activity, and its ability to reduce the catabolic effects of immune stimulation (O’Shea et al., Trends in Food Science & Technology, 1998, 9: 192-196). A number of factors influence the inherent functionality of meat and dairy products via their effect on CLA content. For example, the CLA content of bovine milk is influenced by lactation number, feed allowance, dietary oils and by seasonal effects. The effects of pasture (grass) are particularly noteworthy. Cows on pasture produced milk fat with higher CLA contents than animals receiving only one third or two thirds of their daily feed from pasture [Dhiman et al., Journal of Dairy Science, 1996, 79 (Suppl. 1): 137 Abst.]. For grazing steers, French et al. (Journal of Animal Science, 2000, 78: 2849-2855) demonstrated increasing CLA levels (5.4, 6.6, 10.8 mg CLA/g fatty acid methyl ester) with increasing intakes of grass compared with 3.7 mg/g in animals fed concentrates.

Natural complexity
Natural complexity presupposes that ‘nature does things best’ and that nutrients in foods as eaten are different than if taken in pill or capsule form. For example, it can be argued/proposed that vitamin C in an orange is hydrogen bonded and as such may be more available than that in a tablet. Gormley et al. [Food, Health and the Consumer, Elsevier Applied Science, 1987, pages 71-72 (ISBN 1-85166-108-5)] proposed that whole foods should preferably be eaten whole for at least two reasons, (i) key nutrients are retained, and (ii) nutrients are ‘diluted’. This proposal favours inherently functional foods over conventional (i.e. man made) functional foods in that the concentration of the key compound/agent in the latter may be too high, and there is
also the possibility that the key compound/agent may also be obtained from other functional foods thereby leading to an intake overload.

**Retaining inherent functionality**

Many studies have been conducted on losses of the major nutrients, vitamins and minerals in foods during storage and processing. However, there are relatively few studies on losses of *inherent functionality* and most of these are fairly recent. This is a particularly important field of study especially in products such as prepared salads that are held in chill storage for a number of days, and while appearing fresh may have lost *inherent functionality*, especially in terms of antioxidant compounds.

**Conclusion**

The term *inherent functionality* is useful for the description of foods that have ‘naturally present’ constituents that are protective of, or conducive to, good human health.