1. Science has helped to reveal important information about plant-derived macronutrients and micronutrients, but there are many tens of thousands of plant components included in the diet, and research is beginning to find out about the potential of these compounds for human health.

2. The many thousands of phytochemicals, or bioactive substances, can be classified into 3 main groups: terpenoids (such as carotenoids and plant sterols); flavonoids (including isoflavones (phytoestrogens) and flavonols, such as quercetin) and allied phenolic and polyphenolic compounds; and sulphur-containing compounds (such as allium compounds and glucosinolates). These substances are found in a large range of foods and single foods can contain a whole spectrum of phytochemicals. Consequently, studying these compounds is an immense task.

3. Epidemiological evidence has shown that people who eat more plant-derived foods appear to have better health and lower risk of chronic diseases, such as cardiovascular disease and some types of cancer, although it is not clear whether protection is afforded by eating more protective substances, fewer harmful substances, a combination of the two, or some other factor.

4. Plant bioactive compounds may act at several sites in the body, and modes of action include modification of hormonal profiles, modification of lipid profiles, anti-inflammatory effects and effects on haemostasis. A range of potential mechanisms has been studied, using in vitro and cell culture techniques, but more direct evidence of the effects in humans is needed to elucidate which are the key components with protective effects.

5. Ninety per cent of the cells associated with the human body are bacteria and human adults have a complex gut microflora. Certain gut bacteria may benefit health, and the colonic microflora contributes directly to the metabolism of plant bioactive compounds, such as isoflavones, lignans and glucosinolates. Case control and prospective cohort studies provide support for a protective effect of Brassica vegetables against colorectal cancer. Brassicas (such as cabbage and broccoli) contain glucosinolates, which are metabolised in part by colonic bacteria to active breakdown products (isothiocyanates) that may have the potential to block and suppress colorectal cancer.

6. Human colon bacteria derive energy from undigested food and endogenous secretions. Most of these bacteria use carbohydrate as a source of energy, releasing fermentation products, including short chain fatty acids such as butyrate. In vitro studies show that butyrate stimulates the growth of normal cells, suppresses proliferation of cancer cells and induces apoptosis (cell death) in cancer cells. The use of probiotics and prebiotics to enhance the gut bacterial population is a growing area of interest, but research in this area needs to be treated with caution, as not all bacterial effects are beneficial to health.

7. Phytochemicals are present in plants as they play a role in growth and survival of the plant. For example, beta-carotene is present in chloroplasts in green leaves, protecting the plant from the harmful effects of UV sunlight, and other carotenes are involved in light harvesting for photosynthesis. The number of phytochemicals in plants is vast and their levels vary. Phytochemicals are not necessarily beneficial in humans (e.g. cyanadins in cassava and solanine in green and sprouting potatoes are potentially toxic). More research into the role of phytochemicals in plants may help us to understand what the compounds could potentially do in humans.
8. There is a wide range of nutrients and compounds in beverages that can interact with biochemical and cellular processes. Some beverages contain plant-derived phenolic compounds, which have a diverse range of effects in vitro, suggesting a role in the prevention of chronic diseases including heart disease and some cancers, although epidemiological studies are inconclusive. Any purported health benefits from the phytochemicals in alcoholic beverages must be considered in the light of potential adverse effects of the alcohol content.

9. Intake of flavonoids varies widely and current estimated daily intake is greater than 50mg. The most significant subclass of flavonoids in cereals, nuts and pulses is the phytoestrogens class, including the isoflavones and stilbenes. Isoflavones are structurally similar to human oestrogen and human studies confirm that soya isoflavones can exert hormonal effects (oestrogenic and anti-oestrogenic), which may be of benefit in prevention of e.g. breast cancer, prostate cancer and osteoporosis. Soya has also been shown to have a cholesterol lowering effect. Pure isoflavones do not have the same action as soy protein, illustrating that the effects are complex and it is not yet possible to extract specific compounds from plant foods for specific physiological effects.

10. Much more research is needed to establish the bioavailability of various substances and to understand the importance and relevance of different compounds in order to develop clear dietary guidelines. The key message from currently-available evidence is to eat plenty of plant foods, including a variety of fruits and vegetables, consuming at least 5 portions of these every day.

The Task Force Report Plants: Diet and Health is now available from the BNF price £49.00 (including postage and packing).

Notes: This is a summary of the findings from a British Nutrition Foundation conference held on 11th September 2003 to launch the report of the Plants: Diet and Health Task Force. Speakers were Dr Barrie Margetts (University of Southampton), Professor Malcolm Jackson (University of Liverpool), Professor Ian Johnson (Institute of Food Research), Mr Mike Saltmarsh (Inglehurst Foods), Dr Garry Duthie (Rowett Research Institute), Dr Aedin Cassidy, and Dr Judy Buttriss (British Nutrition Foundation). Professor Robert Pickard (Director-General at the BNF) chaired the conference.

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