Nutrition and the Human Genome (Part 2)

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It has been known for some time that diet and specific nutrients can affect the functioning of our genes. We all know that even when people are eating the same diets, some will develop overweight, some develop heart disease and some develop allergies, while others will not. Wouldn’t it be wonderful to know why? The anticipated benefits from research into the function of genes include advances in the development of nutritious foods and special functional ingredients, optimal diets for individuals and improved methods for preventing many lifestyle-related diseases.

Functional foods for individual needs

Research of the human genome will help to identify just how diet affects our genes and why individuals vary in their response to different nutrients and diets. In turn, this will help in the development of foods with specific nutritional effects, designed to meet the particular needs of an individual. Such foods, containing biologically active components that offer the potential of enhanced health or reduced risk of disease, could help to neutralise the effects of certain genes and even delay the development of some chronic diseases or health problems.

One of the most promising areas is research into aging and disease. Scientists have discovered that the restriction of calories can increase lifespan by as much as 30-40% in some animals yet the exact mechanisms by which it does this and the relevance of the results for human aging remain largely unknown for the time being. Discovering the ways in which calorie restriction affects the function of human genes could pave the way for dietary methods to help increase lifespan and improve the quality of old age.

Research into genes (the human genome) can help in identifying ways to develop special foods for individuals to make health-promoting diets more appealing by improving taste or by adding health benefits to certain foods that are staples in the diet. One example is the role of certain microorganisms in intestinal and overall health. Genetic research will help us to understand why certain bacteria (for example some lactic acid bacteria), appear to have beneficial properties such as improved immune function and gastrointestinal (gut) health. A greater understanding of the types of beneficial bacteria and the way in which they act in the digestive tract can assist our understanding of harmful bacteria in the gut and some foodborne illnesses due to infection e.g. salmonellosis. The expected benefits are safer and more nutritious foods, with improved taste.

The screening of plants and microorganisms could also lead to the discovery of new components with potential health benefits and help identify which functional ingredients work when isolated from various foods and which need to be eaten as a whole food. As a result, novel ingredients and foods with health-sustaining benefits might appear on supermarkets shelves in the future.

Individual diets
Although public health policy currently dictates one generalised set of dietary guidelines for all of the population, one set of guidelines does not necessarily suit everyone. There are many examples of how individuals respond differently to diet. For example, vitamin and mineral needs vary between individuals and with age. The effects of protective phytochemicals (active substances in plants that confer health benefits) such as isoflavones, flavonoids and reservatol, differ from person to person. Sodium increases blood pressure in some people but not in others and the ability of dietary fibre to reduce cholesterol is also subject to genomic influences.

The time will come when it will be possible to use genomic testing to screen individuals for genes related to particular diseases and conditions and to determine an individual's ideal health promoting diet. It may even become commonplace for health care professionals to deliver tailor-made dietary advice based on an individual's needs as determined by information from their genes/genome.

**Improved diagnosis of disease**

It has been known for years that many diseases have a genetic component. Scientists have already identified more than 30 genes linked to diseases such as breast cancer, muscle disease, deafness and blindness.

Information from the human genome is making it possible to identify the exact gene (or genes) that influence a person’s susceptibility to a disease and various biomarkers (indicators of disease risk). For example, 5-10% of breast cancers have a genetic component, meaning that women who have inherited a defective gene for the disease have a higher than average chance of developing breast cancer as well as ovarian cancer. Genetic research will identify ways to detect the defective gene before the disease develops so that steps can be taken to help prevent the disease.

Techniques such as this can be used to screen large numbers of people for the presence of genes or biomarkers that have been linked to an increased risk of developing certain diseases or conditions. Once high-risk individuals are identified, measures can be taken to help prevent the disease or detect it early when treatment methods are most effective. In the case of dietary-related conditions, these interventions may involve dietary changes and/or the inclusion of special food components as part of an overall management strategy.

While genomic research can appear daunting, and even frightening, to some people, improved understanding of the techniques involved and the potential benefits to be derived from this research will hopefully show that it is an area that will advance rapidly and lead to significant breakthroughs in nutrition and food science.

**References**
