

Nutrigenomics - taking Nutritional Medicine to the next level

Over the last half century Nutritional Medicine has contributed enormously to our understanding of why we get sick. Equally, it has provided us with strategies to prevent disease and promote a state of wellness, without primary reliance on drugs and surgery. But it's now time to take this knowledge to a new and higher level of understanding. **Christine Houghton** explains.

A new paradigm in Nutritional Medicine

Nutrigenomics is an emerging discipline which adds a 'multiplier effect' to the benefits we have typically seen from Nutritional and Botanical Medicine. Nutrigenomics identifies food-derived bioactive compounds which have the greatest potential to 'switch on' the protective genes within our cells and those that can 'switch off' the inflammation and disease-promoting genes. Knowing how these cellular 'switches' work enables us to reactivate these protective genes which tend to become 'lazy' as we age.

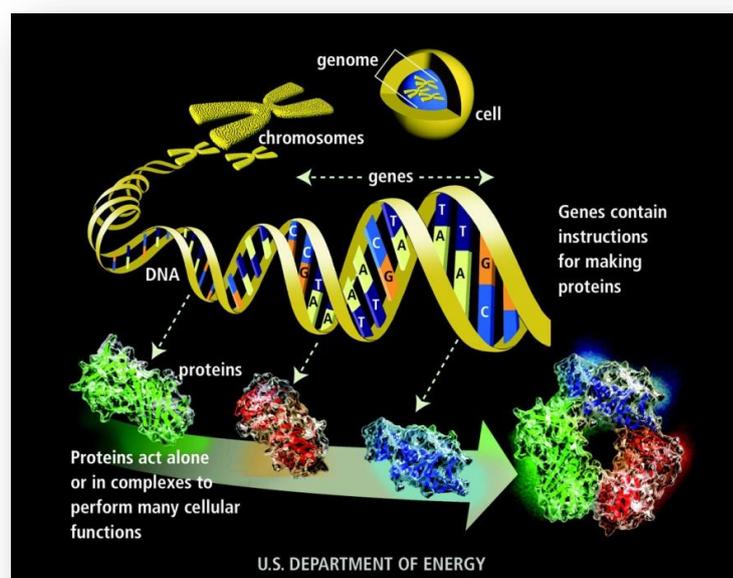
When we can up-regulate genes such as those which carry the code for our cell's own antioxidant enzymes, we can increase our antioxidant reserves literally millions of times more effectively than we can by consuming typical antioxidant vitamin supplements.

The word nutrigenomics means 'food talking to your genes'. Every mouthful of food we consume initiates a complex 'conversation' with the DNA in our cells - conversations which determine whether the protective or disease-promoting cellular switches are activated.

Unravelling our DNA sequence

One of this century's most remarkable achievements must surely be the mapping of the entire human genome. The human genome is the term used to describe the long cabled strands of human DNA which are assembled into groups of genes and located on 23 pairs of chromosomes deep inside our cells.

In 2003, the mapping of the entire sequence of human DNA was completed. Described as a 'unique blueprint' of an individual, it contains every instruction your cells need for your body to grow, function normally, and repair itself. Humans have about 25,000 distinct genes in each cell. Collectively, these genes are like a huge library containing every possible piece of information about each individual person.



We are more the same than different

When we look around at our fellow humans, we see what we think are enormous differences within us. Some of us are tall, others are short. Some people have dark skin, others have fair. Some people can run fast, and others can't – and so on. Yet surprisingly, humans have 99.9% of their DNA in common. This means that all the differences between each individual are coded into just 0.1% of the total. Further, these seemingly miniscule variations can have profound effects on our health and wellbeing.



When your DNA makes 'spelling mistakes'

Human bodies are constantly breaking down old cells and replacing them with new ones. As our cells regularly replace themselves, they copy their DNA so that the new cells contain an identical copy of the original DNA. However, sometimes when our cells divide, mistakes are made - a bit like spelling mistakes in the DNA code. Sometimes these mistakes make no difference but if the gene plays a critical role, the mistake can have a significant effect. These mistakes are actually gene variations or mutations and are often described as SNP's (pronounced 'snips'). The Human Genome Project showed that there about 1.4 million DNA locations where these SNP's can occur.

Cancer can occur through DNA changes like this. Healthy cells make a protective gene known as the *p53 suppressor gene* and its job is to suppress the cancer process. However, early in the development of some types of cancer, the p53 gene may get '*switched off*' because a 'spelling mistake' has been made in the DNA. As a result, the healthy cells lose some of their normal ability to deal with the rogue cancer cells. Another way the p53 or other genes can lose their ability to protect against cancer is through *epigenetic* changes. In this case, a small chemical acts like a paper clip; when it attached to a gene, again the gene gets *switched off*.

Bequeathed by Mum and Dad

Scientists have known for decades that some people have diseases which appear to run in families because they have inherited one or more faulty genes but what is now coming to light, is that there are a whole host of less obvious weaknesses which are inherited. These weaknesses in cellular function may include limited ability to detoxify waste materials in human cells, or a limited ability to produce the protective antioxidant enzymes our cells need to defend themselves. Some genes are needed to repair our DNA if it gets damaged, so that if these genes are '*switched off*' or '*turned down*', long-term damage to cells is more likely.

What does this mean to each individual?

If there are too many defective genes, cells are less likely to function efficiently and disease is more likely to develop. What we don't necessarily know is what type of disease may occur because other genes determine where the greatest weaknesses lie. All we can say is that the cells are less able to defend themselves from harmful free radicals or other toxic assaults. This tells us why some people are more prone to certain disease-promoting defects such as inflammatory or infectious diseases, while others may age prematurely.

Is there any good news?

In fact, there is extremely good news! What is really exciting about the ongoing research is that the disease-promoting processes in most instances can be modified - even in individuals with abnormal genes. This is where Nutrigenomics steps in because we now know how certain food-

derived molecules can activate gene switches. The way in which a gene switch works is shown in Figure 1. A bioactive compound, usually found in a plant can activate certain molecular 'switches' within the cell. That switch in turn targets the DNA in certain genes in that cell so that the genes then activate the cell's internal 'machinery', producing hundreds of protective compounds which the cell uses to defend itself.

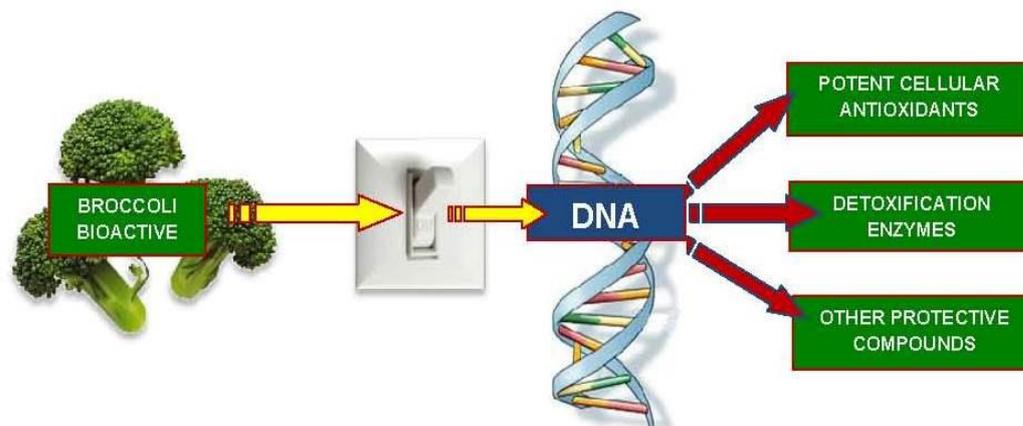


Figure 1: How plant bioactives 'talk to your DNA', activating cellular defences

'Switching on the cell's own defences

One of the most important of these protective switches is known to biochemists as Nrf2. The bioactive compounds in broccoli are known to be the most powerful activators of Nrf2 and Nrf2 switches on at least 200 known protective genes¹. It is these genes which contain the code the cell needs to make its own protective compounds. Among these are potent antioxidant compounds, literally millions of times more powerful than the antioxidants we have been accustomed to taking as supplements.

The Power of Nutrigenomic compounds vs. Antioxidants

The most common antioxidant supplements are those which include vitamin antioxidants such as vitamin C, vitamin E and beta-carotene, as well as those from green tea, olives, red wine, blueberries, pomegranates, açai berries and so on. The latter are often described by marketers as 'super foods' and are all classified chemically as *polyphenols*.

These *polyphenols* are such big bulky molecules that very few of them actually get into the cells! Scientists say that polyphenols display poor bioavailability². Newer research now shows that the antioxidant effect of the *polyphenols* occurs mostly in the digestive tract and not within the cells³. Unfortunately, many of the studies used to promote the *polyphenols* as supplements have been done in test tubes or *in vitro* studies by using impossibly large doses of the substance in animals. One of the newcomers to fit into this category is *resveratrol* found in grape skin or red wine⁴.

Where one molecule from any of the so-called 'antioxidant' vitamins or 'super foods' just mentioned can quench (neutralise) just one damaging free radical, the cell's own antioxidant enzymes can quench literally millions of free radicals per minute! This is why Nutrigenomics takes our understanding to a whole new level. If antioxidant benefit is needed in the cell, the most effective way to achieve it is to use a nutrigenomic substance capable of potently activating the cell's internal defence systems.

Enter sulforaphane (pronounced Sul-4-a-Fane). This is the name of the potent bioactive compound derived from broccoli. Interestingly, the young broccoli sprout contains about 20 to 50 times more *sulforaphane* than the mature vegetable, and because cooking destroys the activity of the plant's *myrosinase* enzyme, a carefully-processed 100% enzyme-active broccoli sprout powder is likely to be a more reliable way of achieving desired benefits.



Sulforaphane is the subject of extensive and ongoing research. It has been shown to be the most potent natural activator of major cellular detoxification enzymes. It also significantly increases the production of one of the cell's own antioxidant compounds, Glutathione.

What other foods have a nutrigenomic effect?

It is likely that as the research continues, scientists will discover a whole host of bioactive plant molecules with significant nutrigenomic effects. Another common food which has been used to extract a potent nutrigenomic compound is the rockmelon, or cantaloupe. French scientists about a decade ago developed a method to extract and protect a compound which nutrigenomically activates the cell's own antioxidant enzymes, the most important of which is known as *superoxide dismutase*.



However, the high SOD melon is nutrigenomically useless unless it is bound to biopolymers of gliadin. The tiny amounts of gliadin are essential for two reasons: 1) The gliadin protects the SOD against degradation of the enzyme in the gut and 2) the gliadin is responsible for the nutrigenomic activation of the genes which code for the cell's three Antioxidant Enzymes, *Superoxide dismutase*, *Glutathione peroxidase* and *Catalase*.

SOD is the cell's primary antioxidant enzyme, being able to quench millions of free radicals per minute. To put this into perspective, a vitamin C molecule is capable of quenching just one single free radical. When the nutrigenomic SOD melon extract is combined with a sulforaphane-yielding 100% enzyme-active broccoli powder, the function of the cell's naturally-occurring defence systems is enhanced.

Where to from here?

Because Nutrigenomics is about the way in which food talks to our genes, the food we choose becomes much more than a way of satisfying the appetite or a source of vitamins, minerals and so on.

Our food supply is literally a huge library of information in constant conversation with the DNA in our cells. Whether our DNA hears messages to



enable it to protect our cells or whether it is assaulted by chemical messages from poor food choices really depends on us, because after all, we are the custodians of our own food choices.

So the responsibility to be healthy really rests with us as individuals and much less on a health professional whose help is so often sought long after we have already upset the delicate balance of switches governing the expression of our genes.



BIO

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B.Sc.(Biochem.), Grad.Dip.Hum.Nutr., R.Nutr., PhD.Cand. is a Nutritional Biochemist with over 30 years' experience as a private practice clinician in Nutritional Medicine. Now, as CEO of Australian company, Cell-Logic Pty Ltd, her particular interest is on Nutrigenomics, a strategy for identifying natural compounds capable of upregulating the genes that cells use to prevent disease-promoting processes. Her work includes translating this research into the production of encapsulated nutrigenomic supplements readily available to consumers globally.

Christine is also the author of "*Switched On – Harnessing the Power of Nutrigenomics to Enhance Your Health*", available as an ebook via Amazon Kindle or in the print version via www.enduracell.com.

For more information you can visit: www.cell-logic.com.au and www.enduracell.com or visit the Cell-Logic [Facebook page](#).

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