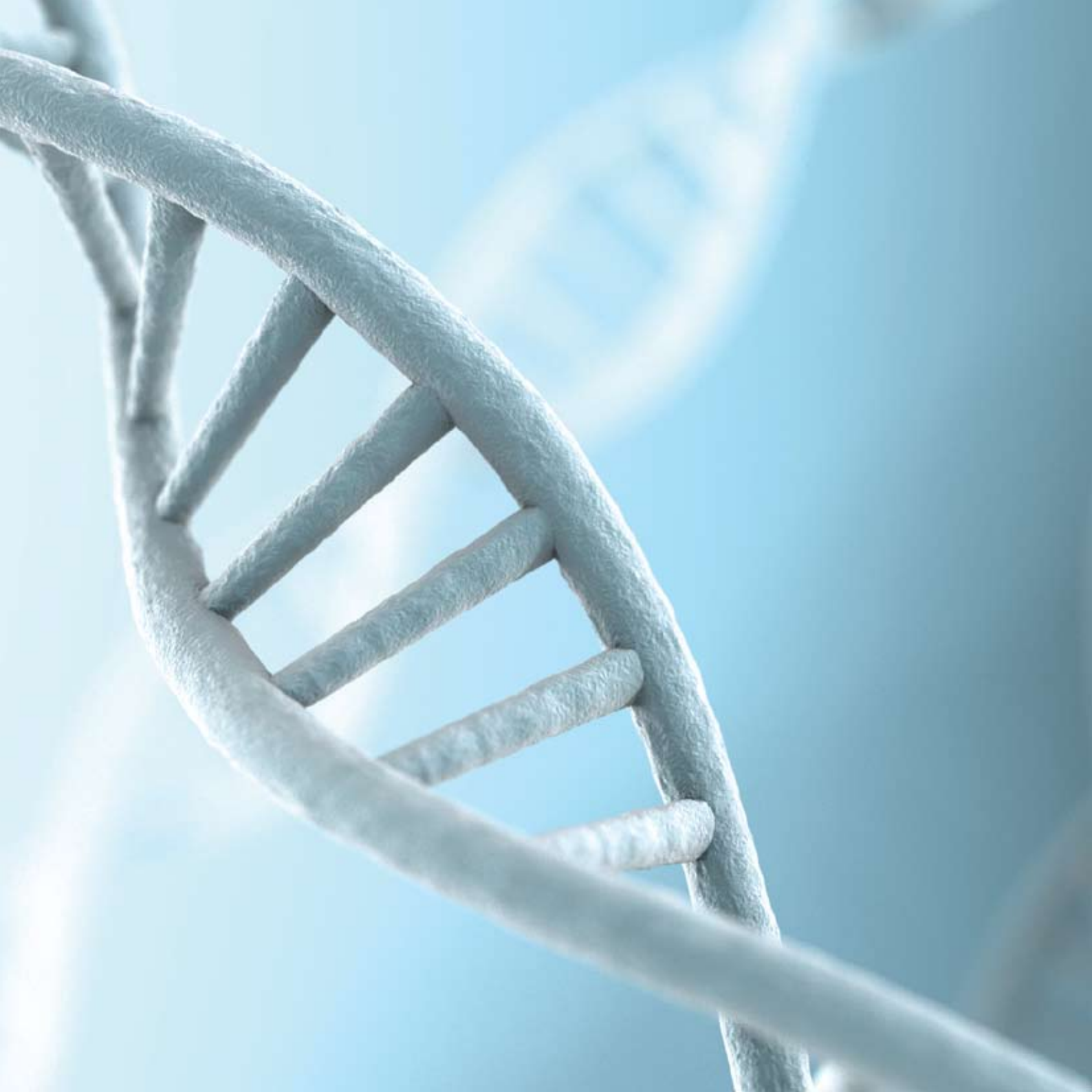

# Pharma foods

## More customised foods blur the line between pharmaceuticals and food as nutrigenomics allow individualised diets to fit genetic profiles.

As awareness of advances in biotechnology is increasing, a growing area of interest is in the use of foods for medical purposes. There is a long-standing tradition in many cultures of using natural herbs and foods to treat ailments. In recent years, so-called 'superfoods' have started to receive increasing attention, particularly in the media. Interest is now rapidly expanding to foods with clinically enhanced properties. Probiotics, prebiotics, functional foods, clinical foods and nutraceuticals are all talked about and promoted as being good for you either in general or by specifically targeting a bodily function, such as improving digestion, bone density and so on. As technology evolves and more is understood about how to tailor food and drug combinations to better fit individual needs, the opportunities for tailored foods that use improved genetic profiling are burgeoning. By 2020, many in the pharmaceuticals and food industries predict biotechnical advances to combine foods grown in the field and drugs developed in the lab. In the next decade, we can expect to see a shift in some of our basics from traditional 'farmer foods' to more sophisticated 'pharma foods'.

The term nutraceuticals, which comes from a combination of nutrition and pharmaceuticals, is used to describe 'food, or a part of a food, that provides medical or health benefits, including the prevention and/or treatment of a disease'. So, one person's functional food can be another person's nutraceutical. Given that they are cheaper than pharmaceutical products and can sometimes provide some of the benefits, nutraceuticals are a growth sector attracting pharmaceutical and biotech companies, including the likes of Monsanto, DuPont, Abbott, Johnson & Johnson, Novartis and Genzyme Transgenic. Clinical foods, or medical foods, are by contrast specifically formulated to meet certain nutritional requirements of people with specific illnesses. They are regulated and therefore prescribed by physicians. Nutraceuticals are, therefore, not clinical foods.

While these products have been appearing on the market in recent years, the next step now on the horizon is in foods created for medical benefit. The big change is the link between food preparation and nutrigenomics, which is applying the sciences of genomics, transcriptomics, proteomics and metabolomics to human nutrition. Nutrigenomics is a relatively new science and is the application of high-throughput genomic tools in nutrition research: now that human genes have been sequenced and we can understand more about our make-up, nutrigenomics is essentially the science that allows us to tailor food to fit our genetic profiles.

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Pharma foods, 'biopharmaceuticals' or 'farmaceuticals', are one outcome of this and are compounds produced from genetically modified crops or animals. They provide higher than usual amounts of various nutrients that can be consumed as foods. What distinguishes them from functional foods, nutraceuticals and their like, are that they are not naturally occurring. They are engineered to provide specific health benefits: for instance, gene 'pharming' allows scientists to alter an animal's DNA by combining it with DNA from another species. The resulting genetically modified animals – transgenic fish, cattle, sheep, goats and chickens – are tailored to provide embedded drugs and proteins for human consumption. Proponents, such as the Biotechnology Industry Organization, see that transgenic animals can not only be provided with traits that will improve disease resistance, but also that they can accelerate growth and increase proteins, provider leaner meats, increased muscle mass and improved nutritional quality. So, for example, a salmon can be raised in half the normal time, have less fat, more meat and include extra nutrients. Although no products are currently on the market, the US National Academy of Science undertook a study that did not identify any food safety concerns. Alongside the ethical issues of blurring the difference between different species, issues around environmental impact and animal welfare are, however, raised by those against this sort of development.

Plant-made pharmaceuticals are produced by using similar technology in plants: transgenic plants are engineered to have resistance to pests and harsh conditions as well as improved shelf life and nutritional value. Modified potatoes have been enhanced with protein and, in 2008, scientists altered a carrot so that it would produce calcium and become a possible cure for osteoporosis. There has also been discussion of the benefit that can be gained for vitamin A deficiency from the consumption of golden rice, which was developed by the International Rice Research Institute to alleviate micronutrient deficiencies in developing countries.

As a group, such pharma foods have been a controversial issue. For example, back in 2007 several food companies lobbied the US Department of Agriculture against the introduction of pharma foods due to 'concerns about their negative impacts on food safety, on markets for food crops and on the integrity of the wider food supply'. PepsiCo saw that 'the significant risk of crop contamination that is present when plant-made pharmaceuticals are produced in food and/or feed crops leads us to the conclusion that the only way to prevent such a contamination is to prohibit their production'. In its 2008 Corporate Social Responsibility report, addressing concern about the testing of plant-made pharmaceuticals, General Mills stated that 'to fully ensure the safety of world production via plants and grains, General Mills currently opposes moving to production of any so-called 'pharma-food' that would use a food crop or food grain to grow or produce plant-made pharmaceuticals'.

However, despite this reticence, and given the increasingly populous and hungry world, many companies are now progressing with the development

of pharma foods. In his initial perspective on the future of food, Jim Kirkwood highlighted the opportunities and challenges:

*"Pharma-foods, the intersection between food and pharmaceuticals, is an area of growing opportunity for many in the food sector. As consumers demand more technologically sophisticated foods with unique, complex health benefits, food companies will need to respond. We now understand more about individuals' disease propensities from the human genome. Therefore nutrigenomic determination of diet becomes technically possible. Technology is advancing and as natural bioactive components are better understood, the line between pharma and food will blur: The challenge will be how to continue to find new ways to continue to provide natural, food-delivered preventative health benefits and begin to provide natural, food-delivered disease state improvement benefits without food becoming a drug."*

*Genetic profiling is advancing very quickly and is now accepted as a good thing.*

In a New York workshop this view gained clear support. As well as the wider recognition of the global need for more proteins and nutrients, participants saw that 'genetic profiling is advancing very quickly and is now accepted as a good thing', 'business models in the pharmaceuticals sector are encouraging significant investment in the area' and that 'nutrigenomics will fundamentally change consumer healthcare as nutritional screening becomes a standard part of health check-ups and consumers readily provide their genetic profile'. Although a controversial subject, given the benefits to be gained, the fast pace of technology development and a shift in government regulation on the horizon, the advent of widespread availability of pharma foods by 2020 looks increasingly likely. Customised foods that match medical benefit to your genetic profile will be in your shopping basket soon.

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