



One Technology Drive, Tolland, CT 06084-3900 USA | +1.860.872.7000 | info@nerac.com | www.nerac.com

Nutrigenomics for Personalized Nutrition

By assessing emerging technologies, food companies can create products that tap into a potentially lucrative market

By Lynn Deffenbaugh, Ph.D., and Natasha Bangel
Nerac Analysts

The field of nutrigenomics could play a significant role in expanded use of nutraceuticals, particularly relative to the growing interest in personalized nutrition. There is a wealth of scientific and scholarly information about the field, or more accurately, the fields of technology relevant to nutrigenomics. The fields of bioinformatics, computational biology, genomics, proteomics, and metabolomics are contributing to our understanding of nutrigenomics.

Using nutraceuticals for health benefits has been especially successful in dietary supplements and, to some extent, in functional foods. The role of the regulatory environment is important in the degree of success for any nutraceutical. Another key factor in nutraceutical success is scientific or technological advances.

For food companies considering incorporating nutraceuticals into their products, a critical question is whether there are ways to look at what technologies are emerging from the scientific world that can be exploited in commercial applications. The primary purpose of such an approach is to determine if a scientific field has advanced to a stage such that commercialization is inevitable and, if so, when investment in commercialization activities is timely and wise. Nerac refers to this approach as Emerging Technology Evaluation. An emerging technology approach is most valuable when the technology comes from a field that is outside a company's core competencies, and oftentimes off its radar screen.

Definitions & Market Potential

Nutrigenomics and its related fields hold promise for better, more optimized use of nutraceuticals such as for more personalized nutrition. Nutrigenomics is a broad and complex group of scientific disciplines that have mutually supported and advanced each other. The potential to target concentrated nutraceuticals at an individual's specific needs sounds like something from science fiction. Yet it might be on the horizon for the general population in the near future.

Nutraceuticals include a wide range of ingredients from the familiar vitamins, minerals, and herbs to bioactive enzymes and probiotics that need to remain alive to deliver some of their effects. These ingredients range in form from liquids, oils, powders, and granules and are used in virtually every type of food or dietary supplement application that exists.

Regardless of the form or application, interest in nutraceuticals is increasing because of the potential health benefits that they can deliver. The market and applications for nutraceuticals experienced unprecedented growth after the passage of the Dietary Supplement Health and Education Act in 1994. This unusual legislation shifted the burden of proof for safety so that *a priori* approval was not needed to market a dietary supplement.

Just about every imaginable application of nutraceuticals for health benefits has been tried in dietary supplements. And while the use and perhaps efficacy of nutraceuticals in functional foods might seem to hold more promise than dietary supplements, the functional supplements market is significantly larger. The regulatory environment is critical, but other factors play a heavy role, too. (To read a related story, please [click here](#))

For example, consider consumer awareness of nutraceuticals and their related health benefits. The relationship between omega-3 oils and cognitive health or probiotics and digestive health is widely known, even if it is not well understood. It is curious, though, that consumers appear to be willing to pay considerably more for nutraceuticals in supplement form than when supplemented into food. Consumers are willing to pay \$40 for a bottle of 100 high-quality fish oil pills, or 40 cents a serving. However, it is unlikely that they would pay an extra 25 cents a serving for bread fortified with omega 3's that would add \$2.50 to a 10-serving loaf.

Emerging Trends

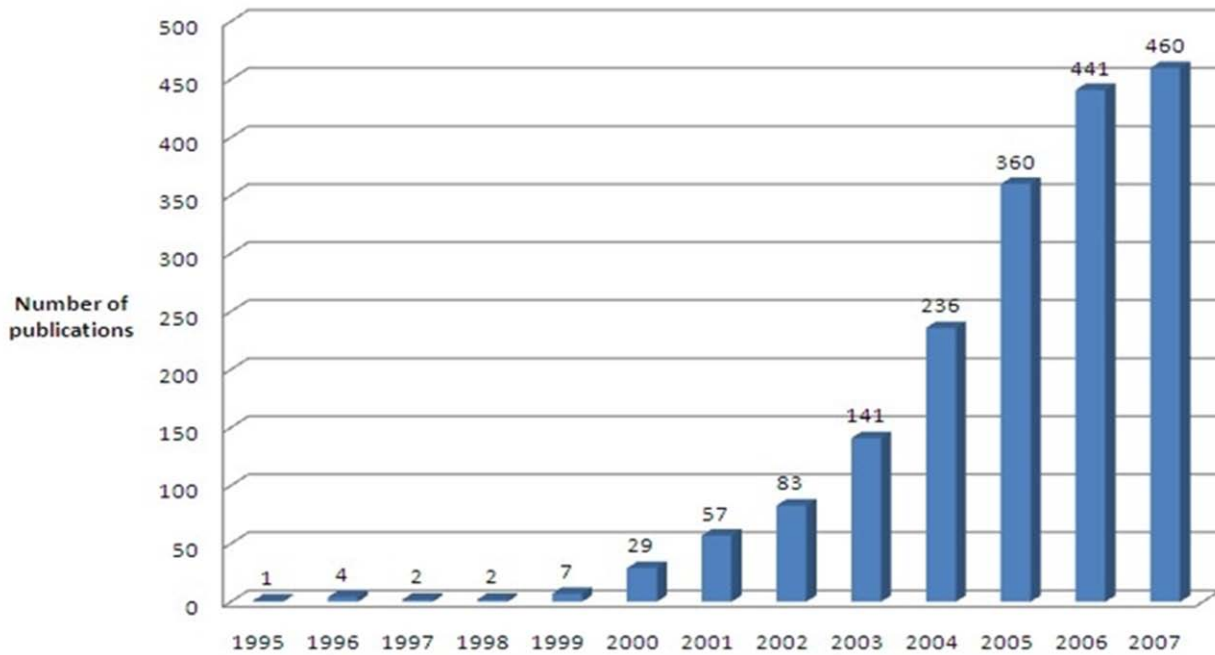
Technology and scientific validation are also critical for nutraceutical success. One example is the myriad of advances over the years in micro-encapsulation for protection of labile nutrients. Another is evolution of botanical extraction technology to maximize beneficial antioxidants and minimize unpalatable flavors. The emerging nanotechnology field weighs in also, providing alternative means to address absorption or dispersion challenges.

Using Nerac's Emerging Technology Evaluation, we can spot activity trends over time in various broad categories. The first step with this approach is to look at the overall level of activity for all relevant references in the field.

For this example, we evaluated various databases for scientific articles linking nutrigenomics with food or dietary supplements. The search was designed to link all aspects of nutrigenomics including bioinformatics, genomics, metabolomics, and proteomics to food and dietary supplements. By performing the search this way we can look at the area from a broad overview. Total activity in journals and patent literature is shown in Figure 1.

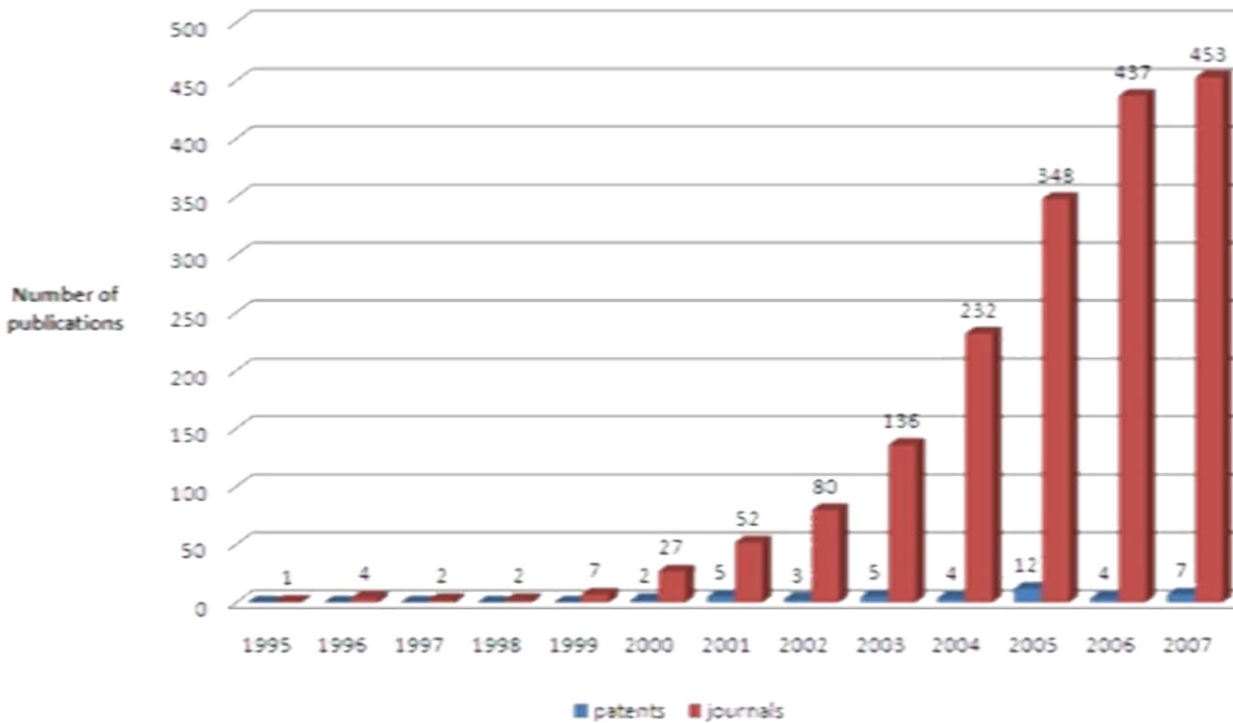
Before 2000, scientific activity in this area was minimal but increased exponentially thereafter; suggesting that this surge started soon after the human genome project was completed in 2000. A closer look suggests that activity may have started slowing after 2006. The 452 articles cited in 2007 were only a slight increase over the 437 articles cited in 2006. Although the data are not shown in Figure 1, the 2008 citations to date would suggest that total activity for 2008 will be lower than in 2007.

Figure 1. Total journal plus patent activity related to nutrigenomics and food.



The next logical step with these data is to aggregate the citations into different types of activities. Figure 2 shows the journal and patent citations separately for this topic. It was surprising that the great majority of scientific citations on this topic were journal references, whereas patent literature activity was disproportionately low. One explanation is that the intellectual property for this technology resides outside food applications. If this observation is true, the opportunity for licensing or partnering relationships may be an effective means to leverage nutrigenomics technology from industries outside the food industry.

Figure 2. Emerging Technology Analytics: Journal versus patent activity related to nutrigenomics and food.



Nutrigenomics' Potential

There appears to be a strong technology backdrop to the nutrigenomics field, lending scientific substantiation to the use of nutraceuticals for personalized nutrition based on individual genetic fingerprints. Scientific activity has increased exponentially. It is recommended that the specific types of technical activity be further segregated.

In addition, activity in other categories, especially regulatory and consumer acceptance, are required. Overlaying the activity into these various categories allows for a graphical view of the relative stage of each category.

The data presented suggest that scientific activity is still strong, but the pace of activity may have peaked. One conclusion is that funding and resources are being freed up for product development and commercialization. On the other hand, regulatory hurdles are serious detractors that must be resolved. A general recommendation is that companies interested in the use of nutrigenomics for personalized nutrition monitor relevant regulatory activity. Nerac analysts can evaluate this on a company's behalf.