

By Dr Philippe Martin\*

# Europe: Riding the nanowave

As funding priorities and levels attest, public authorities in large countries like the US or China and the EU as well as smaller countries like Switzerland have chosen nanoscience and the nanotechnologies as the next technology wave to ride. This wave is moving much faster than previous waves like biotechnologies and information and communication technologies (ICTs). Moreover, while biotech and ICTs delivered identifiable products and services, nanoscience and the nanotechnologies will more likely be a contributing part of products or make them conceptually or technologically possible.

Nanoscience and the nanotechnologies qualify as enablers. They will affect virtually all sectors of the economy. The “nanotech” value chain includes fields as varied as energy capture, transformation, production, storage, and distribution, medical diagnostics, targeted drug delivery, and regenerative medicine, materials science, water treatment and environmental remediation - and every step of the food chain, from agricultural production, to industrial manufacturing and processing, conservation including intelligent packaging and quality sensors, and, finally, consumption as “functional foods”, “nutricosmetics”, “neutraceuticals”, and supplements.

The challenges and opportunities of nano applications stem to a large extent from the novel nature of nanomaterials, defined as materials with one or more dimensions on order of 100 billionth of a meter or less. At some point, making things smaller makes them not just different but alters their behavior. First, small objects have greater reactive surfaces for a given mass.

## Europe wants innovation, but innovation with safety.

To illustrate, cocoa powder dissolves much easier than a chunk of chocolate. Second, for very small objects the laws of classical physics cease to apply because of quantum effects. More problematic still, nanomaterials may hover between the classical and quantum physics domain in the no man’s land of meso-physics, which physicists and engineers have only recently entered to derive rules rather than laws.

For this reason, material scientists remain vague and argue that the gates of the nano-scale open somewhere around a few hundreds of nanometers. Scientists cannot predict the new characteristics and behavior that materials acquire in the nano-range. Thus, sponsors of a nano-product cannot assume that they know the behavior of a nanomaterial on the basis of its properties in bulk. Moreover, they must document the characteristics of a material in its specific nano-form, since within the nano-scale these characteristics may vary as well.

Third, small size reduces the effectiveness of cellular membranes as barriers to the entry of foreign objects into the body and their movement within it. Consequently, risk assessment must operate on a case-by-case basis after having checked the appropriateness of risk assessment methods, protocols and tests.

Taking a special look at applications of nanoscience and the nanotechnologies to food, only two European companies currently advertise the production of nanofood products.

Furthermore, apparently they do not market the products in the EU.

Is it because a growing number of European consumers favor simpler foods containing fewer or no additives? Citizens’ conferences do reveal a priori concerns about nanofood. In addition, they highlight the need for business operators to show real benefits to the consumer, to demonstrate product safety, to communicate more about their corporate vision in the area, and to provide information on the products that they place on the market. However, current manufacturing costs and production capacities present greater barriers to the commercialization and diffusion of nanofoods than consumer preferences, acceptance, and needs. Market analysts expect that the enabling, horizontal nature of nanoscience and the nanotechnologies will eventually offer profit-making opportunities to businesses, new benefits to consumers as well as further improvements in the safety of the food and feed chains.

The EU has consistently provided significant funding for R&D in nanoscience and the nanotechnologies including research on health, environment, and workers’ safety. For the period 2006-2013, it has allocated a total of 3.4 billion euros. Moreover, the EU has given itself a strategy and a European Action Plan to ensure the “safe, integrated, and responsible development” of nanoscience and the nanotechnologies.

In support of risk assessment, the European Commission has asked the independent experts of its non-food scientific committees for scientific opinions, requested a scientific opinion on nano-food from the European Food Safety Authority (EFSA), and asked for an ethical opinion on nanomedicines from the European Group on Ethics.

After consultation with stakeholders, the European Commission has recently proposed a Code of Conduct for responsible R&D in nanoscience and the nanotechnologies. The European Commission plans to publish shortly a legislative review on regulatory aspects of nanotechnologies. Finally, the EU is funding a project on ‘Policy Approaches to Promoting the Safety of Nanotechnologies’.

Current EU food and feed legislation do not include specific provisions for products of nanoscience and the nanotechnologies, although it covers in principle potential health and environmental risks relating to nanomaterials. Firstly, in the EU, business operators cannot place unsafe food on the market and are responsible for their safety. Secondly, business operators using nanoscience and the nanotechnologies will more often than not modify their existing production process or incorporate new ingredients, creating a “novel” product according to EU legislation. Such “novel foods” require a safety assessment and a pre-market authorisation. So, as a rule of thumb, producers and distributors of nanoproducts will have to perform specific tests and submit pre-market authorisation applications for a simple reason. Europe wants innovation, but innovation with safety. \*Dr. Martin oversees nanotechnologies policy and coordination at the Directorate-General for Health and Consumers of the European Commission.

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