

Editorial

Genes & Nutrition: a new journal in a crowded arena

Just imagine the following scenario: a customer is at the entrance of his/her favorite food shop and slides a personal ID card into an optical reader. A special system connecting each shelf of each aisle of the supermarket with the customer's handy phone is activated, guiding him to the "right choice" of food, according to his health status and genetic profile. In fact, on the basis of a specific genetic set up and specific SNPs, our fellow knows that he is likely to develop atherosclerosis, possibly leading to stroke in his mature age. Therefore, his handy phone is beeping "good" in front of the dairy shelf because he is selecting low-fat milk (rather than "half and half") or beeping "bad" in front of the meat shelf, redirecting him towards the fish shelf. At the end of his food shopping, our character goes to the insurance company where, just before renewing his health insurance, an automated system checks his health parameters and compares them with the previous records, cross-checking with his food purchase/consumption data to evaluate whether the insurance premium has to be adjusted according to the updated individual risk of disease....

This picture is certainly very naive, but although resembling the worst fears of Orwell's "1984" it is not totally unrealistic. On the contrary, it is a sensible guess of what might guide our food choices in the near future. Whether we like it or not, chances are that this picture might become very familiar in the future decades. Recent advances in the study of the human genome have rapidly attracted the interest of health operators, who understand the potential consequences of such knowledge in light of the tight relationships between genetic set up and environment. Among the different aspects of what we define "environment", it is now evident that nutrition plays an important role in determining human health and diseases that go beyond the level accepted until the last decade. Several dietary components, nutrients and bioactive molecules have been recognized to modulate gene expression, directly or indirectly, thus significantly affecting signaling pathways (e.g. pro-inflammatory, proliferative, pro-apoptotic signaling) in sensitive genotypes. This can in turn significantly affect the onset and severity of a number of nutrition-related diseases, including atherosclerosis, obesity, diabetes and some types of cancers and neurological degenerations. It is therefore evident that nutrition is able to alter molecular processes and significantly modulate different metabolic pathways, finally resulting in the alteration of disease initiation, development, and progression.

The science of nutrition has been considered up to now a "classical science", with roots as ancient as the IV century B.C., when Hippocrates suggested that balanced nutrition could be a valid alternative to medicine in maintaining good health. Such an ancient patrimony of knowledge has now gained insights into its mechanistic basis, following decades of research that unveiled the role of nutrients and bioactive food components in the control of gene expression. Nutrition is not any more "just how to fuel the engine" but rather something much more complex and deeply entangled with the specific genetic features of living organisms. Nutrigenomic and Nutrigenetic approaches are the obvious consequence of these findings, driven by the technological progresses of high throughput methodologies in molecular biology.

We believe that there is a lot "boiling in the pot" of Nutritional Science. Very difficult tasks have been identified that underscore the importance of our editorial project. The appropriate diffusion of results is fundamental to allow synergistic activities of collaborating scientists in different research centers and in different countries towards the achievement of common goals. International collaborations are essential to meet goals that are far too complex for single laboratory studies. Creation of international nutrigenomics networks using web based tools that ease communication among participating laboratories is the topic of an article in this first issue of Genes and Nutrition, contributed by Jim Kaput and collaborators.

There are additional levels of complexity in studying and understanding the association between diet and health that must be carefully considered. Diseases, even in a pre-clinical, often undetected stage, can exert important effects on gene expression independently of the diet, which acts as a further confounding factor. It is now clear that the majority of nutrients acts as very weak signals and must be considered in the context of chronic, sometimes life-long, exposure. Better than others, nutrigenomic approaches have the potential to highlight the effects of very weak dietary signals, being able to detect modest nutritional deficiencies. For this reason they appear among the best tools to unravel the molecular processes that maintain health and prevent disease development.

Traditional nutritionists must understand the potential for molecular nutrition research and food industry people must be aware of the need of nutrigenomics to develop evidence-based nutrition. A journal can do a lot to reach these goals. We would like to contribute to summarize where we are at the moment. There are two major strategies in nutrigenomics research: one is the discovery of genome-wide dietary target genes and the elucidation of regulatory pathways affecting homeostasis at the level of the whole organism. A second one is the utilization of systems biology to identify molecular biomarkers of early changes in whole-body homeostatic control. The complexity of genotypes, diets, and their interactions looks less undefeatable than it appeared a few years ago. Large-scale projects such as the human genome project have already been successfully undertaken and provide a solid basis to be exploited to identify the genes that cause chronic diseases and the nutrients that regulate or influence their activity. Similarly, the identification of SNPs in genes relevant to nutrient metabolism and in those regulating their expression and activity will be of pivotal importance. The achievement of these targets requires large-scale human studies that, although still difficult and slow, due to the inherent costs and to the complexity of genotypes, are now possible to design. The costs of such research programs represent another important barrier to be conquered before nutrigenomics can express its full potential. Future investments in molecular nutrition research will be pivotal to assure success.

These points are of great interest for both academic and private research. The recent and important achievements in pharmacogenomics have made the importance of genotype-environment interaction increasingly evident. Pharmaceutical companies have been induced to incorporate genotyping as part of their projects for a better assessment of the real limits of safety, toxicity, and efficacy of their products. The identification of non-responding subpopulation groups is equally important for a better formulation of novel foods and food supplements targeted to specific clinical or pre-clinical conditions. Individual genetic profiles can affect nutrient assimilation, metabolization and storage, thus rendering the knowledge of individual responses to a specific nutritional environment extremely important. Taken together, these considerations point at the need to address nutritional requirements associated to optimal individual response at the “personalized” level (or at least at population sub-group level). Once these requirements are defined, an obvious task will be to optimize nutrient intake for each individual (or population sub-group) on the basis of genetic diversity. According to a “personalized” approach, nutritional needs of an individual have to be “adjusted” and modified during the life span to ensure maximum expression of each individual’s potential. This last objective opens an important concern on the need to ensure that nutritional genomic information is used in a socially responsible manner, particularly as it relates to health disparities in subpopulations, such as ethnic minorities, the poor, and the uninsured. Ethical issues raised by nutrigenomics research must not be underestimated, especially in terms of their economical exploitation. Indeed, we believe that the knowledge and any possible utilization of individual genomes opens doors to important ethical and practical consequences that must be taken into consideration by anyone directly or indirectly involved in the study of the association between genetic profile and risk of disease. For this reason we included in this issue a contribution by Ulf Gorman, an intellectual profile usually quite “far” from experimental sciences, a philosopher.

The issues outlined above are the major reasons why we decided to introduce a new journal in a field that could easily be considered overcrowded. There are in fact several “peer reviewed” journals holding the term “nutrition” either in their name or as one of their main topics of interest. On the other hand, a number of recently launched journals deal with genomic, proteomic and metabolomic approaches applied to different areas of research. Many of them are currently accepting and publishing increasing numbers of papers addressing the role of nutrients in

modulating gene expression and consequently in affecting the delicate balance between health and disease. Thus, we felt that this rapidly expanding field, as well as the deep relationship between nutrition and the expression of the genetic potential in human health and disease, required a specific editorial project. We found an independent and active publisher and recruited an editorial board composed of scientists of excellence in different fields of nutrition, ready to start this project, all sharing with us the aims and scopes (and the risks) of a new journal. This is how and why *Genes & Nutrition* was brought into being.

Briefly, the aim of *G&N* is to provide a recipient to publish and diffuse within the scientific community original research and review articles dealing with various aspects of molecular nutrition:

- Interaction between genes and nutrients or food components
- Transcriptomics, proteomics, metabolomics as related to nutrition
- Metabolic pathways affecting diet-related health risks
- Clinical nutrition in genetically characterized human sub-groups
- Genotypic analysis of population groups and nutritional supplementation
- Nutrients and chronic disease markers
- Metabolic effects of functional molecules in novel foods
- Molecular and cellular aspects of the function of genes and proteins relevant to nutrient metabolism

In addition to reporting research and technical improvements, we would like *G & N* to represent a space for debates on consumer perspectives, commercial policies, ethical issues, regulatory affairs and practical applications of nutrigenomics and nutrigenetics in the fields of “Personalized nutrition”, “Functional food development” and “Nutritional policies” targeted to specific population groups. The Journal is open to publication of the proceedings of symposia of special relevance to its aims and scopes and to debates on current topics and emerging issues in the field, and we will greatly appreciate any feedback and suggestions in this direction. It is quite an ambitious project. We are confident we will “hit the base”.

G & N will be published quarterly and our intention is to concentrate on monothematic issues. This first issue is almost entirely dedicated to review and research papers dealing with the molecular aspects of metal ions in nutrition. Micronutrients have been among the first food components for which a specific role was recognized in the regulation of gene transcription and /or translation several years back. Metal ion-dependent gene regulation has attracted increasing interest with the identification and characterization of several distinct genes and gene families involved in transport, storage and chaperone activities. The emerging picture is not yet complete, but it is now clear that complex mechanisms come into play to regulate the intracellular homeostasis of metal ions. But the real reason to start publication with this topic is unfortunately a sad one. This initial issue of *G & N* is in fact dedicated to the memory of a member of the Editorial Board, Professor Arturo Leone, who unexpectedly left us a few months ago, before even seeing the outcome of his editorial efforts. A brief sketch of his life is traced in this issue by his friend and colleague Stefano Bonatti, followed by review and original research papers contributed by scientists working in the field to which he dedicated his entire professional life. Most of them knew him personally; all of them share with us the grief of having prematurely lost his brilliant mind and his enjoyable personality. We wish to thank them all for their invaluable help in making this tribute possible.

Roma, Italy
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