Peter Brabeck-Letmathe

NUTRITION FOR A BETTER LIFE

A Journey from the Origins of Industrial Food Production to Nutrigenomics

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Peter Brabeck-Letmathe is Chairman of the Board of Directors at Nestlé S.A. He started his career at Nestlé in 1968 as salesman and product manager for icecream. From 1970 to 1987 he worked for Nestlé in Chile, Ecuador and Venezuela, later transferring to Nestlé's international headquarters in Vevey, Switzerland, where he took on worlwide responsibility for Culinary Products. In 1992 he was appointed Executive Vice President of Nestlé S.A. with worldwide leadership of strategic business groups while simultaneously being in charge of Marketing Consumer and Corporate Communications, and Public Affairs. In 1997 he was elected as a member of the Board of Directors and appointed Chief Executive Officer of Nestlé S.A., a position from which he resigned in 2008. Since 2005 he has been Chairman of the Board of Directors at Nestlé S.A. Peter Brabeck-Letmathe also serves as Vice Chairman of the Foundation Board of the World Economic Forum in Davos and board member of several companies.

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A Journey from the Origins of Industrial Food Production to Nutrigenomics

Translated from German by Ian Copestake

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FOREWORD

Prof. Dr. Patrick Aebischer

Less than twenty years ago, the UN Committee on Economic, Social and Cultural Rights (CESCR) defined the right to food. It is the "right of every individual alone or in community with others, to have physical and economic access at all times to sufficient, adequate and culturally acceptable food that is produced and consumed sustainably, preserving access to food for future generations". Availability, accessibility, adequacy and sustainability: a rather ambitious definition. And just when we, humans, define the right to food, scientists (notably the then chief UK scientist J. Beddington) predict that by 2030, the demand for food will increase by 50%, for energy by 50%, and for water by 30%, thus creating a '*perfect storm*' of global events. Today (2015) 793 million people still go hungry—down from 927 in 2007. We will need innovation, policy, and behavioral changes to fight this storm. Science and technology, universities and businesses must make a significant contribution.

Can the world population of 2030—that's 8.5 billion people—be fed equitably, healthily and sustainably? The good news is that hunger in its most extreme form has decreased globally from over 1 billion in 1990–1992, representing 18.9 percent of the world's population, to 842 million in 2011–2013, or 12 percent of the population. To meet future food demand, agricultural productivity must increase everywhere, particularly among poor farmers. Meeting this challenge requires continued innovation in food processing and packaging to deliver safe, nutritious, and affordable food. It requires reduction of waste and losses, improved crops tolerant to stress, pollution by smarter use of water, fertilizers and new pesticides. We must do it

all. The question is not whether productivity should be raised to address hunger and malnutrition. The question is how to achieve this. Increasing yields alone will not suffice.

We need a "greener" Green Revolution. The first Green Revolution technological package had a hefty environmental load. Now, a new vista focused on resilience and sustainability, and also wellbeing, is replacing—or adding to—the productivist paradigm. Solving this new equation requires integrative science, appropriate technology, farmers' knowledge and participation, a performing industry and informed consumers.

Today the world produces enough food for all to go without hunger. Yet hungry many are. On one hand, the source of hunger, is poverty: hungry families do not have the means to buy food. On the other, the culprit is the food system: today, one-third of produced food is eaten by pests or rots away. We need to make agriculture more efficient.

Medicine is moving towards the "4Ps", becoming a predictive, personalized, preventive, participatory medicine. Should farming not benefit from the same approach? Smart farming that integrates local knowledge, cutting edge science, appropriate technology, big data, farmers, smartphones, and businesses. Precision farming that leads to better yields through genotype improvement, exact fertilizer input, proper nutrient ratios, adequate irrigation schedules, geospatial techniques of soil identification, and appropriate mitigation of pests and diseases. Precision farming has the potential to reduce the use of external inputs and thus maximize resource efficiency.

Different forms of farming can and must coexist, our current awe for local organic farming notwithstanding. Strengthening local food systems needs appropriate investments in infrastructure, packaging and processing facilities, and distribution channels, keeping in mind that two out of three humans will live in cities by 2050. Two important strands of agriculture–genetic engineering and organic farming–will also have to be judiciously incorporated to help feed the growing population in an ecologically balanced manner.

Former UN secretary general Kofi Annan pledges to use digital technology to clear away one obstacle to progress for the hundreds of millions of African smallholder farmers: their profound isolation. Africa's smallholders are more than capable of feeding the continent if they are able to use the best agronomic practices. "Most have not adopted these improvements, however, because they don't know about them," says Kofi Annan; "using digital technology to reach smallholder farmers to help them organize holds out the potential for another agricultural revolution." The first Green Revolution increased productivity; the 'Green Data Revolution' will create a smarter, more flexible and resilient food system.

Precision farming incorporates appropriate knowledge and practices, and the green data revolution: this marriage of high tech and local improvements is one key to success. As a small, telling example, consider the initiative run by Nespresso and the non-profit organization Technoserve in South Sudan. The program enables farmers to set up cooperatives, raise funds, invest in infrastructure, and commercialize their coffee for export. It combines local *savoir-faire* and top notch technology. In less that two years, it facilitated the creation of three coffee exporting cooperatives in the south of the country, the first commercial coffee to leave South Sudan in over 30 years.

Food security and empowerment of farmers through science is one part of the story. Olivier de Schutter, the special rapporteur to the UN on the right to food, reminds us that the narrative of nutrition changed in a fundamental way when the UN launched its new Sustainable Development Goals in 2015. It moved from a sole focus on undernutrition alleviation and food security to one that includes food quality, equity and food systems, with a central focus on *malnutrition* in all its forms. Malnutrition is indeed a critical public health problem. It affects the most vulnerable populations: children, the elderly and the sick; individuals afflicted with disease, injuries, in social isolation or with limited resources. Malnutrition affects an estimated 30% to 50% of hospitalized adult patients in the United

States. According to the WHO, in 2012, two billion people lacked essential vitamins and minerals.

Are science and industry tuned to answer the challenge of malnutrition? One science-based response to malnutrition is nutrigenomics, the application of genomics tools in nutrition research to understand better how nutrition influences metabolic pathways, how "diet-regulated" genes are likely to play a role in chronic diseases, how nutrients affect people differently. Ultimately, nutrigenomics will lead to efficient dietary-intervention strategies. Industry plays a crucial role in delivering these individualized or group-specific products to the customer.

Nutrient needs should be met primarily by the quality of food. Food science and engineering do produce—or intend to produce—healthier foods. Yet processed foods are increasingly seen as problematic. We do not realize that almost all foods currently consumed are processed. The three pillars of our Greek ancestors–olive oil, wine, and bread–are all processed. We tend to forget the benefits of the modern food system: lower food losses, better preservation and availability, improved nutritional status, convenience and choice. To get the best nutrition, to fight malnutrition, we need all the tools we can get. Fortunately, food engineering is benefitting from the rapid convergence of nanotechnology, biotechnology, computer science and cognitive sciences, opening fascinating new avenues. These include food structuring, package engineering, digestive system simulation and modeling, understanding the bio-availability of nutrients, the mechanisms of satiety and the role of genetic predispositions.

Food engineering is also driven by a number of major food companies. Large company research centers have created an environment in which food research is cutting edge. Food science is one field where universities and industry need each other. Research in nutrition seems pointless if we cannot deliver it to customers and patients; it requires highly qualified human resources and expensive equipment, typically located at universities. Moreover, food science creates plenty of qualified jobs. Indeed, the best food science should

embrace universities, industry, *and* the art of cooking—chefs—, because food is more than just its components.

Nutrition engineering can boast many successes, the "super broccoli", oligosaccharide prebiotics and Lactobacillus acidophilus probiotics in yogurt, whole grain–rich foods, low-gluten foods, foods without allergens and smaller portion packages. Despite this, nutrition engineering is often viewed as ''nutritionism'', the simplistic reduction of food to its nutrient components, and unfavorably compared to "whole foods". While mishaps litter the history of processed food—such as low-saturated, high-trans fatty acid cooking oils—the global attack on processed food is unwarranted. As chef Anthony Warner says, "Food is not good for you based on where it was produced. Nutritional value depends on what the food consists of. ... Natural does not necessarily mean healthy, processed does not necessarily mean unhealthy. We should love fresh food and cooking from scratch, but we should love facts even more. If we, scientists, politicians, health professionals, journalists and chefs continue to distance ourselves from all convenience food, we will distance ourselves from real, time-poor consumers and never change a thing".

I commend Peter Brabeck for a timely book. It is a time of increasing challenges to food system resilience, of the indispensable juncture of the health and sustainability agendas, on the verge of a data-enabled revolution in agriculture. His unique insights are a valued contribution to this most important challenge of our century, feeding nine or ten billion people equitably, healthily and sustainably.

INTRODUCTION

The greatest human desire has always been to lead a healthy and long life. To date, we have already brought this goal a lot closer. Since the mid-19th century, the health of broad social groups in the US and in Europe has improved significantly. The average life expectancy of newborns doubled in both Britain and Germany from 41 and 37 years respectively in 1871 to 80 years in 2015, while in Japan this has now increased from 37 to 85 years.[1] Worldwide, life expectancy in 1820 was 26 years[2] and in 2013 it was 71 years[3].

This development is a crucial part of the result of ever improving nutrition. Only industrial production of food and logistics have provided a sufficient amount of inexpensive, nutritious high quality and risk free food for the broad mass of populations in the cities and the countryside. Medicine has also made parallel advances in the fight against infectious diseases and in the area of hygiene that can be compared with those in food production.

Meanwhile, not only in the US and in Europe, but also in many other parts of the world an affluent society has emerged. By 1996, a clear relationship between the amount of available calories and increasing life expectancy could be detected in highly industrialized societies. The number of calories available has since risen further, but the life expectancy curve has leveled off.[4]

In the last decades, the quantitative growth in food production has not brought people in Western affluent societies any additional benefits. Diseases of affluence such as cardiovascular disease, diabetes and obesity have reached epidemic proportions, and the risk

of developing Alzheimer's disease increases with each year that we get older. For food manufacturers, this means refocusing and generating knowledge of products with new properties, which reach far beyond the replacement and reduction of sugar, salt and fat in food.

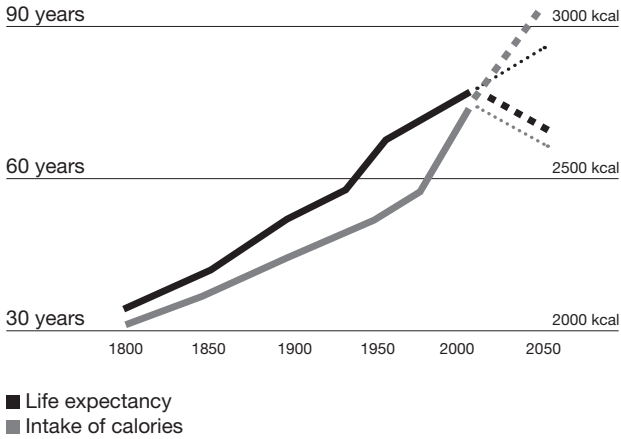

Fig. 1: Correlation between life expectancy and intake of calories

Even in ancient times people were aware that there is a relationship between diet and health. For centuries this realization was the most important foundation of medicine. Medical knowledge was based almost exclusively on observation. Because simply too little was known about the functioning of the body, false and ineffective treatments and recommendations were the rule rather than the exception. To date, there are doctrines that promise a long and healthy life, without being able to provide reliable evidence for their accuracy.

In fact, due to the progress in the various fields of research in the life sciences, the relationship between diet and health has been put in a completely new light. If we change our habits in a similar manner, we can already optimize our health sustainably and prevent certain diseases. The potential is still far from exhausted.

Therefore, the issue of health in the coming decades will trigger a wave of innovation in the food industry. Its advanced technology will play a crucial role in improving the health of entire population groups. The role of science-based personalized health nutrition in the future is to find efficient and cost effective ways to prevent and treat the acute and chronic diseases of the 21st century.

The key messages of the book are summarized in six theses that follow this introduction.

The first chapter begins with the consumers and the question of which diet trends will determine the future, what trends we had in the past and how they were intertwined with the general social developments and changes. This is followed by a consideration of changes in food production, taking account of consumer needs, environmental considerations and resource conservation. The third part of the first chapter offers a first look at the new sciences, which are gathered under the umbrella of the Life Sciences.

The concept of industrial production has been linked positively to many everyday products such as cars or computers. Even products from the entertainment industry are highly appreciated. Compared to this, the food industry has found it more difficult to be perceived positively in today's society.

In the second chapter, I therefore want to take a mental journey through time to show the contribution of the food industry to the progress of humanity, and show the potential future challenges for this industry.

The third chapter will take stock of the present situation of world food, by focusing on overall social development and change.

Food research is discussed in chapter four. Their findings gain much attention in the media and among the public. But many researchers are content to confirm already existing findings and recommendations. Others enter into a competition with their scientific colleagues and try to outdo or disprove them through the publication of ever more shocking reports. At the end the consumer is left completely unsure by the flood of information alone. Therefore, I

turn in the fifth chapter to the responsibility of the food industry, while in the sixth and seventh chapters I deal with the responsibilities of policy makers and the individual. Chapter eight provides an outlook on future developments.

In this book, I attempt to look into the future. Not in the form of speculative science fiction, but on the basis of what is being researched today. The research results will be available in a few years and could revolutionize food production to the extent that we come closer to the realization of the human dream of a healthy and long life. We should not miss this opportunity.

For those who want to learn more about the background and other areas of my ideas and actions, I recommend they read my biography (Friedhelm Schwarz: *Peter Brabeck-Letmathe and Nestlé–a portrait. Creating value together*, Bern of 2010). Information on the WHO guidelines on the subject of sugar, salt and fat can also be found in the appendix.

Peter Brabeck-Letmathe
Vevey/Schweiz, September 2016

THE FUTURE OF FOOD— PERSONALIZED, SCIENCE-BASED, RESOURCES EFFICIENT, CARING

1. The challenge

We all desire a long and healthy life. This requires in the future basic dietary changes: a healthy diet for a growing world population can only be ensured if new scientific knowledge becomes part of the production of foods, if the lifestyle of people is oriented toward the goal of a healthy, long life and with a food system efficiently using natural resources.

2. The model

There will not be a uniform approach to healthy eating for everyone, but rather a personalized diet for different population groups. These differences may be either of a genetic or epigenetic nature, based, for example, on age or dependent on the specific life situation.

3. The responsibility of science

The Life Sciences will provide knowledge on a completely new basis with regard to the relationships of biological functions in the human body, nutrition and health.

4. The responsibility of the Food Industry

On the basis of the scientific knowledge of the life sciences, the food industry is developing products and services for a personalized diet for different populations. It provides these services to preserve resources and be socially beneficial for the greatest possible number of people.

5. The responsibility of politics

Social systems and health systems have to be changed from the treatment of existing diseases to the precautionary prevention of diseases. An open market must enable an efficient allocation of resources and comprehensive innovations.

6. The responsibility of each individual

People need to aspire to a new holistic quality in their personal lifestyle and diet and be supported by educational institutions, the media, the producers and processors of food and the food trade.

CHAPTER 1:
ON THE WAY TO NUTRITION OF THE FUTURE

The reasons why we will feed ourselves differently in the future, is due to the results of scientific research, the manufacture of food and of course constantly changing consumer behavior. Worldwide, consumers will change their behavior and habits in the next 20 years much faster than was the case in the past 60 years. This is due to growing wealth and knowledge and the fact that we are already have technical possibilities in food production that were unthinkable a few decades ago.

However, increasing prosperity not only brings improvements but, as experience shows, even problems. It is not only the companies that have to face the challenges of globalization, it is also every individual who must adapt to global changes and while this is indeed experienced mostly as an advantage it can sometimes be a disadvantage.

Industrial manufacturers of food products are on the one hand expected to supply the ever-growing world population, while on the other hand they have to satisfy the consumption needs of increasingly differentiated consumer groups. 60 years ago, the challenge for the food industry was mainly to produce more and better. Today they must additionally meet an extensive list of demands in terms of sustainability, resource conservation and environmental considerations. They not only do this because of a call by consumers and the politics behind them, but because they have also learned themselves to recognize that growth today in terms of security for the future de-