



## Final Statement of the Workshop on "Bread and Brain, Education and Poverty"



### **The Complexity of the Problems**

Hunger and childhood undernutrition remain a scandal in a world that could produce and make accessible enough healthy food and nutrition services for all.

Hunger violates human dignity. New insights suggest that nutritional deficiencies severely reduce cognitive capacities. The poor not only suffer from hunger, but their future potential is also undermined, and deficient education services further contribute to unfair exclusion. Related problems are worst in poor rural areas and in urban slums, which house over 1,000 million people that live in most adverse circumstances and in poor sleeping conditions that amplify health- and education-related problems.

Given the challenges, a working group was formed in the Pontifical Academy of Sciences by an unusually diverse assembly of scientists, coming from fields such as agriculture, biotechnology, nutrition, brain research and neuropsychology, public health, economics and education. The working group noted the state of nutrition and education problems and identified a set of actions.

### **Understanding the Relationships among Nutritional Problems, Cognitive Potential, Education, and Health**

The problem of hunger (deficiency in calories) is firmly established on the political agenda and reduction of hunger is one of the Millennium Development Goals. Nevertheless, "hidden hunger" (deficiency in micronutrients such as iron, zinc, iodine, and vitamins – in particular vitamin A, D

and folate) is not yet widely recognized as a central problem and does not receive the political support it deserves, considering the magnitude of this public health problem affecting about 2,000 million people.

Deficiency in micronutrients is a major cause of many of these negative consequences on brain development, with all their dramatic and unfair social consequences. There was broad consensus that micronutrient deficiency also interferes with brain development and mental capacity building, and that damage is especially severe within the first thousand days from conception. Interventions to prevent hunger and hidden hunger are, therefore, critical during pregnancy and early childhood.

Based on emerging scientific insights and new technologies, the working group identified opportunities to improve food and nutrition. Actions were reviewed to counter the adverse effects of nutritional deficiencies to prevent related early neuronal damage, targeting not only nutritional needs but also providing affection and emotional and cognitive stimulation for healthy mental development and a sound education.

### **Recognizing the Inadequacy in Educational Services**

“Bread and Brain” problems are most visible in the plight of education. Millions of children are excluded from education and are not receiving their fair share of available knowledge or a sound pedagogic approach to the values of truth, goodness and beauty that make us human and that should support the new generations in a globalized society. The Millennium Goals will not be attained if we don’t take a great leap forward and create new pedagogies that can reach even the most remote and deprived areas of the world.

### **What can be done? Priority Actions for ‘Bread and Brain’**

Successful programs already in place were presented and discussed in detail by the working group, including actions for improved micronutrient nutrition, new digital technologies for use in poor and isolated communities, and early age and child immigrant education, as well as better shelter for poor neighbourhoods. The working group felt that such actions need to be combined in order to achieve the required synergies.

We want to share our conviction that hunger, malnutrition and extreme poverty can be overcome by 2030, if appropriate scaling up of joint efforts is combined with application of the best technologies available.

We noted that addressing food and nutrition security comprehensively requires an agenda for productivity, well-functioning markets, and social protection with direct interventions to facilitate improved nutrition. We also received an overview of the efforts of the International Agricultural Research Centres to keep up with increasing demands for nutritious food.

We learned about the Copenhagen Consensus – a think tank of economists – that identified the

most profitable investments of available financial resources, along with the highest possible development impact for improving micronutrient availability. Of the various possible interventions for that purpose we noted the established potential of interventions by “supplementation” (supplying the missing micronutrients in optimized formulations of minerals and vitamins as a substitute for an incomplete diet), which need substantially more support.

Many poor, however, are out of reach for such interventions and depend predominantly upon starchy staple crops. These are excellent calorie sources, but are unfortunately very poor in micronutrients. An ideal “diversified” diet consisting of animal products, fruits and vegetables in addition to energy-rich staple crops is not accessible to hundreds of millions of poor. Therefore, we found the novel concept of “biofortification” – the genetic enhancement of micronutrients in staple crops – very promising, where data have become available demonstrating the efficacy of this concept, such as the enhancement of provitamin A in Sweet Potato.

We reviewed and discussed the prominent role biotechnology can play to enhance biofortification, such as the example of “Golden Rice” which, in half a cup of rice, provides the missing vitamin A that normal rice does not contain. Lack of vitamin A, for example, leads to blindness and an impaired immune system, causing 500,000 children to be blind and 2 million deaths. Iron deficiency, a problem for ca. 3,000 million people, not only leads to anemia but impairs brain development and has a strong negative effect on intellectual, cognitive and mental capacity with all their social consequences. Deficiencies in vitamin A and D may also have a negative impact on brain development.

The real opportunity offered by plant biotechnology, however, is often blocked by anti-GM initiatives and over-regulation, both of which prevent its proper utilization. In the interest of those suffering from micronutrient deficiencies we call for support of research exploiting the potential of biofortification for public good, and for education and political support for the deployment of biofortified crops by farmers, which can benefit the poor.

Provision of micronutrients is absolutely essential for embryonic development, starting at the time of conception. During this period the only source of micronutrients is the pregnant mother. This strong dependence continues after birth for as long as the mother breastfeeds her baby. However, if the mother’s vitamin stores are depleted due to poor nutrition or frequent pregnancies with a short birth interval, breast milk can become a rather poor source. Reliable provision of micronutrients is, therefore, of outmost importance for pregnant and lactating mothers.

We examined how the adverse effects of deep, concentrated poverty and stress factors compromise brain function, especially in the critical areas of language, executive function, and declarative memory, but also noted that, with positive reparative environments, certain brain functions can be recovered.

In low-income countries there are 72 million children with no schools, and 793 million human beings who cannot read. For these children new technological tools are promising, and information and communication technologies can make a strong contribution to improve educational opportunities, for instance by providing these children with computers.

In order to promote good, early childhood education it is crucial to overcome the sad reality of “poor schools for the poor” observed in many countries and to improve the basic professional training of kindergarten and primary schools directors and teachers around how to address the special needs of children in disadvantaged socio-geographic contexts.

In some contexts, children may take on new roles as teachers, as the place of learning migrates from “formal schools” to other contexts, etc. This is an area ripe for careful interdisciplinary empirical research and intervention.

Investments in early childhood education must be mindful of nutrition and environment, maternal literacy and ongoing teacher education. Once children enter the primary grades, school leadership (teacher/principal) and investments in school facilities have been found to make a difference.

### **What do we hope? Conclusions**

The PAS working group concluded that, while food and nutrition security is a complex issue, there are sound context-specific opportunities to accelerate action. The consequences of nutrition deficiencies for human cognitive capacities must no longer be overlooked, but must motivate us to much faster and more significant actions that combine agriculture with nutritional interventions and innovations in education.

### **Outlook**

The situation urgently demonstrates the need for a new way to bring all science communities related to food and nutritional security together in a permanent international platform for evidence-based advice to policy-makers and society.