



Editorial

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Preliminary remarks

During the 400 years of its existence, the Pontifical Academy of Sciences has carried out its statutory goals by employing various approaches. In the words of its 1976 reformed Statutes, it 'organises meetings to promote the progress of sciences and the solution of important scientific problems...and promotes scientific investigations and research which can contribute, in the appropriate places, to the exploration of moral, social and spiritual problems'.

Inspired by this idea, in October 1982 the Pontifical Academy held a Study Week on Modern Biological Experimentation. In this meeting, Professor J. Schell gave a paper on *Gene Transfers into Plants as a Natural and Experimental Phenomenon*. On this occasion, John Paul II addressed the participants with these words: "I wish to recall, along with the few cases which I have cited that benefit from biological experimentation, the important advantages that come from the increase of food products and from the formation of new vegetal species for the benefit of all, especially people most in need". The Holy Father John Paul II, who was well aware of what Paul VI called the tragedy of world hunger, concluded his message by asking God "to direct the application of scientific research to the production of new food supplies, since one of the greatest challenges that humanity must face, together with the danger of nuclear holocaust, is the hunger of the poor of this world". Encouraged by the Pope's message, in the Jubilee Year 2000 the Academy drafted its first Statement on Genetically Modified Food Plants to Combat Hunger in the World, which

was then published in 2004. Ten years after this first Statement, the Council of the Academy, led by myself and counting on such authoritative members as Ingo Potrykus and Peter Raven, decided to update it with the meeting we are presenting in this volume. It is particularly significant that the new Statement was then signed by all the participants. It is our hope that this new effort will serve to clarify an issue which can undoubtedly and decisively contribute to solving the growing problem of world hunger.

The general view

Individual life times and population densities of any kind of living beings depend to a large extent on the availability of food, or in other words on food security. In archaeological times, humans found their nutrition as gatherers and hunters. About 10,000 years ago, our ancestors started to collect seeds and other plant materials from their preferred food plants. Agriculture then took its start by deliberate planting of the collected materials, growing the new plants up and harvesting their products. This neolithic or food-producing revolution must have taken place independently at different locations on the planet, both in the Old and in the New World. This cultural development allowed the human population to transform from small local or migrating tribes to larger, often resident communities which eventually developed into technologically advanced nations. A number of factors including food security contributed at various stages of this development to limit the ongoing population expansion.

A wide geographic exploration of our planet in the last millennium led stepwise to beneficial exchange of agricultural crops between continents of the Old and the New World. For example, Europe profited tremendously from

the introduction of potatoes, tomatoes and maize from the Americas, while the New World introduced wheat, barley and rice, among other agricultural crops, from the Old World. None of these mass implantations led to serious ecological problems. As a result, food security generally improved and allowed the human population to continue to grow.

For a long time, agricultural management improved food security stepwise, largely through learning by doing and by learning from each other. Breeding methods became introduced and led to the selection of agricultural crops with higher yields and sometimes with higher nutritional values. It is mainly in the last century that increasing scientific knowledge and science-based technologies started to contribute to the improvement of food security, at least in parts of our planet. The green revolution boosted this development.

In the meantime scientific knowledge has tremendously increased, largely by the introduction of novel research strategies. Genomics, proteomics and metabolomics provide us with a rich scientific basis to understand better the sources and nutritional values of the products of many of our common food crops. In addition, research strategies, such as genetic engineering, have become available and can allow one to attempt experimentally to improve nutritional values and yields of food products. Site-directed mutagenesis of inherited genetic information and recombinant DNA techniques introducing carefully selected foreign genetic information into the genome of an agricultural target crop have recently become routine methodologies to reach envisaged improvements. Thanks to the set of actually available research strategies, selected products

of such improvements can be assessed for their genetic setups and functional phenotypes before their introduction into the environment. In contrast to earlier practices, such as conventional plant improvement methodologies, today's molecular biological research strategies can confidently allow the researcher to obtain the envisaged genomic and functional abilities without introducing other, unexpected alterations into the developed product. There is no justification to assume that

carefully carried out and controlled genetic engineering would principally go along with conjectural risks. Rather, molecular methodologies provide to the researcher highly secure and responsible approaches to improve crop properties such as higher nutritional values and improved health of the plant itself.

The good news given here can contribute to render agricultural practices more secure and also more sustainable. We must be aware,

however, that the carrier capacity for agricultural crops is limited on our planet. Any longterm improvement of worldwide food security has to go hand in hand with a responsible and sustainable parenthood, together with the safeguard of the naturally given rich environmental diversity.

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