

worthwhile; the remainder of the conference was chiefly concerned with reporting progress towards achieving those aims.

In the basic sciences considerable advances have been made. The major protein components of seeds are the storage proteins present in protein bodies. These are deficient in lysine in cereals and in sulphur amino acids in legumes. Although there are considerable differences between the storage proteins of legumes and cereals, in both cases they seem to consist of polymorphic families of related polypeptides. In maize, wheat and barley the putative structural genes have been located on various chromosomes and some mapping carried out. Success with *in vitro* synthesis of legumes and cereal storage proteins has been achieved in a number of laboratories and some mRNA has been isolated and cDNA prepared and cloned. These studies should provide a better understanding of the basic mechanisms of protein accumulation in seeds and offer the potential for use of genetic engineering techniques; some of these techniques were discussed in the context of future programmes.

Both as a direct result of the FAO/IAEA programme as well as of studies funded by other agencies, high lysine genes have been found in maize, barley, sorghum and possibly wheat and millet. The current status of the genes in the first three crops was reviewed. Although some progress has been made in understanding the nature of these mutations by determining their chromosome location little is yet known about their biochemical basis other than that the synthesis of the storage proteins is depressed. More information is required as to which of these genes offers the possibility of providing both high quality and high yield. So far the most promising breeding work seems to have been done in sorghum in which yield is not greatly affected, since the smaller size of the high lysine grains is balanced by increased seed number. Very promising results were also reported from CIMMYT, where the use of various modifying backgrounds have led to greatly improved *opaque2* lines of maize. Although some success has been made with the *Hipoly* gene in barley the lysine content of the lines seems to decrease as yields improve. Besides having normal yields new lysine varieties also have to be accepted by the consumers and meet the normal agronomic requirements, such as disease resistance. Although these criteria have not all been met it must be realised that plant breeding takes a long time and it is necessary to be patient. Some idea of the patience required was demonstrated by the

results of the Nebraska programme of high protein wheat breeding which had been in progress for 20 years before the release of the first variety in the US. This variety, which is now finding acceptance on the basis of its general properties, combines increased protein content and high yield.

In legumes the problems are more concerned with yield and protein quality than with protein content. In a critical and forceful talk H. K. Jain (Indian Agricultural Research Institute, New Delhi) pointed out the large amount of selection pressure and breeding that had been exerted on the cereals in comparison with the legumes. Legumes are not poor in total biological yield but insufficient of it is recovered in the harvested seed. Considerable success has been achieved through mutation breeding and recurrent selection programmes in obtaining improved ideotypes of several legumes with a much better harvest index. As regards protein quality, the problem is to improve the amino acid spectrum of the seed protein as well as to decrease the content of the various adverse nutritional factors present in legume seeds.

The conference ended with a review of the technological aspects of plant use and the role plant breeding and

biochemistry has played and must continue to play. Implicit in this must be an increased realisation that weight of produce alone is not enough and that a direct measure of productivity involves an assessment of the quality of the produce and the uses to which it can be put. When the work reported is viewed as a whole it represents a considerable success particularly in the time frame normally required to bring about stable genetic change and to select improved varieties of crop plants. It is therefore particularly disappointing that this programme is not being renewed with increased funding but, at best, will only continue in a limited way with funds from the Governments of the Federal Republics of Germany and of Sweden. Despite the fact that man's major necessity is food, all of which is ultimately derived from plants, the Plant Sciences remain amongst the Cinderellas, poorly funded and unfashionable. The FAO/IAEA programme has shown what can be done with a fraction of the funds spent on such grandiose technological playthings as supersonic travel. □

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A hundred years ago

M. BOUILLAUD, the once celebrated medical practitioner, who is a member of the Paris Academy of Science, assailed M. du Moncel in the sitting of September 30, and asserted that the phonograph and microphone experiments must be the work of ventiloquists. This fit of incredulity was occasioned by the recital of experiments made with the singing conductors. M. du Moncel asked for a commission of investigation to be appointed, although such accusations are not deserving of any notice, and have, indeed, raised universal ridicule. But the regulations of the Academy forbid any commission to be appointed to pronounce on the works or communications of members. Another curious scene took place at the sitting of last Monday. M. du Moncel presented to his colleagues, the "condensateur chantant," which had been

exhibited on the previous Saturday. He retired to the room of the Académie Française, in company with M. Faye, closed the door and sang. His voice was heard coming from a number of sheets of paper, in which six sheets of tinfoil had been inserted, and connected with the wires of an induction coil. M. Bouillaud was obliged to retreat from the position he had taken at the sitting of September 30. He made no allusion to the accusation of ventriloquism, but read a long quotation from Descartes, to show that "even if a speaking machine had been constructed, it could by no means be considered as a thinking machine." He said that speaking was not only a mechanical action, but also an intellectual work, so that neither the phonograph nor the singing condenser could be regarded by any means as really speaking! The whole assembly, in spite of its usual gravity, burst into roars of laughter. M. Milne-Edwards, who spoke at the previous sitting, said with much propriety, he should not have answered M. Bouillaud if he had understood such was his issue. Unfortunately he had understood, as everybody in the assembly did, that M. Bouillaud questioned the honesty of the experimenter.

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