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Special Lectures on Agricultural Biotechnology, by Mauricio Antonio Lopes

Sustainable development is one of the most challenging goals for mankind, and a vital challenge for agricultural production around the world. Over millennia agriculture has evolved from extractive activities and subsistence production to an intensive agroindustry based on modern technologies and, in many instances, disorderly territory occupation and non sustainable utilization of environmental resources. The tendency is for the pressure of agricultural systems over the environment to intensify in the future due to the growing world demand for food, fiber, feed and renewable fuels. And in many parts of the world the pressure for further growth and expansion of agricultural production is incompatible with the time and effort needed to steer it toward more sustainable models. Also, climate change will impose additional stresses to many delicately balanced agro-ecosystems, especially in tropical areas, where significant intensification of biotic and abiotic stresses is expected in the next decades. It threatens to reverse the gains made in the past and to impose severe limitations on future gains the research community could achieve, using conventional methods and tools. Therefore, it is not reasonable to expect that technological progress based on conventional innovation strategies will allow the world to take important leaps toward increasingly safer and sustainable agricultural production systems in a short period of time.

Creative strategies to use advanced technologies, coupled to conventional approaches, are much needed as means to addressing current and emerging problems and opportunities for agriculture. The genomics revolution of the past decade has dramatically improved our understanding of the genetic makeup of many agriculturally important species. Together with the achievements represented by complete genomic sequences, high-throughput and parallel approaches are available for the analysis of transcripts, proteins, pathways and, more importantly, to help extract useful variability from the wealth of resources stored in our germplasm banks and in untapped resources of biodiversity. New genomic technologies coupled to breeding approaches bring opportunities to reduce the impacts of biotic and abiotic stresses on crop productivity and to improve safety, nutritional quality and functionality of agricultural products. Also, new tools to uncover and to handle genetic variability provide the opportunity to channel into the breeding process many new species with underdeveloped genetics. There is no better time to adapt and adopt a new paradigm of gene discovery to tailor biological processes towards overcoming the barriers that will limit agricultural production in a world pressed by increasing environmental challenges.

Also, the sophisticated technical basis and the general nature of modern biotechnology are enabling the development of a wide range of products and processes, creating a new industry and influencing the direction of the global economy. The food, pharmaceutical, chemical, health, energy and information industries are becoming bundled in ways never before imagined. The tremendous advances in the life sciences are making the boundaries between traditionally distinct businesses increasingly fuzzy, as disciplinary integration and convergence generate what promises to be one of the largest industries of the future - the bio-industry. Production of renewable energy, raw materials and bioactive molecules for various industries promise to extend the range of usefulness of biological systems, creating opportunities that will place agriculture among the most sophisticated industries of the world.

As expected, policy oriented research is becoming increasingly important as agricultural innovation interfaces with rapid developing, cutting edge sciences. It is growing the understanding that policies, laws and regulations will be key factors underlying the development of agriculture and bio-industries in the future. Issues related to access and use of advanced technological tools and processes, as well as of biological resources, have acquired political, social, economic and legal dimensions. Therefore, innovation programs that depend on access and use of such components will increasingly depend on better understanding of policy and legal issues related to their mobility and accessibility, taking into account developments in both, international and national contexts.

Reading Material:

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3. Cameron, N.M.S. and Caplan, A. (2009). Our synthetic future. *Nature Biotechnology*, Volume 27 number 12 december 2009.
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