



## Report: EPSO Biofuels Workshop

The Royal Society, Carlton House Terrace  
London, UK

28-29 May 2008



This workshop, the fourth in the series of EPSO workshops, was focused on bringing together scientists, industrialists and funding agencies to discuss current developments in bioenergy research. The outcome of the meeting will be a white paper, developed by EPSO scientists, which will help to integrate research in this field in Europe and promote plant science relevant to bioenergy production. EPSO is grateful to Syngenta, SweetTree and the Porter Institute for co-sponsoring the meeting.

Nearly 50 delegates attended the workshop. They represented the key disciplines involved in establishing a viable bioenergy research and development sector in Europe, including chemical engineering, microbiology, economics and social science, plant science, and industry. This broad representation of the different disciplines was an important factor in determining the success and influence of the workshop.

Richard Templer (Director, The Porter Alliance, Imperial College) described how critical integration across multiple disciplines is for successful bioenergy research. Plant production must be optimised with respect to energy inputs and highly efficient conversion of biomass. Conversion processes such as fermentation must be optimised for optimal conversion of feedstock to useful products, which must then be optimised for different end uses as mixtures for motor fuel, additives and chemical feedstocks. In turn, internal combustion engines need to be re-designed to run on different formulations with unprecedented fuel efficiency. All of these activities must be held together within an over-riding framework of sustainability and economic competitiveness. Nilay Shah, a chemical engineer, and Jeremy Woods, an economist (both from Imperial College) described in more details these aspects of the bioenergy chain. Of particular interest were the systems-based analyses of sustainability at global and at local levels. These studies addressed centrally important issues such as the availability of land, access to production inputs such as water and sunlight, and global trade. A somewhat surprising (at least to the growing band of opponents of bioenergy research) is that there is sufficient land available for cultivating bioenergy crops, and the potential of lignocellulose production and conversion can meet a substantial proportion of transport fuels.

The meeting focused on two potential bioenergy feedstocks: the so-called "first generation" feedstocks oils, starch and sugars, and the "second generation" feedstock lignocellulose.

It was clear that first generation feedstocks needed to be developed to meet current objectives in Europe. Peter Williams (ABAgri, Leeds) described how co-production was an essential component of ethanol production from wheat grains. Starch is fermented to EtOH, fibrous material is processed to ruminant feed, and the protein rich fraction is used for non-ruminant feed. Ian Graham (CNAP, York) described their exciting progress in developing genetic resources for *Jatropha*, an undomesticated bush producing very high levels of seed lipid. It is predicted that, by 2015, 13 million hectares will be cultivated, so there is an exceptional opportunity for improving yields still further.

Progress in developing Poplar, Willow and Miscanthus as sources of lignocellulose was described in three outstanding talks. Michele Morgante (Udine) and Gail Taylor (Southampton) described their progress in developing resources for association genetics in poplar. This will allow the extensive germplasm to be exploited and genes to be identified. In the closely related willow, a crop more specifically suitable for growth in Northern Europe, Angela Karp (Rothamsted) described their breeding populations and selected lines that exhibit stunning yield increases. Iain Donnison

(IBERS, Aberystwyth) described similar advances in the temperate C4 grass Miscanthus. The development of genomic resources for mapping and gene isolation is a high priority in these crops. In the USA maize starch is the current biofuel feedstock, but major progress in developing maize lignocellulose as a feedstock was presented by Simon Warner (Syngenta, RTP). He described how expression of a fungal cellulase in the plant in compartments where it is inactive enabled large increases in saccharification efficiency. As cellulases and other added enzymes represent the main cost in current fermentative conversions, this represents a major step towards efficient use of an abundant source of feedstock. Steve Long (University of Illinois, Champaign-Urbana) described the extensive efforts mobilised in the USA to develop lignocellulosic feedstocks at the BP-funded Energy Biosciences Institute. His presentation described 4 approaches to lignocellulosic feedstock development and gene discovery for decomposition. Underlying all of the projects was the need to increase sustainably feedstock yield. Miscanthus and other C4 grasses are key targets for improvement in his programme.

In his introductory talk Alfredo Aguilar (European Commission, Brussels) described the energy policy of the EU and the key role of the renewable energy sector in meeting the political objectives of 20% renewable by 2020. In this scenario, energy efficient biofuels will play a key role. To support the necessary R&D he provided information on a joint call foreseen for research proposals to develop integrated biorefineries in early 2009. This sets the scene for integrating research activities across Europe.

The workshop was very timely and the speakers described exciting contemporary progress. The ambience of the Royal Society added significantly to ensuring the success of the meeting.

Mike Bevan

5 June 2008

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