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Introduction to Session 1A: Feedstock Genomics and Development

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Genomics research aimed at improving bioconversion properties of feedstocks received a major impetus as a result of the Feedstock Genomics program jointly operated by the U.S. Department of Energy (DOE) and the U.S. Department of Agriculture (USDA). In addition, oil company BP established the Energy Biosciences Institute in collaboration with the University of California-Berkeley, Lawrence Berkeley National Laboratory, and the University of Illinois in Urbana-Champaign. This was followed later on in the year by the establishment of three DOE-funded bioenergy centers. The need to switch from petroleum-based duels to biofuels was underscored by the report of Working Group II of the United Nations-sponsored International Panel on Climate Change (IPCC), in which the wide-spread effects of greenhouse gas emissions on the global climate were presented. IPCC and former U.S. vice-president Al Gore received the 2007 Nobel Peace Prize for their efforts to quantify and disseminate the effects of global warming.

The presentations in Session 1A reflected this new impetus, as evidenced by two oral presentations from recipients of USDA–DOE funding, Dr. William Rooney (Texas A&M University, College Station, TX, USA) and Dr. Rick Dixon (Noble Foundation, Ardmore, OK, USA). Dr. Rooney discussed his research on the development of sorghum for bioenergy production. Photoperiod-sensitive sorghums do not transition to the reproductive stage and can produce large amounts of biomass, as high as 27 Mg ha^{-1}. He also discussed genetic approaches to identify genes controlling sugar accumulation, cell wall composition, and biomass production in sorghum. Dr. Dixon presented his research on the transgenic down-regulation of monolignol biosynthetic genes in alfalfa. Conversion of alfalfa biomass appeared to be primarily dependent on lignin content as opposed to lignin subunit composition. The down-regulation of some of the genes resulted in a noticeable reduction in the total amount of biomass, an undesirable side effect. The impact of lignin content and composition was also discussed by Dr. William Anderson (USDA, Tifton, GA, USA), Dr. James Coors (University of Wisconsin-Madison, WI, USA), and Dr. Gautham Sarath (USDA, Lincoln, NE, USA) in their presentations on Bermudagrass, maize, and switchgrass, respectively. In maize, lignin content appeared to impact biomass conversion

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properties, just like in alfalfa, whereas in Bermudagrass and switchgrass lignin subunit composition appeared to be a more critical factor.

The need to establish reliable methods for the evaluation of biomass conversion properties was expressed in several of the presentations. Methods that were originally developed for the analysis of forage quality seem to provide a reasonable approximation of biomass conversion potential in some species (maize), but not in other species (Bermudagrass). Ms. Michelle Serapiglia (SUNY-ESF, Syracuse, NY, USA) discussed how thermogravimetric analyses may be applicable to determine lignin content and composition in shrub willow. The oral session was concluded with a presentation by Dr. Steven Thomas (Ceres, Inc., Thousand Oaks, CA, USA) on ways in which genetic diversity in switchgrass can be catalogued and exploited for the development of superior germplasm.

Several poster presentations in this session focused on the chemical basis of biomass conversion and the development of methods to determine which features contributed to a more rapid bioprocessing. Approaches included the use of atomic force microscopy, fluorescently labeled cellulases, near infrared reflectance spectroscopy and fluorescence spectroscopy. Other topics represented in the poster presentations included the production of cell wall-degrading enzymes *in planta*, and plant breeding approaches, including the incorporation of mutations and the introduction of transgenes to facilitate biomass processing of a variety of species, including sorghum, wheat, corn, shrub willow, and switchgrass.