

1. The purpose of this MOU is to facilitate and strengthen the collaboration between USDA and DOE in addressing important national issues such as bioenergy, agricultural biosecurity, and improved food quality and crop production. It demonstrates a joint commitment to support high-quality research and integrated projects using plant and microbial genome sequencing and bioinformatics research to meet agricultural and energy challenges.
2. The MOU is needed to ensure coordination of sequencing target selections by both agencies, with respect to peer review and oversight. It will also ensure uniformity and transparency in genomic data release.
3. The MOU provides a framework for the scientific community to propose scientific activities of mutual interest to USDA and DOE in the area of plant and microbial genomics. These activities might include jointly-sponsored community or stakeholder workshops, workforce development or training activities, and listening sessions and information-gathering activities with scientific and professional societies. It also provides an opportunity for jointly-issued and peer-reviewed solicitations, and coordinated international collaborations. Program administrators at CSREES and DOE are encouraged to maintain vigorous lines of communication regarding programmatic priorities in plant and microbial genomics, to synergize activities and avoid duplication of efforts.
4. The benefits of this MOU include identification of emerging priority areas for both agencies. An example is the mutual prioritization of support for enabling genomic technologies that may have significant benefits to the plant and microbial sciences communities. Examples include:
  - a. improved methods of gene identification
  - b. improved methods of sequence assembly
  - c. database integration and accessibility
  - d. improved DNA markers to accelerate marker-assisted breeding for disease resistance
  - e. expanded designation of mission-relevance for proposed sequencing projects (either through the DOE Microbial Genome Program or the JGI Community Sequencing Program)
5. USDA and DOE have a strong history of collaboration in areas relating to plant and microbial genome sequencing and bioinformatics. Both agencies participate in interagency working groups in these areas, and have cooperated on multi-agency solicitations. Prior cooperation includes:
  - a. In 1999, USDA's CSREES - National Research Initiative joined together with NSF and DOE to initiate the U.S. rice genome sequencing project as part of the International Rice Genome Sequencing Project (IRGSP). IRGSP was led by Japan and included researchers from the United States, China, Taiwan, Korea (South), India, Thailand, France, Brazil, and the United Kingdom. For this international collaboration, the 12 chromosomes of the rice genome, totaling approximately 400 million bases, were divided among various participating countries. The U.S. sequenced all of chromosomes 3 and 10 and parts of chromosomes 11 and 12 which required sequencing approximately 90 million bases of the 400 million base rice genome. Through fruitful international collaboration, and the partnership between public plant researchers and private researchers produced a publicly available "finished" sequence for the rice genome 3 years ahead of schedule and leveraged the worldwide investment for the project.
  - b. The DOE Joint Genome Institute's contribution of one million maize whole genome shotgun sequence reads in 2004. This resource provided a foundation for an interagency solicitation, under the auspices of the National Plant Genome Initiative (NPGI), between the U.S. Department of Agriculture (USDA), the U.S. Department of Energy (DOE), and the National Science Foundation (NSF) for future maize genome sequencing.
  - c. A consortium led by the DOE Joint Genome Institute completed the genome sequence of poplar, the first tree species to have its DNA decoded. USDA has supported complementary research on poplar growth and trait transmission.
  - d. The DOE's Microbial Genome Program has yielded draft whole genome sequences for many agriculturally-relevant microbial organisms whose association with plants serve

either as detrimental pathogens for almond, soybean or oak trees (e.g. *Xylella fastidiosa*, *Phytophthora sojae* or *P. ramorum*, respectively), or beneficial nitrogen-fixing symbionts (e.g. *Frankia* or *Bradyrhizobium*).

- e. Future collaboration is evidenced by the DOE Joint Genome Institute selection of the FY06 whole genome sequencing of sorghum, under the auspices of its Community Sequencing Program. One of the world's most important grain crops, sorghum also has significance as the second largest bioenergy crop for ethanol production. Its genetic relationship to other cereals (such as rice) as well as noxious weeds (Johnson grass) make it an especially useful agricultural species, with the potential for improved cross-breeding or trait selection for improved forage or biomass properties.
6. DOE has been a leader in genomics and genome sequencing since it became the first federal agency to fund a genome program and support sequencing the human genome. Its leadership role led to a highly successful MOU and partnership with NIH and the entire International Human Genome Sequencing Consortium to complete the 3 billion base pair sequencing effort well ahead of schedule. This undertaking led to dramatic biotechnology resource development in molecular separations, imaging and expression profiling. Successes in the HGP enabled the high-throughput, cost-efficient genomic analysis of many subsequent genomes; the successor DOE Microbial Genome Program has completed whole genome sequencing for over 200 microbes that play diverse roles in energy production, carbon cycling, or environmental remediation. With its role in the Human Genome Project completed, DOE is again embarking upon an ambitious program to transform genomic information in microbes into predictive, systems approaches and new opportunities for developing renewable energy, reducing climate change and cleaning the environment. To achieve that vision, DOE has begun the Genomics: GTL program, which will combine research in biology, engineering and computation with the development of novel facilities for high-throughput biology projects.
  7. Support of agricultural plant and microbial genomics through the USDA Cooperative State Research, Education and Extension Service (CSREES) National Research Initiative (NRI) competitive grants program advances knowledge for agriculture and related areas through the extramural funding of research, education and extension programs. The NRI is CSREES largest competitive grants program. Since its inception in 1991, the NRI has supported basic and mission-linked research projects in genomics that relate to agriculture, including food, the environment, and communities. Since 2003, the NRI has also supported integrated projects that combine research, education, and extension activities. The goal of these programs is to support a portfolio of plant and microbial research that will provide the knowledge, tools, and approaches needed to sustain and improve U.S. agriculture. Many of these activities can be conducted through collaborations and co-funding from Federal agencies.
  8. This MOU encompasses the following DOE and USDA resources and facilities:
    - a. The DOE Joint Genome Institute—Production Genomics Facility has revolutionized high-throughput sequencing, approaching 100 Million base pairs decoded since its inception. During this relatively brief period, technology innovations have resulted in tremendous cost-savings, quality increases, and accelerated sequence delivery to a rapidly increasing number of scientists. The JGI also strongly supports the development of computational and bioinformatics tools for data management and genome mining.
    - b. DOE resources in structural and molecular characterization, computing, and imaging.
    - c. USDA-CSREES has wide-ranging partnerships with over 130 colleges of agriculture including agricultural experiment stations, cooperative extension services, schools of forestry, and numerous other colleges and universities. The NRI has the broadest eligibility of all the CSREES competitive grants programs, with NRI funding of research projects available to scientists from a wide variety of public, private, and non-profit organizations and as individuals.