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Editorial

Introduction to Translational Seed Biology: From Model Systems to Crop Improvement

Knowledge of seed biology is advancing rapidly, particularly in model systems that allow the integration of genetic, genomic, metabolic, molecular, and biophysical approaches. At the same time, the demands upon seeds in agriculture for germplasm conservation, crop propagation and as end products for food, nutrition and industrial or bioenergy materials are increasing. "Translational" seed biology is the effort to capitalize on this expanding fundamental knowledge base to develop applications for the improvement of seeds as genetic delivery systems for crop production, as foods and raw materials for diverse uses, and as storage materials for germplasm preservation. Scientists studying model systems are developing increasingly more powerful insights into fundamental biological and developmental mechanisms, while agriculturalists continue to refine our understanding of the physiological and environmental factors that limit crop productivity and product quality. These fundamental discoveries and proof-of-concept findings, however, must be transferred into agricultural and commercial applications. Model systems can also inform ecological applications of seed biology, such as using knowledge of seed dormancy mechanisms in management of weedy or invasive species. Similarly, studies of the biophysics of dry systems and desiccation tolerance mechanisms in model systems can translate into better ways to preserve and store germplasm as seeds.

Seeds provide an inherently unifying principle due to interest in them as a plant developmental system and as products of agriculture that provide at least 75% of the food consumed by humanity. The ability to modify seeds by altering their development and composition offers enormous potential to meet the growing global demand for food, but only if those discoveries can be adapted to the biological requirements of seeds as propagules and the pragmatic and economic demands of the marketplace. Bridging this gap between the accelerating pace of knowledge generation and the need to reduce that knowledge to practice was the objective of an international symposium convened at the University of California, Davis, in September 2007. That symposium, titled *Translational Seed Biology: From Model Systems to Crop Improvement*, brought together leading public- and private-sector scientists who focus on diverse aspects of seed biology in a format that emphasized the connections between fundamental discoveries and their applications in agriculture. The intent was to share the progress being made in model systems while also illuminating the challenges associated with bringing a concept into agricultural practice. A further objective of the symposium was to identify high priority challenges and opportunities that could be targeted by complementary research in model systems, crops and ecological settings. A concerted focus on translational seed biology could also serve to demonstrate how public and private funding of fundamental work in model systems can be applied to benefit producers, consumers and the environment, particularly for applications in the regions of the world where the needs are greatest.

The symposium in 2007 was a great success in that it allowed scientists from the broad spectrum of seed biology to share their progress and to initiate a dialog about the challenges and opportunities posed by translational seed biology. In the meantime, both the need for improved seeds and our ability to improve them has continued to increase. As conveners of the symposium, we have therefore invited a number of researchers to submit papers to this special issue to illustrate some aspects of the topics addressed. This issue is not meant to provide a comprehensive view of current seed biology, nor does it fully capture the scientific content and intellectual exchange that occurred at the symposium. Rather, it provides views from various aspects of the overall objective to learn fundamentally how seeds are formed, develop and fulfill their reproductive and conservation functions and how that knowledge can be translated into useful applications in agriculture.

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