Exciting new technologies are rapidly emerging to measure and estimate the physical characteristics of crops and plants, a process commonly referred to as phenotyping. Suites of physical measurements and estimates in regard to a plant or cultivar, either spatially or temporally, improve the characterization of the plant phenome, much in the same way DNA measurements have helped to characterize a plant genome. Not only are emerging technologies increasing the speed, resolution, and scale at which current phenotypes are characterized, technologies are allowing new, previously intractable phenotypes to be discovered and used. Agronomy, crop science, plant breeding and genetics, precision agriculture, plant sciences, and allied disciplines will all be effected by the discoveries and tools of plant phenomics in the coming years. Yet, to be successful in these areas, skill sets, expertise, and tools will need to be applied and developed from areas including computer and data science, engineering, machine vision, metabolomics, robotics, statistical analysis, and remote sensing. Thus the inter- and transdisciplinary nature of characterizing the plant phenome could be a barrier to the potential of phenomics for discovery and development.

The Plant Phenome Journal (TPPJ), a new digital open access journal from CSSA and ASA, will begin accepting articles 27 February (see https://dl.sciencesocieties.org/publications/tppj) to address multiple community needs in this area. First proposed late last year, Society leadership quickly recognized the importance and opportunities for this journal and prepared it for launch in near-record time. To our knowledge, this will be the first journal in the world to focus on phenotypic tools and disciplines, demonstrating the leadership that scientific societies like ours can bring. Similarly, the American Society of Plant Biologists (ASPB) just conducted an outstanding meeting, Phenome 2017, which laid groundwork in bringing together many of the same areas of expertise. As the high enthusiasm at Phenome 2017 made clear, there is a lot of growing interest and activities in plant phenomics. The primary benefits of TPPJ in harnessing this enthusiasm can be explained by a number of interrelated gaps and challenges that the journal will seek to address.

Connecting Research from Disparate Disciplines

The first major challenge of note is that technologies and discoveries are emerging so rapidly and across so many different fields that hubs are needed to coordinate, piggyback research, and minimize redundancy. Currently, researchers looking at, for instance, controlled environment imaging studies could easily miss relevant literature from high-throughput field phenotyping studies published in a more applied crop journal or algorithm development in a computer science journal, and vice-versa. Another alternative has been to publish this work in broad open access journals, but it is even more likely to be buried and missed by larger potential audiences. We envision TPPJ to be a browsable journal that would help connect research from disparate disciplines to develop and advance the field.

Data Storage, Publication Issues

The second major challenge TPPJ will address is what to do with data, especially phenomic big data. Unlike genomic data, which have had a number of federal databases (e.g., NCBI) supported by human and infrastructure to leverage for research, there is no existing infrastructure to leverage for phenomics. Thus there are no recognized long-term data storage solutions, and the existing long-term generic data repositories are prohibitively expensive. The communities have not come together to agree on the long-term cost/benefit ratio of storing this type of data. For instance, in the case of unmanned aerial vehicles, should the raw images, mosaics, or extracted data be retained forever?