

What is the Agricultural Genome to Phenome Initiative?

The Agricultural Genome to Phenome Initiative (AG2PI) is a three-year USDA NIFA-supported project focused on connecting crop and livestock scientists to “compare notes” that could identify similar questions and solutions to address gaps in genome-to-phenome science. AG2PI seeks to enable scientists to learn the language of their peers and to share new technologies and best practices with others across disciplines and within their field.

What is genome-to-phenome science?



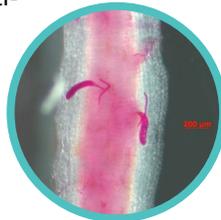
Geneticists are deciphering how genetic code affects physical and behavioral traits — or phenotypes — in plants, animals and humans; which is known as genome-to-phenome (G2P) research. Agricultural geneticists are studying how crop and livestock physical properties connect back to their genetic code as well as how the environment can influence genes, and therefore traits. But research doesn't end at understanding genetics. Creation of new genetic combinations that lead to improved traits in crops and livestock is also an important aspect of G2P science.

How are the project goals being addressed?

The AG2PI team hosts activities that connect agricultural geneticists and breeders with each other and those working with data, statistics, engineering and social sciences. Through field days, workshops and conferences, professionals meet to share knowledge, offer ideas and solutions, and collaborate for scientific advancement and practical applications. AG2PI awards seed grants to encourage research on AG2PI-related topics, particularly ones that are cross-disciplinary and multi-institutional.

Why is this work important?

Beyond the field, pasture and barn, many people are working to help producers achieve their goals of harvesting abundant crops and raising exceptional livestock. Agricultural scientists continually explore ways to improve crops and livestock so farmers can feed the world in more sustainable and economical ways. Building resiliency is becoming more important as the climate continues to alter farm environments. These advancements can help to keep the dependable food supply chain moving, reduce consumer prices while improving farmer profitability and food quality.



How does this help crop and livestock producers?

Improving how agricultural scientists work will accelerate the breeding and genetic gain process. New hybrids can get to the market quicker, enhancing crop production and improving livestock feed.

Disease and pest resistance for both crops and livestock can be improved. Farmers and producers will benefit and profit from growing high-quality crops for seed, feed, fiber and fuel, as well as raising healthier livestock for nutritious meat and milk.

Why does AG2P need to be studied?

The similarity of the genetic basis of crops and livestock lend themselves to similar research methods. However, those conducting the research generally stay within their own plant or animal kingdom and often within their own species. There are research and breeding procedures that could work across plant and animal species.

Data access and storage needs may be managed similarly. Artificial intelligence and machine learning could be applied likewise across these research communities. Sharing this information between the plant and animal kingdoms can eliminate redundancy, streamline the research process and reduce associated costs, thus improving the entire research pipeline.



Photos: Iowa State University, United Soybean Board

TERMINOLOGY

Genome-to-phenome: relationship of the genetic makeup of a plant or animal to its physical makeup

Gene: the code that controls individual traits in plants, animals, and humans

Genotype: the particular allelic makeup of individual genes in an organism

Genome: collective of all the genes in an organism

Genotype + Environment (G+E) = Phenotype

Environment can affect the genotype

e.g., climate can affect fur growth in animals; drought conditions can affect crop yields

Phenotype: the outward expression of a genetic trait

e.g., plants: height, yield, disease resistance, etc.
e.g., animals: fur/hide color, horns, etc.

Phenome: collective of all phenotypes or traits