



AG2PI

Agricultural Genome to
Phenome Initiative

Brenda Murdoch, Jennifer Clarke, Jack Dekkers, David Ertl, Carolyn
Lawrence-Dill, Eric Lyons, Christopher Tuggle, Patrick Schnable

The International 30th PAG Cattle/Sheep/Goat Workshop I
January 14th, 2023



Agricultural Genomes to Phenomes



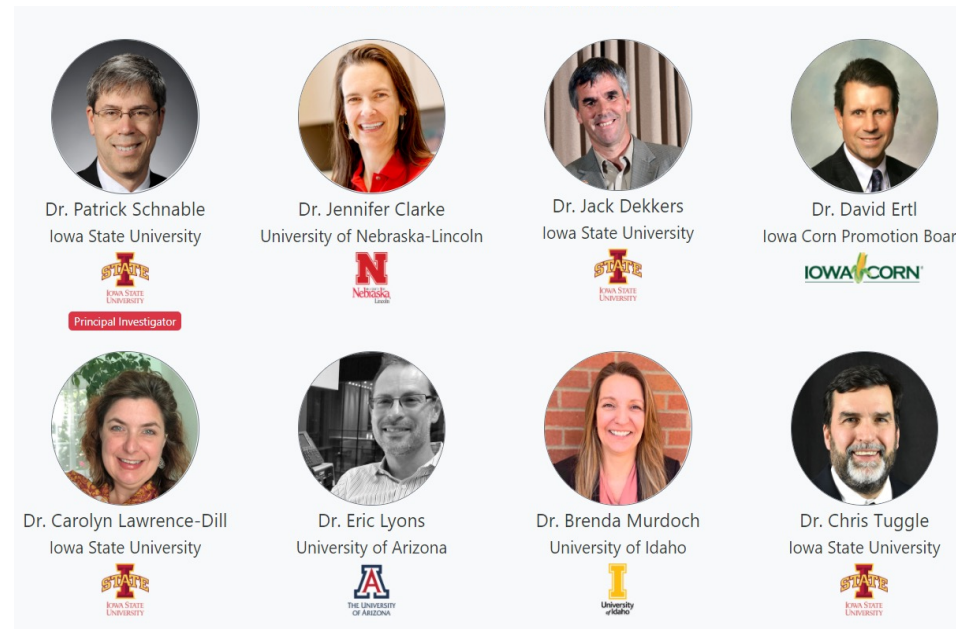
- 2018 Farm Bill directed NIFA to establish a new competitive grant program to support research concerning genomes and phenomes of crops and animals of importance to U.S. agriculture, authorizing up to ***\$40,000,000 annually 2019 - 2023.***
- U.S. Congress appropriated ***\$1M in fiscal year 2020, 2021, & \$2M in 2022*** for AG2PI.

RFA “NIFA’s AG2PI focuses on collaborative science engagement and invites innovative proposals that intend to **develop a community of researchers across crops and animals** that will **lay the foundation for expanding knowledge concerning genomes and phenomes of crops and animals** of importance to US agriculture.”



AG2PI: Creating a Shared Vision Across Crop & Livestock Communities

- Project team was awarded **\$1M in fiscal year 2020, and 2021** for AG2PI.
 - 2020-70412-32615
 - 2021-70412-35233
- Project team was awarded **\$2M in fiscal year 2022** - NIFA AG2PI Collaborative: Continuing to Seed the Future of Agricultural Genome to Phenome Research.
 - 2022-70412-38454



AG2PI: Creating a Shared Vision Across Crop & Livestock Communities

Overall Goal: to assemble a cross-kingdom, transdisciplinary community and prepare this community for an anticipated large-scale R&D effort in AG2P

Objectives

- Develop a community vision for AG2P research
- Identify (shared) research needs, opportunities, & gaps
- Support seed projects to *outline community solutions* to research challenges
- Communicate and disseminate our findings to the research community and the USDA



What's Required to Realize this Vision?


- A *community* of interactive biologists (crop + livestock), engineers and data scientists and members of the community
- More data (genotypes, phenotypes and environment/management practices), ideally from coordinated, multi-location, multi-year projects
- New technologies and analyses methods
- Substantial new R&D investments


Genotype (G) + Environment (E) + G x E = Phenotype (P)





AG2PI

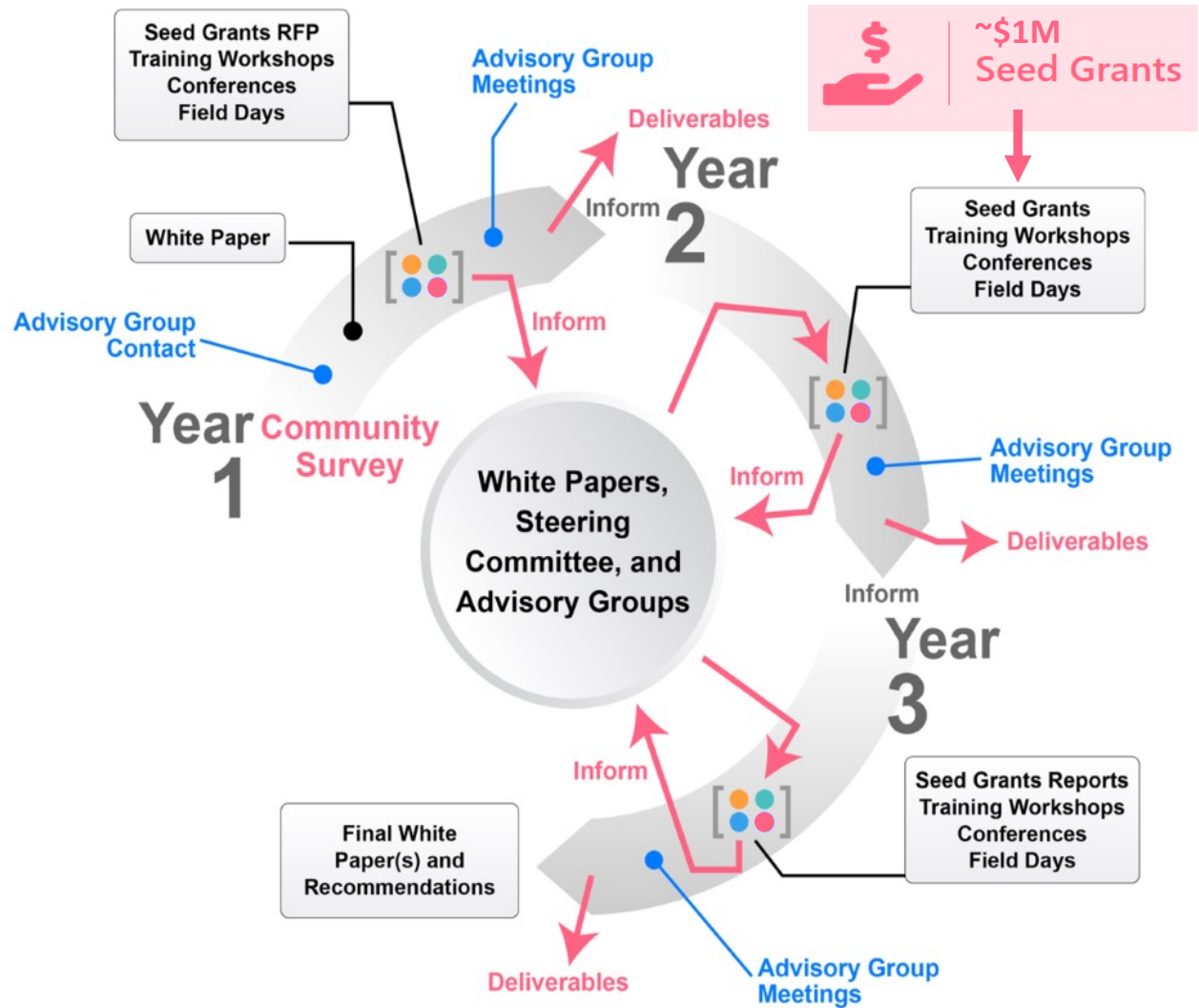
Activities and Timelines

 Field Days

 Training Workshops

 Conferences

 Seed Grants



Field Days / Virtual Open Houses

Every 3rd Wednesday of month 10:30 AM – 12:00 PM (US Central)

Recordings of previous Field Days are at: www.AG2PI.org

Goals

- Expose AG2P community to research activities and resources across crops & livestock
- Share research methods, approaches, capacities
- Identify research and capacity gaps and challenges for AG2P research
- Bring teams together to start to develop joint solutions

Examples of FD Topics

- Implementation of Genomic Selection and the Future of Phenotyping in Dairy Cattle
- Precision Livestock Management on Extensive Rangelands
- Leveraging Microbiomes in Agriculture
- **Feb 8 – Mitigation of Methane Emissions in Dairy Cattle**



Jack Dekkers (Lead), Eric Lyons, Brenda Murdoch, Pat Schnable



Training Workshops

12 virtual workshops per year

Either short (1-2 hrs) or long formats (2 hrs/2 days)

Goals

- To build technical strengths and future collaborative AG2P communities
- Offer workshops to enable researchers from all backgrounds and computational skill levels to develop best practices, common vocabularies, and technical expertise around genomic and phenomic cyberinfrastructure, data tools and pipelines, statistics, and experimental techniques

Workshop Examples

- Image analysis for phenotyping in livestock
- Developing mobile computer vision applications for improving recognition of livestock
- Hand-on machine learning



Eric Lyons (Lead), Jennifer Clark, Chris Tuggle





Goals

- Bring people together to develop the vision and build AG2PI community
- Identify opportunities and resources within the crop and livestock communities
- Communicate and disseminate findings and support discussions across research and stakeholder communities

Scheduled Conferences

- 2022: September 9-10, Ames Iowa
 - “Thinking Big: Visualizing the Future of AG2PI”
- 2023: June 15-16, Kansas City Missouri
 - Mark your calendars



Chris Tuggle (Lead), Jennifer Clarke, Brenda Murdoch



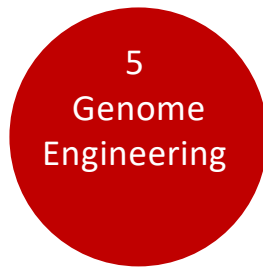
Seed Grants



Goals

- Promote collaboration and support the development and cross-pollination of tools, data, and ideas to enable and facilitate future AG2P research
- Foster first steps towards the development of community solutions
 - Research needs and opportunities, physical infrastructure needs, promote capabilities in data processing, analysis and management

Focus areas funded



Jennifer Clarke, Brenda Murdoch, Jack Dekkers, Carolyn Lawrence-Dill, Eric Lyons



Seed Grants



Round 1:

- 7 grants awarded in March 2021
- 16 Institutions for total of \$130K

Round 2:

- 11 grants awarded September 2021
- 23 Institutions for total of \$300K
- Three award levels: Emerging: < \$20,000
Enabling: < \$50,000
Established: < \$75,000

Round 3:

- 9 grants awarded April 2022
- 27 Institutions for total of \$620K

Other Grant Opportunities

- **Rolling Seed Grants**
 - Supporting single events < \$15K
 - 5 funded, as of December 2022, window closing
- **Working Group Seed Grants**
 - Focused on supporting their formation < \$15K

Round 4:

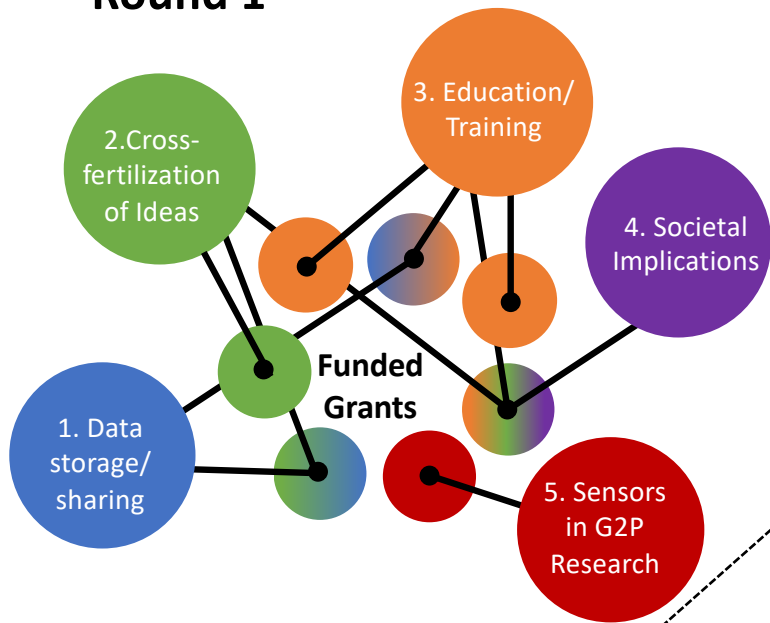
- 6-8 larger “coconut” seed grants
- up to \$250K/grant
- 40 proposal are in review



Jennifer Clarke, Brenda Murdoch, Jack Dekkers, Carolyn Lawrence-Dill, Eric Lyons

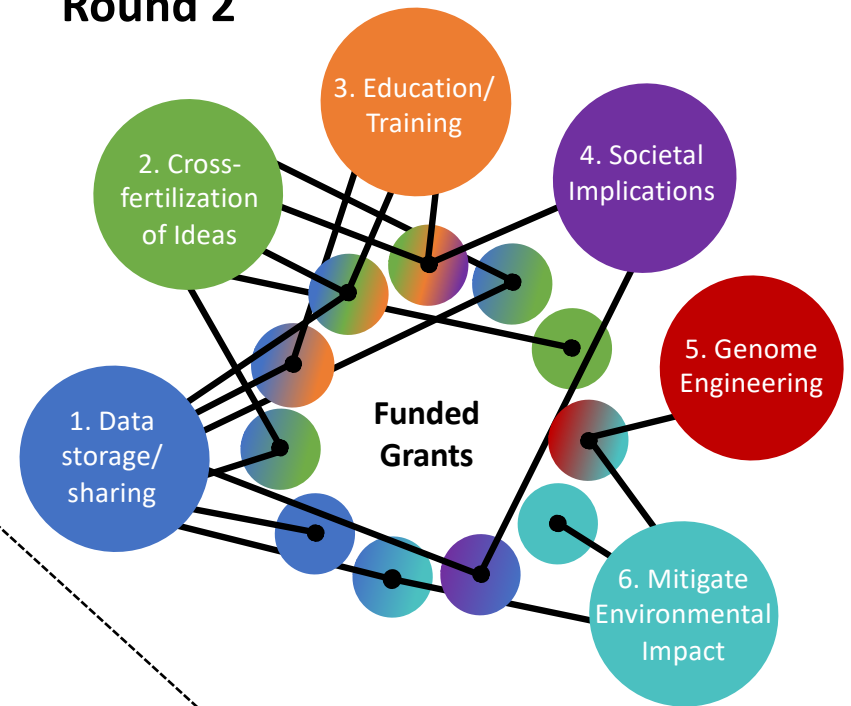


Round 1



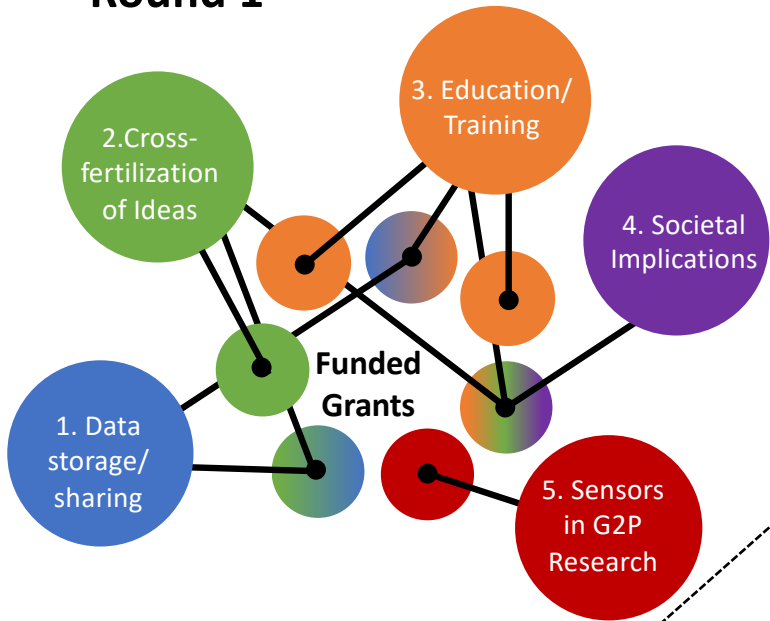
Topic Areas

Round 2

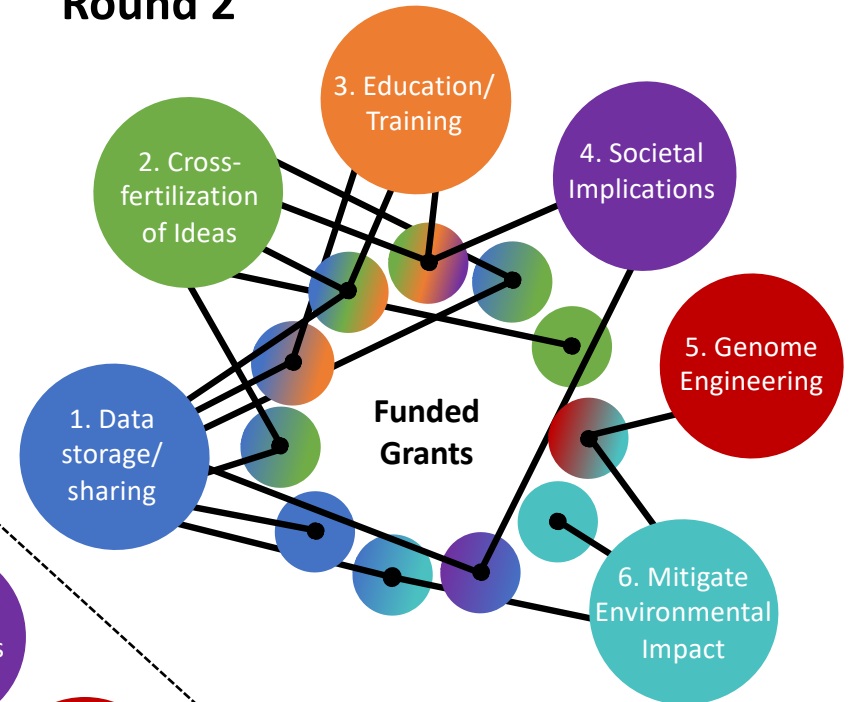


Topic Areas

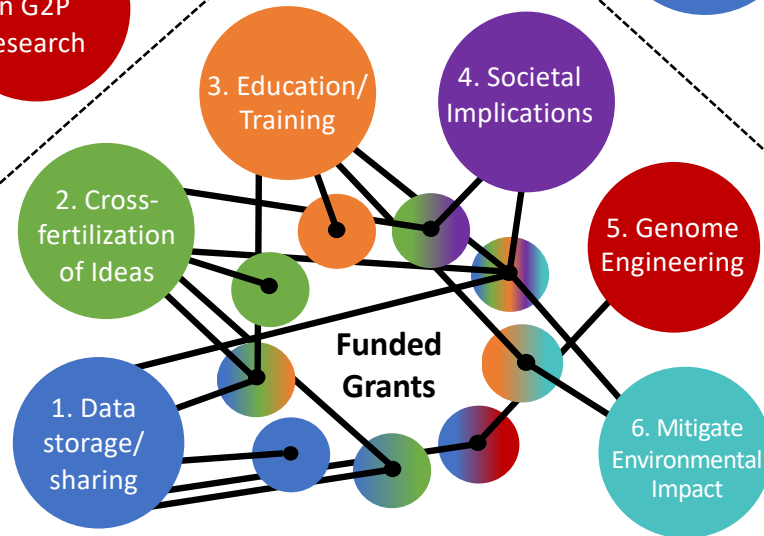
Round 1



Round 2



Round 3



How Can NRSP8 Participate in AG2P?

Develop a Vision

- Identify the research and/ or physical infrastructure needs and opportunities

Develop Community Solutions

- Identify the key components (tools, people, sensors, etc.) necessary for success
- Identify a list of priorities and potential path(s) forward

Working Groups

- Consider working with others to form or participate in a working group



Identified from the Stakeholder Input (2019)

All species and bioinformatic representative were asked to contribute by Dr. Jim Reecy

Goals

- **Understanding genome biology to accelerate genetic improvement of economically important traits.**
 - Link genes to function and phenotypes to genomics and other omics
- **Applying precision agriculture technologies to animal phenotyping.**
 - Identify new traits and simplify/reduce cost of phenotyping
 - Develop precision phenotyping (integrate multiple data types)



Genome to Phenome Priority Areas

- **Developing advanced genomic tools, technologies, and resources for agricultural animals.**
 - Imputation pipelines
 - Develop pan-genomes including all genomic segments
- **Advancing biotechnology to improve the sustainability and efficiency of animal production.**
 - Develop genome editing tools, resources and high throughput approaches
- **Training the next generation of animal scientists.**
 - Develop work force and provide education resources to other professionals



How Can NRSP8 Participate in AG2P?

- What is important to animal agriculture G2P research?
- What do our respective stakeholders need to make genetic progress in a changing environment?
- How can we work with others to expand what we can deliver?
- How can we help inform NIFA as they establish a new competitive grant program to support research the area of AG2P importance to US agriculture?
- U.S. Congress appropriated ***\$2,000,000 in fiscal year 2023*** for AG2PI.



What Does AG2P Research Deliver?

AG2P Research Promises to:

- Increase rates of genetic gain and enhance our ability to predict and efficiently breed for novel traits in different environments

Genotype (G) + Environment (E) + G x E = Phenotype (P)

- Improve our ability to provide farmers with evidence-based recommendations and solutions
- Increase agricultural sustainability and profitability for the benefit of both producers and society



AG2PI

Agricultural Genome to Phenome Initiative

Thank you!

Partnering Organizations



External Stakeholder Member Organizations



Agricultural Genome to Phenome Initiative (AG2PI) is funded by USDA-NIFA awards 2020-70412-32615, 2021-70412-35233, & 2022-70412-38454