

AG2PI

Agricultural Genome to
Phenome Initiative

AG2PI: A Brief Introduction for the FAANG Community

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USDA-NIFA Agricultural Genome to Phenome Initiative

- 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 US agriculture, authorizing up to **\$40,000,000 annually 2019 - 2023**.
 - <https://nifa.usda.gov/program/genome-phenome-initiative>
- U.S. Congress appropriated only **\$1M in fiscal year 2020**
\$1M in fiscal year 2021
\$2M in fiscal year 2022

2020 RFA: “NIFA’s AG2PI focuses on collaborative science engagement and invites innovative research 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.”

Creating a Shared Vision Across Crop & Livestock Communities



Overall objective:

Assemble a transdisciplinary community prepare it for an anticipated large-scale R&D effort in AG2P

Project Team

Executive Board Members



Dr. Patrick Schnable
Iowa State University



Principal Investigator



Dr. Jennifer Clarke
University of Nebraska-Lincoln



Dr. Jack Dekkers
Iowa State University



Dr. David Ertl
Iowa Corn Promotion Board



Dr. Carolyn Lawrence-Dill
Iowa State University



Dr. Eric Lyons
University of Arizona



Dr. Brenda Murdoch
University of Idaho



Dr. Chris Tuggle
Iowa State University



AG2PI aims to connect
crop and livestock scientists to each other
and to scientists working in
data sciences, statistics, engineering and
social sciences
to identify shared problems
and collaborate on solutions
in agricultural genome to phenome
science

Partner Organizations



Role of Partner Organizations

- Provide feedback to AG2PI executive board regarding project activities & next steps
- Link communication between AG2PI, organization employees and members, including sharing AG2PI news and events
- Participate in AG2PI activities and surveys, including contributing materials or expertise



**National Animal
Genome Research
Program
NRSP-8**



AgBioData

Toward enhanced genomics, genetics, and breeding research outcomes through standardization of practices and protocols across agricultural databases



External Stakeholder Member Organizations



Agricultural Genome to Phenome Initiative



National Cattlemen's Beef Association



Role of Stakeholder Organizations

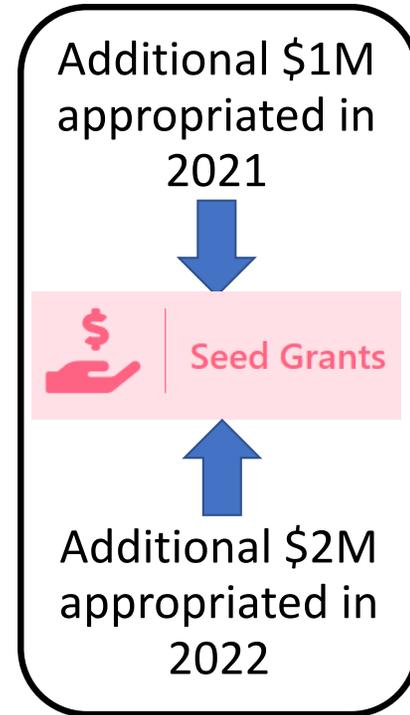
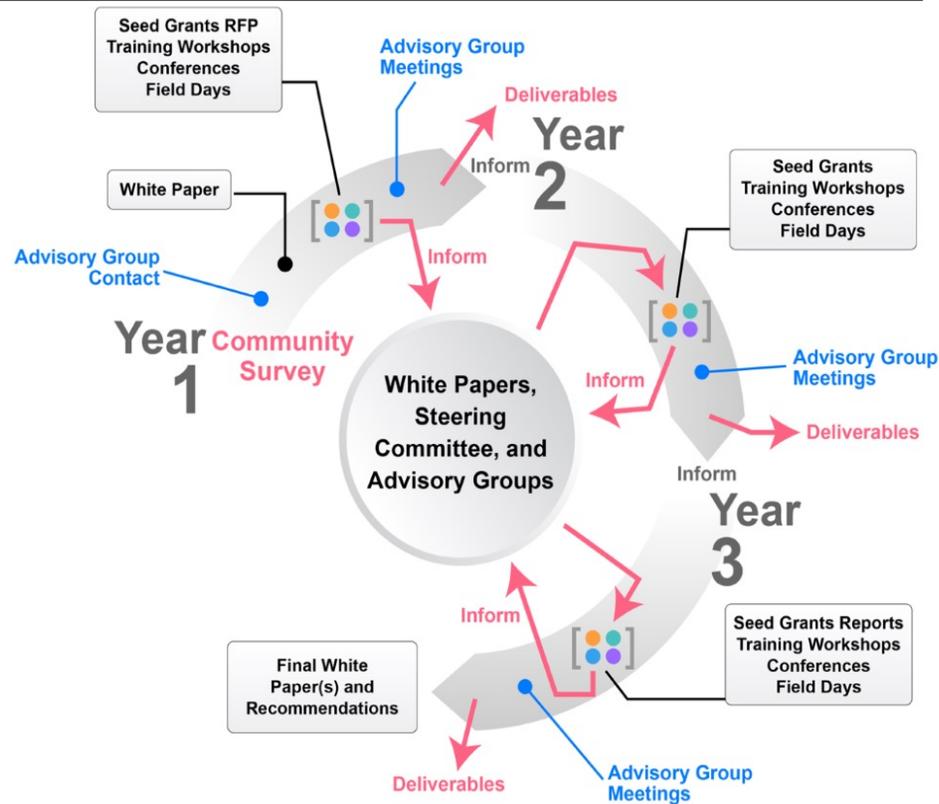
- Link communication between AG2PI, organization employees and members, including sharing AG2PI news and events
- Participate in AG2PI activities, including contributing materials or expertise
- Provide feedback through surveys and one-on-one communication with AG2PI executive board members



Poultry Breeders of America



Activities & Deliverables 2020 grant (\$1M)



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 and resources across crops and livestock
- Share research methods, approaches, capacities
- Identify research and capacity gaps and challenges
- Bring teams together to start to develop solutions

Examples of FD Topics

- Implementation of Genomic Selection and Breeding in Dairy Cattle
- Precision Livestock Management on Farm and Rangeland
- Leveraging Microbiomes in Agriculture

Next FD will be **Feb 8** on
mitigation of methane emissions
in dairy cattle,
Francesco Peñagaricano
(Wisconsin)
Ermias Krebeab (UC-Davis).



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





Goals

- Collect community opinions on topics related to AG2P
- Collect information to better understand current resources and gaps relative to AG2P research
- Provide content for conferences



2020 Survey Purpose:

- Define the genome to phenome community
- Seek community perspectives on the needs for accelerating AG2P research
- Collect ideas about which specific activities would meet those needs

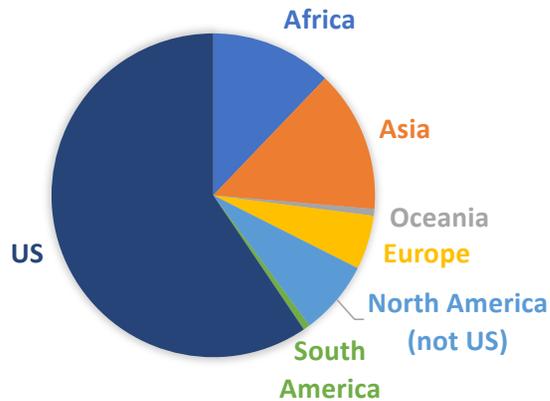
2021 Survey Purpose:

- Identify access and barriers to resources in G2P research, training and other efforts

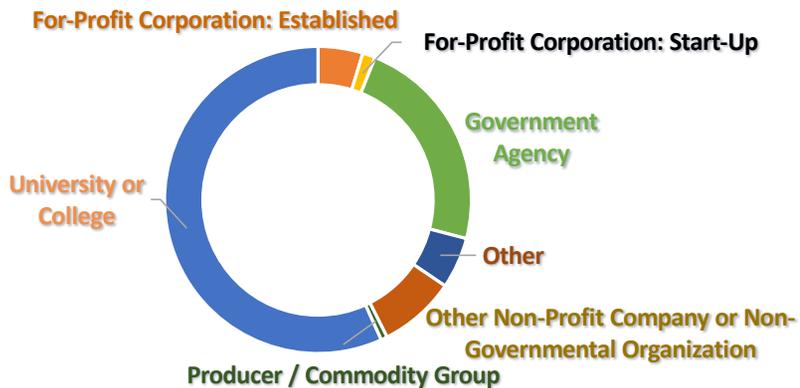
Preprint available on OSF: <https://osf.io/p89vk/>



2022 AG2PI SURVEY RESPONDENTS, BY LOCATION



2022 AG2PI SURVEY RESPONDENTS, BY EMPLOYER TYPE



15-question survey

* These topics came from AG2PI Scientific Advisory Board and Steering Committee

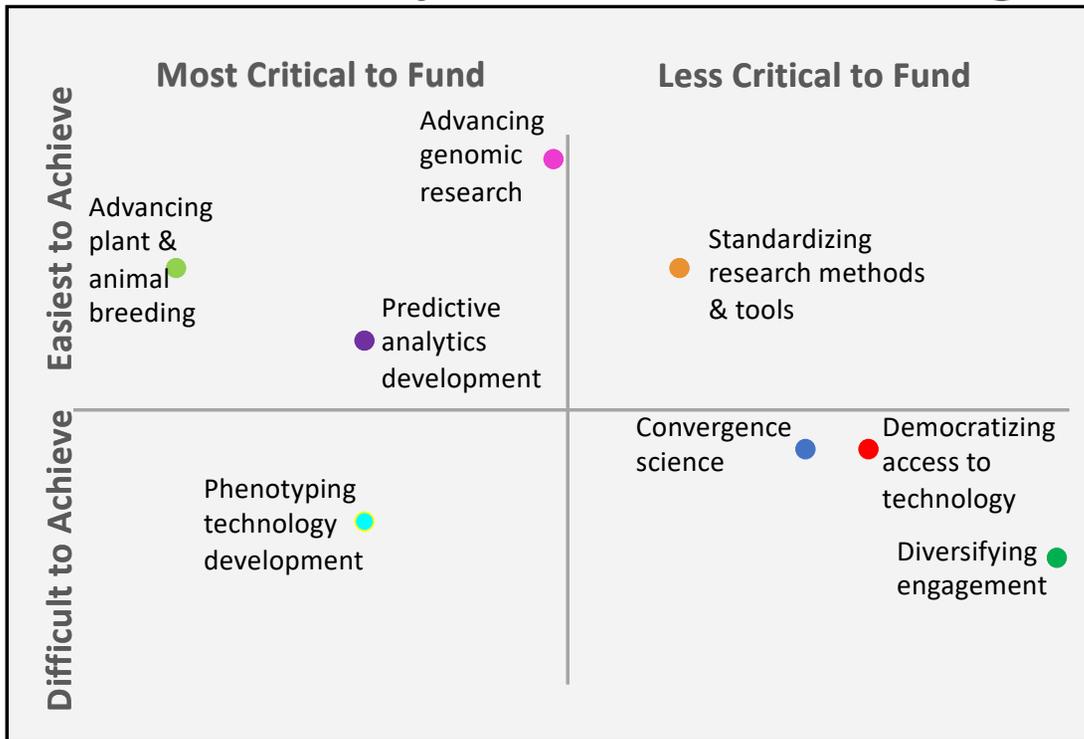
Deployed in June of 2022

Purpose: to narrow the scope of future funding to areas that are most critical to advancing G2P research as well as those that are easiest to achieve

Participants were asked to rank the same topics that are being discussed in this workshop



Identified topics and their ranking



Challenges that overlap topics:

- Shortage of trained personnel
- Disrupting cultural norms in scientific disciplines and industry practices
- Communicating failures to avoid duplicating practices destined to fail
- Gaining public trust or support for new technologies or products
- Continuing to discover new phenotypes, which are currently unknown and untargeted
- Addressing cost-effectiveness
- Navigating intellectual property ownership



Agricultural Genome to
Phenome Initiative

White paper draft based on Sept 2022 Workshop sent to NIFA:
“Current Challenges and the Future of Agricultural Genomes to
Phenomes in the U.S.”

We recommend that AG2PI funding be used to address the following critical milestones:

1. Provide resources to evaluate and **improve Ag G2P predictive tools**, including generation of *benchmark testing datasets*.
2. **Remove current public-private barriers** for collaborating with commercial entities that maintain *large phenotypic datasets*.
3. Establish a **single comprehensive public genome/phenome knowledge base** that enables FAIR data sharing as a foundation for *building on Federal investments* in agricultural genomes.
4. Accelerate the **training of scientists required for agricultural G2P research**, including toward developing and evaluating *data analytics training programs*.
5. Expand the **diversity of people engaged in agricultural G2P activities**, including *researchers, students and producers*.
6. **Identify additional gaps** in knowledge, multidisciplinary team development, education/training, and analytical or quantitative methods relevant to agricultural G2P and strategize and *initiate actions to fill those gaps*.

Please send your thoughts and suggestions!



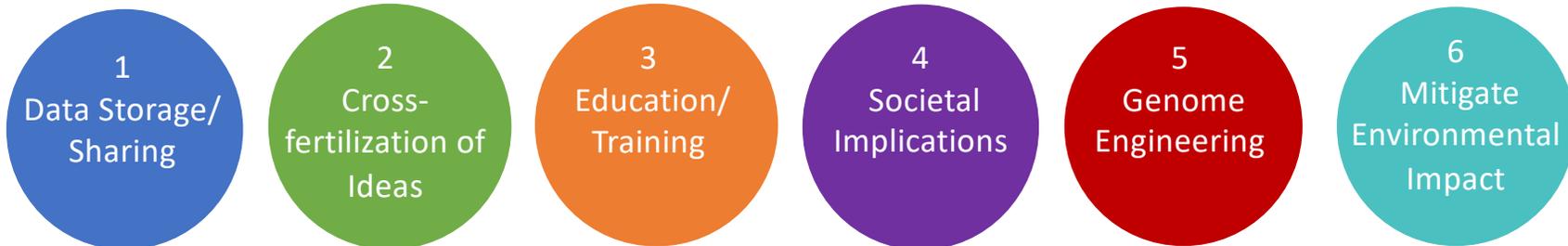


Seed Grants

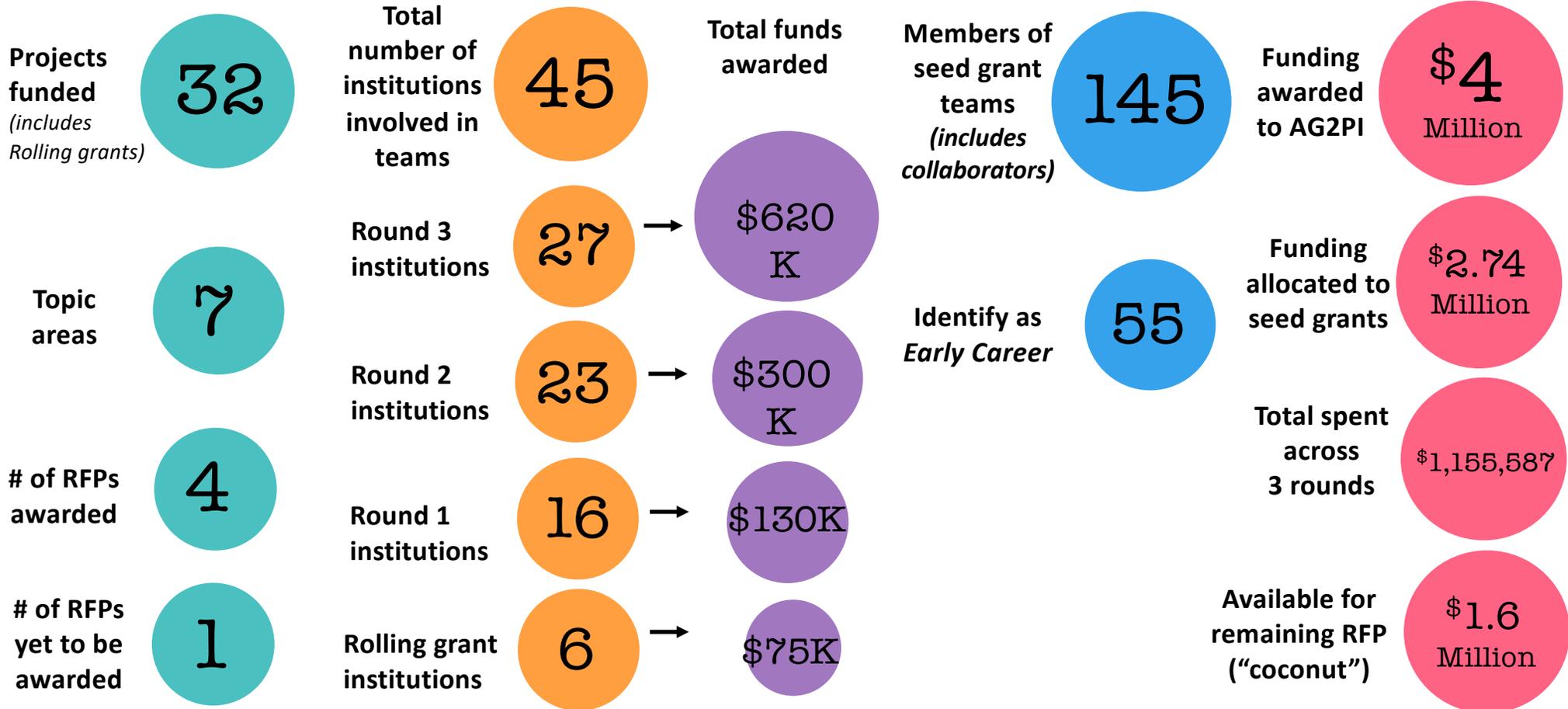
Goals

- 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



Seed Grants Overview – By the Numbers



How Can FAANG Participate in AG2P?

Develop a Vision → Congress wants this from the community (us)

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

Develop Community Solutions → Congress wants this too!

- 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



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Thank you!

<https://www.ag2pi.org>



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How can we improve the AG2P enterprise?

- 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's Required to Realize this Vision?

- A **community** of interactive biologists (crop + livestock), engineers, data scientists and members of the greater community
- More **data** (phenotypes, genotypes and environment/management practices) ideally from coordinated, multi-location, multi-year projects

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

- New **technologies** and analysis methods
- Substantial new **R&D investments**

