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.”
Overall objective:
Assemble a transdisciplinary community prepare it for an anticipated large-scale R&D effort in AG2P

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
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
Activities & Deliverables 2020 grant ($1M)

- Field Days
- Training Workshops
- Community Surveys
- Conferences
- Seed Grants

Additional $1M appropriated in 2021

Seed Grants

Additional $2M appropriated in 2022
Goals
• Expose AG2P community to research activities and resources across crops and livestock
• Share research methods, approaches, capacities
• Identify research and capacity gaps and opportunities
• Bring teams together to start to develop 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

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

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

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

Training Workshops

12 virtual workshops per year
Either short (1-2 hrs) or long formats (2 hrs/2 days)

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/
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

15-question survey

* These topics came from AG2PI Scientific Advisory Board and Steering Committee
### Identified topics and their ranking

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<tr>
<th>Easiest to Achieve</th>
<th>Most Critical to Fund</th>
<th>Less Critical to Fund</th>
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<td>Advancing plant &amp; animal breeding</td>
<td>Advancing genomic research</td>
<td>Predictive analytics development</td>
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<td>Phenotyping technology development</td>
<td>Convergence science</td>
<td>Democratizing access to technology</td>
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<td>Diversifying engagement</td>
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<th>Difficult to Achieve</th>
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<td>Standardizing research methods &amp; tools</td>
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**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
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!
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

1. Data Storage/Sharing
2. Cross-fertilization of Ideas
3. Education/Training
4. Societal Implications
5. Genome Engineering
6. Mitigate Environmental Impact
# of RFPs awarded | 4
---|---
Topic areas | 7
Projects funded (includes Rolling grants) | 32
_round 1 institutions | 16
_round 2 institutions | 23
_round 3 institutions | 27
Total number of institutions involved in teams | 45
Total funds awarded | $620K
Members of seed grant teams (includes collaborators) | 145
Identify as Early Career | 55
Funding awarded to AG2PI | $4 Million
Funding allocated to seed grants | $2.74 Million
Total spent across 3 rounds | $1,155,587
Available for remaining RFP ("coconut") | $1.6 Million
Rolling grant institutions | 6
Rolling grant institutions | 6
Round 1 institutions | 16
Round 2 institutions | 23
Round 3 institutions | 27
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
Thank you!

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https://www.ag2pi.org

@AG2PI
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