

Egg-Tech Prize – Request for Applications

New Technologies for In Ovo Sex Determination

The Egg-Tech Prize, a \$6 million initiative from the Foundation for Food and Agriculture Research (FFAR) and Open Philanthropy, is intended to stimulate development of technologies for accurate, high-speed and early-stage in ovo sex determination of layer chicks. The Egg-Tech Prize has the potential to revolutionize U.S. and global egg production by preventing the culling of day-old male chicks (cockerels) in poultry hatcheries.

The Egg-Tech Prize will call on groups around the world to develop innovative solutions to this problem by developing a commercially and economically viable technology that can identify the sex of eggs prior to incubation.

1. Background

Eggs serve as a nutrient-rich and affordable source of protein in diets around the world. Animal products, including eggs, make up a large portion of Western diets and an increasing proportion of the diets in developing countries¹. In 2016, approximately 74 million metric tons of eggs were produced globally². The United States, second only to China in global egg production, produced about 9 billion dozen eggs in 2018². Growing demand for eggs is also reflected in the increasing numbers of laying hens produced worldwide. However, male, layer-type chicks (cockerels), unable to produce eggs and unsuitable for meat production, are routinely culled within 24 hours of hatching because they have no economic value⁶. Approximately 6 billion cockerels are culled globally every year³, a practice that raises ethical and welfare concerns.

By determining the sex of an egg prior to hatch, male embryos can be identified and eliminated humanely, reducing the cost and carbon footprint of incubating layer eggs and potentially providing a source of valuable materials for other industries. In 2016, the United Egg Producers (UEP), a cooperative representing approximately 95 percent of egg producers in the U.S., announced its goal to end the practice of male chick culling in American hatcheries by 2020⁹.

Efforts to address the day-old culling of chicks in hatcheries are underway with industry and consumer support^{5,8,9}. However, these proposed solutions have various drawbacks that will likely prevent global adoption. An ideal solution would function very early in incubation (prior to chicks developing sensation and also before hatcheries have invested in incubating the eggs), at high-throughput and without the introduction of transgenic DNA into the poultry genome, resulting in a product considered to be a genetically-modified

organism (“GMO”). To spur the development of innovative “clean” technologies with the potential for global adoption, FFAR and Open Philanthropy are investing in the development of solutions that are accurate, highly reproducible and that function prior to incubation.

2. Objective

The objective of this prize is to stimulate the development of new technologies to accurately identify the sex of poultry embryos prior to incubation.

3. Research Areas Supported

This program will support research projects that seek to develop a technology capable of identifying the sex of poultry prior to incubation. For Phase I, we anticipate the following:

- The technology will be highly accurate (high sensitivity and specificity)
- Functions prior to incubation of eggs at 37-38 °C
- Is capable of processing 2,000 eggs per hour
- **Ideally** non-invasive/does not penetrate the eggshell

Scientific approaches may include any technically feasible methods for identifying embryo sex, including but not limited to genetic, hormone or chemical-based assays that use microfluidics, polymerase chain reaction (PCR), robotics, spectrophotometry or light scattering, colorimetry, volatile chemical detection, sensors and/or machine-learning.

4. Program Timeline and Award Information

Anticipated Funding

FFAR anticipates awarding up to \$6 million dollars in total under this program.
Matching funds are not required.

Phase I: Seed Funding.

Objective: Explore new ideas or significant improvements of existing technology

Number of Anticipated Awards: 0–5

Maximum Request: \$400,000 per project

Application Due Date: May 15, 2019

Anticipated Project Start Date: Fall 2019

Project Duration: 12-24 months

Indirect Expenses: A maximum of 10% of the total award may be used for indirect costs. FFAR’s indirect cost allotment is not an indirect cost rate applied to the total modified direct costs but instead it is an overall allotment from the Total Funds Request, also known as the Total Project Costs, to be used for IDC. This means 90% of the total funds requested must go directly to the proposed research. So, if you

request the maximum, the total direct cost available to the project is $\$400,000 \div 1.111 = \$360,000.00$.

Phase II: Prize Competition

Objective: Develop and validate working prototypes that meet the Phase II criteria (draft criteria provided below. Final criteria to be published in 2020).

Number of Anticipated Awards: 1

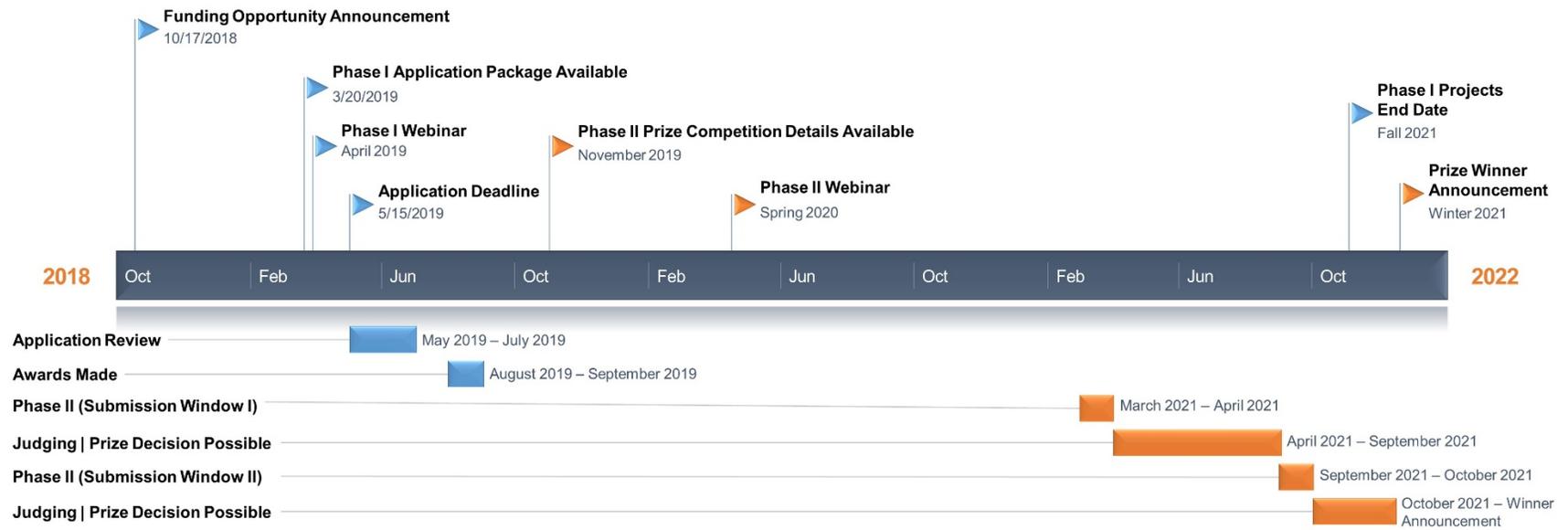
Award Amount: up to \$4,500,000 (final amount to be determined at the time of the Phase II announcement)

Application Package Available: November 2019

1st Window for Application Consideration: Spring 2021

Program Closes: Winter 2021

Egg-Tech Prize Timeline



Key Dates:

Phase I

October 17, 2018: Funding Opportunity Preview

March 20, 2019: Phase I Application Package Available at
<https://grants.foundationfar.org/>

April 2019: Webinar

May 15, 2019 3:00 PM (EDT): Application Deadline

August – September 2019: Applicants Notified and Awards Made

September 2019: Anticipated Projects Start Date

Phase II

FFAR anticipates that Phase II will open in early 2020

Details to be released in late Fall of 2019

**There is a two-hour grace period with all application deadlines

5. Eligibility

Any domestic or international public or private institution, consortium, non-profit organization, for-profit company, tribal government entity or any combination of the above is eligible to apply.

Participation in Phase II of the competition does not require that a Research Team apply for or receive an award in Phase I. **Phase II will be open to all Research Team(s) regardless of previous participation or funding in Phase I of the Egg-Tech Prize.**

6. Phase I Review Process

Review Process: Submitted full applications will undergo review using a two-stage peer review process: (1) Internal review, and (2) Egg Tech Prize Steering Committee review. In the first stage, applications will be evaluated by a combination of FFAR staff and independent, scientific experts using the application review criteria posted in RFA. Applications judged to be most meritorious by the Prize Steering Committee based on comparisons with other applications from the same cycle will be recommended for funding. All reviewers are required to read and acknowledge acceptance of FFAR's [Conflict of Interest Policy](#) and [Non-Disclosure Agreement](#). We make reasonable efforts to ensure that applications are not assigned to reviewers with a real or apparent conflict with the applicant or project personnel. Reviewers with a conflict of interests are recused from evaluating or participating in the discussions of applications with which they have a conflict. Each stage of the review is conducted confidentially, and as such, FFAR is responsible for protecting the confidentiality of the contents of the applications.

Applications recommended for funding by the Steering Committee will go to the Scientific Program Director and FFAR's Executive Director to consider program priorities and available funding level.

Full applications are evaluated based on scored primary review criteria and unscored secondary review criteria. The bullets under each criterion may serve as a guideline to applicants when writing their applications, and as a guideline to reviewers on what to consider when judging applications. The bullets are illustrative and not intended to be comprehensive. Reviewers will evaluate and score each primary criterion and subsequently assign a global score that reflects an overall assessment of the application. The overall assessment will not be an average score of the individual criterions; rather, it will reflect the reviewers' overall impression of the application. Evaluation of the scientific merit of each application is within the sole discretion of the peer reviewers and they may raise additional factors to consider that are not covered in the bullets for each criterion.

The following guidelines are illustrative of the merit-based review criteria. Scientific innovation (approximately 25%).

Applications should describe a highly innovative scientific concept that differs from existing approaches to addressing the challenge of in ovo sex determination, with the goal of developing an ideal "Clean Technology."

Is there preliminary evidence or theoretical estimates of the accuracy, speed, optimal timing and safety of the described technology?

What is the potential accuracy?

Will the technology function prior to incubation of eggs at 37-38 °C?

Is the technology equally effective across poultry breeds and species?

Will the technology impact hatching rate?

Does the technology require penetrating the eggshell, and if so, is the process to do this consistent with hatchery procedures and food safety protocols?

Strategy for Proof of Concept (approximately 25%).

What are the methods for developing a prototype?

Is the strategy for proof-of-concept studies reasonable and scientifically feasible?

Will the chosen approach be more successful than existing methods?

Is the study designed for statistical significance?

Will the project demonstrate that the technology accurately identifies embryo sex at a rate of 2,000 eggs per hour?

Are there collaborations and documented partnerships that strengthen the capacity to carry out the goals or implementation of the project?

Are there preliminary data or other evidence that support the approach and likelihood for success?

Are the potential risks and pitfalls adequately identified and addressed?

Feasibility and Timeline (approximately 25%).

Is the approach scientifically feasible?

Is the timeline reasonable for the work described?

What are the potential effects on hatch rates, hatchery/farm productivity and chick welfare?

What are the potential costs and plans for licensing/industry adoption?

Is the research environment (facilities, equipment and institutional/corporate support) appropriate to conduct the research?

Are the expected milestones and outputs clearly described?

7. Phase II Draft Review Process

Important Note: Phase II will not be open to receive applications until 2020. Final criteria will be announced when Phase II opens for applications.

Phase II will involve development and validation of a working prototype of a clean technology. Success will require evidence that the working prototype meets the prize criteria described, including possible in-person demonstration.

8. Terms and Conditions

Every Grant Agreement is unique to the project. However, the Foundation for Food and Agriculture Research expects applicants to have reviewed the [sample Grant Agreement](#) prior to applying to ensure applicants are aware of the applicable terms under which the grant is offered. FFAR will only entertain potential modifications to the Grant Agreement under the most exceptional circumstances. Successful applicants are strongly encouraged to sign the Grant Agreement as presented.

FFAR is not liable for any claims, liabilities, damages, losses, expenses, injuries, demands, suits, and judgments, including without limitation reasonable attorneys' fees and costs, arising from or relating to participation in or pursuit of the Egg-Tech Prize.

Estimated Number of Awards: To be determined. The number of awards depends on the quality and the total funds requested of successful application(s). The number of applications funded is left totally to the discretion of FFAR including choosing not to fund any applications under this opportunity.

If an application is selected for funding, FFAR reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to, matching funds, or other budget information. Potential grantees are free to accept or reject the Grant Agreement as offered.

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In addition, specific intellectual property (IP) terms for the Egg-Tech Prize include the following:

“Research Team” refers to each applicant or team of collaborators that applies for and/or receives research funding or a prize award.

FFAR employees, advisors and funding collaborators will not disclose the identity of Research Teams and will hold each Research Team’s application information and other materials in strict confidence.

Research Teams must own the rights to their proposed technology or elucidate plans to protect such intellectual property. Any intentionally false representation to this effect will violate the terms of the Award Agreement and may result in cancellation of the award and the return of any funds to FFAR.

Inventions (whether patentable or not), compositions of matter, discoveries, materials, methods, improvements, devices, formulas, processes, products, data, software and other copyrightable works created, made, developed, conceived or reduced to practice by the Research Team using research funding or prize awards, including without limitation all associated patents, copyrights, trade secrets and know-how (**“Project Results”**) shall be the property of the Research Team or the Research Team’s institution;

At regular intervals during each Research Team’s performance of the Project and at the conclusion of each Research Team’s Project, each Research Team shall provide FFAR with a detailed description of its use of research funds or prize awards and any resulting Project Results;

Research Team shall make the Project Results available for research and academic purposes through non-exclusive, royalty-free licenses;

Each Research Team shall have the right to commercialize Project Results, either itself or through one or more commercial licensees, for the purposes of further development of Project Results toward the goal of widespread commercial adoption of a new sex selection chick-culling technology resulting or derived from the Project Results in accordance with the following:

(a) Entities who intend to develop technologies resulting from the Project for commercial sale (whether a Research Team or a commercial licensee of a Research Team) (each, a **“Developing Entity”**) must: (i) develop a development and commercialization plan describing how such Developing Entity intends to bring such technologies to market; (ii) agree to appropriate diligence requirements and development milestones intended to advance commercial development and bring such technologies to market; (iii) not grant exclusive licenses for Project Results (or any technologies resulting or derived from Project Results) to any end users in a manner that would prohibit the applicable technologies from being broadly accessible to end users; and (iv) agree to use commercially reasonable

efforts to make Project Results (and any technologies resulting or derived from Project Results) broadly accessible to potential end users.

(b) Research Teams may impose royalties or other financial terms in association with their grant of commercial licenses relating to Project Results;

(c) As a condition of a Research Team receiving research funds or prize awards, FFAR may impose financial terms intended to cause repayment to FFAR of research funds or prize awards (plus reasonable additional amounts) in the event that such Research Team achieves commercial milestones associated with significant revenue;

(d) If a Developing Entity intends to grant an exclusive license to any Project Results (or any technologies resulting or derived from Project Results), such entity shall allow FFAR to provide input on potential partners and licensees, and shall reasonably consider FFAR's input on such potential partners and licensees, provided that any grant of any exclusive license to potential end users for such technologies that would prevent other potential end users from using or accessing such technologies shall require FFAR's prior written approval;

(e) If FFAR determines in good faith that any Developing Entity that is exclusively responsible for development of Project Results or any technology resulting or derived from Project Results is not using commercially reasonable efforts to bring applicable technologies to market in accordance with an approved development plan or is otherwise not in compliance with any applicable conditions of research funding or prize awards, FFAR may notify the applicable Developing Entity of such concern. Such Developing Entity must respond to such concerns in writing within sixty (60) days and identify how it intends to address such concerns and the timeline for addressing them. If the Developing Entity has not addressed such concerns within sixty (60) days (which timeline FFAR may agree to extend), FFAR may request to meet with such Developing Entity to afford the Developing Entity an opportunity to demonstrate to FFAR's reasonable satisfaction that the Developing Entity has a commercially reasonable plan and the ability to bring the applicable technologies to market in accordance with the development plan. At that meeting, FFAR and the Developing Entity will agree upon any required changes to the development plan and any required timelines. If the Developing Entity thereafter does not achieve the immediately following milestone or other critical event identified in the revised development plan, then (i) in the case of a Developing Entity that is a commercial licensee of a Research Team, the Research Team shall terminate any exclusive license granted to the Developing Entity or convert any such license to non-exclusive, upon reasonable request of FFAR, or (ii) in the case of a Developing Entity that is a Research Team, FFAR shall have the right to assume, or to appoint a third party to assume, the lead role in the development and commercialization of such technologies, and FFAR or such third party shall receive all licenses necessary to assume such role.

9. To Apply

PREPARE TO APPLY: PLEASE SEE BELOW FOR APPLICATION TEMPLATE

Please note: All applications **MUST** be completed and submitted through [FFAR's online grants management system](#).

APPLICATION SUBMISSION GUIDELINES:

Applications must be submitted through FFAR's online application receipt system. If you are a new user, register for an account by clicking the green "Register" button at the top right corner of the home page. You will receive a confirmation email to activate your account before you can sign-in to your account. Once you log in, click on the corresponding program to start your application.

Only applications submitted through this portal will be considered eligible for evaluation. FFAR will not accept applications submitted by any other medium. There is a two-hour grace period for all deadlines. Applications that are not submitted by the deadline or within the grace period will not be accepted. To be fair to all our applicants, FFAR cannot grant an extension to applicants who missed the deadlines posted in the Key Dates section.

Contact Information

FFAR Staff Contact

Please direct all scientific content inquiries to Dr. Timothy Kurt, Scientific Program Director: tkurt@foundationfar.org

Please direct all inquiries related to application submission to: grants@foundationfar.org

Please direct all other inquiries to Briana Hanlon, Scientific Program Associate: bhanlon@foundafar.org

Technical Support Contact

Hours of operations: Monday – Friday 6am – 10pm EST; weekends: 10am – 6pm EST

Phone support: Monday – Friday 8am – 8pm EST

Email: support@smapply.io

References

1. Burlingame, B. & Dernini, S. Sustainable Diets and Biodiversity: Directions and Solutions for Policy, Research and Action. International Scientific Symposium, Biodiversity and Sustainable Diets United Against Hunger, FAO Headquarters, Rome, Italy, 3-5 November 2010. in (Food and Agriculture Organization of the United Nations (FAO), 2012).
2. Conway, A. World egg production up 18 percent in 2016 from 10 years ago. *Poult. Trends* 32–38 (2018).
3. Krautwald-Junghanns, M.-E. *et al.* Current approaches to avoid the culling of day-old male chicks in the layer industry, with special reference to spectroscopic methods. *Poult. Sci.* **97**, 749–757 (2018).
4. Mueller, S. *et al.* Carcass and meat quality of dual-purpose chickens (Lohmann Dual, Belgian Malines, Schweizerhuhn) in comparison to broiler and layer chicken types. *Poult. Sci.* **97**, 3325–3336 (2018).
5. Steiner, G. *et al.* Gender determination of fertilized unincubated chicken eggs by infrared spectroscopic imaging. *Anal. Bioanal. Chem.* **400**, 2775–2782 (2011).
6. Weissmann, A., Reitemeier, S., Hahn, A., Gottschalk, J. & Einspanier, A. Sexing domestic chicken before hatch: A new method for in ovo gender identification. *Theriogenology* **80**, 199–205 (2013).
7. Leary, S. L. *et al.* AVMA guidelines for the euthanasia of animals: 2013 edition. in (American Veterinary Medical Association Schaumburg, IL, 2013).
8. Galli, R. *et al.* Sexing of chicken eggs by fluorescence and Raman spectroscopy through the shell membrane. *PLoS ONE* **13**, 1–14 (2018).
9. McDougal, T. US farmers commit to end male chick culling. *Poult. World* 8–8 (2016).

Application Form

Please note: All applications MUST be completed and submitted through [FFAR's online grants management system](#).

Please do not include background information on the issue to be addressed unless it is specifically relevant to the proposed solution.

Project Executive Summary

The project summary should be an overview of the proposed project written in the third person, informative to others working in the same or related fields, and, insofar as possible, understandable to a technical reader. It should not be as technical as a typical abstract. It should be a brief, high-level description of the full application, including, project objectives, anticipated outcomes, potential impact, budget, partners/collaborators, timeline, and an explanation of why the project is innovative.

Public Abstract

Should the proposed project be selected for funding, the public abstract would be used in the funding announcement and it is intended for a general audience (do not include proprietary information in this section). Describe, in simple, nontechnical terms, the overall goals of the proposed project, the potential significance of the results, and the impact of the work on advancing the food and agriculture sector.

Project Description

The project description should provide a clear proof of concept and statement of the work to be undertaken. It must contain the following subheadings, address the stated prompts, and be limited to 5,000 words.

Introduction

A summary of the knowledge that has laid the groundwork for this technology, including any relevant preliminary work or data that has informed the development of the concept and/or technology.

Approach

A detailed account of the procedures or methodology you will use to achieve the goals and supporting objectives. The account must have enough information for a panel of experts to judge the merit of the project. All application information is treated as confidential.

The account should include:

- i) Proposed project activities described sequentially.*
- ii) Techniques and materials to be used, including their feasibility and rationale.*
- iii) How will this technology accurately determine the sex of chicken embryos in ovo? What is the expected sensitivity and specificity? Will the technology function prior to incubation of eggs (if not, at what day)? What is the potential operating speed or rate of function for the technology (early prototypes need to be highly accurate while sexing at least 2,000 eggs per hour)?*
- iv) A description of anticipated project risks and potential weaknesses of the technology and how you will mitigate them.*
- v) How will data be analyzed or interpreted for statistical significance?*
- vi) Plan to communicate results or amplify outcomes to stakeholder audiences.*

Project Goals and Objectives

Please list the objectives by year for the duration of the project. For Goals, list specific aims that the project is trying to accomplish in each year of the project. For Objectives, list specific measurable

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actions that will be taken to achieve the corresponding goal. These goals and objectives will also be used when submitting and evaluating progress reports and assessing project success.

How many years is the proposed project?

- *One Year*
- *Two Years*

How many goals and objectives do you have for Year 1?

Year 1 Goals and Objectives

How many goals and objectives do you have for Year 2?

Year 2 Goals and Objectives

Anticipated Outcomes or Outputs

Clearly describe in detail how the project will result in a working prototype. Summarize how the proposed research creates new paradigms or could have alternative applications. This section should communicate the potential impact of the technology should the goals of the project be achieved.

Data and Information Management Plan

To facilitate data and information products sharing, all full proposals submitted to the Foundation for Food and Agriculture Research must include a data management plan. (Note: Information products may include documents [i.e. reports, workshop summaries, etc.], multi-media curricula for education and training [i.e. video and/or online tutorials, manuals and handbooks, etc.]; and other media and communication platforms.)

Do you own the intellectual property rights for your technology and/or have a clear path to protect and commercialize your technology? Please describe briefly.

What are the potential costs of production of the technology? Please describe a business plan that may include licensing and other options to make the technology available to the industry.

Even in the unlikely case in which no data or any other information products will be produced, a plan must be submitted that states "No information products are expected to be produced from this project."

Have you identified barriers that might inhibit the uptake and adoption of your research outcome(s)?

Yes *No*

What are they and how will your project propose to address them?

How do you propose to identify and address them?

Have you identified barriers that might hinder the optimal or intended use of your research outcome(s)?

Yes *No*

What are they and how will your project propose to address them?

*Will your research outcome(s) be scale neutral? (Scale neutral here means feasible at any production scale). *Yes* *No**

What barriers might obstruct them from scaling up or down?

How do you propose to address these barriers?

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