



University Council

March 11, 2022

UNIVERSITY CURRICULUM COMMITTEE – 2021-2022

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Dear Colleagues:

The attached proposal from the Office of Research for a new Institute for Integrative Precision Agriculture will be an agenda item for the March 18, 2022, Full University Curriculum Committee meeting.

Sincerely,

Susan Sanchez, Chair

University Curriculum Committee

cc: Provost S. Jack Hu
Dr. Marisa Pagnattaro



Proposal to Establish the
Institute for Integrative Precision Agriculture

Proposed by Allen Moore and Jaime Camelio
March 2022

Motivation

From the inception of land grant universities in 1852, the agriculture industry has incorporated technology developed with university partners to improve crop yields, reduce labor, and provide for a growing population and urbanization. Georgia has played a meaningful role in this effort. Eli Whitney invented the cotton gin near Savannah in 1793, changing farming forever. In 1920, more than 25 million mules and horses powered American farmland. Over a few decades, the introduction of tractors revolutionized agricultural production. The Rural Electrification Act of 1936 dramatically altered American farms, bringing light and power to the rural countryside. Similar transformational events included hybrid seed corn, fertilizer produced by the Haber process of nitrogen fixation, and the widespread development of insecticides and pesticides. More recently, genomics, bioengineered food and fiber, and applications of molecular tools have greatly increased production.

Today, we are faced with the challenge of feeding a growing world population in which demand for food is expected to increase by 70%. This will require advancements in efficiency along with different approaches related to our food system. The southeastern United States, and Georgia in particular, has a unique opportunity through favorable geography, climate, business environment, and civic leadership to “feed the future.” Agriculture is the largest industry in the state and, unlike many states such as those in the Midwest, is extremely diverse.

Current Status at UGA

Agricultural research is a recognized area of strength at UGA. The university is ranked in the top 10 internationally in poultry science, entomology, and plant genetics and genomics. Plant genomics is a particular area of strength, found in both the College of Agricultural and Environmental Sciences (CAES) and Franklin College of Arts and Sciences. Likewise, poultry science is a strength in both CAES and the College of Veterinary Medicine. The new growing College of Engineering has the only Agricultural Engineering program in Georgia, and it is one of the oldest in the country. In addition, UGA has invested in other areas of growth in recent years, including informatics and data analytics. Finally, Georgia and the rest of the southeastern United States present interesting and unique challenges in agriculture, such as a greater diversity of crops, climate, and soils. For example, cotton and peanuts, two large global commodities widely found in this region, present very diverse problems that are different from traditional technologies being developed for corn or soybean, major crops found in other areas of the United States.

Precision agriculture incorporates information and data from variation in the field to optimize inputs and maximize productivity. The rise of technology enhanced equipment alongside greater use of sensors, coupled with widespread availability of GPS, has revolutionized farming. The use of cloud computing and

data storage has further enhanced data driven decision making in agriculture. Integrative precision agriculture is the next step, integrating multiple sources of data and influencing production and post-production of agricultural processes. With integrative precision agriculture, we are taking the next step and influencing the entire agricultural process.

The next generation of integrative precision agriculture goes beyond engineering for specific solutions. It involves synthesizing data from multiple inputs and types then using “big data” approaches to create novel solutions to specific environmental challenges. It also goes beyond just “precision” in that it includes other key aspects such as “decision,” “digital” and “innovative,” hence the term “integrative” in that this effort must be all inclusive for the needs of today’s complex agricultural science enterprises.

Integrative precision agriculture is an important key to our future by fusing new technologies and big data to improve the efficiency of agricultural production through better decision making. UGA is currently ranked as one of the top 25 universities in the world for precision agriculture, according to the trade publication, *Precision Ag*. UGA’s precision agriculture researchers in the College of Agricultural and Environmental Sciences and Warnell School of Forestry and Natural Resources are working closely with Georgia’s producers to provide practical solutions to the challenges faced in agriculture across our state. We already have a strong extension presence in precision agriculture. For example, UGA precision agriculture researchers have provided farmers with yield and profit maps for cotton—allowing them to determine the viability of precision agriculture and to identify the most profitable areas of their fields.

The growth of UGA’s College of Engineering (ENGR) into a thriving comprehensive college brings new technologies and solutions to agriculture that complement the efforts of CAES and Warnell. Engineering researchers from electrical engineering led a national program to develop automated methods of harvesting blueberries, a crop that is becoming increasingly important to Georgia agriculture. UGA researchers in computer systems engineering have helped identify the financial benefit of applying GPS guidance to planting and inverting peanuts as well as the feasibility of variably applying defoliants and other critical inputs on cotton. Faculty from CAES and the ENGR are developing information-centric approaches to improve greenhouse production and increase value to the grower. In addition to ENGR, faculty in Franklin College of Arts and Sciences are contributing expertise in AI, computer science, geography, genetics, and plant biology in precision agriculture initiatives on campus and across the state.

Vision

To build on UGA’s strengths and move these critical technologies closer to farmers, the University proposes the creation of an Integrative Precision Agriculture Institute that would connect the work done by CAES, UGA’s College of Engineering, Franklin College of Arts and Sciences, and other USG institutions, with private agribusinesses. The institute will provide the conduit connecting external agricultural industry with researchers and resources within UGA. Using public and private resources, this effort will also provide a collaborative administrative structure to accelerate and lead the development and commercialization of precision agricultural innovations in Georgia. This endeavor would attract highly skilled and innovative talent to Georgia, enhancing the competitiveness of Georgia’s agricultural and technology industries. This effort will have seamless connectedness across research, teaching and outreach/extension which are core to our land-grant responsibilities.

Mission & Outcomes

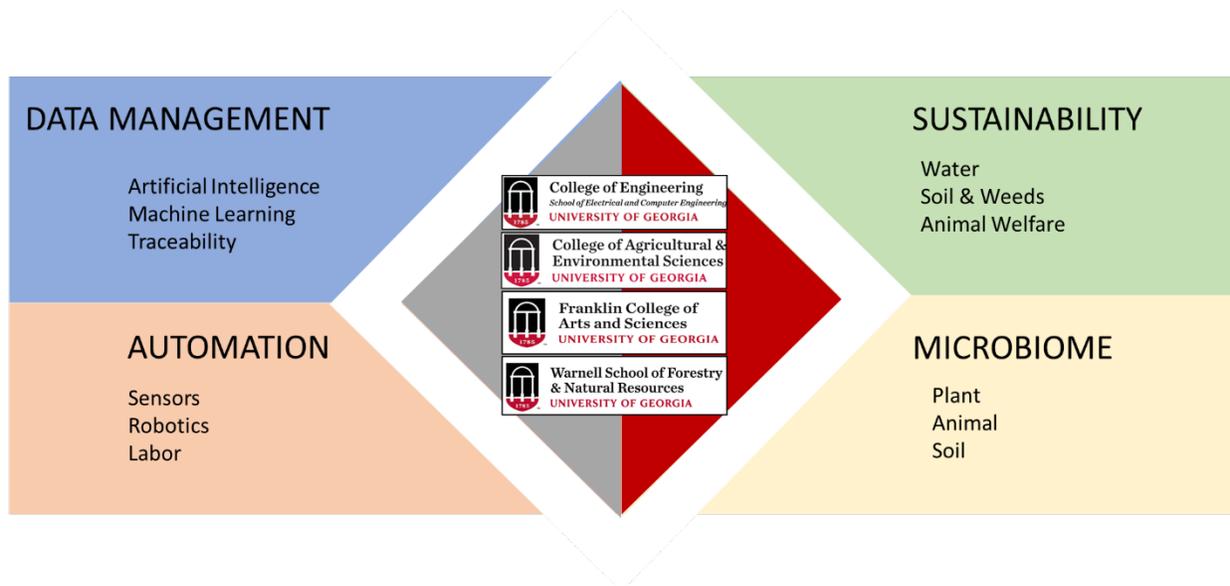
The mission of the proposed **UGA Institute for Integrative Precision Agriculture** is to cultivate and support interdisciplinary research in developing next generation technologies for agriculture by connecting researchers across campus and connecting researchers with industry to provide wholistic solutions to problems defined by industry. The Institute will provide a forum for ongoing interactions and brainstorming, ensuring that the connection between industry and academia persists beyond the initial identification of a problem. The goal is to work together to address the key issues facing agriculture and society by integrating research from biology, engineering, computer science, data science and statistics, physics, chemistry, public health, veterinary medicine, and the social sciences and humanities to address issues of relevance to the agriculture industry. This integration of approaches allows researchers to address current and future problems, developing precise solutions that ensure productivity, sustainability, and food security for a growing population. In particular, the IIPA will focus on solving the three major challenges facing sustainability of agriculture: water, labor, and sustainable resources. The initiative will bring together the key core elements of a research university – learning, research, innovation, and entrepreneurship.

The IIPA does not replace an academic's research focus, nor replace activity in their home department. Instead, the IIPA will provide an opportunity to expand opportunities to apply specialist scholarship in trans-disciplinary teams. Thus, membership in the institute is not tied to ongoing activities but represents a willingness to contribute where the academic specialty might prove valuable.

The UGA Precision Agriculture Initiative will focus on the top-8 agricultural industries in Georgia (poultry and eggs, peanuts, cotton, livestock, controlled environment agriculture, fruits and vegetables, forestry) – areas where we have research strengths and can become global thought leaders.

Within the context of our key crops, there will be four key areas of opportunity integrated in the initiative: Sustainability, Biology, Automation, and Data Management. Each of these key areas of opportunity aligns with some of the biggest global agricultural challenges that will need to be solved in the 21st century. Faculty expertise will fit within one of these four categories.

Each area will have additional nexus points relating to where interdisciplinary work is most likely to cross and lead to durable solutions. These nexus points will bring together different parts of the university, as well as external partners from around the world.



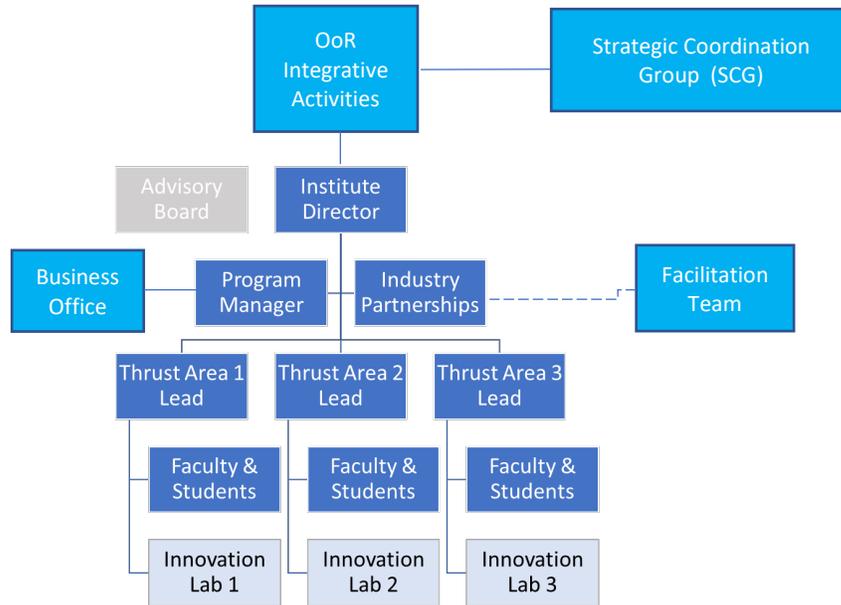
Organization

The Institute for Integrative Precision Agriculture will be led by a director, who is recommended by the Vice President for Research and the deans of the participant colleges, then approved by the provost. The director will report to the VP for Research. For up to the first two years, until a director is hired through a national search, the institute will be led by interim co-directors: Dr. Jaime Camelio, Associate Dean for Research, Innovation, and Entrepreneurship in the College of Engineering, and Dr. Allen Moore, Associate Dean for Research in the College of Agricultural and Environmental Sciences. Both Dr. Camelio and Dr. Moore have been involved in the IPA initiative since its inception.

The director (or interim directors) will identify key thrust areas of research after surveying key industrial partners and mapping faculty capabilities. Each area will be led by a faculty member that will be responsible for organizing the faculty with expertise and interests related to each specific area. The institute looks for an expansive approach to research by trying to incorporate different perspectives in each domain.

Membership in the institute is voluntary. Continued membership depends on active participation in workshops and projects sponsored by the institute. Members can come from any college or school, with the permission of the dean of that college or school.

The following organization chart is proposed, with the institute fitting into a new supervisory structure, Office of Integrative Activities, being instituted by the Vice President for Research. The advisory board illustrated below will be constituted by the deans of the UGA participating colleges and 3 – 5 industry representatives. The advisory board will meet bi-annually and provide advice in the direction of the institute.



Funding

The University of Georgia has invested in the integrative precision agriculture initiative in two ways. First, the Office of the Provost has funded 7 new faculty positions through a campus cluster hire and these new faculty will reside in either the College of Engineering or the College of Agricultural and Environmental Sciences. Two additional positions will be funded by the College of Engineering and the College of Agricultural and Environmental Sciences. These hires will be made over the next two years (FY23 and FY24). Second, while not necessarily targeted at precision agriculture, there is an ongoing hiring initiative in Data Science and Artificial Intelligence across the university. In addition, the Governor of Georgia has proposed funding for additional faculty positions in his FY23 budget.

The most important personnel additions will come in two types: “bridgers” and “world-experts”. The bridgers are faculty with broad experience and knowledge base that can connect different units across campus. They are important for two reasons. First, the biggest current challenge in precision agriculture is that its component pieces do not fit together well. Organizations that help precision agriculture break through will be the ones who have broad enough knowledge to pull together the disparate pieces. Similarly, bridgers are required because precision agriculture cannot be advanced in research silos. UGA can only excel in precision agriculture by being cross-disciplinary. The current organization needs to add people who can help the existing structure act in a cross-disciplinary way. Secondly, world leaders will provide inspiration, leadership, and recognition. The upfront cost is higher, but established researchers help jump start new initiatives such as this.

In addition to the faculty positions contributed by the provost to the colleges, initial seed funding will be provided by the provost, the Vice President for Research, the College of Engineering, and the College of Agricultural and Environmental Sciences. Initial budget has been set at \$300,000 (\$75,000 each). As new colleges are represented in the institute (e.g., Veterinary Medicine, Franklin College of Arts and Sciences, Warnell School of Forestry and Natural Resources, etc.), together with CAES and ENGR, the respective deans will be asked to contribute to ongoing costs.

Proposed Institute Activities

It is envisioned that the institute will provide organizational support for multiple activities to enhance collaboration among faculty from different units and to be a conduit for industry collaboration. Activities that are being considered, but are not limited to:

Facilitate communication and collaboration: The institute will lead efforts to bring together faculty and other key players to enhance networking and collaborative efforts that will address critical needs and elevate work of the institute. In partnership with UGA and College communication units, the institute will lead a proactive communication strategy that highlights work, opportunity, and impact of IIPA.

Industry Workshops: The institute will organize semiannual workshops within a particular topic of interest. The workshop will be an opportunity to engage industry in discussions related to key topics of industrial interest. The format will consider participation from industry, government agencies, faculty (from UGA and other institutions), and students. During the workshop, a session will be dedicated to road mapping activities that identify potential research opportunities.

Seed Funding: The institute will run a seed funding program in collaboration with the office of the Vice President for Research to invest in areas identified in the workshops or submitted by faculty. We will work with the different colleges to secure graduate student co-investment opportunities, as well.

Innovation Labs: The institute will engage faculty to align in the development of physical platforms for technology exploration in the key thrust areas. The goal of these platforms is to engage a large number of students (undergraduates and graduates) to develop initial capabilities in the domain. These capabilities will then be used for workforce development that connects with industry needs, but also prepares the laboratories to engage with industry in research discussions and projects.

Institute Review

To ensure that IIPA is fulfilling its mission and meeting its goals, periodic reviews will be performed. Yearly goals will be explicit, coupled with key performance indicators to evaluate direction of progress. The yearly goals will be produced with input from a governing council, consisting of the dean of the College of Agricultural and Environmental Sciences, the dean of the College of Engineering, the Vice President for Research, and the provost (or their designated representatives). Line management of the institute director(s) will be by the Vice President for Research. As part of regular annual reporting to the governing council, the institute director(s) will provide a formative review of progress towards the current year's goals. In addition, the institute's initial institutional review will occur in year three as required by UGA policy and every five years thereafter. Reviews will be conducted according to the PRAC policy and procedures of OIA. Key measurable outcomes that will be tracked and quantified by the institute include industry participation, faculty engagement, student involvement, external funding, collaborative publications, among others. In addition, the institute director(s) will provide yearly input on faculty participation to the relevant department heads of the tenure unit within which the faculty member resides. This input will be written and available to be used in the annual evaluation of the faculty member as well as third year reviews, and promotion and tenure, as appropriate.

Education Plan

The IIPA has no plans to establish new degree programs at this time. Engineering degrees have requirements that are not a part of degrees in agriculture. However, collaboration across colleges should result in new course offerings that address modern IPA and that are offered in the appropriate home

department and college. In addition, success in cultivating relationships with industry partners will naturally depend on matching their needs with UGA expertise and resources to meet those needs. A major resource available are students; a major attraction of industry working with UGA is access to student talent. Likely collaborations with mission organizations will include UGA helping meet these organizations' education and training needs. As such, existing UGA education programs and associated faculty and students may benefit from the training opportunities that emerge. New courses that meet industry needs may be developed within the appropriate department. The Institute can and should be a mechanism for industry to inform the course offerings in IPA at UGA. In addition, industrial funding could include not only training of students and postdocs through joint research projects, but also opportunities for training and professional development of industry staff through existing UGA advanced degree offerings and continuing education courses.

Innovation District Integration

The proposed research activities in the institute align with current activities identified by the UGA innovation district leadership team. It is expected that the institute innovation labs will be key facilities in the proposed Phase III of the Innovation District. The demonstration innovation labs will be used to build interactions with industry participants in the district and to facilitate innovation and entrepreneurship activities.