NC 11194 Nanotechnology and Biosensors
Meeting Minutes

Meeting dates: August 11-12, 2026
Meeting type: Hybrid (in-person and remote)
Meeting venue: University of Illinois Urbana-Champaign and Zoom

1. **Current Officers**
    - **Chair:** Yi-Cheng Wang, University of Illinois
    - **Secretary:** Diana Vanegas, University of Arkansas
    - **Administrative Advisor:** Tala Awada (USDA-NIFA Administrative Advisor)
2. **In-Person Participants**
    - Mohammed Kamruzzaman, Agricultural and Biological Engineering, University of Illinois
    - Boris Camiletti, Crop Sciences, University of Illinois
    - Sundararaman Gunasekaran, Biological Systems Engineering, University of Wisconsin
    - Yi-Cheng Wang, Food Science and Human Nutrition, University of Illinois
    - Evangelyn Alocilja, Biosystems and Agricultural Engineering, Michigan State University
    - Chenxu Yu, Agricultural and Biosystems Engineering, Iowa State University
    - Hazal Turasan, Food Science and Human Nutrition, University of Illinois
    - Diana Vanegas, Biological and Agricultural Engineering, University of Arkansas
    - Changmou Xu, Food Science and Human Nutrition, University of Illinois
    - Matt Stasiewicz, Food Science and Human Nutrition, University of Illinois
    - Braulio Macias, Food Science and Human Nutrition, University of Illinois
3. **Remote Participants**
    - Jose Reyes, Agricultural and Biological Engineering, University of Florida
    - Anhong Zhou, Biological and Chemical Engineering, Utah State University
    - Omer Sadak, Food, Nutrition, and Packaging Sciences, Clemson University
    - Mengshi Lin, Food, Nutrition and Exercise Sciences, University of Missouri
    - Olga Tsyusko-Unrine, Plant and Soil Sciences, University of Kentucky
    - Jian Shi, Biosystems and Agricultural Engineering, University of Kentucky
    - Kailong Zhang, Biosystems and Agricultural Engineering, University of Kentucky
    - Jeong-Yeol Yoon, Biomedical Engineering and Biosystems Engineering, University of Arizona
    - Kurt Ristroph, Agricultural and Biological Engineering, Purdue University
    - Tala Awanda, USDA-NIFA Administrative Advisor and Associate Dean for Research at the University of Nebraska-Lincoln
    - Steven Thomson, USDA NIFA National Program Leader
4. **Call to Order and Welcome**

    The meeting was called to order by Yi-Cheng Wang. Participants were welcomed to the University of Illinois Urbana-Champaign. Opening remarks by Rodney Johnson, associate dean for research and director of the Illinois Agricultural Experiment Station, at University of Illinois, highlighted the value of multistate collaborations in addressing complex agricultural, food safety, and environmental challenges and emphasized the alignment of the NC-1194 project with USDA priorities.

Ronaldo Maghirang, head and professor in the department of Agricultural & Biological Engineering, also welcomed attendees and recognized the accomplishments of the NC-1194 project, including extensive publication output, graduate student training, and development of technologies relevant to food and agriculture. The recently approved project renewal for the next five-year period was also acknowledged.

5. **Administrative Updates**

Tala Awada, Administrative Advisor, provided updates on multistate activities and emphasized:

- The importance of submitting annual reports within 60 days of the annual meeting.
- Continued emphasis on demonstrating relevance to current and emerging USDA priorities.
- Increased attention to collaborative impact, stakeholder engagement, technology adoption, and implementation beyond laboratory development.
- Anticipated future emphasis on livestock, ranching systems, grasslands, forestry, and broader managed landscapes in research portfolios.

Members welcomed Tala Awada to the committee and expressed appreciation for her support and guidance.

Steven Thompson, USDA-NIFA, provided programmatic updates. Major updates included:

- New Notices of Funding Opportunity (NOFOs) are expected soon following extended review processes.
- The current Nanotechnology program will likely be renamed, although nanotechnology-related research topics will continue to be supported.
- Proposal submission deadlines will be pushed later than historical schedules.
- Agricultural Systems programs are increasingly emphasizing:
    - Transition to practice
    - Technology transfer
    - Applied science
    - Measurable impacts. Researchers were encouraged to strengthen partnerships with Extension personnel.
- AI Institutes currently have no identified funding for additional rounds.
- Proposal pressure continues to increase substantially across NIFA programs. For example, the Data Science and AI program received 418 applications.
- Funding rates remain highly competitive, with estimated success rates of approximately:
- 3–4% for Data Science and AI,
- 7–8% for Engineering and Nanotechnology programs.

Discussion followed regarding proposal review timelines, reviewer availability, delayed notifications, program leadership changes, and communication pathways for applicants.

6. **Membership and Project Renewal**

The Chair reported that the NC-1194 project has been renewed for the next project cycle (2026–2030). Members were reminded that participation is not automatically renewed and that each participant must work through their institution to be added to the new project. The new project period begins October 1, 2026.

7. **Discussion with S1077 Multistate Group**

Matt Stasiewicz presented an overview of the S1077 multistate research project, *Enhancing Microbial Food Safety by Risk Analysis*, and discussed opportunities for collaboration between S1077 and NC-1194. Discussion focused on:

- Linking biosensor technology development with real-world food safety applications.
- Opportunities in rapid detection and management of Salmonella in poultry production.
- Connecting technology developers with industry stakeholders and Extension networks.
- The potential for future workshops, proposal development activities, and focused working groups around high-priority food safety challenges.

Members emphasized that close engagement with industry is essential for identifying practical technology needs and accelerating adoption.

8. Station Reports

a) Wisconsin

Sundararaman Gunasekaran

- Development of nanozyme and single-atom nanozyme platforms.
- Detection of antibiotics in dairy systems.
- Electrochemical sensing of neonicotinoid pesticides using laser-fabricated graphene-based single-atom catalysts.

b) Utah

Anhong Zhou

- Raman spectroscopy combined with machine learning and deep learning.
- Detection of plant stress responses.
- Microplastic exposure studies using Raman spectral analysis and advanced data analytics.
- Development of educational programs in agricultural AI and instrumentation.

c) South Carolina

Omer Sadak

- Single-wall carbon nanotube sensors for nitric oxide monitoring.
- Graphene quantum dots.
- Electrospun nanofiber packaging technologies.
- Active and intelligent food packaging applications.

d) Missouri

Mengshi Lin

- Surface-enhanced Raman spectroscopy (SERS) and transformer-based machine learning models.
- Detection and quantification of pesticide residues and multi-pesticide mixtures in food samples.
- Development of bacterial nanocellulose production systems.

e) Michigan

Evangelyn Alocilja

- Decentralized diagnostics using magnetic and gold nanoparticle biosensors.
- Rapid detection of *Salmonella* and *Campylobacter*.
- Smartphone-based biosensor analytics.
- Validation of biosensors in commercial poultry processing facilities.

f) Kentucky

Olga Tsyusko-Unrine

- Safe-by-design evaluation of nanomaterials.
- Toxicity screening of boron nitride nanomaterials used for PFAS remediation.
- Environmental safety assessment of nanoparticle-enabled fertilizer delivery systems.
- Evaluation of impacts on soils, earthworms, microbial communities, and environmental sustainability.

g) Iowa

Chenxu Yu

- Nanoplastic-protein interaction studies using Raman spectroscopy, FTIR spectroscopy, machine learning, and artificial intelligence for environmental and human health risk assessment.
- AI-enabled predictive modeling and molecular dynamics simulations to quantify nanoplastic-protein binding behavior and identify potential mechanisms associated with nanoplastic accumulation in biological systems.
- Development of experimental and computational platforms for characterizing nanoplastic interactions with biomolecules and generating quantitative indicators of binding strength.
- Evaluation of woody and grass-derived biochar amendments to reduce ammonia and nitrous oxide emissions and improve nutrient retention during manure composting.
- Microbial ecology and systems-level analysis of composting processes, including microbial community engineering, greenhouse gas mitigation, and field-scale applications for sustainable nutrient management.

h) Indiana

Kurt Ristroph

- Development of carbon-based nanocarrier formulations to improve foliar uptake, systemic movement, and utilization efficiency of agrochemicals in crops.
- Application of flash nanoprecipitation technology for scalable, cost-effective encapsulation of pesticides and other agricultural actives using low-cost, agriculture-compatible materials.
- Evaluation of nanoparticle transport within plants, including strategies to enhance movement from leaves to stems and roots for improved management of soil-borne pests and diseases.
- Development of metalloporphyrin-based tracers and imaging approaches to track nanoparticle fate, transport, and payload release in plants using ICP-MS and X-ray fluorescence mapping.
- Demonstration of improved root delivery of nanoencapsulated esfenvalerate in celery, achieving substantially greater root accumulation than commercial formulations and showing promise for managing root-feeding insect pests.
- Ongoing USDA-supported research focused on nanoparticle-enabled delivery systems for crop protection applications, including citrus greening disease management and improved agricultural chemical efficiency.

i) Illinois

Yi-Cheng Wang,

Co-Presenters: Braulio Macias, Hazal Turasan, Mohammed Kamruzzaman, and Boris Camiletti

- Development of nanomaterial-based time-temperature indicators for monitoring quality changes in shelf-stable milk through colorimetric responses and silver-gold nanoparticle systems. (Yi-Cheng Wang)
- Conversion of agricultural biomass waste into functionalized aerogels for triboelectric energy harvesting, self-powered sensors, and wearable devices capable of monitoring human motion and health-related signals.
- Production of nanomaterials from agricultural byproducts for food and material applications, including controlled assembly of nanoparticles to modify structural and functional properties.
- Development of biodegradable plant-based surface-enhanced Raman spectroscopy (SERS) biosensor platforms using protein-derived nanofibers for food safety applications, with emphasis on improving sensor selectivity and creating disposable wipe-based sensing systems.
- Development of low-cost biodegradable organic nanozyme-based sensors and smartphone-enabled platforms for point-of-use detection of pesticides, herbicides, mycotoxins, heavy metals, and food contaminants.

j) Florida

Jose Reyes

- Investigation of enzyme stabilization under high-pressure conditions to improve the long-term performance of enzymes used in biosensors and biocatalytic applications.
- Development of structure-function models linking protein stability to the presence of large internal cavities, with the goal of predicting enzyme responses to pressure and designing more stable enzymes.
- Experimental evaluation of pressure-induced stabilization of oxidase enzymes relevant to biosensing applications, including ascorbate oxidase and amino acid oxidases.
- Investigation of sucrose phosphorylase enzymes to validate relationships between protein structure, cavity volume, activation volume, and pressure-enhanced thermal stability.
- Development of predictive approaches for optimizing enzyme stability and catalytic performance under industrial processing conditions, with applications in biosensors, biocatalysis, and biotechnology.

k) Arkansas

Diana Vanegas

- Development of laser-induced graphene (LIG) nano-biosensors for low-cost environmental water quality monitoring and agricultural applications.
- Fabrication of aptamer-based electrochemical biosensors for detection of *Escherichia coli* in hydroponic nutrient solutions amended with partially treated wastewater.
- Development of copper nanoparticle-mediated nanosensors for detection of glyphosate contamination in water sources affected by agrochemical pollution in rural communities of southwestern Colombia.

- Application of nanomaterials and biosensing technologies to support rapid, field-deployable monitoring of microbial and chemical contaminants in environmental water systems.
- Integration of participatory research approaches to facilitate community adoption, implementation, and long-term use of low-cost environmental monitoring technologies in underserved rural regions.

l) Arizona

Jeong-Yeol Yoon

- Development of the SALSA (System Automated Loading for Sample Analysis) platform, a paper microfluidic and smartphone-based sensing system that combines biomolecular interactions, automated data collection, and machine learning for low-cost chemical and biological detection.
- Detection and classification of PFAS ("forever chemicals") in water using protein- and amino acid-based sensing arrays coupled with machine learning, including validation with groundwater and reclaimed wastewater samples.
- Development of rapid paper microfluidic assays and smartphone-enabled analytics for antithrombin deficiency screening to support clinical decision-making during surgical procedures.
- Application of multispectral smartphone imaging, autofluorescence measurements, and deep learning methods for identification of skin microbiota and detection of *Staphylococcus aureus* associated with atopic dermatitis.
- Integration of cloud computing, robotics, machine learning, and automated paper-based sensing platforms to enable high-throughput biomolecular analysis and field-deployable diagnostics.
- Ongoing research on microplastic and nanoplastic toxicity, including studies of kidney and blood-brain barrier models to evaluate cellular uptake mechanisms, morphological changes, and toxicological impacts on human cells

9. Discussion of Multi-State Collaboration Opportunities

The committee engaged in an extensive strategic planning discussion focused on increasing collaboration among NC-1194 members through multi-institutional publications, proposal development, stakeholder engagement, and emerging research areas involving artificial intelligence (AI), machine learning (ML), and biosensors. Members noted that the group had previously produced collaborative review papers on biosensors and microplastic detection and discussed opportunities to build upon those successes during the new project cycle.

Collaborative Review Papers

Several topics were proposed for future multi-author review or perspective papers:

- Challenges and opportunities in biosensor development, including issues related to reproducibility, validation, and technology translation.
- Integration of AI, machine learning, and large language models (LLMs) with biosensors, nanotechnology, digital agriculture, and environmental monitoring systems. Members

discussed the growing importance of AI-driven agriculture and the potential role of biosensors in generating the large, high-quality datasets required for AI applications.
- AI-enabled biosensors for early detection and mitigation of foodborne outbreaks. The topic was proposed as a potential review article focused on recent advances in sensing technologies, outbreak monitoring, and predictive analytics.
- Biosensors and nanotechnology in agriculture in the era of AI, machine learning, large language models, and circularity. Members discussed the possibility of framing a review paper around future directions for integrating sensing technologies, sustainability, and digital agriculture.

Members recognized that many review articles already exist in some of these areas and emphasized the importance of identifying unique contributions, knowledge gaps, or forward-looking perspectives that distinguish NC-1194 efforts from existing literature.

Several attendees expressed interest in leading collaborative writing efforts and agreed to further refine review paper concepts and circulate outlines to the membership for participation.

AI, Machine Learning, and Future Research Directions

A significant portion of the discussion centered on the rapidly expanding role of AI in agricultural and environmental systems. Members discussed opportunities to explore:

- Applications of machine learning and large language models for agricultural decision support, precision agriculture, environmental monitoring, and biosensor-enabled data analysis.
- Opportunities to use biosensor-generated datasets to support development of predictive models, digital agriculture tools, and future AI-enabled agricultural systems.
- Current limitations in the agricultural domain, including the lack of sufficiently large and standardized datasets needed to support advanced AI and large language model applications. Members noted that generating high-quality datasets may represent an important future role for biosensing technologies.
- Development of perspective or white papers identifying critical data gaps, future research needs, and strategies for integrating sensing technologies with AI-based agricultural systems.

The committee also discussed educational and extension opportunities related to AI literacy, technology adoption, and support of agricultural stakeholders using AI-enabled decision-making tools.

Collaborative Proposal Development

Members emphasized the importance of increasing multi-institutional proposal development activities and moving beyond individual research efforts toward more coordinated team science initiatives. Several participants noted that interdisciplinary proposals incorporating engineering, biosensors, economics, entrepreneurship, extension, stakeholder engagement, and industry participation are increasingly favored by funding agencies.

Discussion highlighted several strategies for improving competitiveness:

- Identifying USDA-NIFA and other funding opportunities that align with NC-1194 objectives.
- Forming smaller thematic teams within the larger NC-1194 group to pursue specific proposal opportunities.
- Incorporating extension specialists, industry collaborators, economists, and stakeholder groups into proposal teams to strengthen technology adoption and technology readiness components.
- Leveraging existing collaborative relationships to establish long-term proposal development pipelines that can respond rapidly to new funding opportunities.

Members acknowledged practical challenges associated with large multi-institutional proposals, including budget limitations and varying faculty career stages, but agreed that strategic collaborations involving subsets of the group could significantly enhance competitiveness for future funding opportunities.

Stakeholder and Extension Engagement

Consistent with earlier discussions regarding future meeting venues and USDA priorities, the committee emphasized the need to increase engagement with stakeholders, extension personnel, industry representatives, and end users of biosensor technologies. Participants noted that future collaborative activities should incorporate stakeholder feedback early in the research and development process to improve relevance, usability, and societal impact.

Members also discussed opportunities to expand participation of extension specialists in NC-1194 activities and to incorporate extension-focused perspectives into future publications, meetings, and proposal development efforts.

10. **Election of New Officers**

    Chair Yi-Cheng Wang led a discussion of leadership succession and officer responsibilities for the NC-1194 committee. Members reviewed the committee's standard leadership progression, in which the Secretary advances to Vice Chair and subsequently to Chair, with officer responsibilities including preparation of annual meeting minutes, coordination and submission of the annual report within 60 days of the meeting, facilitating communication among the committee members and between committee and the USDA, and organization of the subsequent annual meeting. Due to recent turnover among previously elected officers who had left their institutions, the committee considered an adjusted succession plan for the upcoming year. Following discussion, the committee approved the following slate of officers for the 2026-2027 reporting year:

    - **Chair:** Diana Vanegas (University of Arkansas)
    - **Vice Chair / Chair-Elect:** Olga Tsyusko-Unrine (University of Kentucky)
    - **Secretary:** Hazal Turasan (University of Illinois Urbana-Champaign)

    The newly elected officers will assume responsibility for coordinating committee activities, organizing the 2027 annual meeting, and preparing the annual report and meeting minutes for submission to USDA-NIFA.

11. **Discussion of Venue and Date for the Next Annual Meeting**

The committee discussed several options for the location and timing of the 2027 NC-1194 Annual Meeting, with particular emphasis on identifying venues that would strengthen engagement with stakeholders, industry partners, extension professionals, and potential end users of biosensor and nanotechnology research. Members noted the increasing emphasis by USDA on technology translation, implementation, and stakeholder-driven innovation and discussed how future meetings could better facilitate these interactions.

Several potential venues and affiliated conferences were considered, including:

- The **American Phytopathological Society (APS) Plant Health 2027 Meeting** in Minneapolis, Minnesota, as an opportunity to engage with plant pathologists and broaden collaborations around agricultural applications of biosensors and nanotechnology.
- The **International Association for Food Protection (IAFP) Annual Meeting**, which was viewed favorably because of its strong participation from industry representatives, food safety professionals, and USDA personnel, as well as its relevance to biosensor applications in food safety and quality assurance.
- Opportunities to co-locate future NC-1194 meetings with conferences or organizations that provide direct access to stakeholders, extension networks, industry representatives, or USDA personnel. Members discussed the importance of moving beyond technology-focused meetings to interact directly with potential users and adopters of NC-1194 research outputs.
- Potential partnerships with **Industry-University Cooperative Research Centers (IUCRCs)** and other organizations that regularly convene industry stakeholders, providing opportunities to introduce NC-1194 research activities to potential collaborators and end users.
- A substantial portion of the discussion focused on the importance of stakeholder engagement. Members emphasized that future research should be informed by stakeholder needs early in the technology development process, rather than after technologies have already been developed. Participants noted that stronger engagement with stakeholders, extension personnel, industry representatives, and user communities could improve research relevance, facilitate future funding opportunities, and increase the likelihood of successful technology adoption.

The committee did not reach a final decision regarding the 2027 meeting venue or dates. Instead, members agreed that additional information should be gathered regarding potential locations, conference opportunities, travel logistics, stakeholder engagement opportunities, and scheduling conflicts before making a final selection.

12. **Motions and Actions**

Motions Approved

1. **Approval of the new slate of NC-1194 officers for 2027.**
    - Chair: Diana Vanegas, University of Arkansas

- Vice Chair: Olga Tsyusko-Unrine, University of Kentucky
- Secretary: Hazal Turasan, University of Illinois
- Approved unanimously.

Action Items

1. Members will complete institutional enrollment procedures for participation in the renewed NC-1194 project beginning October 1, 2026.
2. The secretary will coordinate preparation of the 2026 annual report prior to the 60-day reporting deadline.
3. Interested members will explore collaborative discussions with S-1077 around food safety challenges, including Salmonella monitoring in poultry systems.
4. Members will explore development of collaborative review papers addressing biosensors, nanotechnology, agricultural sensing, and AI-enabled technologies.
5. Members will identify and circulate potential USDA-NIFA and other funding opportunities suitable for multi-institutional proposal development.
6. Potential review paper leaders will develop preliminary outlines and invite participation from NC-1194 members.
7. Members were encouraged to acknowledge NC-1194 in publications, conference presentations, and proposal submissions that align with project objectives to strengthen visibility and demonstrate collaborative impact.
8. Members will pursue collaborative multistate proposal opportunities aligned with emerging USDA priorities.
9. Members will submit suggestions for potential 2027 meeting locations, affiliated conferences, and dates to the incoming officers.
10. The incoming Chair, Diana Vanegas, will compile proposed venues and meeting options and distribute a survey to the membership to facilitate selection of the 2027 annual meeting location and dates.
11. The leadership team will evaluate venue options using criteria such as accessibility, stakeholder participation opportunities, industry engagement, USDA participation, and relevance to NC-1194 research priorities before a final decision is made.
12. The newly elected officers will assume responsibility for coordinating committee activities, organizing the 2027 annual meeting, and preparing the annual report and meeting minutes for submission to USDA-NIFA.

Meeting Adjourned at 1:30 pm.