AEIC 2023 Fall Meeting Minutes

P.L. Hunst, AEIC Secretary

Hosted by BASF, October 18-19, 2023

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AEIC Fall 2023 Meeting Minutes

October 18-19, 2023

Durham, NC

P.L. Hunst (BASF), Secretary

The AEIC Fall 2023 Meeting was held on October 18-19 with approximately 67 in-person attendees and 10 virtual attendees. John Zheng, Vice President, welcomed everyone to the meeting and presided over the round table introductions following the antitrust reminder.

Ryan Johnson, Global Head Stewardship for BASF, welcomed the group to North Carolina. BASF is a global company with 111,481 employees and 82000 customers. BASF's EBIT in 2022 was 69 billion euros. BASF is a diversified chemical company which includes agricultural solutions. Farming is the biggest job on earth. It is sophisticated and uses a lot of information. Three (3) percent of the earth is available for farming. Success in farming is soil and water protection, pollinator and biodiversity protection, health and safety protection, high quality and high productivity. Sustainability in farming is finding the right balance between society and helping farmers. BASF also wants to create a positive impact on the agricultural food system. BASF Agricultural Products employs 13,300 people and operates in 140 countries. There are 28 chemical sites, 25 R&D sites and 200 seed production sites. Sales in 2022 were 10 million euros. Agricultural Solutions portion includes seeds and traits, vegetables, crop protection, digital farming, biologicals and seed treatment.

AEIC BUSINESS MEETING

Approval of 2023 Spring Meeting Minutes: A motion was made and seconded to approve the minutes posted on the website. Motion was approved by member vote.

Treasurer Report (L. Muschinske): The Treasurer presented the 2023 proposed budget as follows:

Beginning Balance as of January 1, 2023	$ 37,000	$ 37,495	Account balance as of 1/20/21
2023 Membership Dues Received	$ 14,000	$ 13,850	
Meeting registration fees - Spring Meeting	$ 4,000	$ 4,250	
Meeting registration fees - Fall Meeting	$ 4,000	$ 6,100	
Total Projected Revenue	$ 22,000	$ 24,200	Actual YTD Revenues

Expenditures			
Scientific Paper	$ 4,000	$ -	
DE Franchise Tax Report - Report generation fees	$ 25	$ 25	
ANSI/ISO Initiative (AOCS - ISO TAG)	$ 2,900	$ 2,900	
Board Meeting Expenses	$ 600	$ 672	Est
Spring Meeting Expenses (including speaker travel allowance)	$ 5,000	$ 6,787	
Website hosting, maintenance, security	$ 500	$ 662	
Credit card processing and bank service charges	$ 300	$ 602	
Fall Meeting Expenses (including speaker travel allowance)	$ 6,000	$ 12,814	Est
Graphic design material creation	-	-	
Marketing (Swag for 30yrs)	$ 300	$ 625	Swag/Banner
Subscriptions – conferences	-	-	
Miscellaneous	-	$ 37	
Total Projected Expenses	$ 19,625	$ 25,124	Actual expenses
PROJECTED BALANCE	$ 39,375	$ 36,571	Current Balance

A motion was made/seconded and voted positive to accept the Treasurer update.

Membership Update (L. Muschinske): The following table depicts the current membership composition of AEIC:

AEIC 2023 Member Summary				Updated: 10/16/2023
		Potential Dues	Unpaid	Amount Unpaid
Large Corporate Members (1,000+ employees)	6	$ 6,000	0	$0
Medium Corporate Members (50 to <1000 employees)	11	$ 5,500	0	$0

Small Company Members (< 50 employees)	13	$ 3,250	0	$0
Associate Members	3	$ 150	0	$0
Individual Members	2	$ 200	0	$0
(Comp for hosts)		$ (1,400)		
TOTAL	35	$ 13,700	0	$0

100% of the dues have been collected.

Vice President Nomination: The AEIC Board requested nominations for the Vice President position. Nominations will be accepted thru October 31. One nomination was received during the meeting. Voting will occur via email ballot in November.

Spring Meeting 2024: Bayer Crop Science will host the meeting on April 17-18 (WG on afternoon of April 16) in Chesterfield, MO.

Suggested topics: CRISPR detection; pulse crops; non-row crops; brainstorming session for new projects; seed IP; seed production.

AEIC/Gates Ag One Engagement: Gates Ag One has approached AEIC concerning putting together training materials and workshops for certain countries possibly in Africa. A group met to discuss and decided a proposal with more details and focus is needed from Gates Ag One in order to proceed.

Protein Working Group Updates (C. Ament/Eurofins): The Protein Working Group (PWG) is co-chaired by Chis Ament (Eurofins) and Tao Geng (Bayer) The PWG currently has 5 active work streams (Multiplex Validation, MS for Protein quantification, Allergen Analysis, Extraction Efficiency, Intractable Proteins/Characterization). The **allergen analysis** work stream has 15 members. The group explored options of an in vitro gastric digestion (pepsin) manuscript and an endogenous allergen level database. The workstream is now looking for new proposals. The **multiplex validation** WS goal is to publish guidelines for standardized validation parameters and acceptance criteria for single-plex and multi-plex protein analysis methods. The scope of the guidelines has been narrowed to only focus on validation. A rough draft is under review. The **MS for protein quantitation** The goal of the WS was to publish a scientific paper reviewing and summarizing evidence supporting both ELISA and LC/MS/MS as valid analytical techniques to assess protein concentrations in plant tissues. The paper is going through

AEIC and member companies' review. The **extraction efficiency** is discussing methodologies for establishing extraction efficiency. The WS has identified similarities across all 4 methods for soluble and insoluble extractions and western blot by densitometry. All methods are scientifically sound and can be applied to determine the overall extraction efficiency. Cleanup of the white paper is underway and still hope to publish in 2023. It was suggested that this white paper could be published under ISO as it would not cost anything but yet would receive wide exposure. The **intractable protein** group has 15 members and meets monthly to work on a manuscript for protein safety assessment of intractable proteins. The PWG is also discussing "ambiguous results for protein methods" and whether this should be a standalone workstream or incorporated into another workstream. The PWG is also working on the update of the FAQ section on the AEIC website.

Composition Working Group (B. Fast, Corteva): The group is working on ways to support acceptance of combustion (Dumas) vs the Kjeldahl method in the biotech industry for estimation of crude protein levels. The literature review is done. The Dumas method uses non-corrosive chemicals and is capable of high throughput. The CWG has collected samples for corn and soybean and sent them to EPL and Eurofins for analysis. The results show agreement between the labs. The spread in the results of the soy samples may have been caused by the age of the samples and the group will investigate further. The group will map out the way forward to provide the necessary support for the combustion method (Dumas) among labs. An outline for a publication has been developed and the WG will begin drafting sections. The publication will justify replacement of Kjeldahl analysis with Dumas in crop composition studies based on comparable results. The CWG is also looking to align industry on what analytes are analyzed in composition studies by starting with soybean and then proceed to other crops. The group is also looking to align industry on how statistical differences are explained in studies. Differences are explained using a combination of in-study reference ranges, literature ranges and/or internal historical ranges. The goal is to align on an approach which will utilize these ranges and explain significant differences.

Nucleic Acid Working Group (F. Ghavami, Eurofins BDI): The group has 29 members and meet every month. The NAWG has completed updating the FAQ language for the AEIC website to include information on genome editing, NGS, PCR/qPCR, digital PCR, and isothermal PCR. Next steps include determining a deadline for publishing FAQs on website and determining copyright for the content (who and how)The group is now focusing on the educational materials, i.e., slideset for genome editing, PCR/qPCR, etc. Ambiguous results discussions are on hold for now. Anyone wishing to join the NAWG should contact Farhad Ghavami (farhadghavami@eurofinsus.com).

Website Updates (D. Houchins, Romer Labs): Current slides on website are now on a google site for editing and are being checked for content and are now bogged down on copyright of graphics. C. Mitchell (Kemp Proteins) offered to make protein graphics to help replace some of the graphics. After a brief discussion of shareable drive options, it was decided that the group should go with Google Docs.

Google Docs		
	1 user (like presently)	Business Starter
Docs, Sheets, Slides, Forms content creation	Yes	
Drive Secure cloud storage	15 GB / user	30GB / user
Extra Storage	$20/year for 100GB	?
Shared drives for your team	(No)	?
Gmail Secure email	Yes	Custom and secure business email
Custom business email	No	
Meet Video and voice conferencing	100 participants	100 participants
Meeting recordings saved to Drive	No	No
Admin Centralized administration	No	Security and management controls
Group-based security policy controls	No?	
Customer support	Self-service online and community forums	Standard Support
Cost	Free	$6 per month
We can establish an organizational email and use this to set up a google drive.		
Would need someone to be responsible - one or more 'managers'		
All of the AEIC files on the Google drive take up less than 3.5GB (including some IEC files.		

ISO Update (M. Sussman, USDA AMS): It was suggested that ISO would be a good place to publish AEIC white papers as there would be no cost to AEIC and paper would have a wide exposure. The biomolecular analysis landscape of ISO is medicine/health sciences to life sciences to food/agriculture. ISO TC 34/SC 16 is the Biomarker Group which has 45 countries interested in its work and falls under food/agriculture in ISO. R. Shillito is the Chair, M. Sussman is the Committee Manager and D. Williams is the TAG Secretary. There are 8 WGs in TC34/SC16 which include: meat speciation, sub-sampling of seeds/grains, rapid nucleic acid amplification methods, biobanking for agriculture and food production, molecular biomarkers of agricultural fiber-cotton, microarray detection, genetically engineered content detection and quantification, single laboratory validation of qualitative real-time PCR. TC 34/SC 16 has 35 published standards, 11 of which are for identification of meat species. Standards being developed include biobanking for agriculture, guidelines for single lab validation of qualitative real-time PCR, DNA barcoding of fish and fish products and smart farming which is the modern use of information and communication technology. SC 38 is for textiles which has been looking at GM cotton detection. SC 93 is for starch. A desire by organic industry to test cotton for GM traits has resulted in ISO paper on Detection of DNA in cotton used for textile production – Part 1: Extraction of DNA from cotton seed and derived raw materials used for textile products. The organic industry has changed focus during the paper development so ISO will now need to readjust the focus of the document. Two other standards have also been published: a) General guidelines for single laboratory validation of qualitative real-time PCR methods; and b) Methods of analysis for the detection of specific DNA targets in food, feed, seeds and other

propagules of food and feed crops by us of polymerase chain reaction – general requirements.

Cereals and Grains Assoc.: Proficiency program for flour quality and safety (R. Shillito, Shillito Associates): A proficiency program consists of sending samples to labs to allow them to test their accuracy in performing analytical methods and monitor ongoing performance. It is an interlaboratory comparison and participants receive a report of their performance against the mean result of all laboratories. Accuracy is expressed as a z-score. Lab participation promotes confidence and ensures procurement process has reliable and reproducible analytical results to support a supply chain. Cereals & Grains offers proficiency series in flour analysis, label analysis, rheology and food safety. C&G contracts with a supplier to prepare the samples sent to participant labs. Participants complete testing within a month using their normal testing program and enter results into online portal. A new series for alternative flours will start shipping in Jan 2024. Any lab interested may subscribe using QR code:

Participants will receive bimonthly samples of flour from pulses, grain and non-wheat cereal sources such as peas, quinoa, millet and lentils.

Smart Farming and the BioDigital Transformation (R. Shillito, Shillito Associates): There is an ISO Smartfarming Standards Advisory Group (SAG SF) which includes 9 sub-groups (crop production, livestock, urban farming, climate and environment, original equipment manufacturing, terminology and semantics, social aspects, data and supply chain). There are 2 delegates/country. The intent is to deliver a roadmap on Smart Farming in September 2022 (actual was Jan 2023). This group has completely ignored biotechnology. The scope of the SAG SF is to identify the challenges/opportunities, relevant standards, possible synergies and gaps in the work of ISO technical committees in the context of smart farming and the UN Sustainable Development Goals and propose next steps and priorities for ISO action. There were 40 recommendations but none for biotechnology. The IEC Standards Exploration Group (SEG12) met in July 2021. The goal was to produce a roadmap for standardization in the area of bio-digital convergence by June 2023 (now Dec 2023). Biotechnology is covered in WG5 – Agricultural Bioengineering. SEG12 overlapped with SmartFarming, i.e., coordinate with ISO committees (sequencing and data handling, breeding animal and plant, analytical methods for DNA and protein). Gaps include drone, robots remote sensing; supply chains; resolution of data ownership issues in sensing, machinery, blockchain, etc;

improvements in managing and understanding huge data sets. SEG12 has drafted a final report which will be sent to Secretariat for final editing. SEG12 recommends a horizontal SC be established under TC34 Food and Food Products to focus on the application of biotechnology and breeding techniques in agriculture.

NAICC (National Association of Independent Crop Consultants)(C. Ament, Eurofins): The NAICC met in Nashville in January 2023. NAICC's key issues are: a) endangered species act and biological evaluation of pesticides for registration review; b) FIFRA revision and the Protect America's Children from Toxic Pesticides Act; c) EPA PRIA; d) IR-4 for minor crops; and e) resistance management. The next meeting will be in San Antonio in January, 2024 (www.NIACC.org).

AOCS (American Oil Chemists Society): International Standards Organization (ISO): For those interested in joining the ISO TC 34 subcommittees listed below, please contact Denise.Williams@aocs.org

  - SC 16 SC 16 Horizontal Methods for Molecular Biomarker Analysis
    - WG8 Meat Speciation
    - WG 9 Subsampling of Seeds and Grains
    - WG 10 Rapid Nucleic Acid Amplification Methods
    - JWG 11 Biobanking Agriculture and Food Products
    - JWG 12 Molecular biomarkers of agricultural fibers
    - WG 14 Genetically Engineered Content Detection and Quantification
    - WG 15 Single laboratory validation of qualitative real time PCR
  - SC 2 Oleaginous seeds and fruits and oilseed meals
  - SC 11 SC 11 Animal and vegetable fats and oils
  - SC 4 Cereals and pulses
- AOCS Annual Meeting and Expo, Montreal, Quebec, Canada April 28-May 1, 2024. Find more information at: AOCS Annual Meeting
- COMING in Spring 2024: 8th Edition of Official Methods and Recommended Practices of the AOCS method book. Check out our digital and site license options!

HESI PATB (L. Mouries, ILSI): The ILSI HESI (Health and Environmental Sciences Institute) model is to bridge research to translation. HESI works through scientific committees (18 currently) which are in focus areas: accurate and efficient chemical risk assessment, safe and effective medicines, environmental quality and sustainability, food safety. Committees have a public-private balance, i.e., not just industry members. All outputs from committees' work are to be made available in the public domain. The PATB (Protein Allergens, Toxins and Bioinformatics) Committee mission is to advance the scientific understanding of the relevant parameters defining allergenic proteins and protein toxins in foods and feeds. The areas of focus are defining what makes a protein allergenic; defining what makes a protein toxic, developing WOE approach to

evaluate safety of novel proteins expressed in food and feed biotechnology products; developing bioinformatic approaches; and communicate findings and best practices to the broader scientific community. The PATB has >20 peer-reviewed publications; participated in >40 scientific workshops and symposia globally; launched the COMPARE allergen database. The group provides a strong historical knowledge base of novel foods safety assessment approaches. It is also a venue to facilitate public-private interactions. More information can be found at: Protein Allergens, Toxins, and Bioinformatics (PATB) - HESI - Health and Environmental Sciences Institute (hesiglobal.org).

New Book: Application of Sampling and Detection Methods in Agricultural Plant Biotechnology (R. Shillito, Shillito Associates): Book was published on 29 July 2022. It includes a chapter on the detection of genome edits. It can be purchased using the QR code:

Toastmasters (R. Shillito): Toastmasters is a program that uses constant practice to improve communication, presentation and leadership skills. Anyone can become a great communicator. More information may be found at:

Toastmasters Information

Find a Toastmaster Club

The AEIC Business Meeting was adjourned.

INVITED TALKS

New DNA Detection Technologies: Nanoparticles (R. Skaar, NanoBio Designs): PCR was first technology used in multiplex traits. This was followed by sequencing, NGS and digital PCR. The use of nanoparticles improves genetic detection by increasing

sensitivity, multiplexing and sequencing. Surface hybridization has generally been used in protein detection but has now been adapted for DNA to give rapid assay times and easy sample preparation. Dyed/chemiluminescent beads by Luminex can detect 500 targets simultaneously. In sequencing, beads provide low non-specific binding, an increased binding capacity and allows rapid purification. Generally for new traits detection requires technical expertise, a sterile environment, complex methods and cost barriers. Nanoparticles provide traceability, assays are easy to use and can be standardized. NanoBio Designs wants to make genetic detection "no big deal". Microparticles are used in a direct hybridization approach and require no amplification step. Process is: collect samples →grind→extract→place on test card with particles. Vision is to connect supply chain with easy to use method for non-technical user. NanoBio is currently standardizing and validating assays and is looking for users.

Absolute Quantitation with Digital PCR (J. Cammerata, Syngenta): The detection question is whether DNA is present and how much. PCR data is used in QC, transformant screens, specific variant detection. For GM products, the desire is to know how many copies are present and gene expression, i.e., genes of interest and zygosity. Real-time PCR has been the workhorse. It uses an intercalating dye which fluoresces when dsDNA is present. In Taqman, fluorescence is read on every cycle and compared to a standard curve. Relative quantitation is based on threshold cycle (CT). The challenges with real-time PCR is that abundant targets are needed; rare targets are hard to tell from noise; noise and contamination issues with method. Digital PCR (dPCR) provides unbiased, absolute quantitation. DNA is broken up into thousands of pieces to start. Accurate quantitation depends on the assay efficiency. An efficiency of less than 1 will cause CT to be later and harder to detect rare targets. Inhibitors always cause issues with efficiency. With dPCR, endpoint reads are being taken and thus, efficiency is not as important as with real-time PCR. The BioRad QX600 digital droplet system requires 3 machines. It does allow multiplexing and costs $500/plate. The QuantStudio Absol Q dPCR using a microfluidics plate with 20048 wells. It analyzes the whole sample volume and costs $108/plate. Quantitation is a Poisson model. Negative droplets are important for determining the actual positive numbers. Less DNA gives better resolution. Multiplex can be done in same channel. Partitioning improves the rare event detection since there is better signal in a droplet than in a bulk sample. For gene editing, a droplet assay for non-homologous end joining detection has been developed by using 3 assays on test sample and synthetic DNA. The probe qualities determine the ability to distinguish SNP from deletion. Restriction digestion is critical for quantitative insertions. Determining gene expression with dPCR is more robust in presence of inhibitors than with real-time PCR. Dilution is the solution for troubleshooting.

Mass Spectrometry Technologies (J. Shippar, Eurofins Food Integrity and Innovation): There are many types of mass spectrometry: MS, MS/MS, triple quad. Triple quad ionizes sample to gas phase. For quantitation, source is ionized→3 quads (high vacuum)→detector (electron multiplier). Triple quad is routinely used for pesticide analysis. It is versatile since protein can be extracted in non-volatile buffers. Proteoforms are not one form and there may be multiple, variable modifications.

Challenges for protein analysis are proteoforms, multiple charge states, complex samples, specific sample cleanups needed. Quantification is done by using surrogate peptides to represent proteins. These are digested to fragments and a heavy-labeled standard is used. A stable isotope-labeled (SIL) peptide is spiked into all samples and calibrators. Peptides are commonly used for standards. The advantages of MS for protein detection are specificity, sensitivity, linearity, multiplexing (12 proteins or 17 peptides). Emerging MS techniques are time of flight (TOF) and orbital trap which provide high resolution to separate peptides but have lower sensitivity than the triple quad. The ion mobility process is ionization→mobility separation→mass/charge separation→detection. This is used for chiral analysis, identify positional isomers, lossless ion manipulations. For MS, the biggest challenge is the identification of unknown compounds/peptides.

Leveraging Bioinformatics and Machine Learning in Protein Development Workflows (C. Mitchell, Kemp Proteins): Kemp Proteins has been around since the 1990s and is known for taking on difficult to purify proteins but also has a continuum of services. Kemp is located in Frederick, MD. Important elements to know in developing workflows are a) what is the protein, b) what is the scale, and c) what will be the use of protein. For a GMP process, assays are developed, then up-down optimization, and reproducibility determined. A process for using bioinformatics is sequencing→bioinformatics→structural modeling→disorder prediction→feasibility score. Engineering mode is first and then expression mode (cell-free and expression host). Hypothetical proteins are useful to understand pathogens but are heavily biased to human systems. LLM implementation is used for predicting localization. T5 models are used to understand sequences as to whether nuclear localized or mitochondrial localized. Use of ProtSCL model identified 246 compartments. ProtSig: signal sequences synonymous with secretory tags but are actually targeting sequences. ProtGlyc: Has higher accuracy and detects glycosylation in les characterized microbial and plant species. ProtTMD: Trained on 3.2 million sequences with a higher accuracy and was better at predicting less characterized non-human system. ProtIQ: Looks at all the data/methods and compiles in 32 seconds; also produces a 3D model. Multiomics are used for a program, i.e., genomics, transcriptomics, proteomics, epigenomics datasets. Flexibility is critical so all expression systems are assessed (mammal, insect, microbial). Small scale expression/purification used to overcome some issues in workflow. Again, critical to understand goals, process modeling, have flexibility of purification and empirical data/reproducibility.

History of Biotech Crops (L. Privalle, BASF (ret.)): Biotechnology is an extension of traditional plant breeding. The enabling technology for biotechnology is: 1)discovery of DNA (1869); 2) elucidation of DNA structure (1953); 3) discovery/use of restriction enzymes to cut DNA (1972); 4) Southern technology for DNA analysis (1975); 5) sequencing of DNA (1976); 6) use of biolistic gun to insert DNA into cells (1983); 7) use of PCR, Agrobacterium (for DNA insertion), oligomer synthesis (1984) and 8) ability to use Agrobacterium to transform monocot cells (1994). Plants that are herbicide-tolerant and/or insect resistant are the main GM plant products among crops. The challenges for plant biotechnology have been to put a gene into the plant genome and then

regenerate a transformed plant cell to a plant that expresses the gene of interest. The regenerated plants needed to be fertile in order to have progeny that would express the intended phenotype. Biolistics used brute force to blast desired exogenous DNA, RNA or protein into a cell. Particles were coated with the gene of interest and fired into the cells with mechanical force. Biolistics was replaced by the use of Agrobacterium, a bacterial plant pathogen, to transfer foreign genes into host plants. Agrobacterium transformation had more finesse than biolistics and resulted in "cleaner" insertions of DNA into plant cells. There was also some use of protoplasts to generate transformed cells. In 1992, the Flavr Savr Tomato was commercially introduced by Calgene. The tomato had increased shelf life and fungal resistance. In 1994, the first insect resistant and herbicide tolerant traits were commercially introduced (Bt176 corn, bromoxynil-tolerant cotton and Roundup Ready soybean). In 1995, the insect-resistant New Leaf Potato, herbicide-tolerant T25 corn, Roundup Ready canola and European corn borer resistant MON 810 corn were launched. 1996 saw the introduction of the virus-resistant papaya, Invigor canola and Bt11 corn. In 1998, Roundup Ready sugarbeet was launched. Considerations for plant biotechnology are plant germplasm (need good germplasm); value capture for the biotech traits; trait patents; a path to market for a trait; stopping the use of antibiotic resistance markers in transformation; and refuge considerations for insect-resistance traits. In 1997-98, the EU approved Bt176, MON 810, T25 corn but in late 1998-2004, a moratorium was put on GM plants. Today, most GM products approved in the EU are for import only. The founders of plant biotechnology are Mary-Dell Chilton (Washington U./Syngenta), Rob Fraley (Monsanto) and Marc Van Montagu (Plant Genetic Systems). GM crops have been rapidly adopted by U.S. growers. However, practical insect resistance to the Bt proteins inserted into plants has developed over the last 20+ years. Monarch butterflies and Cry1Ab in corn pollen was an issue in the early 2000s as it was claimed that Bt corn was causing the disappearance of monarchs. Today, monarchs are no longer considered endangered and it was shown that Bt corn contributed much less to monarch deaths than car windshields. GM plants have increased productivity and contribute to maintaining biodiversity. They are also good for the environment by contributing to a reduction of carbon dioxide. Regulatory for GM products is ever evolving—some countries like Japan being more rational and simplifying the process for stacked trait crop products which has resulted in other countries such as Brazil and Argentina following their lead. In 2020, the USDA launched new rules for GM products to streamline their process.

Unlocking Nature's Toolbox: Benefits and Lessons from Microbial Technologies (B. Johnson, AgBiome): The microbiome is an untapped resource for agricultural solutions. Plant extracts have been used since the 17th century for pest control and fertilizers. In 1938, Bt solutions were used on plants for pest control. The use of Bt proteins became more widespread in the 1950s but from 1950-1990s synthetic chemicals dominated the pest control market. Biologicals reduce chemical residues; provide flexibility in application; good for worker safety; natural compounds which are favored by consumers; and lower the carbon footprint. AgBiome is looking to feed the world responsibly. The Genesis discovery program integrates microbe screening, genomics, metagenomics and assay results to accelerate lead molecule discovery. Microbes are isolated, sequenced and screened for activity. Organisms are bioprospected and

biobanked globally. AgBiome has all the metadata and had isolated 120,000 microbes and sequenced them. Genomic prescreening of the collection is also done. The company is working on improving the predictability of AI models. Two products have been commercialized: Howler and Thea (both fungicides). The company is also working on herbicides, fertility factors and lepidopteran control products. Working with microbes it is best to fail fast in order to succeed, i.e., lab→greenhouse→field. However, lab and greenhouse assays do not always translate to field performance. Must analyze "fit for purpose" and be clear what the target is to drive decisions. For commercialization, grower feedback is essential and products must fit existing agricultural systems. Scale up of microbial products is hard. However, growers have easy and effective control of pests without residue tolerance limitations. Products are safe to all crops tested; mix easily and cleanly; OMRI listed for organic use; have multiple MOAs so reduced pest resistance; and can reduce or replace synthetic chemicals. The challenges with biologicals include consistency of performance; maintaining stability and activity; grower acceptance; and cost of goods.

Artificial Intelligence and Analytical Trends (J. Gottula, SAS): Genrative AI (ChatGPT) is at the top of the "hype cycle" currently. First Principles AI is thinking through the question. Composite AI is self-serve analytics and needs not just data scientists but a team of scientists with different backgrounds. EU EFSA uses differences and equivalence for composition data, i.e., compare to comparator or to references. Flaws to implement EFSA guidance include the comparator genetic composition is not equivalent to the GM genetic composition; reference varieties do not capture an adequate range of diversity; and reference varieties are different from the comparator variety. Composition endpoints are structurally related but have correlation errors. The independent analysis of each result in multiple testing is a problem. Each endpoint needs to be distilled in a few enrichment vectors and then use cluster-based difference testing. Self-service data analysis is crucial for frontline business and science decisions. Data generators possess invaluable understanding of the data. Site analyte inverse weighting leads to less equivalence. If reference varieties are not working change them. For decision intelligence, identification is the important variable, then assess scenarios and classify. Always need a human in the loop. Decision intelligence reduces intensive data sets into actionable classifications. Algorithms and machine learning can both provide estimates. For generative AI, safety parameters should be defined, collect the data, perform statistics. ChatGPT is "wishy-washy" on a deeper dive in questions, i.e., more of a flat response. Worse response was when it was asked about EU regulations. In summary, composite and first principles enable stat inference; synthetic data and decision intelligence facilitate faster and more robust decision frameworks; AI simulation supports extrapolation to edge scenarios; generative language models can summarize lots of information quickly and spark ideation; SAS enables regulatory scientists to adopt and expand multimodal analytics.

Plant-based Solutions for a Healthier World (D. Chauhan, Pairwise): Pairwise has facilities in Durham and RTP, NC and Arroyo, Ca and has 160 employees. Their vision is to build a healthier world through better fruits and vegetables. Their Conscious Foods brand was launched in 2022 and the first product was commercialized in 2023. Focus is on salads

and blackberries. Eighty-five (85) % of blackberry consumers dislike the seeds in the fruit so the goal is to introduce seedless blackberries with a longer shelf life. For salads, 48% of consumer buyers are bored with the choices. Salads have little differentiation, a complex cold chain and a different breeding scheme. Pairwise has used CRISPR to reduce the pungency in salad greens and are looking to improve plant architecture, harvest, shelf life and availability. Pipeline is first looking at crop science→data science→identify gene→gene editing→ transformation→molecular screening→controlled environment trait testing. Brassicas are pungent and to reduce this myrosinase needs to be inactivated. Myrosinase was reduced by knocking down 17 copies. An efficient transformation system was developed which yielded 100-300 plants/FTE/week. Cultivar and species specificity affect transformation. The Conscious Greens salad has tested well with consumers. For blackberries, seedlessness is in the proof of concept work. Pairwise has a collaboration with PSI for blackberry germplasm. The gene terminal fl 1 is the key gene controlling flowering. This was edited in blackberry down to 4 copies. The consequence was early flowering leading to early fruiting. The plants are also more bushy which also promotes a greater yield of fruit.
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Pairwise Tour

Attendees at AEIC Meeting:

Name	Organization
Ament, Chris	Eurofins Food Chemistry (Speaker)
Anspaugh, Doug	BASF
Atkinson, Tara	Corteva
Balvin, Kevin	SGS North America
Bednarcik, Mark	Syngenta
Brix, Kalyn	SoDak Labs
Brune, Phil	Syngenta
Cammarata, Joseph	Syngenta (Speaker)
Chamberlain,John	EnviroLogix
Chauhan, Raj Deepika	Pairwise (Speaker)
Cheever.Matt	BASF
Cisneros, Krystal	BASF
Dennis, Jared	BASF
DePinto, Jeff	Ethos Biosciences
Dharmasri, Cecil	Bill & Melinda Gates Agricultural Innovations
Edmison, Dustin	SGS
Fast, Brandon	Corteva
Fendley, Ann	BASF
Gargiulo, Serena	BASF
Geng, Tao	Bayer
Ghavami, Farhad	Eurofins BDI
Ghoshal, Durba	BASF
Gillikin, Jeff	NCSU
Gillikin, Nancy	BASF
Gonzalez, Gerardo	Ethos Biosciences
Gottula, John	SAS Institute (Speaker)
Green, Eric	BASF
Grossman, Steve	Primera Analytical Solution Corp.
Gunasekara, Dulan	BASF
Haack, Abby	EnviroLogix
Hall, Nate	BASF
Hardin, Shane	BASF
Houchins, Donna	Romer Labs
Hunst, Penny	BASF
Johnson, Brant	AgBiome (Speaker)
Johnson, Ryan	BASF (Speaker)
Juvale, Parijat	BASF
Kenward, Kim	20/20 Seed Labs Inc
Kouba, Kristen	Corteva
Leamon, John	Meso Scale Discovery
Lipscomb, Liz	BASF
Lor, Jim	BASF

Lyons, Derek	NanoBio Designs
Makani, Mildred	Syngenta
Marangoni, Nayara	EnviroLogix
Maruthamuthu, Murali	BASF
Mitchell, Carter	Kemp Proteins (Speaker)
Mittendorf, Volker	Bill & Melinda Gates Agricultural Innovations
Motyka, Shawn	BASF
Muschinske, Luke	Eurofins Microbiology
Nelson, Craig	Indiana Crop Improvement Assn
Playdon, Alex	20/20 Seed Labs Inc
Poe, Martha	BASF
Privalle, Laura	BASF (Retired) Speaker
Ranjan, Rakesh	BASF
Rocha, Mitscheli Sanches	BASF
Sathischandra, Sashi	BASF
Scaife, Ann	Eurofins Food Chemistry
Shillito, Ray	Shillito & Associates (Speaker)
Shippar, Jeff	Eurofins US (Speaker)
Skaar, Ryan	NanoBio Designs (Speaker)
Sondeno, Rachael	OMIC USA
Song, Feng	Syngenta
Spiegelhater, Frank	Eurofins GeneScan
Sussman, Michael	USDA AMS (Speaker)
Syme, David	BASF
Tetteh, Afua	BASF
Umthun, Angela	Stine (Individual)
Verhalen, Brandy	Corteva
Wang, Mao	Syngenta
Wang, Rong	Bayer
Wang, Yanfei	Bayer
Whitt, Sherry	BASF
Williams, Denise	AOCS (Speaker)
Withers, John	BASF
Wu, Jessica	Primera Analytical Solution Corp.
Wu, Pei-Ying	BASF
Xia, Min	BASF
Zheng, John	Indiana Crop Improvement Assn