



ANALYTICAL RESOURCES CORE

COLORADO STATE UNIVERSITY

ARC MONTHLY BULLETIN

SEPTEMBER 2023

Welcome to the ARC Bulletin, a monthly newsletter to keep you informed about the latest happenings in the ARC. Here you will find information about our team, job opportunities, equipment and facilities, upcoming seminars, and other exciting news!

RESEARCH SPOTLIGHT

This month's research spotlight features Jacob MacWilliams' recent publication in the Journal of Economic Entomology, "Biology and management of hemp russet mite (Acari: Eriophyidae)" - <https://doi.org/10.1093/jee/toad137>.

Jacob is a research associate in the research group of Dr. Punya Nachappa, Associate Professor in the department of Agricultural Biology at CSU (www.nachappalab.com).

In his interview below, he describes how the ARC's instrumentation and expertise played a critical role in enabling new insights into hemp pest biology and management.



ARC TRIVIA

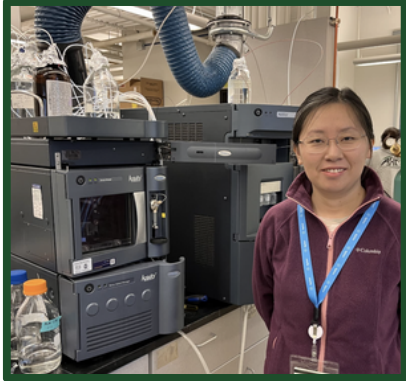
How many undergraduate and graduate student interns are currently working for the ARC?

Thank you Jacob, for speaking with us! We are thrilled to hear how our facilities have aided in advancing your research.



Hemp russet mites on hemp.
Photo credit: Olivia Carter, CSU

Jacob MacWilliams worked together with former M.S. student Christopher Hayes to study hemp russet mites and their biology as well as control options. Hemp russet mites are microscopic pests that cause significant loss of yield and can impact cannabinoid levels in hemp. They are considered the most devastating pest of hemp. There is limited information on these mites' biology and management.



“With this research, we are looking to see the impact of cannabinoids on the mite as well as the impact the mite has on cannabinoid levels in hemp, and that’s where the ARC comes in. We used liquid chromatography mass spectrometry and targeted quantitative assays to quantify cannabinoids. Drs. Linxing Yao and Corey Broeckling were instrumental in this project. Linxing ran the instrument and was great at helping me understand everything she was doing, but they also had the expertise to deliver the results quickly so we could move forward with our research,” said MacWilliams.

They found that hemp plants with mites led to decreased cannabinoid production compared to uninfested plants. They also found that the mites prefer low cannabinoid hemp varieties compared to high cannabinoid varieties and suspected that cannabinoids could be a plant defense mechanism similar to that of caffeine or nicotine in their respective plants.

They theorized that mites would have reduced reproduction as a result of the higher cannabinoid levels after supplementing the leaves with CBD, the predominant cannabinoid in hemp. With the help of the ARC and M.S. student Olivia Carter, MacWilliams was able to quantify these supplemented CBD levels within the hemp leaves. However, mites did not seem to be affected by the increased levels of just CBD. So, there may be other plant compounds such as other cannabinoids or terpenes that may be affecting mite reproduction not CBD.



Hemp russet mites damage to hemp plants.
Photo credit: O. Carter, CSU

For this research study, MacWilliams and Carter prepped and submitted thirty leaf samples for analysis by the ARC. Currently the Nachappa lab is also working on two other projects with the help of the ARC mass spec team, and the lab plans on continuing to use the ARC to research various other cannabinoids that may create a difference in response to mites. Additionally, MacWilliams hopes to look at how cannabis aphids and various other insects respond to cannabinoids within hemp plants, as well as the understanding the adaptive role of cannabinoids.

We look forward to featuring more of our users' research.
Want to have your research in the spotlight?
Be sure to cite our RRID (SCR_021758) so that we can find you!

NEW EDUCATIONAL OFFERINGS

ARC-TEM CLASS

The ARC has been offering intense 8-week long classes for CSU graduate students and postdocs to learn the principles and operation of the ARC's transmission electron microscope. This class is taught by ARC research scientist and TEM manager, Dr. Roy Geiss. Due to huge interest and the limited capacity of 8 students per class, we are planning another session in the Spring of 2024. The class involves 2h/week of group lectures and 2h/week/person of private hands-on learning with Roy on the TEM. Topics that will be covered are TEM alignment, imaging, diffraction, STEM, and EDS. Expectations for participating in this class are having completed SEM training in the ARC and an agreement from your PI for covering the class fee (\$1,400, includes TEM instrument time). For more information or to reserve a spot, contact Roy.Geiss@colostate.edu.



ANNOUNCING THE ARC SELF-SERVICE MASS SPECTROMETRY METABOLOMICS TRAINING COURSE!

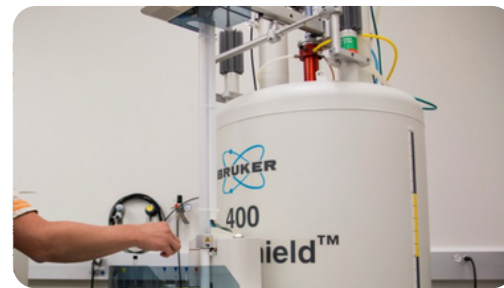
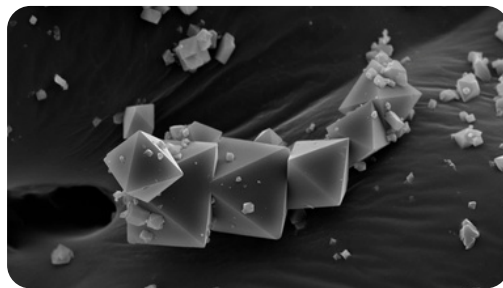
ARC Self-Service MS Metabolomics
Interest Form



In this new training course we will use a variety of green teas as a test set to learn the process of sample extraction, data acquisition, processing, analysis and visualization for untargeted, MS-based metabolomics using open source and freely available software tools. Each participant will generate their own tea extract dataset to use with the data processing tools, and learn a processing workflow that can be applied to their own projects. The course will take place over two weeks in a total of four, ~4 hr sessions. The training course will be offered quarterly and can accommodate 4-6 participants for each course.

The cost of attendance for CSU students/employees is \$200 (\$50/ training session) plus UPLC-QTOF-MS instrument time. If you are interested, fill out the form here: <https://forms.office.com/r/ccqNesGySW> or use the QR code above.

For more information, contact Claudia.Boot@colostate.edu



ARC FALL & SPRING SEMINAR SERIES

**Hosted by the Analytical Resources Core
Office of the Vice President of Research**



ANALYTICAL RESOURCES CORE
COLORADO STATE UNIVERSITY

Learn about the ARC's latest developments and newly added technologies available to CSU researchers and regional companies. This year the ARC experts themselves will present the technologies, analytical services, and educational resources each of their labs have to offer. Join us as we delve into a diverse array of scientific instruments and methodologies, enabling you to harness the full potential of our facilities.

Date	Presenter	Topic
September 6	Karolien Denef	Overview of the Analytical Resources Core
October 4	Corey Broeckling	Mass spectrometry-based metabolomics
November 1	Jackie Chaparro	Inductively coupled plasma mass spectrometry and ionomics applications
December 6	Roy Geiss	Electron microscopy
January 10	Linxing Yao	Targeted quantitative analysis
February 7	Gustavo Diaz	Metaproteomics - who is doing what in microbial communities
March 6	Claudia Boot	Self service mass spec offerings in the ARC
April 3	Indrani Bhowmick	Materials analysis techniques
May 1	Alyssa Winter May	MALDI mass spectrometry and macromolecular analysis
June 5	Rebecca Miller	Surface analysis techniques
July 3	Michele Mailhot	Nuclear Magnetic Resonance (NMR)
August 7	TBD	X-ray diffraction and scattering techniques

First Wednesday of the month | 2-3 pm

www.research.colostate.edu/arc/arc-seminar-series/

Join our [mailing list](#) to stay receive further updates

TEAM UPDATES

Congratulations, Rebecca!

Rebecca Miller was recently promoted to a Research Scientist in the ARC, where she'll continue to provide services and expertise to CSU research programs around materials surface analysis and electron microscopy. Rebecca has been working as a postdoctoral fellow in the ARC since she graduated with her Ph.D. in 2020 with Professor Amy Prieto in the Department of Chemistry. In her role in the ARC, she has worked with over 60 PIs from over 20 departments and trains over 60 students each year on SEM, XPS and various other surface analysis techniques.



"I'm passionate about helping others advance their analytical research experience and expertise through creating a welcoming lab space, generating and sharing helpful resources, and connecting with researchers at CSU about their work."

ON THE CALENDAR



SEPT
29

NMR User Focus Group meeting

From 12-1pm in Yates 102/103. This is an opportunity for NMR users to discuss any issues or needs with NMR lab manager Michele Mailhot. There will be cookies!

We are continuing our Fall and Spring Seminar Series, where the lab managers of the ARC will present the technologies, analytical services, and educational resources each of their labs have to offer. Join us as we delve into a diverse array of scientific instruments and methodologies, enabling you to harness the full potential of our facilities.

OCT
4

Mass spectrometry-based metabolomics - Corey Broeckling, Director ARC-BIO

Metabolomics is a phenotyping approach with a focus on small molecules in biological, environmental, or ecological samples. This seminar will provide an overview of metabolomics approaches using mass spectrometry, and describe some resources withing ARC for performing metabolomics analysis.

Further details will be posted on our website in the coming days.
<https://www.research.colostate.edu/arc/arc-seminar-series/>

EQUIPMENT UPDATES

New soldering capabilities for PPMS sample prep

We have a new soldering station for our Physical Properties Measurement System (PPMS) Dynacool Electrical Transport Option (ETO) which has multiple fine tips for soldering your sample, hot air rework station, and desoldering setup. We hope it will help the users with their PPMS sample preparations. For more information, contact Indrani.Bhowmick@colostate.edu.



What is PPMS?

PPMS allows researchers to study properties like magnetism, electrical conductivity, thermal conductivity, and more, under various conditions such as different temperatures and magnetic fields. This is crucial for understanding how a material behaves in different environments and helps in designing materials for specific applications. For instance, scientists can use a PPMS to explore how a material responds to magnetic fields at extremely low temperatures. This information is vital for developing technologies like magnetic storage or superconducting materials for energy applications.



ARC TRIVIA ANSWER

Answer: 9!

(Ada Graham, *Biochemistry*; Chris Evans, *Chemical Engineering*; Maggie Dense, *Architecture/interior design*; Maggie Hirsch, *Fisheries, Wildlife and Conservation Biology*; Brooke Beresford, *Journalism and Media Communication*; Reyna Baldwin, *Zoology*; Gwen Wilusz, *Chemistry*; Acacia Sack, *Biology*).

THANK YOU FOR CITING US USING OUR RRID!

Check out recent publications using the ARC:

McMahon CJ, Martinez B, Henry CS. Characterization of Factors Affecting Stripping Voltammetry on Thermoplastic Electrodes. *Journal of The Electrochemical Society*. 2023 Sep 16. <https://iopscience.iop.org/article/10.1149/1945-7111/acfa68/meta>

Shakouri M, Hu J, Stolle C. Assessing regional variability in chemical composition and pozzolanic reactivity of corn stover ash in the United States. *CEMENT*. 2023 Dec 1;14:100086. <https://www.sciencedirect.com/science/article/pii/S2666549223000324>

Aoun M, Orenday-Ortiz JM, Brown K, Broeckling C, Morris CF, Kiszonas AM. Quantitative proteomic analysis of super soft kernel texture in soft white spring wheat. *Plos one*. 2023 Aug 31;18(8):e0289784. <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0289784>

Ohmi T, Oswald IW, Neilson JR, Roth N, Nishioka S, Maeda K, Fujii K, Yashima M, Azuma M, Yamamoto T. Thiocyanate-Stabilized Pseudo-cubic Perovskite CH (NH₂)₂PbI₃ from Coincident Columnar Defect Lattices. *Journal of the American Chemical Society*. 2023 Aug 30. <https://pubs.acs.org/doi/full/10.1021/jacs.3c05390>

Safanelli JL, Sanderman J, Bloom D, Todd-Brown K, Parente LL, Hengl T, Adam S, Albinet F, Ben-Dor E, Boot CM, Bridson JH. An Interlaboratory Comparison of Mid-Infrared Spectra Acquisition: Instruments and Procedures Matter. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4548803

McDermott MJ, McBride BC, Regier C, Tran GT, Chen Y, Corrao AA, Gallant MC, Kamm GE, Bartel CJ, Chapman KW, Khalifah PG, Ceder G, Neilson JR, Persson KA. Assessing Thermodynamic Selectivity of Solid-State Reactions for the Predictive Synthesis of Inorganic Materials. *arXiv preprint arXiv:2308.11816*. 2023 Aug 22. <https://arxiv.org/abs/2308.11816>

Kostenkova K, Levina A, Walters D, Murakami HA, Lay PA, Crans DC. Vanadium (V) pyridine-containing Schiff base catecholate complexes are novel lipophilic, redox-active and selectively cytotoxic in glioblastoma (T98g) cells. *Chemistry–A European Journal*. 2023 Aug 15:e202302271. <https://chemistry-europe.onlinelibrary.wiley.com/doi/abs/10.1002/chem.202302271>

Savargaonkar AV, Munshi AH, Soares P, Papat KC. Antifouling Behavior of Copper-Modified Titania Nanotube Surfaces. *Journal of Functional Biomaterials*. 2023 Aug 4;14(8):413. <https://www.mdpi.com/2079-4983/14/8/413>



Using the ARC?

Please cite or acknowledge us by our Research Resource ID

RRID: SCR_021758

in publications that include any data generated in or by our facility

