Beautiful Work

I used to joke that I would wake up early and “marinate in existential dread” for an hour or two before launching off to work. Not so lately! Alison Doyle (Associate Director for the ISU Research Park) challenged me back in April to start doing yoga with her – weekday mornings at 5:30 AM. Insane, no? Since then, I’ve done yoga 2-5 times per week at the Ignite Studio before the crack of dawn. It’s been great for my health and for my brain. I jetted out of shivasana one morning to write down an idea for one of my grad students before I lost it – it just bubbled up into consciousness like a gift.

In hot yoga, you warm up, then work on stretches, balancing poses, and flows that use the weight of your body to get a great workout and build strength. At the end, instructors often have a parting comment, a bit of gratitude, or some wisdom to share. Denise Coberley is one of the instructors that shows up for those early morning sessions. In addition to being a great yogi, she’s a PhD student in Applied Linguistics and Technology who is focused on science communication and policy. Why am I introducing you to Denise? Because she ends class by telling us something I think is really meaningful. Denise tells us that we did, “Beautiful work.”

I think about that phrase a lot lately in the context of CALS research. Not that some work product is beautiful or that an idea is beautiful (though some ideas really are beautiful), but that the research activity itself is beautiful.

In this edition of the CALS Office of Research & Discovery newsletter, we highlight how Karl Kerns and his colleagues turned one opportunity to get a piece of equipment into a series of wins that support the science. Looking at what they’re doing, I can’t help but marvel…. What beautiful work!

Are you looking to get new equipment? The Equipment and Infrastructure Seed Grants are due this Friday, 13 October. Thanks to Darwin Campbell, we also have a new equipment browser called ATLaS to help you find what you need to do your own beautiful work.

Carolyn Lawrence-Dill
Associate Dean
Research & Discovery
Latest cell sorter technology at Iowa State ‘opens new doors’ for research

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By Ann Y. Robinson

This is the third and final story in a series highlighting CALS researchers and their journeys to funding and enlightenment. The other articles feature work by Joshua Selsby, professor of animal science, and Melha Mellata, associate professor of molecular microbiology.

Karl Kerns, assistant professor, animal science (standing in back), with doctoral students Alexandra Keller and Tyler Weide, during a tour of new laboratory equipment in Kildee Hall. Photo by Madelyn Ostendorf, Iowa State.

Equipment has arrived at labs in Kildee Hall and the Molecular Biology Building that will revolutionize research possibilities for faculty and students at Iowa State University.

For the Kerns Lab in Kildee, the new equipment will help predict male fertility by identifying biomarkers that signal which sperm cells have the best chance of siring successful offspring.

Karl Kerns, assistant professor of animal science, led the effort to bring the next-generation equipment to campus. He investigates the biochemical makeup of sperm cells, including their proteins, lipids (fats) and
use of energy sources. His research focuses on production animals, primarily swine and cattle, but has implications for humans and other animals.

New tools
Kerns and students working with him recently gave a tour of the latest research instruments that are helping build a Single Cell Phenomics Center. The center will make it possible for researchers in animal and plant sciences to pursue in-house projects that would have been impossible before.

The new equipment that arrived at Kildee Hall is the Becton Dickinson (BD) FACSMelody. The advanced cell sorter allows bulk or single-cell dispensing of samples into 96-well plates or microscope slides for downstream analysis of genes, proteins, metabolites and other aspects of sorted cells along with in vitro fertilization. The BD FACSMelody complements an ImageStream flow cytometer that detects and measures physical and chemical characteristics of cells or particles, at up to 28,000 cells per second. The resulting data is translated by associated software that illuminates the detailed cellular images and can feed them into artificial intelligence and deep learning pipelines used to analyze bio-based images at amazing speed.

During a demonstration, fluorescent, colored shapes on a screen conveyed important information about the sperm cells’ viability, health and fertility potential. For other projects, the images could provide similar insights into plant cells, immune cells, ovarian oocytes or even virus particles.

At the same time, the university was able to acquire the BD FACSDiscover S8, a revolutionary tool that can perform both image- and spectral-based sorting. Sorting cells based on images is useful for cells that do not have the ability for biomarkers to discriminate cell types -- or in situations when a large, comprehensive profile is needed to study a highly complex disease. The FACSDiscover S8 is now part of the Flow Cytometry Facility within the Office of Biotechnology, where it is available for use by all ISU researchers.

“This suite of next-generation equipment will enable research questions we could not have begun to answer before,” Kerns said. “Iowa State is the first land-grant institution to have the FACSDiscover S8. Currently, the only other institutions that have this type of equipment are medical and cancer research facilities.”

“Having these tools right next to Kildee Hall in vitro fertilization labs will support next-generation sperm and embryo research,” Kerns said. “We can expect this will lead to new insights for livestock reproductive management, ultimately creating more food with less resources in the face of harsher climates.”

Funding puzzle
To bring this set of equipment - worth more than $1 million - to Iowa State required solving a funding puzzle. A multidisciplinary team in the College of Agriculture and Life Sciences, including Kerns and faculty collaborators Thomas Lübberstedt, agronomy, and Aileen Keating and Elizabeth Bobeck, animal science, formed to seek funding. At first, they secured a $120,000 CALS equipment grant (that comes through USDA Hatch capacity funds) to acquire the BD FACSMelody.
Upon this success, they applied for support from the Cost Sharing Program for Research Tools sponsored by Iowa State’s Office of the Vice President for Research to attain the total $180,000 for the Melody. One thing led to another, and after conversations with the Biotechnology Council and Flow Cytometry Facility, they discovered there was mutual interest in obtaining the BD FACSDiscov 8. The original CALS equipment grant served as seed money, with the Office of the VPR and the Office of Biotechnology providing most of the remaining funds. The manufacturer also provided some discounting to help make it possible to bring the advanced equipment to land-grant labs.

**Impactful capabilities**

“In the end, we ended up getting more capabilities than we originally envisioned at a lower cost,” Kerns said. “The research this suite of equipment allows is spectacular. It will have a large impact on our ability to serve our agricultural stakeholders,” he continued.

The collaboration is a “cool example” of how saying “yes” can lead to even bigger and better outcomes, according to CALS Associate Dean for Research and Discovery Carolyn Lawrence-Dill. “Karl’s path to acquiring the funding he wanted started with a single ‘yes’ from CALS. From there, he and the team used that to build the infrastructure they need to do cutting-edge work.”

Student researchers are already benefiting. For example, the new tools are contributing to a livestock fertility testing project that Kerns and about a dozen students have created through the CALS Innovation and Entrepreneurship Faculty Fellows program. Employing precision data and biomarkers, they are developing a diagnostic platform that uses pipetting robots to prepare samples for more efficient and accurate fertility tests for the swine industry.

During the recent tour, genetics and genomics doctoral students Tyler Weide and Alexandra Keller demonstrated how the new equipment in Kildee can rapidly identify and characterize cellular biomarkers. When asked how working with this advanced technology might influence their careers, they both agreed it “opens up new doors,” and allows them to “go to a whole different level” in their research programs.