

# Sparks of Discovery

AISL #1241429

**Analytical Chemistry & Sustainability**  
**Cathy Middlecamp, Professor in the Nelson Institute for Environmental Studies**  
 Analytical chemistry investigations utilizing fourier transform infrared spectroscopy connected to environmental science and sustainability.

**Center for Complexity & Collective Computation (C4)**

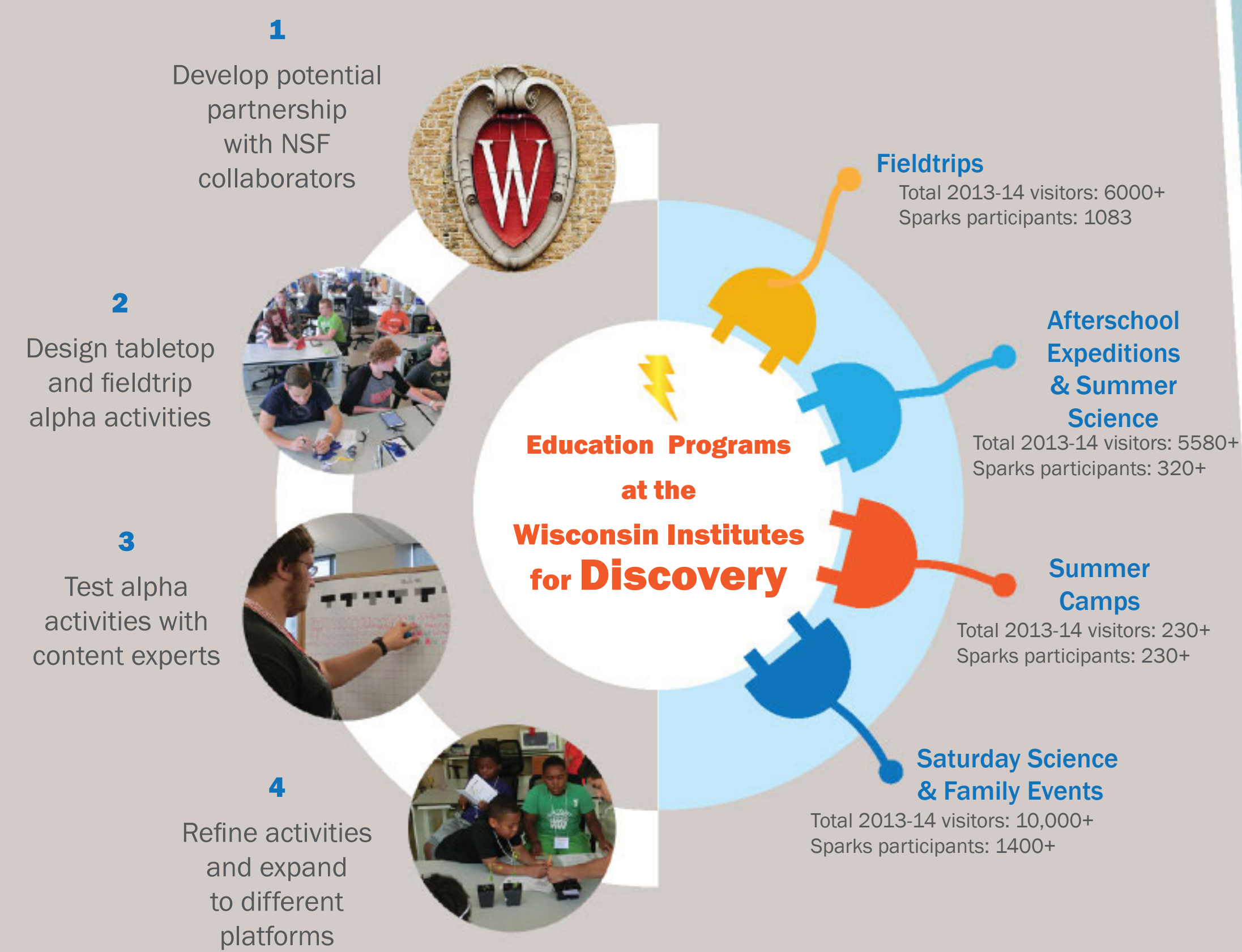
**Jessica Flack, Co-Director of the C4**  
 Complexity science investigations that model phenomena such as the collective behavior of ant colonies and neural networks showcasing how mathematical thinking can solve problems in science and engineering.

## Sparks' Goals

- 1 Develop hands-on modules** within each interdisciplinary collaboration with an outcome of three age-grouped activities that engage participants in understanding interdisciplinary science.
- 2 Seek to empower underrepresented students** by providing in-depth experiences in interdisciplinary science. The student's engagement in the activities will lead to identify shifts where they consider new STEM options in their academic and career track.
- 3 Connect UW-Madison faculty with the public** to share their research and insight into the process of studying interdisciplinary science and technology.
- 4 Share completed activity modules** with both informal and formal science educators through a digital platform.

**Microscopy**  
**Randall Goldsmith, Assistant Professor of Chemistry**  
 A series of engineering and scientific investigations connected to microscopy leading to the development of a portable single molecule microscope.

## Development Process



Significant progress has been made in all interdisciplinary Sparks activity modules. Through continued support of the SPARKS of Discovery project from the Morgridge Institute for Research, UW-Madison, and the Wisconsin Alumni Research Foundation (WARF) the fall of 2014 K-12 field trip experiences at the Wisconsin Institutes for Discovery will offer 10 unique grade level 75 minute field trips experience that have come out of the Sparks of Discovery Project. The next steps are to complete the development cycle for all 6 interdisciplinary research areas and develop a digital partnership to share the Sparks modules broadly.

**Microfluidics**  
**Doug Weibel, Associate Professor of Biochemistry**  
 Investigations of fluid dynamics and the potential of the microfluidics device as a 'lab-on-a-chip' that can solve scientific problems by integrating engineering, physics, chemistry, and biology.

## Progress & Evaluation

The next major discoveries in science and engineering will depend on researchers working closely together, collaborating across disciplines in STEM. Sparks of Discovery is developing inquiry-based activity modules that offer the public an opportunity to engage in interdisciplinary science investigations. We have been implementing the Sparks' activities at the interdisciplinary research facility on the UW-Madison campus: the Wisconsin Institutes for Discovery. Even at this early stage we have had a great deal of engagement and trials of the activities.

Youth that are underrepresented in STEM careers from community centers and clubs such as the Boys and Girls Club of Dane County have provided ongoing feedback as they engaged with the first cycle of activities developed from the Sparks of Discovery Project. This feedback has helped shape activities and assure a level of relevance when the activities are implemented in field trip programs, festivals, and afterschool and summer science programs with K-12 school groups, neighborhood centers, adults, and many families from the community.

One of the focal points of our evaluation process is to assess progress in reaching our Sparks goals of connecting underrepresented youth to STEM academic and career possibilities. We have utilized a number of survey instruments based on the activation survey, careers and interest survey, and custom open-ended questions sets that connect to STEM academic and career awareness.

At this point we have implemented 424 Sparks of Discovery surveys since January of 2014. We have done some preliminary evaluation of surveys from a group of participants that completed the microfluidics' module. We are actively engaged in evaluation of the larger data set in connection to our goals and we are preparing adjustments to our survey instrument for fall 2014 programming events.

## Next Steps & Challenges

As we continue to evaluate progress towards our goals we will look to make our evaluation strategy more comprehensive. The informed consent process is challenging to carry out in our drop-in program formats that are attended by many neighborhood and community groups. We are also refining methods to assure that longitudinal data of repeat participants can become an efficient part of the survey process. At this point our consented data is largely composed of summer camp groups and school based field trip groups.

We look forward to continuing refinement and development with our six NSF collaborators. The development cycle model has helped to streamline creation, implementation, and evaluation by identifying alpha testing, beta testing, and continuous improvement strategies as the modules are developed. We will be moving through the Sparks development cycle this fall to develop 'Botany and robotics' and 'Analytical chemistry and sustainability' modules. The other four Sparks modules have moved through at least one cycle and are being modified and created based on the planning and feedback received over the past year.

**Epigenetics**  
**Xuehua Zhong, Assistant Professor of Genetics, Epigenetics**  
 Investigations of epigenetics through modeling, simulations, and extended lab activities that investigate DNA methylation as an epigenetic regulator in a plant model, Arabidopsis.

## Thank You



**UW-Madison NSF Collaborators**

\*PI Doug Weibel, Associate Professor of Biochemistry  
 Cathy Middlecamp, Professor in the Nelson Institute for Environmental Studies  
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