The Natural Sciences are relevant to everyone. However, STEM (Science, Technology, Engineering, and Mathematics) subjects are not always presented in school in a way that captures imaginations and inspires students to pursue STEM careers. This is especially true for girls and minorities.

Our solution to this problem involves the College of Natural Sciences faculty. In addition to teaching, they are actively conducting basic and applied research selected by the scientific community as being the most relevant to the needs of society. We collaborate with these faculty on the design of unique STEM experiences and kits for 4th through 12th grade students that aim to inspire the next generation to want to learn more about the sciences.

**Message from the Director**

Lot’s of exciting news and new projects on the horizon! Here is just a sampling of what we have going on:

**New Raspberry Pi Computers**
Over winter break, we installed 24 Raspberry Pi computers equipped with ExplorerHat Pro boards for quickly adding physical and chemical sensors to programs made in the Scratch programming environment. We are adding a small amount of coding to each STEM kit we design. We are also co-teaching a course called “SimSTEM: Simulating STEM Topics Using Scratch and Netlogo Coding” with Dr. Ashok Prasad and the Poudre School District Educational Technology folks.
STEM Fridays Now Part of Science Methods
This is our fourth year of STEM Fridays! Thousands of 4th through 12th grade students have been given the opportunity to visit our cutting-edge STEM lab where they get to explore being a scientist or engineer by studying the same topics and approaches used by CSU faculty researchers. Dozens of Preservice science education majors in the BSNS degree program have been volunteering to help facilitate the learning. Now, we are very excited to announce that STEM Fridays are formally part of the EDUC 460 Science Methods course!

New Rotary Club Partnership
Members of the Rotary Club are now taking the Get Energized kits into schools and helping the students use the kits. They have a wealth of knowledge to share from their careers in the STEM fields.

NABT Workshop and Paper
Next summer we will collaborate with the NABT on our second professional development workshop at the EOC. Our collaboration with the Biology Guppy Group continues to be fruitful and is summarized in the forthcoming paper, “Small fish, big questions: Inquiry kits for teaching evolution” to appear in the American Biology Teacher.

New Marmot Metabolism Exhibit
Undergraduate biology major, Victoria Allyn, has designed a cool new prototype exhibit at the EOC comparing marmot metabolism to human metabolism. We are hoping to have the finished exhibit done by the end of the academic year. This is one component of the Broader Impacts of a new project we have with professors Dr. Greg Florant and Dr. Seth Donahue.
New 3D Visualization System
Sadly, we retired our first generation portable 3D projection system after nine years of programs. This system was nice, because it was very easy to explain how it worked. Our new system, however, is much easier to use, brighter, better color rendition, and even more portable!

Solid State Diffusion
We have begun our new collaboration with Dr. Jamie Neilson on his new NSF CAREER grant. We will be designing a STEM kit on how solid state diffusion is being used by researchers to develop new materials for electronic devices.

NPS Ice Science Kits
We are working with the national parks of Alaska to design the ultimate STEM kits on ice cores and permafrost. We will be getting feedback on our prototype kits at a workshop at the University of Alaska, Fairbanks in July 2017.

Best of Both Worlds Conference
I was invited to give a Keynote presentation at the 8th BoBW conference held in Estes Park in September 2016. My talk titled, Inspiring Students with the Joy of Scientific Discovery was well received by the international audience and I left with renewed energy. The goal of the conference was to share best practices between the “industrialized world” and the “developing world.”

Every week we meet new undergraduate, graduate, post-docs, faculty, and community members interested in STEM outreach. Their passion helps energize us as we look for ways to connect the dots.

Andrew Warnock
Dr. Andrew Warnock, Director
“There is a theme to all of the educational opportunities that the CNSEOC provides. Whether it is field research or investigations performed in the classroom, they ask students to seek natural patterns based upon observations, data collection and analysis. The CNSEOC develops and shares educational experiences that model critical thinking skills central to promoting the advancement of science.”

— Mike Viney, Science Teacher, Blevins Middle School
Focus #1: STEM Experiences

Research questions, data collection and analysis, interpretation, and scientific communication are the basic elements that weave through each of our programs. Mathematics, culture and place are used to help connect students to the science.

**STEM Fridays:** Pre-service science teachers help facilitate weekly hands-on experiences for 4th through 12th grade students and their teacher in our high tech experiential learning lab or in the field at our GetWET water science site.

**Colorado Science and Engineering Fair:** As one of the top state science fairs in the nation, we draw on thousands of middle and high school students from the best teachers across the state of Colorado. The fair encourages authentic student driven research mentored by leading scientists and engineers. ([www.csef.colostate.edu](http://www.csef.colostate.edu))

**Keynotes and Workshops:** Each semester we host a variety of keynote lectures or hands-on professional development workshops attended by CSU and K-12 faculty and students, as well as informal educators.

**SciTrek:** Our summer camp for high school juniors and seniors is a capstone experience where students contribute to a five-year tree ring research project at Lory State Park.

**MST-Day:** Math-Science-Tech Day brings together culture and STEM. Sixteen classes of fourth grade students from five local schools with the highest percentages of students receiving free or reduced lunches participate in three 45 minute hands-on sessions presented by faculty followed by an interactive cultural performance.
“The EOC has coordinated the Colorado Science and Engineering fair for close to two decades. Student winners go on to compete in the International Science and Engineering Fair. The Center does an outstanding job coordinating the fair for the state of Colorado. An important strength of the EOC is the stability of the staff. The Center builds upon past experiences, develops new programs, and brings in new partners. This is critical for long-term sustainability.”
– Dr. Nancy Rader Kellogg, Colorado Science Education Network
Focus #2: STEM Kits

The STEM Kits that we create are derived from the research projects of CSU faculty. We delve into their research methods to find the essence that we distill into an educational kit. How does the researcher approach a problem? What sorts of experiments are used to solve the problem? How can we give students the joy of discovery? These are the elements that make a great educational experience. Kits focus on scientific process, scientific illustration, data collection and analysis, and communication of results.

We develop several categories of kits:

**Broader Impacts/CAREER:** Faculty seeking funding from the National Science Foundation are required to have a concrete plan for how they will inform society about the importance of their work. We make it easy for them to reach a wide audience.

**Distance Learning:** The Masters of Natural Science Education degree serves science teachers globally. A key piece of this exciting program is that every course includes a hands-on lab component. We work with faculty on the design of these labs. We also assemble and ship the kits.

**National Parks:** Since 2012, we have been collaborating with the National Park Service on the design of hands-on STEM kits for schools that surround National Parks in Hawai‘i and Alaska.

**Foundations & Donors:** We have developed kits with specific grants from foundations and gifts from private donors. We are currently seeking new partnerships to support our kit lending program.
“I am grateful for having colleagues like the three of you who share a passion for improving science education. Your support of both research and teaching is invaluable. I love being able to brainstorm with all of you about how CSU can meet K-16 teachers’ needs to improve student learning outcomes and attitudes about science and mathematics.”

— Dr. Meena Balgopal, Associate Professor of Biology, CSU
Focus #3: STEM Kit Lending Library

Kits are packaged to be used individually or by pairs of students and are easy to transport. Teachers and informal educators can check out a classroom set of 15 kits for a week at a time. Because the kits are largely self-guided, students can work at their own pace and teachers are freed up to help the students who are struggling or suggest extensions for kids who want more.

**Biology**
- Small Fish - Big Questions Kit
- Hominid Skulls Kit
- Physiology of Hibernation Kit *(coming soon)*

**Chemistry**
- Get Energized! Kit
- The CO₂ Kit *(coming soon)*
- Solid State Diffusion Kit *(coming soon)*

**Computer Sciences**
- Pico Pong Kit

**Earth & Environmental Sciences**
- Ice Cores and Permafrost Kit *(coming soon)*
- Really Ancient Fossils Kit
- Soil Carbon Kit

**Engineering**
- Solar Cars Kit

**Physics**
- Revolution Kit
- Get Critical! Kit
“You have influenced my students directly through STEM Fridays, you have helped me maintain my enthusiasm as a teacher through seminars, and you have opened conversations with teachers and given us tools for teaching controversial topics such as fracking and evolution. You provide continuing education for me in a manner that is not readily available elsewhere.”

— Vicky Jordan, Retired Science Teacher, Wellington Middle School
Focus #4: Mentoring

Pre-service teachers: Teaching science is not an easy job. Our center offers opportunities for enthusiastic students to see how effective hands-on teaching methods can be.

- The approximately 55 students in the Bachelors of Science in Natural Science major are advised through our center.
- Our center is the home of the STEM Educators Club, where we offer space to study, coffee and snacks, trips to conferences, and opportunities to connect with schools and teachers (e.g. STEM Fridays).

In-service Teachers: The best teachers are life long learners themselves. We offer a selection of opportunities for teachers to reinvigorate their passion for teaching.

- STEM Fridays allow us to show teachers in real-time what elements are needed to create successful hands-on STEM lessons for their students.
- A variety of Professional Development Workshops and Lectures provide networking opportunities and support for topics that are difficult to teach (e.g. evolution).

Under-represented in STEM fields: All of our programs strive to encourage young women and minority students to consider a STEM career. Two programs in particular include their success as the primary goal.

- SciTrek and SummerVet are weeklong summer camps that attract mostly female students from across the nation.
- The weekly after school Triunfo Mentoring Program pairs first generation college students with mostly Hispanic youth for homework help and STEM activities.
“As a teacher, I look forward every week to having the lessons of the week revisited and explained from a different point of view by college students. This is a tremendously valuable experience for these kids, especially because many of them have no family members who have had the college experience. My fourth graders get to actually sit in a college lab with college students just a few years older than they are and this makes the goal of attending college seem more attainable. Tutoring is the highlight of many of these kids’ week.”

— César Fuentes, Teacher, Harris Bilingual Immersion School
Each pin represents a student or teacher who has participated in one of our programs or uses our materials.
“It was my first time in Colorado, and I felt so welcomed at the camp. I was super excited to go out and actually do the tree coring myself. That’s an experience I wouldn’t have been able to do anywhere else! It amazes me everything you can learn about a tree from the core.”

– Noemi Guevara, SciTrek Alum currently majoring in biology at CSU
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