CIRES

CIRES Innovation

Cooperative Institute for Research in Environmental Sciences

The CIRES Innovative Research Program—which encourages novel, unconventional, or basic research that might otherwise be difficult to fund—celebrated 11 years of achievement in 2009. Funded projects do not necessarily have an immediate practical application or guarantee of success, but many have succeeded greatly, as demonstrated by a few examples below. With seed grants from about $5,000 to $30,000, the Innovative Research Program supports pilot or exploratory studies, from instrument development to laboratory, field, or model work.


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CIRES Innovative Research Program

IRP fuels a journey from atmospheric science to vaccines

An Innovative Research Program (IRP) grant helped former CIRES Director Dr. Robert Sievers transform himself from an atmospheric chemist into a medical researcher determined to save lives with better vaccines.


Dr. Robert Sievers

Dr. Sievers applied for an IRP grant in 1999, the year the innovation-encouraging program was established. Dr. Sievers was an atmospheric chemist who studied how tiny atmospheric particles called aerosols contributed to Denver's wintertime brown clouds and other air pollution events.

To support his research, Dr. Sievers figured out how to create particles in the laboratory, particles tiny enough to stay airborne for a long time. The process (carbon dioxide-assisted nebulization with a bubble drier) made extremely fine powders from liquid solutions. Like real airborne pollutants, the laboratory-made powders could also penetrate deeply into the lungs. Dr. Sievers soon began thinking about whether his technique could be used to make inhalable medicines instead of pollutants.

In the 1990s, he and his colleagues began experimenting with dry particulate medicines for asthma and other lung diseases. In 1999, the IRP provided about $20,000 to help the research team test out some new ideas and start attending conferences on the medicinal use of aerosols.

"The grant gave us the flexibility to try some things that we couldn't justify trying under any of the other grants we had at the time," Dr. Sievers said. "It was money that let us dare to try a totally different direction."

The IRP funding also enabled Dr. Sievers and his colleagues to gather data that were critical for applying for more conventional grants. It can be difficult for a researcher, even one that's highly respected in their field, to win funding for an entirely new idea.

Today, the Dr. Sievers lab is focused on measles vaccines. During the last decade, he has received millions of dollars in funding, from the Bill and Melinda Gates Foundation and the Foundation for the National Institutes of Health, to focus on measles, a disease that kills 500 people around the world daily, most of whom have no access to vaccinations.

Conventional versions of the vaccine are presently injected, with needles expensive enough to encourage dangerous reuse. The liquid vaccine must be refrigerated, and the water in it is heavy, which adds further to shipment costs.

Dr. Sievers has developed a powdered, stable version of the measles vaccine (a weakened virus), which is administered through a small plastic sack with a neck like a water bottle's neck. A test animal or child takes a deep breath, and is vaccinated, Dr. Sievers said. There's no pain, and no need for dangerous needles.

Clinical trials will begin in 2010 in India, where Dr. Sievers has research colleagues, and where the disease still kills nearly 200,000 children, annually.

"I believe we can transform health in the developing world," Dr. Sievers said .

In 2009, Colorado Governor Bill Ritter honored Dr. Sievers with the first Governor's Award for Research Impact, in the public health category.

Supporting rainy-day science

Rain affects every aspect of human life, from agriculture to recreation, but it's difficult to get it right in weather forecasts and climate models. Deadly storms still slip below weather radars, and climate models still use relatively simple portrayals of cloud systems. CIRES' Christopher Williams won an IRP grant in 2008, to develop an inexpensive (~$12,000) radar system, using technologies developed for the mobile phone, police radar, and video games. Similar commercial systems cost more than $200,000, making them cost-prohibitive for use in precipitation research. Dr. William's dual-frequency vertically pointing precipitation profiling radar is now set up for testing in eastern Boulder County, CO, and he hopes the small investment CIRES made in his work could lead to big improvements in weather forecasting and climate modeling.

CIRES scientist Dr. Christopher Williams sets up a prototype dual-frequency vertical profiling radar system, funded by an IRP grant.

IRP grant inspires long-term research

As a child growing up in Ontario, Canada, Shari Fox liked to dig caves in snowdrifts and curl up inside to nap. In graduate school at the University of Colorado (Geography), she turned her love for things cold and snowy into Arctic climate research, linking physical science and indigenous knowledge. Fox wanted to create a CD-ROM (then a new technology) of her research findings, to be used as a teaching tool in indigenous communities, and as a public report. She applied for, and won, a CIRES IRP grant to do it.

"It seems strange now to think of multimedia as innovative, but back then it was," says Fox, now Dr. Shari Gearheard. "People told me that my project was perceived as a risk, that it was kind of unusual. But somebody saw value in it, and I think that says a lot about CIRES. Now this kind of communication about science has become more conventional. CIRES was ahead of the game."

Today Dr. Gearheard is a CIRES National Snow and Ice Data Center research scientist based full-time in Clyde River, Nunavut, Canada. Among other research activities, she leads the Siku-Inuit-Hila project, in which Inuit, Inughuit, Iñupiat, and scientists are working together to study local-scale climate and sea ice changes.

"For me, the IRP was really critical," Gearheard said. "It allowed me to give this unique product back to the community, and I made a lot of good relationships through that project. It helped set the stage for all the work I continue to do. More: http://nsidc.org/research/bios/gearheard.html.

Dr. Shari Gearheard

Tracking carbon's origin

In 2003, CIRES researcher Dr. John Miller (with NOAA's Global Monitoring Division) and two colleagues won an IRP grant, to test if radioisotopes of carbon could help them track the origin of carbon dioxide in the atmosphere. Fossil fuel CO_2 contains no ^{14}C because it is lost to radioactive decay; all other CO_2 sources (biomass burning, for example) contain ^{14}C at levels similar to those in ambient air. Fossil fuel emissions of CO_2 are the main cause of anthropogenic climate change, but had not been measured directly in the atmosphere above North America prior to this grant.

Dr. Miller, Dr. Pieter Tans (NOAA), Dr. Scott Lehman and graduate student Jocelyn Turnbull (both University of Colorado), used IRP funding to obtain the ^{14}C concentration of air samples with great accuracy, using accelerator mass spectrometry. Their experiments included air samples collected in New England, Colorado, and during a railway-based expedition across Northern Russia and Siberia.

The scientists concluded that ^{14}C measurements represent the most accurate way to track fossil fuel CO_2 emissions. In the New England data, they found that forest uptake of CO_2 was "masking" the full extent of fossil fuel emissions. In the Eurasian data, the researchers found an increase in $^{14}CO_2$ from West to East, consistent with heavy fossil fuel emissions in highly populated Europe (low ^{14}C) and a smaller fossil fuel influence on air in remote eastern Siberia (higher ^{14}C).

"Now we are hoping that ^{14}C measurements become a fundamental part of NOAA's monitoring program," Dr. Tans said.

More: doi:10.1029/2005GL024213 and Turnbull, JC et al. (2009), *Atmospheric Chemistry and Physics*.

More Information

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A train heading from Russia across Siberia bears scientific instruments from CIRES and other institutions, to measure CO_2 from fossil fuel use and other sources.