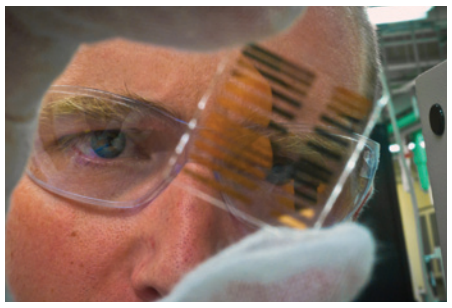
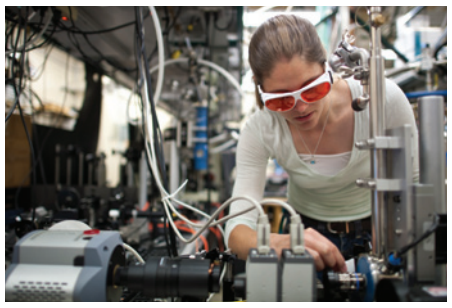
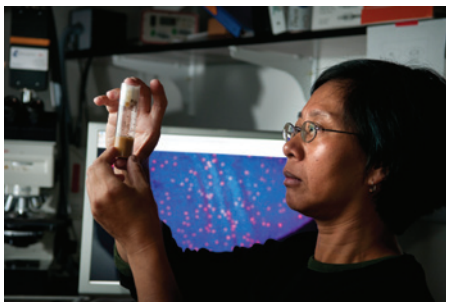
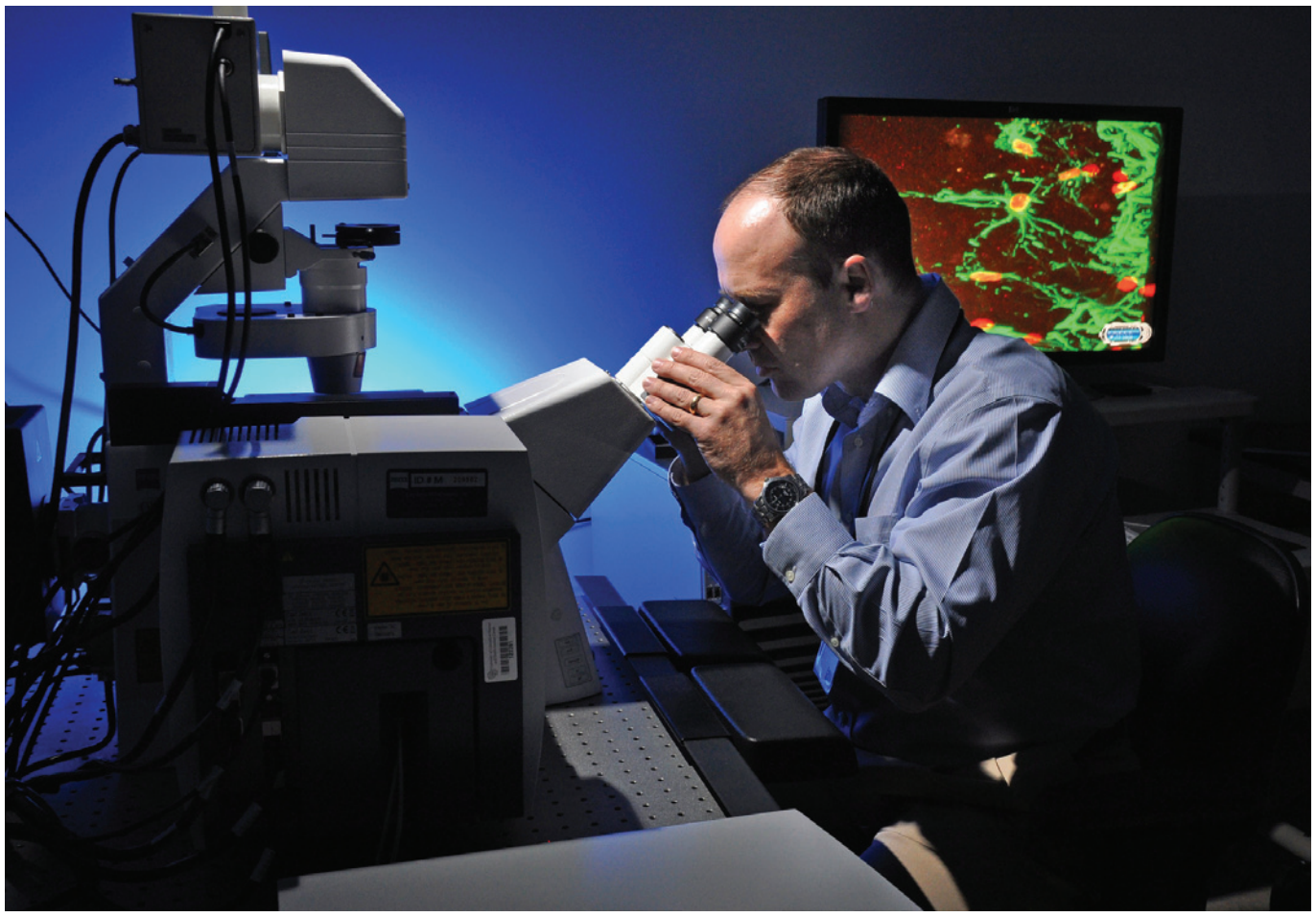
2012

DISCOVERIES









Universities, labs & the economy

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A special publication of:

Boulder County Business Report

Northern Colorado Business Report

Wyoming Business Report

The ROI on innovation has never been stronger.

The Power of Partnership

The University of Colorado Denver | Anschutz Medical Campus has established a national leadership position in transforming university innovations into real-world medicines.

We are a catalyst—bringing faculty inventors and researchers together with biotechnology, pharmaceutical, device and information technology companies—to translate ideas into products that make a difference.

It's a partnership that provides seamless collaboration between our researchers and clinicians, and your company—supported by our broad range of research labs, affiliated hospitals and bio-specimen facilities. We offer the kind of connections and services that ensure ideas are leveraged to their greatest potential and improve clinical outcomes.

To learn how your company can take advantage of our fresh thinking, research expertise and partnership approach, visit ucdenver.edu/PartnerNow.

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University of Colorado
Denver | Anschutz Medical Campus

‘Discoveries’ launches new voyage

Highlighting the impact of Colorado, Wyoming universities, labs

Science is the heart of our economy. Research at universities and federal laboratories in Colorado and Wyoming drive billions of dollars in impact, from Laramie to Denver and Aurora, Fort Collins to Boulder, Golden to Greeley.

The names are powerful: the Colorado School of Mines, Colorado State University, the University of Colorado Boulder, the University of Colorado Anschutz Medical Campus, the University of Colorado Denver, the University of Northern Colorado and the University of Wyoming.

Federal laboratories include the National Center for Atmospheric Research, the National Oceanic and Atmospheric Administration, the National Renewable Energy Laboratory, the Centers for Disease Control and Prevention and many others.

The impact of these institutions can be found in direct dollars spent, spinoff dollars generated, research dollars raised, private companies lured to the region, technologies developed and spinoff companies created.


Nelson


Nuttall


Wood

Patents generated by research institutions are many and varied. Strengths range from bioscience to veterinary medicine, aerospace to software, clean technology to energy.

At our publications — the Boulder County Business Report, the Northern Colorado Business Report and the Wyoming Business Report — we stand at ground zero for much of the science that has made our region a national research powerhouse. We report daily on the discoveries that are made, the companies that are created and the researchers who are honored.

That proximity prompted us to take a deeper look at the impact of these institutions on the economies of Colorado and Wyoming. The result is Discoveries: Universities, Labs & the Economy, a special section inserting in all three of our publications.

Through Discoveries, we seek to demonstrate for our readers how important these institutions are to the region’s economy. For this purpose, we broadened our traditional coverage areas to include those research institutions in Aurora, Denver and Golden — institutions such as the Colorado School of Mines, NREL and CU’s Anschutz Medical Campus.

Readers will learn about some of the researchers and technologies that drive these institutions and help fuel our economy. They’ll learn about their economic impact and their challenges.

But this coverage does not end with this section. We know — and we hope the reader understands — that no single section could adequately describe the scope of these institutions and their impact on the economy. That’s why Discoveries will become an ongoing monthly feature in each of our publications, highlighting new technologies, new discoveries and the researchers behind them.

In the months ahead, readers can also look to our websites — www.bcbr.com, www.ncbr.com and www.wyomingbusinessreport.com — for a full Discoveries microsite, featuring all of the print content, along with new features.

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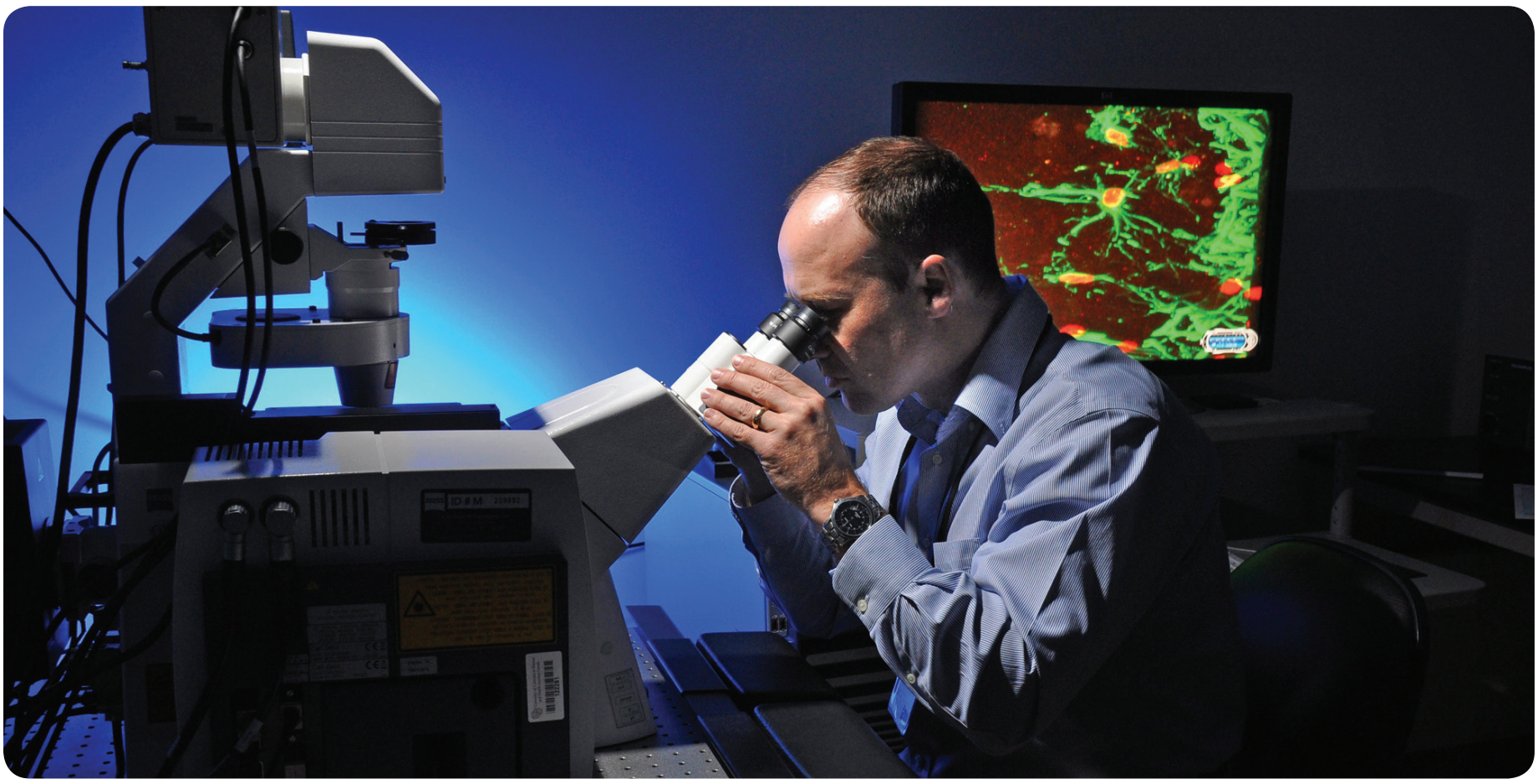
Higher education, high pursuits

Their mission: delivering breakthrough research that can change lives



COURTESY OF GLENN J. ASAKAWA/UC

Dr. Stephen Davies, an associate professor in the Department of Neurosurgery at UC Denver's Anschutz campus, uses a confocal laser microscope to create detailed three-dimensional images of cells such as the astrocyte visible on the screen at right. Davies hopes his research with stem cells will lead to breakthroughs in repairing spinal-cord injuries.

BY STEVE LYNN

Universities in Colorado and Wyoming have generated tens of billions of dollars in economic activity over the years and will no doubt do so for years to come, even as prospects for state and federal funding dim.

Technologies developed at the universities – from biotechnology to renewable-energy solutions – have formed the basis of scores of new companies in just the past few years.

Revenue from royalties based on the sales of products protected by university patents, including legal settlements, totals more than $100 million.

The University of Colorado alone is among the top 10 universities nationwide in the number of companies created.

These universities provide essential research and train a large number of scientists and engineers. That, of course, is why federal funding is crucial for them.

At CSU, for example, more than 80 percent of the university's research funding comes from federal agencies such as the National Science Foundation and National Institutes of Health, said Bill Farland, vice president of research.

The rest of its funding comes from the private sector and foundations; a small amount comes from the university itself to match some of the grants it receives.

"With the slowing down of the economy, the federal agencies who provide these competitive funds have been, for the most part, flat, or just a few percent above, keeping (up) with inflation, for the last couple of years," he said.

Much is at stake, including innovations that could change life as we know it.

More immediately, Colorado's higher-education system alone supports nearly 98,000 jobs and $4.25 billion in wages and salaries, according to a 2006 study commissioned by the state Department of Higher Education.

College degrees, as everyone knows, boost the earnings potential for graduates.

Coloradans with a four-year degree earned a median annual income of more than $45,000 in 2007, according to data from the American Community Survey. Median earnings for residents with only a high-school degree were just $28,200.

Here's a look at the economic impact of institutions of higher learning in Colorado and Wyoming where cutting-edge discoveries are being made.

COURTESY OF CSU

CSU's Patrick Shipman, a mathematics professor and co-director of the Laboratory for Mathematics in the Sciences, at work on an experiment with chemistry student Juan Martinez.

CU Anschutz Medical Campus

The University of Colorado Anschutz Medical Campus in Aurora received nearly $400 million in research funding in 2010. Its economic impact amounts to more than $2 billion in total economic activity statewide.

Anschutz employs more than 8,000 workers and has a total employment impact of more than 17,000 jobs in Colorado.

Anschutz Medical Campus serves more than 500,000 patients annually at its hospitals, University of Colorado Hospital and Children's Hospital Colorado. It's also home to the schools and colleges of Medicine, Pharmacy, Dental Medicine and Public Health.

Researchers here have accomplished an impressive list of breakthroughs.

Last year, for example, scientists in the school of medicine showed that a kind of human cell generated from stem cells and transplanted into spinal cord-injured rats can repair damage to the nervous system and help the animals regain movement.

The medical school also pioneered an approach to analyzing thyroid problems that could eliminate the need for tens of thousands of thyroid surgeries nationwide annually.

For every dollar of state funding, it's estimated that the UC Denver School of Medicine generates more than $52 in clinical revenues, grants, contracts and other revenues.

University of Colorado

Packing a $5.3 billion economic impact, the University of Colorado has 57,400 students and nearly 27,500 faculty, staff and student workers, according to a CU study released earlier this year. Other studies have estimated economic impact of the third-largest employer in the state at as high as $6 billion.

CU, which has four campuses, boasts $2.6 billion in direct spending. Average annual earnings of its employees totals nearly $45,000 – directly accounting for $1.2 billion in economic activity.

Student spending topped $500 million, with CU-Boulder accounting for the lion's share at nearly $318 million.

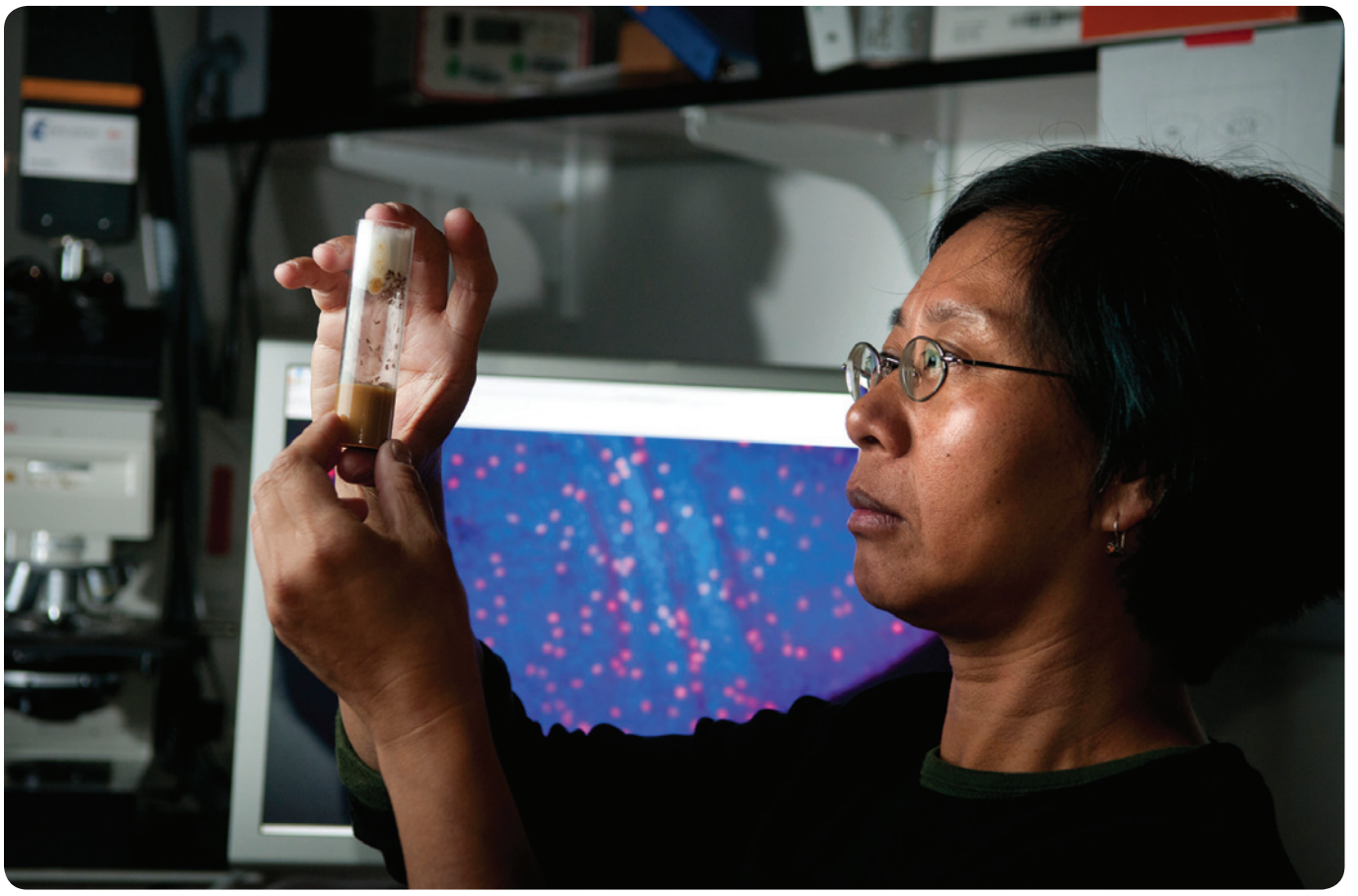
The university system secured more than $793 million in research funding from federal, state and private sources in fiscal 2011.

"It's a lot of federal dollars coming back to Colorado for research," said Brian Lewandowski, research associate for the University of Colorado Leeds School of Business. "It's not local money being spent; it's additional, external dollars being infused into this state's economy."

Of course, some of the federal dollars leave the state because CU and other universities here do research with faculty from other schools nationwide, he added.

At the same time, technology emerging from CU research labs has led to the founding of 11 new companies with a focus on life sciences and clean energy in fiscal 2011.

"That's another benefit of having any of these research universities here," Lewandowski said.



COURTESY OF CU

UC Boulder Associate Professor Tin Tin Su, who works in the molecular, cellular and developmental biology department, holds a vial of fruit flies that she uses for her research into a CU drug-screening technology to identify novel therapies for cancer. The monitor is a microscopic view of fruit fly cells.

Colorado State University

CSU's nearly 100,000 Colorado-based alumni account for more than $5.2 billion in annual household income, representing 3.7 percent of the state's total household income, according to a 2012 report by the university.

"It's a very strong statement about the impact of the university generally on the state and the local community," said Farland, CSU's vice president of research.

Those earnings generated $365 million in income and state sales-tax revenue and $202 million in local sales and property tax revenue.

As the largest employer in Northern Colorado, CSU employs about 6,200 workers. The university supports a total of 13,140 jobs through direct employment and related spending.

Annual household income generated in the state by CSU's direct and indirect employment amounts to $403 million annually.

Annual student spending in just Fort Collins totals $168 million, supporting 628 non-university jobs in the city, according to a 2009 CSU report. CSU's total contribution to city of Fort Collins' coffers, including sales, property, use and other taxes, totals nearly $13 million.

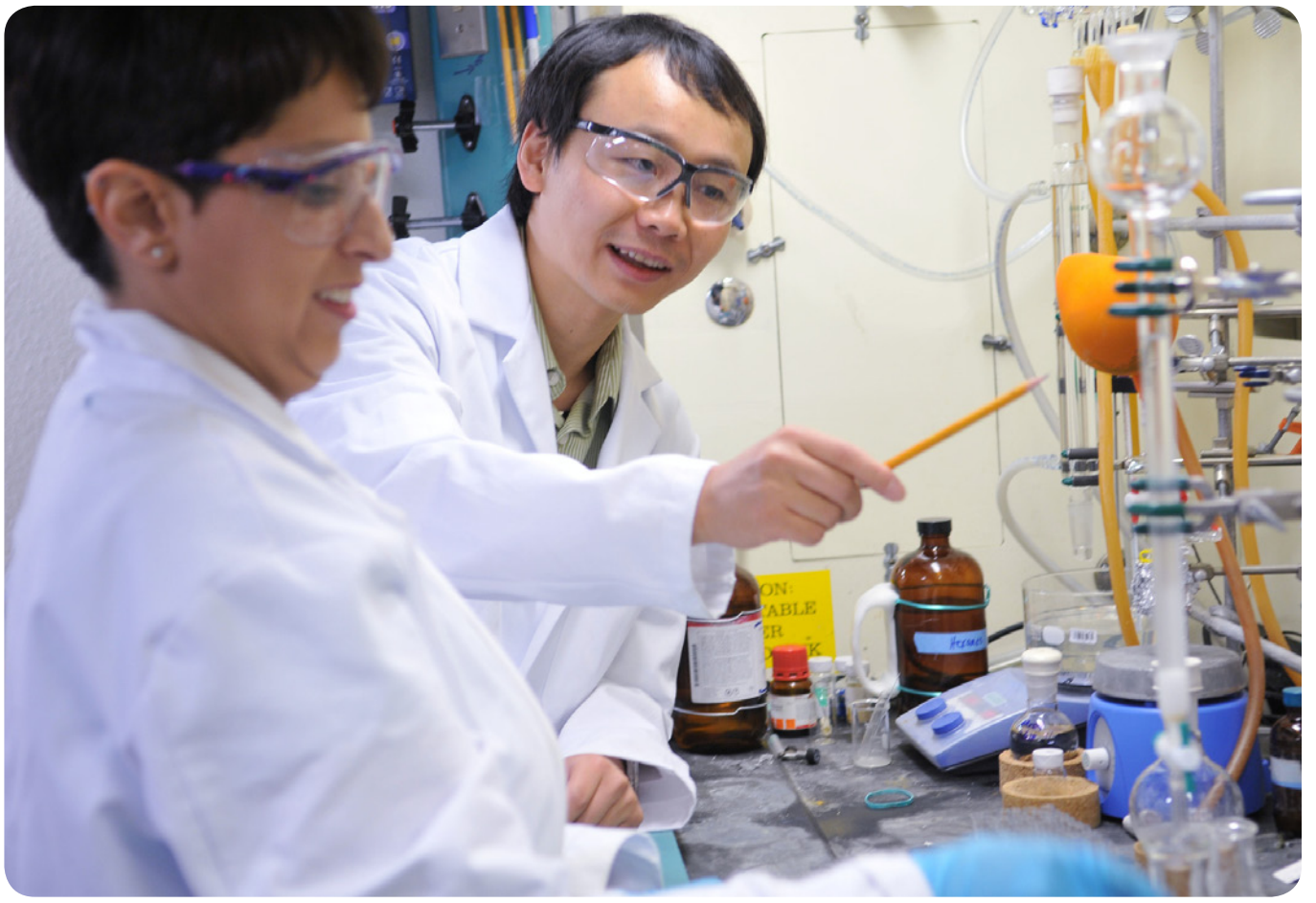
The number of inventions by CSU faculty and researchers surged 132 percent between 2007 and 2011 vs. the previous five years.

CSU Ventures, the university's technology transfer group, reported 515 new inventions during the period. The increase puts CSU in the 99th percentile among institutions with more than $125 million in annual research funding.

Additionally, CSU has created 20 start-up companies in the past five years, leading to hundreds of private-sector jobs, according to the 2012 report. Driving innovation in the state, the university's research resulted in 277 patents, patent filings and patent disclosures last year.

CSU also has licensed 136 technologies to private enterprise since 2007.

CSU generates more than $300 million in research spending annually that funds studies in the fields of engineering, biophysics, veterinary medicine, chemistry, atmospheric sciences and business.



COURTESY OF GLENN ASAKAWA/UC

Assistant Professor Hang (Hubert) Yin, right, works with a graduate student in his lab in the chemistry and biochemistry department at UC Boulder. The Yin research lab works on the interface of chemistry, biology and engineering with particular focuses on structure-based drug design, cell signaling biochemistry, biotechnology development, and membrane protein simulations.

Colorado School of Mines

Colorado School of Mines in Golden has 31 active technology-transfer licenses that netted the university nearly $125,000 this year. It issued nine patents and established two startups.

Mines research significantly affects industry statewide. For one, Mines Chemistry Professor Kent Voorhees invented bacterial detection technology licensed to Longmont-based MicroPhage Inc. The company reached an agreement with health care giant Cardinal Health to distribute the technology to help patients with life-threatening infections.

The school's payroll also contributes to the state's economy. Last year, Mines paid $69 million to 3,730 employees, including student workers.

The school's broader economic impact on the region has included $150 million in spending in campus design and construction since 2009. That has resulted in the creation of about 1,100 jobs.

University of Northern Colorado

UNC spends about $23 million annually on goods and services within the state of Colorado, according to a UNC study that analyzed economic impact last decade. Almost $8 million of the total is spent in Northern Colorado, mostly in Greeley.

Student spending within the Greeley and Weld County areas was estimated to range from $53 million to $72 million per academic year, contributing additional state and local sales tax revenue of over $3 million.

About $63 million is paid annually to nearly 5,900 full-time and part-time workers in Northern Colorado. More than $55 million went to employees living in Weld County, including $49 million to Greeley residents.

The study pegged faculty and staff spending in the state at between $10 million to $15 million. Spending in Weld amounts to between $8 million to $12 million. It estimated spending in Larimer County at more than $1 million.

In addition, the university spends an average of more than $15 million annually on facility improvement and construction in Colorado.

University of Wyoming

The university's impact on the economy of Wyoming is plenty evident, though the university has not done its own economic impact study.

The school employs nearly 4,500 nonstudent faculty and staff and nearly 3,000 student employees throughout the state. Nonstudent and student employees enjoy a combined payroll of $199 million.

The university is no slouch in technology transfer.

Most of the some 65 technology companies in Laramie have ties to the school, said William Gern, vice president of Research and Economic Development. Before 1994, less than a dozen technology companies were located there.

"We estimate that 85 percent of the technology-based companies in Laramie have some relationship to the university, whether they're spin-outs, startups, (or) whether they're incubated by the … Wyoming Technology Business Center," Gern said.

These tech companies, estimated to employ more than 600 people, tend to pay higher wages and benefits – an average of $35,000 annually with a total payroll of $21 million.

The companies also produce products and services sold outside the region, according to a 2012 Laramie Technology Workforce Project report.

"This introduces new dollars into the community and supports local service providers, retailers, and infrastructure needed for a growing, healthy local economy," the report says.

Powerhouses of innovation

Federal labs deliver $1.5B in economic impact

BY STEVE LYNN

They employ thousands of the nation's top minds, generate hundreds of millions of dollars in economic activity and are often engaged in life-changing work.

The federal labs found in Colorado and Wyoming are much more than buildings filled with men and women in lab coats.

Numbering 26 in all, these labs are nothing short of economic powerhouses, leaders in fields that include renewable energy, climate and weather, space physics, telecommunications, agriculture and earth science.

Their breakthroughs have come in hurricane forecasting, oil-spill air quality assessment, Lyme disease prevention, energy efficiency, detection of aquatic invaders and crop science, among other areas.

According to a 2011 study by the University of Colorado Boulder's Leeds School of Business, the 25 labs in Colorado created 16,500 direct and indirect jobs, hiring some of the brainiest people on the planet, including those with Nobel prizes.

Lab worker salaries and benefits, as might be imagined, are considerably better than the state average in Colorado, amounting to more than $93,000 in 2010, providing an important source of income-tax revenue to the state.

The net economic benefit of the labs totaled $1.2 billion in fiscal 2009, growing to $1.5 billion in fiscal 2010.

Occupying 4.7 million square feet of real estate, these facilities have over the past few years pumped plenty of money into the construction industry. The value of the building projects at the labs studied by CU topped $84 million in fiscal 2009 and $201 million in fiscal 2010.

Nearly three-quarters of the labs' employees resided in Larimer, Boulder and Jefferson counties. The same percentage lived in their own homes, contributing significantly to property taxes. Values of their homes averaged $351,000 in Boulder County, $258,000 in Jefferson County and $243,000 in Larimer County.

The CU analysis notes that federal laboratories have long been productive members of Colorado's economy due to stable jobs and federal dollars. But the labs mean much more: high-tech firms tend to locate near these facilities, partnerships are formed with universities on research projects, and lots of technology-transfer activity takes place.

Labs such as the Centers for Disease Control and Prevention in Fort Collins focus on nothing less than saving lives.

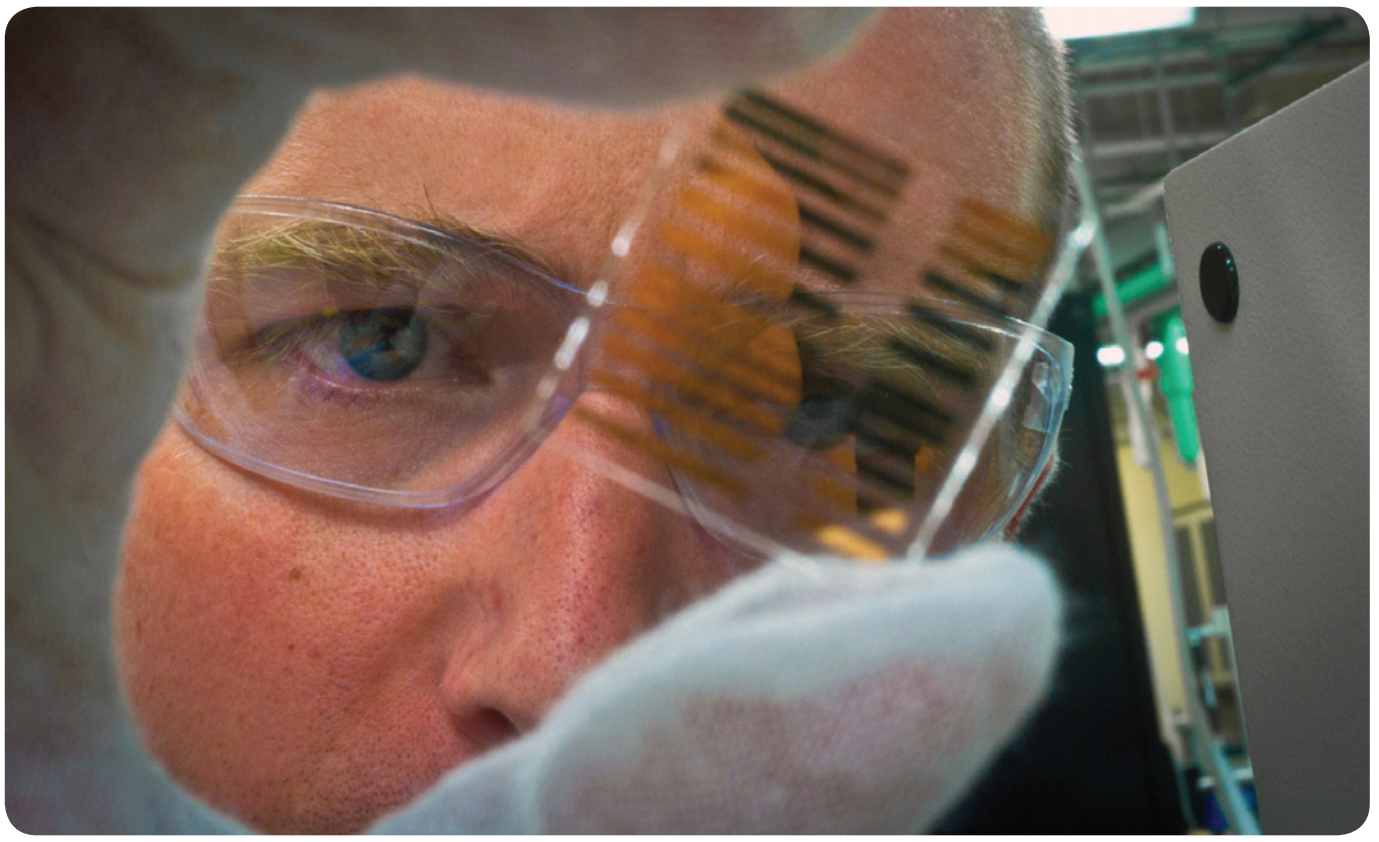
The lab's Division of Vector-Borne Diseases tracks diseases such as the West Nile virus and Lyme disease, and more recently the Heartland virus it discovered in Missouri, and has studied their effects. It also works closely with companies to develop important vaccines and disease prevention measures.

"We have a number of things that we've done recently that we're very proud of," said Dr. Lyle Petersen, the lab's director.

The lab is collaborating with Inviragen in Fort Collins to develop a vaccine for Dengue fever, a virus spread by mosquitoes that occurs in Puerto Rico and the U.S. Virgin Islands.

"There are more than 100 million cases of Dengue per year, so this is a very big deal," he said.

It also is working with Fort Collins' InVitria to create vaccinations for animals to prevent rabies and Lyme disease from spreading to



COURTESY OF DENNIS SCHROEDER/NREL

NREL Senior Scientist Robert Tenent works for the Chemical and Material Sciences Center, specializing in electrochemistry research. Here, he's working on a small sample of thin file lithium ion conductors in the molecular layer deposition lab.

Want to know more?

A study on the economic impact of the labs, conducted by the Business Research Division of UC Boulder's Leeds School of Business, can be found at http://www.co-labs.org/economic_impact.html

humans. Additionally, the lab has developed a test that quickly diagnoses plague, which must be treated early.

At the National Renewable Energy Laboratory in Golden, scientists aim to lower the cost of renewable energy while increasing its efficiency. Only Germany and Japan have facilities that do research at such a high level.

"We do what we can in order to try and move technology from the laboratory into the marketplace," NREL spokesman George Douglas said. "We have very robust programs working with hundreds of companies to move technology into the energy market."

The lab has recently been able to achieve a world-record 43.5-percent conversion efficiency rate in solar cells. The technology remains expensive, but solar companies are at least using it to increase the efficiency of their solar technology.

Scientists also have found a way to make ethanol out of corn stock and leaves rather than using corn kernels. The ethanol costs a similar amount to make, and it allows producers to avoid drawing corn from the food supply.

The lab also has developed an air-conditioning unit that consumes a fraction of the electricity used by conventional units and releases less carbon dioxide. Air-conditioning currently consumes about 15 percent of the electricity generated in the United States. It contributes to peak electrical demand on hot summer days and can lead to higher power costs, rolling blackouts and brownouts.

For its part, a Bureau of Reclamation lab in Denver has helped discover how to detect the early presence of invasive mussels in the nation's lakes.

"We have definitely given a lot of people an edge and an understanding," said Denise Hosler, manager of the mussel detection lab in Denver.

After zebra mussels were found in Lake Mead in 2007, a team of scientists went to work to address the costly problem. The mussels can attach themselves to pipes, limiting water flows in hydropower and water delivery systems, and to boats. They also litter beaches with shells and suck nutrients out of water, which can make fish unhealthy.

Where they live

The people who work in Colorado's federal labs predominately live in four counties:

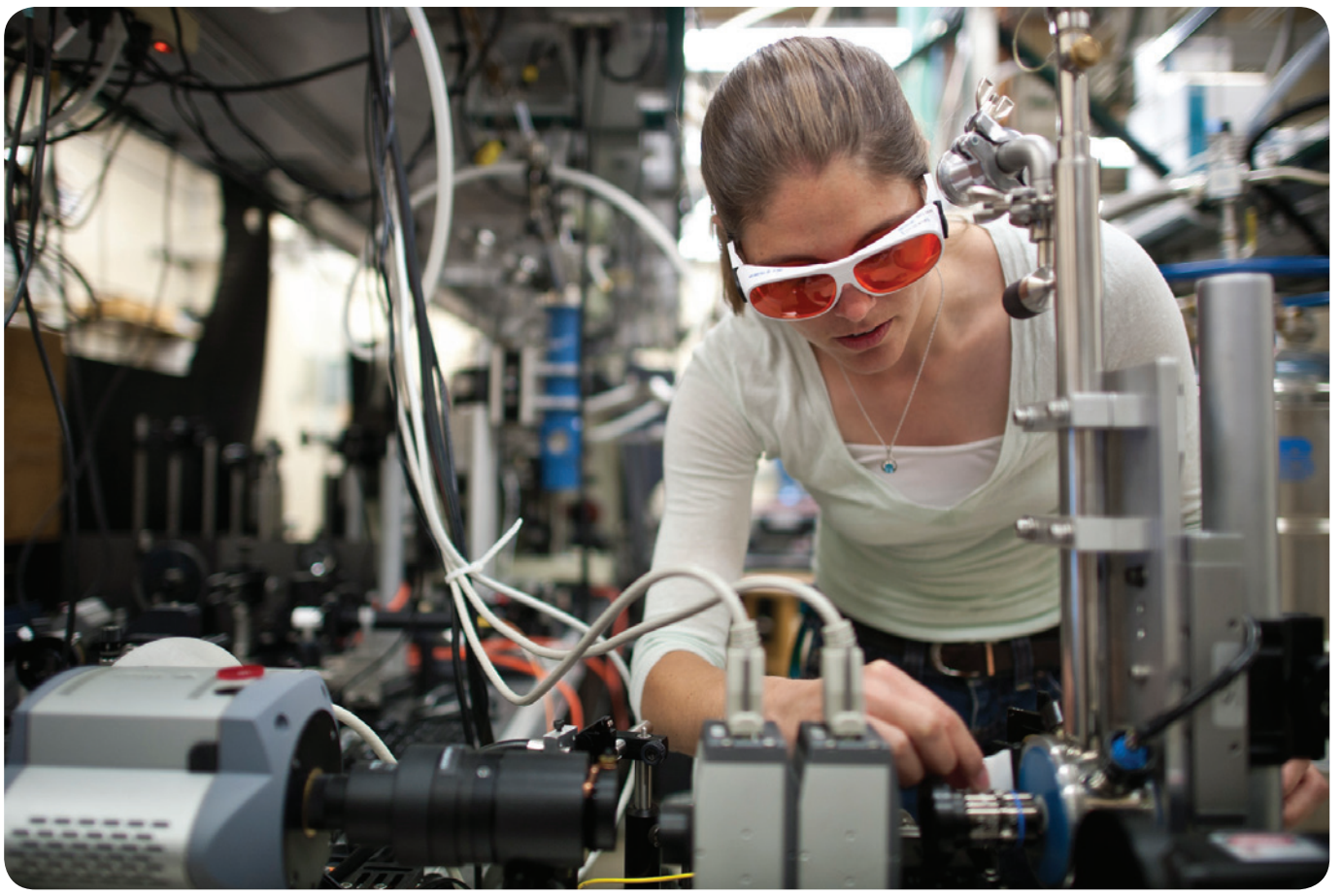
Boulder: 2,880
Jefferson: 2,171
Larimer: 803
Denver MSA: 3,620
Colorado total: 7,725

In the Great Lakes area alone, the zebra mussel cost the power industry $3.1 billion between 1993 and 1999, according to the Bureau of Reclamation. The mussels' total economic impact reached more than $5 billion.

Responding to the challenge, Bureau of Reclamation scientists took water samples and then tested them for the presences of microscopic mussel larva using a variety of high-tech methods, including DNA testing. The early-detection method has allowed water managers to take steps to reduce the spread of mussels, including lowering water levels, which reduces the amount of oxygen in water that allows mussels to proliferate.

COURTESY OF SCOTT BAUER/USDA

Staff at the USDA's National Seed Storage Laboratory in Fort Collins preserve more than 1 million samples of plant germplasm. Here, technician Jim Bruce retrieves a seed sample from the sub-zero storage vault for testing.



COURTESY OF DENNIS SCHROEDER/NREL

National Renewable Energy Laborator researcher Kirsten Alberi works in NREL's luminescence mapping laboratory at the Solar Energy Research Facility.

Many of the labs saw a jolt in funding under the American Recovery and Reinvestment Act. Funding from the stimulus for lab construction and operations totaled more than $112 million in fiscal 2009 and 2010.

Having spent what remains of their stimulus funding, lab directors today fear the consequences of sequestration, or large cuts to federal programs that could take effect in January.

The labs could see an across-the-board reduction of 8 percent if lawmakers let the cuts occur.

"That just puts more uncertainty into the equation," said Bill Farland, director of CO-LABS, a consortium of Colorado's federally funded labs formed in 2007.

"My real hope is that we will get a more reasonable and bipartisan balanced budget approach to deal with the budget issues and get away from this idea of huge, across-the-board cuts."

That's a hope shared by many, both in and outside of the lab.

PeptiVir

Its vaccine research could help protect us from a wide range of illnesses

BY IVY HUGHES

A biotech company based at the Anschutz Medical Campus in Aurora is working on a vaccine platform that could have major implications for a wide range of patients.

PeptiVir's four researchers are working on creating "cross-protective" antibodies that could potentially protect people against the influenza virus, respiratory syncytial virus (RSV), parainfluenza, HIV, Ebola and coronaviruses such as SARS.

Each of these viruses shares a common feature. They have a surface protein that binds the cells to the host and an infusion protein that infects the host. The problem is that the binding proteins undergo a lot of mutations, making it difficult to develop a universal vaccine against these viruses.

"With normal seasonal flu vaccinations, you get an immunization before the season with the version of that protein we think will infect you that year," said PeptiVir Chairman Richard Duke. "But these proteins mutate a lot."

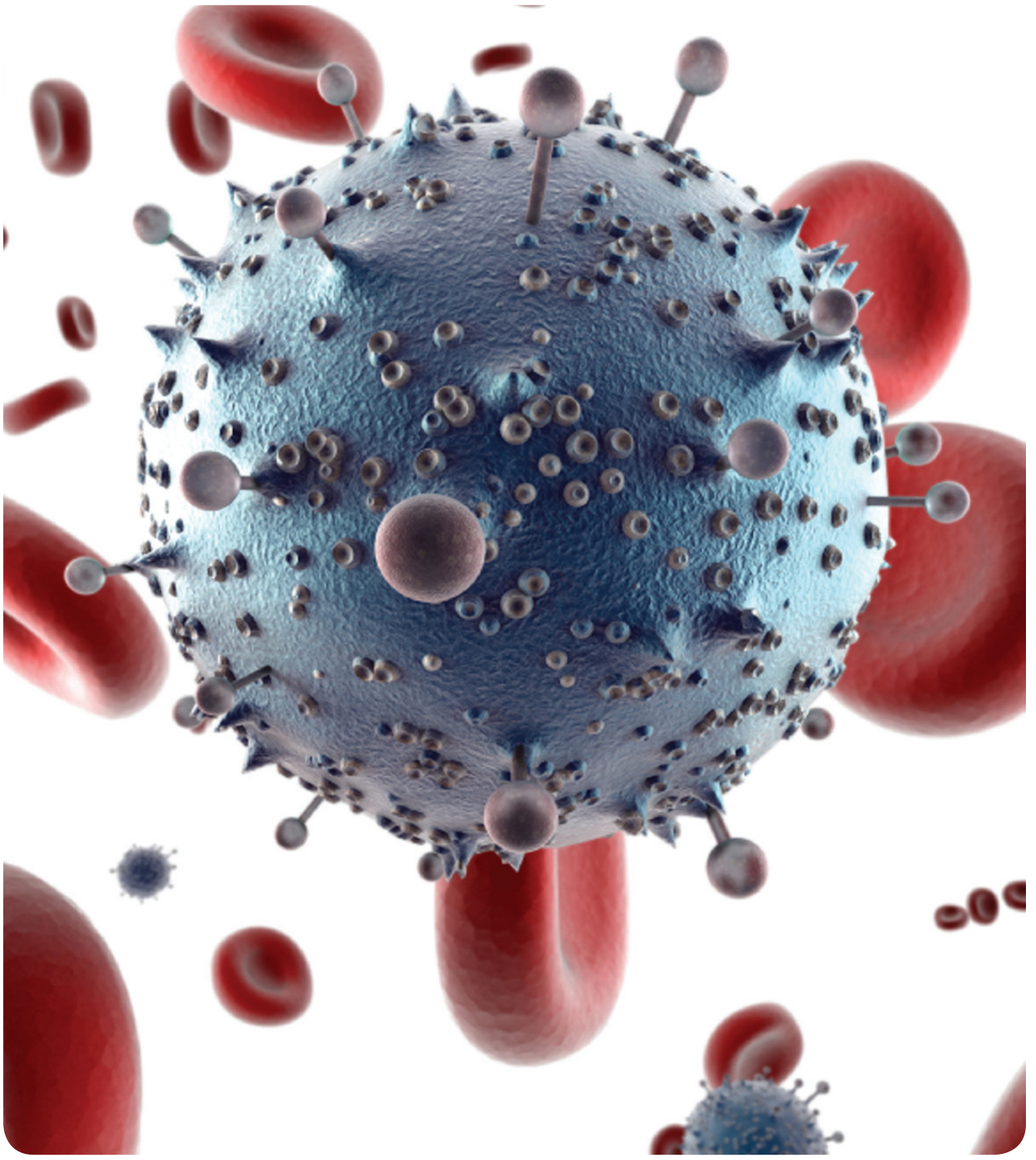
While getting a new flu shot every year is annoying, these mutating proteins can cause a lot more problems. Because they can interact with animal versions of a virus — think avian or swine flu — they can lead to pandemics.

Those who are exposed to and survive pandemics tend to have antibodies that protect against cross-infection. The PeptiVir technology allows researchers to create a synthetic version of these antibodies, which would allow for protection against multiple strains.

The PeptiVir platform could lead to long-term vaccinations for certain viruses we currently cannot protect against.

With cancer patients, this technology could help antibodies in isolated proteins that are often overwhelmed by complex protein structures, increasing the effectiveness of the antibody.

PeptiVir launched in 2010 with a $300,000 loan from the Colorado Institute for Drug, Device and Diagnostic Development, an organization that helps turn research into product development.



At any one time, the CID4 looks at 20 to 30 ideas, evaluating the economic viability of bringing the idea to market. Duke happens to be the CEO of CID4.

"In the case of PeptiVir, they were heads above the crowd in terms of therapeutics," Duke said. "They also fit into our model of investing in providing active management where our money could lead to something."

The platform technology was developed by University of Colorado Biochemistry Professor Robert S. Hodges.

Outside funding is critical in an industry where products can take years to develop without any ROI. In fact, even if PeptiVir had enough funding today to start clinical trials, which would test on animals, it couldn't actively start the trials for another year.

CID4 has helped PeptiVir raise an additional $450,000 in grant funding since the company was founded.

The idea is that PeptiVir will not make the actual vaccination. Instead, it will partner with a larger company that will then complete additional trials and, if applicable, use the technology to develop an actual vaccine.

Storefront or Classroom?

At CSU, it's both. Professor Kelly D. Martin leads her students to real-world experience by lending their knowledge to local businesses. The collaborative marketing plans they create prepare students and business owners for future success.

Colorado State University

Precision Photonics

Making optical components sharper for telecom, aerospace and more

BY JOSH MITCHELL

COURTESY OF PRECISION PHOTONICS

The company's focus widend after the telecom boom ended.

For Precision Photonics Corp., it's all about focus.

The focus comes from the precision optical components, coatings and assemblies manufactured in its Boulder facility.

The focus also comes from a staff with a diverse background in spectroscopy and metrology, working in the tradition of the company's founders: scientists from JILA, formerly known as the Joint Institute for Laboratory Astrophysics, which is operated by the University of Colorado and the National Institute of Standards and Technology.

Chris Myatt, who founded Precision Photonics in 2000 with his wife, Sally Hatcher, was taught by a pair of Nobel laureates. He earned his Ph.D. at CU under the tutelage of Carl Wieman, who won the Nobel physics prize in 1995, did his postdoctoral work on quantum computing at NIST with Dave Wineland, who won the National Medal of Science in 2007 and shared the Nobel physics prize this year.

Myatt also guided the 2009 incubation of mBio Diagnostics, a Boulder-based subsidiary of Precision that develops low-cost medical devices, and is now chief executive of that company. mBio works to deliver a proprietary fluorescence-based technology that allows rapid diagnosis from a single drop of a patient's blood, plasma or serum for low-cost HIV and hepatitis testing.

Precision Photonics originally targeted the optical telecommunications sector while it was booming. When the telecom bubble burst, Precision's focus widened.

One of Precision's early hires was engineer Nick Traggis, who joined the team in 2001 and worked his way up through the ranks to become vice president for new-product development. "The reward," he said, "is that I get to work with the caliber of people I do — the smartest people, and I mean our customers as well as my co-workers."

Traggis said the instruments developed and manufactured by Precision's staff of 35 are developed for the telecommunications, aerospace, defense, biomedical and semiconductor industries.

Traggis also serves as vice president for product development at Chicago-based IDEX, an industrial holding company that acquired Precision Photonics for $20 million in April. IDEX also acquired Boulder-based Advanced Thin Films, and the two acquisitions will operate in the same Boulder space.

"Both brands will still exist depending on the product line," Traggis said. "This move was more driven by legal and financial considerations than anything else."

The collaboration with CU continues for Precision Photonics, Traggis said. "We continue to hire from their research groups," he said. "Two of our best salespeople are out of the laser-research program at CU."

Those salespeople target Precision Photonics' products and technology to the industrial, defense, telecommunications and research markets, Traggis said.

"We've learned from CU how to build better metrology tools, how to measure our optics better," he said. "With their research we can hit tighter specifications."

Traggis said Precision's goals include "coming up with higher-power laser operations — especially welding and cutting lasers — first for defense and then trickling down to industrial uses."

COURTESY OF PRECISION PHOTONICS

A variety of ion-beam sputtered coated optical products manufactured by Precision Photonics.

GOOD ADVICE FOR FISHING (AND ADVERTISING)

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BRINGING **YOUR MESSAGE** CLOSER TO **YOUR MARKET**

Bright Agrotech

Its hydroponic tower is saving growers money, yielding 'live' produce

COURTESY OF UW

Nathan Storey of Bright Agrotech, with some of his patented vertical hydroponic towers in the UW greenhouse. The company now has its own greenhouse in Laramie.

BY JOSH MITCHELL

Saving farmers money by maximizing greenhouse space is just one of the benefits of a patented technology developed by a University of Wyoming spinoff.

Bright Agrotech has secured a patent on a vertical hydroponic tower that could one day be in grocery stores across the United States. Nate Storey, who runs the company with his partner, Paul Bennick, developed the technology while working on his doctorate in agronomy at UW.

His towers, which his company also manufactures, allow fruits and vegetables to be grown vertically. This allows a lot more to be grown in a lot less space, saving money when it comes to heating a greenhouse in the winter, he said.

His method also allows the produce to be taken to market live, which saves money when it comes to harvesting and labor, Storey said, adding, "We eliminate 60 percent of the costs in the producer's budget."

The towers, which are about 5 feet tall, can be taken into the grocery store and plugged into an irrigating display that he has also patented.

"The consumer cuts their own greens and herbs live at market," Storey said.

Moreover, the towers can result in a fresher and healthier product, he said. For instance, when a head of lettuce is harvested it begins losing a chemical than makes it healthy, he said. Since his method allows the customers to harvest the product right at the store, they take home a healthier vegetable, he said.

"It's much fresher; it tastes better," Storey said, adding that it is also a fun experience for the customers to clip their own vegetables.

The idea that the customer cuts their own produce at the grocery store can also cut down on contamination that could occur during shipping and handling, Storey said. The store also cuts down on waste since the produce is alive, meaning no refrigerator is needed to keep the vegetables cool.

"There's no spoilage at the store," he said. "Everyone makes more money and gets a better-valued product."

A prototype display is being used at a Laramie health food store, and Storey hopes to one day see it in supermarkets across the United States.

"We see this technology as essentially supporting local farmers who want to grow greens and vegetables and herbs in their community," he said.

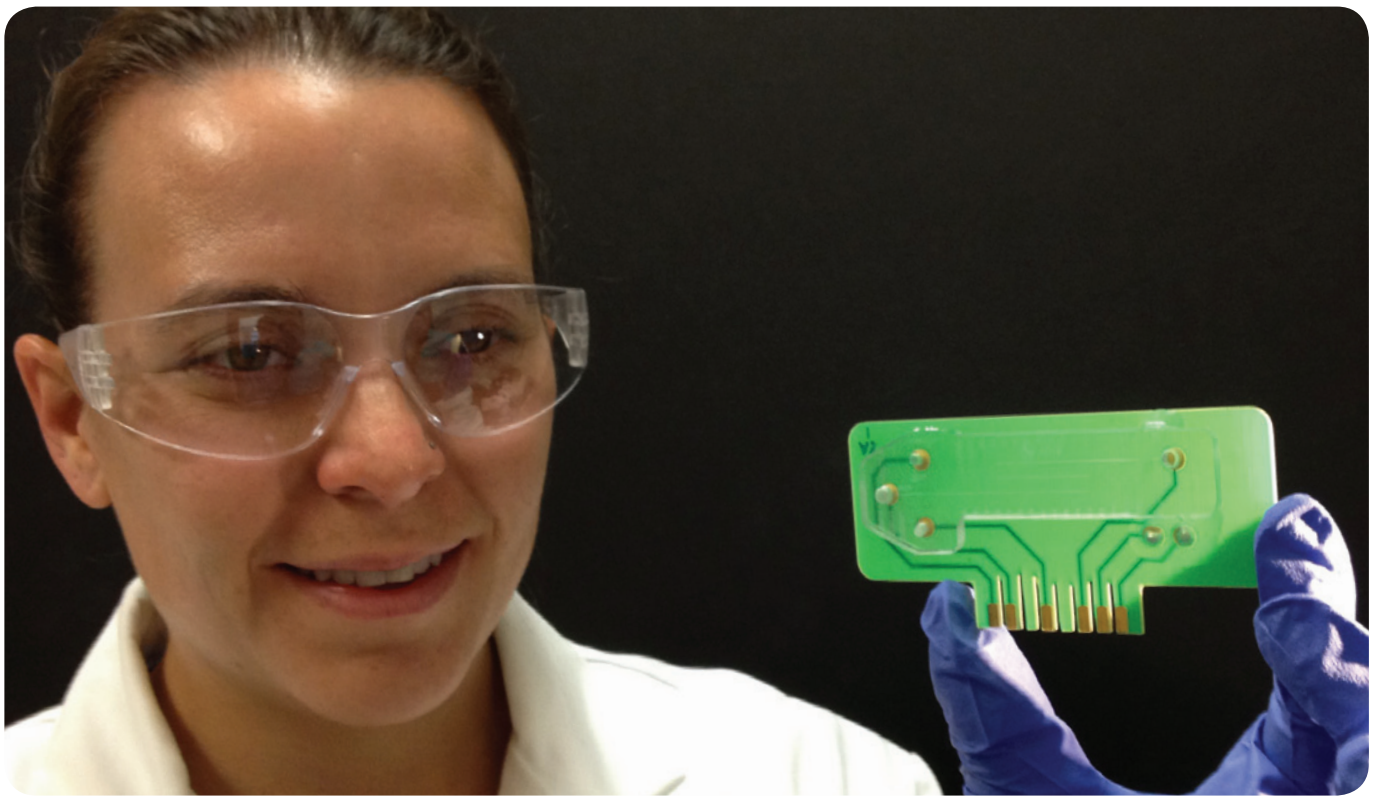
Christine Langley, chief operating officer of the Wyoming Technology Business Center, said the company has a bright future. "They are a young company with a tremendous amount of potential," she said. "We expect them to be a very large business in the next three to five years."

Bright Agrotech has office space in the Wyoming Technology Business Center incubator on the UW campus.

Carbo Analytics

Its lab-on-a-chip technology promises to transform multiple industries

BY IVY HUGHES



COURTESY OF CARBO ANALYTICS

Carbo Analytics system engineer Dawn Rohrbacker.

Technology developed by Fort Collins-based Carbo Analytics could save the beer, pharmaceutical, biofuel and soft-drink industries thousands of dollars in production costs.

Carbo Analytics utilizes lab-on-chip technology to separate and analyze sugars used during fermentation processes such as brewing beer. During production, a sample is taken and in about 15 minutes, the producer knows what's happening with the sugars.

"This is a benefit because they can't otherwise follow sugars during the production," said Carbo Analytics President and founder Dale Willard. "They can follow it after the fact through a lab, but then you essentially learn you've created a defective product after you've created a defective product. You've wasted product, labor and had production delays."

For brewers, this technology means fewer batches of bad beer. For pharmaceutical companies, this means fewer bad pills. The pharmaceutical industry uses sugars in tablets as stabilizers. As with beer production, what happens to the sugars during production was a mystery until after a batch had been ruined. Now, manufacturers can follow the sugars during production.

This technology allows soda manufacturers to track sugars during production so they can ensure the product's sugar content matches nutrition labels.

For biofuels, which also rely on fermentation for production, the implications of tracing and understanding sugars during production means better, purer biofuels.

"Sometimes we like to say we put the hardhat on the analysis and allow it to be done on a product line so they (manufacturers) can follow sugars as production occurs," Willard said.

> "I'm the guy that starts with an idea."
>
> – Dale Willard, CEO

The technology has the potential to vastly reduce waste and improve quality for a variety of industries, which is why Carbo Analytics recently won the Outstanding Venture 2012 award at the U.S. Department of Energy's National Renewable Energy Laboratory's 25th Industry Growth Forum.

"It was great to get out there and get some validation from the people you're hoping to impress with the brand you're trying to build," Willard said. "Nationally, it's the premier forum for companies in the space."

The award caught the attention of venture capitalists and angel investors, relationships that could prove useful for Carbo Analytics.

Right now, Carbo Analytics designs instrumentation to specifically fit a company's needs. By 2014, it plans to roll out two mass-produced analytics devices. A benchtop unit and online unit will gather samples from a production line, send it to a data management system and give the customer analysis in about 15 minutes.

This is expected to generate revenues in the $5 million to $10 million range.

Willard also hopes to grow his team of seven part-time employees to 12, a sizeable expansion for what started as a one-man show when Carbo Analytics was founded in January 2011.

Carbo Analytics is the second lab-on-chip company founded by Willard. In 2003, he founded Advanced MicroLabs, which uses lab-on-chip technology to analyze water for the power industry. Willard eventually left Advanced MicroLabs to found Carbo Analytics.

With the help of five Colorado State University MBA students, Willard wrote a business plan for Carbo Analytics and secured $460,000 from the U.S. Department of Agriculture and $250,000 from the Colorado Office of Economic Development and International Trade. Not only did he have CSU's help on the business plan, the whole concept behind Carbo Analytics was developed from intellectual property that came out of CSU's chemistry department.

"I'm the guy that starts with an idea and builds the early-stage company out of it," Willard said. "Hopefully it gets to a point where it can be built into a full revenue-generating enterprise by me or someone else."

FracOptimal

Its hydraulic fracturing technology promises greater efficiency, less waste

BY DALLAS HELTZELL

The process of hydraulic fracturing — or "fracking" — to free up pockets of oil and gas has become politically contentious. However, thanks to work done by FracOptimal LLC, a company spun off from research at Colorado School of Mines, it at least might become more productive, efficient and economical — and have less potential environmental impact as well.

Flaska

Fleckenstein

The process involves drilling — but for Will Fleckenstein, an adjunct professor of petroleum engineering at Mines, it's far from boring.

"We're right in the middle of this nexus of unconventional oil and gas recovery," Fleckenstein said. "This could be bigger than Facebook, and the number of people who really understand it is very, very small."

Louisville-based FracOptimal was born out of collaboration between Fleckenstein and entrepreneurs at the Boulder Innovation Center, now Innovation Center of the Rockies. Fleckenstein wanted to license, patent and market the new "fracking" technology — the first time Mines' petroleum-engineering department had developed a process to be patented — and the center helped him start the private company.

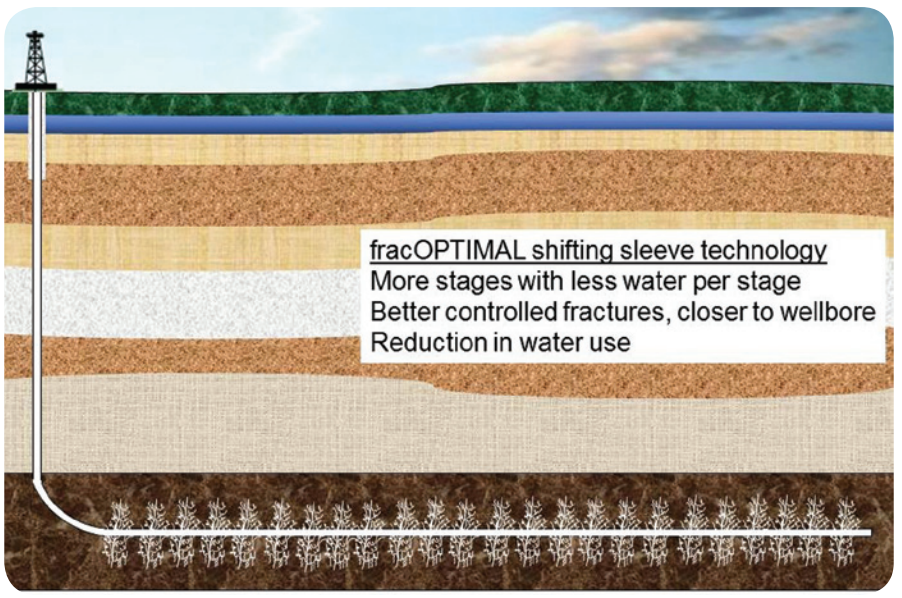
At the center he met Todd Flaska, who had a master's degree in marketing from UCLA, had been a senior business development manager at Sun Microsystems, and had managed strategic alliances for Louisville-based Storage Technology Inc.

The team formed FracOptimal, and Flaska, who became chief executive in February 2010, developed the business plan, applied for the patent and sold the technology and development option to a worldwide oil-and-gas services company.

Drilling for oil or gas is time-consuming, complicated and expensive. About two-thirds of new U.S. wells involve horizontal bores and extract only about 10 percent of the hydrocarbon that could be available along that bore, Fleckenstein said. The process involves boring a single vertical well down to the hydrocarbon-bearing rock — sometimes nearly three miles below the Earth's surface. The bore then continues horizontally for up to two miles. The rock surrounding the horizontal bore is sealed off in sections called "stages," and fluid — containing water, sand and chemicals — is pumped into the rock at intense pressure to fracture it and release the pockets of oil or gas. The petroleum is supposed to enter the well casing and then be pumped to the surface.

The problem is that to keep that water pressure high enough to create a large network of fractures, the stages must be kept short, and the number that can be placed along the horizontal bore is limited.

The technology developed at Mines, Flaska said, can use an unlimited number of stages and can fracture them with equal pressure



COURTESY OF FRACOPTIMAL LLC

Hydraulic fracturing to free deposits of oil or gas is done in "stages" along a horizontal bore. FracOptimal's technology allows for an unlimited number of stages and equally high pressure of the fracking-fluid delivery.

> "We now have a great mechanism to develop a commercialization process."
>
> – Todd Flaska, chief executive FracOptimal

— and the balls it uses to separate the stages can be sensed from the surface.

If the technology results in even a little more productivity, Fleckenstein said, it's worth it. "If you're able to increase the productivity of one of these wells by 20 to 50 percent, it has tremendous monetary value."

Not only that, added Flaska, but it can save water as well.

"It's never been used in a real well yet," he said, "but we believe we can do it with 20 percent water reduction — but that's a real guess."

Selling the technology is far from the bottom of the creative well for FracOptimal, Fleckenstein said.

"We now have a great mechanism to develop a commercialization process" for this type of technology, he said.

One option is to partner with service companies that pump fracking fluids, Fleckenstein said. "They can take our technology and combine it with other technologies in their product line," he said. "That would make all their services more

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UC Anschutz

Myron Levin

BY MAGGIE SHAFER

Dr. Myron Levin first began studying infectious disease to avoid going to war.

The University of Colorado professor of pediatrics and medicine graduated from Harvard Medical School in 1964, at the height of the Vietnam War. Levin knew that, like so many others, if he didn't find his way into the public health service, he'd be drafted.

Nothing like war to make cancer look appealing.

During his time at the National Cancer Institute, he had over 60 patients die battling leukemia. But it wasn't the leukemia that killed them – it was other infectious viruses like chicken pox, taking advantage of a child's weakened state.

"When I started at the cancer institute I thought I'd get into cancer, but instead I got into infectious disease," he said. "And it's a fascinating field to be in."

Levin completed residency training in medicine at Albert Einstein College of Medicine in 1966, and infectious diseases fellowship training at Harvard Medical School in 1971. He worked for Harvard Medical School for more than 10 years, before coming to CU in 1982.

His work at the university's School of Medicine on the Anschutz Medical Campus has led to the creation of Zostavax, a vaccine for shingles.

Shingles — a form of herpes — is caused by the same virus as chicken pox, which remains dormant in nerve cells even after the individual fully recovers. It can become active again as people age and their immune systems deteriorate. If left untreated, it can be deadly, especially for the elderly.

Zostavax, made by Merck & Co. Inc., is a live, weak version of the same virus. When injected, it causes the immune system to ramp up its defenses to the virus before the disease has a chance to take over.

"The reason people get shingles is that they lose their immunity to a virus that already lies in them," Levin said. "As we get older, our immune system that keeps it from coming out starts to wane."

Zostavax can reduce an adult's risk of shingles by 50 percent, and in the cases it doesn't prevent, it greatly attenuates.

While Levin started work on the drug in 1984, it was 2005 before it was finally licensed. Securing enough funding for research and testing took 15 years.

"Finding timely funding is a huge obstacle," he said. "Many people have good ideas, and a lot just don't make it."

Today, about 20 percent of adults over 50 have received the vaccine. Levin attributes the lag time between the release and widespread use to the lack of marketing Merck originally did for it, due to a paucity of the vaccine. But now that supply is up, so is marketing.

"It's really starting to catch on now," he said.

Levin has continued to work on the vaccine, searching for a greater understanding of the virus, including how it maintains itself in the nerves and what causes it to come out of dormancy. He sees Zostavax, the first shingles vaccine attempt, as only the beginning of the process.

"The vaccine has given us principles that we can build on to build better vaccines," he said.

Levin believes that both public and private investment in research is not only key to continued innovation, but an effective way to produce economic growth.

"Just as we put money into tourism, we should be putting money in to research," he said.

"We have to make sure they (investors and legislators) understand the incredible capabilities of the med school campus."

Colorado School of Mines

Terri Hogue

BY MJ CLARK

Water is a big issue throughout the West, but Colorado School of Mines professor Terri Hogue had to go east to find a school that took water as seriously as she does. She moved from California to Colorado in July.

"One of the things that attracted me to CSM was the focus and forward-thinking (approach) about water here," she said. "They have a cross-department, cross-campus hydrologic sciences and engineering program. Water has become a big part of the mission here."

The Colorado School of Mines, along with Stanford University, the University of California at Berkeley and New Mexico State University together established the Engineering Research Center for Re-inventing the Nation's Urban Water Infrastructure. The four universities are sharing in a four-year, $18.5 million grant from the National Science Foundation to address the looming water crisis.

Hogue, an associate professor at CSM's Civil and Environmental Department, is heading up the NSF's Water Sustainability and Climate program to investigate urban ecosystems and water management that, ironically, will study water systems in her former hometown, Los Angeles.

Hogue and her fellow researchers will be asking some fundamental questions including, "What is the water being used for?" and "What services does that water use provide?"

For example, she said, "the cost of getting water to where it needs to be in L.A. is high — it's one of the biggest energy consumers in the state. Is there any energy payback to the water use — like trees providing a cooling effect that lowers energy consumption?"

Closer to her new home, Hogue is also studying the impact of fire on hydrologic cycles, or the circulation and conservation of water.

"When fires happen, the soil surface is altered and water is prevented from getting into the soil," she explained. "Ash clogs the pores and a waxy, hydrophobic layer forms. This takes awhile to break down and can reduce the amount of water reaching the groundwater system."

The Waldo Canyon area in Colorado Springs — site of a devastating wildfire this summer — is her new laboratory, where multiple methods are being employed to treat the burned areas, depending on conditions such as burn severity, degree of slope, type of vegetation, and so forth.

As a result, "there are lots of little labs out there," Hogue said. "We want to see if we can tweak out at all if the treatments (generally, different types of mulch) had any impact."

In Southern California, she notes, "They typically don't treat after fires. It's expensive to lay down straw or wood mulch over large regions."

The Waldo Canyon Fire is also interesting to her because of the high number of homes built close to wild areas and the potential for flooding and runoff.

In California's Northern Sierra, Hogue also works on fuel treatments — thinning the forests to prevent catastrophic fires — and is studying whether fewer trees using water lead to extra water on the surface or in the ground.

As a newcomer to CSM, Hogue is still looking for graduate students to work on new research projects. Although she brought a few students with her from California, "I'm always looking for good students," she said.

Recently, Hogue received news of her latest laurel: she was elected secretary for the hydrology section of the American Geophysical Union, the largest association of earth and space scientists in the world.

University of Colorado

Bruno Giacomazzo

BY MJ CLARK

If a picture is worth a thousand words, a video is worth many more and is perhaps the best way to explain the complex work being done by the University of Colorado's Bruno Giacomazzo.

His most recent achievement is the subject of a video posted by NASA's Goddard Space Flight Center in September after Giacomazzo led a team of astrophysicists that used computational models to explore the mergers of supersized black holes.

Set to appropriate space music, the supercomputer simulation illustrates what happens when black holes — each one millions of times more massive than our own sun — merge. The binary black holes orbit each other, rotating faster as they draw closer together.

Because these objects are so massive, they produce gravitational waves that undulate too slowly to be detected by ground-based facilities. At present, the only way to see what happens is to rely on the computer simulation.

According to NASA's description, "Close to these titanic, rapidly moving masses, space and time become repeatedly flexed and warped. Just as a disturbance forms ripples on the surface of a pond, drives seismic waves through Earth, or puts the jiggle in a bowl of Jell-O, the cyclic flexing of space-time near binary black holes produces waves of distortion that race across the universe."

Gravitational waves do not provide one crucial piece of information: the precise position of the source. To really understand the event, researchers need an accompanying electromagnetic signal — a flash of radiation (from radio waves to X-rays) that will allow them to pinpoint the merger's host galaxy.

Understanding the electromagnetic counterparts of a merger requires tracking the interactions between the black holes, which can move at more than half the speed of light in the last few orbits, along with the hot plasma (magnetized gas) that surrounds them.

Giacomazzo and his team developed the super-computer simulations that for the first time show what happens in the plasma during the last stages of a black hole merger. The simulations were run on the Pleiades supercomputer at NASA's Ames Research Center in California, with additional simulations run on the Ranger supercomputer at the University of Texas and the NASA Center for Climate Simulation at Goddard.

"What's striking in the magnetic simulation is that the disk's initial magnetic field is rapidly intensified by about 100 times, and the merged black hole is surrounded by a hotter, denser, thinner accretion disk than in the un-magnetized case," Giacomazzo explained.

The most interesting outcome of the magnetic simulation is the development of a funnel-like structure — a cleared-out zone that extends up out of the accretion disk near the merged black hole.

"This is exactly the type of structure needed to drive the particle jets we see from the centers of black-hole-powered active galaxies," Giacomazzo said.

Other projects Giacomazzo is working on include the development of the fully general relativistic magnetohydrodynamic code "Whiskey," that is used to study several astrophysical phenomena including gamma-ray bursts, binary neutron stars, black hole binaries, and the accretion-induced collapse of neutron stars to form black holes.

University of Northern Colorado

Susan Keenan

BY MJ CLARK

University of Northern Colorado researcher Susan Keenan is out to swat mosquito-born viruses like malaria, dengue, yellow fever and West Nile virus – a family of viruses known as flaviviruses.

These viruses take a devastating toll on the Third World, as there are currently no clinically useful antiviral drugs available. And, as the rest of the world learned with the introduction of West Nile to the United States in 1999, disease doesn't care where you live. West Nile is now endemic in 47 of the lower 48 United States.

Keenan's area of expertise is what's called "rational" drug design, and she's working to find drugs that can prevent and/or treat these scourges. Since 2007, her partner in the lab has been Dr. Brian Geiss at Colorado State University.

Keenan and Geiss have developed a drug that binds to the protein critical for viral replication. By blocking the protein's function, the virus can't make the proteins it needs to replicate and the virus' genome will lose protection and can be destroyed by the healthy cell it was trying to invade.

Keenan, who has a diverse educational background including a degree in chemistry, a Ph.D. in pharmacology and physiology, and postdoctoral work in computational chemistry, has trained in both computational aspects and in the lab using molecular biology tools. Although she's worked in cancer and pain research, she says "work on relatively neglected diseases is really my passion."

For the past decade Keenan has researched drug design for West Nile, malaria, yellow fever or dengue fever. Any of these flaviviruses can result in hospitalization or death.

The keystone of Keenan's research is finding small molecules that inhibit the function of a protein or enzyme essential for the survival of the flavivirus.

First, the duo screened large chemical libraries for molecules that inhibited a specific enzyme, and then used computer modeling to find molecules that were best able to bind to the viral protein. One of the molecules they discovered reduced virus replication in cells by a factor of 1,000.

Now that the researchers have confirmed that the drug works against several different viruses, they are working to improve the drug's effectiveness and testing how well the drug works in animal models. There is a lot more work to be done before their drug is ready to be used as an investigational new drug on humans.

"I would love for us to be at the point where we have an investigational new drug in the early phases of clinical trials for the treatment of diseases caused by flaviviruses," Keenan said. " We have a long way to go, but I am excited that we are making inroads toward that goal."

University of Wyoming

Keith Carron

BY MJ CLARK

In the original "Star Trek" series, one of the most interesting devices was the tricorder: a little box that Spock would wave in the general direction of an object and which then would report on the exact chemical composition of that object. It was very handy when dealing with hostile alien environments.

Today, military personnel facing rooms that may be booby-trapped with explosives are able to do much the same with devices that are manufactured in Laramie, Wyo.

The devices are called Raman spectrometers, which illuminate material with lasers and then identify the material and its potential hazards from a safe distance.

These spectrometers are manufactured by DeltaNu, a company founded in 1998 by a pair of University of Wyoming professors: serial inventor Keith Carron and Robert Corcoran, along with Gene Watson, a longtime tech entrepreneur.

DeltaNu was sold to Silicon Valley tech firm Intevac Inc. in 2007 with the stipulation that the company remain in Laramie.

Carron, who left academics to head DeltaNu and first served as its general manager, then vice president at Intevac, realized after two years that, "I still like research, and I didn't really like doing spreadsheets and managing a business like that."

UW asked him to come back to academia and head the chemistry department. "So, in a way, I'm back into management," he said, "but I'm also back into research, so I'm very happy."

Carron's current research is along the same lines as the technology that developed into DeltaNu. "This is what entrepreneurs do," he said. "We're always innovating, thinking about how to make money."

Carron and his two graduate students have just published three papers that have been well-received. The trio has developed a new class of materials for surface-enhanced Raman spectroscopy consisting of hollow, buoyant silica microspheres coated with gold nanoparticles. The new materials allow for a novel type of molecular assay dubbed "lab-on-a-bubble" or LoB.

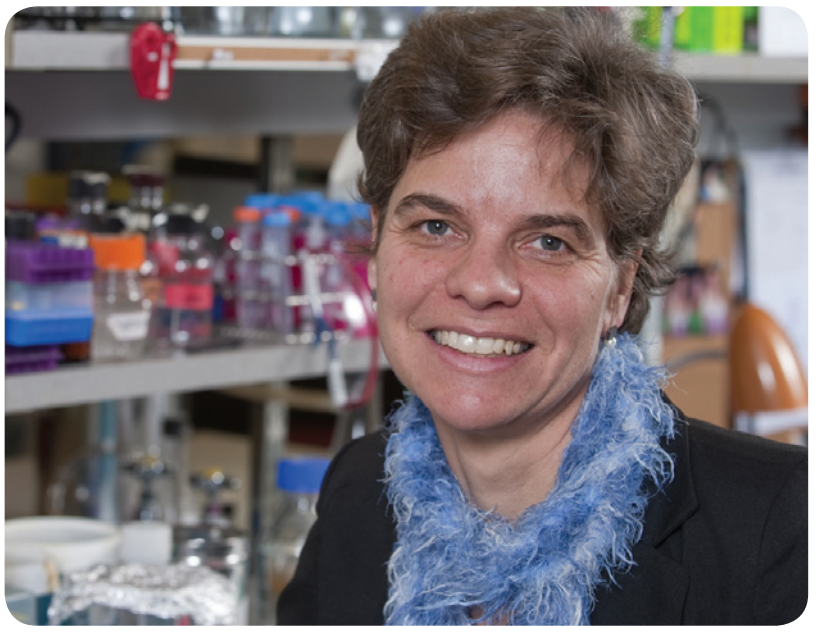
Carron explained that the LoB are "little microscopic bubbles that pull the assay to the top of the solution. When the assay results are pulled to one spot, it makes the test more sensitive."

For example, the team has tested detection of cyanide — a useful model for environmental studies — and found that they obtained a surface-enhanced Raman scattering signal 28 times larger using the LoB system than with the more conventional approach of using colloidal gold nanoparticles that didn't float.

Not even on "StarTrek" did they imagine tricorders in the guise of tiny, gold-dusted micro-bubbles.

Colorado State University

Karolin Luger



BY MJ CLARK

Unraveling the mysteries contained in the proteins that organize and bind DNA into packages small enough to fit comfortably into cell nuclei has won Colorado State University's Karolin Luger multiple awards and honors — and may even hold the secret to a cure for some cancers.

Since joining the faculty of CSU in 1999, Luger has become a University Distinguished Professor in Biochemistry, earned a Searles Scholarship and is the university's only Howard Hughes Medical Investigator (an honor she has won twice, and which funds half of her research lab, as well as 100 percent of her salary).

A description of her work doesn't exactly roll off the tongue.

"We're looking at how the proteins involved in genome packaging contribute to the genome," she explained. "There is additional information that's embedded in addition to the DNA sequence."

That additional information is referred to as epigenetic, literally "above genetics." It is this epigenetic information that accounts for the differences found in identical twins. And, the differences get more pronounced as twins age and experience different environments.

"The saying, 'DNA is not your destiny' is really true," Luger said. "Your DNA is smarter than just your DNA sequence."

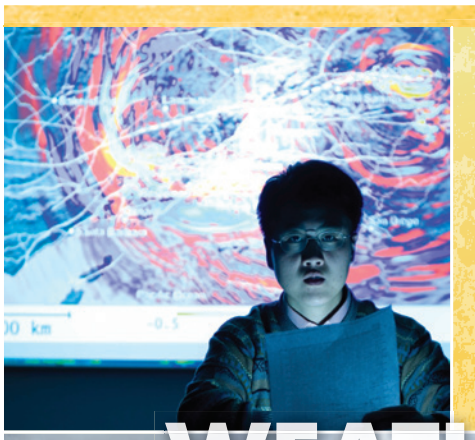
Bundling DNA is not an easy task. Mammalian DNA is about 2 meters long, while the place it occupies within the cell is 10 one-millionths of a meter wide. The DNA needs to be unbundled for use, and rebundled again.

One area that Luger is interested in is how packaged DNA structures react to DNA damage and how they repair it. For example, cells have trouble repairing DNA due to damage inflicted by too much sunshine. Information on how DNA is repaired can have a big impact on cancer research.

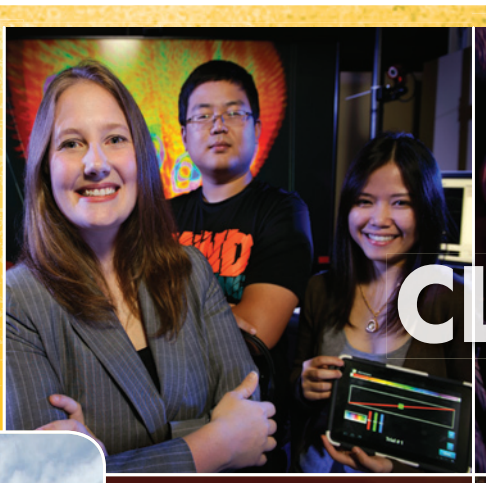
Luger's biophysics lab "has a lot of fancy, complicated equipment" she says, admitting to being "a bit of a gear head." However, she also sees herself as a small business owner.

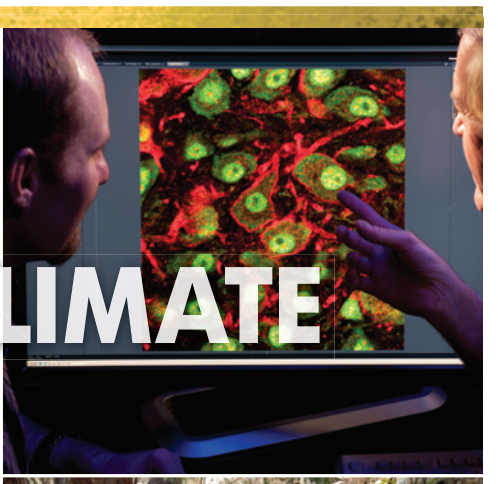
"Everyone's raving about the importance of small business for the economy, while at the same time giving higher education a bad rap," Luger said. "I would maintain that they're not that separate.… My lab employs 20 people. I get grants from foundations and trust funds, and we buy things in the local economy.

"Our product is not something that you can touch, but it is knowledge and it is training. … Undergraduates who would otherwise fry hamburgers or mow lawns get a full-time summer job in my lab, and this includes thorough training in a working laboratory. This experience often leads them to pursuing a career in research."



The University of Wyoming is integrating the use of supercomputers into research and teaching. Supercomputing provides UW students with deep, interdisciplinary experiences and the understanding that they'll need for their future careers. And it puts UW Earth system research into the forefront.





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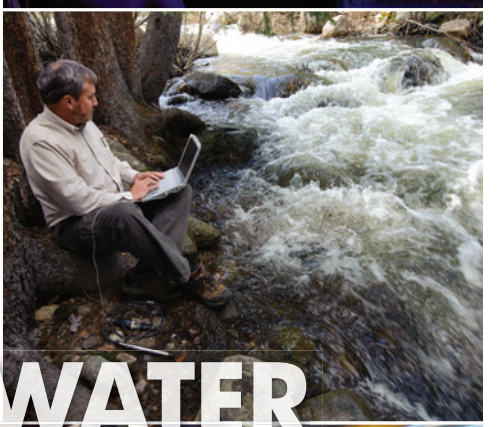

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UNIVERSITY OF WYOMING

From lab to market

Commercializing technologies developed by the public sector

BY MICHAEL DAVIDSON

Universities and laboratories in Colorado and Wyoming are teeming with great ideas. Some could change the world — and be worth millions.

Unfortunately, those ideas might never realize their potential if they do not make it out of the lab and into the market.

Whether at universities or national research centers, technology transfer offices help bridge the gap between the lab bench and the marketplace.

Their goals are to help researchers protect their intellectual property and find entrepreneurs or companies that can commercialize the technology.

If the office and researcher are successful, they have created a product that can improve people's lives and businesses and make a little bit of money for the inventor, investors and their institution.

If they're really successful, they could benefit from a windfall, such as the $30 million the University of Colorado will receive for licenses related to the use of Botox to treat bladder disorders.

How it works

The University of Colorado, Colorado State University, the University of Wyoming and Colorado School of Mines each have tech transfer programs. So do federal labs, such as the National Renewable Energy Laboratory.

While university offices have variations in how they are structured and how they split potential royalties, they share far more in common in how they work and their mission, according to Todd Headley, president of CSU Ventures, the technology transfer program for Colorado State.

Staff must understand the research being conducted at their university and understand the areas where its faculty members are strongest. They also must know industry trends and what kind of inventions might find a place in the market, Headley said.

"We spend a lot of time focusing on faculty and research, and spend a lot of time looking at industry and its needs," he said.

Wheat breeding is a cutting-edge science, thanks in part to Scott Haley and his team of researchers at the CSU Wheat Breeding and Genetics Program. CSU is breeding wheat that can survive eastern Colorado's harsh winters and dry summers. In 2011, more than 65 percent of the 2.5 million winter wheat acres in Colorado were planted with CSU-developed wheat varieties.

V. "Chandra" Chandrasekar is a Colorado State University electrical and computer engineering professor. He and his students are part of a team that is developing small radar systems that eventually could help meteorologists better predict where tornadoes will form.

PHOTOS BY DAN BIHN, COURTESY CSU VENTURES

Technology transfer offices have expertise in business development and intellectual property law that researchers lack, and if there is something they don't know, they have connections to people with experience and knowledge of their fields, such as patent lawyers and serial entrepreneurs.

Those connections raise the chances a company will license a technology or a viable business will be created, said Tom Smerdon, the University of Colorado's interim associate vice president for technology transfer.

"We want to ensure they can hit the ground running and they do have a chance for success," Smerdon said.

One goal is to make the process as easy for researchers as possible, so they can get back to the lab to improve their discovery,, said Will Vaughan, director of CSM's office of technology transfer.

"The professors are rightly focused on cutting-edge science. They shouldn't have to focus on these things, and most just throw up their hands and say, 'Deal with it,'" Vaughan said. "Their passion is research."

Working with research-minded faculty can require some outreach and education.

"We're working to change the entrepreneurial culture here, to help professors understand you can do patents and you can do research," Vaughan said.

That can mean hosting events on campus to let faculty and students know the office exists and what it does, said Davona Douglass, head of UW's Research Products Center, which runs its university's tech transfer office.

Unlike other tech transfer offices, the Research Products Center also is charged with helping independent inventors, either individuals or businesses. The center works with about 100 inventors a year who are not part of the University of Wyoming system, Douglass said.

The center's dual role is an effort to get a greater impact from Wyoming's relative lack of resources. Wyoming residents are just as inventive as Coloradans, but the state lacks IP lawyers or a concentration of entrepreneurs, she said.

All the offices have websites with in-depth and clear explanations of how the process works.

Researchers do need to know that not all inventions receive patents, can be licensed to an existing company or can be the building block of a startup.

That's why, to launch companies or license a technology, the offices have to be proactive, Headley said.

"The hope is you can make the funnel bigger at the top, so you need to get more people in the door," he said.

Owning the idea

The commercialization process begins outside the office, when a researcher comes up with an

invention that might have commercial promise.

The researcher's first step is to make contact with the technology transfer office.

The initial contact could be through an email or quick chat in which the researcher tells a staff member a little bit about her idea and the staff member outlines how the process will work.

Soon the researcher will need to disclose more details about her invention, the process that led to its creation, where the money for her research came from and what commercial need she sees it filling.

According to the most recently available data from the offices, CU had 226 disclosures from researchers across its campuses in the most recent fiscal year. CU received 117 disclosures, while UW had 33 disclosures from inventors affiliated with the university and 95 disclosures from independent researchers. Colorado School of Mines did not provide data in time for publication.

It's at that step the technology transfer department begins its work in earnest and tries to find answers to the key questions that will determine if the invention has a chance of making it.

One of the first is whether the technology could get a patent. That means the invention has to be new, can't be obvious and is useful.

Meeting those criteria can be pretty hard, and it can take a few years before the U.S. Patent and Trademark Office makes a ruling. That is why one of the major roles of tech transfer offices is to guide inventors through potential intellectual-property minefields.

CU and CSU have specialists on their staffs who are experts on IP issues. They and smaller schools rely on outside counsel specializing in intellectual-property law to deal with thornier issues.

They also provide advice to researchers to increase their odds of receiving a patent. CU's website emphasizes the importance of lab notebooks, which can help establish when a discovery was made. CSM's explains when researchers can share their results with peers.

A key statistic provided by CSU Ventures underscores how hard the patent process can be: Over the past five years, the office has submitted 710 patent applications; the Patent and Trademark Office has issued 56 patents.

Building a business

While the IP specialists are at work, the staff also looks at the commercial prospects.

A lot of the inventions are in very raw form, and there are a lot of reasons they might not be viable, Headley said. Some are technical matters. The invention might work in the lab, but not be scalable to industrial size. Or it could be too expensive to produce or use.

Someone also has to want it, which is why the offices have to cultivate contacts and market technologies available for licensing.

Company cofounders or licensees have to be the right fit. The researcher also has to decide if she wants to license the technology and prioritize their academic work or take what can be the much harder step of launching a company.

"What we're really trying to do is find the best home for a technology, and usually it's a very obvious decision," Headley said about the startup or license question. As for the proper match, that can make the difference between success or failure.

"That's one of the absolutely key components of this, and that's one of the areas we work the hardest."

In Colorado, researchers get help from the Innovation Center of the Rockies, formerly the Boulder Innovation Center. The center works with CU, CSU, CSM and the University of Denver.

The ICR has a network of about 1,400 potential advisers, investors or founders, said Tim Bour, its head. It also has program managers who can help connect inventors with the right people.

In Wyoming, the Research Product Center might have even closer ties to industry. It was launched in 1999, as a collaborative effort between the university and the Wyoming Business Council, a state economic development organization, Douglass said. It also maintains close ties with the Wyoming Business Network.

As might be expected, the amount of experience inventors have varies, as do their needs.

"There are some faculty members that have started companies before, and there are some members who have never thought about it before. It totally spans the range," Bour said. "We adapt the process to the specific interests of the faculty member."

If they want to form a company, finding cofounders and potential investors is essential. In fact, it might be the hardest part.

"I would say that we get one or two companies per year, and I would hope for more," Bour said. "Generally speaking, the rate of invention far outpaces the rate of commercialization."

The numbers from the tech transfer office are a bit better than that, but not dramatically so. CU helped launch 10 startup companies and CSU helped launch six. UW's "representative list" of spin-outs has seven companies, Douglass said.

Cashing in?

Starting a company is one thing. Making it successful is another.

The outcomes vary widely, and the spinoffs from the University of Colorado system show just how different the outcomes can be.

From 1994 through September 2011, the last available report, 118 companies have been formed based on CU intellectual property. In that time, 23 have ceased operations, and many are small companies not far beyond the research stage.

Seven have become public companies, such as Broomfield-based ARCA Biopharma, and five of those have been acquired by larger public companies, such as ColorLink, which was bought by RealD. Others, including OPXBIO, have received significant amounts of venture capital and strategic investment.

The results uncover some of the unavoidable truths about technology transfer, Smerdon said. It's hard, takes a lot of time and only a few companies or licenses hit it big.

"Some view university technology transfer as a potential source of significant revenue for universities … but the timeline from invention disclosure to commercial product and royalties can be quite long," Smerdon said.

"It's unrealistic to look at technology transfer as being this gold mine of near-term revenues when it takes so long sometimes to see those," he said.

Some of the big earners are CU's aforementioned Botox licenses. In the 1990s, Dr. Richard Schmidt, then a urology professor at the University of Colorado Health Sciences Center in Denver, began working with the botulinum toxin, which is used in Botox.

Schmidt found that strains of the toxin could be used to treat overactive bladders and benign prostatic hyperplasia. The treatment proved successful enough that Allergan Inc., the California-based pharmaceutical company that makes Botox, has received approval from the FDA to market as a therapy.

Allergan pays royalties to CU, including the $30 million it received this spring.

The Botox revenue is a rare home run, and accounts for the vast majority of the $32.8 million licensing revenue generated by CU in the past fiscal year.

Inventors, their departments and the university divide up the revenue, and they do it in different ways. UW is the most generous to inventors, with 60 percent going to them. CU splits the money evenly between the inventors, the tech transfer office, the inventors' lab or research center and the university. CSU Ventures receives 40 percent of revenue after it recoups what it spent protecting the IP and marketing the product, inventors get 35 percent and the remainder goes to the inventors college and to CSU's research office.

Colorado School of Mines has a tiered approach. The first $30,000 in revenue is split between the inventor and the tech transfer office. After that, 35 percent goes to the inventor, 35 percent goes to the university and 30 percent to the researcher's department.

NREL: It's not just solar any more

GOLDEN — It is possible that the only institutions that rival universities for the amount of ideas and inventions they generate are federal labs, and the pre-eminent example might be the National Renewable Energy Laboratory in Golden.

Founded in 1977, NREL is part of the Department of Energy and is funded by the federal government, with a budget of $388.6 million in fiscal 2011.

Research at NREL can range from cutting-edge research and development that might be years away from bearing fruit to working with small companies to improve their technologies, said William Farris, association lab director for innovation partnering and outreach.

By design, NREL's focus is narrow. Its scientists study only renewable energy and energy efficiency technology. However, its impact has been profound. The lab's research and personnel have shaped the solar power and wind industries, Farris said.

"You'd be hard-pressed to find a solar company in the U.S. that doesn't have an NREL alumni on its staff," Farris said.

NREL's legacy dates back to the days when it only focused on solar energy, but in 1991 its mission was broadened.

Now it includes facilities such as the National Wind Technology Center, which can be seen from most of Boulder County. Turbine builders large and small use the facility to test equipment and designs.

While the technology transfer mission is shared with universities, there are major differences in how NREL and universities operate.

At NREL, the goal of technology transfer is to form partnerships with private industry.

"The ideal for us is to do early research that is innovative and has market potential, and then we work with a partner," Farris said.

While many NREL researchers have started companies, they almost always have to leave the lab to do so. Federal rules are strict about conflict of interest and use of federal funds for private companies.

"It's hard to have a foot in both camps," Farris said.

That does not discourage NREL staff, who recognize their work can have the greatest effect if it's taken up by private industry and becomes widely adopted.

"Most of the staff here believes in clean energy and the mission," Farris said, "and they want to see the research get into the market and make an impact."

University clusters link research, market

BY MOLLY ARMBRISTER

COURTESY OF CASEY A. CASS, CU

Graduate students work in a lab in the Jennie Smoly Caruthers Biotechnology Building at UC Boulder, home of the university's Biofrontiers Institute.

Universities can be among the strongest economic-development engines, and part of that can be attributed to the work done at university "clusters," or engines for linking research and commercial products.

The University of Colorado, University of Wyoming and Colorado State University are all home to these types of efforts in some form or another, and each is growing and introducing new research that either have or could morph into a marketable product.

At CU, clusters are called research institutes. CU houses 11 of these research institutes, which accounted for more than half of the $380 million in 2012 sponsored research dollars at the university. The institutes employ 900 researchers, student and support staff who work on issues ranging from natural history to biotechnology.

One of the foremost institutes at CU is the Biofrontiers Institute, formerly the Colorado Initiative in Molecular Biotechnology. The Biofrontiers Institute is headed up by 1989 Nobel laureate Tom Cech, who discovered the principle of RNA catalysis.

Cech's more recent research involves proteins in chromosomes that may have implications for cancer patients. Cech's work dovetails with the research done at the Biofrontiers Institute, which focuses on taking discoveries and extending them into real-world applications that improve human health and well-being.

Research there is divided into four areas: Large datasets and genomics, biophysics and imaging, chemical biology and drug development and regenerative biology.

One of the most recent companies to spring from the Biofrontiers Institute is MyoKardia Inc., which was launched earlier this year in conjunction with Stanford University and Harvard University Medical School with $38 million in venture capital.

MyoKardia is developing small molecule therapeutics to address clinical needs for patients with genetic heart disease. The company is based in San Francisco and has begun work on two genetically driven types of a heart disease called cardiomyopathy, which both weakens and enlarges the heart muscles.

At CSU, these clusters are called "superclusters," and the most recently established, the clean energy supercluster, was unveiled in 2008 with the assistance of then-Gov. Bill Ritter and then-Sens. Wayne Allard and Ken Salazar.

CSU is home to two other superclusters, one focusing on cancer research and the other on infectious disease. The establishment of the superclusters was a response to the realization that there were opportunities for commercialization based upon research at the university but that additional investment was required.

To that end, the university initially invested "several thousand" dollars in each cluster, according to Bill Farland, vice president of research at CSU.

More than 100 faculty members work at these superclusters, which also spawned CSU Ventures, a university-funded entity aimed at business development.

The superclusters have made a difference in the amount of licensing and patenting emerging from CSU, Farland said.

Between 1997 and 2006, 18 startups came out of CSU, but between 2007 to 2011, that number jumped to 20.

Similarly, the number of patents emerging from CSU was 124 between 1997 and 2006, but from 2007 to 2011, half the number of years, the number of patents springing from the university was 165.

Today, the three clusters combined receive $2 million annually to help them in their work.

Perhaps the most prominent company so far to emerge from CSU is Prieto Battery, the manufacturer of a lithium-ion battery that is billed as environmentally friendly, more efficient and less expensive than traditional batteries.

At UW, the Western Research Institute does research that is funded both through grants and through private financing.

WRI has three areas of expertise: highway materials, such as asphalt technology, environmental technology and energy use. While it can be said that WRI's "product" is research, the institute has patented several processes that are applied throughout the industries it serves.

For example, WRI's pre-combustion thermal mercury removal technology has been shown to remove

Clusters of innovation

Hundreds of researchers and others work at Colorado and Wyoming university research clusters or institutes.

UC research institutes

Alliance for Technology, Learning and Society — ATLAS is an initiative in education, research, creative work and outreach in which information and communication technology is "the enabling force."

Biofrontiers Institute — Works to leverage and expand Colorado's leadership in biotechnology and its promise for human advancement.

Cooperative Institute for Research in Environmental Science — Explores aspects of the Earth and searches for ways to understand how natural and human-made disturbances impact our planet.

Institute for Behavioral Genetics — Conduct and facilitate research examining the genetic bases of individual differences in behavior.

Institute of Arctic and Alpine Research — CU's oldest institute focuses on polar and alpine regions, where effects of global change are especially pronounced, as well as environmental challenges that span local, regional and global scales.

Institute of Behavioral Science — Provides a setting for interdisciplinary, collaborative research on problems of societal concern.

Institute of Cognitive Science — Gained a reputation for the promotion of interdisciplinary research and training in cognitive science and applies theories on that subject to real-world problems.

JILA — Explores questions about quantum physics, the design of precision optical and X-ray lasers, the principles underlying the interaction of light and matter, and processes that have governed the universe for nearly 14 billion years.

Laboratory for Atmospheric and Space Physics — Focuses on the study of Earth's atmosphere, the sun, and the solar system and is the world's only research institute to have sent instruments to all eight planets and Pluto.

Renewable and Sustainable Energy Institute — A joint institute between the University of Colorado and the National Renewable Energy Laboratory addressing problems in energy.

University of Colorado Museum of Natural History — Contributes to knowledge of the natural world and the humanities through research, teaching, and public education.

CSU 'superclusters'

Clean Energy and Cenergy — Works to enhance the ability of university scientists and business partners to speed clean and renewable energy research to the marketplace.

Cancer Research and NEOTrex — Dedicated to speeding the transition of life-saving cancer research from the academic world to the global marketplace.

Infectious Disease and MicroRX — A first-of-its-kind enterprise to speed the transition of life-saving research on infectious diseases from the academic world into the global marketplace.

University of Wyoming

Western Research Institute — Renowned for work in advanced energy systems, environmental technologies and highway materials research.

up to 80 percent of the mercury in Powder River Basin coal. The technology has the capability to increase efficiency by 3 to 4 percent at Powder River Basin coal plants.

Other WRI-produced technology holds potential for alternative energy generation and environmental remediation.

Microbial fuels cells is a newer technology on which WRI is conducting research focused on "enhancing degradation of organic contaminants while generating electricity."

According to WRI's website, "power generated by MFCs is sustainable, environmentally-friendly, and very versatile because the fuel source can easily vary from sugar, to sewage, to groundwater contaminated with petroleum products. Opportunities for this multitasking technology are virtually limitless."

COURTESY CSU

Amy Prieto heads up Prieto Battery, one of the most prominent companies to emerge from CSU.

From the classroom to the boardroom

Professors on corporate boards helping fledgling companies find their footing

BY DAN COOK

The professor as corporate board member.

Some seek the role. Some are invited. Others do, perhaps reluctantly, to protect their baby. But all are changed by it. That's because, when a university professor joins the board of directors of a for-profit company, that professor is entering a world almost diametrically opposed to that of academic life.

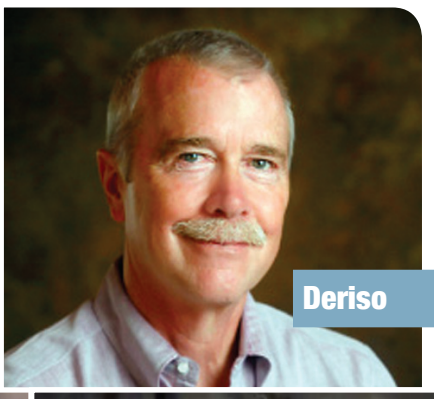
That said, professors say board experience has proved invaluable, benefiting not only their personal academic careers but allowing them to share real-world business knowledge with their peers and students.

"I actually think that being involved in biotech helped my academic career (until I gave it up completely)," says Larry Gold, Ph.D. "Academic research ought to have a real-world focus, and helping companies helps one identify important societal needs."

Gold ought to know. The University of Colorado Boulder professor currently serves as chairman of the board and chief executive officer of SomaLogic, the company he founded in 1999. Much sought-after as an advisor to biotech businesses and as a speaker at conferences and seminars, Gold considers himself today a corporate executive rather than a university professor. The opportunity to get real-world business experience has been powerful for him, launching a second career where risk replaces security, marketing replaces research, and the organizational chart of the corporation replaces the flat structure of academia.

Gold has served on numerous boards of directors, both for companies he helped found or others that sought his counsel. The two experiences differ greatly. The founder's natural desire to set the direction for the company often drives his or her role as a board member, while a non-founder from academia has a more defined role.

"(My) experiences were uniformly interesting and always different from each other," he says. "The overlap was that biotech is a difficult business, and boards always face similar fund-raising issues and issues of intentions. Boards often think that founders aim too broadly, and founders often think that board members are too focused. The resolution of that tension occupies many board meetings."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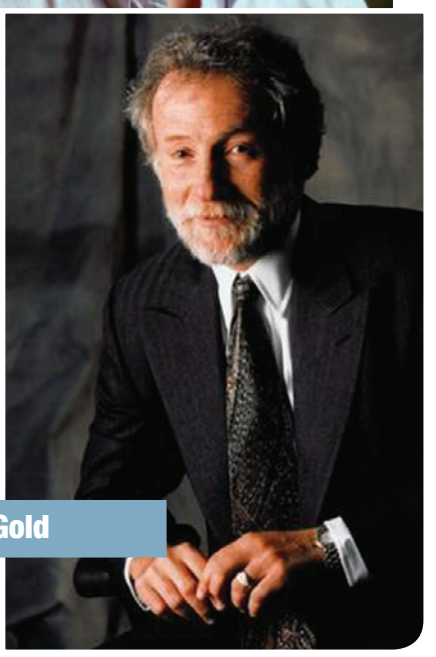
Gold

Gold adapted willingly to the for-profit environment and understands where he can add value as a board member. But many academics find it hard to make the transition to the rough-and-tumble of a world built around selling a product rather than discovering it.

As founder, CEO and board member of Prieto Battery, Dr. Amy Prieto has had a ringside seat at what it takes to market an innovative product. Prieto is an assistant professor in the Department of Chemistry at Colorado State University, holds a Ph.D. in Inorganic Chemistry from the University of California, Berkeley and completed her postdoctoral research training at Harvard University. An acknowledged expert in nanowire chemistry, her cutting-edge work on lithium batteries led her to launch Prieto Battery in 2009.

Three years later, she is grateful for the experience of running a company and serving on its board. "This experience has benefited me tremendously in terms of being able to put my research into a big-picture context and to articulate my ideas clearly to a wide range of audiences," she says.

But it took a period of adjustment to understand how different the rules were in the corporate world where, she found, "there is much less emphasis on understanding how things work well, and more on marketing the ideas effectively."

After years of living in the academic realm, Prieto had to make a shift. A battery is a very specific product, and there are plenty of them for sale. She needed people who could describe why customers should buy the Prieto lithium ion rechargeable battery. This was a different breed of colleague than she was used to.

"You will have to learn to communicate with people who have very different backgrounds than in academia," she says. "It's a completely different culture, so you need to have an open mind."

As a member of the board of her company, she had to grow into her role. No one was going to tell her what the rules of engagement were for her as a board member. "I don't think there is a defined role, I think each founder has to determine for themselves what role suits them best and best utilizes their talents," she says. Her advice to company founders who are adjusting to a corporate setting is to try to stay focused on their area of expertise: product development.

"I will say that what professors need to keep in mind is that founding a company takes an enormous amount of time and effort. The key to making it work well with your academic career is to get really good people into management and board positions so that you can focus the

time that you have to spend on the company on the actual ideas" rather than the everyday details of running a for-profit company, she says.

For those in academia who have been approached about joining the board of a for profit company, she advises them: "You need to meet the entire team (if possible). Determine what the culture is and if you fit it well. Make sure you understand what the expectations are."

Todd Headley, president of CSU Ventures at Colorado State, agrees that academics need to have an open mind when they join a for profit board. Professors like Larry Gold who make the full transition to corporate executive from academia are uncommon, he says. Most founder/board members want to stay involved in the product area but prefer to hand off most management tasks. Those who are asked to join boards should be ready to learn the ways of the business world, and stay within their areas of expertise at the beginning of their experience.

Founders in particular may want to stay closely connected to their academic roots. "Eventually many of the founders we have here still want to be on faculty," he says. "They want someone else to run the company, while they stay engaged on the technical side. Their true passion is for research and discovery, not sales and marketing."

By stepping aside from day-to-day operational duties, but retaining a seat on the board, the founder can stay engaged in her or his "baby" without yielding to the temptation to micromanage.

There is another way to experience for-profit board duties without all the responsibilities of full board membership: Join a company's advisory board.

That's how George Deriso prefers to share his expertise with early-stage companies. Deriso is adjunct professor of management and entrepreneurship in the Leeds School of Business at UC-Boulder. He actually traveled a different route to his current advisory board status. His first career was in the for-profit world, where he held positions at major corporations like Apple and AT&T prior to founding Falcon Venture Partners, a Colorado private equity firm that funded start-ups. His expertise in business led him to UC-Boulder as a lecturer. He moves easily between the academic and corporate worlds, and also devotes considerable time to serving on the boards of non-profits.

"I do quite a bit of advisory board work for for-profits," he says. "I've worked with high tech companies, low-tech companies, companies that do things like hand tools and magnetic switches. Most recently I've gotten involved in advisory boards of social enterprises."

These new breed organizations have missions to meet global socio-economic needs, but also to do so for a profit.

"These are impactful socially-involved for-profits," he says. "One that I work with is Bliss, which helps Pakistani girls to get an education and teaches them skills that they incorporate in crafts integrated into high-fashion handbags. The profits, or proceeds, go for recruiting more girls."

Deriso finds this type of board engagement highly satisfying, and less structured. No monthly board meetings, no specific roles to play. He can bring his many years of experience to solve a range of problems these young companies encounter as they try to change the world. And, there are no liability issues that full board membership brings with it.

"My role typically is not something I decide, but is something that is lacking in the team," he says. "For example, I've done a lot of fund raising and angel investing. If someone is looking for capital, I look to fashion their enterprise in a package and design their pitch and talk to investors and even introduce them to investors. It's something I'm good at and enjoy doing."

The rewards for his academic career are primarily reaped by his students, he says.

"Business and entrepreneurship are a practitioner's art," he says. "You can read about business and listen to business leaders speak, but it's very much like reading about playing the piano — it doesn't mean you can sit down and play one. The more that I can participate with a business, the more I can bring that to the classroom and inspire them to do the same thing."

So, for the professor considering a position on a for-profit board, perhaps the consensus advice would be: Keep an open mind, expect to encounter an organizational structure unlike one you've ever seen, keep your eye on you area of expertise, and don't give up your university office.

Linking startups with seasoned hands

Incubators and accelerators help them take next steps into the business world

BY MAGGIE SHAFER

There's no doubt that Colorado and Wyoming universities are bursting with entrepreneurial ideas and innovations with the potential to change the world. What business incubators and accelerators do is provide them with the opportunity to try.

These startup support organizations partner with early-stage companies and act as both a roadmap and a guide, helping turn what may have started as a homework assignment into a fully functioning, often lucrative business.

"You come in with a product and you leave with a company," said Nicole Glaros, the managing director at TechStars, a Boulder-based accelerator.

While the services provided and methods employed by the incubators vary, their programs most often include business coaching, adviser mentoring, assistance in accessing capital, a temporary space and a network of like-minded entrepreneurs and seasoned business veterans – an invaluable resource for a still-feeble startup.

The Wyoming Technology Business Center, the business development program for the University of Wyoming, is located on campus in Laramie and has a second location planned for Casper, Wyo. The 30,000-square-foot facility in Laramie, which opened in 2006, equips WTBC tenants with laboratory, office and conference room space.

With a focus on technology-based startups, and more recently including bio-science companies, the WTBC serves a crucial role in generating business in a largely rural state. Its relationship with UW is beyond a partnership – the two are inseparable.

"The university has a strong sense of an economic-development mission," said Jon Benson, the CEO of the WTBC and an adjunct professor at UW. "Typically in Laramie, this is the engine generating new startup opportunities."

Benson, who teaches entrepreneurialism, partners with UW's College of Business for an annual business plan competition. The grand prize: free space in the incubator for a year.

Bright AgroTech LLC, a company the WTBC currently partners with, was started by a UW doctorate student in agronomy. The startup produces vertical hydroponic systems, allowing users to increase their crop production. Benson said Bright Agrotech's technology has been patented, and, with the help of the center, the founders are working on a plan for taking it to market.

The four "graduates" of WBTC now employ a combined 85 people and utilize 25,000 square feet of space. But Benson sees this as only the beginning. With the recent purchase by UW of Cirrus Sky Technology Park in Laramie, it's expected that the school plans to offer more WTBC graduates a permanent home in the future.

Northern Colorado's Rocky Mountain Innosphere has a similar mission: to assist and accelerate promising startups towards success, with the ultimate goal of economic growth for the entire region.

Mike Freeman, CEO of the Innosphere, describes Colorado State University as a critical partner in this mission. RMI works closely with CSU Ventures, the nonprofit arm of the university dedicated to technology-transfer and commercialization for student and faculty-led businesses.

"The relationship (between CSU Ventures and the Innosphere) is a natural fit," said Todd Headley, president of CSU Ventures. "Our interests are really aligned for what we want


Bour


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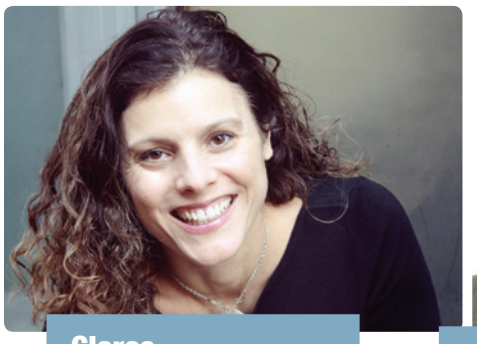

Glaros


Freeman

What's the difference between an incubator and an accelerator?

It depends on who you ask. While definitions vary, most would say something like this:

Incubators typically work with brand-new businesses, or with brand-new entrepreneurs with a business idea, providing them with what they need to become a viable, lucrative operation. This can include office space, mentors, a business plan and capital. The process could take several years, and often includes R&D.

Accelerators do a lot of the same, but are typically a faster paced, more intense program, graduating clients in a matter of months. They may take equity in the company in exchange for capital needed to get off the ground.

to do."

In addition to the more tangible resources that incubators provide universities, Headley said the sense of community they create for small companies coming out of CSU is also valuable.

Two CSU startups are the most recent product of this partnership: KromaTiD, the creator of products that analyze defects and damage to human chromosomes, and OptiEnz, a manufacturer of devices that allow users to measure concentrations of chemicals in environmental and industrial settings. Both companies started calling the Innosphere home this fall.

"The Innosphere is a fantastic partner and has provided us with the guidance and services to help our company take the next step into the business world," said Chris Tompkins, president and CEO of KromaTiD.

As a nonprofit, the Innosphere doesn't take equity in its companies, but rather commits to helping its partners get the capital they need through its various resources, including a growing donor pool.

Many of the companies it works with are housed in the Innosphere itself, a 32,500-square foot building equipped to shelter up to 35 nesting businesses.

The space itself encourages collaboration – conference rooms and various meeting spaces can be found on each of the three floors.

Doug Johnson, the Innosphere's vice president, describes the space as "allowing small companies to behave like larger ones."

Many are taking advantage. The Innosphere is currently working with 33 companies – close to saturation.

Elsewhere, the Innovation Center of the Rockies in Boulder also partners with the state's schools. But the non-profit business accelerator is unique in that it focuses on job creation based on technology emerging from all of Colorado's research universities.

Eighty-percent of its effort is directed at commercializing technology developed at the University of Colorado, Colorado School of Mines, CSU and the University of Denver, said Eric Gricus, ICR's program manager.

Those efforts have paid off. The center has worked with more than 125 research teams and has nine startups based on university intellectual property being formed, resulting in 402 jobs and nearly $75 million in new capital-boosting economic activity in Colorado.

"Incubators represent hope and the promise of prosperity that new businesses provide," Gricus said. "Our role in commercializing technology and creating jobs is more important than ever."

The Unreasonable Institute, a Boulder-based incubator in its fourth year, works so closely with its mentors from CU Boulder that they often sleep over.

The Institute hosts its entrepreneurs, mentors and investors in a single home, to live and work and learn together for six weeks in an intimate and focused business-building program. But this is no pajama party.

"For real capital and mentorship you need to be able to cultivate a relationship well beyond a pitch or a passing interaction," said Banks Benitez, the vice president of partnerships. "If we can create a place where they can co-exist, then relationships will form, and mentorship and capital will follow. We build that ecosystem."

Taking advantage of its academic neighborhood, the institute partners with CU Boulder for events, mentors and speakers, lining up a mentor program that has attracted entrepreneurs from 36 different countries and all over the U.S.

Some of the companies themselves have come from this partnership. Bould, a summer 2012 graduate of the Unreasonable Institute, was co-founded by CU alum Stephan Lepke and Shane Baldauf, along with their partner Shane Gring. The company assists architects in finding green building careers and earning the necessary credentials to qualify for them. The Denver-based company recently won the Hitachi Foundation's Young Entrepreneurs Program Award – which included a $40,000 grant – and is now "gaining some serious traction," said Benitez.

"The Unreasonable Institute offered us an opportunity to step back and truly analyze our venture and our desired impact – the effects of which are still resonating today," said Gring. "We are now laser focused on our core business competency of green work force development."

The Unreasonable Institute isn't the only one gleaning from its academic surroundings. TechStars – which has additional locations in Texas, Washington, New York and Massachusetts – also works with CU, although Glaros wouldn't describe it as a "formal partnership." She said the accelerator is dependent on the community as a whole, and the mentorships and support it provides.

Brad Bernthal, an associate clinical professor at Colorado Law School and the director of the entrepreneurship initiative at the Silicon Flatirons Center, is one of TechStars mentors. He sees the relationship between mentor and accelerator as symbiotic.

"It (mentoring) is the 'right' thing for community leaders to do," Bernthal said. "It keeps me relevant to see what the best and brightest new companies are into. And the mentor network itself is so powerful that it is a privilege to be part of it."

He considers a mentorship an "enormous boost" for a startup, gaining access to experienced individuals and their business networks. Glaros agrees.

"It's inspiring to see the community support these startups," she said. "It comes back to them in ways they can't quantify."

Incubators and accelerators

Innovation Center of the Rockies
Year established: 2005
Incubator or accelerator: Accelerator
Location: Boulder
Person in charge: Tim Bour, executive director
Fields of focus: Life-science, clean-tech, natural and organic products, aerospace, nano/optical/engineered, software and IT hardware. Adding agriculture and veterinary science.
Number of companies graduated: 60-plus.

Rocky Mountain Innosphere
Year established: The business incubator initiative was started in 1998, under the auspice of Fort Collins Technology Incubator.
Incubator or accelerator: Incubator
Location: Fort Collins
Person in charge: Mike Freeman, CEO
Fields of focus: Software, bioscience, clean engines, clean energy and clean-water technologies.
Number of companies graduated: Nine (but it's actually more, though graduated companies were not always tracked at the beginning.)

TechStars
Year established: 2006
Incubator or accelerator: Accelerator
Location: Boulder. Additional locations in Boston, Mass.; New York City; San Antonio, Texas; and Seattle.
Person in charge: Nicole Glaros, managing director for Boulder location
Fields of focus: Internet.
Number of companies graduated: 65 (from the Boulder location)

The Unreasonable Institute
Year established: 2009
Incubator or accelerator: Accelerator
Location: Boulder
Person in charge: Teju Ravilochan, CEO
Fields of focus: Entrepreneurs solving social and environmental issues.
Number of companies graduated: 70 have graduated, 61 still active

The Wyoming Technology Business Center
Year established: 2006
Incubator or accelerator: Incubator
Location: Laramie, Wyo.
Person in charge: Jon L. Benson
Fields of focus: Technology companies.
Number of companies graduated: Four

Colorado and Wyoming's Nobel laureates

SIDNEY ALTMAN

Education: Massachusetts Institute of Technology, Bachelor in Science; University of Colorado, Boulder, doctorate; Harvard University, postdoctoral fellow; MRC Laboratory, Cambridge, visiting research fellow.

Place of employment: Yale University, Sterling professor of molecular, cellular and developmental biology and chemistry.

Description of work that received the Nobel: Discovery of a catalytic RNA enzyme.

Impact of that work: Had a widespread impact on the basis of the origin of life and on people studying different kinds of RNA inside cells.

What do you think is the most important discovery ever made? I have no idea what the most important discovery ever made is. Perhaps, it might be the discovery of how to make fire.

THOMAS CECH

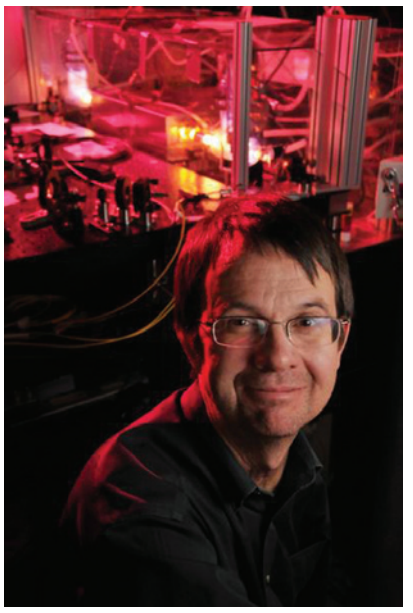
Education: Grinnell College, Bachelor of Arts; University of California, Berkeley, doctorate; Massachusetts Institute of Technology, postdoctoral research.

Place of employment: CU Boulder, distinguished professor of chemistry and biochemistry and molecular, cellular and developmental biology; CU BioFrontiers Institute, director; Howard Hughes Medical Institute, investigator.

Description of work that received the Nobel: Along with Sidney Altman and Thomas Cech, discovered that RNA in living cells is not only a molecule of heredity but also can function as a biocatalyst.

Impact of that work: This discovery, which came as a complete surprise to scientists, concerns fundamental aspects of the molecular basis of life. Many chapters in our textbooks had to be revised.

What do you think is the most important discovery ever made? Charles Darwin's natural selection.



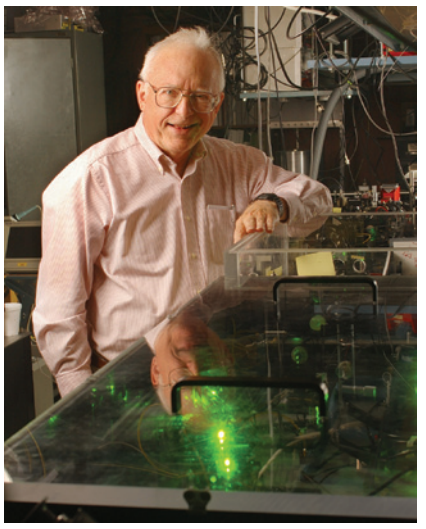
ERIC CORNELL

Education: Stanford University, Bachelor in Science; Massachusetts Institute of Technology, doctorate.

Place of employment: Cornell is a fellow of the National Institute of Standards and Technology, chair and fellow of JILA (a joint institute of CU Boulder and NIST) and an adjoint professor of physics at CU Boulder.

Description of work that received the Nobel: Cornell and Carl Wieman were cited for their landmark 1995 creation of the world's first Bose-Einstein condensate, a new form of matter that occurs at just a few hundred-billionths of a degree above absolute zero, and their early studies of the condensate's properties.

Impact of that work: The discovery launched a new field of atomic physics that has spawned thousands of scientific papers and a treasure-trove of scientific discoveries. The original apparatus that made the Boulder discovery is now at the Smithsonian Institution.



JOHN "JAN" HALL

Education: Carnegie Institute of Technology, Bachelor in Science and Master of Science; Carnegie-Mellon University, doctorate.

Place of employment: Hall is an adjoint professor of physics at CU Boulder, a retired fellow of JILA and a scientist emeritus at NIST.

Description of work that received the Nobel: Hall's work in developing an optical frequency comb allowed scientists to more accurately measure the frequencies of visible light, a highly difficult task because the frequencies are so small. Hall was cited for his "contributions to the development of laser-based precision spectroscopy, including the optical frequency comb technique."

Impact of that work: Hall's research helped transform lasers from a laboratory curiosity into a widely used tool in fields including telecommunications, electronics and medicine.

CRAIG MELLO

Education: Brown University, Bachelor in Science; University of Colorado, molecular, cell and developmental biology graduate program (transferred after two years, no degree); Harvard University, doctorate.

Place of employment: RNA Therapeutics Institute, co-director; Blais chair of molecular medicine; investigator at Howard Hughes Medical Institute and its program in molecular medicine.

Description of work that received the Nobel: Co-discovery of RNA interference, a natural gene regulatory mechanism that uses short pieces of RNA as guide sequences to shut down cognate genes.

Impact of that work: RNAi allows researchers to turn off the expression of any gene at will. Synthetic RNAs are available targeting every human gene and researchers can introduce them into cells in order to determine the function of any given gene. The same system functions in all animals and plants so there are many exciting applications in basic science and agriculture.

What do you think is the most important discovery ever made? The personal discovery of essence (purpose and meaning), which follows from the contemplation of the mystery of existence in every human life. In science it would probably be the domestication of wheat, because without farmers there would be no scientists. In biology, the discovery of the relatedness of all life, evolution, and the remarkable degree to which the molecules of life, DNA, RNA and protein, still reflect that common origin today.

JASON F. SHOGREN

Education: University of Minnesota, Duluth, Bachelor of Arts; University of Wyoming, doctorate.

Place of employment: University of Wyoming, Stroock professor and chair.

Description of work that received the Nobel: The Intergovernmental Panel on Climate Change was awarded the Nobel Peace Prize in 2007, along with Vice President Al Gore for their work on the science and policy of climate change. As a member of the IPCC, all us scientists were a "party to the prize." My work was as a lead author on a chapter on costing methodologies. The chapter examined what we know about how to put a price tag on reducing the risk posed by climate change, through investing in mitigation and adaptation strategies.

Impact of that work: The IPCC has had a significant impact on the discussion and debate on climate change, both within the science and policy communities. The IPCC continues to work on assessment reports, and continues to influence decision makers around the globe.

What do you think is the most important discovery ever made? In economics, the idea that matters most is that trade/coordination creates economic value and well-being. In general, Sir Isaac Newton's universal gravitation and laws of motion.

CARL WIEMAN

Education: Massachusetts Institute of Technology, Bachelor in Science; Stanford University, doctorate.

Place of employment: Wieman is a distinguished professor of physics, fellow of JILA (a joint institute of CU-Boulder and the National Institute of Standards and Technology located on the CU campus) and a President's Teaching Scholar at CU Boulder. He is currently on leave from his 20 percent appointment at CU and 80 percent appointment at the University of British Columbia.

Description of work that received the Nobel: Wieman and Eric Cornell were cited for their landmark 1995 creation of the world's first Bose-Einstein condensate, a new form of matter that occurs at just a few hundred-billionths of a degree above absolute zero, and their early studies of the condensate's properties.

Impact of that work: The discovery launched a new field of atomic physics that has spawned thousands of scientific papers and a treasure-trove of scientific discoveries. The original apparatus that made the Boulder discovery is now at the Smithsonian Institution.

DAVID WINELAND

Education: University of California, Berkeley, Bachelor of Arts; Harvard University, doctorate; University of Washington, postdoctoral research.

Place of employment: National Institute of Standards and Technology and University of Colorado, Boulder, group leader and NIST fellow.

Description of work that received the Nobel: Wineland shared the prize with Serge Haroche of the Collège de France and Ecole Normale Supérieure in Paris for "ground-breaking experimental methods that enable measuring and manipulation of individual quantum systems."

Impact of that work: The Nobel citation notes that Wineland and Haroche's methods have enabled science to take "the very first steps towards building a new type of super-fast computer based on quantum physics. Perhaps the quantum computer will change our everyday lives in this century in the same radical way as the classical computer did in the last century. The research has also led to the construction of extremely precise clocks that could become the future basis for a new standard of time, with more than hundred-fold greater precision than present-day cesium clocks."

— Maggie Shafer

10 discoveries that changed the world

BY MARK WILCOX

1

Liver transplants, CU-Anschutz

The "father of organ transplantation" received his unofficial title after performing the first liver transplant in 1963 while at the University of Colorado Medical School, now called the CU Anschutz Medical Campus. Though Dr. Thomas Starzl's first attempt was unsuccessful due to a lack of effective immunosuppressive drugs that would keep the body from rejecting the transplant, in 1967 he was able to make it work with superior drugs. Today, doctors perform more than 6,000 liver transplants in the United States every year, creating a web of changed lives that could easily blanket the world.

2

Bone cancer operations, CSU

Not every life-altering medical discovery starts out with knowledge that applies to humans. Stephen Withrow, former director of Colorado State University's Animal Cancer Center, has focused on bone cancer in animals as a model for human diseases and, more importantly, treatments. He created an alternative treatment to amputation for bone cancer he pioneered in cats and dogs wherein cancerous bones are removed and replaced with bones from other animals. The procedure is becoming the standard of care after its crossover from the animal world into humans. According to the university, the procedure has been adopted by cancer treatment centers across the nation and has been highly successful in preventing amputations in children diagnosed with osteosarcoma, the sixth most-common bone cancer in children.

3

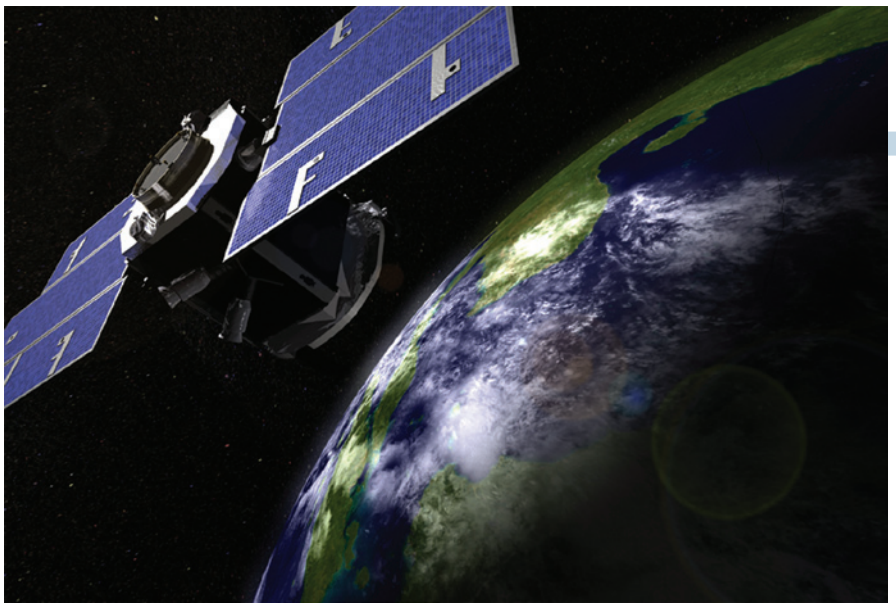
Parshall flume, CSU

Water rights have always been a big issue in the West and around the world, which may be what has made Ralph Parshall's invention widely used for nearly a century. In 1921, Parshall developed and patented the Parshall flume at the then-named Colorado Agricultural College's hydrology lab in 1921. Though Parshall died in 1959, his invention is still widely used to assess water flow in irrigation ditches, sewers and more the world over. Though technology has been added in some cases to wirelessly report data or otherwise augment the flume, the basic core remains the same. His contribution has earned him the title "father of the flume."

4

Composite materials, UW

Firehole Technologies was the second company to graduate from the University of Wyoming's Technology Business Center. Software the company produces analyzes the strength of composite materials and helps private companies make lighter, stronger materials. A good example: Boeing's 787 Dreamliner, the first plane largely made up of composite material. These composites make the plane fuel-efficient and strong, and Boeing modeled a lot of the 787 design using Firehole software. "It's really putting a disruptive change in everything from sports to transportation," founder Jerad Stack says of his software.



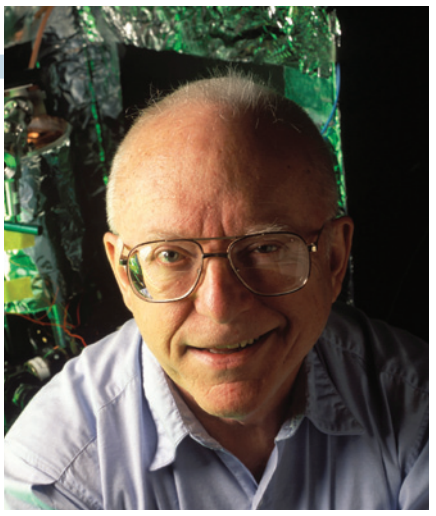
5

Up in the clouds, CSU

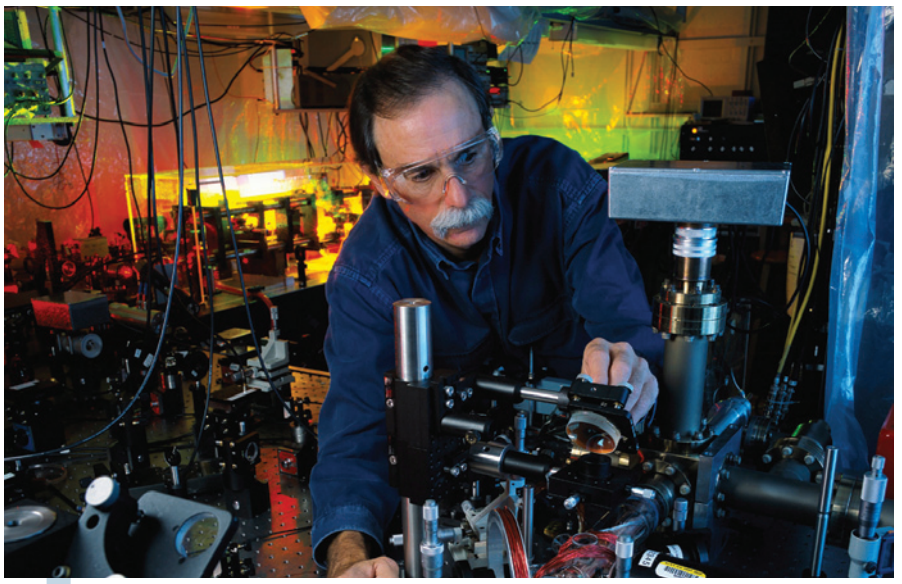
This CSU contribution has not only changed the world, it has also traveled around it more than 34,000 times. CloudSat is the world's first cloud-profiling radar in orbit, launched in April 2006 and orbiting 438 miles above Earth. The CloudSat is the first radar to "see through" clouds, checking water and ice content to improve weather forecasting, particularly in the accuracy of severe storm warnings. As of October, CloudSat had gathered 1.1 billion vertical profiles of clouds and distributed more than 1.2 million gigabytes of data to the international science community, according to the Cooperative Institute for Research in the Atmosphere, or CIRA, which is based at Colorado State and is responsible for the satellite's data collection. Graeme Stephens, a former CSU faculty member, collaborated with NASA to develop the satellite. Stephens is now director of NASA's Center for Climate Sciences.

6

Let there be lasers, CU-Boulder



University of Colorado researcher John (Jan) Hall won a 2005 Nobel Prize in physics for work that made it possible to measure light frequencies with an accuracy of 15 digits. His work happened at JILA, a joint institute of CU-Boulder and the National Institute of Standards and Technology. His work with laser-based spectroscopy has led to extremely accurate clocks, improvements in GPS technology and more. Hall has also been highly instrumental in implementing lasers in everyday communications technologies. His work even fundamentally redefined the meter via increased accuracy in measuring light.



7

Ionic zero, CU-Boulder

Not to be left out in the cold, CU lecturer and National Institute of Standards and Technology researcher David Wineland took home the 2012 Nobel Prize for physics for his work in developing a technique that cools ions to near absolute zero. The technique traps, with lasers, single electrically charged ions in a vacuum and cools them to nearly minus 460 Fahrenheit. The breakthrough has literally changed the world for quantum physicists, who have had to rely strictly on thought and conjecture for understanding of quantum physics until now. The discovery paves the way, like Hall's research, for greater accuracy in both GPS and atomic clocks, which are tied to each other since GPS satellites rely on atomic clocks for accuracy. Perhaps more importantly, Wineland opening the door to quantum physics should pave the way for quantum computing, which will be a quantum leap for mankind.

8

Genome testing to avoid thyroid surgery, CU-Anschutz

An individual's story tells well how this research has changed the world for some cancer patients. Emelia Johnson-Tabakoff faced diagnosis with both thyroid and ovarian cancer simultaneously. Under old techniques, surgery would have been required to find out if the suspicious lump on her thyroid was malignant or not. Meanwhile, chemotherapy treatment couldn't have begun on her diagnosed ovarian cancer until her body recovered from the surgery, which for many patients turns out to be unnecessary. And with the ticking clock of ovarian cancer, it was good news that research pioneered by CU's Bryan Haugen allowed pathology experts to examine a relevant 167 out of about 22,000 of Johnson-Tabakoff's thyroid genes. Her genome testing concluded the lump was benign and she was able to move on with chemo treatment and her life. The genome testing has been commercially available since 2011.

9

Gene machines, CU-Boulder

Chemistry and biochemistry professor Marvin Caruthers is a pioneer in methods for rapid chemical synthesis of DNA and RNA. He even created a way to automate the process, resulting in "gene machines" that quickly replicate DNA patterns without hands-on time from researchers. This research, pioneered about 30 years ago, has resulted in an explosion of pharmacology and biotechnology advances while also aiding basic biology research. Armed with his research, Caruthers has spun off several companies that have developed drugs that treat everything from anemia to rheumatoid arthritis.

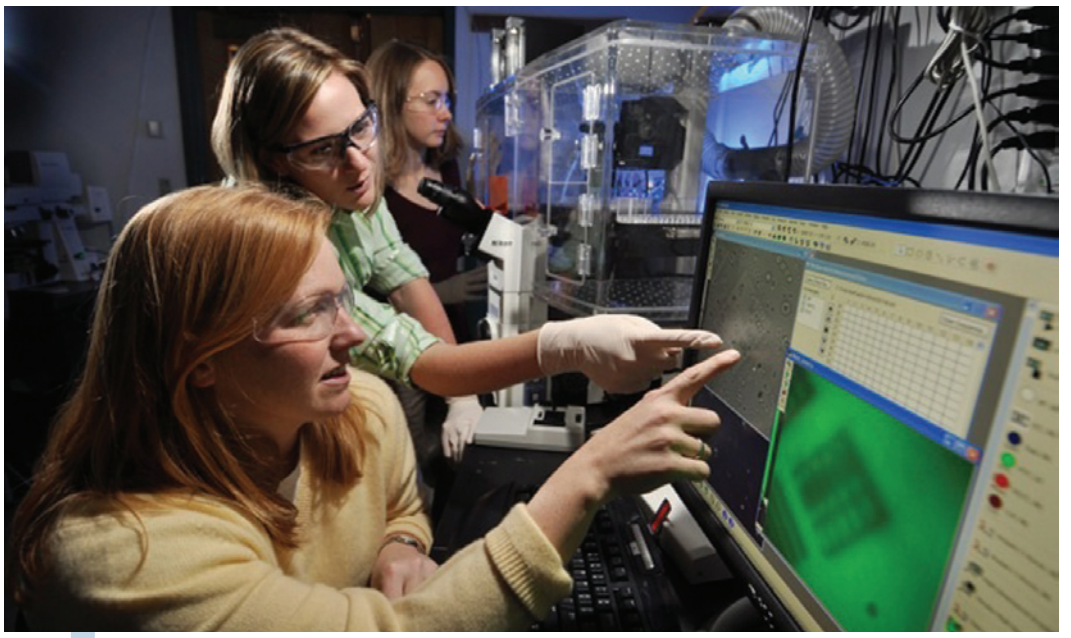
10

Parkinson's breakthrough, CU-Anschutz

Researchers at CU's Anschutz Medical Campus have discovered a drug that stops the progression of Parkinson's disease by turning on a protective gene in the brain. Drugs currently used just treat the symptoms, but the new CU drug — now being tested on humans after successful testing on mice — stops it from getting worse. More than 1 million Americans suffer from the degenerative illness.

10 discoveries that could change the world

BY MARK WILCOX



1

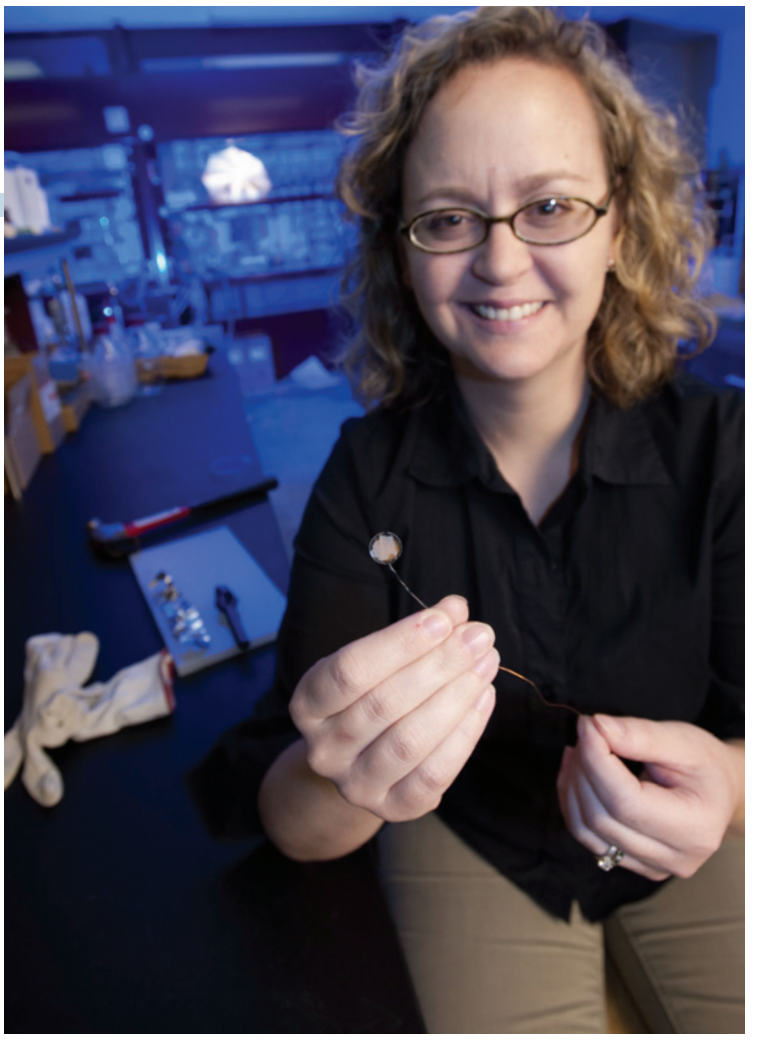
Imitating life, CU-Boulder

Traditional medicine has asserted for some time that cartilage does not grow back. Professor Kristi Anseth, working at the crossroads of engineering, chemistry and biology, is challenging that assertion. She has been perfecting polymers that the body responds to as if they were living tissue; using them as scaffolding to, for instance, help regrow cartilage. She is now developing liquids to be injected into the body, which are then hardened with ultraviolet light to be replaced by natural tissue as it fills in. Her tech nology may have applications for heart defects, bone and tissue regrowth, producing insulin in diabetics and even brain tissue regeneration.

2

Fully charged, CSU

The world has plenty of applications for a battery that is a 1,000 times more powerful and lasts 10 times longer than lithium ion batteries while accepting a full charge in only five minutes. That is exactly what chemistry professor Amy Prieto is working on with steady progress. The sponge-like "3D lithium-ion" batteries will be cheap to produce and be highly recyclable. And for some, the best part lies in the fact that citric acid is the most corrosive thing used to manufacture the batteries. The applications extend from the obvious cell phones and gadgets all the way up the tech tree to electric vehicles and even grid storage.



3

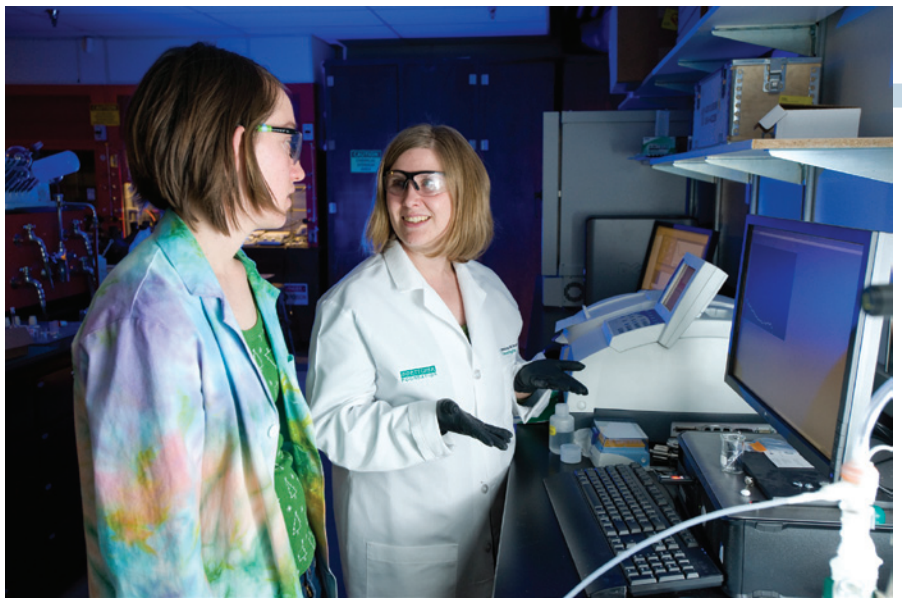
Ditch the needle, CU-Boulder

Biochemistry and chemistry professor Robert Sievers may have paved the way to help medicine leave needles in the dust. When he isn't breathing powder from the marble sculptures he creates, he is working with powder that could prevent diseases through inhalation. An inhalable vaccine – an unusually fine powder – he developed will hit human clinical trials soon and lead to the development of other vaccines for everything from tuberculosis to cervical cancer. The inexpensive vaccines could literally reshape vaccines as the world knows them.

4

To walk again, CU-Anschutz

Superman would be proud if he were still alive. Christopher Reeve's foundation, dedicated to healing spinal injuries after the actor who played Superman suffered a paralyzing spinal-cord injury, funded part of Stephen Davies' research, which has already shown the ability to heal spinal-cord injuries in rats to a nearly-normal ability to walk. The technique implants stem cells and encourages nerve cells to regenerate quickly. Because of the speedy change, pain for paralysis patients will be kept to a minimum. The technique could transfer into human usage in the "not-too-distant future," though exact timeframes are difficult to predict, according to Davies. The cells could also be used to treat a variety of other neurological disorders.



5

Injuries that dissolve away, CSU

Band-Aids have nothing on what CSU has in the works. Researcher Melissa Reynolds is about halfway through a three-year, $1.3 million Department of Defense grant to create a biodegradable, gauze-like wound-healing material. The polymer offers healing properties through its incorporation of naturally occurring nitric oxide, which can help prevent infection and encourage cell growth. The technology could be used for both surface and deep wounds. The body would simply dissolve the substance away, leaving healthier tissue behind. Of course, the applications extend far beyond a battlefield. "These materials could be dropped out of a plane (after a natural disaster) as the first line of defense toward injuries that tend to cause long-term problems," Reynolds says.

6

Burning ice, CSM

What energy crisis? It's somewhat paradoxical that the source that, when burned, could possibly provide more energy than all other fossil-fuel sources combined comes from under water. Burning ice, or methane hydrates, are naturally occurring deposits of natural gas's base component, methane, that lock into ice-lattice structures that look similar to white ice. They can be found both onshore and offshore, abounding in Arctic permafrost and in sediments along every continental shelf in the world. Colorado School of Mines researchers at the university's Center for Hydrate Research are seeking ways to refine production models for hydrates. This could further augment natural-gas production, possibly boosting the fuel source that already provides about a quarter of all energy consumed in the United States with new power plants being constructed fast as coal's dominance slips.

7

West Nile drug, CSU and UNC

West Nile, dengue and yellow fever viruses affect about two-thirds of the world, and yet no clinically useful antiviral drugs are available for these major killers. The Center for Disease Control and Prevention estimates more than 30,000 people in the United States have gotten West Nile Virus since the first reported U.S. case in 1999, with about 220 deaths reported to the center. While yellow fever is more regionalized to the tropics of Africa and South America, dengue fever is a major cause of illness and death, infecting about 100 million people annually. These mosquito-borne viruses must replicate to grow, and CSU's Brian Geiss, alongside the University of Northern Colorado's Susan Keenan, are developing a drug that can stop the replication by latching on to a protein needed for viral replication.

8

Medicinal snake venom, UNC

Many people dislike or even fear snakes, but their venom may hold the sought-after key to treat and prevent the spread of some dominant forms of cancer. Skin, breast and colon cancers could cede to purified compounds found in snake venoms used in anticancer drugs according to early results from research by UNC biology professor Stephen Mackessy. Not many labs in the world perform the kind of biochemical analysis of snake venom that Mackessy's does, for reasons obvious to most. Few would question his knowledge on the subject – he literally wrote the handbook on venoms and toxins of reptiles. If successful in further development, the potential for the venom anti-cancer drugs is nearly limitless with those cancers claiming more than a million lives every decade.

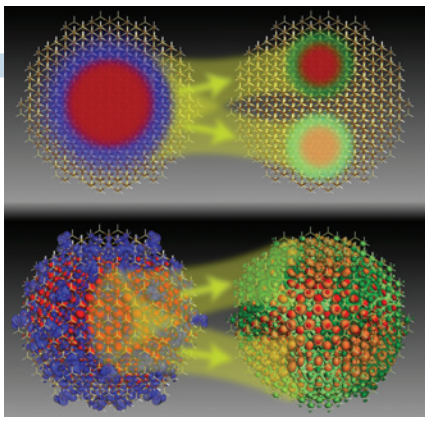
9

Arsenic removal, UW

Arsenic, unlike snake venom, has no potential to cure cancer. On the contrary, it has been shown to cause bladder, lung and skin cancer, and may cause kidney and liver cancer, according to the Natural Resources Defense Council. Additionally, tests in 25 states showed arsenic "at unacceptable cancer risks" in the drinking water of a "conservative" estimate of 34 million Americans. It is introduced in water supplies often through agricultural or industrial activities. Worldwide the problem is even bigger. KJ Reddy, a professor in UW's Department of Ecosystem Science and Management, invented a simple patented arsenic-cleaning process that is currently being developed and marketed. His process introduces specific nanoparticles that oxidize toxic arsenic into less-toxic compounds.

10

Efficient solar, CSM



The word "exciton," besides being fun to say, could change the way the world views solar. According to CSM research, an exciton, or an electron filled with light energy, could potentially transfer its load to more than one electron. The result? More electricity generated from the same amount of sunshine. "We can now design nanostructured materials that generate more than one exciton from a single photon of light, putting to good use a large portion of the energy that would otherwise just heat up a solar cell," researcher Mark Lusk said. In a world fearing the effects of global warming and fossil-fuel depletion, more efficient solar panels may sound like free energy, which can only be a good thing.

A makeover in the works for patent law

BY MICHAEL DAVIDSON

In 2013, the U.S. Patent and Trademark Office will begin to implement the America Invents Act. The 2011 law is the biggest change to patent law in decades, partly because it changes one of the key criteria for awarding a patent.

Starting March 16, the United States will move to a "first to file" system. That means the inventor who first submits his application to the USPTO wins a potential dispute over who can claim priority.

The U.S. previously used a "first to invent" system, which required patent examiners to try to determine who had first made a discovery or perfected an invention.

In making the change, the U.S. joins most other countries in using the first to file criteria. It also provides inventors and investors with confidence the intellectual property crucial to their company really does belong to them.

"It will probably help everybody that the first person to file is the winner," said Curtis Vock, an intellectual property lawyer at the Boulder office of Lathrop & Gage.

Vock

In theory, the change will lead to fewer lawsuits, as no one has to dispute something as hazy as when an idea crossed the threshold of being novel, non-obvious and useful, the three criteria patent applications are judged by.

"You have to essentially litigate to decide who wins" under the first-to-invent system, Vock said.

The law also gives some much needed resources — like money — to the patent office, said Michael Drapkin, an IP lawyer at Holland & Hart's Boulder office.

Previously, fees collected by the USPTO could be diverted elsewhere, which contributed to a backlog that maxed out at 750,000 applications.

"You can already see the backlog coming down quite substantially," Drapkin said. The backlog stood at 608,000 through September, according to the USPTO.

The law also has provisions that lower fees and could streamline the litigation process, Drapkin said.

The America Invents Act could have some drawbacks, although it will take time for their magnitude to be evident, Vock said.

One already clear: Small inventors who might not be familiar with the patent process could lose the race to the office to companies with IP specialists, Vock said. New provisions in disputing patents also look to be overly influenced by big companies and slanted against the little guy.

"It's going to be very difficult for small companies to get a patent if a big company doesn't want you to," Vock said.

But a modern, more efficient and better-staffed patent office should benefit everyone in the long run. The average length of time it takes for the office to approve or issue a final rejection is now 32 months. The office's goal is to lower that to 20 months by 2015.

> "It will probably help everybody that the first person to file is the winner."
>
> – Curtis Vock
> Lathrop & Gage

Inventions vs. patents

A lot of work is necessary for an idea to move from the lab bench or classroom to the market. While ideas and inventions are tested and improved in the lab, someone has to protect the intellectual property, file patents and help start a business.

University technology transfer offices were created for that purpose. The offices are staffed by or work with intellectual property lawyers, business development specialists and entrepreneurs to help scientists realize an idea's potential.

The universities provided the following information about the number of invention disclosures made by researchers, patents applications and patents issued and the number of companies formed. The data is for the 2012 fiscal year.

University of Colorado system Technology Transfer Office
Inventions disclosed: 226
Patents applications filed: 315
U.S. patents issued: 38
Startup companies formed: 10

CSU Ventures (Colorado State University)
Inventions disclosed: 117
Patents applications filed: 157
U.S. patents issued: 12
Startup companies formed: 6

Colorado School of Mines Office of Technology Transfer
Inventions disclosed: 33
Patents applications filed: 22
U.S. patents issued: 9
Startup companies formed: 2

University of Wyoming Research Products Center
Invention disclosures: 128
Patents applications filed: 31
U.S. patents issued: 8
Startup companies formed: N/A

Anticipation builds over patent office

BY MICHAEL DAVIDSON

Drapkin

It took hours of meetings, thousands of airline miles and a persistence one federal official joked was akin to stalking for Denver to land one of the first U.S. Patent and Trademark Offices outside the Washington, D.C., area.

But if the office, scheduled to open in downtown Denver by September 2014, has anything close to the projected $440 million overall economic impact its boosters expect, it will have been more than worth it.

The U.S. Patent and Trademark Office announced in July that it would open three satellite offices around the United States, and that one would be in Denver. An additional office already has opened in Detroit.

The announcement came after an intense lobbying effort from local elected officials, business leaders and lawyers.

Michael Drapkin, a lawyer at the Boulder office of Holland & Hart, helped lead the effort. Drapkin said he made 15 trips to Washington over four years to promote the idea, and other lawyers and officials did the same.

In the big picture, the office will help the USPTO's efforts to modernize, add staff and attract better talent to its ranks, Drapkin said. Through September, the office had a backlog of more than 608,000 patents to review.

The long waiting period to know whether a patent is approved or to appeal a rejection is a drain on inventors trying to build a company around their ideas.

"Having a more efficient patent office really does benefit the small inventor," Drapkin said.

Since its founding, the USPTO has been based in the Washington, D.C., area, where it employs about 7,800 examiners.

"That's great for people who live in the Beltway," Drapkin said. "But not having satellite offices distributed throughout the U.S. is not fair."

Inventors who needed to meet with a patent examiner or judge have had to make the long trip, as have their lawyers. The Denver office will save inventors throughout the West a lot of travel and money, Drapkin said.

While shorter trips could benefit some inventors right away, it might take years to understand the true impact of the office, said Curtis Vock, a partner at Lathrop & Gage. It is expected the office will employ about 130 workers when it opens, but the staff could grow to almost 600.

Some applications might end up going to the D.C. area, but the odds of staying close to home will grow increasingly favorable to local inventors.

"It will be more and more likely you'll be able to see the examiner in Denver," Vock said.

The future office also will have intangible benefits for local inventors and intellectual property lawyers.

"I think it's going to be great because it will add a buzz we've never had here before," Vock said.

The funding quest

Companies, nonprofits and others step in as government support ebbs

BY BETH POTTER

COURTESY OF CSU

Colorado State University's Engines and Energy Conversion Laboratory is funded mainly from private donations. From left: Gov. John Hickenlooper, CSU President Tony Frank, Dr. Bryan Willson, founder and director of the lab, and Bill Ritter, former governor and director of the Center for the New Energy Economy at CSU. The group toured the lab in May 2011.

Professors and students at universities along the Front Range and Wyoming work hard to get money for research from any source where they can find it.

Funding from federal institutions such as the National Institutes of Health, the National Science Foundation and the National Aeronautics and Space Administration still dominates the millions of dollars that flow into research institutions in the region. However, private companies, nonprofits and individuals also step up to the plate on a regular basis to give money to targeted research projects.

For example, Colorado State University associate professor Mark Paschke and a team of graduate students are focused on ecological restoration research on the Western Slope as part of a $2 million endowed chair from Shell Oil Co.

The original $18.5 million Engines and Energy Conversion Lab at CSU in Fort Collins also received sizable donations from private donors, including $5 million from the Bohemian Foundation and $2.5 million from Woodward Inc. Other researchers at CSU get funding from Exxon Mobil Corp. and other companies.

"Within our college, the vast majority of the money still comes from the government for sponsored research, but that's getting smaller, and the amount coming from private industry is increasing," said Paschke, who holds the Shell Endowed Chair of Restoration Ecology in the Warner College of Natural Resources.

While sponsored research dollars from private companies and foundations makes up less than 25 percent or so of the total received at area universities, researchers and administrators are working to make the numbers rise.

At CSU, for example, Lou Swanson, vice president for research and industry engagement, is responsible for pushing private company proposal agreements up 65 percent to $38 million in fiscal 2012 vs. $23.2 million in 2011.

CSU has long-standing relationships with a wide variety of private-sector entities because of its culture as a land-grant institution, said Kathi Delehoy, senior associate vice president for research administration.

Tuberculosis researchers at CSU recently received $3.65 million from the Bill and Melinda Gates Foundation. In all, Gates has given about $11 million in grants to the CSU Foundation to be used for tuberculosis research projects and others, Delehoy said.

The Gates Foundation also funds research programs at the University of Colorado-Boulder, including a recent $100,000 grant to Mobile Assay Inc. to do research on mobile applications for seed-borne pathogens.

Gates also has been heavily involved in funding for research for a human papilloma virus, vaccine for the developing world. Robert Garcea, a doctor and researcher at the BioFrontiers Institute at CU-Boulder, is working to create an inexpensive version of the vaccine. Garcea also is working with a few as-yet-unnamed Colorado companies to get a vaccine that can be sold commercially.

At the University of Wyoming, Marathon Oil Corp. gave $1 million for research aligned with the state's energy industry this year. The gift will be leveraged with public funds of up to additional $1 million to help the university pursue partnerships with companies in the industry.

The Marathon Oil announcement is the first of several public-private partnerships expected to total $30 million this year.

A $100,000 award came to CU-Boulder professor Deborah Jin — an adjunct professor of physics and a fellow of the National Institute of Standards and Technology — in the form of a L'Oréal-UNESCO For Women in Science award. Jin was cited by an awards jury "for having been the first to cool down molecules so much that she can observe chemical reactions in slow motion, which may help further understanding of molecular processes which are important for medicine or new energy sources."

The long-sought milestone was achieved at JILA, formerly known

as the Joint Institute of Laboratory Astrophysics at CU-Boulder, in 2008.

Still, an estimated 90 percent of all university research funding continues to come from the public sector, according to people involved with getting research technology commercialized.

If you're a local company spinning out of research at an area university, you most likely have benefited from a government grant. Of course, sometimes, private money follows public dollars.

Delehoy

Paschke

For example, InDevR LLC, a diagnostics test company in Boulder, received a $3 million, three-year grant from the National Institutes of Health to work on a flu test.

InDevR more recently received a $5.8 million grant through the federal Defense Advanced Research Projects Agency.

The company leveraged the research grant to collaborate with GE Global Research to develop a device that can diagnose flu and other infectious diseases such as malaria, E. coli and salmonella.

GE Global Research is the central technology development arm of General Electric Co.

Research dollars

- In the four-campus University of Colorado system, all non-federal sponsored program awards totaled $222.1 million in fiscal 2011, the most recent period for which figures were available, about one-quarter of the total $793.4 million in awards.
- Anschutz Medical Campus in Aurora had $400.1 million in total public and private funding for FY 2011; CU-Boulder had $359.1 million; CU-Denver had $21.8 million; and CU-Colorado Springs had $12.4 million.
- The non-federal funding portion breaks down to: Anschutz Medical Campus, $134.7 million; CU-Boulder, $77.6 million; CU-Denver, $5 million; and CU-Colorado Springs, $4.8 million.

Sponsored program agreements can include consulting agreements and scholarship awards, as well as direct private funding.

Research parks draw technology, economic development

BY BETH POTTER

Universities and laboratories in Colorado and Wyoming are teeming with great ideas. Some could change the world — and be worth millions.

Whether they're full-blown business incubators and just a cluster of buildings, research-park complexes are serving as focal points for drawing research funding to the Front Range and Wyoming.

And now, construction may soon begin on what is perhaps one of the more ambitious research park projects in the wider region.

The Cirrus Sky Park planned in Laramie could encompass 150 acres on land in a $7 million transaction. University of Wyoming officials have an option to buy about 23 acres of the parcel.

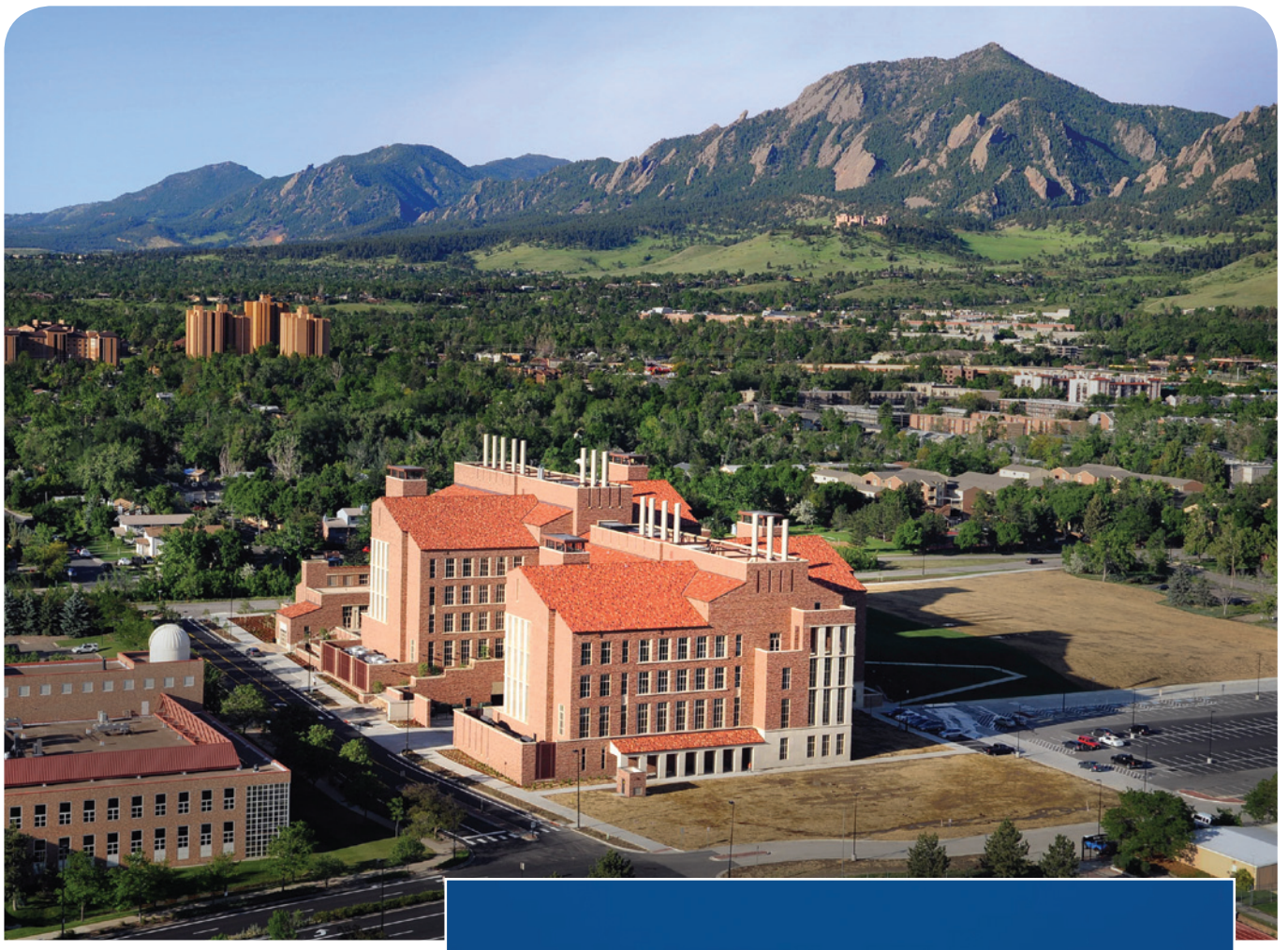
Companies that graduate from the Wyoming Technology Business Center incubator may someday have homes in the new research park, said Christine Langley, chief operating officer at the incubator, which has been operating since 2006.

"Hopefully, we'll spin out companies into the possible future research park," Langley said, "but right now our graduates spin out into the local community."

Until then, interest is growing from high-tech companies in the region in the new park, said Gaye Stockman, president and chief executive of the Laramie Economic Development Corp. Economic development officials want to move quickly on the project. Construction could start in March, if everything goes as planned with funding, Stockman said.

"It's a quick process," Stockman said. "It won't be years in the making."

A recent study in Laramie found the city houses more than 60 technology firms, several of which are expected to move to the new Cirrus Sky Park. The Laramie Economic Development Corp. has asked the Wyoming Business Council for $5.4 million to help buy the land.



COURTESY OF THE CU

The Jennie Smoly Caruthers Biotechnology Building is a 336,800-square-foot research and teaching facility on CU-Boulder's East Campus.

COURTESY OF CSU

Colorado State University's Research Innovation Center is part of its Foothills campus.

The potential for success is there.

In Fort Collins, the 60,000-square-foot Research Innovation Center was built in 2010 with more than $50 million in bonds on Colorado State University's Foothills campus. It quickly attracted eight startup companies, said Rick Lyons, director of the Infectious Disease Research Center. Lyons also oversees the building.

Those tenants include CHD Biosciences Inc., which develops sterilization products, Prieto Battery, which has an innovative new battery product, Advanced MicroLabs, which is developing sensor technologies, and Vivaldi Inc., a vaccine lab specializing in influenza.

With the incubator on the top floor of the building and academic labs on the first floor, the companies are "very much embedded into the university culture," Lyons said. "The whole point is to enhance collaborative interactions between the private sector and the academics here."

In one such collaboration, CHD Biosciences workers needed some help with some animal experiments and were able to get it from CSU faculty working nearby, Lyons said.

The building's annual operating budget is $2 million. Millions of dollars more in funding is generated from the incubator every year, Lyons said.

In addition to the Infectious Disease Research Center, the building

houses a National Institute of Allergy and Infectious Diseases office, a division of the National Institutes of Health that has funding of $25 million to $35 million over a five-year period, Lyons said.

The facility has several special biosafety labs to support the infectious-disease research as well as a 7,700-square-foot vivarium, an enclosed area used to study organisms.

Elsewhere, the nonprofit Innovation Center of the Rockies in Boulder now has relationships with the University of Colorado, Colorado School of Mines, Colorado State University and the University of Denver's Office of Technology Transfer.

Executive Director Tim Bour oversees an incubator in Boulder as well as related programs involved with helping universities commercialize inventions and intellectual property. Client companies work with the incubator for about three or four months before "graduating" into the market, Bour has said.

The incubator has had clients in a wide variety of industries, including

Langley

natural and organic, software, renewable energy/clean tech, bioscience, nanotechnology, optical-products and engineered-products. The incubator gets money from the public and private sectors as well as from client fees.

Another piece of the "research park" puzzle in Boulder is in the Jennie Smoly Caruthers Biotechnology Building, a 336,800-square-foot research and teaching facility on CU-Boulder's East Campus. More than 60 faculty and 500 researchers and staff are housed in the building.

Research space in the new building was designed specifically to create an environment that promotes collaboration between scientists, according to people involved with the building. It was funded by $65 million in private support as well as public and university support.

In Aurora, more than 100 companies have passed through the Fitzsimons Research Park on the $1.5 billion Anschutz Medical Campus.

Several collaborations are going on at the research park.

• Researchers at the Charles C. Gates Center for Regenerative Medicine and Stem Cell Biology have a new technique to cultivate red blood cells, which can be used to make blood. The technique would need to go through human clinical trials to get necessary U.S. Food and Drug Administration approval before being commercialized.

• Researchers in a separate project developed a biofeedback device to help promote weight loss. The device is enabled to work with Bluetooth and tracks the calories a user burns.

• Researchers at the University of Colorado Cancer Center discovered a new diagnostic biomarker for colon cancer.

Some well-known local bioscience companies passed through the Anschutz campus as well.

Myogen Inc. was one. The company created a hypertension drug based on research from CU-Boulder, the CU Health Sciences Center in Aurora and the University of Texas Southwestern Medical Center. Myogen Inc. was sold for $2.5 billion in 2006 to Gilead Biosciences Inc. in Foster City, Calif.

Arca Biopharma Inc. in Boulder also came out of the Anschutz incubator. The company makes drug treatments targeting heart disease.

The incubator is governed by the Fitzsimons redevelopment authority, representing the city of Aurora and the University of Colorado.

The money men (and women)

BY JOSH COOLEY

Denver start-up FullContact was incubated in 2011 with $1.5 million in Series A funding. Its business model proved worthy, and the cloud-based contact management service landed $7 million in Series B funding in July 2012.

"For us, raising a round lets us hire a bigger team and accelerate our plans to grow the company," said Kipp Chambers, marketing engineer at FullContact.

FullContact now has 18 employees and is hiring.

"We planned on doing all of this eventually through our own growth," Chambers said. "But the infusion of funds allows us to move forward and get our products to market more quickly."

FullContact's experience is indicative of Colorado's venture-capital fueled economy at large. Colorado attracted more than $3.5 billion in VC investments between Jan. 1, 2007 and Sept. 30, 2012, according to the National Venture Capital Association.

It's not just tech companies getting the money.

Door to Door Organics, a Lafayette-based company, raised $2 million in the third quarter of 2012. The company, founded in 2005, partners with farmers to bring fresh, organic produce and natural groceries to homes, offices and co-ops in Colorado.

"Over the years, we have developed a deep relationship with our customers, and have been working toward our vision to build the best e-grocery experience on the planet," said Chad Arnold, CEO and president of DTDO. "Raising a round of capital helps to validate that vision and all that we have already accomplished, which motivates the whole team."

> "Venture capital goes to where there's a lot of innovation."
>
> – Brad Feld
> Foundry Group

Colorado's Front Range cities have achieved a critical mass that attracts innovative companies and the investors who infuse them with cash.

"They really have a fantastic ecosystem," said Emily Mendell, vice president of communications for the NVCA. "It's an example we often point to as a region that has successfully built a thriving start-up ecosystem."

Companies that get VC funding can benefit the entire entrepreneurial "ecosystem."

"The experience, intellectual talent and networks that can be established through a venture relationship can be very important," said Arnold. "The funding can also establish a level of business viability in the marketplace, enabling relationships with key vendors and customers that weren't previously possible."

Boulder, with a population of about 100,000, ranked 16th nationally in 2011-2012 for VC investment, while Denver, with a population of about 620,000, ranked 20th, according to the NVCA.

"Boulder has the highest concentration of startups on a business basis, and it's probably the highest percentage in the world," said Brad Feld, managing director of the Foundry Group, a Boulder-based VC firm. "It's open, collaborative, forward-looking, and innovative – it's very exciting. Collaboration wins."

Boulder's entrepreneurial environment was not created by chance.

"We've developed a framework for how this has worked that we call the 'Boulder Thesis,'" said Feld.

What does that thesis hold?

For starters, "the startup community must be led by entrepreneurs," said Feld. "They (also) must take a long-term view toward building the startup community; they must be inclusive of anyone who wants to get involved and they have to have activities and events that engage the entire entrepreneurial stack."

"Innovation is essential in any society long-term, as a country and a society," Feld continued. "Humans fundamentally like to create things, and if you can create that vibrancy, you create a place where people want to be."

Boulder, as everyone knows, consistently attracts innovators.

"I've always believed that venture

capital goes to where there's a lot of innovation, and a lot of investors from around the country are investing in Boulder companies," Feld said.

Some of the most promising startups get incubated by TechStars, a startup accelerator that funds technology-oriented companies and provides education, networking and coaching.

To date, TechStars companies have raised more than $232 million in funding and have hired more than 1,000 full-time employees.

"Almost all of the net new job growth in 30 years has come from new companies," Feld said. "This engine of job creation is innovation and the creation of new companies."

Startup Colorado and Startup Weekend are additional initiatives that help nurture the state's entrepreneurial ecosystem.

Faculty and researchers at Colorado's universities also generate ideas that attract VC funding which lead to the commercialization of their products. For example, CSU Ventures, a nonprofit 501(c) (3) at Colorado State University in Fort Collins, helps its inventors acquire VC funding and commercialize their products.

"Colorado has a very good climate for entrepreneurship," said Todd Headley, president of CSU Ventures. "There's a lot of innovation coming out of Colorado, and out of the universities. It's a great place to live, and so people who want to do these sorts of things are here. You want to provide them with the ecosystem and the opportunity to succeed."

CSU Ventures has helped launch startups like Prieto Battery, a company that invented a revolutionary rechargeable lithium-ion battery technology and Solix Biosystems, a developer of algae-production technology designed to produce algal biocrude and other algal products on an industrial scale.

Wyoming sees less VC – it had only one deal worth $1 million in the first half of 2012, according to the NVCA.

However, vested economic entities in Wyoming have worked to create a business-friendly atmosphere that supports entrepreneurs and helps launch startups.

The state of Wyoming's federally-funded Small Business Innovation Research operation, its Small Business Technology Transfer Initiative and its Phase 0 Program, are co-managed by the Wyoming Business Council and the University of Wyoming Research Office to incubate startups.

"Wyoming has received over $50 million in SBIR/STTR funding," said William Gern, vice president of research and economic development at UW. "Per capita, that's more than what we should be getting. We think Wyoming was the first state to initiate an official statewide Phase 0 Program, and we think other states have emulated us."

The Phase 0 program annually provides up to 24 awards to startups in the amount of $5,000 each. Startups are emerging in the state, particularly in the southeast corner, despite a lack of institutional VC dollars.

"There is really getting to be an exciting cluster of tech businesses in the Laramie area," said Ben Avery, business and industry division director for the WBC. "There have been six or seven companies that have incubated there, and there's a cluster of tech businesses that employ collectively 100 people. Over time as these grow, mature and network, we'll see more investment from private equity."

University researchers, companies work together for technological advances and business opportunities

BY BETH POTTER

Innovation, as any mad scientist will acknowledge, rarely happens as a solitary pursuit, which is why collaborations between researchers, companies and universities are increasingly on the rise across the Front Range and Wyoming.

It's what some might call a virtuous cycle.

Researchers create new products and technologies, then license them from universities and create new companies. Large sums of money often end up with the university in such a case — money that can be used to help other researchers work on commercializing yet another new product or technology.

And so on and so on.

Larry Gold, a University of Colorado-Boulder professor and a biotech "serial entrepreneur," is well known for helping create one of the more high-profile collaborations.

Gold hosts the annual GoldLab Symposium to bring leaders in the health-care industry to Boulder to speak. He also is a founder of SomaLogic Inc., a company that researches proteins in the body used as biomarkers for disease.

In 1989, Gold and a graduate student started working on the technology in his lab, funded by a $100,000 grant from the National Institutes of Health.

Since then, Gold estimates the industry has spent $1 billion in similar research — and now SomaLogic partners with leading national companies such as Quest Diagnostics Inc. in New York and Novartis International AG, based in Basel, Switzerland.

"We have done a good job of getting into collaborations with really smart, good people," Gold said. "It's thrilling. You learn new stuff every day, and you can't ask for more than that."

Gold also is known for founding NeXagen Inc. in Boulder, which later became NeXstar Pharmaceuticals Inc. In 1999, NeXstar merged with Gilead Sciences Inc. to form a company that would develop products to treat infectious diseases.

SomaLogic is just one of many examples of smaller companies collaborating with big national firms on research projects.

The new Jennie Smoly Caruthers biotechnology building on the University of Colorado Boulder campus is another place where collaboration is part and parcel of everyday thinking.

Boulder professor and biochemist Marv Caruthers donated $20 million to the university in 2007 in his wife's name, after she died of cancer.

Marv Caruthers was a co-founder of Amgen Inc. and a founder and investor of several other Boulder biotech companies. Now based in Thousand Oaks, Calif., Amgen is the largest biotechnology company in the world, and employs about 700 people at facilities in Boulder and Longmont.

Caruthers is known for designing techniques to build DNA and RNA, the molecules of heredity in the human body. He received a National Medal of Science from the White House in 2007 for his work.

Working at the Jennie Smoly Caruthers building is Tom Cech, Nobel Prize laureate who won the prize in chemistry in 1989. Cech is director of the BioFrontiers Institute, which is designed to encourage collaboration between researchers and companies.

At the University of Colorado at Denver, faculty members in the departments of ophthalmology and bioengineering who started the company ShapeTech LLC recently signed a collaboration agreement with Abbott Medical Optics Inc. in Santa Ana, California.

The two companies will jointly develop new polymers used in cataract surgery.

Several research projects at CU's Anschutz Medical Campus recently received up to $250,000 each in grants from the state of Colorado to help them move their products and research toward commercialization. The researchers had to show matching federal grants or non-founder private investment to be eligible for the money.

AUROGEN INC
City: Fort Collins
Founder/GM: Douglas Ishii
Year of Spinoff: 1992
Tech developed: Pharmaceutical treatments for neurodegenerative disorders
Status: Active
No. of employees: 3

Aubrey Poore (seated) and Jeff Poore

NUMERICA
City: Loveland
Founder/GM: Aubrey Poore
Year of Spinoff: 1996
Tech developed: Tracking and data-fusion solutions; DOD mathematical solutions
Status: Active
No. of employees: 65

CYTOLOGIC
City: Boulder
Founder/GM: Paul Thompson, Mark D Howell, Lee Leber
Year of Spinoff: 1998
Tech developed: Biomedical-based technology device for cancer treatment
Status: Active but not operational, pending resolution of certain legal issues
No. of employees: 0

FOOD FRIENDS
City: Fort Collins
Founder/GM: Jennier Anderson, Debbie Vosters
Year of Spinoff: 2002
Tech developed: Nutrition education programs for preschoolers
Status: Active
No. of employees: 2

Bryan Willson

ENVIROFIT INTL
City: Fort Collins
Founder/GM: Bryan Willson
Year of Spinoff: 2003
Tech developed: Clean, efficient cook-stove technology; two-stroke engine retrofit kits; solar lighting technology
Status: Active
No. of employees: 20

ATMET LLC
City: Boulder and Lafayette
Founder/GM: Craig Tremback, Robert Walko and Roni Avissar
Year of Spinoff: 2001
Tech developed: Meteorological modeling
Status: Active
No. of employees: N/A

BROTICA
City: Bellvue
Founder/GM: Lou Bjstad, Elisa Bernklau
Year of Spinoff: 2002
Tech developed: Termite attractants and monitoring systems
Status: Active
No. of employees: 6

ADVANCED MICROLABS
City: Fort Collins
Founder/GM: Charles Henry
Year of Spinoff: 2003
Tech developed: Lab-on-a-chip based monitoring and detection
Status: Active
No. of employees: 10

KEEN INGREDIENTS
City: Louisville
Founder/GM: Claire Burnett, Laurie Scanlin
Year of Spinoff: 2004
Tech developed: Quinoa products
Status: Active
No. of employees: 1

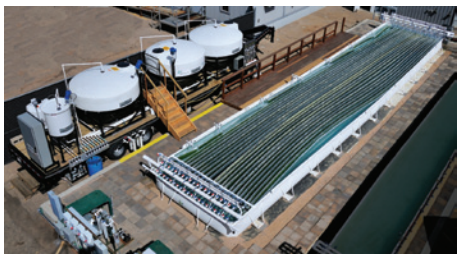
BIOPOLY LLC
City: Fort Wayne, Ind
Founder/GM: Susan James
Year of Spinoff: 2006
Tech developed: Self-lubricating polymers
Status: Subsidiary, Schwartz Biomedical
No. of employees: N/A

GONEX
City: Boulder
Founder/GM: Terry Nett, Michael Glode
Year of Spinoff: 1996
Tech developed: Compounds that can be administered as a single injection to pharmaceutically sterilize any animal
Status: Active
No. of employees: N/A

Image from NCBR 2007

OPTIBRAND LTD
City: Fort Collins
Founder/GM: Dr Bruce Golden, Ralph Switzer, Bernard Rollin
Year of Spinoff: 1998
Tech developed: Patented technology for auto capture of retinal images
Status: Active
No. of employees: 2

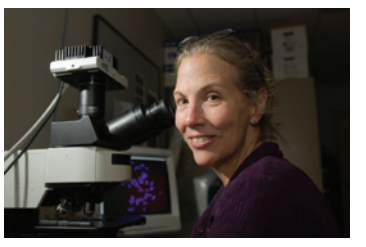
DRIVVEN
City: San Antonio, Texas
Founder/GM: Matt Viele
Year of Spinoff: 2003
Tech developed: Automotive control and data acquisition solutions for research and production applications
Status: Acquired
No. of employees: N/A



Solix Lumian Ags4000, from NCBR April 22, 2011

SOLIX BIOFUELS
City: Fort Collins
Founder/GM: Bryan Willson
Year of Spinoff: 2006
Tech developed: Algae-based biofuels production
Status: Active
No. of employees: 20

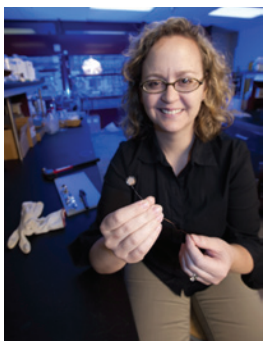
BEKEN LEARNING SYSTEMS
City: LaPorte
Founder/GM: Steve Benoit
Year of Spinoff: 2007
Tech developed: Online instruction, homework and assessment systems
Status: Active
No. of employees: N/A



Susan Bailey

KROMATID
City: Fort Collins
Founder/GM: Susan Bailey, Edwin Goodwin, Joel Bedford, Andrew Ray, Michael Cornforth
Year of Spinoff: 2007
Tech developed: Molecular cytogenetics assays, reagents and kits for use in research and clinical laboratories
Status: Active
No. of employees: 5

PHYTODETECTORS, INC
City: Fort Collins
Founder/GM: June Medford
Year of Spinoff: 2008
Tech developed: Plant-based sensors for environmental monitoring applications or synthetic biology
Status: Active
No. of employees: 2



Amy Prieto

PRIETO BATTERY
City: Fort Collins
Founder/GM: Amy Prieto
Year of Spinoff: 2009
Tech developed: Rechargeable lithium-ion battery technology
Status: Active
No. of employees: 9

PLURA BIOSCIENCES
City: Lafayette
Founder/GM:
Year of Spinoff: 2010
Tech developed: Vendor of specialized catalysts and chemicals for the manufacture of life science products
Status: Active
No. of employees: 2

XUV INC
City: Fort Collins
Founder/GM: Carmen Menoni, Jorge Rocca
Year of Spinoff: 2010
Tech developed: Soft lasers: Compact extreme ultra-violet laser sources
Status: Active
No. of employees: 3

SEAFORTH
City: Fort Collins
Founder/GM: Azer P. Yalin
Year of Spinoff: 2011
Tech developed: High-energy fiber-optic laser delivery solutions for engine and industrial applications
Status: Active
No. of employees: 1

RIDGELINE INSTRUMENTS
City: Broomfield
Founder/GM: Francesc Junyent
Year of Spinoff: 2011
Tech developed: Design, construction, programming, and maintenance of custom-radar instrumentation
Status: Active
No. of employees: N/A

THIN AIR NITROGEN SOLUTIONS
City: Fort Collins
Founder/GM: Michael Massey, Jessica Davis, Jessica Gwyn Davis
Year of Spinoff: 2008
Tech developed: Bacteria-based nitrogen extraction from plant fertilizer
Status: Active
No. of employees: 3

CARBO ANALYTICS
City: Fort Collins
Founder/GM: Dale Willard
Year of Spinoff: 2011
Tech developed: Lab-on-a-chip technology for analysis of sugar for sugar related industries
Status: Active
No. of employees: 7

DIAZAMED
City: Fort Collins
Founder/GM: Melissa Reynolds
Year of Spinoff: 2012
Tech developed: Technology for the development of medical device coatings to prevent blood-clotting and infection
Status: Active
No. of employees: 2

LUMIERE DIAGNOSTICS
City: Fort Collins
Founder/GM: Lawrence Goodridge
Year of Spinoff: 2012
Tech developed: Food and water-safety diagnostics
Status: Active
No. of employees: 2

OPTIENZ SENSORS
City: Centennial
Founder/GM: Kenneth Reardon
Year of Spinoff: 2010
Tech developed: Measurement/ monitoring capabilities for organic chemical concentration
Status: Active
No. of employees: N/A

CAROS CONSULTING
City: Fort Collins
Founder/GM: Jeni Cross, Pat Aloise-Young, Gwen Sieving
Year of Spinoff: 2011
Tech developed: Consultants with expertise in implementing energy efficiency programs at large organizations
Status: Active
No. of employees: 3

VetDC from 2012 Rocky Mountain Tech

VETDC
City: Fort Collins
Founder/GM: Steven Roy
Year of Spinoff: 2009
Tech developed: Animal health/veterinary products
Status: Active
No. of employees: 5

GLIACOR THERAPEUTICS
City: Fort Collins
Founder/GM: Dr Ronald Tjalkens, Stephen Safe, Dorothy Colagiovanni
Year of Spinoff: 2011
Tech developed: Anti-inflammatory therapeutics for halting the progression of Parkinson's disease
Status: Active
No. of employees: 3

Dean Hendrickson

SURGIREAL
City: Fort Collins
Founder/GM: Dean Hendrickson, Fausto Bellezzo
Year of Spinoff: 2012
Tech developed: Simulators that offer "life-like" surgical training technology
Status: Active
No. of employees: 2

AIG INSTRUMENTS
City: Littleton
Founders: Devin Karns, Jonathan Meuser, Matthew Posewitz, Edward Dempsey
Year of spinoff: 2010
Tech developed: instruments for the measurement of various elements and compounds in an accurate and non-obtrusive manner during the production of biofuels.
Status: Active
No. of employees: Not available

Will Fleckenstein

FRACOPTIMAL
City: Louisville
Founder(s): Will Fleckenstein
CEO: Todd Flaska
Year of spinoff: 2011
Tech developed: Bringing to market a device to optimize fracking operation in oil wells by not constraining the width of the tube and allowing several more fracking sites per well.
Status: Active
No. of employees: 3

METAFLUIDICS
City: Golden
Founder(s): David Marr; John Oakey
Year of spinoff: 2002
Tech developed: diagnostic lab on a chip using novel optical trapping, fluorescence detection and fluid control technology.
Status: Inactive
No. of employees: Not available

MICROPHAGE

MICROPHAGE
City: Longmont
Founder(s): Kent Voorhees
CEO: Don Mooney
Year of spinoff: 2002
Tech developed: easy-to-use, rapid diagnostics that provide the information on bacterial infections.
Status: Active
No. of employees: 22

OPTITECH
City: Golden
Founder(s): Kadri Dagdelen;
CEO: Kadri Dagdelen
Year of spinoff: 2005
Tech developed: Computer modeling of undergroud oil reservoirs
Status: Active
No. of employees: Not available

Stephen Boyes

THERAGNOS
City: Golden
Founder(s): Stephen Boyes
CEO: Stephen Boyes
Year of spinoff: 2008
Tech developed: Develops theragnostic (diagnostic and therapeutic) nanodevices which have a number of applications in the emerging medical field of theragnostics.
Status: Active
No. of employees: Not available

TCP BIOMEDICAL
City: Golden
Founders: Reed Ayers
CEO: Inga Tamayo
Year of spinoff: 2012
Tech developed: Bone replacement material made using a proprietary reaction and uses no bovine material.
Status: Active
No. of employees: Not available

INNOVATIVE LASER SOLUTIONS
City: Denver
Founder(s): Jeff Squier
CEO: Naresh Mandava
Year of spinoff: 2011
Tech developed: new laser technology to allow a greater accuracy and area ablated in laser eye surgery.
Status: Active
No. of employees: Not available

FORO ENERGY

COURTESY FOROENERGY.COM

FORO ENERGY
City: Lakewood
Founder(s): Ramona Graves
CEO: Joel Moxley
Year of spinoff: 2008
Tech developed: high-power lasers for drilling in the oil, natural gas, geothermal, and mining industries.
Status: Active
No. of employees: Not available

NANOTHREAD
City: Arvada
Founder(s): Mark Lusk
Year of spinoff: 2008
Tech developed: highly purified single-walled and multi-walled carbon nanotubes by a unique process that will yield any length desired and, potentially, with control of chiralty and therefore electrical and physical properties and without the need for extensive purification.
Status: Inactive
No. of employees: Not available

2B TECH (INDEVR)
City: Boulder
Founder(s): John Birks et al.
Year of spinoff: 2003
Tech developed: only manufacturer of portable high-precision, high-accuracy ozone monitors based on UV absorbance.
Status: Merged

3QMATRIX
City: Boulder
Founder(s): Christopher Bowman, Kristi Anseth et al.
CEO: Johan Baeck,
Year of spinoff: 2008
Tech developed: Degradable thiolene hydrogel for wound care and drug delivery
Status: Inactive

ADVANCED CONDUCTOR TECHNOLOGIES
City: Boulder
Founder(s): Danko van der Laan
Year of spinoff: 2012
Tech developed: High-performance superconducting cables for power transmission and energy storage
Status: Active

AGENTSHEETS
City: Boulder
Founder(s): Alexander Repenning
Year of spinoff: 1997
Tech developed: Game authoring technology, educational simulation tools
Status: Active
No. of employees: 4

ALD NANOSOLUTIONS
City: Broomfield
Founder(s): Steven George, Alan Weimer et al.
CEO: P. Michael Masterson
Year of spinoff: 2003
Tech developed: Atomic layer deposition (ALD) coating chemistry methods for depositing ultra-thin films on particulate surfaces.
Status: Active

AMIDEBIO
City: Louisville
Founder(s): Michael Stowell et al.
Year of spinoff: 2010
Tech developed: Novel manufacturing method for peptide and protein research reagents and clinical products
Status: Active

AQUALEX GROUP (FKA MERIDIAN WATER)
City: Boulder
Founder(s): JoAnn Silverstein
Year of spinoff: 2004
Tech developed: Biological denitrification of water
Status: Active

2C TECHNOLOGIES
City: Senegal
Founder(s): Jeffrey Olson, Naresh Mandava
CEO: Ramgopal Rao
Year of spinoff: 2008
Tech developed: Method for treating vision loss and blindness due to retinal damage

ACCELERATION BIOPHARMACEUTICALS INC.
City: Watertown, Mass.
Founder(s): Leland Shapiro
CEO: Lynn, Ralf
Year of spinoff: 2003
Tech developed: Develops proprietary, immune-based therapies for viral and inflammatory diseases.
Status: Active

AGADA PHARMA (FKA NEWELLINK)
City: Boulder
Founder(s): M. Karen Newell Rogers
Year of spinoff: 2003
Tech developed: cancer treatment, dichloroacetate, a chemical compound, robs cancerous tumors of the energy they need to grow.
Status: Inactive

AKTIV-DRY
City: Boulder
Founder(s): Robert Sievers, Brian Quinn, John Carpenter
CEO: Robert Sievers
Year of spinoff: 2002
Tech developed: dry powder stabilization and processing solutions for the vaccine, pharmaceutical, and biotechnology industries.
No. of employees: 5

ALLOGENESIS
City: Denver
Founder(s): Mark Roedersheimer
Year of spinoff: 2009
Tech developed: Wound-healing extract for treating burns and other tissue damage
Status: Active

APOPLOGIC PHARMA
City: Aurora,
Founder(s): Richard Duke, Donald Bellgrau, John Stewart, Lajos Gera, Paul Bunn, Daniel Chan et al.
Year of spinoff: 2006
Tech developed: Development and commercialization of Breceptin, a unique oncolytic drug for the treatment of a wide range of solid tumors. Breceptin induces cancer cell apoptosis by targeting specific receptors on the surface of the tumor cells.
Status: Active

ARCA BIOPHARMA
City: Broomfield
Founder(s): Michael Bristow, Carmen Sucharov et al.
CEO: Michael R. Bristow
Year of spinoff: 2005
Tech developed: pharmacologically unique beta-blocker and mild vasodilator being developed for the prevention of atrial fibrillation in patients with heart failure.
Status: Merged
No. of employees: 11

ASTRA LITE
City: Boulder
Founder(s): Steven Mitchell et al.
Year of spinoff: 2012
Tech developed: LIDAR device for determining remotely and accurately depths of semi-transparent media
Status: Active

BIOAMPS INTERNATIONAL
City: Aurora
Founder(s): Robert Hodges, Yuxin Chen et al.
Year of spinoff: 2008
Tech developed: Antimicrobial compounds for treatment of lethal infectious diseases
Status: Inactive

BIORELIX
City: New Haven, Conn.
Founder(s): Robert Batey et al.
CEO: Brian Dixon
Year of spinoff: 2007
Tech developed: Use of novel bacterial RNA targets called RiboSwitches for targeted antibiotics
Status: Active

COURTESY BIOTRICITYMEDICAL.COM

BIOTRICITY MEDICAL
City: Aurora
Founder(s): Simon Rock Levinson
Year of spinoff: 2009
Tech developed: Implantable biogenerator to create an indefinite power supply for implanted medical devices
Status: Active

BLUESUN
City: Colorado Springs
Founder(s): Charles C. “Chip” Benight
Year of spinoff: 2008
Tech developed: Web-based self-help service for post-traumatic recovery of individuals suffering from mental trauma
Status: Active

CARDIAC ACCESS
City: Denver
Founder(s): Roop Mahajan, Manish Marwan
Year of spinoff: 2004
Tech developed: application of an artificial neural network to the challenge of accurately screening for and diagnosing heart murmurs
Status: Inactive

ARCHEMIX
City: Cambridge, Mass.
Founder(s): Larry Gold et al.
CEO: Kenneth M. Bate
Year of spinoff: 2001
Tech developed: aptamer therapeutics for the prevention and treatment of chronic and acute diseases in Massachusetts. Its aptamer product candidates include ARC1779 for thrombotic microangiopathyies and carotid endarterectomy surgical procedure.
Status: Active

BAROFOLD
City: Aurora
Founder(s): Theodore Randolph, John Carpenter et al.
Year of spinoff: 2003
Tech developed: PreEMT is a patented technology for the disaggregation and controlled refolding of proteins with high fidelity of native structure at yields and efficiencies not always achievable using existing technologies.
Status: Active

BIOPTIX (FKA ALPHASNIFFER)
City: Boulder
Founder(s): Dana Anderson, Victor Bright et al.
CEO: Richard Whitcomb
Year of spinoff: 2004
Tech developed: proprietary E-SPR (Enhanced Surface Plasmon Resonance) technology platform for the detection of molecular interactions
Status: Active

BIOSIPS
City: Boulder
Founder(s): Julee Herdt, Kellen Schauermann
Year of spinoff: 2011
Tech developed: Environmentally-friendly structural insulated panels for building construction
Status: Active

CANN-EASE
City: Boulder
Founder(s): Tony Jones
Year of spinoff: 1995
Tech developed: clear, greaseless topical treatment developed specifically for dryness and friction associated with the use of oxygen by nasal cannula and CPAP/IBIPAP masks.
Status: Active

BLACK HOLE VISUALIZATIONS
City: Boulder
Founder(s): Andrew Hamilton
Year of spinoff: 2010
Tech developed: scientifically accurate general relativistic visualizations for use in movies and television.
Status: Active

CARDIOCEUTICS
(FKA KEYSTONE BIOMEDICAL)
City: Westminster
Founder: Lawrence Horwitz
Year of spinoff: 1997
Tech developed: dedicated to commercializing the antioxidant bucillamine — its primary drug development program — for the prevention and treatment of major diseases lacking safe and effective therapeutic options.
Status: Active

CDM OPTICS
City: Boulder
Founder(s): W. Thomas Cathey, Edward Dowski
Year of spinoff: 1997
Tech developed: commercializing CU technology for improving the clarity and depth of field of optical images.
Status: Acquired

CLARIMEDIX
City: Boulder
Founder(s): Robert Poyton, Michael Stowell
Year of spinoff: 2011
Tech developed: Pipeline focused on vascular dysfunction. Technology is a non-invasive light-based medical device in the form of an LED patch which can be applied noninvasively over a region of interest and trigger local, controllable and safe nitric oxide production, even under low oxygen conditions.
Status: Active

CLEAN URBAN ENERGY (CUE)
City: Chicago
Founder(s): Gregor Henze
Year of spinoff: 2011
Tech developed: platform that monitors the performance and electric demand of a building's heating, ventilating, and air-conditioning (HVAC) system in relation to its thermal mass (the mass in and of the building, such as concrete, furniture, and books). Once the software has "learned" how energy is stored and released by the building's thermal mass, it implements strategies that optimize the building's HVAC operations as a function of electricity prices, hourly temperatures, humidity, solar radiation and carbon emissions.
Status: Active

COLDQUANTA
City: Boulder
Founder(s): Dana Anderson et al.
CEO: Rainer Kunz
Year of spinoff: 2007
Tech developed: development of BEC-generating devices and systems, allowing them to be accessible to a wide range of research, educational, and industrial institutions.
Status: Active
No. of employees: 13

COLORLINK
City: Boulder
Founder(s): Kristina Johnson, Gary Sharp, Douglas McKnight
Year of spinoff: 1995
Tech developed: Inventors and suppliers of photonics-based solutions.
Status: Acquired

CYCLEGEN
City: Boulder
Founder(s): Larry Gold et al.
Year of spinoff: 2007
Tech developed: Methods for the selective treatment of tumors by calcium-mediated induction of apoptosis
Status: Inactive

CAVEO THERAPEUTICS
City: Aurora
Founder(s): Douglas Graham et al.
Year of spinoff: 2006
Tech developed: Therapeutic targets and biomarkers for diagnosis, treatment, and therapy
monitoring for leukemia, solid tumors, and thrombosis
Status: Inactive

CELLO BIOENGINEERING
City: Boulder
Founder(s): Stephanie Bryant et al.
Year of spinoff: 2008
Tech developed: Novel soft matter testing technology for tissue regeneration applications

CLARO SCIENTIFIC
City: St. Petersburg, Fla.
Founder(s): Jeffrey Galinkin et al.
Year of spinoff: 2011
Tech developed: Proprietary software and database system SpectraNet interprets multidimensional optical profiling diagnostic technology to deliver highly precise, detailed and quantitative information about the composition and character of biologic and non-biologic samples in less than 5 minutes
Status: Active

CLP MICROTECHNOLOGIES
City: Boulder
Founder(s): Chris Bowman et al.
Year of spinoff: 2005
Tech developed: specializes in the microfabrication of polymeric devices with diverse chemical, electrical and mechanical properties
Status: Inactive

COLORADO CANCER THERAPEUTICS
City: Aurora
Founder(s): John Stewart, Lajos Gera, Leland W. K. Chung, Daniel Chan, Paul Bunn, Robert Hodges
Year of spinoff: 2011
Tech developed: Novel anti-cancer compounds that have shown efficacy in slowing the progression of certain forms of pancreatic cancer, non-small cell lung cancer, and prostate cancer
Status: Active

COPERNICAN ENERGY
City: Boulder
Founder(s): Alan Weimer, Christopher Perkins
Year of spinoff: 2007
Tech developed: Energy production via solar-thermal conversion of biomass
Status: Acquired

DHARMACON
City: Lafayette
Founder(s): Marvin Caruthers et al.
Year of spinoff: 1995
Tech developed: Expertise in bioinformatics, RNA biology, and synthesis chemistry allowed it to develop a complete line of products for the RNAi researcher, including the first rationally designed siRNA, the siGENOME siRNA collection, targeting all unique genes in the human, mouse, and rat genomes. Further breakthroughs came in chemical modifications for siRNA specificity, and novel molecules for microRNA modulation.
Status: Acquired

DOUBLE HELIX
City: Boulder
Founder(s): Rafael Piestun et al.
Year of spinoff: 2012
Tech developed: 3-D super-resolution imaging technology for microscopy applications
Status: Active

ENDOSHAPE
City: Aurora, Boulder
Founder(s): Christopher Bowman, Robin Shandas, Malik Kahook,Naresh Mandava, Chris Yackacki et al.
CEO: Bill Aldrich
Year of spinoff: 2007
Tech developed: Shape memory polymer stents for vascular and non-vascular applications
Status: Active

FLASHBACK TECHNOLOGIES
City: Boulder
Founder(s): Steven Moulton, Greg Grudic; CEO: Gordon Van Dusen
Year of spinoff: 2010
Tech developed: Fast, non-invasive detection of acute blood loss volume and prediction of cardiovascular collapse in emergency situations
Status: Active

FREE POWER TECHNOLOGIES
City: Boulder
Founder(s): Regan Zane, Zoya Popovic
Year of spinoff: 2006
Tech developed: Power electronics to enable batteryless and wireless operation of devices
Status: Inactive

GLOBEIMMUNE
City: Boulder
Founder(s): Donald Bellgrau, Richard Duke et al.; CEO: Timothy C. Rodell
Year of spinoff: 1997
Tech developed: therapeutic products for cancer and infectious diseases based on proprietary Tarmogen platform.
Status: Active
No. of employees: 35

John "Jan" Hall

HALL STABLE LASERS
City: Boulder
Founder(s): John "Jan" Hall
Year of spinoff: 2004
Tech developed: surface plasmon resonance common path interferometer

DISPLAYTECH
City: Longmont
Founder(s): David Walba
CEO: D. Mark Durcan
Year of spinoff: 1994
Tech developed: Liquid crystal microdisplays for digital still cameras, camcorders, and personal communication products
Status: Acquired

ECORTEX
City: Boulder
Founder(s): Randall C. O'Reilly; CEO: Dave Jilk
Year of spinoff: 2006
Tech developed: machine vision software component that is capable of classifying and recognizing objects, people and context directly from digital images.
Status: Active

EYETECH
City: Boulder
Founder(s): Larry Gold et al.
Year of spinoff: 2000
Tech developed: treatment for wet age-related macular degeneration
Status: Acquired

FOCUSED X-RAYS
City: Boulder
Founder(s): Webster Cash
Year of spinoff: 1997
Tech developed: High resolution optics
Status: Active

GENOPLEX
City: Denver
Founder(s):
Year of spinoff: 1997
Tech developed: A genetic information discovery company, utilizing sophisticated gene sequencing technologies, targeting neural/behavioral science diseases and disorders
Status: Inactive

GOGY
City: Broomfield
Founder(s): Bret Fund
Year of spinoff: 2012
Tech developed: Interactive e-learning software
Status: Active

HEPQUANT
City: Greenwood Village
Founder(s): Gregory Everson et al.
Year of spinoff: 2008
Tech developed: Non-invasive method to measure liver function for diagnosing liver disease and monitoring therapeutic efficacy
Status: Active

HIBERNA
City: Boulder
Founder(s): Leslie Leinwand et al.; CEO: Tom Marr
Year of spinoff: 2007
Tech developed: Identification of novel therapeutic targets for preventing or reversing metabolic disorders
Status: Active

HIGH PRECISION DEVICES
City: Boulder
Founder(s): Bill Hollander
Year of spinoff: 1993
Tech developed: scientific instrumentation, integrating precision mechanics with optics, cryogenics, electronics and vacuum/ultrahigh vacuum.
Status: Active
No. of employees: 22

ICVRX
City: Aurora
Founder(s): Dan Abrams, Raymond Bunch,Thomas Anchordoquy, Michael Royals, Karen Stevens
Year of spinoff: 2010
Tech developed: Drug reformulations and delivery systems targeting disorders of the central nervous system
Status: Active

ILLUMASONIX
City: Boston
Founder(s): Robin Shandas
Year of spinoff: 2007
Tech developed: Non-invasive diagnostic tool for analyzing blood flow in connection with cardiovascular diseases
Status: Active

IMMURX
City: Lebanon, N.H.
Founder(s): Ross Kedl et al.
CEO: David DeLucia
Year of spinoff: 2006
Tech developed: immunotherapy to treat cancer and chronic infectious disease.
Status: Active

INDEVR
City: Boulder
Founder(s): Kathy Rowlen, Rob Kuchta, Christpher Bowman, Hadley Sikes et al.
CEO: Kathy Rowlen
Year of spinoff: 2005
Tech developed: provide rapid and cost-effective solutions for virus quantification and pathogen detection.
Status: Merged
No. of employees: 6

ION ENGINEERING

ION ENGINEERING
City: Boulder
Founder(s): Jason Bara, Dean Camper, Richard Noble, Douglas Gin
CEO: Buz Brown
Year of spinoff: 2009
Tech developed: Technology enabling efficient and economical capture of CO2 and other contaminants from natural gas wells and coal-fired power plant emissions.
Status: Active

JIANGYIN PROTELIGHT (FKA CHANGCHUN PROTELIGHT)
City: China
Founder(s): Robert Hodges, Yuxin Chen et al.
Year of spinoff: 2007
Tech developed: Novel antimicrobial compounds for the treatment of infectious diseases
Status: Active

JOVION CORP.
City: Boulder
Founder(s): Garret Moddel
Year of spinoff: 2006
Tech developed: Low-cost production of hydrogen for energy generation
Status: Active

K T PHARMA (FKA SERENDIPITY PHARMA)
City: Boulder
Founder(s): Tad Koch et al.
Year of spinoff: 2005
Tech developed: therapy options for the treatment of solid tumors based on Doxoform, a patented chemotherapeutic drug related to doxorubicin.
Status: Active

KM LABS
City: Boulder
Founder(s): Margaret Murnane, Henry Kapteyn
Year of spinoff: 1994
Tech developed: the first robust and repeatable mode-locked Ti:sapphire laser capable of generating more than 10fs light pulses.
Status: Active
No. of employees: 26

KNOWLEDGE ANALYSIS TECHNOLOGIES
City: Boulder
Founder(s): Thomas Landauer et al.
Year of spinoff: 1999
Tech developed: Intelligent Essay Assessor, designed to automatically analyze and score standardized writing assessments.
Status: Acquired

LINERATE SYSTEMS
City: Louisville
Founder(s): John Giacomoni, Manish Vachharajani
CEO: Steve Georgis
Year of spinoff: 2009
Tech developed: accelerate connection scalability, packet processing and throughput.
Status: Active
No. of employees: 25

LOCOMOTION
City: Boulder
Founder(s): Rodger Kram et al.
Year of spinoff: 2006
Tech developed: improved treadmill therapy solutions for gait disorders
Status: Inactive

LOHOCLA
City: Aurora
Founder(s): Michael Browning et al.
CEO: Boris Tabakoff,
Year of spinoff: 2003
Tech developed: developing biological markers (diagnostics) that aid the physician in properly allocating Lohocla-developed medications to the appropriate patients.
Status: Active

LSVT GLOBAL (FKA GLEECO)
City: Tucson, Ariz.
Founder(s): Lorraine Ramig et al.
Year of spinoff: 2005
Tech developed: an innovative and clinically proven method for improving voice and speech in individuals with Parkinson's disease.
Status: Active

MBIO DIAGNOSTICS
City: Boulder
Founder(s): Chris Myatt
Year of spinoff: 2009
Tech developed: rapid, accurate diagnosis for multiple indications with a single drop of blood taken from a patient in a clinic or doctor›s office.
Status: Active
No. of employees: 24

MENTOR INTERACTIVE
City: Boulder
Founder(s): Barbara Wise, Sarel Van Vuuren, Ronald Cole, Wayne Ward
CEO: Brian Kohn
Year of spinoff: 2004
Tech developed: develops new products for the children's education software and learning technologies market.

MEDSHAPE SOLUTIONS
City: Atlanta
Founder(s): Christopher Yackacki, Robin Shandas, Kristi Anseth et al.
CEO: Kurt Jacobus
Year of spinoff: 2006
Tech developed: Orthopedic fixation devices constructed using shape memory materials
Status: Active

METACYTOLYTICS
City: San Marino, Calif.
Founder(s): M. Karen Newell Rogers
Year of spinoff: 2012
Tech developed: Compounds for treating drug resistant tumors based on disrupting the metabolism of cancer cells
Status: Acquired

MICRO g LACOSTE
A DIVISION OF LRS

MICRO-G LACOSTE
City: Lafayette
Founder(s): Jim Faller, Tim Niebauer
Year of spinoff: 1993
Tech developed: absolute gravimeters
Status: Active
No. of employees: 35

MOBILEASSAY
City: Boulder
Founder(s): Donald Cooper
CEO: Lee Burnett
Year of spinoff: 2012
Tech developed: Smartphone-based,app-enabled mobile real-time diagnostic technology
Status: Active

MYOGEN
City: Boulder
Founder(s): Michael Bristow, Leslie Leinwand, J. David Port et al.
Year of spinoff: 1999
Tech developed: lead product candidate, ambrisentan, for the potential treatment of pulmonary arterial hypertension, is an orally available endothelin receptor antagonist.
Status: Acquired

miRagen™ Therapeutics

MIRAGEN
City: Boulder
Founder(s): J. David Port, Carmen Sucharov, Michael Bristow et al.
Year of spinoff: 2009
Tech developed: MicroRNAs for the diagnosis, treatment and prevention of heart disease
Status: Active
No. of employees: 25

Mosaic Biosciences

MOSAIC BIOSCIENCES
City: Aurora
Founder(s): Kristi Anseth, Christopher Bowman
CEO: Marty Stanton, Ph.D.
Year of spinoff: 2011
Tech developed: advancing a new class of synthetic materials to support native tissue regeneration.
Status: Active

NEXSTAR
City: Boulder
Founder(s): Larry Gold
Year of spinoff: 1995
Tech developed: proprietary pharmaceutical products to treat oncological, hematological, and infectious diseases.
Status: Acquired

OCTALMEDIA
Founder(s): Daniel DeKalb et al.
Year of spinoff: 2001
Tech developed:
Status: Inactive

Charles Dinarello

OMNI BIO PHARMA
(FKA APRO BIOPHARMA)
City: Greenwood Village
Founder(s): Charles Dinarello, Leland Shapiro et al.
CEO: Steven Bathgate
Year of spinoff: 2006
Tech developed: Anti-inflammatory proteins for auto-immune and inflammatory diseases, such as Type 1 diabetes.
Status: Active

ONCOLIGHT
City: Boulder
Founder(s): Alan Mickelson
CEO: Stanley Swirhun
Year of spinoff: 2005
Tech developed: a cross-disciplinary effort combining life science and physical science expertise which seeks to develop an instant biopsy device using light to detect cancer
Status: Inactive

ONCOTHERIX (FKA PEAK BIOSCIENCES)
City: Aurora
Founder(s): Kevin Lillehei
Year of spinoff: 2009
Tech developed: Implantable filament for delivering cancer therapeutics to tumors
Status: Active

ONKURE
City: Longmont
Founder(s): Xuedong Liu
Year of spinoff: 2011
Tech developed: compounds that inhibit cancer cell growth and metastasis.
Status: Active

ONCOTHERIX (FKA PEAK BIOSCIENCES)
City: Aurora
Founder(s): Kevin Lillehei
Year of spinoff: 2009
Tech developed: Implantable filament for delivering cancer therapeutics to tumors
Status: Active

OPX BIOTECHNOLOGIES
City: Boulder
Founder(s): Michael Lynch, Ryan Gill
CEO: Charles R. Eggert
Year of spinoff: 2007
Tech developed: rapid, rational, and robust optimization of microbes and bioprocesses to manufacture bioproducts with equivalent performance and improved sustainability at lower cost compared with petroleum-based alternatives.
Status: Active
No. of employees: 17

OPX BIOTECHNOLOGIES
City: Boulder
Founder(s): Michael Lynch, Ryan Gill
CEO: Charles R. Eggert
Year of spinoff: 2007
Tech developed: rapid, rational, and robust optimization of microbes and bioprocesses to manufacture bioproducts with equivalent performance and improved sustainability at lower cost compared with petroleum-based alternatives.
Status: Active
No. of employees: 17

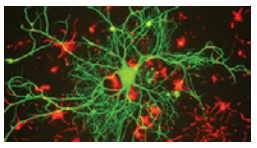
PEAK AGE
City: Colorado Springs
Founder(s): Sara Qualls et al.
Year of spinoff: 2008
Tech developed: Neurological wellness and assessment tools for elderly-care management
Status: Active

PEPTIVIR
City: Aurora
Founder(s): Robert S. Hodges
CEO: Richard C. Duke
Year of spinoff: 2010
Tech developed: Peptide-based universal influenza vaccine
Status: Active

PFS (PROPELLANT FRACTURING & STIMULATION)
City: Denver
Founder(s): Richard Passamaneck
Year of spinoff: 2001
Tech developed: Safe, environmentally friendly and cost-effective well stimulation solutions
Status: Active

PERSONALOGY
City: Boulder
Founder(s): Joshua Alspector
Year of spinoff: 2000
Tech developed: Software that learns preferences based on usage
Status: Acquired

PHIAR
City: Boulder
Founder(s): Garret Moddel et al.
Year of spinoff: 2002
Tech developed: applying the concepts of metal-insulator nanotechnology to terahertz-wave and ultra-high-speed electronic components.
Status: Inactive



PHOSPHOSOLUTIONS
City: Aurora
Founder(s): Michael Browning et al.
Year of spinoff: 1998
Tech developed: Specializing in the neurosciences and protein phosphorylation, antibodies cover the research areas of Alzheimer›s, Parkinson›s, epilepsy, learning and memory, anxiety, drug abuse, and schizophrenia, as well as the GABA, dopamine and glutamate pathways.
Status: Active

POWERSICEL
City: Boulder
Founder(s): Bart Van Zeghbroeck
CEO: John Torvik
Year of spinoff: 2002
Tech developed: developed a superior silicon carbide power transistor technology, poised to accelerate wireless data systems and services by enabling higher data rates at lower cost.
Status: Acquired

PRECISION PHOTONICS
City: Boulder
Founder: Chris Myatt, Sally Hatcher
Year of spinoff: 2000
Tech developed: precision optical components, coatings and assemblies
Status: Acquired
No. of employees: 35

PROTECHSURE
City: Golden
Founder(s): Gail Harrison, Michael Glode, Rajesh Agarwal, Theresa Pacheco, Thomas Anchordoquy
Year of spinoff: 2011
Tech developed: Sunscreen with anti-cancer properties
Status: Active

QFLUX
City: Boulder
Founder(s): Conrad Stoldt
Year of spinoff: 2009
Tech developed: Novel low-cost method of producing uniform nanoparticles for energy applications
Status: Active

RED WAVE ENERGY
City: Glen Ellyn, Ill.
Founder(s): Garret Moddel et al.
CEO: James Nelson
Year of spinoff: 2011
Tech developed: technology to generate renewable energy from the previously untapped infrared and near IR spectrum. Electron tunneling devices for solar energy conversion and other applications
Status: Active

PRECISION BIOPSY
City: Boston
Founder(s): Priya Werahera et al.
Year of spinoff: 2008
Tech developed: Optical biopsy needle for improved diagnosis of prostate and other cancers
Status: Active

PROTEOME RESOURCES
City: Aurora
Founder(s): Xuedong Liu
CEO: Randy Swenson
Year of spinoff: 2005
Tech developed: manufacture unique and high-purity reagents for study of the Ubiquitin-Proteasome System (UPS) in particular, and for the production of highly-purified proteins in general.
Status: Inactive

PHOBOS ENERGY
City: Lafayette
Founder(s): Robert Erickson
Year of spinoff: 2009
Tech developed: Technique for increasing the power generated by solar PV arrays when its panels are mismatched, and also provides simpler interconnection and wiring.
Status: Active

PHYSICAL ACTIVITY INNOVATIONS
City: Fort Collins
Founder(s): Raymond Browning, James Hill, Edwrd Sazonov et al.
Year of spinoff: 2010
Tech developed: Shoe-based device for movement sensing, biomechanical analysis and behavior modification
Status: Active

PROSPEX MEDICAL IV
City: Boulder
Founder(s): Malik Kahook, Naresh Mandava, Robin Shandas
Year of spinoff: 2012
Tech developed: Novel method for the in-situ attachment of a secondary intraocular lens onto an implanted lens
Status: Active

QGENTA
City: Aurora
Founder(s): David Ross, David Siegel et al.
Year of spinoff: 2009
Tech developed: Therapeutics for the treatment of solid tumor cancers
Status: Active

REPLIDYNE
City: Louisville
Founder(s): Charles McHenry et al.
CEO: Collins, Ken
Year of spinoff: 1999
Tech developed: faropenem medoxomil, an oral community antibiotic that is in Phase III clinical trials for the treatment of acute bacterial sinusitis, community-acquired pneumonia, acute exacerbation of chronic bronchitis, and uncomplicated skin and skin structure infections in adults
Status: Acquired

RIBOZYME PHARMA
City: Boulder
Founder(s): Thomas Cech et al.
Year of spinoff: 1994
Tech developed: ribozyme-based biotherapeutics and diagnostic tools for the treatment and monitoring of significant human diseases.
Status: Acquired

RXKINETIX
City: Louisville
Founder(s): Theodore Randolph, John Carpenter et al.
CEO: Harry Ross,
Year of spinoff: 1997
Tech developed: new therapeutics for oncology care.
Status: Acquired

SEEHEAR
City: Aurora
Founder(s): Howard Weinberger
CEO: Allen Schultz
Year of spinoff: 1997
Tech developed: method of diagnosing physical conditions in a patient by collecting and analyzing cyclical body sounds such as heart beat, peripheral vessel sounds or breath sounds.
Status: Inactive

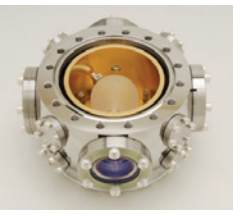
SECURICS
City: Colorado Springs
Founder(s): Terry Boult
Year of spinoff: 2005
Tech developed: patents and software designed to improve the accuracy of biometric software, as well as the Biotope technology which transforms biometric data into a secure token, which can then be revoked and reissued in case of biometric identity theft.
Status: Active

SHAPE OPHTHALMICS
City: Boulder
Founder(s): Malik Kahook, Naresh Mandava, Robin Shandas
Year of spinoff: 2012
Tech developed: Shape memory polymer punctalplug and micro shunt devices for ophthalmic applications
Status: Active

SENTRY BIOSCIENCES
City: Greenwood Village
Founder(s): Ding Xue
Year of spinoff: 2004
Tech developed: search for compounds that regulate the process of programmed cancer cell death (apoptosis).
Status: Active

SHAPE TECH
City: Boulder
Founder(s): Malik Kahook et al.
Year of spinoff: 2011
Tech developed: Shape memory polymer devices for treating ophthalmic conditions
Status: Active

SIERRA NEUROPHARMA
City: Aurora
Founder(s): Raymond Bunch, Daniel Abrams, Karen Stevens, Thomas Anchordoquy
Year of spinoff: 2008
Tech developed: Drug reformulations and system for delivering antipsychotic drugs directly to the brain
Status: Inactive



STABLE LASER SYSTEMS
City: Boulder
Founder(s) Mark Notcutt, John "Jan" Hall
Year of spinoff: 2009
Tech developed: frequency-stabilized laser systems, and vacuum and optical hardware for laser stabilization systems.
Status: Acquired

SOMALOGIC
City: Boulder
Founder(s): Larry Gold et al.
Year of spinoff: 1999
Tech developed: protein-binding reagents and SOMAscan proteomic assay technologies that can identify and quantify more than 1,100 proteins across approximately seven logs of concentration in small sample volumes.
Status: Active

SUVICA
City: Boulder
Founder(s): Dr. Tin Tin Su, Gan Zhang
CEO: Judy Hemberger
Year of spinoff: 2011
Tech developed: Screening and development of novel small molecule cancer drug candidates
Status: Active

SYBERENETY
City: Colorado Springs
Founder(s): Rory Lewis, Terry Boult
CEO: Steve Bassett
Year of spinoff: 2010
Tech developed: products and services that "change the game" in the addiction rehabilitation and recovery industry.
Status: Active

TAIGA BIOTECH
City: Aurora
Founder(s): John Cambier et al.
CEO: Yosef Refaeli
Year of spinoff: 2008
Tech developed: Stem cell based method for treatment of immune deficiency, cancer and leukemia
Status: Active

TECHOSHARK
City: Boulder
Founder(s): Richard Han
Year of spinoff: 2009
Tech developed: app that interacts with Facebook to allow users to both connect with friends and meet and learn about new people in real time based on location.
Status: Active

TIGON ENERTEC
City: Boulder
Founder(s): Jean Koster et al.
Year of spinoff: 2010
Tech developed: the TIGON hybrid propulsion solution is based on a proprietary gearsystem with two power inputs and one power output.
Status: Active

TOUCH OF LIFE (TOLTECH)
City: Aurora
Founder(s): Karl Reinig et al.
Year of spinoff: 1996
Tech developed: interactive anatomical software

TUSAAR
City: Lafayette
Founder(s): Mark Hernandez
Year of spinoff: 2009
Tech developed: technology that creates more efficient and cost-effective methods of purifying metal-laden acidic water.
Status: Active
No. of employees: 5

VESCENT PHOTONICS
City: Denver
Founder(s): Michael Anderson, Scott Davis
Year of spinoff: 2002
Tech developed: electro-optics technologies, tunable lasers and electronics for precision laser control as well as liquid-crystal waveguides for laser beam steering in communications and laser ranging.
Status: Active
No. of employees: 13

WESTERN STATES BIOPHARMA
City: Aurora
Founder(s): Carl Edwards, Li Li et al.
Year of spinoff: 2010
Tech developed: Discovery of TCISMs, proteins that selectively regulate the adaptive immune process. Blocking TCISMs can stop the destructive cytokines that lead to disability in inflammatory diseases.
Status: Active

TALIGEN THERAPEUTICS
City: Aurora
Founder(s): V. Michael Holers, Joshua Thurman et al.
CEO: Abbie Celniker,
Year of spinoff: 2004
Tech developed: technology based on recombinant fusion proteins and monoclonal antibodies focused on orphan diseases, age-related macular degeneration and severe inflammatory diseases.
Status: Acquired

TERRASPARK GEOSCIENCES
City: Broomfield
Founder(s): Geoffrey A. Dorn
Year of spinoff: 2006
Tech developed: Insight Earth Structure provides new workflows and processes, called voxel processing, to image the boundaries of salt bodies and canyons in 3D seismic volumes.
Status: Active

TISSUE GENETICS
City: Aurora
Founder(s): Jeffrey Holt
Year of spinoff: 2007
Tech developed: Tissue-based protein truncation test for cancer diagnosis
Status: Inactive

TRASONA
City: Boulder
Founder(s): Paul Wischmeyer et al.
Year of spinoff: 2004
Tech developed: technologies for activation and manipulation of heat shock proteins
Status: Inactive

V-CLIP PHARMA
City: Azusa, Calif.
Founder(s): M. Karen Newell Rogers
Year of spinoff: 2008
Tech developed: Immune-based therapeutics for treatment of viral and autoimmune diseases
Status: Acquired

VG ENERGY
City: San Marino, Calif.
Founder(s): M. Karen Newell-Rogers
CEO: Haig Keledjian,
Year of spinoff: 2012
Tech developed: "Metabolic disruption» technology for increasing the oil content of algae for biofuels production
Status: Active

WINDOM PEAK PHARMA
City: Boulder
Founder(s): Michael Vasil, Robert Hodges et al.
Year of spinoff: 2005
Tech developed: novel antibiotics to treat infectious diseasesn by identifying antimicrobial agents which directly affect the function of a pathway that may abolish the ability of a variety of bacteria to cause disease.
Status: Inactive

WINTERS ELECTRO OPTICS
City: Longmont
Founder(s): Michael Winters
Year of spinoff: 1993
Tech developed: frequency-stabilized helium-neon lasers
Status: Active

XALUD THERAPEUTICS
City: San Francisco
Founder(s): Linda Watkins
Year of spinoff: 2010
Tech developed: Naturally anti-inflammatory cell-signaling proteins for treatment of chronic pain

XENOPUR SYSTEMS
City: Boulder
Founder(s): Mark Hernandez
Year of spinoff: 2004
Tech developed: Technology to remove heavy metals from industrial process wastewater.
Status: Inactive

XERIS PHARMA
City: Austin, TX
Founder(s): John Carpenter et al.
Year of spinoff: 2012
Tech developed: ready-to-use Glucagon rescue pen for diabetic seizures.

THE BLUE SKY GROUP
City: Laramie
Founder/CEO: John Pope
Year of Spinoff: 1999
Tech developed: Fuel cells, natural-gas technologies.
Status: Active.
No. of employees: 50

FIREHOLE COMPOSITES
City: Laramie
Founder/CEO: Jerad Stack
Year of Spinoff: 2000
Tech developed: Commercial composites, analysis expertise and software
Status: Active
No. of employees: 17

BRIGHT AGROTECH LLC
City: Laramie
Founder/CEO: Nate Storey
Year of Spinoff: 2010
Tech developed: Hydroponic and aquaponic agriculture systems specializing in high yield, space-saving designs.
Status: Active
No. of employees: 4

ENWYO
City: Laramie
Founder/CEO: Michael Urynowicz
Year of Spinoff: 2012
Tech developed: Technologies to rejuvenate coal-bed methane wells.
Status: Active
No. of employees: 3

From Wyoming Business Report December 2009

DELTANU
City: Laramie
Founder/GM: Keith Carron, Bob Corcoran, Eugene Watson/ Ed Murrer, general manager
Year of Spinoff: 2000
Tech developed: Portable and bench-top spectrometers, powerful, modular Raman microscopy systems, and advanced, high sensitivity, low-light imaging cameras.
Status: Subsidiary of Intevac Inc. of Santa Clara, Calif.
No. of employees: 17

SOFTRAY INC.
City: Laramie
Founder/CEO: Paul Johnson
Year of Spinoff: 2002
Tech developed: A system for rapid detection of pathogenic bacteria and fungi in blood and blood products.
Status: Active
No. of employees: 2

GLYCOBAC LLC
City: Laramie
Founder/CEO: Don Jarvis
Year of Spinoff: 2011
Tech developed: Custom glyco-engineered insect cells for the production of biotherapeutics such as cancer-fighting antibodies.
Status: Active
No. of employees: 1

Federal labs directory

CENTERS FOR DISEASE CONTROL AND PREVENTION LAB (CDC/DVBID)
3150 Rampart Road
Fort Collins, CO 80521
800-232-4636/770-488-4760
www.cdc.gov/ncezid/dvbd/index.html
About: Collaborating to create the expertise, information, and tools that people and communities need to protect their health — through health promotion, prevention of disease, injury and disability, and preparedness for new health threats.
Person in charge: Lyle Petersen, director of Division of Vector-Borne Diseases
Year founded: 1940

COOPERATIVE INSTITUTE FOR RESEARCH IN ENVIRONMENTAL SCIENCES (CIRES)
CU Campus Box 216
Boulder, CO 80309
303-492-1143/303-492-1149
www.cires.colorado.edu
About: As a world leader in environmental sciences CIRES is committed to identifying and pursuing innovative research in earth system science and fostering public awareness of these processes to ensure a sustainable future environment.
Person in charge: Dr. Bill Lewis, Ph.D., interim director
Year founded: 1967

COOPERATIVE INSTITUTE FOR RESEARCH IN THE ATMOSPHERE (CIRA)
Colorado State University
Fort Collins, CO 80523
970-491-8448/970-491-8241
www.cira.colostate.edu
About: CIRA is a cooperative institute that is also a research department within CSU's College of Engineering. Its vision is to conduct interdisciplinary research in the atmospheric sciences.
Person in charge: Christopher Kummerow, director
Year founded: 1983

CU JOINT INSTITUTE FOR LABORATORY ASTROPHYSICS (JILA)
CU Campus Box 440
Boulder, CO 80309-0440
303-492-7789/303-492-5235
jila.colorado.edu
About: Basic research and development in five areas: atomic molecular experimental physics, atomic and molecular theory, precision and gravitational measurement and astrophysics.
Person in charge: Eric Cornell, director
Year founded: 1962

LABORATORY FOR ATMOSPHERIC AND SPACE PHYSICS (LASP)
1234 Innovation Drive
Boulder, CO 80303-7814
303-492-6412/303-492-6444
lasp.colorado.edu
About: Planetary, atmospheric and space sciences research; engineering division designs and builds space flight hardware; mission operations division operates spacecrafts.
Person in charge: Daniel Baker, director
Year founded: 1948

NATIONAL ECOLOGICAL OBSERVATORY NETWORK (NEON)
1685 38th St., Suite 100
Boulder, CO 80301
720-746-4844/720-746-4870
www.neoninc.org
About: Manages large-scale ecological observing systems and experiments on behalf of the scientific community.
Person in charge: Russ Lea, CEO
Year founded: 2007

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)
325 Broadway
Boulder, CO 80305-3328
303-497-3000/303-497-6235
www.nist.gov
About: Research and services relating to time and frequency; produces standards, technology and measurements for the United States.
Person in charge: Michael Kelley, acting NIST Boulder Laboratories director
Year founded: 1901

NATIONAL OCEANIC & ATMOSPHERIC ADMINISTRATION (NOAA)
325 Broadway
Boulder, CO 80305
303-497-6000/303-497-6951
www.boulder.noaa.gov
About: Research, services and technology development related to oceans, atmosphere and geophysical environments.
Person in charge: Don Mock, executive director
Year founded: 1954

NOAA EARTH SYSTEM RESEARCH LABORATORY (ESRL)
325 Broadway
Boulder, CO 80305-3328
303-497-6643
www.esrl.noaa.gov
About: Scientists study atmospheric and other processes that affect air quality, weather, and climate. By better understanding the dynamic Earth system, we can better understand what drives this afternoon's haze, next month's hurricanes, and next century's climate.
Person in charge: Don Mock, executive director
Year founded: 2005

NOAA NATIONAL GEOPHYSICAL DATA CENTER (NGDC)
325 Broadway
Boulder, CO 80305
303-497-6826/303-497-6513
www.ngdc.noaa.gov
About: Provides stewardship, products and services for geophysical data describing the solid earth, marine, and solar-terrestrial environment, as well as earth observations from space.
Person in charge: Don Mock, executive director

NOAA NATIONAL WEATHER SERVICES - WEATHER FORECAST OFFICES (WFO)
325 Broadway
Boulder, CO 80305
303-497-6000
www.crh.noaa.gov/bou
About: Provides weather, water and climate data, forecasts and warnings for the protection of life and property and enhancement of the national economy.
Person in charge: Don Mock, executive director

NOAA SPACE WEATHER PREDICTION CENTER (SWPC)
325 Broadway
Boulder, CO 80305
303-497-6000
www.swpc.noaa.gov
About: The nation's official source of space weather alerts, watches and warnings. SWPC provides real-time monitoring and forecasting of solar and geophysical events which impact satellites, power grids, communications, navigation, and many other technological systems. SWPC also explores and evaluates new models and products and transitions them into operations. SWPC is also the primary warning center for the International Space Environment Service and works with many national and international partners with whom data, products, and services are shared.
Person in charge: Don Mock, executive director

NATIONAL RENEWABLE ENERGY LABORATORY (NREL)
15013 Denver West Parkway
Golden, CO 80401
303-275-3000
www.nrel.gov
About: Centers for science and technology support the research and development efforts of the U.S. Department of Energy.
Person in charge: Dan Arvizu, director
Year founded: 1977

NATIONAL SNOW AND ICE DATA CENTER (NSIDC)
1540 30th St.
Boulder, CO 80303
303-492-8028/303-492-2468
www.nsidc.org
About: The National Snow and Ice Data Center studies the world's frozen realms, or cryosphere. Specializes in snow, ice, glaciers, frozen ground, and climate. Also manage and distribute scientific data on the cryosphere, and support other researchers who use the data. Shares data and knowledge with the public. NSIDC is part of the University of Colorado's Cooperative Institute for Research in Environmental Sciences.
Person in charge: Mark Serreze, director, senior research scientist
Year founded: 1976

NTIA INSTITUTE FOR TELECOMMUNICATIONS SCIENCES (ITS)
325 Broadway
Boulder, CO 80305
303-497—5216/303-497-5993
www.its.bldrdoc.gov
About: Promotes advanced telecommunications and information infrastructure development in the U.S., enhancement of domestic competitiveness, improvement of foreign trade opportunities for U.S. telecommunications firms and facilitation of more efficient and effective use of the radio spectrum.
Person in charge: Alan W. Vincent, director
Year founded: 1943

RENEWABLE AND SUSTAINABLE ENERGY INSTITUTE (RASEI)
2445 Kittredge Loop Drive, Fleming Building Suite 208
Boulder, CO 80309
303-492-0284
rasei.colorado.edu
About: A joint institute between the University of Colorado Boulder and the National Renewable Energy Laboratory (NREL).
Person in charge: Michael Knotek, director
Year founded: 2006

UNIVERSITY CORPORATION FOR ATMOSPHERIC RESEARCH (UCAR)
1850 Table Mesa Drive
Boulder, CO 80305
303-497-1000/303-497-1172
www.ucar.edu
About: Research and development related to atmospheric sciences, provides advanced research facilities for the science community, technology transfer.
Person in charge: Thomas J. Bogdan, president
Year founded: 1960

NATIONAL CENTER FOR ATMOSPHERIC RESEARCH (NCAR)
1850 Table Mesa Drive
Boulder, CO 80305
303-497-1000/303-497-2411
www.ucar.edu
About: Scientific research laboratory. Mission is to understand the behavior of the atmosphere and related systems. Visitor center, exhibits and tours are located at the Mesa Lab facility.
Person in charge: Roger Wakimoto, director
Year founded: 1960

US AIR FORCE ACADEMY RESEARCH CENTERS AND INSTITUTES (USAFA)
2354 Fairchild Drive, Suite 4K25
USAF Academy, CO 80840-6200
719-333-7731/719-333-4094
www.usafa.af.mil
About: The Academy's research mission is to plan and execute research programs in Air Force-relevant technology. This includes basic and applied research in aeronautics, biomimetic sensors, nanosatellites, rocket propulsion and space physics, lasers and optics, hydrogen fuel cells and ionic liquids, aging aircraft structures and materials, modeling and simulation, human effectiveness, molecular biology, unmanned aerial vehicles, information technology applications, and robotics.
Person in charge: Col Robert Kraus, chief scientist
Year founded: 1954

NCAR-WYOMING SUPERCOMPUTING CENTER (NWSC)
8120 Veta Drive
Cheyenne, WY 82009
307-996-4321
nwsc.ucar.edu
About: Provides advanced computing services to scientists studying a broad range of disciplines, including weather, climate, oceanography, air pollution, space weather, computational science, energy production, and carbon sequestration. It also houses a landmark data storage and archival facility that will hold, among other scientific data, unique historical climate records.
Year founded: 2012

US DEPARTMENT OF THE INTERIOR

BUREAU OF RECLAMATION (BUREC)
Sixth and Kipling, Building 67
Denver, CO 80025
303-445-2720 /303-445-6379
www.usbr.gov/pmts/tech_services
About: Engineering, science, research and support center for projects related to water resources. Provides specialized expertise to Reclamation's programs, regions and area offices, to other Federal agencies, and to international customers.
Person in charge: Lowell Pimley, director
Year founded: 1902

NORTH CENTRAL CLIMATE SCIENCE CENTER
Colorado State University
1231 East Drive
Fort Collins, CO 80523
970-226-9144
www.doi.gov/csc/northcentral/index.cfm
About: The North Central Climate Science Center was created to provide scientific information, tools and techniques that managers and other parties interested in land, water, wildlife and cultural resources can use to anticipate, monitor and adapt to climate change.
Person in charge: Dr. Jeff Morisette, director
Year founded: 2012

US DEPARTMENT OF TRANSPORTATION

FRA-TRANSPORTATION TECHNOLOGY CENTER
55500 DOT Road
Pueblo, CO 81001
719-584-0750/719-584-0711
www.aar.com/index.php
About: Transportation research and testing organization, providing emerging technology solutions for the railway industry throughout North America and the world.
Person in charge: Lisa Stabler, president
Year founded: 1967

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL SYSTEMS RESEARCH UNIT (ASRU)
2150 Centre Ave., Building D, Suite 200
Fort Collins, CO 80526
970-492-7300/970-492-7310
www.ars.usda.gov
About: ASRU exists to provide leadership in systems research for developing sustainable and adaptive integrated agricultural systems.
Person in charge: Dr. Laj Ahuja, research leader
Year founded: 1985

ARS CROPS RESEARCH LABORATORY
1701 Centre Ave., Sugarbeet Research Unit
Fort Collins, CO 80526
970-492-7149/970-492-7160
www.ars.usda.gov
About: Uses distinctive site environmental and disease-free characteristics and specifically developed team expertise to develop new biotechnologies, discover new information and techniques to identify and produce genotypes exhibiting superior disease and stress tolerance and agronomic qualities and provide new knowledge that improves production efficiency and biochemical processing characteristics.
Person in charge: Dr. Leonard Panella, supervisory research geneticist
Year founded: 1969

FOREST SERVICE, ROCKY MOUNTAIN RESEARCH STATION (RMRS)
240 W. Prospect Road
Fort Collins, CO 80526
970-498-1100
www.fs.fed.us/rmrs
About: Administers and conducts research on experimental forests, ranges and watersheds while maintaining long-term databases for these areas. Oversees activities on more than 260 research natural areas and lead ecosystem management and research partnership projects in Arizona, Montana, New Mexico and Nevada.
Person in charge: George S. "Sam" Foster, station director
Year founded: 1909

CENTRAL GREAT PLAINS RESEARCH STATION (ARS)
40335 County Road GG
Akron, CO 80720
970-345-2259/970-345-2088
www.ars.usda.gov
About: Enhances the economic and environmental well-being of agriculture by development of integrated cropping systems and technologies for maximum utilization of soil and water resources. Emphasis is on efficient use of plant nutrients, pesticides and water and soil conservation/preservation.
Person in charge: Merle F. Vigil, research leader, soil scientist
Year founded: 1907

NATIONAL WILDLIFE RESEARCH CENTER (NWRC)
4101 LaPorte Ave.
Fort Collins, CO 80521
970-266-6000/970-266-6010
www.aphis.usda.gov/wildlife_damage/nwrc/
About: Scientists develop new tools and technologies for use in wildlife damage management related to agriculture, natural resources, and human health and safety.
Person in charge: Larry Clark, director
Year founded: 1886

US GEOLOGICAL SURVEY (USGS)
Denver Federal Center, Building 810
Denver, CO 80025
303-236-5900
www.usgs.gov
About: The USGS is a science organization that provides impartial information on the health of ecosystems and environment, the natural hazards that threaten people, the natural resources people rely on, the impacts of climate and land-use change, and the core science systems that help to provide timely, relevant and useable information.
Person in charge: Randall Updike, regional executive
Year founded: 1879

USGS CENTRAL ENERGY RESOURCES SCIENCE CENTER
Denver Federal Center, MS 939
Denver, CO 80225
303-236-5900/303-236-5888
energy.usgs.gov
About: Conducts research and assessments on the location, quantity, and quality of mineral and energy resources, including the economic and environmental effects of resource extraction and use; and conducts research on the environmental impacts of human activities that introduce chemical and pathogenic contaminants into the environment and threaten human, animal (fish and wildlife), and ecological health.
Person in charge: Chris Potter, director

USGS COLORADO WATER SCIENCE CENTER
Denver Federal Center, MS-415, Building 53
Denver, CO 80225
303-236-6900/303-236-4912
co.water.usgs.gov
About: Operates more than 200 data collection sites in Colorado for acquiring information on surface-water, groundwater, water-quality, and precipitation. Many of the sites are equipped with satellite telemetry, which provides real-time data via GOES satellites and downlinks, which enables the posting of data to the Web for public dissemination.
Person in charge: James E. Kircher, director

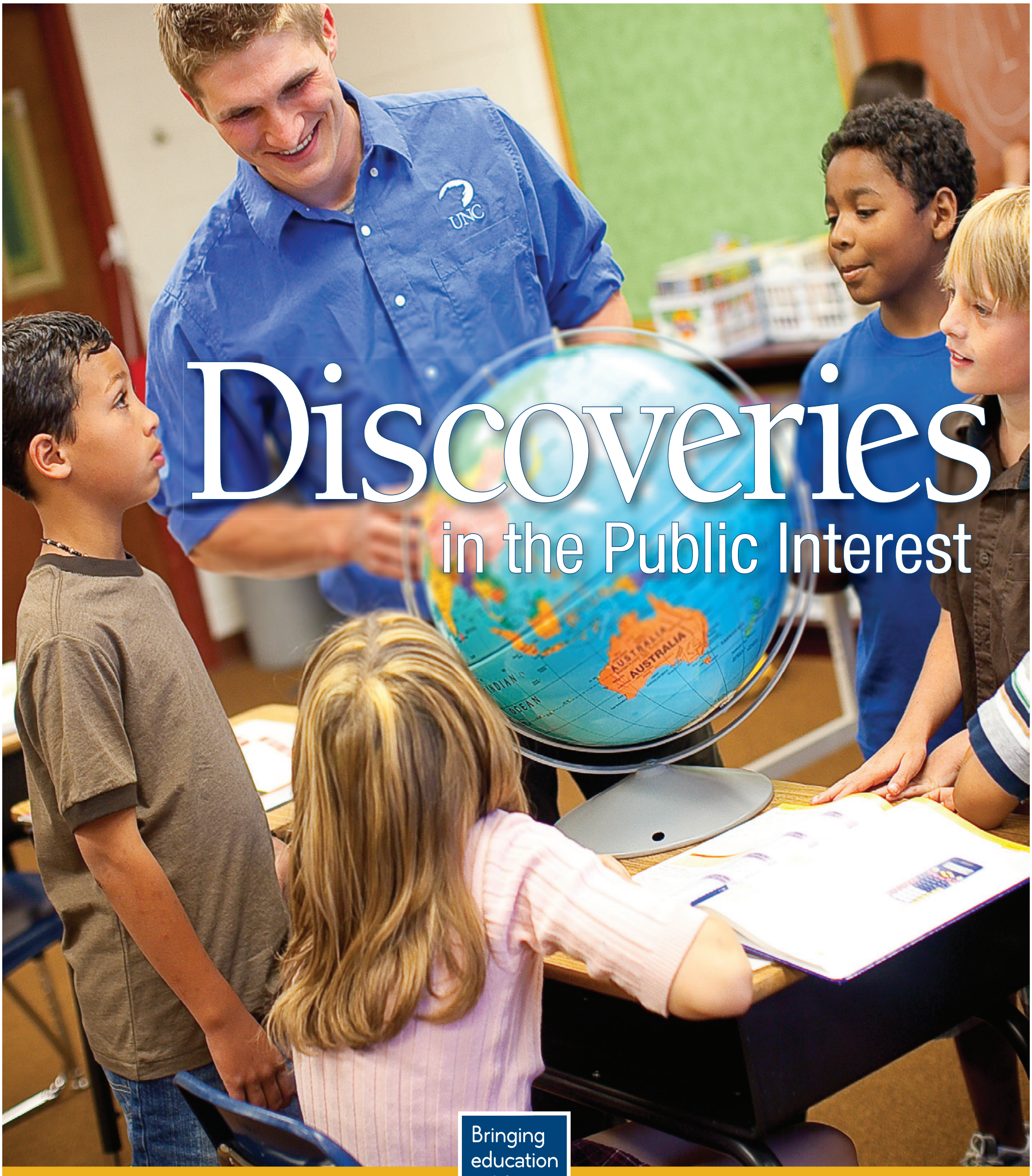
USGS FORT COLLINS BIOLOGICAL SCIENCE CENTER
2150 Centre Ave., Building C
Fort Collins, CO 80526
970-226-9100/970-226-9230
www.fort.usgs.gov/default.asp
About: Faced with the complexities and growing urgency of natural resource issues, land and resource managers need information that is accurate, current, and usable. The U.S. Geological Survey Fort Collins Science Center (FORT) in Colorado fulfills this need by providing sound scientific data and technical assistance to Department of the Interior bureaus and other natural resource agencies.
Person in charge: David Hamilton, director
Year founded: 1996

USGS GEOLOGIC HAZARDS SCIENCE CENTER
1711 Illinois St.
Golden, CO 80401
303-478-5041/303-273-8600
geohazards.usgs.gov
About: The USGS works with many partners to monitor, assess and conduct targeted research on a wide range of natural hazards so that policymakers and the public have the understanding they need to enhance preparedness, response and resilience.
Person in charge: Jill McCarthy, chief scientist

USGS GEOSCIENCES AND ENVIRONMENTAL CHANGE SCIENCE CENTER
Denver Federal Center, Building 25
Denver, CO 80225
303-236-5345
gec.cr.usgs.gov/index.html
About: The role of the Geosciences and Environmental Change Science Center is to use integrated studies of geology, biology, hydrology and spatial analysis to understand the earth's past and present changes.
Person in charge: Buddy Schweig, director

USGS MINERAL RESOURCES SCIENCE CENTER
Denver Federal Center, Building 20
Denver, CO 80225
303-236-1800/303-236-1811
minerals.cr.usgs.gov/index.html
About: Historically, the mission of the Central Mineral and Environmental Resources Science Center has been to: Conduct research toward basic understanding of metallic and nonmetallic nonfuel mineral deposits and their geologic environments and processes of formation; apply this knowledge to assessments of the nation's nonfuel mineral endowment; determine the potential environmental consequences of mineral resource development.
Person in charge: Ian Ridley, director

USGS WATER QUALITY TESTING LABORATORY
Denver Federal Center, Building 95
Denver, CO 80225
303-236-2000
nwql.usgs.gov
About: Collects and disseminates reliable, impartial and timely information that is needed to understand the nation's water resources.
Person in charge: Randy Updike, regional director



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