



Rocky Mountain
Biological Laboratory
Science at the Top
Spring Newsletter 2011



Dear RMBL Members, Friends, and Community,

Science is about exploration and discovery. Any institution that supports science must be willing to continually improve in order to support the innovation that lies at the heart of science. Visitors to Gothic in the next several years will see such improvement in action. The centerpiece of this change will be the construction of a new Research Center that will enable scientists to integrate modern lab techniques with field work. Other planned projects for 2011 include continued upgrades to housing, preparation for a new Visitor's Center next to the Town Hall, upgrades to our telecommunications system, and improvements to our water distribution system. Additionally we will remove two buildings from wetlands, thereby clustering heavy use buildings around the county road, and creating more contiguous natural habitat for research and education.

These improvements are a critical part of making RMBL a sustainable scientific institution. RMBL's value to the larger world increases through time. Knowledge begets knowledge. With time, our scientists have a greater ability to track and understand a changing world, and to answer fundamental questions about how the world works. From upgrading our physical plant, to modernizing our information systems, to supporting our people and places, these changes will make RMBL more sustainable.

However, change rarely comes without growing pains. We are doing extensive planning to minimize disruption to RMBL's daily operations and to avoid impacts to research. Parking and access will be a challenge. There will be some confusion and inconvenience. Despite the upcoming disruption, I ask you to share in the excitement of this change as the efforts we make in the next several years to improve RMBL will be a legacy that we give to future generations. Together we are building a scientific institution that will provide critical information that informs how we understand and manage a complex world.

Sincerely,

Ian Billick, Ph.D.
RMBL Executive Director



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Cover photo by: Will Petry
A blooming corn lily
(*Veratrum californicum*) along the
Gothic Road.

Development

Remembering Loved Ones With a Memorial Gift to RMBL

The James Robert Kingsdale Telecommunications Suite



In 1990 Jim Kingsdale visited Crested Butte for the first time and, overwhelmed by its spectacular beauty, immediately decided this was where he wanted to spend more time. After retiring from the cable television industry in 1994, Jim and his wife, Nina, eventually settled in Crested Butte where he became a well-known advocate for several community projects and an enthusiastic contributor to many worthy non-profit causes in our valley.

From April 2006 until his untimely death in December 2009, Jim shared his insights on major transformations occurring in energy on his website, Energy Investment Strategies, and received much praise for his commentary. He also loved traveling with his family and meeting new people when he wasn't enjoying life in Crested Butte.

"Jim always regarded the work of the Rocky Mountain Biological Laboratory with great esteem and was in the process of working more closely with its Board on its development program just before his death," says his wife Nina. "Being able to give back to an outstanding institution like RMBL with its world-class scientific research and educational programs was something he had looked forward to. RMBL's contribution to understanding our fragile and precious environment, both globally and locally, resonated with Jim's concern for our planet and especially for the delicate balance of the eco and water systems in our local community."

It is with great pride that his extended family honors Jim and his rich legacy by establishing the James Robert Kingsdale Telecommunications Suite within the new RMBL Research Center. We'd like to think that Jim would have truly enjoyed seeing this investment made in his name for the future of science.

The Keith Krakauer Animal Care Suite

Keith Krakauer showed an interest in animals from a very early age, collecting specimens and bringing home pets of many sizes. His love for the natural world brought him to RMBL in 1995 and he spent three summers roaming the meadows and mountains around Gothic, working with Dr. Chris Floyd and Dr. Dirk Van Vuren in various capacities. He graduated from the University of Colorado in 1996 and proceeded to Texas A&M-Kingsville where he received an MS in Biology in 2003 under the direction of Dr. Steve Smith, whom he had met at RMBL. Keith often said that Gothic was his favorite place in the whole world and that his time at RMBL not only made him life-long friends but also gave him a real connection to nature and the community.

After Keith passed away in 2004 his family established the RMBL Krakauer Scholarship Fund for deserving students for whom a summer at RMBL would be particularly meaningful. To honor Keith's love of RMBL even further, the Krakauer family recently decided to name the Keith Krakauer Animal Care Suite in the new Research Center after their son. "It's hard to describe how important RMBL was to Keith. His time there was so special and transformative and really solidified his commitment to science. It is our hope that a part of him will always live on at RMBL," said his father John. For students and scientists using the new Animal Care Suite, the spirit of Keith's passion for science, and animals in particular, will be good company. For more information on Keith's life, please visit www.captainpoodle.com.



Research

Comprehensive Evolutionary Analyses Within Our Reach

Contributed by: Nely Pohl

What started as a high school science fair project became the life's work of a RMBL scientist. While collecting butterflies outside of Washington D.C., Dr. Ward Watt became interested in the variation of insects. After corresponding with Yale and RMBL scientist Dr. Charles Remington, Ward joined Remington's lab as an under-

graduate to study butterfly evolutionary biology. And while sorting butterflies in Yale's Peabody Museum of Natural History collections, the first insight of Ward's career hit him: populations of *Colias* butterflies that live in colder habitats have darker hindwing undersides. This observation led Ward to his graduate dissertation and to a four-decade career studying butterfly metabolism and evolution. Building on that first observation, Ward found that *Colias* butterflies all fly at a similar narrow range of body temperatures, regardless of whether they live in cold or hot environments. This suggested that something is constraining the evolution of the butterflies and that we should explore the metabolism of butterflies.

Using one of the few molecular tools available in the early 1970's Ward examined the enzyme PGI (phosphoglucose isomerase). Enzymes are proteins that control chemical reactions and this particular enzyme is found in all animals. It is part of glycolysis, the pathway by which animals convert food to energy. Ward discovered that the *Colias* butterflies have genetic variability that produces different variants of the PGI enzyme. Further analysis indicated that some of the PGI variants are more efficient at helping process food while other variants are able to function over a wider range of temperatures.

In the early 1980's Ward made a series of predictions for how butterflies would fly in nature, based upon how the different variants of the enzymes performed under different temperatures. Indeed, at low environmental temperatures butterflies that possessed more efficient versions of the PGI enzymes were able to fly more. Also, as predicted, under unusual

heat stress, butterflies possessing the thermally stable but less efficient PGI variants survived longer.

The relationship between flying time and the enzyme matters. Ward and his collaborators found that increased flight activity also means that males spend more time successfully finding and courting females, and that females have more time to spend finding suitable sites to lay their eggs. Because of the importance of flying to how many offspring a butterfly can produce, this study

demonstrated an elegant connection between a single gene (coding for the PGI enzyme) and evolution.

Further developments in genetics and molecular biology allowed Ward to look deeper into the genes and proteins. Ward sequenced the genes responsible for producing the different PGI variants. Additionally, using modern techniques for untangling protein structure, Ward was able to identify how small changes in the

proteins affected the ability of the enzymes, and ultimately the butterflies, to work over a range of temperatures.

Techniques that facilitate the gathering of large amounts of genetic data are now allowing Ward and his collaborators to extend their evolutionary studies beyond a single enzyme. A survey of the enzymes that work in concert with PGI indicates that whereas some enzymes like PGI are directly shaped by natural selection, other enzymes possess genetic variations that have no effect on the number of offspring produced by butterflies. Thus, some of the variation we see in enzymes is being shaped by natural selection and other variation is not. Nature is complicated.

Ward has spent his career following a simple observation about color in butterflies to understand all organisms. Taking advantage of developing technologies to explore evolution, he has sequenced genes, resolved protein structure, examined metabolic pathways, and watched what butterflies do in nature. His four-decade long – and counting – career makes it clear that an understanding of evolution encompassing natural history, biochemical function, genetic structure, behavioral and ultimately evolutionary patterns is within our reach.



Photo courtesy: Ward Watt

Education

Undergraduate Student Profile

Marcella Fremgen, Western State College

What inspired you to spend a summer at RMBL?

I don't even remember how I had heard about RMBL, but I think it was during my freshman year at Western State College. At the time, I had no idea how competitive it was to study there, or the different study options and the varied work available in Gothic. I thought it would be a great way to spend a summer and decided to keep RMBL in mind when I started applying for jobs. A couple of years later, I was on an ecology field trip to RMBL, where the students from Western met Ian Billick and toured the town-site. I told Ian that I was really interested in studying in Gothic and 8 months later I found myself checking in at Weese. The main reason I wanted to work at RMBL was the location. Gothic is gorgeous! Getting to walk out your front door on a backpacking trip after work on a Friday is something few people are lucky enough to do. The friendly, academic community and the great research opportunities were a tremendous bonus as well.



Marcella Fremgen, an undergraduate from Western State College, poses with her research plant, heartleaf bittercress (*Cardamine cordifolia*), alongside the Deer Creek trail while backpacking with friends this past summer.

What sort of work did you do?

Most of my work was for Dr. Noah Whiteman. However, he arrived a couple of weeks later than I did, so I did get a little exposure to other projects. I worked for Johannes Foufopoulos banding mountain white crowned sparrows, which was a really fun experience. I also helped Caitlin Wells with golden-mantled ground squirrel time budget analysis, and got to help mist net bats for Dr. Chris Floyd's wildlife class. For Noah, I worked on heartleaf bittercress (*Cardamine cordifolia*) induced chemical defense. I had a lot of field time collecting specimens at both Emerald Lake and along the 401 Trail, but also spent a lot of time in the lab doing some sample preparation and larval transfers.

What was your biggest "take away" from this work?

I learned so much from this experience that it's really difficult to pinpoint the biggest lesson. Academically, I learned that scientific design is crucial, but it is not set in stone and can be flexible if needed. But most of what I learned was more related to my personal experience. I learned that enthusiasm and the desire to learn can take you great places and give you great opportunities and great memories. It may sound like a cliché, but it's absolutely true. The only thing

I would change would be to have more than 10 weeks up in Gothic!

Tell us a little bit more about yourself.

My twin sister, Aleshia, and I are from Golden, CO. I think my goals and aspirations have always been to make a positive impact on species or habitat conservation, but the ways I think about doing that (management, research, non-governmental organizations...) change constantly. But the main objective to affect conservation is something my

sister and I have been interested in since we were little. Life at Western State College is great! There are so many opportunities and great people there (in both Gunnison and on campus). It was a great place for me to come to school, as a student and a person. My sister, Aleshia, worked for Dr. Kailen Mooney on tri-trophic interactions on tobacco root (*Valeriana edulis*). Aleshia and I wanted to differentiate our experiences and resumes, and therefore chose to select different mentors working on different systems. A few weeks into the program, we were talking about our proposals and came to realize we were actually both working on plant induced defense using bioassays. It was pretty funny that we tried so hard to be separate and ended up doing similar projects!

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2010 Financial Report

This financial report is unaudited. Audited financial reports are posted on www.rmbll.org as they become available.

Revenue

Physical Plant	\$202,089
Food Service	\$119,348
Administrative Fees,	
Grant Overhead & Interest	\$292,520
Grants to Support Research	\$429,051
Contributions	\$781,297
Events	\$ 14,730
Gains on Investment	\$269,657
Other	\$ 99,040

Total Revenue **\$2,207,733**

Expense

Physical Plant	\$456,461
Food Service	\$115,021
Research	\$557,403
Coursework	\$ 42,064
Environmental Education	\$ 40,547
Store	\$ 34,033
Administration	\$530,227
Development	\$193,536
Other	\$ 12,055

Total Expense **\$1,981,347**

RMBL Balance Sheet

31-Dec-10

Assets

Cash & Cash Equivalents	\$ 554,969
Cash Held for Others	\$ 150,231
Accounts Receivable & Other Assets	\$ 85,738
Prepaid Expenses	\$ 1,759
Investments	\$1,423,430
Property & Equipment	\$1,990,674
Property Assets*	\$ 987,660
Total Assets	\$5,194,461

Liabilities & Equity

Accounts Payable & Credit Cards	\$ 8,188
Unearned Deferred Revenue	\$ 150,231
Equity	\$5,036,042

Total Liabilities & Equity **\$5,194,461**

*Property Assets are properties outside of the Gothic townsite that are owned by RMBL. These properties may be sold.

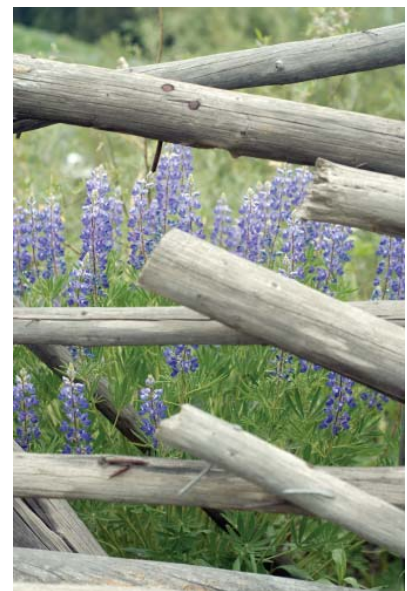


Photo by: RMBL Archives

RMBL Alumni Corner

In early 2011 RMBL began an alumni search campaign in an effort to track down the names and contact information of people who have spent time in Gothic starting with the year 1960. Perusing the Gothic census rolls, in addition to some of Billy Barr's personal records, has been a walk down memory lane for us as we piece together a community of nearly 5,000 scientists, students, and others who have spent time in Gothic, many of whom began their RMBL careers in the early '60s and '70s. We've stumbled upon more than a few pairs of RMBL sweethearts and we celebrate every time a graduate student gets that hard-earned "Dr." in front of his or her name.

Finding alumni is only the first step in our efforts. We will soon begin an alumni communication effort to reengage and connect RMBL alumni. We are seeking out memories of Gothic and current updates, personal and professional, to share with your peers. Send them along to laurel@rmbll.org. We also recently started an alumni e-newsletter. If you haven't received it, send us your email address.

Opposite Page Bottom Left: Diana Cosand, Derek Henrie, and Dr. Chris Floyd are checking a local pond for breeding adults of the threatened boreal toad (*Bufo boreas boreas*). This population has been monitored near Gothic for years, and the data are sent to the U.S. Fish & Wildlife Service and the Colorado Department of Wildlife.

2010 Snapshots



Photo by: Annie Starr

Above: Thanks to funding support from the Crested Butte Rotary the Community Foundation of the Gunnison Valley, and Gunnison Kiwanis, a student from the CB Community School learns hands-on science while water quality testing with RMBL Environmental Education staff and the Coal Creek Watershed Coalition.



Photo by: Sarah Rudeen

Above: Every summer RMBL hosts two Volunteer Invasive Weed Days in Gothic. Join us in 2011 on July 21st and August 10th to help eradicate some of the non-native flora in our research areas. Please call Laurel at (970) 349-7231 or email: laurel@rmbll.org, for more information or to sign up to help. Lunch is included!



Photo by: Will K. Petry

Above: Dr. Kailen Mooney is studying how genetic variation in plants influences the composition of their associated insect communities and, in turn, how such variation in insect communities may influence plant fitness. Here he is at Brush Creek with western thatching ants (*Formica obscuripes*) and aphids (*Aphis valeriana*) on a female valerian or tobacco root (*Valeriana edulis*) plant.

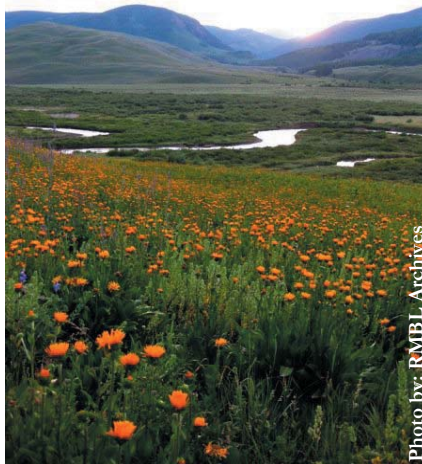


Photo by: RMBL Archives



Photo by: Will K. Petry

Above Right: REU recipients Mitchell Lopez and Aleshia Fremgen gathering some pupa that make their cocoon in *Valeriana edulis*. This was a part of Aleshia's 2010 experiment in which she was looking at the effect of plant sex and presence/absence of ants on the size of the pupa. **Below:** Hiking the famously breathtaking West Maroon trail between Aspen and Gothic.



Photo by: Will K. Petry



Photo by: Dave Larson



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The Rocky Mountain Biological Laboratory provides equal opportunities in science and education without regard to race, color, religion, national origin, gender, or sexual orientation.

News from Gothic

Recycling & Retrofitting RMBL

Construction of the Research Center is triggering additional changes to our physical plant as we recycle existing buildings to better accommodate RMBL's mission. These changes are driven by our desire to ensure RMBL's long-term sustainability, minimize impacts to research sites, and to gracefully accommodate users and visitors of our facilities. The following changes will remove two buildings from wetlands, open up more meadow habitat, and cluster use around the county road and other buildings. While these changes include an addition of approximately 3500 square feet to RMBL's total physical plant, there will be no net increase to the number of buildings nor any change to RMBL's programs or operations.

The changes started last fall with the relocation of Murray Lab to a site close to the physical plant shop. This summer Murray Lab will remain a laboratory for field researchers. After the new Research Center is complete (timeframe early summer 2012) Murray will become a new storage facility, replacing Old Johnson as storage.

Thanks to a gift from the Weekley Family Old Johnson



The Vera Adams Johnson Lab, commonly known as Old Johnson, will be carefully moved across the meadow to the north side of the Gothic Town Hall to be retrofitted as the Weldon and Rosalie Weekley Visitor's Center. It will house the General Store and adult environmental education.

will be converted to a Visitor's Center this fall. RMBL will move Old Johnson out of the wetlands to a location just north of the Town Hall/General Store. The General Store contents will be moved into Old Johnson and will be integrated with displays about RMBL as well as meeting space for groups. Additional planned physical plant improvements include the creation of a traffic circle in front of the new Research Center, installation of a new water supply next to Maroon Cabin and associated improvements to our water distribution system. In 2011 we will also renovate Richards Cabin and make improvements to the septic systems in its vicinity.

In 2012 much, though not all, of the research space in Willey Laboratory will be moved into the new Research Center. This space in Willey will eventually be converted to office and administrative space. Weese, which currently holds summer office space, will either be removed or converted to meeting space. The Kids Nature Camp, which is currently based out of the Old Savoy cabin, will move into the General Store building and Old Savoy (also