

The Continuum

Winter/Spring 2014

Natural Sciences & Mathematics
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303-871-2693



LETTER FROM THE DEAN

DEAR FRIENDS OF NSM,

I hope you had a wonderful holiday season. I am writing this letter on the eve of the new year to welcome you to our latest issue of The Continuum. This has been another great if not transformative year here at the Division of Natural Sciences and Mathematics.

We continue focusing our effort on the educational experiences of our students, and we are positioning ourselves to boost our research footprint. Sciences and mathematics are all about a journey of discovery with one's mentors. NSM offers wonderful opportunities for our students to grow professionally as they learn from and work with top experts in their fields of study. Classroom instruction intricately

interwoven with guided research and scholarship in state-of-the-art laboratories is DU's powerful differentiator on the modern landscape of STEM education. With this newsletter we will update you on what is going on at NSM and, at the same time, we invite you join in and help us take sciences and math at DU to the next level. As you know, DU is 150 years young. In this year of Sesquicentennial celebrations we reflect on our glorious past but mostly plan for an exciting future. In this issue you will learn about our new initiatives and hires, new research grants and projects, books and discoveries.

If you are ever in the DU area, please stop by and visit us. We are always happy to reconnect with alumni and friends.

Andrei Kutateladze

Dean, Division of Natural Sciences and Mathematics



UNIVERSITY of
DENVER

NATURAL SCIENCES & MATHEMATICS

SESQUICENTENNIAL NEWSLETTER



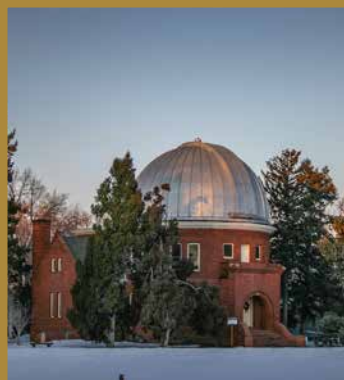
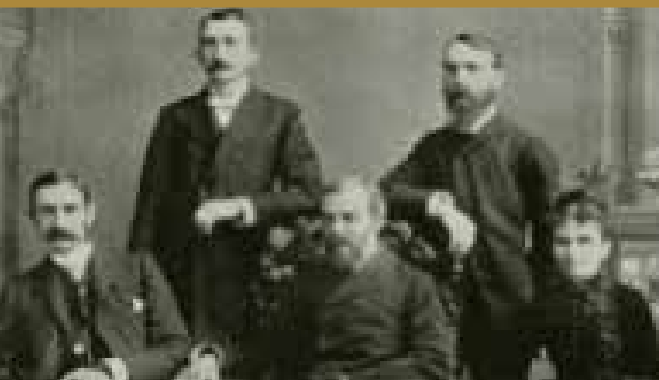
► In 2014, the University of Denver will celebrate its 150th anniversary since it was first founded by John Evans in 1864. As the University looks back on its rich history to celebrate and commemorate this historic year, the Division of Natural Sciences and Mathematics (NSM) also wishes to celebrate and observe the numerous achievements and inspiring path that has led to its renowned position at DU today.

Unlike other departments and colleges on campus, NSM can trace its roots back to the very start of the University of Denver. Of the University's first five faculty, two members were professors in the sciences. Sidney Howe Short was nicknamed "Colorado's Edison" as he was an avid scholar and inventor in Physics and Chemistry. Not only was Short a leader in his fields, he was also a leader at DU where he was named the University's Vice President and was head of NSM at the time (originally named the School of Natural Science). Another member of the University's first faculty was Herbert Alonzo Howe. He was a prominent astronomer of his time as well as a respected and admired faculty member at DU. He designed the Chamberlin Observatory and was also named an acting chancellor for several months in 1899 after the second chancellor, William F. McDowell resigned.

One interesting historical tidbit is that several leaders and administrators that have shaped the University have also shared a home in NSM. In fact, in the past sixty years there have been only 6 chancellors and 3 have come from NSM – and more specifically, all are from the department of Chemistry (Alter, Smith, and Coombe). We look forward to seeing others from NSM lead and shape the University.

"Our [DU's] First Faculty"

From left to right: Sidney H. Short, Herbert A. Howe, chancellor David Hastings Moore, O.B. Super, and Frances Fish



DU'S HISTORIC CHAMBERLIN OBSERVATORY (1894) OPEN HOUSE

Once a month for the next 6 months, 7-10 p.m. Saturdays
Chamberlin Observatory
2930 E. Warren Ave.
Cost: \$2 (or free with DU I.D.)
More information:
303-871-5172

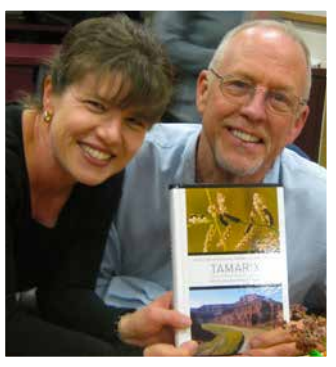
MATH PROFESSOR DR. MICHAEL KINYON HONORED AT UNIVERSITY OF DENVER 2013 CONVOCATION

► The University of Denver prizes research that benefits the public good and teaching that transforms the lives of students. Purposeful research and inspired teaching are celebrated each year with an awards presentation at the fall Convocation ceremony, which took place Thursday, Oct. 3 of 2013, in Magness Arena. NSM's mathematics Professor Michael Kinyon received the United Methodist Church, University Scholar/Teacher of the Year Award for 2012/13. He was introduced as a well-rounded mathematician with research interests and accomplishments spanning diverse areas. Kinyon has authored nearly 60 articles, six of which appeared last year. He has attained near perfect scores in his student evaluations on every quarter for every course he has taught. When asked, his students identified Dr. Kinyon as "the professor who could draw a perfect circle on any surface at any time...and did it in almost every class". We are proud to have Michael as part of our dedicated and caring faculty! Past NSM awardees include Dr. John Kinnamon-Biological Sciences (2008/09), Dr. Sandra Eaton-Chemistry and Biochemistry (1995/96) and Dr. Herbert Greenberg-Mathematics (1981/82).

From left to right: Chancellor Robert Coombe, Scott Leutenegger, Michael Kinyon, Provost Gregg Kvistad



...AND THIS JUST PUBLISHED



Tamarix: A Case Study of Ecological Change in the American West
Edited by Anna Sher and Martin F. Quigley

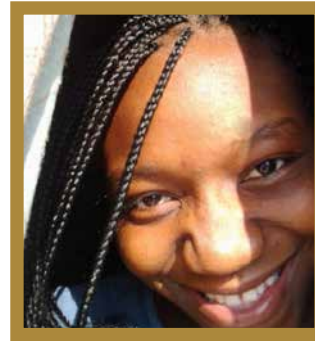
most important researchers in the field, representing a full spectrum of scientific perspectives. Reviewers all agree that this is a groundbreaking compilation of essays on an invasive species which could easily be used as a model case study for other ecological systems working through the various impacts of an invasive species on changes to the native system.

Reviews:

"*Tamarix* is not just about the impacts of an exotic species, but is in fact an outstanding entry point into many of the most important ecological and conservation questions that scientists and land managers are grappling with today; Do non-native species provide important ecosystem services? What is the best way to manage a landscape dominated by non-native species? What are the ethical and ecological reasons for removing non-native species? Because of this well-written book, *Tamarix* will become a key example for introducing young scientists and land managers to the complexities of dealing with exotics species in established ecosystems." —Richard Primack, Boston University and author of *Essentials of Conservation Biology*

"This book represents the most comprehensive work yet published of the biology, ecology, and sociological impacts of *Tamarix*. Most impressive is the unbiased approach, broad perspective, and science-based standards used to address the many controversial issues related to positive benefits or negative impacts of *Tamarix*." —Joe DiTomaso, University of California, Davis, and author of *Aquatic and Riparian Weeds of the West*

▶ A new text book has been edited by two faculty members in the Dept. of Biological Sciences on the biologically and politically important invasive plant species *Tamarix*. This edited volume contains 25 essays by 41 authors on the hybrid swarm that represents invasive tamarisk, including its biology, ecology, politics, history, management, and even the philosophical and ethical issues involved with designating a particular species as "good" or "bad". These works reflect the controversy that has arisen around the role of *Tamarix* in our ecosystems and what should (or should not) be done about it, particularly in the context of the release of a biological control agent. This text includes the examination of the many facets of this interesting plant, encompassing a collection of written works from the



FIRST-YEAR PUKSTA SCHOLAR SETS SIGHTS ON BETTERING THE COMMUNITY

Photo courtesy of Laleobe Olaka

▶ First-year student Laleobe Olaka is one of three 2013 Puksta Scholars at DU. "It's a program that helps to further and better the community, and I've always wanted to do that," says Ms. Olaka, a Nigerian native who moved to the U.S. with her family at age 6. "Puksta also requires each scholar to do a project, which for me is another stepping stone towards opening a nonprofit."

Laleobe, a 2013 graduate of the Denver School of Science and Technology, entered DU in September as a first-year student and one of three 2013 Puksta Scholars. The Puksta program, run through DU's Center for Community Engagement and Service Learning, helps fund students interested in working for the public good.

Laleobe Olaka knows she wants to make a career out of helping people, and she knows that a University of Denver education will help her reach her goal. At DU, she plans to study biology as a lead-in to a graduate degree in nursing. There's a personal connection here, as well — Ms. Olaka's little sister is quadriplegic, and she has helped with her care for most of her life. "She was born that way, and the doctors said she's not going to live past the age of 5," Ms. Olaka says. "She's constantly proving them wrong. She's 12 right now, and I wanted to go into the medical field because I knew the first thing I wanted to do was help her out. I always thought I wanted to be a neuroscientist and do surgery on her, but that's kind of extreme. I wouldn't want to mess up."

Already Ms. Olaka volunteers with Colorado Uplift, a nonprofit that teaches leadership and life skills to urban youth in Denver, and at Children's Hospital, where she works with kids at risk for HIV. Eventually she would like to open a nonprofit that addresses poverty or hunger. "I really enjoy helping people out, and I really enjoy spending time with people and seeing the difference my work does to their lives, whether it's in a small way or a big way," she says.

In addition to her work in the Puksta program, Ms. Olaka states that she is looking forward to studying abroad. She also sees the University as a place where she can begin to make connections that will help her for the rest of her life.

Posted by Greg Glasgow, September 4, 2013

2013 NSM AWARD CEREMONY RECIPIENTS



**EXCELLENCE IN RESEARCH:
DR. BARRY ZINK
DEPT. OF PHYSICS & ASTRONOMY**

Over the last seven years Barry has established a research program with the general goal of probing thermal and thermoelectric physics in nanostructures, thin films, and novel materials. This work seeks to answer fundamental and applied questions ranging from spintronics, to quantum detectors and quantum information, to materials for energy harvesting and next-generation nanoelectronics. His work has been supported by the Department of Energy, the

Nanoelectronics Research Initiative, and the NSF CAREER award, among others. He continues to receive awards supporting this innovative work and we look forward to seeing how Dr. Zink's work will be used in the development of all these areas of applied sciences.

**EXCELLENCE IN TEACHING:
DR. HILLARY HAMANN
DEPT. OF GEOGRAPHY & THE ENVIRONMENT**

Dr. Hamann sets the standard for being thorough and meticulous in the preparation and execution of her courses. This comment came from a student in her First Year Seminar course and was particularly descriptive of Hillary's approach to her classroom practice:

I thought the course was great! It was challenging but a nice intro to college. I learned things that I could take to other courses and really gave me the tools to consider rivers in a different, more critical way. One of my favorite moments was when I was in my Intro to Int'l Politics class and my professor said, "I'm not sure how water law works in Colorado." My hand shot up and I said, "I know that!" And I explained it to the whole class and professor—everything I said came from my Colorado's Rivers class.

Dr. Hamann has established herself as an excellent and conscientious classroom teacher in both foundational and upper-level courses and we feel is not only one of the best teachers in the division, but at the University as well.



**OUTSTANDING JUNIOR FACULTY:
DR. TODD BLANKENSHIP
DEPT. OF BIOLOGICAL SCIENCES**

Outstanding junior faculty must exemplify excellence in the many facets of being a successful faculty member of NSM. Todd received a \$1.4 million NIH R01 grant entitled "Dynamics of Epithelial Polarity Proteins and Their Control of Tissue Architecture" and was also awarded a competitive postdoctoral position from the Renew DU program who will be working collaboratively with another biology faculty to study P-granule function during embryogenesis. Due to his

research expertise, Dr. Blankenship was also invited to speak on his research at the European Drosophila Conference in Barcelona, Spain which is the eminent "fly" meeting in all of Europe. This past year, Todd also premiered the most popular first-ever offered upper division course in biology entitled Cell Biology of Cancer. Students not only found his course interesting but also found that it contained the type of information they need to be successful in pursuing their future careers in pre-allied health fields. As a junior faculty member, Todd embodies the true spirit of being a successful member of the NSM family.

**OUTSTANDING SERVICE-FACULTY:
DR. NANCY LORENZON
DEPT. OF BIOLOGICAL SCIENCES**

Dr. Lorenzon's service activities are not only abundant in number, but also in quality, especially when it comes to the involvement of student affairs in her home department of Biological Sciences and the division of NSM. She has served on at least seven vital committees always taking a lead or most active role. Of note, she is vice-chair of the University's Institutional Animal Care and Use Committee (IACUC) as well as being the director of the animal facility. Her work in these areas is absolutely essential to the success of the division's research mission. For these reasons, Dr. Lorenzon was asked to play a major role in the design process for the proposed animal facility in the new Center for the Study of Aging. Nancy also took



2013 NSM AWARD CEREMONY RECIPIENTS, CONTINUED

the lead in the development of the new Professional Science Master's degree with a concentration in Biomedical Sciences. This involved not only curricula design but also identifying and securing stake holders from across campus and throughout the Front Range area to play a role in the successful implementation of this new degree program. Nancy's ability to bridge partnerships both internally and externally continues to create success for NSM! Last but not least, Nancy has also been one of Biological Sciences' primary undergraduate recruiters, meeting with numerous prospective students and their families.



OUTSTANDING SERVICE-STAFF: JOEL BENSON OFFICE OF THE DEAN, NATURAL SCIENCES & MATHEMATICS

Joe Benson has held several positions here at DU and we are very pleased that he decided to bring his wealth of wisdom and experience to the NSM Dean's Office. Joe started working at the University of Denver in December of 1994 where he was hired as the Budget Officer for the Daniels College of Business. He became the Assistant Controller for Budget Operations in 2000 and served on the Banner

Finance implementation committee. In March of 2003, Joe moved into the position of the Director of Student Financial Services and while in that position, oversaw the Bursar's Office, Cashiering Services, and the Pioneer Card office. In April of 2007, Mr. Benson continued to expand his areas of expertise by becoming the Director of Business Services. This meant overseeing Purchasing Services, Accounts Payable, the Warehouse, and Mail Services in addition to Student Financial Services. Lastly, in October of 2012, he became the Director of Budget and Planning in the Division of Natural Sciences and Mathematics. He has played an essential role in helping all departments in the division to become more efficient in the evaluation and management of their financial affairs all with a positive and supportive attitude. We all consider ourselves lucky that Joe landed in NSM when he did!

MOVERS AND SHAKERS

There were several changes in the familiar faces around the division this year. Here is a list of folks who made the "Movers and Shakers" list.

EMERITI:

- Dr. Judy Snyder (Biological Sciences)
- Dr. Jim Hagler (Mathematics)
- Dr. Ronald Blatherwick (Physics and Astronomy)

NEW LECTURERS:

- Dr. Adriana Suarez Corona (Mathematics)

NEW STAFF:

- Amanda O'Connor (Geography and the Environment)
- Margene Brewer (Biological Sciences)

TENURE & PROMOTION:

- Dr. Scott Barbee, Associate Professor (Biological Sciences)
- Dr. Kingshuk Ghosh, Associate Professor (Physics and Astronomy)
- Dr. Jennifer Hoffman, Associate Professor (Physics and Astronomy)
- Dr. Martin Margittai, Associate Professor (Chemistry and Biochemistry)

UNIVERSITY AWARDS:

- Dr. Michael Kinyon (Mathematics) United Methodist Church, University Scholar/Teacher of the Year
- Dr. Steve Iona (Physics and Astronomy) – Faculty Pioneer Award
- Dr. Susan Sadler (Biological Sciences) 2013 Outstanding Student Organization Advisor Award
- Dr. Matthew Taylor (Geography and Environment) William T. Driscoll Master Educator Award
- Dept. of Geography and the Environment – 2103 Community Engagement Award



RESEARCH NEWS: FABULOUS FIVE

WHAT HAPPENS WHEN AN INTERNSHIP GOES TO THE DOGS? LITERALLY!



Lisa Wickman. Class of 2015, Biology major and Chemistry/Environmental Science minors

surgery suite learning to build surgical packs, surgery clean-up, how to intubate a dog, draw blood and prep animals for surgery." When asked what she loved best and least about her experience, Lisa replied that working everyday with the animals and the wonderful LPCHS staff was the best and that saying goodbye to all the animals was definitely not! If there is one word which summarizes Ms. Wickman it would have to be 'passionate'. Her caring nature and work ethic earned her not only an internship but a greater understanding of what skills would be necessary to work extensively with animals - and it only convinced her further that her future lies in the company of that such as Dr. Dolittle.

▶ This story came from the Internship Insights website and highlights a biology student, Lisa Wickman, who had an interest and a passion to obtain and internship which works up close and personal with animals. Lisa's drive and initiative led her to the La Plata County Humane Society (LPCHS) where she would come one step closer to her "dream job" of becoming a wildlife veterinarian. "I had two jobs (at LPCHS): one as a kennel tech...helping with feeding, cleaning, exercising animals and anything else that needed to be done and one as a vet tech in the

▶ Although this year we had numerous research proposals which were successfully awarded, we thought you might find the following representatives very interesting. Enjoy!

1 BIOLOGICAL SCIENCES

Dr. Jack Kinnamon received an award in collaboration with the University of Colorado Denver entitled "Scanning Block Face 3D EM of Taste Buds". The main goal of this interesting project is to utilize a new technology, called Block Face Serial Electron Microscopy (EM), to assemble a complete 3D understanding of the functional organization of taste buds. Block face serial EM allows for sequential acquisition of ultrastructure level (e.g., 40 nm resolution) images of tissue blocks through about 100-200 μ m of depth. Because the tissue block does not move within the EM machine, there is no problem of section alignment, shrinkage or swelling giving an accurate and valuable 3D structure. Dr. Kinnamon's lab will use these structures to aid in the answering of questions about taste bud structure and function, such as:

- Is there evidence of specialized points of contact, e.g. accumulation of vesicles, at areas of contact between the different types of taste cells?
EM micrographs show substantial contact between different types of taste cells. The 3D EM micrographs will be used to determine whether there is morphological evidence for specialized contacts between these cell types.
- Do single nerve fibers have specialized contacts with all types of taste cells or just some?
Previous studies indicated that single nerve fibers form functional contacts with only one type of taste cell (e.g. light or dark), but this was based on a limited sample of nerve fibers. Our data set will permit a more rigorous test of this claim.
- What is the 3D relationship between nerve fibers and nerve cell types?
Type I cells have extensive flattened sheet-like processes that extend between and envelop other cells and nerve fibers of the taste bud. The block face EM micrographs will permit reconstruction of the different cell types to establish unequivocally the 3D relationships between them.

A taste of the daily workings in the Kinnamon lab...

FABULOUS FIVE, CONTINUED

2 CHEMISTRY AND BIOCHEMISTRY

Drs. Gary Bishop and Don Stedman are working to make our air quality better with a grant entitled “Measuring On-Road Emission on the Move”. Grant activities will encompass collecting on-road data for more than 20,000 light-duty vehicles for not only emission of hydrocarbons, carbon monoxide and nitric oxide but also ammonia, nitrogen dioxide and sulfur dioxide. The data will be used to analyze the effectiveness of Low Emission Vehicle II (LEVII) programs in California. This grant also implements a new data collecting methodology to identify gross evaporative emitters that have been challenging to capture in the past. The goal of this type of creative data capture is to promote the spread of low-emission programs such as those implemented in California to other states across the nation. It gives a whole new meaning to “Start your engines!”. For more on this story visit the website: blogs.scientificamerican.com/guest-blog/2013/05/23/a-new-way-has-been-found-to-make-truck-emissions-testing-more-accurate-and-less-costly

3 GEOGRAPHY AND THE ENVIRONMENT

Dr. Matthew Taylor received a collaborative award with Woods Hole Oceanographic Institution and the Universidad del Valle (Guatemala City) with the title “Tree-ring Drought Reconstructions in Guatemala and Honduras”. This important project builds on prior work utilizing tree-ring chronologies taken from high elevation Central American conifers to examine hydroclimatic variability along the length of the ‘Dry Corridor’ that stretches from western Honduras to the western ‘altiplano’ of Guatemala. This work will further the continued expansion of the geographic range of dendrochronology into regions

of Central America that may already be experiencing the early consequences of anthropogenic climate change. Data will be made available to scientists as well as the public through the NOAA World Data Center for Paleoclimatology. This type of international collaboration is crucial to our mission here at the University of bringing education and opportunity to our partners across the world. To learn more about Dr. Taylor’s research, visit his website at mysite.du.edu/~mtaylor7/site/home.html.

4 MATHEMATICS

This past summer, the Department of Mathematics hosted the Third Mile High Conference on Nonassociative Mathematics funded by a grant from the National Science Foundation. This conference hosted not only speakers from a variety of fields in nonassociative mathematics but was attended by 58 researchers from 17 countries making this a truly interdisciplinary and internationally attended meeting. The cross-disciplinary collaborations which result from conversations and presentations taking place at the meeting are critical to the advancement of all areas of nonassociative mathematics. This conference was also accessible to grad students and post-doctoral students to have an opportunity to interact with leaders in the field and their current research. Another important aspect of the conference is for the leaders in this area to update and identify the most important open problems requiring research in the field and then to discuss how this list will be disseminated and maintained. The Co-chairs of the meeting, Drs. Michael Kinyon and Petr Vojtechovsky soundly declared this meeting a success! For more math happenings visit their online newsletter at du.edu/nsm/departments/mathematics/media/documents/newsletter/fall_2013_final.pdf

5 PHYSICS AND ASTRONOMY

In 2013 Dr. Jennifer Hoffman received an award to study the patterns of decomposing stars entitled “The Geometry of the Stellar Winds and Shock Structure in V444 Cyg”. The amount of mass a star sheds via stellar winds during its lifetime determines its eventual fate: whether it dies gently and becomes a white dwarf or whether it explodes violently as a supernova, leaving behind a neutron star or black hole. This grant uses a multi-technique study which combines X-ray spectroscopy and optical spectropolarimetric methods to describe the 3D nature of the shock and wind structure in a star called V444 Cyg. V444 Cyg provides a unique opportunity to study a star’s evolution because of its eclipsing nature. As Jennifer explains, “In eclipsing binaries, the two stars take turns crossing in front of each other from our perspective as they complete their orbits. When one of them is in back, we know that all the light we see must come from the other one (or else be indirectly reflected from the surrounding material). The eclipses give us a geometrical constraint that we don’t have in non-eclipsing systems.” Using data patterns obtained from both the x-ray spectroscopy and spectropolarimetric analysis will allow the Hoffman lab to build a realistic 3D model of the complex winds in the eclipsing system and allow them to quantify its mass loss characteristics, giving a better understanding on the origin of neutron stars and black holes. Something to ponder as we look out at all those stars...For more information visit Dr. Hoffman’s website at grammai.org/jhoffman.

USING MACROMOLECULAR X-RAY CRYSTALLOGRAPHY TO AID IN THE DEVELOPMENT OF VACCINES AND TREATMENT DRUGS

▶ The CCHF virus is considered a dangerous emerging disease by the CDC and has fatality rates as high as 80%. Originally identified in the Congo by a member of the former Soviet Union, the virus has rapidly spread throughout Africa, Asia, and Europe. More recently CCHF has become a topic of interest to researchers in the United States due to the 2009 death of a U.S. soldier stationed in Afghanistan. The more particular symptoms of CCHF in humans include fever, prostration, and severe hemorrhages. To date there is no FDA approved vaccine or drug available to treat the CCHF virus.

Assistant Professor Dr. Scott Pegan (Dept. of Chemistry and Biochemistry) and his lab of undergraduate and graduate student scientists are investigating a CCHF viral enzyme known as a viral ovarian tumor domain protease. Specifically, they are using a mix of structural biology and enzymology techniques to reveal its, as well as other related enzymes, impact on the human immune system. They have been able to obtain the atomic level structure of the CCHF viral ovarian tumor domain protease bound to its human protein target. Dr. Pegan's long-term goal is to translate the structural understanding of this specific viral protein into information which can be used for drug development and vaccine development. The investigating team led by Pegan hopes that by targeting this key protein a feasible treatment for the CCHF virus can result saving a multitude of lives across the globe.

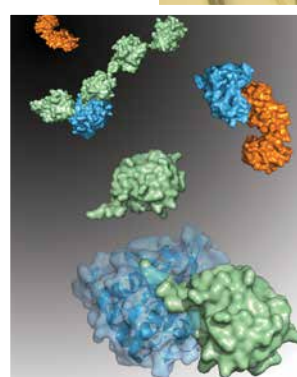
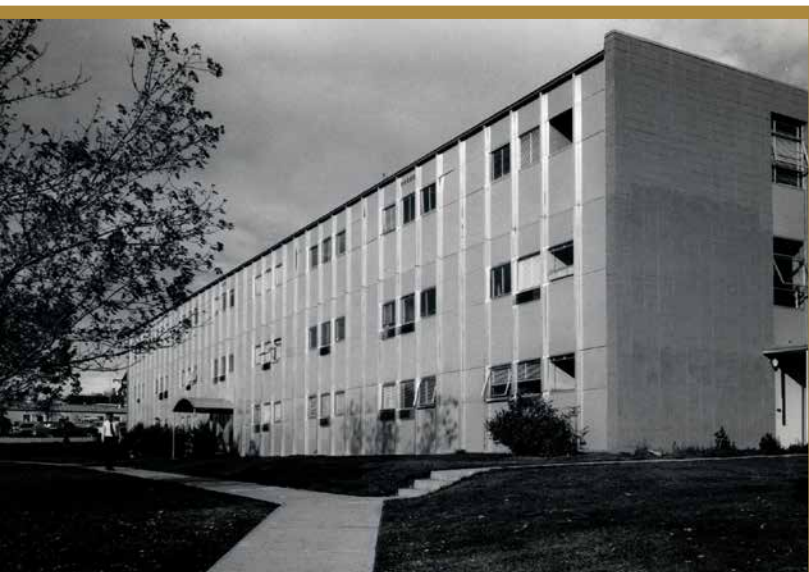


Figure 1. DU student Sean Connor loads cryogenically frozen protein crystals at the Life Science Collaborative Access Team's X-ray beam-line located at Argonne National Laboratory's Advance Photon Source in Illinois.



Figure 2. Structural renderings of the Crimean-Congo Hemorrhagic Fever viral protein in complex with various human protein targets.



GOODBYE JOHN GREEN HALL!

John Greene Hall (JGH) has been the home of the Mathematics Department for several decades. Built in 1958 as a temporary building (originally only with two stories), it has served generations of math majors and graduate students, most of you included. As of today, JGH is slated for demolition in early 2014.

A new, larger building for the Daniel Felix Ritchie School of Engineering and Computer Science will be built on the footprint of JGH and, partially, on the surrounding parking lots.

NATURAL SCIENCES & MATHEMATICS DEANS & STAFF:

Andrei Kutateladze, Dean
Nancy Sasaki, Associate Dean
Joe Benson, Director of Budget and Planning
Karen Escobar, Assistant Director of Budget & Planning
Kirsten Norwood, Executive Assistant to the Dean

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