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FACULTY newsletter

CPMS Physical and Mathematical Sciences

To Bhutan and Back Again

ABOVE Humanitarian geology took Rupper to Bhutan.

Summer Rupper

There they were, more than 7,000 miles from BYU, with pounds of snow gear and weather equipment in their backpacks.

Dr. Summer Rupper, of the Department of Geological Sciences, traveled last summer with graduate student Josh Maurer and a team of scientists to Bhutan, a small country in Southeast Asia, to study uninvestigated glaciers in the Himalayas.

Their research of these glaciers could greatly affect the lives of numerous people in the region because so many depend on these glaciers and their runoff. "These glaciers generally form the headwaters for some of the major rivers of the world," Rupper said. "And as they retreat, some of the big questions are, what will the impact of that retreat be on water resources?"

The water flow coming from these glaciers could flood villages downstream, as well as affect the use of fresh water, hydroelectric power, and agriculture in the area.

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Origami Helps Math Take New Shape

Photos courtesy of Robert Lang

Making paper cranes proves that you don't need a pencil and paper to do math . . . well, at least not the pencil.

Robert Lang, a recognized origami artist and physicist, spoke on campus about the math behind his beautiful, folded-art creations.

"Origami is an art form that even a math person could love," Lang said at the lecture. He went on to explain how math began to be involved in origami in more recent years, resulting in much more complex shapes, but still one uncut sheet of paper.

Lang described two broad fields of research in origami: origami mathematics, which deals with number fields and geometry, and computational origami, which studies algorithms and computability in more of a computer science emphasis.

Lang argued that if you use both types of mathematical origami, you could get specific answers to general geometric questions. In origami, a point is defined as the spot where two lines come together. One way artists can make new lines is by folding two points together and flattening, creating a new edge or line.

Through origami math, it is possible to approximate distances along an edge of a sheet of paper. For example, imagine you want to find a point that divides an edge into two segments whose lengths are proportional to x and (1-x). Then the number of folds needed is the number of bits needed to represent x as a binary fraction.

"One of the things I love about origami math is that there are easily understood, unsolved problems," Lang said. "Maybe one of you will solve some of them."

Lang explained some of the problems he solved while researching how many ways one can make a point or line with one-fold origami. Originally, it was accepted that there were six distinct operations for forming a line by aligning different combinations of points and lines.

When a seventh axiom was discovered, it changed the origami world.

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Dates to Note

College Award Nominations Due
Wednesday, Jan. 9

SRC Website Opens for Abstract Submissions
Tuesday, January 15

College Awards Banquet
Thursday, January 31
6p.m., WSC Ballroom

University Award Nominations Due to the College
Wednesday, February 6

Izatt-Christensen Lecture
General Session
Wednesday, February 6
4p.m., JSB Auditorium
Technical Presentation
Thursday, February 7
11a.m., BNSN W111

Summer Rupper

ABOVE Rupper's research could affect thousands of lives for good.

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Lang's research has been looking into two-fold axioms, where you make two folds at the same time. He and his collaborator have found more than 400 different operations, opening up a myriad of possibilities to the future of origami mathematics.

Lang has received international praise for both his mathematical research and artistic sense of origami. He even designed and folded a Google Doodle honoring Akira Yoshizawa, the Japanese grandmaster of origami.

Students responded well to the lecture, saying it was engaging on many levels.

"In the end, the talk highlighted one of the most exciting things about math: it pops up in all sorts of unexpected places," said Abraham Frandsen, a mathematics major. "Understanding the mathematical framework of the world inevitably accelerates progress and facilitates a blossoming of intellectual and even artistic achievement."

by: Alysa Kleinman

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Satellite images show the glaciers retreating, but scientists don't know the magnitude of the melt rates or the mass index of the glaciers themselves. Much of the past history of these glaciers remains unknown, making studies like this one all the more important.

Rupper led a portion of the crew of 21 scientists and mountaineers to find more answers for the Bhutanese people.

What is found in these and future studies may help Bhutan be better prepared for any potential changes in water level as the glaciers melt in some parts and collect ice in others.

Dr. Rupper believes glaciology (the study of glaciers) is one place where geology influences human life. What we learn about glaciers can have a direct impact on those who live close to and downstream of them. And these particular glaciers are special for her.

"The glaciers of the Himalayas are feeding the greatest percentage of the world's population, and much of it very, very poor," Rupper said. "So the changes in these systems have potentially a huge impact on these societies and, by default, on the world."

by: Curtis Penfold

College Publications

Chemistry and Biochemistry

L.D. Hansen, J.B. Nielson, "Chapter 10 Lactose Chemistry", Food and Nutritional Components in Focus No.3 Dietary Sugars: Chemistry, Analysis, Function and Effects, 2012

Geological Sciences

C.J. Spencer, R.A. Harris, M.J. Dorais, "Depositional Provenance of the Himalayan Metamorphic Core of the Garhwal Region, India: Constrained by U-Pb and Hf Isotopes in Zircons", Gondwana Research, 2012, volume 22/issue 1, pp. 26-35

C.J. Spencer, R.A. Harris, M.J. Dorais, "The Metamorphism and Exhumation of the Himalayan Metamorphic Core, Eastern Garhwal Region, India", Tectonics, 2012, volume 31, pp. 1-18

C.J. Spencer, C.W. Hoiland, R.A. Harris, P.K. Link, E.A. Balgord, "Constraining the Timing and Provenance of the Neoproterozoic Little Willow and Big Cottonwood Formations, Utah: Expanding the Sedimentary Record for Early Rifting of Rodinia", Journal of Pre-Cambrian Research, 2012, volumes 204– 205, pp. 57– 65

Mathematics

A. Francis, T. Jarvis, D. Johnson, R. Suggs, "Landau-Ginzburg Mirror Symmetry for Orbifolded Frobenius Algebras", Proceedings of Symposia in Pure Mathematics, 2012, volume 85, pp. 333-353

N. Andersen, P. Jenkins, "Divisibility Properties of Coefficients of Level P Modular Functions for Genus Zero Primes", Proceedings of the American Mathematical Society, 2013, volume 141/issue 1, pp. 41-53

Mathematics Education

K.R. Leatham, "Problems Identifying Independent and Dependent Variables", School Science and Mathematics, volume 112/ issue 6, 2012, pp. 349-358

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