

People Are Animals, Too

Dr. Dean Wilkinson and his business and life partner Dr. Pepita Wilkinson own a thriving veterinary practice in Socorro—Animal Haven, and offer real-world vet clinic experience to many of our pre-vet undergraduate students. In 2012 after a change in faculty, Dr. Dean answered a plea to teach a class on a temporary basis. This revealed a natural talent and love of teaching that has made him indispensable to New Mexico Tech. His courses on a variety of topics are frequently cross-listed with Psychology and are among the most popular biology electives. He brings to his classes real stories and biological specimens from his practice, and, on one memorable occasion, his own horse carefully painted with her skeleton on one side and her musculature and organs on the other!



Dr. Dean earned his B.S. in Animal Sciences at NMSU and his Doctorate of Veterinary Medicine at Colorado State University.

Hands-on training for all Students



Scorpion displaying fluorescence under UV light.

One of the strengths of the NMT Biology Department has been the commitment to providing research and lab experience to all of students. Dr. Kaarin Goncz, brings a plethora of experience in both science and education to the biology teaching labs. Dr. Goncz received a Ph.D. in Biophysics from UC Berkeley and a M.Ed. from the University of Vermont. She has

since been involved in genetics research, K-12 science education and outreach and, small business ventures. In addition to teaching General Biology III and Genetic Engineering, Kaarin works with the faculty in the Department to renovate existing lab courses and create new and exciting experiences for our students from classical experiments in microbiology to cutting edge research in metagenomics. The new Biomedical Sciences undergraduate and the current Accelerated Masters in Biology degree program require students to participate in research projects. With the increase in undergraduate research projects, Kaarin has developed curriculum for training in research methodology. She is also an enthusiastic advocate for STEM education and is involved with the Masters in Science for Teachers (MST) program as an Instructor and Adjunct Professor.

Biology Degrees Awarded:

B.S. in Biology
B.S. in Biology with Environmental Science Option
M.S. in Biology
M.S. in Biology with Biochemistry Option
Accelerated BS/MS in Biology
Minor in Biology
Minor in Geobiology

Interdisciplinary Degrees:

B.S. in Environmental Science with Biology Option
B.S. in Biomedical Sciences—Biology, Chemistry or Neuroscience option with engineering concentration in Biochemical Engineering, Bioinformatics, Biomaterials or Biomechanics
Ph.D. in Biotechnology—Incorporates the departments of Biology, Chemistry, Psychology, Computer Science, Mathematics, Earth and Environmental Sciences, Chemical Engineering, Mechanical Engineering, Materials Engineering, Environmental Engineering and Management



People in the Department:

Linda DeVeaux, PhD, Professor, Chair: Radiation microbiology, extreme survival mechanisms, and surface water pathogenicity Linda.DeVeaux@nmt.edu

Thomas Kieft, PhD, Professor: Deep subsurface biosphere, Animal-microbe interactions Thomas.Kieft@nmt.edu

Snežna Rogelj, PhD, Professor: Drug discovery, cancer, pathogens, biosensors, anti-microbial materials Snezna.Rogelj@nmt.edu

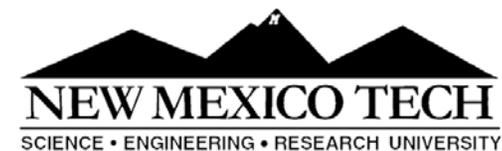
Benjamin Duval, PhD, Asst. Professor: Plant ecology, climate change, soil science, applied ecology Benjamin.Duval@nmt.edu

Kaarin Goncz, PhD, Lab Associate, Instructor, Adjunct Professor, MST Program Kaarin.Goncz@nmt.edu

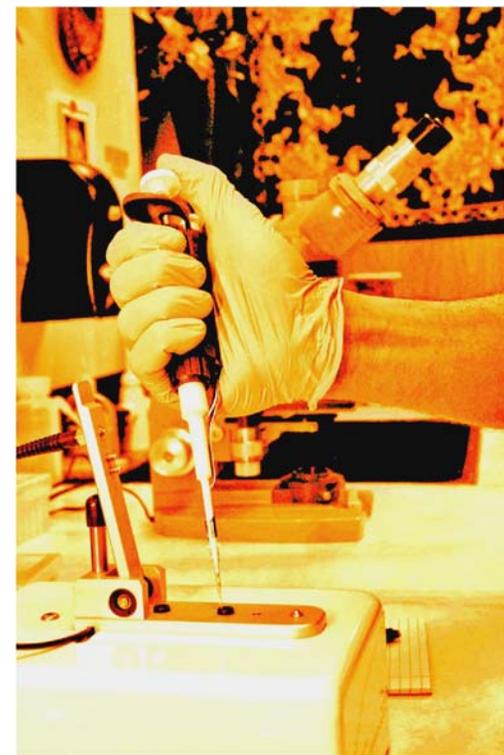
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New Mexico Tech Biology Department Research

Climate Change Hits Belowground



Heavy traffic and smoke billowing from factories is what most people associate with carbon gases and climate change, but soils hold more carbon than all plant life on Earth. Dr.

Ben Duval, pictured, is hoping to understand how plant roots and microbes in the soil help store that carbon belowground. Along with graduate students, Duval is studying what triggers native New Mexican piñon and juniper trees to make seeds in our dry ecosystems, a process that requires plants to put some of their carbon into roots. Soil bacteria and fungi chemically change the carbon, and play an important role in keeping it in the ground. Duval is also working on a Department of Energy funded project that will measure how much carbon gets into the soil from crop roots, and if the amount of carbon that stays belowground depends on a farmer's decisions about how and when to use fertilizer and irrigation. www.DuvalEcology.org

Illuminating Lampenflora

New Mexico Tech microbiologist Dr. Tom Kieft, his graduate students, and staff from the National Cave and Karst Research Institute (NCKRI) conducted a research project

to help the National Park Service solve a problem at Carlsbad Cavern. Artificial lightning, which is essential for visitors to enjoy the natural wonders of the cave, has the unintended consequence of promoting the growth of algae and cyanobacteria, termed "lampenflora." The Park Service has recently installed new LED lights to save energy and to lessen



the algal problem by using wavelengths of light that are less favorable to algae. Working under a grant from the Park Service, Kieft monitored the formation of photosynthetic biofilms for two years at multiple sites in the famous Big Room at the Cavern. They also used high-throughput DNA sequencing to thoroughly characterize the microbes within the biofilms. Information gained through this study should help the Park Service to preserve the beautiful cavern features in a pristine state.

What makes some microbes so tough and nasty?

Dr. Linda DeVeaux is a microbiologist studying organisms that inhabit extreme environments, as well as some that are not so extreme. For example, some extremophiles can withstand 1000x



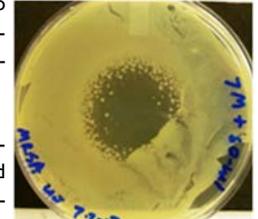
more radiation than a human cell. Others not only survive in briny water, but actually require it. The way these cells do that is still somewhat of a mystery, but it is clear that protecting their DNA and proteins from these stresses is a key factor. Using molecular and genetic techniques, Dr. DeVeaux and her students are helping to unravel the basis for these extreme adaptations. In somewhat less extreme environments, microbes exchange DNA on a regular basis. Human activities, including extensive use of antimicrobial compounds, has led to an increase in microbes with

antibiotic resistance and increased pathogenicity. Certain environments seem to be hotbeds for this activity, and may result in the emergence of a "superbug". By analyzing the entire genetic content of these environments, it may be possible to predict when this will happen, and protect us from a disease outbreak by newly evolved pathogens. Understanding the genetic basis for these adaptations will allow us to apply these findings to situations as varied as space travel, cancer treatment, and emerging infectious diseases.

Booster Shots for Old Antibiotics

Antibiotics have been saving lives for the past 60 years, but their widespread use has resulted in evolution of highly drug-resistant bacteria. Multi-drug resistant bacteria are now a global threat as fatality rates in some cases approach 50%. For example, about 30,000 people a year in the US die from infections with Methicillin-resistant *Staphylococcus aureus* (MRSA) while MRSA hospitalization

stays double. Dr. Snezna Rogelj, and her team at New Mexico Tech invented a set of drugs that re-invigorate standard antibiotics. Their drugs restore the activity of seven diverse classes of antibiotics against a wide variety of drug-resistant and drug-sensitive bacteria, including MRSA, VRE and CRE and *B. cepacia*. In combination, such drug-resistant bacteria are once again susceptible to low doses of well tested, clinically proven and widely prescribed antibiotics.



As illustrated in the photograph, a related compound directly kills MRSA when activated by light (center of plate); this reduces 100,000,000 MRSA cells to 0 within two minutes of irradiation with plain white light. Analogous effect can be achieved on cancer cells.

Cellular energy – a billion years in the making

The enzymes that carry out cellular respiration and photosynthesis are distributed across three entirely distinct and separately inherited genomes, yet eukaryotic health and fitness is critically dependent upon their successful interaction. Moreover, maternally inherited cytoplasmic genomes rarely undergo sexual recombination and exist in dozens to thousands of copies per cell, while corresponding nuclear genomes are bi-parentally inherited, one or more copies from each parent, via sexual reproduction. The Sharbrough lab investigates how, in the face of these fundamentally different genetic systems, mitochondria and chloroplasts are able to successfully maintain the molecular machinery responsible for nearly the entire supply of cellular energy. We use a combination of different eukaryotes to investigate these fundamental questions including crop plants such as wheat, cotton, quinoa, peanuts, and coffee as well as the globally invasive New Zealand freshwater snail *Potamopyrgus antipodarum* (pictured).

