Extremophiles!

Tiny organisms that thrive in the harshest conditions on Earth could change the way we address environmental toxins, antibiotic resistance and much more.
Meet Melat

In a time when differences so often foster conflict, misunderstanding and divisiveness, Melat Weldeselasie sees reasons to celebrate.

Melat Weldeselasie believes differences create beauty, something she has worked hard to honor and advocate for in her many roles on campus. She has served as a CBS peer mentor and a Students Crossing Borders community advisor, and been a member of Ethiopian and African student associations.

The CBS senior received the 2018 Josef Mestenhauser Student Award for Excellence in Campus Internationalization for her activities. She hopes the recognition will encourage other students working to promote global competence.

“We live in an absolutely beautiful world and there is so much power in being able to recognize and value beauty and difference in people, cultures, languages and even in our shared and intertwined experiences,” Weldeselasie said. “I believe campus internationalization brings us closer to being able to recognize and value that beauty.”

Upon her graduation, Weldeselasie will continue to pursue her passions for people, travel and service as a Peace Corps volunteer in Guatemala. In her role as a healthy schools coordinator, she will focus on improving health instruction in rural schools, a position that aligns with her long-term goal of a career in healthcare. —GINA VAN THOMME
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A MESSAGE FROM THE DEAN

An invitation to reconnect

It is hard to believe we bid farewell to another graduating class. This was my third commencement as dean of the College of Biological Sciences, and each year my appreciation for the community and camaraderie on display that day in May grows. Professor Emeritus John S. Anderson — a figure familiar to generations of CBS students — led the newly minted alumni in “Hail! Minnesota” at the end of the ceremony as he does each year. It was a moment of nostalgia for the graduates, many of whom learned the song from John at Nature of Life as first-year students.

This year we brought things full circle by inviting the Class of 1968 to participate in the festivities. Fifty years ago, they joyfully tossed their mortar boards in the air. There were only a handful of them at that celebration five decades ago. This spring, nearly 400 graduates crossed the stage at 3M Arena at Mariucci. They joined more than 15,000 alumni as part of a community that extends around the world.

In this issue of BIO, you’ll meet a handful of those alums including Gail Buhl, who spends her days educating the public about hawks, owls, eagles and other birds of prey at the University of Minnesota’s Raptor Center. You will meet Mary Kemen, a physician and fourth-generation Gopher with a passion for inspiring a love of science in schoolchildren. You will also meet Beau Miller, a 2014 graduate who uses his background in biology to advise clients at a major investment bank, and read about the recipients of our Alumni Achievement Award and Emerging Leader Award.

All of them have in common a deep interest in understanding how the world works and sharing their discoveries with others.

“At commencement each year we tell our graduates that they are now part of a community of alumni that they can rely on to support and nurture them as they venture forth into the world.”

At commencement each year we tell our graduates that they are now part of a community of alumni that they can rely on to support and nurture them as they venture forth into the world. As alumni of this College, you are part of that community. Let us know what you are up to and where you are going. Send us an update using our online form — z.umn.edu/cbsclassnotes. Or contact our alumni relations coordinator, Katie Beaudet (kmb@umn.edu) to learn more about opportunities to get involved. We look forward to hearing from you!

VALERY FORBES, Dean
The news dropped in December. For the members of the University of Minnesota Marching Band, it was a moment of excitement that had to be kept under wraps for weeks.

“We found out we were performing in the Super Bowl halftime show at our end-of-season banquet in December,” says Bethany Rowbal, a CBS undergraduate and alto saxophone player. “I wasn’t expecting to get the news then, but when it was announced that we were going to be in the show, the room went crazy.”

While keeping the plan a secret until they stepped out on the field February 4, Rowbal and her fellow marching band members put in over 50 hours of rehearsal time to get ready for one of the most anticipated music performances of the year.

Helping play the background music for Justin Timberlake’s “Suit and Tie” as well as performing as dancers and in other roles during the halftime performance was a once-in-a-lifetime experience for many of the students.

“I thought I knew what it was going to be like since we’d been practicing at U.S. Bank Stadium all week, but it was a whole different experience with people lining the sidelines waiting to see us and asking us who we were,” Rowbal says. —LANCE JANSSEN
To market they go!

You might not expect to see science activities at the farmers market, but if you visit one of several Twin Cities markets this season you just might. Market Science, a group that takes science to local farmers markets, will once again set up shop at Midtown, Richfield and Nokomis farmers markets. The goal: to connect with the community and inspire an interest in science. Each event has a different theme with hands-on activities and plenty of time for visitors to ask questions, start conversations, or simply say “hello.” Market Science will also venture further afield to attend fairs and markets as far away as Bemidji before bringing it back home at the end of the summer for STEM Day at the Minnesota State Fair August 23!

Visit z.umn.edu/marketscience for dates and details.

A year-long look at lakes

On January 2, Lesley Knoll bundled up against the frigid cold of a northern Minnesota day and stepped outside, camera in hand. It would be the first of many forays to the same spot on the shore of Lake Itasca. She has returned every day since — no matter the conditions — to snap a photo for her #lake365 project.

For Knoll, station biologist at Itasca Biological Station and Laboratories, the social media venture is part science, part public engagement. She is interested in changes in ice cover and photos help tell that story in a way numbers alone cannot. Her idea has caught on. Scientists and others in at least nine states and five countries are participating in the online project!

Follow along on Twitter and Instagram with the #lake365 hashtag.
Aiming for the stars

The idea of space travel appeals to many people, but much remains unknown about how leaving the Earth’s atmosphere and spending time in a low-gravity environment impacts our bodies at the cellular level. Kate Adamala and Aaron Engelhart, researchers in the College’s Department of Genetics, Cell Biology and Development who specialize in synthetic biology, are part of a project taking flight this summer to find out. “We know that there are changes that happen to astronauts during space flight, but we don’t know exactly what that entails,” says Engelhart. The project, led by NASA interns, involves the launch of a small rocket into low-Earth orbit with synthetic cells on board. Stay tuned!

Read about the project at z.umn.edu/synthe ticbioinspace

Something in the air

Did you know there are plants that can live independent of soil? It’s true! And you can see a display of more than a dozen specimens from around the world at the College of Biological Sciences Conservatory. The genus Tillandsia, more commonly known as “air plants,” is found in forests, mountains and deserts, but you don’t need to go on a long trek to see them.

Go to cbs.umn.edu/conservatory to plan your visit.

The secret lives of animals caught on camera

The University of Minnesota’s Lion Center launched a new photo-centric citizen science project called SnapshotSafari earlier this year. Modeled on its popular predecessor, Snapshot Serengeti, the project offers a fun and accessible way for people to contribute to researchers’ efforts as they study the effectiveness of different wildlife conservation efforts.

Here’s how it works: Special cameras designed to snap a quick succession of pictures when they detect heat and motion were set up in more than a dozen parks and wildlife reserves throughout southern and eastern Africa. The resulting photos, which contain candid glimpses of elephants, giraffes and lions and other animals, are uploaded to the SnapshotSafari page on the Zooniverse website. From there, volunteers can identify the animals and behaviors they see.

“By collecting data from all of these protected areas in the same way, we will gain a broader understanding of the status of species, like lions, on a continental scale,” says Craig Packer, world-renowned lion researcher and head of the U of M Lion Center.

Interested in participating? Go to snapshotsafari.org.
Researchers at Cedar Creek Ecosystem Science Reserve have worked for decades to find a way to preserve and maintain the threatened Minnesota oak savanna ecosystem. Finding some success in prescribed burns, researchers also see the savanna at the field station slowly morphing into a grassland as younger oaks struggle to regenerate from the four to seven burns per decade. To tackle this challenge, Cedar Creek investigators will look to Minnesota’s past to find answers for the future.

“We are bringing a herd of 30 to 40 bison to Cedar Creek this summer to see what impact they have on restoring this critical Minnesota landscape,” says the station’s Associate Director Forest Isbell. “Bison are known from other research to be important for restoring grasslands, but little is known about their role in savanna ecosystems.”

In grasslands, bison graze on plants that may otherwise dominate the ecosystem, offering the chance for increased biodiversity. The team at Cedar Creek sees the potential for bison, once a prevalent species in landscapes across the state, to graze on the plant species they often try to control through prescribed burns, thereby moderating the fire effects and offering a potential chance for younger oaks to flourish.

“Our research has the potential to uncover an effective new strategy for restoring and maintaining a unique and vanishing Midwest ecosystem,” says Isbell. —LANCE JANSSEN

Interested in helping Cedar Creek welcome back the bison at a special event June 13? It’s easy! Become a member and receive an invitation. Join online at z.umn.edu/cedarcreekmembership
THINKING GLOBAL

CBS Dean Valery Forbes embarks on an international research collaboration that brings big-picture perspective to predicting — and potentially preventing — risks to the environment.

How might a new pesticide affect the balance of plant, animal and microbial life in a stream? What unanticipated changes could cascade through an ecosystem as the result of an oil spill? Finding the answers to these kinds of questions is the domain of ecological risk assessment. An expert in the field, College of Biological Sciences Dean Valery Forbes has spent her career thinking about how to better predict impacts of stressors such as pollutants, invasive species and climate change on ecosystems using mathematical models.

This fall, Forbes will collaborate with colleagues in Germany on projects related to ecological risk assessment. She was one of five researchers worldwide to receive this year’s Helmholtz International Fellow Award, designed to foster collaboration between top scientists and institutes associated with the Helmholtz Association in Germany.

You were nominated by the Helmholtz Centre for Environmental Research in Leipzig and will have an opportunity to collaborate on research with scientists at the center. What are your plans? Among other things, I am looking forward to the chance to work again with my colleague Volker Grimm. Volker is internationally recognized for his work in individual-based modeling and, in particular, for promoting good modeling practice to increase the transparency, consistency and robustness of what can be pretty complicated models. We’re thinking of writing a book or possibly developing a series of digital products to provide guidance on model development, implementation and documentation to encourage the use of such models in specific applications, such as for chemical risk assessment.

You lived and worked abroad for decades. Can you say a little about the value of international collaborations of this kind? It’s an absolutely invaluable experience not to mention great fun! The methods we use to solve scientific problems do not align with national boundaries, nor do the problems we are trying to solve. Doing science as part of an international team can be very challenging, sometimes very amusing, and almost always extremely rewarding. The diversity of perspectives leads to more effective and creative problem solving. Having the opportunity to live and work abroad is a tremendous experience and anyone who has the chance should do it, even if only for a short period of time. It really helps you to see your own culture in a new light. It challenges your assumptions and preconceptions, and makes you appreciate many things that you take for granted.

Pet away worry and stress before tests?

High-stakes tests can cause female students to underperform compared to their male counterparts according to a new study led by Sehoya Cotner, a professor in the Department of Biological Teaching and Learning. After uncovering the gender discrepancy behind this time-honored approach to student assessment, she wanted to explore ways to decrease test anxiety itself.

“We thought therapy animals might help our students who underperform as a result of test anxiety,” says Cotner, who worked with the University’s Pet Away Worry and Stress (PAWS) program to bring in therapy animals before tests in two classes this spring.

Cotner will evaluate the results from the exams before coming to a conclusion on whether some of the PAWS program’s fabulous Fidos can help reduce student stress. The initial response was as warm and fuzzy as you’d expect. “A quick peek at the comments suggests that the students really enjoyed the experience,” she says.

Read about the study and Cotner’s work at z.umn.edu/STEMstudy.
The global population is swelling, placing more pressure on our food supply. At the same time, plant diseases, limited farmland and a changing climate threaten to further hamper food production. What this all means to Dan Voytas is that scientists have their work cut out for them.

“In the coming decades, plant agriculture is going to face a lot of challenges,” says Voytas, professor of genetics, cell biology, and development in the College of Biological Sciences. Voytas is director of a new research center that brings together experts from five University of Minnesota labs to gear up plant science for the road ahead. The Center for Precision Plant Genomics, officially launched in February, will advance plant gene-editing tools and expand knowledge into how plants grow and develop. By creating new genetic blueprints that embrace good traits and cut out negative ones, the center aims to build a future with more nutritious and bountiful produce, a healthier environment and crops that withstand the strains of a changing climate.

The University is a leader in genomics, having launched the Center for Genome Engineering back in 2008 as one of the only efforts of its time to edit DNA in living cells. It was through this center that Voytas and Feng Zhang, assistant professor of plant and microbial biology, invented the TALEN technology to make pinpoint changes to specific genes. Voytas put this technology to work in 2011 with the launch of University startup company Calyxt, which uses TALEN to develop crops with healthier characteristics.

Despite these past successes, editing a plant’s genome still poses a challenge. Scientists must make sure the right proteins and DNA reach the cell’s nucleus and change it in the desired way — and only the desired way. They must also successfully grow an entire plant that includes the edited cells. It became clear that forging ahead would mean honing in on plants alone, separate from human and animal gene-editing approaches. “What we realized as the field of gene editing has advanced is it’s become more specific to distinct domains of life,” Voytas says. “The goal of the Center for Precision Plant Genomics is to keep pushing gene-editing technology forward with a focus on plants.”

The new center relies on the collaboration between its member
labs, each of which brings unique skills and knowledge to the table. Joining Voytas are three other CBS faculty (Michael Smanski, Nathan Springer and Feng Zhang), along with one faculty member from the College of Food, Agricultural, and Natural Resource Sciences (Robert Stupar). What their collective effort could accomplish is extensive. Precision genomics could be used to create a variety of wheat that resists stem rot, a devastating fungal infection, or to develop new varieties of apples. These techniques could also help the scientists alter plants’ metabolism so they produce more of the carbohydrates, protein and oils that we eat, along with pharmaceutical compounds and raw materials for industry.

To Nathan Springer, professor of plant and microbial biology and leader of one of the new center’s member labs, the possibilities in precision genomics are nearly endless. Springer’s lab has several projects researching the genetic traits of corn. He believes gene editing could, for example, allow them to improve corn’s ability to withstand extreme heat and cold, making it a more stable crop for a changing climate.

“It is time to use these approaches to make better crops and answer fundamental biological questions,” Springer says. “Bringing together researchers with the right skills and goals to do this is what excites me about the center.” —KEVIN COSS

MINNESOTA STATE OF MIND

Balancing act across the triple ecotone

Minnesota’s shifting ecosystems hold clues to the likely impact of climate change on the landscape.

While the United States encompasses many different ecosystems from desert to tundra, Minnesota is where three of the biggest of them converge.

“Minnesota is at the intersection of the three great ecosystems of North America — northern forests, southern and eastern deciduous forests, and the prairie,” says Clarence Lehman, a professor in the College’s Department of Ecology, Evolution and Behavior. “They’ve met here for thousands of years, shifting as conditions shifted. No other place has all three. This is unique to Minnesota.”

For those interested in tracking the effect of climate change on the continent’s major ecosystems, Minnesota is a great place to observe those changes.

Why here? Climatic conditions are just right to sustain all three ecosystems. It’s wet enough for trees. It’s dry enough for prairie. It’s warm enough for deciduous trees and cold enough for all the needle-leaved trees. “We call this three-way balance point a triple ecotone,” says Lehman. “It’s a place where you can examine and understand changes that are happening, because that triple meeting point shifts as climate shifts.”

Lehman points out that the College’s field stations — Itasca Biological Station and Laboratories in northern Minnesota and Cedar Creek Ecosystem Science Reserve about an hour from the Twin Cities — offer unparalleled opportunities to study those changes.

“The triple ecotone is moving north at a few miles a year and, based on its current trajectory, will move through Itasca before the end of this century. In that not-so-distant future, the pine-fringed lakes of Minnesota will still exist,” says Lehman. “They’ll just be in Ontario instead.

“Because we have field stations at each end of this shifting triple ecotone, we have an opportunity to study the effects of climate change on these ecosystems, but also explore how we might make them more resilient,” says Lehman. —STEPHANIE XENOS
IRON-OXIDIZING BACTERIA CALLED MARIPROFUNDUS FERROOXYDANS USE DISSOLVED IRON AS AN ENERGY SOURCE, CREATING RUST IN THE PROCESS.
Imagine the most extreme environment possible. It’s likely a place without much obvious life. As it turns out, even the most inhospitable spots often teem with microorganisms. In places that seem devoid of other life, these microbes show an incredible capacity to thrive. These organisms are dubbed “extremophiles” for their ability to survive in physically or geochemically extreme conditions like frigid mountaintops, sulphurous hot springs or arsenic-rich lake sediment. Still, it’s important to remember that the “extreme” description is one given to these organisms by humans. As an example, we may require oxygen to live, but some extremophiles thrive without it.

Extremophiles interest scientists for many reasons, including the ways they’ve adapted to over-the-top (or way-down-deep) surroundings by keeping their cellular proteins stable and active.

What do these small-but-mighty microorganisms have to teach us about the past, the present and the future of life here on Earth? Three College of Biological Sciences researchers are studying extremophiles, in all their hardy glory, from samples taken in locations all over the world. Here’s a peek into their labs to learn more about what they study and why.

**ENZYMATICALLY PROMISCUOUS**

The adage about one person’s meat being another person’s poison is exemplified by the research conducted by Mikael Elias, a faculty member in the Department of Biochemistry, Molecular Biology and Biophysics and the BioTechnology Institute. While arsenic is highly toxic to humans, Elias has studied extremophiles that thrive in arsenic-rich environments. “It’s a poisonous molecule, yet these microbes survive in it, and my work looked at how they manage to do that,” he says.

The journal *Nature* published his findings, which were also the topic of many popular science articles. In describing the importance of the extremophiles he studied, Elias cites the butterfly effect (in which a small change in a complex system can have large effects elsewhere). “One little molecule can have a very big impact at the phenotypic level.”

These days his lab focuses on halophilic proteins, which are extremophiles that thrive in salt. “We take genes from organisms found in extremely high- or extremely low-salt lakes in South America, mostly from

**We might be on the road to creating an alternative to antibiotics, or we could find a way to hack bacterial communication to prevent them from becoming virulent.**

— Mikael Elias
high-altitude lakes in Argentina and Chile,” he explains. Elias works at the molecular level to make and produce pure proteins, then “tricks” the bacteria to produce proteins of interest.

“I’m interested in biological molecules that are enzymatically promiscuous,” he says. “Enzymes are special proteins that can accelerate chemical reactions, and I’m looking particularly at ones that have the ability to catalyze a reaction different from the one for which it has been selected.” Work like this could play a role in evolving new enzymes, perhaps ones that could be useful in industrial processes and production. The work could also play a role in bioremediation and bacterial control.

“We might be on the road to creating an alternative to antibiotics, or we could find a way to hack bacterial communication to prevent them from becoming virulent.”

AN ELECTRIFYING PURSUIT

When most people think of Hawaii, they probably picture palm trees, tropical birds and sandy beaches. For Jeff Gralnick, the extremophile Mariprofundus ferrooxydans, which gets energy through chemical reactions, comes to mind. A professor in the Department of Plant and Microbial Biology, and a member of the BioTechnology Institute, Gralnick studies a neutrophilic, chemolithotrophic, gram-negative bacterium which grows by oxidizing ferrous to ferric iron. His lab is full of samples from Lōihi Seamount, an active submarine volcano 22 miles off the coast of the island of Hawaii.

“They’re collected from a thermal vent. The samples are collected about 1,000 meters down, and when you see them, they look like mats of orange fluffy stuff, busy making an iron stock and projecting it out one side of their cell.”

Another location Gralnick uses for sampling is much closer to the University’s Twin Cities’ campus. In a story reminiscent of Jules Verne’s Journey to the Center of the Earth, he has descended 2,341 feet in Minnesota’s Soudan Mine to observe and sample communities of extremophiles that live and even thrive despite the absence of light. “In some ways, the Soudan Iron Mine is not only a window into the deep subsurface, but also a portal back in time,” he says.

In his lab, Gralnick studies heat-loving thermophiles that generate electricity, which were isolated from an iron-rich hot spring in Russia. “Their metabolism is naturally faster at higher temperatures,” he says. “We are exploring ways we can use them to generate electricity faster or in greater abundance.

“Some of the bacteria that we’re seeing are able to convert iron(II) into iron(III), essentially forming rust or iron oxide,” says Gralnick. “Nobody knows how those bacteria do what they do.” Saying that he’s interested in “cool microbes that do neat things that could be used to solve problems,” Gralnick adds, “We’re looking for signatures of life in these unusual environments. You never know what will pan out.”

HERE BEFORE US

Trinity Hamilton might be something of an extremophile herself. She was born and raised in rural Montana, where isolation was the “extreme” element in her environment. “I grew up in the middle of nowhere in Montana,” she says. The skills she gained on countless horseback rides and camping trips served her in good stead during her Ph.D. research in Yellowstone National Park where she studied, among other things,
SNOW ALGAE IN ANTARCTICA TURN THE SURFACE OF SNOW PINK. COLLEGE OF BIOLOGICAL SCIENCES RESEARCHER TRINITY HAMILTON STUDIES THE MICROORGANISMS, KNOWN AS “PHOTOTROPHS,” WHICH GROW ON THE SURFACE OF GLACIERS AND MAY ACCELERATE SNOW MELT.
X-tremely useful glossary

HALOPHILES: These salt-lovers can be found anywhere with a concentration of salt five times greater than the salt concentration of the ocean, such as the Great Salt Lake in Utah, Owens Lake in California, the Dead Sea and even in evaporation ponds.

MESOPHILES: That includes us! This term describes organisms that live in more moderate environments.

POLYEXTREMOPHILES: An organism that qualifies as an extremophile under more than one category.

PSYCHROPHILES: They like it cold. These extremophiles live in environments at temperature below -5° F. Their proteins have adapted their amino acid composition to live in cold conditions.

THERMOPHILES: They like it hot, and they thrive at temperatures between 113° and 251.6° F. While temperatures as high as these cause most proteins to unfold and stop functioning, these extremophiles have adapted their proteins to cope.

nitrogen fixation across geochemical gradients. That’s where she first became interested in the rich fabric of extremophile life to be found in the park. “There’s such a broad range of pH, temperature and geochemistry in Yellowstone,” she says. “You can walk 20 yards and take a sample from a bubbling mud pot, then turn a few degrees and walk right up to a clear flowing stream.”

Phototrophs can offer insights into the origin of life. They were on Earth long before us.”

—Trinity Hamilton

66

Phototrophs can offer insights into the origin of life. They were on Earth long before us.”

—Trinity Hamilton

Phototrophs, she says, hold the key to information about a time when our planet was quite different.

“Phototrophs can offer insights into the origin of life. They were on Earth long before us when there was no oxygen or ozone and the temperature and precipitation were very different. They have been driving biological cycles here on Earth for orders of magnitude longer than us and have adapted and evolved to thrive in nearly all sunlit environments including those at the extremes.”

—JULIE KENDRICK
Itasca in a bottle

Fungi are often the stars of the decomposition world. From morels to coral fungi, these oft-recognized decomposers frequently show off through vibrant and oddly-shaped growths, which morph from the ground or dead trees. But what about the bacteria that may also break down this organic material? Enter Itasca in a Bottle, a project led by College of Biological Sciences undergraduate Sam Willard and Itasca Biological Station and Laboratories Director Jonathan Schilling.

Willard and Schilling kicked off the project last summer at Itasca, collecting and isolating more than 20 wood decomposer fungi and bacteria into glass bottle microcosms. By taking the bacterial colonies, simulating the wood degrading environment in lab, the researchers hope to gain insights into the role these microbes play in decomposing wood in boreal forests.
Mary Kemen’s family has always valued the importance of a good education. Both Kemen and her husband, Brian Randall (MD ’84), had parents who were public school teachers. Kemen is a fourth-generation University of Minnesota alum who graduated from the University’s Medical School 100 years after her grandfather enrolled at the University as a freshman. Before medical school, Kemen earned degrees in botany and biochemistry in the College of Biological Sciences. Now, she is making sure new generations of students have opportunities to expand their own scientific educations by deepening their understanding of the natural world.

An anesthesiologist who practices in Cedar Rapids, Iowa, Kemen recently made generous gifts to both the College of Biological Sciences Conservatory and Cedar Creek Ecosystem Science Reserve.

On a campus visit this fall, Kemen attended an event at the Conservatory and was struck by the enduring effect her own experiences had on her. Kemen did undergraduate research with former faculty member Douglass Pratt at the Conservatory.

“I had not been there for more than 40 years, and it just took me back,” she says. “There’s a wonderful symmetry to it all.”

Kemen is an advocate for the power of quality science education beginning as early as possible in a child’s life.

“It’s so important to show children how fun science is and to encourage them to remain interested in science throughout their lives, no matter what careers they choose,” she says.

Expanding K-12 education programming is especially important for a highly competitive school like the College of Biological Sciences, says Kemen.

“We need to move one ring further out from our own students to those young people who aren’t in the College, but who will be making an impact on society in other ways. It’s important to find ways to help...
To test or not to test?

If you are thinking about opting in to consumer genetic testing, here are a few things to consider.

So you’re thinking about joining the more than 12 million people who have tried out consumer genetic testing. Maybe you are curious about your ancestry and prepared for the possibility of discovering some family secrets. Or perhaps you want to know whether you possess genes linked to a specific disease. Whatever your reasons, here are a few things to think about if you are considering giving genetic testing a go.

- **Most consumer genetic tests do not look at the whole genome.** Our genomes contain three billion nucleotide pairs. Most consumer DNA tests look at only about one million of those. Needless to say, that’s a lot of missing information. That will change in coming years, but for now the scope is limited.

- **Consumer genetic testing companies are not all equal.** Some use different approaches and work with different baseline data, which means results — and accuracy — vary. Which test you choose will depend on the kind of information you are most interested in obtaining, so look at a few and choose the one that fits your interests best.

- **DNA surprises happen.** Some people will have unexpected discoveries about their family makeup or their risk of serious diseases. Things can quickly go from fun to serious. If you find yourself in one of these situations, a genetic counselor can help answer your questions.

- **Predicting the chances of developing a particular disease is complicated.** Your genes are complex. In most cases, your genes are a small piece of what is contributing to the risk of disease. These tests are looking at only a sliver of information about you and do not take into account your family history, diet or other risk factors. Therefore they generally do a poor job of testing for and estimating complicated risks.

- **Most tests don’t get too granular.** If you’re in it to learn more about your ancestry, it’s good to keep that in mind. Want to know if your family is French or German? Consumer genetic tests usually don’t get that detailed. More often they can tell you the percentage northwestern European but not differentiate French, German or Swiss independently.

A word of caution: Consumer DNA testing companies can share and, in some cases, sell the data they collect, which means your genetic information can end up in third-party hands. Just something to keep in mind if privacy is a paramount concern. If you have questions, the best thing to do is contact a genetic counselor through the National Society of Genetic Counselors www.nsgc.org. —HEATHER ZIERHUT

Heather Zierhut, Ph.D. is assistant professor and associate director of the Genetic Counseling Graduate Program in the Department of Genetics, Cell Biology and Development. She trains future genetic counselors and researches the outcomes and effectiveness of the counseling methods currently in use.
CBS ALUMNA GAIL BUHL EDUCATES THE PUBLIC ABOUT THE ROLE OF RAPTORS SUCH AS LUTA, A RED-TAILED HAWK WHO CAN NO LONGER SURVIVE IN THE WILD DUE TO VISION LOSS.
The University of Minnesota Raptor Center treated a record 1,085 raptors in 2017, so it’s no surprise that as the center’s Education Program Manager, Gail Buhl (B.S. Biology ’97) has seen a lot of birds.

But on a recent Friday afternoon, the raptor that captured the attention of Buhl and her colleagues wasn’t a patient, but a red-tailed hawk perched in an elm tree across the street.

While Buhl and her colleagues chatted excitedly about the sighting, Liz, a Raptor Center volunteer, appeared holding another bird. “That’s Rowan!” Buhl said of the raptor perched on Liz’s gloved left hand. “That’s the same species that’s sitting in the tree, but now you can really see it!”

Being on a first-name basis with raptors is all in a day’s work for Buhl, who oversees the center’s education birds. Birds like Rowan receive special training after being deemed unfit to survive in the wild.

Buhl’s career has been focused on creating what she refers to as “beak to nose experiences,” overseeing the nearly 1,200 community programs the Raptor Center facilitates annually at sites such as schools, libraries and even the Minnesota State Fair. Buhl also manages the center’s educators and its collection, which includes scheduling a raptor’s weigh-in or vet appointment, assigning educators to attend community programming, or — her personal favorite — working hands-on with a raptor.

“I’ve always been interested in birds;” Buhl said. “Apparently even before I could walk I was reaching toward robins in the yard and things like that. I am naturally drawn to anything that flies, but especially birds.”

Buhl first began working with the Raptor Center as a volunteer during her time as an undergraduate in the College of Biological Sciences. Although she initially began volunteering with hope of attending veterinary school, Buhl’s work with the Raptor Center sparked an interest in rehabilitation work that ultimately changed her career path.

After graduation, Buhl worked as a wildlife biologist at a nature center before taking a position with Minnesota Zoo’s World of Birds Show. She went on to establish Wolf Ridge Environmental Learning Center’s raptor education program, a position she credits with teaching her the nuts and bolts of environmental education, skills she has continued to build on in her current role.

Lately, both that role and the Raptor Center have expanded in exciting new ways. The center is currently in the early stages of a significant renovation project with Buhl at the helm as one of the project managers. The center plans to add two interpretive exhibits, revamp its gift shop, install a new A/V system, and redo its floors, walls and lighting.

Adding to the excitement is the launch of “Outdoor Investigator,” the second part of the center’s online learning platform, Raptor Lab. Designed for integration into middle-school STEM curriculum, Raptor Lab supplies live data-tracking from the center’s clinic, allowing students to learn about charting data, writing research papers, and conducting experiments all while discovering the rehabilitation process.

As the center continues its main goal of facilitating a raptor’s rehabilitation and release into the wild, both the renovation and Raptor Lab will help introduce the public to the presence — and importance — of these birds. Buhl believes this will promote an understanding that will ultimately benefit both humans and raptors.

“If humans perceive a threat, the general reaction is to get rid of it, not to learn about it,” Buhl said. “That’s a reaction we do not want. Raptors are an incredibly important part of the ecosystem. They’re the top of the food chain. So are we. If you are paying attention to what is happening to them in the wild and in the ecosystems, what’s happened to them may happen to us.”

And if there is one thing Buhl hopes she can teach others about raptors, it’s this: “I really want people to know that these are our neighbors. They are part of our world and we are part of their world.” —GINA VAN THOMME

“For most, seeing a raptor is a rarity. For Gail Buhl, it’s just another day on the job.”

“…”
How did you end up in investment banking? My career path since college has been somewhat unusual but I’ve been fortunate to find a career that suits my personality and interests as well as leverages the skills I acquired as a student in the College of Biological Sciences. I never envisioned myself in a lab or clinic after graduation, but I thought business or law could be a good match — so out of college I jumped right into a job at a patent law firm and found working with new technologies highly stimulating. So much so, in fact, I decided to pursue a master’s in patent law to become a patent agent. I think my work ethic, analytical skills and intellectual curiosity, coupled with my passion for the biological sciences, has contributed much to success in my current role — and I have my CBS degree to thank for that!

Describe a typical day at work. It really depends on the news of the day. On my team, we analyze all aspects of both large and small biotechnology companies that are developing innovative therapeutics to treat diseases of high unmet needs (gene editing, cellular therapy, RNAi, etc.) This ranges from researching mechanisms of action, studying a new biological pathway or disease, parsing through newly-released clinical data, building epidemiological models or conducting financial analysis. There is a constant flow of information emerging every day that we examine. We then provide our unique viewpoints to our clients (who are institutional investors in the stock market, such as hedge funds, mutual funds, university endowments, state pensions). We advise them on which public companies and technologies we believe to be impactful investments in science and medicine.

What do you like most about your job? One aspect of my job that motivates me is that I’m constantly learning. Whether I’m researching an emerging therapeutic area, innovative technology modality, or novel disease target, I always feel engaged in the most exciting and cutting-edge discoveries in the life sciences.
AND THE WINNERS ARE ...

Each year, the College recognizes a few of our many exceptional graduates with the Emerging Leader Award and the Alumni Achievement Award. The Emerging Leader Award goes to a recent alumnus who is making an impact in their field. The Alumni Achievement Awards is given to an accomplished alumnus who graduated more than 10 years ago. This year’s recipients have made their mark in very different ways, but each put their biology background to use to make the world a little bit better.

EMERGING LEADER AWARD

Kimberly VanderWaal
Assistant Professor, Veterinary Population Medicine, University of Minnesota

While an undergraduate, Kimberly VanderWaal (B.S. Ecology, Evolution and Behavior, ’07) worked in the lab of renowned lion researcher Craig Packer. She spent time doing field research in the Serengeti, an experience that left a profound imprint and inspired a lifelong passion. VanderWaal went on to study disease spread among cattle and wild ruminants in Kenya. Her current research focuses on understanding the mechanisms of disease spread among animals and ways to model that behavior for further understanding and disease prevention. She is an international leader in the use of network analysis in disease ecology.

ALUMNI ACHIEVEMENT AWARD

Angela Trepanier
Associate Professor, Molecular Medicine and Genetics, and Director of the Genetic Counseling Program, Wayne State University

Angela Trepanier (M.S. Genetic Counseling, ’94) is a leader in the emerging field of genetic counseling. Her research focuses on developing and evaluating approaches for educating both medical providers and the public on issues relating to genomics and genetic counseling. Trepanier received the Strategic Leadership Award from the National Society of Genetic Counselors and the President’s Award for Excellence in Teaching from Wayne State University. She is known for her strong commitment and contributions to graduate education in genetic counseling.

ALUMNI ACHIEVEMENT AWARD

Robert Desnick
Dean for Genetics and Genomics Medicine, Professor and Chair Emeritus, Department of Genetics and Genomic Sciences, Mt. Sinai School of Medicine

Dr. Robert Desnick (Ph.D. Genetics, ’71) was an early innovator of pharmacologic chaperone therapy and the scientific co-founder of Amicus Therapeutics, a biopharmaceutical company focused on the treatment of diseases by this novel approach. By combining clinical and basic research, he successfully developed effective treatments for genetic diseases that have benefited numerous patients with lysosomal diseases and porphyrias disorders. In addition to his efforts to treat inherited metabolic diseases, Dr. Desnick has been an innovative leader in efforts to prevent recessive genetic diseases by prenatal and premarital carrier screening. He is certified by the American Academy of Pediatrics.

“We are so proud of the achievements all of our alumni. The recipients of these awards embody the curiosity and drive to discover shared by all of those who make up this wonderful community.” – CBS Dean Valery Forbes
This is the century of biology. Our ability to understand and impact the world around us using biology is evolving fast. The Campaign for the College of Biological Sciences is about building capacity now so we can create a better tomorrow. It’s about making investments in our students, spaces and best ideas to make the most of this moment and ensure continued momentum.

Learn more at driven.cbs.umn.edu