



# AVENUES OF SCIENTIFIC DISCOVERY

## INFORMATION BOOKLET

APRIL 7<sup>TH</sup>, 2016

MEMORIAL UNION

GREAT PLAINS ROOM

NORTH DAKOTA STATE UNIVERSITY

FARGO, ND

# AN NDSU GRADUATE STUDENT LED EVENT

*“Using the innovative research being conducted at North Dakota State University to achieve an interactive science experience for area youth.”*

-NDSU Graduate Students

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## IN PARTNERSHIP WITH:

The NDSU Center for Math and Science Education and  
Office of Teaching and Learning.

- *Dr. Paul Kelter*

## SPONSORED BY:

- NDSU Office of Admissions
- NDSU Graduate School
- NDSU Center for Distance and Continuing Education
- NDSU Division of Student Affairs

# Our Objectives, with regards to...

## *Area Students*

- Creating a fun and safe environment for area youth to learn about core science concepts from a number of different disciplines
- Encouraging critical thinking skills in scientific discovery
- Providing an environment for youth to interact with science professionals

## *Area Schools*

- Presenting diverse college science opportunities
- Promoting a partnership between the University and the local school districts

## *Graduate Students*

- Gaining valuable skills in communicating science
- Mentoring area youth on the educational aspects of college
- Providing an opportunity to give back to the community in a unique and relevant way

## *Graduate Departments*

- Showcasing the science being performed in the department through positive outreach in the community
- Providing graduate students experiences in leadership and communication in science
- Developing ties with local scholars for future endeavors

## *Graduate School/University*

- Giving back to the community in a unique and creative way
- Graduate students working together to form connections with area schools
- Showcasing the talents of students at NDSU



# AoSD 2016 EVENT ABSTRACTS:

## Participating Graduate Student Associations:

- Animal Sciences - <https://www.ag.ndsu.edu/ansc>
- Biological Sciences - <http://www.ndsu.edu/biology/>
- Chemistry & Biochemistry - <http://www.ndsu.edu/chemistry/>
- Coatings & Polymeric Materials - <https://www.ndsu.edu/cpm/>
- Engineering - <https://www.ndsu.edu/coe/>
- Entomology - <https://www.ndsu.edu/entomology/>
- Pharmacy - <https://www.ndsu.edu/pharmacy/>
- Physics - <http://www.ndsu.edu/physics/>
- Plant Science - <https://www.ag.ndsu.edu/plantsciences>
- Public Health - <http://www.ndsu.edu/publichealth/>
- Veterinary & Microbiological Sciences - <http://www.ndsu.edu/vetandmicro/>

*“Super interesting and fun. I enjoyed it a lot.”*

*“Very interesting hands on demos were the best!”*



*This is great! There is STEM all over the place! Thanks! Please do this again.  
Our students need to know that this STEM is Real and Alive!  
-Thanks! Nancy Schnabel (Park Christian School)*

## Animal Science

### Beef, By-products and Beyond:

Animal science is described as "studying the biology of animals which are under the control of mankind". Historically, the degree was called animal husbandry and focused on developing new methods to efficiently raise livestock such as cattle, sheep, pigs, poultry, and horses. As time progressed however, it was realized that animals can be used for much more than producing meat and providing a means of travel. In fact, everywhere we look an example of animal science can be seen. On average, 98% of an animal carcass is used with 55% being consumed by people and their pets, and the remaining 45% used as inedible by-products. These by-products include things such as plastic bags, car and bike tires, glue in wood work and musical instruments, fireworks, biofuels, toothpaste and even shampoo and conditioner. The list is endless. Animals are also used to recognize different behaviors and ensure their comfort and health in different production settings. We can use animals to learn about nutrition, genetics and reproduction, explore ways of treating diseases such as cancer and diabetes, even assist in finding ways to reduce greenhouse gas emissions and slow global warming. And this is just the beginning. In order to help students understand the impact animals have on our lives, the activities will involve several different stations where students will have the opportunity of learning how to grade meat, view the reproductive and digestive tracts of different species, hear about research that is done to assist in human healthcare and gain a better understanding of how the bacteria in ruminant digestive tracts helps to break down food and produce gases such as carbon dioxide and methane.



*"Made me feel smart because I could relate to it! Don't change a thing!"*

*"I liked the section where I was explained the different types of meat."*

*"The meat science booth was my favorite!"*

*"Animal Science booth was fun!"*

## Biology

DNA (deoxyribonucleic acid) is present in every living thing on earth. It contains all of the information necessary to build an organism, whether it be a plant, insect, or human. Nearly every cell on the planet (except red blood cells and some viruses) contains long fibers of DNA. In animals and plants, DNA is wrapped around large proteins, which we call chromosomes. At the Biology booth, students will be able to extract the genetic material from strawberries. Strawberries are octoploid, which means they have eight copies of each chromosome. With such a large amount of DNA present, we can actually see the DNA with our naked eye once it's been extracted. Not only that, but solutions made up from basic household chemicals will be used to extract the DNA. This mixture contains only soap, salt, and water. The soap is used as a detergent to break apart the plasma and nuclear membranes of the strawberry cell to give us access to the genetic material, while at the same time, the salt breaks up the protein chains that surround the nucleic acids. What is left is a big clump of DNA!



*"All of the workers were so nice!"*

*"I really enjoyed the DNA extraction, very simple and hands on!"*

## Chemistry/Biochemistry

Have you ever cooked? Cleaned something? Taken medicine? Eaten a snack? Taken a breath of air? If so, you've already encountered both chemistry and biochemistry! While the field can sound quite intimidating, even to college students, the truth is that these sciences are a critical part of our daily lives, the world in which we live, and even our own bodies. Since everything you can taste, smell, or touch is a chemical, we are all essentially chemists performing reactions every day without even realizing it! To demonstrate just how prevalent chemistry is in the world around us, the Department of Chemistry and Biochemistry will be featuring activities using materials you might find in the kitchen or strewn about the house. In our hands-on demonstrations, we will explore a very common chemistry technique - known as chromatography - which is often used by chemists to separate different chemical parts of substances. In our activity, we will use chromatography to visualize the components of different colors of pen ink. We will also explore the principles of diffusion by creating underwater 'fireworks' using cooking oil and food coloring, and use household materials like spices to produce vivid colors through acid-base reactions.



*“Very cool expo, different way of getting the info across with all the hands on experiments. Learned a lot!”*

*“It was a lot of fun and a great learning experience. I also enjoyed the diversity of each station.”*



## **Coatings & Polymeric Materials**

Although you may not realize it, you come in contact with polymers and coatings every single day. From paints inside and outside your home, automobile coatings, pop can liners, plastics, even cosmetics and shampoos! In the Department of Coatings and Polymeric Materials, we focus on developing new and improved organic polymers that can be made from renewable resources such as linseed and soybean oils. These polymers are then applied as coatings to protect the material underneath from sunlight exposure, corrosion, or degradation processes that can ruin the material.

At the Coatings & Polymeric Materials booth, we will include two presentations that show the differences between polymers and coatings. The first exhibit will be a hands on polymerization technique that is often used to make nylon, called interfacial polymerization. With this example, students will be able to easily make nylon polymer by winding a glass stir rod with polymer as it is made when it passes through the interface. The second demonstration will involve making coatings using “NeverWet” by Rust-Oleum, which repels liquids. In this demonstration, we will spray the coating on different objects, and students will be able to pour various items such as water, mustard, and chocolate syrup over both coated and uncoated surfaces to better understand the effects of hydrophilicity.

## **Engineering – Civil Engineering**

Surveying is a branch of civil engineering which deals with the measurements of the terrestrial positions, distances, and angles. These measurements are later used to develop maps and drawing. Basic concepts of geometry, trigonometry, physics and engineering are most commonly used for taking these measurements. Surveying is the backbone of all civil engineering and infrastructure projects. This field of civil engineering has expanded dramatically with the recent advancements of technology.

At the Civil Engineering booth, you will be able to participate in hands-on activities using a very simple, yet very effective instrument, known as “Level” in the field of surveying. This is a device used to measure the elevation differences of between different components of a structure. Its use is universal and not limited to only civil engineering projects. Many have seen the surveying crew working alongside the roads or highways, focusing through a telescopic like instrument mounted on a tripod, which in fact is “Level”. You’ll will be first explained the principle behind this instrument and then provided an opportunity to use it and take readings.

## **Engineering – Geotechnical Engineering**

Geotechnical engineering is the science behind the soil supporting our infrastructure; from the ground under your house all the way to the soil below the tallest skyscrapers. Behavior of soil can vary greatly based on its type, amount of moisture, particle size, and tons of other factors. Therefore, it is very important to classify soil through laboratory testing to identify soil properties in order to know exactly what type of material is supporting a structure.



At the Geotechnical Engineering booth, we will go over the basics of soil classification and the four major soil groups that effect engineering structural designs. You'll get hands-on experience with classifying soil into categories (gravel, sand, silt, and clay) and running basic laboratory tests on Fargo clays in the form of plastic limit and liquid limit testing. Testing and displays will demonstrate the vastly different material properties soil types, why it is important to know the nature of soil laying under our structures, engineering challenges for structural design, and what problems can occur if soils are not properly considered in engineering design.

## Entomology

Insects, bugs, and all sorts of creepy crawly things play a huge role in our lives, whether we like them or not. Insects pollinate our food, decompose our wastes, and play a pivotal role in the food chain. They are by far the most common type of animal in the world and one of the most diverse. The NDSU Entomology Club will be guiding activities that focus on insect physiology and different insect parasites. Students will get firsthand experience on the vast array of different types of insects and the role they fulfill in our world. Emphasis will be on how insects function and how their behavior and bodily functions differs from mammals (especially humans). It might surprise you how strong a human would be if it had the strength of an ant! Swing by for some live demonstrations of the proportional strength of a hissing cockroaches, dissections of the major insect organ systems, and quick training on how to easily recognize beneficial or disease causing insects. The squeamish need not fear, handling the bugs is completely optional!

## Physics

The universe is full of things we can't see, but that still effect us everyday.

Electricity can power buildings and lights, but how does it really work? A bicycle tire appears to lose air in the cold, and seems to gain it back when it warms up, but why is that? Plants become brittle and break when they freeze while paper actually seems just as sturdy in the freezer, but what causes that? At the Physics booth, students will be able to participate in demonstrations and perform experiments that illustrate how humans can harness the invisible forces that cause these phenomena. See

how temperature affects gases and everyday materials, how to pull liquid oxygen out of thin air, and how to make circuits work using electricity. Hope to see you at our booth!



***“All of the stations were very interesting and I actually learned quite a bit. My favorite station was the physics with the liquid nitrogen.”***

## Plant Science

It is no longer a secret that the world population is projected to reach 9 billion in 34 years. Most of us will be 50 to 65 by the year 2050. How will we feed the growing population on a limited amount of resources such as land and water? This problem is being taken on by the Department of Plant Sciences at NDSU each day to determine proper production practices, weed and resource management, improve crop development to resist insects or disease and survive in varying environmental conditions. From plant breeding to weed management to production research, the Plant Sciences Department is involved in all aspects of this lurking crisis we will one day face. Whether you know it or not, you are impacted every day by researchers all around the world who have made advancements in food production. Students will learn about the great discoveries of Gregor Mendel and his Punnett squares, the necessary components for plant survival and weed management. Each factor is observed by the Department of Plant Sciences and targets each one to improve development of crop plants or management tactics in order to efficiently provide food and fuel for the world. The plant sciences booth will feature live weeds, a variation of seed market classes, fertilizer samples, and basic components of plant breeding. With your involvement in this community, YOU too can be part of this solution to increase the efficiency of food production.

## Public Health Association

Disease Outbreak Investigation: Public Health is the science of preventing diseases, encouraging healthy lifestyles, and prolonging life. The Public Health Association of NDSU will be putting students in the role of epidemiologists who need to track and manage infectious diseases. Whether it be ebola, measles, or the zombie virus, epidemiologist need to track and stop the spread of the disease, or it could spread around the world. The teams will work to figure out who was the index case or “patient zero” in their group. Students will also



gain an appreciation for the importance of disease screening and vaccinations prior to exposure. With this knowledge, infection control practices and vaccines can be established to prevent the disease from occurring again. Stop by our booth and become disease detectives. Can you find patient zero?

## Veterinary & Microbiological Sciences

Microbes cover every surface of the planet, on your body, doorknobs, and water. You have more microbes on your hand than there are people on the planet. Microbes can be both good and bad. They produce up to 50% of the oxygen we breathe, but some microbes can be life threatening.

Students will learn about a variety of microbes from both categories. The

microbiology booth will feature pond water to observe live protozoa, staining techniques to identify different types of bacteria, bacteria art to display the diversity of microbial life, and environmental isolates of bacteria to demonstrate how common they really are! A worksheet will be provided with the activities to catalog the student's journey through the microbial world. In addition, we will be giving away microbiology themed prizes!

Going hand-in-hand with Microbiology, is Immunology. This is the study of how our immune system interacts with our bodies to prevent disease, fight and cure disease, and even cause disease within our own bodies-like Allergies! This interactive booth about Immunology will be focusing on how your immune system functions with allergic asthma, a chronic inflamed lung disease caused by our own hyperactive immune system. Students will be able to learn about different immune cells, how antibodies capture and display antigens to these immune cells, and see where in the body the immune cells come from by dissecting mouse models. Understanding how our immune system works is the cure to helping our bodies fight disease!



*“The simple kindness of one guy working the microscope changed my entire day.”*

*“Very fun and interactive! The students putting on the presentations did very good job!”*

*“Very cool by getting the students involved with the activities.”*