



The Virginia Governor's School for Agriculture

2024
COURSE
DESCRIPTIONS



AGRICULTURAL, LEADERSHIP,
AND COMMUNITY EDUCATION
VIRGINIA TECH.

WEEKS 1 & 2 | CORE COURSES

All students will participate in the core courses offered by the Virginia Governor's School for Agriculture during the first two weeks of the program. These courses help to establish baseline information across many areas of agriculture in the broadest sense and provide cross-disciplinary connections, as well as the Virginia Governor's School for Agriculture experience.

WEEK ONE

The Central Roles of Biochemistry in Agriculture, Disease, and Drug Discover

Instructors: [Dr. Stefan Roberts](#), [Dr. Biswarup Mukhopadhyay](#), and [Dr. Michael Klemba](#)

In this course the students will learn how a combination of advanced genomics/metagenomics and biochemistry research is opening new avenues for improving agriculture productivity in a sustainable way. The importance of biochemistry in enhancing our understanding of cancer will also be discussed. Finally, the students will learn how we use biochemical assays to discover new medicines. The opportunities for the next-generation of students to make exciting contributions through careers in this fast-moving cutting-edge discipline will be presented.

Cultivating Connections and Communicating about Agriculture

Instructor: [Dr. Jean Parrella](#)

Agricultural communicators engage with the public about topics ranging from agricultural production and marketing to food consumption and health. They serve as a vital bridge between industry experts and the broader community. This course will help students develop proficiency in audience analysis, visual communication strategies, storytelling techniques, science writing, and public speaking. Through a hands-on and interactive approach, students will practice the art of connection and the science of communicating about agriculture.

Dairy Science 101: From Cow to Table

Instructor: [Dr. Kayla Alward](#)

In 2023, US dairy farmers produced 94% more milk while using 57% fewer animals compared to 1950. How does the US produce more milk with fewer cows? Advancements in animal genetics, management and precision dairy technology are tools that dairy farmers use to improve milk production, animal well-being and sustainability of their farms. This class will provide a basic overview of cow milk production and marketing and will cover trends in production, physiology of lactation, advancements in technology and the shift towards sustainable agriculture. Educational and career opportunities in dairy will also be explored. We will wrap up this class with a visit to the Virginia Tech Dairy Center at Kentland Farm to see a working dairy operation in action! Please plan to wear closed toe shoes and be ready to interact with dairy cows.

Economics is Everywhere! Some Key Concepts to Understanding the Agriculture Economy

Instructor: [Dr. Mike Ellerbrock](#)

Students will learn how economics relates to their everyday lives and the world around them through discussions of economic development, poverty, comparative advantage, financial planning, and the business of doing business.

Plant Sciences: What Are Genetically Modified Crops and How Are They Made?

Instructor: [Dr. Bas Bargmann](#)

In this lecture, we will explore methods in biotechnology for the production of genetically modified crops. We will discuss the past, present, and future of how we change the characteristics and appearance of our crops -be it through traditional breeding methods, transgenics, or genome editing- and compare their respective advantages and disadvantages. We will delve into some detail on the state-of-the-art tools that we use in the lab to study and manipulate plant DNA to broaden our understanding of how plants work on a molecular level. We will imagine what may be possible in the near and far future. We will close with a discussion of GMO technology and how we see the progression of agriculture in this respect.

Responsible Use of Animals in Research

Instructor: [Dr. David Schabdach](#)

This course will introduce students to a variety of considerations associated with the use of animals in research activities including regulations, welfare, and ethics. Interactive discussions will examine how we utilize animals in society and challenge individuals to consider multiple points of view.

WEEK TWO

Engineering in Agriculture, Medicine and the Life Sciences

Instructor: [Dr. Dwayne Edwards](#) and [Biological Systems Engineering Faculty](#)

This course describes the engineering profession, how it is related to other fields of knowledge, and how it differs from other career paths. The emphasis will be on the current state of the engineering profession, and particularly on the role engineering plays in Agriculture, Medicine and the Life Sciences. Students will learn about key issues facing the global community in which engineering can play a key role, particularly in the areas of climate change, biotechnology, delivery of health care, ecology, and food. This is a team-taught course that will include faculty members and graduate students who will share their experiences, approaches, and tools they use to solve problems of the present and future.

Introduction to Fish and Wildlife Conservation

Instructor: [Dr. Kevin Hamed](#)

We will explore the role of agriculture and private land in fish and wildlife conservation. Students will be introduced to practices that create and enhance wildlife habitat on farms.

Leading Climate Change Through Transformational Leadership

Instructors: Mr. Israel Oyedare and Ms. Sonika Poudel

This presentation will offer participants an in-depth understanding of climate change and the role that transformational leadership can play in dealing with this global issue. Students will learn about the various components of climate change actions, the significant impacts of climate change on different groups of the population, and how transformational leadership can drive effective climate initiatives using Nigeria and Nepal as examples.

One Health

Instructor: [Dr. Laura Hungerford](#)

One Health is the recognition of the interconnectedness of humans, animals, plants, and environments and is crucial for improving health. Everything we do involves interactions with other species and environments around us. Most people in the US have pets - meaning we even live in 'multispecies families' - and agriculture is based on optimizing health and productivity of other species. This course will explore how a One Health lens can give us new understanding of health problems, including but beyond zoonotic disease, and stimulate new ways to improve health and well-being.

The Value of the Library in the Digital Age

Instructor: [Ms. Kiri DeBose](#) and [Ms. Kirsten Dean](#)

It is estimated that our human knowledge (everything we know) is doubling every year, and doubling at an increasing rate. In this age of vast digital information, the library still stands as a mainstay of credible and scholarly evidence to be used to support our opinions. This course will provide techniques and strategies to use the library in today's digital environment. Topics include finding and evaluating sources, exploring databases, and responsible research practices.

WEEK 3 | IMMERSION COURSES

The Immersion courses during Week 3 will provide students with the opportunity to dive deeper into more specific topics within the broader scope of agriculture. These classes will have a maximum of 20 students as a way to better facilitate discussions, conversations, and immersive experiences such as labs and field trips. Students will register for one AM course and one PM course during Week 2. **Additional instructions for registration will be provided in Week 2.**

AM CLASSES:

Bioengineering in Plant Science

Instructor: [Dr. Bas Bargmann](#)

We will introduce molecular biology tools used for plant science in the lab. *Arabidopsis thaliana* (thale cress) is the model system that is used in plant biology labs around the world to study the regulation of plant growth and development, among many other things. We will manipulate plant growth by treating seedlings with plant hormones and monitor the effect on root growth and development. Furthermore, we will use genetically modified plants to visualize hormone signaling events on a cellular level with microscopic imaging of reporter genes that turn active cells in specific regions of the root blue. Students will get hands-on experience with user-friendly microscopes to image cell-level effects of growth manipulation. If you bring your own laptop, you will be able to capture microscopic pictures and movies of the plants and show them to your friends and family at home.

Fish and Wildlife Conservation

Instructor: [Dr. Kevin Hamed](#)

Students will explore the amazing world of fish and wildlife conservation. We will focus on the role of private lands focusing on agricultural areas. Students will visit agricultural areas to observe best management practices and conduct hands-on learning activities. Pants, closed-toed shoes, and sun protection are required for these visits.

Focus on the Animal Sciences

Instructor: [Ms. Jessica Neary](#)

Each day's session will focus on a different species and their purpose. Students will explore and apply practical concepts related to animal husbandry and discuss differences in how specific species are managed. There will be an overview of swine, beef, dairy, and the poultry industry. We will also discuss research applications for the different species. On July 9 students will visit the new Kentland Swine Center and as well as the Beef Feedlot; pants, closed toed shoes, and sun protection are required.

Green Engineering

Instructors: [Dr. Sean McGinnis](#) and [Dr. Durelle Scott](#)

In this course, students will learn about the connections between engineering, agriculture, and environmental impact by considering the life cycle of agricultural and energy systems. Methods to

both qualitatively and quantitatively assess a wide variety of air, water, and soil environmental impacts will be discussed along with real-world examples. Students may participate in an off-campus field trip which connects renewable energy, land, and agriculture where pants, closed-toed shoes, and sun protection are required.

Plant Sciences Introduction: The Big Data and AI Revolution in Agriculture

Instructors: [Dr. David Haak](#), [Dr. Song Li](#), [Dr. David McCall](#), and [Dr. Hasan Seyyedhasani](#)

Students will explore how gene sequencing, remote sensing, automation, and AI can be used to improve crop production and management. Students will visit (1) AgTech innovation center to learn robotics, 3D modeling, and hyperspectral imaging; (2) Genomic sequencing center to see the machines used to sequence plant and animal genomes. and (3) Turf center to learn to use drones to collect data in the field, and use GPS guided sprayer for precision management.

PM Classes:

Animal Reproduction

Instructor: [Ms. Jessica Keane](#)

How animals reproduce is both a fascinating topic and critically important for good animal management. The basic principles of male and female reproduction are explained. Main factors influencing fertility, the technologies used in the field, and the impact of reproduction on the production system is explained. This three-day course will focus on the dissection of pregnant and non-pregnant bovine female reproductive tracts, the molecular basis of reproduction, and applied reproductive techniques. There will be a wet lab each day with a hands-on component. Therefore, closed toed shoes and clothing appropriate for labs is strongly encouraged.

Bees and Beekeeping

Instructor: [Dr. James Wilson](#)

Honey bees play a vital role in agriculture in Virginia and the United States as a whole. Learn the basic biology of this fascinating, truly social insect, how and why we manage colonies, and just how honey bees support agriculture. Topics will include honey bee biology and pollination, getting started in beekeeping, and products of the hive. The field trip will be to the Virginia Tech Teaching and Extension Apiary (Bee Yard) at Prices Fork Research Center to introduce students to working colonies of honey bees, all safety equipment provided.

Choosing Wisely: What Economics Has to Offer

Instructor: [Dr. Mike Ellerbrock](#)

In this classroom-based course students will learn the basics of economic decision-making and how markets operate. Students will participate in microeconomic applications by investigating what can be done to successfully manage our natural resources.

Introduction to Biological Systems Engineering

Instructor: [Dr. Dwayne Edwards](#) and [Biological Systems Engineering Faculty](#)

Biological Systems Engineering (BSE) connects biology and engineering to solve complex, critical problems in the areas of ecology, sustainability, environmental protection, biotechnology, and human health. This discipline prepares graduates to develop engineering solutions that safeguard our land and water resources, detect and prevent human diseases, and produce food, pharmaceuticals, and polymers. Building on Engineering in Agriculture, Medicine and the Life Sciences, this team-taught course will describe current challenges in BSE and how students, graduates and faculty are working to design sustainable solutions. Students may participate in an off-campus field trip to the Stream Lab; appropriate sun/insect protection and clothing are required.

Mining the Microbial Diversity for Drug Discovery and Production of Chemicals Out of Food Waste

Instructors: [Dr. Biswarup Mukhopadhyay](#), [Dr. Kylie Allen](#), and [Dr. Endang Purwanti](#)

The students will be introduced to diverse microbes as the greatest experimentalists. These organisms have built metabolic tools through an extensive array of activities for more than 3.5 billion years, while diversifying and sustaining life on Earth. Students will participate in experiments that are designed to mine a part of this vast microbial resource towards the discovery of new drugs and turning food waste that is polluting our environment into valuable fuels and chemicals such as food and preservatives. The course will introduce them to advanced microbiology, biochemistry, chemistry, and computational methodologies including the application of bioreactors, advanced chromatography, mass spectrometry and data science. Visits to sites where useful microbes live and learning how scientists eavesdrop into their metabolic activities in their habitat and then analyze those into a laboratory environment will be part of this course.

WEEK 4 | IMMERSION COURSES

The Immersion courses during Week 4 will provide students with the opportunity to dive deeper into more specific topics within the broader scope of agriculture. These classes will have a maximum of 20 students as a way to better facilitate discussions, conversations, and immersive experiences such as labs and field trips. Students will register for one Week 4 Immersion course during Week 2. **Additional instructions for registration will be provided in Week 2.**

Aesthetic Horticulture: Combining Art and Science in Floral Design

Instructor: [Isabella Kim](#)

Application of design elements and principles in creation of a variety of floral designs for the home, including bud vases, centerpieces, and a special party design. Additional info includes obtaining and preparing flowers, working with containers and design aids, design evaluation, and maintaining flower quality. No previous experience needed.

Climate Change Impacts and Society

Instructor: [Dr. Courtney Leisner](#)

This course will discuss major drivers of climate change and how climate change impacts our daily lives. Students will learn about the atmospheric and geologic science underlying climate change and how they can translate this knowledge into solving this “wicked” problem. The course will include interactive lectures and discussions and culminate in student-led group debates focused on using primary literature to discuss current societal hot-topics surrounding climate change.

Equine Science: Raise Them Right – Managing Equine Youngstock from Birth to Sale

Instructor: [Mrs. Natalie Slone](#)

This course will discuss raising foals for sale. The course begins with safety and handling of horses, discussions on breeds of horses and registries, and offers hands-on opportunities for grooming adult horses and activities related to basic equine training principles for the first day. The second day focuses on foaling and neonatal care and includes hands-on opportunities to practice early foal handling & training techniques utilizing the Virginia Tech foals. The course ends with discussing marketing strategies for young horses across several disciplines and offers hands-on opportunities to learn about showing young horses to buyers, understanding nutritional needs of growing horses and taking sales/registration photos. Students must wear closed-toe shoes, long pants (not athletic wear), and have their shoulders covered in order to handle horses. Course occurs primarily outdoors so dress accordingly and bring water bottles.

Food Science: Fermented Foods and Food Additives

Instructors: [Ms. Madhvi Singh](#) and [Dr. Sean O’Keefe](#)

In this class we will study the fascinating world of fermented foods. Our ancestors thousands of years ago had no refrigeration and no stores, and they used fermentation to save and process foods, improving nutritional value along the way. We will also look at additives used by the food industry, what they are, why they are used and what regulations they follow.

Insects and Society

Instructor: [Dr. James Wilson](#)

Insects impact all aspects of our lives, from food security to human health. Insects can be beneficial, inspiring, and harmful depending on the context. This course will explore the variety of roles that insects play in the natural and human designed environment. Learn about insect ecosystem services, conservation and diversity, and the challenges we face with pest insects. To continue to feed and protect a growing world population, we must understand the six-legged wonders that outnumber all other animals on earth.

What is an Ideal Meal? Food Systems for Human and Planetary Health

Instructors: [Dr. Sarah Misyak](#), [Dr. Molly Parker](#), and [Ms. Maria DeNunzio](#)

The course will discuss the relationships between food systems and human and planetary health. The 'farm to fork' processes of the food system are significant influences on the health of the planet, and climate change is threatening the fragile systems we have built to sustain human health. At the same time, healthy dietary patterns can be difficult to achieve because of food system barriers in access, affordability, and availability. Each component of the food system has a complex relationship with human and planetary health, and students will engage in discussions about how needs, perceptions, and resources at individual, community, and societal levels interact with the food system. The course will be centered on student-led discussions of their 'ideal meal.' Students will describe their ideal meal and different factors that influence their food choices. Classroom discussion will guide students towards understanding of diverse dietary patterns that can promote human and planetary health. We will visit at least one food store in Blacksburg to connect the classroom discussion to a real-world example.