

STEM SESSION TRANSCRIPT

APRIL, PLANTS

Dr. Robyn Fischer

Hello, my name is Robyn Fischer. I have a PhD in biological sciences from Northern Illinois University and have taught college biology for 18 years. Additionally, I have worked at IMSA, a residential STEM high school run by the state of Illinois, for four years. I am currently a microbiology online instructor for Rasmussen University and do both on-demand and online tutoring.

I have been working with Science Olympiad as a regional and state Event Supervisor for many different events since 2006. I started out in Illinois, then was in New Mexico for four years, and currently am supporting Minnesota and Wisconsin Science Olympiad. I have been a National Event Supervisor for the Ecology, Water Quality, Green Generation rotation since 2010. I am also a member of the Rules Committee for the Life Science events. In addition to updating and creating new event rules, I help with content creation for these events, and even created Water Quality kits with our partner Ward's Science.

My long and twisted career through higher education has given me experience in everything from organismal biology for my graduate focus, to cellular and molecular biology for my current teaching and curriculum focus. At IMSA I help drive high school students' research projects. Any given day I may find myself helping a fifth grader with basic physics to having a conversation with an upper-level college student on plant physiology or gene expression. From the start of my career, I have kind of bounced around teaching different things, as I love a challenge. My current role as a tutor also keeps me on my toes in everything biology. I am very excited that this month the MY SO topic is plants. Students will be tested on basic botany and select agricultural science topics. I would now like to introduce Ronda Hamm, an entomologist and an educator at Corteva Agriscience. She will share her experiences in the agricultural industry and how the April MY SO focus on plants can help students interested in this field.

Dr. Ronda Hamm

Hello Science Olympiad participants and coaches. I'm Dr. Ronda Hamm, and I'm an entomologist and educator at Corteva Agriscience. Thanks for choosing to participate in MY SO plants month. Plants are incredibly exciting to study, and important. They provide the food on our plates, the materials for our homes and clothes, and provide habitat for many creatures on the planet. Your participation will allow you to explore these organisms in much more depth. It's experiences like these that might just put you on the path to becoming a plant breeder, agronomist, plant pathologist, entomologist, plant geneticist, data scientist, ecologist, soil scientist, or any of the other careers in plants - and there are lots.

The summer before my senior year in high school, I received an internship opportunity. You can think about MY SO being a similar experience, where you spend time learning a specific subject, in this case, plants. For me, I thought this eight-week internship would basically be a short summer job. That summer I spent time learning about ants and their interactions with another insect called scale. Ants will actually protect these scale insects from natural predators, so my project was to extract chemical compounds produced by plants and determine if there were any repellent effects on the ants. Little did I know at the time, but that summer led me to pursue a Bachelors of Science degree in agricultural education, with an emphasis in plant science, and a Masters and a PhD in Entomology, and eventually to a

career as an entomologist, working on how we can use integrated pest management to protect our food supply from insect pests and preserve beneficial insects like lady beetles, bees, and butterflies. I've also studied genetics using insects and plants. There are lots of ways to put your passion for plants into practice.

At Corteva Agriscience, we work on seeds, crop protection, and digital services. By combining conventional and new seed and trait technologies, Corteva Agriscience is delivering more ways to meet the needs of a growing population. As demand for food increases worldwide, farmers need choices that allow them to maximize their productivity while building a sustainable future for their land, business, and communities. Crop protection products allow farmers to fight pests including weeds, diseases, insects, and nematodes.

When it comes to helping plants grow, they need nutrients just like you and I. Nitrogen is an important plant nutrient, but it can also be lost due to leaching, denitrification, and volatilization, which can be harmful for the environment. We work on nitrogen stabilizer products to keep nitrogen in the root zone and available to the plants. This product not only impacts the plants, but it also helps the environment by reducing greenhouse gas emissions. The more you know, the better decisions you can make. The software and digital solutions from Corteva Agriscience provide real-time, field-by-field information to maximize yield, which is the amount of crop or food produced. They can also help manage costs and plan for a successful future. This is where plant science and computer science meet, creating another unique opportunity for students interested in computers and technology like satellites and drones.

Your exploration of plants through MY SO and your participation in Science Olympiad could lead you to be the scientist who uses plants to solve our global challenges like climate change, feeding the increasing global population to prevent hunger, and maintaining or restoring habitat to support biodiversity. Your impact as a plant scientist can change the world. I'm proud of my company, Corteva Agriscience, partners with Science Olympiad so that more students like you can find and follow their own career pathways in STEM. Thank you, good luck learning about plants, and have fun.

Dr. Robyn Fischer

I would now like to introduce Colin Barber, a Science Olympiad alum. He is currently working on his PhD in microbiology at UC Berkeley. The Microbe Mission event inspired him on his path.

Colin Barber

My name is Colin Barber, and I'm a former Science Olympiad competitor. Some of you might remember me from the opening ceremony of the 2019 National Tournament at my alma mater, Cornell University, where I spoke about how Science Olympiad transformed me as a scientist and as a person.

Briefly about me - it might surprise you to know that Science Olympiad was not something I threw myself into at first, but Science Olympiad eventually convinced me to give myself over completely. In truth, it was the Microbe Mission event that converted me to a full-time Science Olympiad competitor and eventually, a full-time scientist. After high school, I completed a degree in Microbiology at Cornell University, where I kept contributing to Science Olympiad via Science Olympiad at Cornell. After college, I decided to work towards a PhD in Microbiology, which led me to UC Berkeley, where I do research on microbial chemistry today. I've also worked with Golden Gate Science Olympiad.

Now here you might think, hold on, this is plants month, what gives? And my response is this - microbiology and plant biology are not separable. Let me provide an example taken directly from my undergraduate research. For years, plant biologists knew of a disease called rice-seedling blight, which is a costly disease of rice plants caused by a filamentous, mold-like fungus called *rhizopus microsporus*. For a long time, the source of the toxin that enables the killing of rice plants, termed rhizoxin, eluded researchers. It turns out that rhizoxin is not produced by the fungus itself, but rather by bacteria that live inside fungal cells. The story gets weirder. To ensure that bacteria are translated



from generation to generation, the fungus packages bacteria into its spores. Indeed, the image you're looking at are bacteria tagged with a fluorescent protein inside a fungal spore. So, every newly germinated fungus is endowed with the weaponry it needs to infect rice seedlings. But, if the bacteria are eliminated from the fungus, which is a manipulation we can carry out in the lab, the fungus will not produce spores. So the bacteria exert total control over fungal reproduction. Thus, we're led to a global picture of the symbiosis. Bacteria and fungi, as an alliance, invade rice seedlings to grow and reproduce. But, because the fungus relies on bacteria to produce the toxin required for infection, fungus will not reproduce unless bacteria are housed within fungal cells.

Now imagine what our understanding of this plant disease would be if we didn't even know there was a bacterial player. As it turns out, cross-phylum and even cross-domain interactions are common, but not always in a disease context. We're no stranger to this. Our gut is home to trillions of bacterial cells that modify our health in ways that we don't yet understand. This is what makes biology such a beautifully chaotic science. Every organism is subject to an unending evolutionary process to cope with clearly infinite biological, chemical, and physical challenges encountered on an everyday basis. The results of this process are up to biologists to explore through the scientific method, which often leads us to unexpected discoveries, like a bacterial ventriloquist hidden within a fungus. Over billions of years, evolution has also turned bacteria, fungi, and plants into talented chemists. This realization is a fundamental driver of my PhD research today. I discover new molecules produced by streptococcus mutans, the primary agent of dental cavities, and a major constituent of dental plaque. I'm especially interested in molecules called specialized metabolites which don't participate in core metabolic processes - thinking about things like glycolysis, and amino acid biosynthesis here - but instead fulfill other biological functions. For example, specialized metabolites can selectively kill competitor bacteria as antibiotics, they can serve as chemical signals, they can help scavenge nutrients, almost anything that helps the producer persist in the oral environment.

Solving this evolutionary riddle, why and how, the organisms use their chemistry talent to produce specialized metabolites, is the game I play every day. Answering it requires not just deep knowledge of biology, but of chemistry and physics as well. In the words of Isaac Asimov, there is a single light of science, and to brighten it anywhere is to brighten it everywhere. I consider myself deeply indebted to Science Olympiad, not just instilling the specific curiosity about what microbes are, but a general curiosity about how everything works and where microbes fit in that framework. Which leads me to this. Your curiosity is the most powerful tool you have. If you ask deep, probing questions about plants, if you are thrilled about the prospect of learning more about the universe, if you have a distaste for facts that don't square with one another, then you are ready to be a scientist because you'll find you have unending verve to explore this very strange universe we happen to live in. You can even do a PhD. So my charge to you is the following - nurture, cherish, and honor your unexplainable curiosity about plants. Although it can meaningfully advance things like the fight against hunger or climate change or environmental destruction it doesn't have to. Because in the words of Einstein, curiosity has its own reason for existing. In short, be curious about plants and all the science surrounding them. Good luck this month, and I'm looking forward to seeing you all in person again.

Dr. Robyn Fischer

Lastly, I would like to say that I hope everyone has fun learning about plants and agriculture this month as you tackle all of the interesting material provided for the April MY SO. Whether you end up in a STEM field or not, Science Olympiad supports and encourages students in so many ways and you are sure to get some great tools for your journey as a student and as a member of your community along the way. Science Olympiad provides students with not only great content that helps them in their classes, but exposes them to fields that they might not have otherwise considered as they plan for their future. It also allows you to develop skills such as critical thinking that are needed today in order to be successful.