Discovery Series

2019-2020
Resource Guide

DAYTON LIVE

Wednesday, May 6, 2020
9:30 a.m. or 11:30 a.m.
Victoria Theatre

Conceived and performed by Kevin Cornell

Discovery Series

Welcome to the 2019-2020 Discovery Series at Dayton Live. We are very excited to be your education partner in providing professional arts experiences to you and your students!

I am thrilled that Mr. C is bringing his unique perspective on S.T.E.A.M. (Science, Technology, Engineering, Arts, Math) to the Victoria Theatre. He is one of PBS's Learning Media Digital Innovators and has a passion for bringing science into the classroom in a fun, exciting, and musically-infused way. This brand-new show, having its world premiere here in Dayton, and we could not be more excited that you and your students are here to be inspired!

The information and activities in this resource guide have been carefully crafted to help you and your students explore the many ways a live theatre experience can open up learning opportunities. Grade level icons will help you determine which activities are good for students, too. And don't forget to take advantage of the local resources listed inside to extend the play-going experience and make even more curricular connections for you and your students. Thank you again and welcome!

The Education & Engagement Team

Curriculum Connections

You will find these icons listed in the resource guide next to the activities that indicate curricular connections. Teachers and parents are encouraged to adapt all of the activities included in an appropriate way for your students' age and abilities. FULL STEAM AHEAD WITH MISTER C fulfills the following Ohio and National Education Standards and Benchmarks for kindergarten through fourth grade.

Ohio's New Learning Standards Related to FULL STEAM AHEAD WITH MISTER C

This resource guide was created by Natalie Katona. All activities are available for distribution and use in the classroom or at home.

ENGLISH STANDARDS:
Grade 2- RI.2.2, RI.2.3, RI.2.6
Grade 3- RI.3.2, RI.3.3, RI.3.6
Grade 4- RI.4.2, RI.4.3, RI.4.6
Grade 5- RI.5.2, RI.5.3, RI.5.6
Grade 6- RI.6.2, RI.6.3, RI.6.6
Grade 7- RI.7.2, RI.7.3, RI.7.6
Grade 8- RI.8.2, RI.8.3, RI.8.6

SCIENCE STANDARDS:
Changes in Motion
Matter and Forms of Energy
Electricity, Heat and Matter
Light, Sound and Motion
Matter and Motion
Cycles of Matter and Flow of Energy
Forces and Motion

MATH STANDARDS:
MEASUREMENT AND DATA
GEOMETRY

ART STANDARDS:
Grade 2- TH:Pr5.1.2, TH:Cn11.1.2
Grade 3- TH:Pr5.1.3, TH:Cn11.1.3
Grade 4- TH:Pr5.1.4, TH:Cn11.1.4
Grade 5- TH:Pr5.1.5, TH:Cn11.1.5
Grade 6- TH:Pr5.1.6, TH:Cn11.1.6
Grade 7- TH:Pr5.1.7, TH:Cn11.1.7
Grade 8- TH:Pr5.1.8, TH:Cn11.1.8

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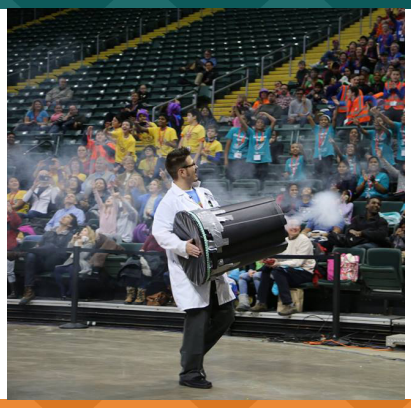
About the Play

Are you ready for some hair-raising science, toe-tapping music and mind-blowing media? Join Mister C for another fun day of learning in the lab! As the creator and host of Full STEAM Ahead, a new show on PBS Kids' member stations CET and ThinkTV in southwest Ohio, Mister C is no stranger to finding exciting and engaging ways to explore STEAM (Science, Technology, Engineering, Art, and Math) in our everyday lives. This world premiere of Full STEAM Ahead Live will have everyone singing, dancing and learning to the tune of science. Students and teachers will be amazed with this fun and educational series as Mister C uses humor, media and the engineering design process to make the ordinary extraordinary!



Spotlight on Mister C

FULL STEAM AHEAD WITH MISTER C is a program designed by Kevin Cornell. Kevin has worked in education in Dayton, Ohio for 17 years as a fifth grade science teacher, an elementary principal, and a curriculum development specialist. He has involved his daughter in his live Hair Raising Science shows and outside of education and show business, he and his family enjoy playing soccer and cracking jokes. His one passion in his career is to integrate education concepts with his love for music. You can find his science clips on both PBS's ThinkTV and YouTube. To learn more about his experiments, visit:

https://www.youtube.com/c/learningscienceisfun

http://www.thinktv.org/stemworld/full-steam-ahead/

Ohio Spotlight

STEAM (Science, Technology, Engineering, Art and Math) education is the focal point of FULL STEAM AHEAD WITH MISTER C. The Ohio Academy of Science is one of the leading supporters of STEAM education in the state. Their mission is to foster curiosity, discovery, innovation, and problem-solving skills in Ohio. They do this through programming such as annual science days, where students submit and present technical science reports and products they create. They also partner with COSI to host one of the largest science fairs in the world. The academy also provides scholarship opportunities to students.

For more information about the academy, please visit: http://ohiojournalofscience.org/index.

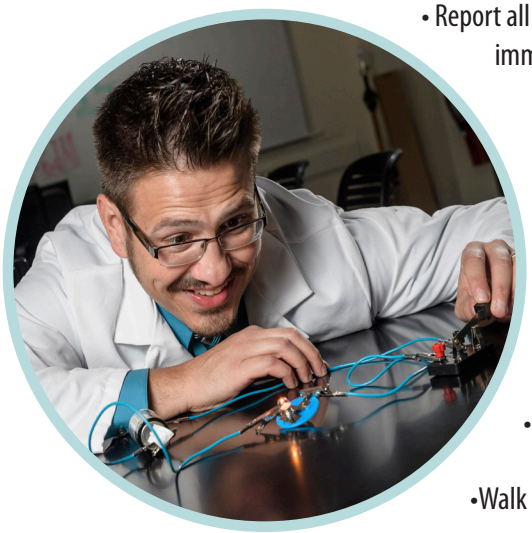
Pre-Show Conversation Starters

FULL STEAM AHEAD WITH MISTER C explores the engineering process while using the Scientific Method. Prepare your students for these amazing experiments by discussing these questions:

1. Describe the Scientific Method.
2. What are some important scientific discoveries that changed the world?
3. Describe what you think the engineering process would be, what is it like to be an engineer?

Lab Safety

For Mister C to have his scientific experiments be successful, he first must set up a safe lab environment. Whenever you're doing a science lab, you should be following these tips:



• Report all accidents, injuries, and breakage of glass or equipment to you instructor immediately. The teacher or adult should be the only person handling broken materials.

• Keep pathways clear by placing extra items (books, bags, etc.) on the shelves or under the work tables to avoid people tripping and falling or spilling materials.

• Long hair (chin-length or longer) must be tied back to avoid catching fire or dipping in chemicals.

•Leave your work station clean and in good order before leaving the laboratory.

•Learn the location of the fire extinguisher, eye wash station, first aid kit, and safety shower.

•Walk calmly in the lab without running to avoid bumping into materials or one another.

•Wear safety goggles at all times to avoid damaging eyes when working with heat, chemicals, or cutting materials.

•Do not taste or smell chemicals

•Never point a test tube being heated at another student or yourself. Never look into a test tube while you are heating it.

•No eating or drinking in the lab at any time!

The Scientific Method

When Mister C has a problem that needs to be solved, he must use the Scientific Method. All experiments and scientific theories are worked through this process. Read through the steps of the Scientific Method and then discuss the prompts following.

The Scientific Method

Observation/ Question
Topic for research and experimentation or question that needs to be answered

Discuss as a class some important scientific inventions or discoveries.
- What do you think the questions were that prompted those discoveries to be made?
- What is an observation you have made about your neighborhood, school, or environment? What are some questions you could ask about those observations that would lead to an experiment?

Research
Find out about the topic

Research: Discuss how you would research to gain background knowledge on the following questions
- Who is the better predator: a tiger or lion?
- Does salt water dissolve objects quicker than fresh water?

Hypothesis
Predict the outcome to the problem

Hypothesis: Discuss a possible hypothesis for each question and explain the reasoning behind it.
- Who burns energy quicker: a dog or a cat?
- An elephant at the zoo has stopped eating, what could be causing this?

Experiment
Develop a procedure to test the hypothesis

Experiment: Briefly discuss an experiment that could be designed to test one of the hypothesizes you discussed.

Collect Data
Record the results of the experiment

Analysis
Examine the data

Collect/Analysis of Data: Discuss the different ways scientists can collect data and the different data types they need to collect.

Conclusion
Compare the hypothesis to the experiments results

Conclusion: Discuss the following experiment and what your conclusion would be from the data given.
- Studies have shown that reading on white paper could be leading to concentration issues in children. A teacher handed out the same article on white paper, yellow paper, and green paper. They then had to answer five basic comprehension questions based on one read of the article. You hypothesized that paper color does not affect concentration and everyone would do about the same on the questions.

Data collected:
White paper scored an average of 2/5 questions correct, yellow paper averaged 3/5 questions correct, and green paper averaged 4/5 questions correct.

What is your conclusion based on the hypothesis and data?

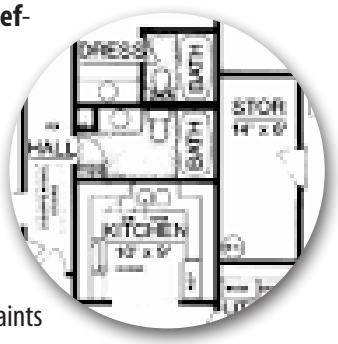
Engineering Vocabulary

To complete Mister C's engineering challenges, you should know the language! Study up on these common engineer terms before coming to see FULL STEAM AHEAD WITH MISTER C.

Constraint- a limitation or restriction.

Criteria- the requirements needed of a project or product and the standards to which it will be judged.

Design brief- a written plan that identifies a problem to be solved and its criteria and constraints



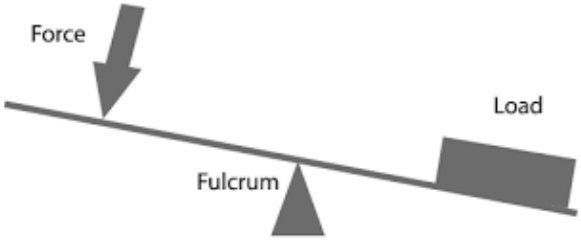
Design process- a systematic problem-solving strategy use to develop many possible solutions to solve a problem

Design statement- describes what an engineer should do to solve the problem without specifically stating how to solve the problem.

Experiment: A scientific procedure undertaken to make a discovery or to test a hypothesis.

Force: Anything that acts on a body to change its rate of acceleration or alter its momentum.

Fulcrum: The point on which a rest or is supported and on which it pivots.



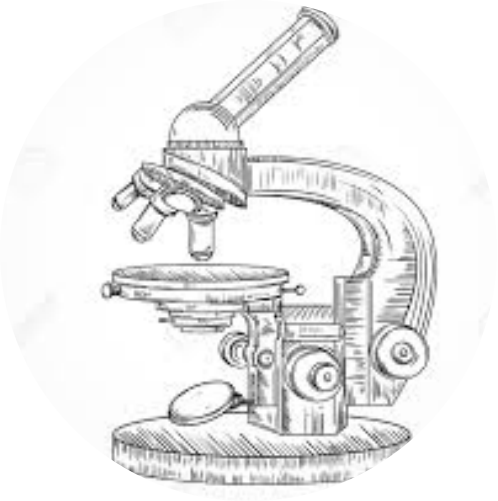
Research- study of materials and sources to establish facts and find new conclusions.

Lever: A rigid bar resting on a pivot, used to help move a heavy or firmly fixed load with one end when pressure is applied to the other.

Model- a detailed visual, mathematical representation of an object or design.

Prototype- a full-scale working model of a design.

Sketch- a rough, handmade drawing that represents the main features of an object or scene .



Marshmallow Launcher

Name _____

Use the engineering process to design and create your own marshmallow catapult! Compete against your classmates to see who can get their marshmallow to go the furthest distance.

Problem: To launch your marshmallow the furthest distance

Materials:

• 10 wooden skewers • Rubber band • 10 large marshmallows • Plastic spoon • Roll of masking tape • Yard Stick or measuring tape

Steps:

1) Study the materials given, how can you use these to design a catapult? What will need to be used and where will you use it? What are the different materials for?

2) Sketch out some design ideas in the space provided

Sketch Here:

3)Construct your catapult, you can change or manipulate the materials you are given in any way to design your catapult. You will only be given these materials; no materials will be replaced and you cannot ask for additional materials.

4) Run your trials before competing with your classmates and fill out the chart with your data.

Trial Number	Marshmallow Distance Traveled	What changes will you make to your design?

Concluding Questions: Answer these questions based on your data table

1) Which catapult design gave you the furthest distance?

_____

_____

2) Why do you think that design gave you the best result?

_____

_____

3) What patterns did you notice about how far the marshmallow would travel based on the changes you would make to your design?

_____

_____

For younger students, consider giving them examples of catapults to design and test.

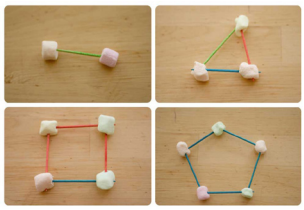
Toothpick Towers

SCIENCE MATH All Grades

Name _____

Problem: •Why don't bridges or buildings fall under so much weight stress?
•Can you build a bridge that will the most marbles without breaking?

Materials: • 20 toothpicks per student or student group • One ball of modeling clay for student or student group
• Marbles to test how much weight the tower can hold



Experiment:

1) Study the different shapes one can make with toothpicks.
Think about other shapes you can make using the toothpicks and marshmallows.
2) **Hypothesize**, how many marbles do you think you will be able to get a tower to hold? _____
3) Sketch and design your tower in the space given below

Sketch Here:

4) Construct your tower using the following criteria:
a.The tower must be at least two toothpicks high
b.It can only use the materials listed on this sheet
c.You may change or manipulate the materials
d.It must hold the marbles for ten seconds without collapsing

5) **Collect your Data**: Fill out the chart to track the data of your attempts of creating the strongest tower.

Trial Number	Marbles Held Before Collapse	What changes will you make to your design?
1		
2		
3		

Concluding Questions: Answer these questions based on your data table

1) Which catapult design gave you the furthest distance?

_____

_____

2) Why do you think that design gave you the best result?

_____

_____

3) What patterns did you notice about how far the marbles would travel based on the changes you would make to your design?

_____

_____

Types of Energy

SCIENCE

All Grades

Name _____

MECHANICAL - The type of energy that is stored in objects caused by tension. (ex: an unwound slinky)

THERMAL – The type of energy created from moving molecules that creates heat and fire.

CHEMICAL – The type of energy stored in the bonds of molecules. Coal and natural gas are used to create energy to power trains, cars and other ways to travel all over the country.

RADIANT – The energy associated with the movement of light. Also known as solar energy.

ELECTRICAL – The type of energy that comes from tiny charged particles called electrons. (Ex: lightning)

NUCLEAR – The type of energy created when atoms are split or fused. This energy is created in Nuclear Power Plants.

Label the picture with the energy type it represents					
Mechanical	Thermal	Chemical	Radiant	Electrical	Nuclear

_____ _____ _____

_____ _____ _____

Spinning Color Wheel

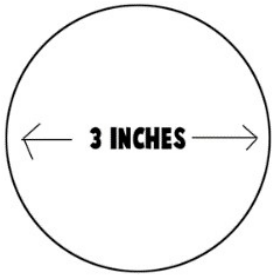
SCIENCE ARTS All Grades

Name _____

MATERIALS NEEDED

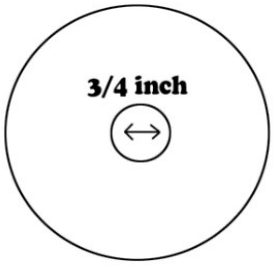
• White cardboard, 1 piece per student • String, 1 piece per student • Markers, crayons, colored pencils, or paint •Scissors • Compass

Step 1



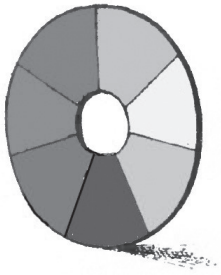
Take a piece of white cardboard, and from it cut a circle about 3 inches across using your compass to trace the circle.

Step 2



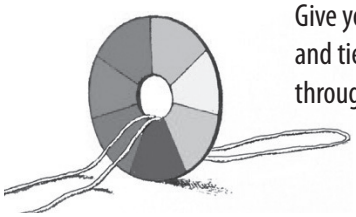
Place your compass in the center of your circle. Trace a circle that is ¾ of an inch and then cut out that circle from the middle.

Step 3



Divide the circle into 7 equal parts, and using your coloring materials color the wheel in the order of the rainbow: red, orange, yellow, green, blue, indigo, and violet.

Step 4



Give your wheel time to dry. Take your string and tie it into a large loop, pull the loop through the hole.

HOW TO PLAY WITH YOUR NEW COLOR WHEEL SPINNING TOY

Now hold the ends of the loop one in each hand. Twist one end of your loop until it is tightly woven together. Then, pull both ends of your rope taught. The wheel will spin quickly, causing the colors to merge into gray or white. Now you've learned that white light is a combination of all the colors!

Extension: Other combinations to try!

See if you can use just the primary colors on your wheels to make the secondary colors by trying these combinations. Change the wheel into a six-piece wheel, alternating between the two colors.

Bue and red to make purple

Blue and yellow to make green

Yellow and red to make orange

Magnetic Slime

SCIENCE ARTS All Grades

Name _____

Mister C uses slime to teach about chemical reactions and polymers. Extend his project and see if you can meet the challenge of making oozing slime magnetic! This is a hands-on science activity you have to do to believe.

You Will Need:
•8 oz. bottle of school glue •Borax •Large mixing bowl •Plastic cup Measuring cup and utensils
•Zipper-lock bag •Iron filings or iron powder •Neodymium magnet •Water

Procedures:
1. Empty the entire bottle of school glue into the large mixing bowl. Add water to the empty glue bottle, tighten the lid, and shake it up. Pour the water and glue solution from the bottle into the bowl. Add some iron filings or iron powder to the mixture of water and glue before stirring the entire mixture.
2. Measure 1/2-cup of water and pour it into the plastic cup. Add 1 teaspoon of borax to the cup of water and stir the solution. Add the borax solution to the mixture in the bowl. Mix it up VERY well. Hover the neodymium magnet near the slime and witness some ooey, gooey, slime-based magnetism.

What is happening?

What makes this slime magnetic? The iron filings are magnetic! Iron is one of three elements (cobalt, iron, and nickel) that are magnetic at room temperature. The mixture of school glue with borax and water produces a putty-like material called a polymer. In simplest terms, a polymer is a long chain of molecules.

You can use the example of cooking spaghetti to better understand why this **polymer** behaves in the way it does. When a pile of freshly cooked spaghetti comes out of the hot water and into the bowl, the strands flow like a liquid from the pan to the bowl. This is because the spaghetti strands are slippery and slide over one another. After a while, the water drains off of the pasta and the strands start to stick together. The spaghetti takes on a rubbery texture. Wait a little while longer for all of the water to evaporate and the pile of spaghetti turns into a solid mass -- drop it on the floor and watch it bounce.

Polymers are made out of long strands of molecules like spaghetti. If the long molecules slide past each other easily, then the substance acts like a liquid because the molecules flow. If the molecules stick together at a few places along the strand, then the substance behaves like a rubbery solid called an elastomer. **Borax** is the compound that is responsible for hooking the glue's molecules together to form the putty-like material.

Now, what prevents the iron filings from flying out of the slime?
The slime is able to hold onto its iron filings by adhesion. Adhesion is the force that holds molecules of different substances together. In addition to adhesion, the slime is bonded together by cohesion, the force that holds molecules of the same substance together. The combination of magnetism, adhesion, and cohesion results in the weird, stretchy volcanoes that appear when you hover the neodymium magnet near the slime!

Tie Dye Chemistry

SCIENCE ARTS All Grades

Name _____

With some simple materials, you can learn about the properties of liquids and solutions. A solution is a homogeneous mixture in which one or more substances are dissolved into another substance. Solubility is the ability of a chemical to dissolve in a liquid and create a solution. Use permanent markers, some fabric, and rubbing alcohol to examine how solubility works!

Materials Needed:

•White fabric squares, one per student. You may also have students bring in white t-shirts or other clothing to dye.

•Permanent colored markers •Rubbing alcohol (70%) •Cups or jars •Eye droppers or pipettes •Rubber bands

Steps/Procedure:

1)Lay your fabric over the mouth of the cup or jar and spread it tight. Hold the fabric in place using a rubber band.

2)Use the permanent colored markers to draw designs on your fabric. Use dots, lines, or other shapes. Only color on the part of the fabric that is on the mouth of the cup or jar.

3)Use a dropper to place 5-10 drops of the rubbing alcohol on the designs. Wait a few minutes for the alcohol to soak the colors.

4)Repeat steps 1-3 several times on different areas of the fabric.

What's happening?

The dye in the permanent markers can only absorb and spread so far into the fabric. When you added the alcohol, the dye began to dissolve. The fabric still absorbs the alcohol and dye, spreading the dye farther across the fabric. The alcohol dries and the dye becomes part of the fabric. You can now wash the fabric without worrying about it washing out of the fabric.

Data Collection

Section of Fabric	How did the fabric look after applying permanent marker?	How did the fabric look right after you applied the rubbing alcohol?	How did the fabric look after you let the rubbing alcohol set for 3-5 minutes
1			
2			
3			

Conclusion Questions:

1) Describe what happens after you press the markers into the fabric. _____

_____

_____

2) Describe what happens when you add drops of alcohol. _____

_____

_____

3) **Hypothesize** what you think would happen if you use water instead of alcohol. _____

_____

_____

4) **Hypothesize** why you used permanent markers instead of washable markers. _____

_____

_____

Resources for Students and Adults

Books for Students about Science

Mistakes that Worked: 40 Familiar Inventions & How They Came to Be, Written by Charlotte Foltz Jones and Illustrated by John O'Brien. Delacorte Books for Young Readers, 1994.
Case Closed?: Nine Mysteries Unlocked by Modern Science, Written by Susan Hughes and Illustrated by Michael Wandelmaier. Kids Can Press, 2013.
Girls Think of Everything: Stories of Ingenious Inventions by Women, Written by Catherine Thimmish and Illustrated by Melissa Sweet.

HMH Books for Young Readers, 2002.

Publications for Teachers and Parents:

Awesome Science Experiments for Kids: 100+ Fun Stem/Steam Projects and Why They Work, Written by Crystal Chatterton. Rockridge Press, 2018.
The Everything Kids' Easy Science Experiments Book: Explore the world of science through quick and fun experiments!, Written by J. Elisabeth Mills. Everything, 2001.
Kitchen Science Lab for Kids: 52 Family Friendly Experiments from Around the House, Written by Liz Lee Heinecke. Quarry Books, 2004.

Websites:

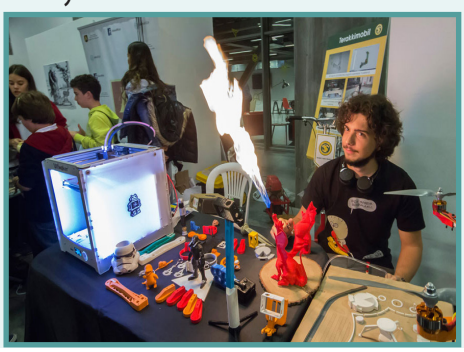
https://www.exploratorium.edu/- The official website for the Exploatorium Museum in San Francisco, California offers scientific videos, inexpensive science experiments to do at home or in a classroom, and other science related activities.

https://www.sciencebuddies.org/- This website offers aide in finding the perfect science fair project as well as guides to help students complete that project.

https://sciencebob.com/- A website created by a former teacher with experiment videos, science fair ideas, and scientific facts.

Victoria Fuse's Local Resource

Dayton, Ohio has started a new tradition at Carillon Historical Park. Each year people who have a passion for creating, designing, and inventing come together at the Dayton Mini Maker Faire. Visitors to the event can see a variety of activities such as video game design, 3D printing, art in different medias, and Mister C's science experiments, as well as other creative innovations. Each year, teams of makers get together in the Boneyard Build- Off where teams are given a challenge to meet and a pile of garbage to make it happen. Students can learn a lot about tinkering and other engineering sciences by visiting the fair and its many exhibits. To learn more about what the event has to offer, please visit: https://dayton.makerfaire.com/.



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DISCOVERY series

138 North Main Street
Dayton, OH 45402

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OTHER BROADWAY PROGRAMS:

Background on Broadway
Bagels & Broadway

HAIR RAISING SCIENCE

Kevin Cornell takes on the role of Mister C for PBS's Thinktv. Mister C is a creative, innovative, and inspiring educator who combines video and music with technology to enhance the educational experience for all learners. In 2016 he was named the Lead PBS Digital Innovator for the state of Ohio, in recognition of his outstanding use of digital media and technology as learning tools. Mister C is known for marching and dancing to his own beats and creating unique STEAM-themed multimedia projects. The songs and videos found on PBSLM are designed to help students grasp concepts that can often be challenging to understand.

DON'T FORGET

All schools that receive scholarships for a show and/or transportation are asked to create thank-you letters or cards for our sponsors. Please address your students' thank-you notes to:

DISCOVERY Sponsors
c/o Victoria Theatre Association
138 North Main Street
Dayton, OH 45402

Ohio Arts Council
MONTGOMERY COUNTY