"Just because you can't see something, doesn't mean it's not there."

-Willard Wigan

WILLARD WIGAN

MICROSCULPTOR

ART SO SMALL... YOU CAN'T SEE IT

Ripley's Traveling Shows

EDUCATION AND PROGRAMMING RESOURCE GUIDE

WILLARD WIGAN

MICROSCULPTOR

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WHAT TO EXPECT
on Your Field Trip

Welcome to the World of Willard Wigan!

In a speech to a group of students called "What is Your Life's Blueprint?" Martin Luther King said in 1967, "If you can't be a sun, be a star. For it isn't by size that you win or fail. Be the best of whoever you are." These words deeply impacted the world of Willard Wigan. He went on to create his own blueprint as a world-renowned sculptor. You and your students are about to experience something you have never seen before and, in fact, something you cannot see at all.

On your field trip to **Willard Wigan: Microsculptor**, your class will have to look through microscopes in order to view his creations. These rare sculptures are more than three times smaller than the period at the end of this sentence. Can you imagine that? You will see Florence Nightingale in the eye of a needle and Michelangelo's David on the top of a nail!

Willard makes tools that are small enough and sharp enough to carve with precision under the microscope. These include fine bits of razorblade attached to toothpicks and shards of diamonds. "When I wake up in the morning, I get a magnifying glass and look on the pillow for eyelashes. They become my paintbrushes," he says. Each sculpture has its own challenges but with practiced technique, Willard is able to put together intricate microscopic works of art. The collection you see in this exhibition is composed of materials ranging from nylon and sand to 24 carat gold and Kevlar.

Willard takes as much time as he needs to prepare for the intense concentration required for working on his miniatures. He has been training his body and mind for decades. He must be extremely still and quiet while working with such minute materials. While the normal resting heart rate for adults ranges from 60 to 100 beats per minute, you will learn that Willard is capable of slowing his heart rate to 40 bpm. This gives him time to work in between heartbeats and reduces the likelihood of hand tremors. The whole process of sculpting and painting one piece of art can take six weeks to three months of working through the lens of a microscope.

As they explore Willard's work, your class will see real-world applications of their STEAM instruction (Science, Technology, Engineering, the Arts, and Math). There are 12 amazing microsculptures along with an explanation of how dyslexia influenced his inspiring achievements. The educational possibilities at **Willard Wigan: Microsculptor** are as big as the work itself is small.

Using this Resource Guide

As a companion to your experience at **Willard Wigan: Microsculptor**, this Resource Guide complements your classroom instruction and makes the most of your school field trip. It contains original STEAM-related classroom and on-site activities designed to be flexible and used to meet the needs and capabilities of your class. You know your students better than anyone else.

Following this introduction, you will find a biography of Willard along with a Q&A in his own words. Next, four interdisciplinary project ideas, "The Little Things," center on key STEAM topics related to Willard's work. Students will convert measurements between macroscale and microscale, investigate how good habits, practice, and healthy choices are at the center of Willard's amazing physical abilities, research the coefficients of friction for materials Willard uses in his work, and discuss myths and misconceptions about dyslexia.

While on their field trip, students are encouraged to direct their own learning by seeking out the sculptures that interest them the most. "Snap, Chat, Post" is a photo scavenger hunt to be used as a roadmap to posting their personal discoveries online.

A list of programs, events, and activities for teachers, families, and groups called "Small World. Big Impact." is included for museums hosting the exhibition. These are community outreach suggestions support the STEAM learning initiatives in **Willard Wigan: Microsculptor**.

We know how important it is to justify field trips and document how instructional time is spent outside of your classroom. To that end, this Resource Guide is directly correlated to the Next Generation Science Standards, Common Core State Standards for Mathematics and English Language Arts, and the National Fine Arts Standards. These connections, listed in "The Bigger Picture," show how the exhibition experience and its corresponding activities fit into your middle school and high school curriculum.

These education resources can be used before, during, and after your field trip. They will help students get ready for the teachable moments found throughout **Willard Wigan: Microsculptor**. When you return to school, refer to this Resource Guide as you continue to explore links between the themes of the exhibition and your classroom STEAM instruction.

"I was told I would become nothing. Now I am showing people how big nothing is."– Willard Wigan

Seeing is Believing

For your reference and preparation, here is a list of the amazing sculptures (and their materials) your class will see on your field trip to **Willard Wigan: Microsculptor**. Believe it or not!

• **Benetton Babies – Kevlar**
The United Colors of Benetton ads from the 1990s were designed to be thought-provoking and controversial and they often featured social themes. The brand also aimed to bring together disparate groups of people, including those of different races and cultures, as captured in this piece.

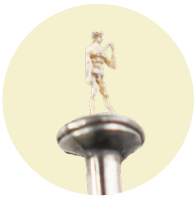
• **Big Momma's House – Various, including wood and bark**
Screenwriter Darryl Quarles came up with the idea for "Big Momma" from what the neighborhoods called his own real-life mother. What better way to commemorate Martin Lawrence's performance as the large grandmother than with this tiny figure?

• **Curious Cat – Nylon**
"Curiosity killed the cat", the proverb used to warn of the dangers of unnecessary investigation or experimentation does not apply here. This curious kitty lives on in this stunning piece.

• **Panther – Kevlar**
There's a mystique surrounding panthers—sleek, elusive, and quiet as midnight. They are actually just leopards that have a black color mutation that turns their normally golden fur black to match their spots.

• **Cassius Clay and Sonny Liston – Nylon**
Smaller than the head of a matchstick, this tiny boxing ring features the famous 1964 match between Sonny Liston and Cassius Clay in which Clay won the match by a technical knockout and then announced to the world, "I am the greatest!"

• **Golden Galleon - 24ct gold**
One of three galleons Willard has assembled, the ship itself is made from a chip of 22 karat gold, one of Willard's favorite media with which to work.



• **David – Kevlar**

Willard's appreciation of the world's master artists and their most well-known pieces led him to sculpt this tiny replica of Michelangelo's David.

• **Florence Nightingale – Nylon**

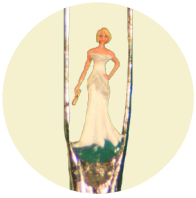
Famous for her care of wounded soldiers, Florence Nightingale changed the way the world thought about nursing. Did you know Nightingale spoke six languages? Willard has captured "The Lady with the Lamp" perfectly in this sculpture.

• **Charles Dickens – Nylon**

Best known for writing A Christmas Carol, Charles Dickens was arguably one of the greatest writers of his time. Dickens once published under the pseudonym "Boz" and owned a beloved pet raven!

• **Christmas Tree – Various, including fabric strands**

It just isn't Christmas without a tree! This detailed sculpture features decorations on the tree itself, as well as presents below. It can take as many as 15 years to grow a real Christmas tree of typical height!



• **Sophisticated Lady – Nylon and Gold**

Elegant and graceful, this beautiful figurine features a blond woman in a full-length evening gown, complete with handbag.

• **Lady on a Bridge – Various, including nylon, fabric and sand.**

Featuring gorgeous countryside details, this sculpture of a woman on a bridge shows Willard's fine workmanship as seen in the trees and other natural elements.

THE ARTIST:
Meet Willard Wigan

Art You Cannot See

Willard Wigan is a British sculptor who creates microscopic art. He came from a very humble beginning as one of seven children born to Jamaican immigrants. Willard grew up in a tough neighborhood in the 1960s. Although he suffered from undiagnosed dyslexia and mild autism, he didn't let that hinder him from achieving renowned status in the art world. His hand-crafted sculptures are among the smallest ever created—one measures less than the size of single human blood cell—and he believes they can be even smaller!

Willard's creative journey began when he was five years old. He often skipped school to hide from the ridicule and harassment of his classmates. Instead, he spent his time building tiny houses and furniture for ants in his garden shed. Yes, ants! When his mother found him, she discovered the small houses he was building and encouraged him to continue. This moment influenced Willard throughout his career

Cut Down to Size

Unlike today, no one talked about dyslexia and autism in the 1960s. Willard's learning problems went undetected. His teachers were not trained to recognize and support his disabilities. Without knowing any better, they told him that he was stupid and would never amount to anything. Once when he could not do the work, his teacher pointed to him and explained to the class that, "Willard is an example of failure."

Nothing could be further from the truth. Even though Willard was victimized over his learning disability as a child, he was able to overcome his disadvantages and achieve an extraordinary career as an artist.

Eyelashes as Paintbrushes

Willard creates his micro-sculptures inside a small bedroom in his apartment in England. He works in the middle of the night when it is the quietest and there are no interruptions. Besides the physical challenges and skill level of working at such a small scale, other elements affect his work. The slightest movement can ruin a sculpture. Static electricity from him connecting two pieces, a speck of dust falling into his work space, or vibrations from a truck passing by outside can destroy hours or weeks of work.

For two decades, Willard worked during the day in a factory and sculpted his miniatures at night. He also had a job as a live mannequin for a clothing store where he could practice staying still and holding his breath for long periods of time. Now Willard can sculpt for over 16 hours straight. To achieve the mental and physical state of concentration to do this, he has to meditate and create the right atmosphere.

How Big is Nothing

Today, Willard Wigan is a world-famous artist worthy of his very own museum exhibition. His is a true story of overcoming great odds to become the biggest at creating the tiniest form of art. From being bullied in school to being awarded the Most Excellent Order of the British Empire (MBE) for his contributions to the arts, Willard is an inspiration to many. One of his admirers is the Queen of England! He sculpted her portrait on a coffee bean to celebrate her Diamond Jubilee in 2012. Remember when Willard was such a failure as a student? He went on to receive an honorary doctorate degree from the University of Warwick and a place as a two-time Guinness World Record holder for the Smallest Sculpture Made by Hand.

Willard Wigan: In His Own Words

"I want to inspire people especially those people who have a learning difference like me. If I never had this condition, I wouldn't be who I am today. I want to show them what can be achieved if you try."

What is your favorite of your sculptures?
The Last Supper

Why?
Because of the movement and amount of figures in the sculpture. It was very challenging.

What is the strangest thing to happen to you?
I once swallowed one of my pieces, Alice in Wonderland. I'd got the Mad Hatter, the teapot, the Hare, the Dormouse, and the Rabbit, so Alice was last. And I got the shape of her, and painted her with an eyelash, and then I went to put her behind a chair, and my mobile phone went off. And you know when your mobile phone goes off when you don't want it to, the first thing you do is inhale. And there was no more Alice.

Do you feel like you're getting better at your work?
Oh yeah, I'm getting better. The world hasn't seen Willard Wigan yet. They're going to see a lot more. My mum used to say "Be the Muhammad Ali of microscopic work." I used to see him on TV going "I am the greatest," and I thought "Yeah, I'm going to become that." He's someone who has really inspired me. I love artists like Michelangelo, Salvador Dali, Henry Moore. I look up to greatness. It doesn't matter if it's art or tennis or football, I like seeing greatness. And I hope that I'm an inspiration to other kids who have autism. Not just people with autism, anyone with low self-esteem. I'm here to deliver the smallest, biggest message in the world.

THE LITTLE THINGS:
Interdisciplinary Activities and Project Ideas

1. Micro Math: What is "Small?"

Willard Wigan's sculptures straddle the boundary between the micro and macro worlds. Using the eye of a needle as a frame or the head of a pin as a base, the tools and media he uses to create his art must be tiny. He often starts by identifying fragments as small as a single carpet fiber, a fleck of gold or diamond, dust floating in a sunbeam, a fragment of a smashed dinner plate. He improvises the tools he needs, such as tweezers made from eyelashes and acupuncture needles flattened into hooks. Even items that start larger, such as a plastic cable tie, end up whittled into a sliver by a very small knife.

A microscope is necessary to both create and appreciate Willard's work, which is usually measured in micrometers (microns). To put his accomplishments in context, complete the unit chart below, then use the data to convert measurements between the macroscale and the microscale.

Unit	Symbol	Equivalent to 1 m	Inches (Fraction)
Meter	m	1	
Decimeter	dm	10	
Centimeter	cm	100	
Millimeter	mm	1,000	
Micrometer (micron)	µm	1,000,000	
Nanometer	nm	1,000,000,000	

- How tall are you in centimeters? Millimeters? Micrometers?

- What is the surface area of your desk in square millimeters?

- In 2017, Willard's sculpture of a baby, "Warwick," broke his previous Guinness World Record as the Smallest Statue Made by Hand at .07822 mm (3/1000 of an inch). Calculate the ratio for "Warwick" and your height.

- In 2013, Willard's sculpture of a gold motorcycle, "Golden Voyage," became a Guinness World Record as the Smallest Statue Made by Hand at 3 microns. How does that compare to the 0.005 mm average height of his figures? Calculate the ratio for "Golden Voyage" and your height.

• Willard has used the antennas and claw of a dead aphid fly as his tools. If these flies are smaller than the head of a pin, what length do you think the antenna he used as a paint brush might be?

• Willard's eyesight has often been compared to that of a bird of prey. For most humans, however, the smallest object that can be seen with the naked eye is 100 µm. List examples of items you predict are that size.

Rank these objects Willard uses by their comparative sizes, smallest to largest. You will see some of them under the microscope on your field trip to **Willard Wigan: Microsculptor.**

Grain of sand
Spider web
Cotton fiber
Silk fiber
Wool fiber
Grain of salt
Nylon fiber
Human hair

Answer Key

Answers for Chart:

Unit	Symbol	Equivalent to 1 m	Scientific Notation	Decimal Form
Meter	m	1	10^{0} m	1.0 m
Decimeter	dm	10	10^{-1} m	0.1 m
Centimeter	cm	100	10^{-2} m	0.01 m
Millimeter	mm	1,000	10^{-3} m	0.001 m
Micrometer (micron)	µm	1,000,000	10^{-6} m	0.000,001 m
Nanometer	nm	1,000,000,000	10^{-9} m	0.000,000,001 m

Answers for Ranking by Size:

spider web (3-8 µm), cotton fiber (10 µm), wool fiber (10-55 µm), silk fiber (15 µm), nylon fiber (varies based on type), human hair (average diameter 100 µm), grain of sand (500 µm), grain of salt (500 µm)

2. A Heart for Art

Each sculpture has its own challenges, but one technique Willard uses on every piece of his art is control over his own body—even the actions you think of as involuntary such as heart rate. As his sculptures become smaller, the skill and dexterity with which he must work is extremely controlled. “I started to learn to breathe properly,” he says. “I’d squeeze my fingers together to stop the pulse from moving my finger. Then I started to hold my breath, and I found that each time my pulse stopped, there was more stability.”

Willard taught himself to slow down his breathing and work in the spaces between his heartbeats. He can sit for 22 hours without moving and slow his rate down to 40 beats per minute. “The stillness of it is very important - you have to control the whole nervous system, you have to work between the heartbeat - the pulse of your finger can destroy the work,” he explains. Other times, his pulse is just the force he needs. He uses the tremor caused by his own heartbeat as a jack hammer to chisel tiny particles.

Investigate how good habits, practice, and healthy choices are at the center of Willard’s amazing abilities.

• Why does Willard avoid both caffeine and alcohol? What are their effects on the nervous system? How would they hamper his skill?

• How do the nervous system and circulatory system intersect and make it possible to control your heart rate? Which parts of Willard’s nervous system is he able to “override?” Review the anatomy and functions of your nervous system to see how effective Willard’s process truly is.

central
peripheral
somatic
autonomic
sympathetic
parasympathetic

• The average resting heartrate for an adult is between 60 and 100 beats per minute. To calculate your resting heart rate, feel your pulse on the inside of your wrist or along the carotid artery of your neck. Count how many times it beats in 30 seconds and double that number. How do you compare to Willard’s 40 beats per minute when he is working? You will be able to officially test your heart rate on your class visit to the exhibition. Compare your results.

• There are other careers, such as a surgeon or a biathlete, for which consciously lowering your heartrate is helpful. In fact, some biathletes train to shoot their targets between heart beats, just like Willard does with his carefully controlled movements. What other professions can you think of where this type of self-control is beneficial?

• Early in his career, Willard worked as a live mannequin for a store. It gave him great practice at staying still. Compete with a classmate to see who can sit motionless the longest, with no voluntary movements. How long did you last? What finally made you move?

• While Willard has been working at this his whole life, there are methods you can try that are supposed to temporarily lower your own heart rate. Examine the effectiveness and the science behind each technique listed below. Do they work? And if so, how?

- o **Breath slowly and deeply**
- o **Splash cold water on your face**
- o **Gently massage your carotid artery**
- o **Relax through visualization or meditation**
- o **Progressive muscle relaxation**
- o **Lie down flat on your back**

3. Force of Nature: Friend or Foe

Willard Wigan's works are at the crossroads of art, physics, and materials science. Though miniscule and verging on the nanoscale, his microscopic sculptures are still a step away from quantum physics, meaning that they are governed by the same scientific laws and theories that affect objects many times their size. Because many properties are based on ratios of surface area and volume, the scale of Willard's materials makes it difficult to predict whether forces like friction, gravity, or electromagnetism will be constructive or destructive. Even air itself can have an effect, such as when the gentle wind from a flying insect's wings launched a piece out of sight. "A fly flew past when I was working on a sculpture and blew it away," Willard says. "The breeze from the fly's wings was like a hurricane."

• Pick three topics from the list below, research the science behind them, and explain whether you think these elements of classical mechanics benefit or hinder sculpting under the microscope.

Snell's Law
Gravity
Newton's Laws of Motion
Static electricity
Sound waves
Grain boundary

• Applying paint to his work has its own challenges, considering Willard's paintbrushes are often eyelashes or hairs from a dead fly. "Paint starts to turn into little blobs, and it starts to dry very quickly," he explains. How do surface tension, adhesion, and capillary action play a role in his painting process?

• Willard can skip the super glue and use friction to hold many pieces in place. When describing a piece featuring The Hulk, Willard recalls "I had to make little holes in the base of the needle, to shove his feet in. So most of my work, I don't use glue. They go in with their own friction." Coefficients of friction can help predict whether the force will be friend or foe. Explore the coefficients of friction for four pairs of materials Willard has used to predict how they interact each other and how his works might employ them.

Spider web
Glass
Cellophane
Cotton
Human hair
Salt
Kevlar
Sewing needles (carbon steel)
Wood
Nylon
Sand
Gold

4. Learning Differently

No one talked about dyslexia in the 1960s, so Willard's learning problems went undiagnosed. His teachers told him that he was "stupid and would never amount to anything." He was bullied over his learning disability as a child. However, he overcame his disadvantages and achieved tremendous success despite the odds.

Dyslexia is a language-based disorder that involves difficulty in learning to read or interpret words, letters, and other symbols. It is estimated to affect between 15% and 20% of the population. In spite of increasing awareness of it, there are still many myths and misconceptions about dyslexia, who it affects, and how it manifests. Can you separate fact from fiction in this True/False activity?

1. _____ Dyslexia is more common in boys than girls.

2. _____ Children outgrow dyslexia as they mature.

3. _____ Dyslexia only affects speakers of the English language.

4. _____ A person who cannot read has a low IQ.

5. _____ A person is only dyslexic if they write letters or numbers backwards.

6. _____ Indications of dyslexia cannot be seen on an MRI or other brain imagining.

7. _____ People who are dyslexic cannot learn to read or write.

8. _____ Dyslexia can be cured.

• Dyslexia can affect the ability to write as well as read, but it does not affect general intelligence. In fact, people with dyslexia excel in many different areas because the way they process language allows them to be extremely creative. Select a person from the list below to find out how dyslexia affected their lives and career choices. Present your research to the class.

Anderson Cooper *(journalist)*
Andrae Crouch *(musician)*
Ansel Adams *(photographer)*
Bella Thorne *(actor)*
Byron Pitts *(author/journalist)*
Carl Lewis *(athlete)*
Carol Greider *(Nobel Prize scientist)*
Catherine Drennan *(scientist/professor)*
Channing Tatum *(actor)*
Danny Glover *(actor)*
Dav Pilkey *(author)*
Daymond John *(Shark Tank star/CEO)*
Florence Welch *(musician)*
Fred Epstein *(neurosurgeon)*
Frank Gore *(athlete)*
Henry Winkler *(actor/author)*
Jack Horner *(paleontologist)*
Jamie Oliver *(chef)*
Jerry Pinkney *(author/artist)*
Jewell Lloyd *(athlete)*
John Irving *(author)*
Kiera Knightley *(actor)*
Lloyd Everitt *(actor)*
Magic Johnson *(athlete)*
Muhammed Ali *(athlete)*
Octavia Spencer *(actor/author)*
Pablo Picasso *(artist)*
Patricia Polacco *(author)*
Richard Branson *(entrepreneur/businessman)*
Salma Hayek *(actor)*
Steve Jobs *(entrepreneur/businessman)*
Steven Spielberg *(director)*
Tim Tebow *(athlete)*
Tom Cruise *(actor)*
Vincent Fantauzzo *(artist)*
Whoopi Goldberg *(actor/comedian)*

Answer Key

Answer Key for True/False activity:
All statements are False.

SNAP, CHAT, POST:
Photo Scavenger Hunt

Activity Page: Make a copy for each participant excluding the Answer Key at the bottom. Students can work in small groups or individually. Have them select 4-6 of the following clues depending on your available time and their interest in a particular sculpture. Bring them together as a class on the bus or back at school to answer all 12 questions to complete the hunt. Think small and have a big time!

Share your personal experience with Willard Wigan: Microsculptor on Snapchat, Twitter, Facebook, and Instagram!

1. Record a brief video of a member of your group reacting during their first look through the microscope at Willard Wigan's masterpieces.

2. Two heads are better than one! Find a sculpture that features two people and take a picture of yourself in front of it, with a friend of course!

3. Take a picture of one member of your group at the only sculpture placed within a razor blade.

4. Which of the featured sculptures is made mostly out of wood? "Wood" you be able to tell without the use of a microscope? Snap a pic to see if you can!

5. Two feline species can be found at **Willard Wigan: Microsculptor**. Take a picture of your favorite cat!

6. A picture is worth a thousand words, so take a picture of the sculpture featuring a celebrated English author.

7. Take a selfie with the microscope that reveals your favorite sculpture at the exhibition.

8. The event commemorated in this sculpture took place in 1964. Take a photo showing the names on the label of the two men balanced on the head of a pin.

9. Take a photo of the photo! Find the image of the Huf House.

10. The famous original of this work is made of marble, but this version is carved from Kevlar. Which sculpture is it?

11. Have a friend take a picture of you posing in the same position Willard Wigan created for the founder of modern nursing.

12. Do you see a glint of gold? Photograph the piece made from something measured in karats.

2. Benetton Babies or Cassius Clay & Sonny Liston; 3. Panther; 4. Big Momma's House; 5. Curious Cat or Panther; 6. Charles Dickens; 8. Cassius Clay & Sonny Liston; 10. David; 11. Florence Nightingale; 12. Golden Galleon

SMALL WORK, BIG IMPACT:
Community Outreach

Take your visitors inside Willard Wigan's microscopic world with community themed events and group activities focused on specific youth, student, and adult audiences. Even though it might be a small place, there's room for everyone!

Student Journalists on the STEAM Beat

Contact subject area middle school/high school teachers in your community including English, Journalism, Creative Writing, Engineering and Design, Broadcast Media, Yearbook, and School Newspaper. Invite them and their students to attend a "Small Art, Big Impact Press Conference" at **Willard Wigan: Microsculptor**. Coordinate with your PR and Marketing teams to greet the students, explain how a press conference works and moderate the discussion. Provide each student with your standard Press Kit with WW exhibition information, short bios of your panelists, and a souvenir Media Badge. Consider including a branded Reporter's Notebook.

Set up a panel of experts at a table with tented name identification; one or two people from your museum and one or two local art and science volunteers. Ask each panelist to prepare short (2-3 minutes) remarks about the exhibition itself and their insights about reimagining traditional methods of creating art and the engineering challenges presented by creating microsculptures. Open the conversation to questions from the student journalists. Conclude with a tour of the exhibition allowing students to take photos and video and to interview your experts. Be sure to follow up with the teachers for copies of their print, broadcast, and social media stories.

Bigger than the Badge: Boy Scouts and Girl Scouts

Boy Scouts: Detailed connections to **Willard Wigan: Microsculptor** will help Scouts obtain the experience necessary to fulfill badge requirements in several categories—including Art, Engineering, Model Design, and Sculpture. Plan a weekend of related activities for the Scouts to earn one of their prized badges.

Girl Scouts: In addition to supporting several key aspects of the National Leadership Journeys (Think Like an Engineer), **Willard Wigan: Microsculptor** can also be tied directly to the specific requirements for Proficiency Badges including Life Skills (Artist) and STEM (Science and Technology).

Small World: Meet-Ups & Tweet-Ups

Bring like-minded individuals together at **Willard Wigan: Microsculptor** to meet, tweet, pin, and post about their experiences at the exhibition. Happy Hour events, monthly meetings, and club membership campaigns can drive attendance to your venue and create buzz in your local community.

The unique themes found within **Willard Wigan: Microsculptor** will attract existing groups to the exhibition to view the show together and discuss their particular areas of interest:

- **Sculptors**
- **Multimedia Artists**
- **Micro-surgeons, Nanotechnologists, Micro-engineers**
- **STEM Clubs**
- **Guinness World Records Enthusiasts**
- **Dyslexia Support Groups**
- **Homeschool Families**
- **Art, Math, and Science Teachers**
- **Young Professionals**

THE BIGGER PICTURE:
Curriculum Standards

We know how important it is for teachers to justify field trips and document how instructional time is spent outside of their classrooms. With this in mind, both the activities in this Resource Guide and the experiences students have during their field trip to **Willard Wigan: Microsculptor** are correlated to the Next Generation Science Standards, Common Core State Standards for Mathematics, Common Core State Standards for English Language Arts, and the National Core Arts Standards. These connections are arranged by content area and grade level.

Next Generation Science Standards

Middle School: MS-LS1-3, MS-PS2-2, MS-PS2-4, MS-PS3-2, MS-PS4-2
High School: HS-LS1-3, HS-PS1-3, HS-PS2-1, HS-PS2-6, HS-PS3-2

Common Core State Standards for Mathematics

Middle School: CCSS.MATH.CONTENT.6.RP.A.1, CCSS.MATH.CONTENT.6.RP.A.3.D, CCSS.MATH.CONTENT.7.EE.A.2, CCSS.MATH.CONTENT.8.EE.A.3, CCSS.MATH.CONTENT.8.EE.A.4
High School: CCSS.MATH.CONTENT.HSN.Q.A.1, CCSS.MATH.CONTENT.HSN.Q.A.2, CCSS.MATH.CONTENT.HSN.Q.A.3

Common Core State Standards for English Language Arts and Literacy in Science & Technical Subjects

Grades 6-8: CCSS.ELA-LITERACY.RST.6-8.7, CCSS.ELA-LITERACY.WHST.6-8.7, CCSS.ELA-LITERACY.WHST.6-8.9
Grades 9-10: CCSS.ELA-LITERACY.RST.9-10.5, CCSS.ELA-LITERACY.WHST.9-10.7, CCSS.ELA-LITERACY.WHST.9-10.9
Grades 11-12: CCSS.ELA-LITERACY.RST.11-12.7, CCSS.ELA-LITERACY.WHST.11-12.7, CCSS.ELA-LITERACY.WHST.11-12.9

National Core Arts Standards

Middle School: VA:Re7.1.7a, VA:Cn11.1.7a, VA:Re7.1.8a
High School: VA:Re8.1.Ia, VA:Cn11.1.Ia

Girl Scouts: In addition to supporting several key aspects of the National Leadership Journeys (Think Like an Engineer), Willard Wigan: Microsculptor can also be tied directly to the specific requirements for Proficiency Badges including Life Skills (Artist) and STEM (Science and Technology).

For additional support please contact **travelingshowsupport@ripleys.com**.

WILLARD WIGAN

MICROSCULPTOR

PRINTABLE ACTIVITY SHEETS

Micro Math:
What is smalll?

Name: _____ Date: _____

A microscope is necessary to both create and appreciate Willard's work, which is usually measured in micrometers (microns). To put his accomplishments in context, complete the unit chart below, then use the data to convert measurements between the macroscale and the microscale.

Unit	Symbol	Equivalent to 1 m	Inches (Fraction)
Meter	m	1	
Centimeter	cm	100	
Millimeter	mm	1,000	
Micrometer (micron)	µm	1,000,000	

How tall are you in centimeters? Millimeters? Micrometers?	What is the surface area of your desk in square millimeters?
Willard's eyesight has often been compared to that of a bird of prey. For some, the smallest object that can be seen with the naked eye is 100 µm. List examples of items you predict are that size.	Willard has used the antennas and claw of an aphid fly as tools. If these flies are smaller than the head of a pin, what length do you think the antenna he used as a paint brush might be?

• In 2017, Willard's sculpture of a baby, "Warwick," broke his previous Guinness World Record as the Smallest Statue Made by Hand at .07822 mm (3/1000 of an inch). Calculate the ratio for "Warwick" and your height.

• Rank these objects Willard uses by their comparative sizes, smallest to largest. You will see some of them under the microscope on your field trip to **Willard Wigan: Microsculptor.**

Grain of sand
Spider web
Cotton fiber
Silk fiber
Wool fiber
Grain of salt
Nylon fiber
Human hair

SMALLEST:
LARGEST:

A HEART FOR ART
Activitie Sheet

Name: _____ **Date:** _____

Investigate how good habits, practice, and healthy choices are at the center of Willard's amazing abilities.

• How do the nervous system and circulatory system intersect and make it possible to control your heart rate? Which parts of Willard's nervous system is he able to "override?" Review the anatomy and functions of your nervous system to see how effective Willard's process truly is.

Central	
Peripheral	
Somatic	
Autonomic	
Sympathetic	
Parasympathetic	

• Why does Willard avoid both caffeine and alcohol? What are their effects on the nervous system? How would they hamper his skill?

• The average resting heartrate for an adult is between 60 and 100 beats per minute. To calculate your resting heart rate, feel your pulse on the inside of your wrist or along the carotid artery of your neck. Count how many times it beats in 30 seconds and double that number. How do you compare to Willard's 40 beats per minute when he is working? You will be able to officially test your heart rate on your class visit to the exhibition. Compare your results.

• There are other careers, such as a surgeon or a biathlete, for which consciously lowering your heartrate is helpful. In fact, some biathletes train to shoot their targets between heart beats, just like Willard does with his carefully controlled movements. What other professions can you think of where this type of self-control is beneficial?

• Early in his career, Willard worked as a live mannequin for a store. It gave him great practice at staying still. Compete with a classmate to see who can sit motionless the longest, with no voluntary movements. How long did you last? What finally made you move?

• While Willard has been working at this his whole life, there are methods that are supposed to temporarily lower your own heart rate. Examine the effectiveness and the science behind each technique listed below. Do they work? And if so, how?

- Breath slowly and deeply
- Splash cold water on your face
- Gently massage your carotid artery
- Relax through visualization or meditation
- Progressive muscle relaxation
- Lie down flat on your back

FORCE OF NATURE
Friend or Foe

Name: _____ **Date:** _____

Pick three topics from the list below, research the science behind them, and explain whether you think these elements of classical mechanics benefit or hinder sculpting under the microscope.

Snell's Law
Gravity
Newton's Laws of Motion
Static electricity
Sound waves
Grain boundary

Applying paint to his work has its own challenges, considering Willard's paintbrushes are often eyelashes or hairs from a dead fly. "Paint starts to turn into little blobs, and it starts to dry very quickly," he explains. How do surface tension, adhesion, and capillary action play a role in his painting process?

Willard can skip the super glue and use friction to hold many pieces in place. When describing a piece featuring The Hulk, Willard recalls “I had to make little holes in the base of the needle, to shove his feet in. So most of my work, I don’t use glue. They go in with their own friction.” Coefficients of friction can help predict whether the force will be friend or foe. Explore the coefficients of friction for four pairs of materials Willard has used to predict how they interact each other and how his works might employ them.

Spider web	**Kevlar**
Glass	**Sewing needles (carbon steel)**
Cellophane	**Wood**
Cotton	**Nylon**
Human hair	**Sand**
Salt	**Gold**

LEARNING DIFFERENTLY
Activitie Sheet

Name: _____ **Date:** _____

Dyslexia is a language-based disorder that involves difficulty in learning to read or interpret words, letters, and other symbols. It is estimated to affect between 15% and 20% of the population. In spite of increasing awareness of it, there are still many myths and misconceptions about dyslexia, who it affects, and how it manifests. Can you separate fact from fiction in this True/False activity?

1. _____ Dyslexia is more common in boys than girls.

2. _____ Children outgrow dyslexia as they mature.

3. _____ Dyslexia only affects speakers of the English language.

4. _____ A person who cannot read has a low IQ.

5. _____ A person is only dyslexic if they write letters or numbers backwards.

6. _____ Indications of dyslexia cannot be seen on an MRI or other brain imagining.

7. _____ People who are dyslexic cannot learn to read or write.

8. _____ Dyslexia can be cured.

Dyslexia can affect the ability to write as well as read, but it does not affect general intelligence. In fact, people with dyslexia excel in many different areas because the way they process language allows them to be extremely creative. Select a person from the list below to find out how dyslexia affected their lives and career choices. Present your research to the class.

Anderson Cooper
(journalist)

Andrae Crouch
(musician)

Ansel Adams
(photographer)

Bella Thorne
(actor)

Byron Pitts
(author/ journalist)

Carl Lewis
(athlete)

Carol Greider
(Nobel Prize scientist)

Catherine Drennan
(scientist/professor)

Channing Tatum
(actor)

Danny Glover
(actor)

Dav Pilkey
(author)

Daymond John
(Shark Tank star/ CEO)

Florence Welch
(musician)

Fred Epstein
(neurosurgeon)

Frank Gore
(athlete)

Henry Winkler
(actor/ author)

Jack Horner
(paleontologist)

Jamie Oliver
(chef)

Jerry Pinkney
(author/ artist)

Jewell Lloyd
(athlete)

John Irving
(author)

Kiera Knightley
(actor)

Lloyd Everitt
(actor)

Magic Johnson
(athlete)

Muhammed Ali
(athlete)

Octavia Spencer
(actor/ author)

Pablo Picasso
(artist)

Patricia Polacco
(author)

Richard Branson
(entrepreneur/ businessman)

Salma Hayek
(actor)

Steve Jobs
(entrepreneur/ businessman)

Steven Spielberg
(director)

Tim Tebow
(athlete)

Tom Cruise
(actor)

Vincent Fantauzzo
(artist)

Whoopi Goldberg
(actor/ comedian)