EDUCATION @ MESA ARTS CENTER

NATIONAL GEOGRAPHIC LIVE!
ZOLTAN TAKACS: DEADLIEST LIFE SAVERS

Ikeda Theater | February 8 | 10:15 AM | Grades: 5 - 8

2017/2018 EDUCATOR RESOURCE GUIDE

EDUCATION @ MESA ARTS CENTER

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ABOUT ZOLTAN TAKACS, TOXINOLOGIST…

National Geographic Live! brings you Zoltan Takacs, a Hungarian herpetologist who travels around the world researching and collecting deadly venom. Zoltan's interest in snakes began at an early age when he spent his summers in Transylvania finding all types of snakes and amphibians. This childhood fascination led him to research the venom that many snakes and other dangerous creatures secrete. Zoltan was one of the inventors of designer toxin technology which transforms deadly venom to be used in human drugs. Venoms can have very particular properties that Zoltan hopes scientists can use to create drugs to help people with all manner of medical conditions.

In this search for deadly venoms, Zoltan has traveled to 133 countries and survived 7 snakebites along the way. Although that many snakebites might deter most people, Zoltan Takacs remains passionate in his search for new venoms. Throughout his travels he has had numerous dangerous encounters and plenty of adventures in the wilderness. Please enjoy this journey into some extreme environments as you learn more about the important role deadly snakes and amphibians can play in the study and development of human medicine!

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WELCOME!

Dear Educator,

Thank you for selecting a **National Geographic Live!** field trip with the Mesa Arts Center. We have a dynamic season planned and we look forward to connecting you to our many speakers and presentations. With National Geographic Live, students are able to experience dynamic presentations and make educational connections well beyond the classroom.

We also recognize and appreciate the energy and time spent on your part in coordinating field trips. In this guide we have provided information to help make this the best experience possible.

In addition, the Mesa Arts Center has many open and inviting spaces that make good places to hold a brown bag lunch. Prior arrangements for lunch accommodations need to be made by either calling (480) 644-6540 or emailing outreach@mesaartscenter.com.

Please contact our offices should you have any additional questions (contact info on last pg.).

Enjoy the show!

TEACHER AND CHAPERONE INFORMATION

Chaperones

- Assign each chaperone a designated group of students and provide him/her with a written list of the students in that group.
- Ask chaperones to stay with their assigned group throughout the field trip. Adult chaperones are responsible for the students' conduct and behavior throughout their visit to the Center.
- Please review theater etiquette rules and responsibilities with all chaperones.
- Have the phone numbers of every chaperone in your group to quickly access each other in case of emergency.

Theater Etiquette

- No Food or Drink inside the theatre (besides bottled water).
- Students must be accompanied by chaperones at all times.
- Cameras and recording devices may not be used during the performance.
- Please silence cell phones and resist the urge to text message.
- Listening and following the House Managers and Ushers will help the seating and dismissal process.
- Feel free to laugh, clap and enjoy the show but also to be respectful of those around you.

CURRICULUM CONNECTIONS

National Geographic Live: Zoltan Takacs: Deadliest Life Savers

Arizona's College and Career Ready Standards

These standards can be achieved by using the discussion questions and the STEAM lesson included in this guide.

Speaking and Listening

Grades 5-8.SL.1 — Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.

Grades 5-8.SL.2 — Ask and answer questions about key details in a text read aloud or information presented orally or through other media.

Science

SC07-S4C3-02 — Explain how organisms obtain and use resources to develop and thrive in niches and predator/prey relationships.

SC08-S4C4 -01 — Explain how an organism's behavior allows it to survive in an environment.

SC07-S4C3-03 — Analyze the interactions of living organisms with their ecosystems.

Arizona's College and Career Ready Standards

These standards can be achieved by using the STEAM lesson included in this study guide.

Math

5.MD.A.1 — Convert among different-sized standard measurement units within a given measurement system, and use these conversions in solving multi-step, real-world problems.

6.RP.A.3 — Use ratio and rate reasoning to solve mathematical problems and problems in real-world context.

7.RP.A — Analyze proportional relationships and use them to solve mathematical problems and problems in real-world context.

7.G.A.1 — Solve problems involving scale drawings of geometric figures, such as computing actual lengths and areas from a scale drawing and reproducing a scale drawing at a different scale.

Mathematical Practice 1 — Make sense of problems and persevere in solving them.

Mathematical Practice 2 — Reason abstractly and quantitatively

Mathematical Practice 6 — Attend to precision.

CURRICULUM CONNECTIONS CONTINUED

National Geographic Live: Zoltan Takacs: Deadliest Life Savers

Arizona's College and Career Ready Standards

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Science

Strand 1 of the Science standards lays out the Inquiry process for students in grades 5-8. Performance objective details vary by grade but the general goals of each Concept are below:

SC-S1C1 — Observe, ask questions, and make predictions.

SC-S1C2 — Participate in planning and conducting investigations, and recording data.

SC-S1C3 — Organize and analyze data; compare to predictions.

SC-S1C4 — Communicate results of investigations.

Additionally these standards support the Engineering Design Process:

Grade 5:

SC05-S3C1-02 — Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.

SC05-S3C1-03 — Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.

SC05-S3C2-03 — Design and construct a technological solution to a common problem or need using common materials.

Grades 6-8:

SC-S3C2-01— Propose viable methods of responding to an identified need or problem.

SC-S3C2-02 — Compare possible solutions to best address an identified need or problem.

SC-S3C2-03 — Design and construct a solution to an identified need or problem using simple classroom materials.

Speaking and Listening

Grades 5-8.SL.4 — Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.

21st Century Learning Skills

By using the STEAM lesson included in this guide, students can become more proficient in the following Competencies:

- **Critical Thinking**
- **Creativity**
- **Communication**
- **Collaboration**

DISCUSSION QUESTIONS

Pre-Performance Discussion Questions

Zoltan Takacs was fascinated by snakes at an early age, especially by the venom that some snakes have. What do you know about venom? Did you know there are four major types of venoms? You can read more about those venom types here: https://www.nationalgeographic.org/news/snake-charmer/

In his search for venomous snakes and reptiles, Zoltan Takacs has had some dangerous experiences. He feels the benefits of obtaining venom for study outweigh the risks. Have you ever done something dangerous on purpose? Was there a greater benefit in the situation that caused you to do something dangerous?

What is something you want to know about snakes, reptiles, or venom? What are you hoping Zoltan Takacs discusses in his presentation? You can find out more about Zoltan Takacs and see some of his photography by checking out his website here: http://zoltantakacs.com/

Post Performance Discussion Questions

What was something surprising or interesting you learned from Zoltan Takacs' presentation on venomous animals?

In what ways did Zoltan Takacs demonstrate curiosity, responsibility, empowerment, and persistence in his work? Why do you think these attitudes are important for explorers?

Did Zoltan Takacs make any call to action to support his work? Are there any changes we can make in our day to day lives to support the Earth or medical research? What can we work on together as a group?

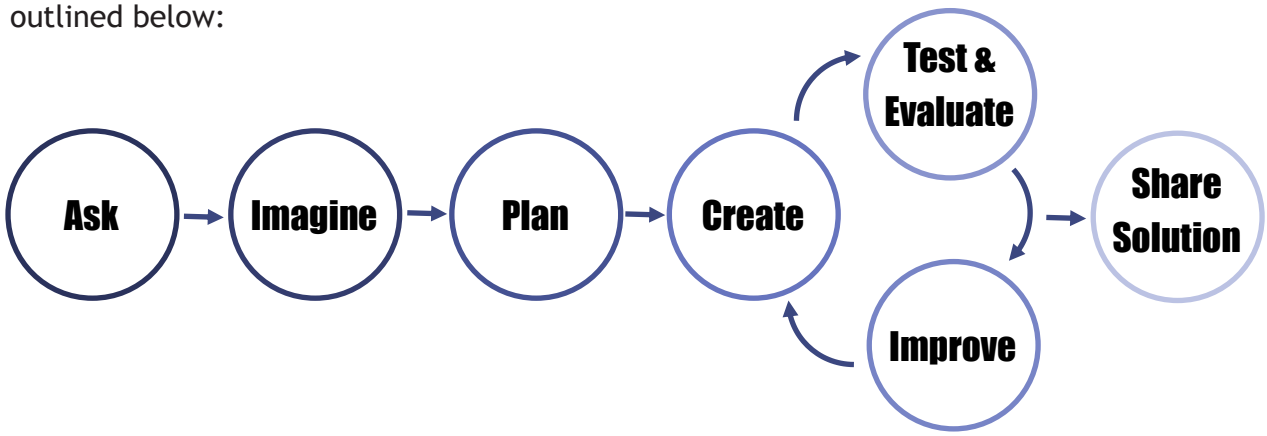
WHAT IS STEM?

STEM is a common buzzword in education these days, so it is important to know what exactly STEM is, and also what it is not. A true STEM lesson not only incorporates different subject areas, but also works to develop students' abilities to think creatively, reason, investigate, and work as a team. Here is a breakdown of what STEM means:

S Science	T Technology	E Engineering	M Math
The study of the natural world.	While traditional digital technology meets this part of STEM, technology is any product made by humans to meet a want or need. Any product created by students to solve a problem can be considered technology.	The design process students use to solve problems.	The study of numbers, equations, functions, and geometric shapes and their relationships.

A science experiment is not necessarily a STEM lesson. The requirements below need to be met as well for a lesson to be STEM based learning:

- The lesson focuses on a real world problem/issue.
- Students are working in productive teams.
- Students are engaging in hands-on inquiry and open-ended exploration. Students should be able to redesign as needed (within time constraints) so there should not be an exact end product/result predetermined by the teacher in mind.
- Students understand that there are multiple right answers to the posed problem and that failure can be used to reevaluate and make changes towards discovering a solution.
- The lesson uses the *engineering design process (EDP)*. EDP is similar to the scientific method and is outlined below:



- Adding any type of art component to the lesson changes STEM to STEAM.

BIOMIMICRY STEAM LESSON

Zoltan Takacs contributes to scientific research by obtaining venoms from dangerous animals which is then used in medical research. This is not a practice that can be replicated in the classroom naturally, but students can explore the related study of biomimicry. "Bio" means life and "mimicry" means to copy or mimic, so biomimicry is the study of animals and how their natural adaptations can be mimicked in the human world to create efficiency and sustainability.

Ark Hotel modeled after a shell design.

ASK (REAL WORLD PROBLEM)	As the world becomes more crowded and ecological concerns intensify, building efficient homes with sustainable materials is increasingly important. Animals build homes uniquely suited to their environment and survival needs. Through the study of biomimicry, we can look at how animals build their homes and see if any of the features that make them most successful can be adapted to human homes or buildings. To help students understand biomimicry you can share some of the examples on page 10. Ask students, "Can you create a scaled model of a building or home that mimics at least one desirable quality of a vertebrate's home?"
MATERIAL POSSIBILITIES	Students will need a variety of materials to choose from to create their building model. Cardboard, paperboard from food boxes such as cereal boxes, plastic cups, construction paper, index cards, paper bags, aluminum foil, paperclips, string, pipe cleaners, tape, glue, scissors, etc. To take this from a STEM to a STEAM lesson, give students access to crayons, colored pencils, markers, paint, or other art materials to add their artistic touch to their building model.
IMAGINE & PLAN	After students have been grouped and presented with the problem, they will need to decide on which class of vertebrate they are going to research to create their building model. Encourage groups to pick different animal classes so that there are a variety of building models. Things to consider when designing your building model: What are the advantageous features of your animal's home? What type of person or group can benefit from a house modeled after this animal class? What biomimicry design elements can you incorporate that can make the building more efficient? Are you choosing materials that your teacher is able to acquire? Students should sketch out their building design *to scale* before moving on to the create stage.

Modified from lesson at: http://teachers.egfi-k12.org/live-like-an-animal/

CREATE	After presenting their design sketch and explaining the design choices to their teacher, students can create their building model as long as the materials are available to them. If after presenting the design plan, the students are informed that a material is not available to them they will need to reevaluate their plan and revise it to work with available materials. Remind students that they should be measuring materials to match their scaled design so that they are not using more than necessary or being wasteful with materials. If you are incorporating art into this lesson, offer students materials to add their personal aesthetic flair to their building model.
TEST, EVALUATE, & IMPROVE	Since students will not actually be able to test these as true buildings, instead they can present their building to at least one other group. Students should explain design choices and detail how the building's design incorporates biomimicry for their chosen animal class. The other group can provide constructive feedback and then, in turn, present their design for feedback as well. Then provide time for groups to improve their design if needed based on the feedback they received.
SHARE SOLUTIONS	Once the building models have been explained, evaluated, and improved if needed, students can present their final products to the class. Each student in the group should have a role or part in the presentation. The class can discuss any factors that may contribute to the success or failure of each building model.

Eastgate Centre in Zimbabwe modeled after termite mounds.

LITERACY CONNECTIONS

- *Students could also write a research paper about an animal home. They should include information about where the home is located, what materials it is made of, and any special features of the home.*
- *Students can write a narrative about an animal who has a problem with his home and seeks help from other animals.*

BIOMIMICRY EXAMPLES

Give your students an introduction to Biomimicry by watching Janine Benyus (the co-founder of the Biomimicry Institute) give a short explanation in this video, "What is Biomimicry?":
https://www.youtube.com/watch?v=FBUpnG1G4yQ

Here are some examples of biomimicry in nature:

- Radar and sonar navigation technology and medical imaging inspired by the echo-location abilities of bats
- Swimsuit, triathlon and bobsled clothing fabric made with woven ribbing and texture to reduce drag while maintaining movement, mimics shark's skin
- Adhesives for microelectronics and space applications inspired by the powerful adhesion abilities of geckos and lizards
- Water filters designed like animal cell membranes to let certain things pass through while others are kept out
- Running shoes with technology learned from studying the mechanics of animal feet
- Super strong and waterproof silk fibers made without toxic chemicals by spiders
- Underwater glue for slippery surfaces, as made by mussels
- Anti-reflective, anti-glare film used for flat panel displays, touch screens, lamps, and phone and PDA lenses replicates the nano-structures found in the eyes of night flying moths
- A better ice pick for mountain climbers designed after the woodpecker.
- Glow sticks made with light-up chemicals, just like fireflies
- Very efficient pumps and exhaust fans applying the spiraling geometric pattern found in nautilus sea shells, galaxies and whirlpools
- Hook and loop material (Velcro©) inspired by cocklebur plants
- A wind-driven planetary rover design that maximize drag, learned from the tumbleweed
- Self-cleaning exterior paint, tiles, window glass and umbrella fabric inspired by the slick leaves of the lotus flower plant and its natural ability to wash away dirt particles in the rain
- Reduced-drag propeller designs inspired by the spiral shape of kelp, which moves with the current rather than fight it, so much less energy is required to move water or a ship

Ideas found in lesson at: http://teachers.egfi-k12.org/design-from-nature/

BIOMIMICRY LESSON GROUP PLANNING SHEET

Group members:_____

_____

Chosen vertebrate class:_____

GATHER INFORMATION

Before brainstorming ideas, research at least 3 animals from your animal class and record information about their homes. Try to find at least 4 important features about each animal home so that you have plenty of information when it is time to brainstorm.

Animal	Type of Home or Shelter	Important Features

BIOMIMICRY LESSON GROUP PLANNING SHEET

BRAINSTORM IDEAS

After your group has enough information, brainstorm together following these rules:

- Only positive comments
- Encourage wild ideas
- Write down all ideas
- Build on the ideas of others
- Stay focused on the topic

Record your ideas here:

_____

_____

_____

_____

_____

CHOOSE A DESIGN

After discussing all the ideas, choose the design that is the most promising and can be made with the materials at hand. If the group wants to choose an idea that needs a material that is not available, you can ask your teacher to see if the material might be made available. Write a description of your design here:

_____

_____

_____

_____

SKETCH DESIGN

On a separate piece of paper, draw a sketch of your idea. Include the dimensions of the actual size the building would be as well as the scaled sizes that you will need to build your model.

MATERIALS NEEDED

List all the materials you will need to complete your building model.

_____

_____

_____

_____

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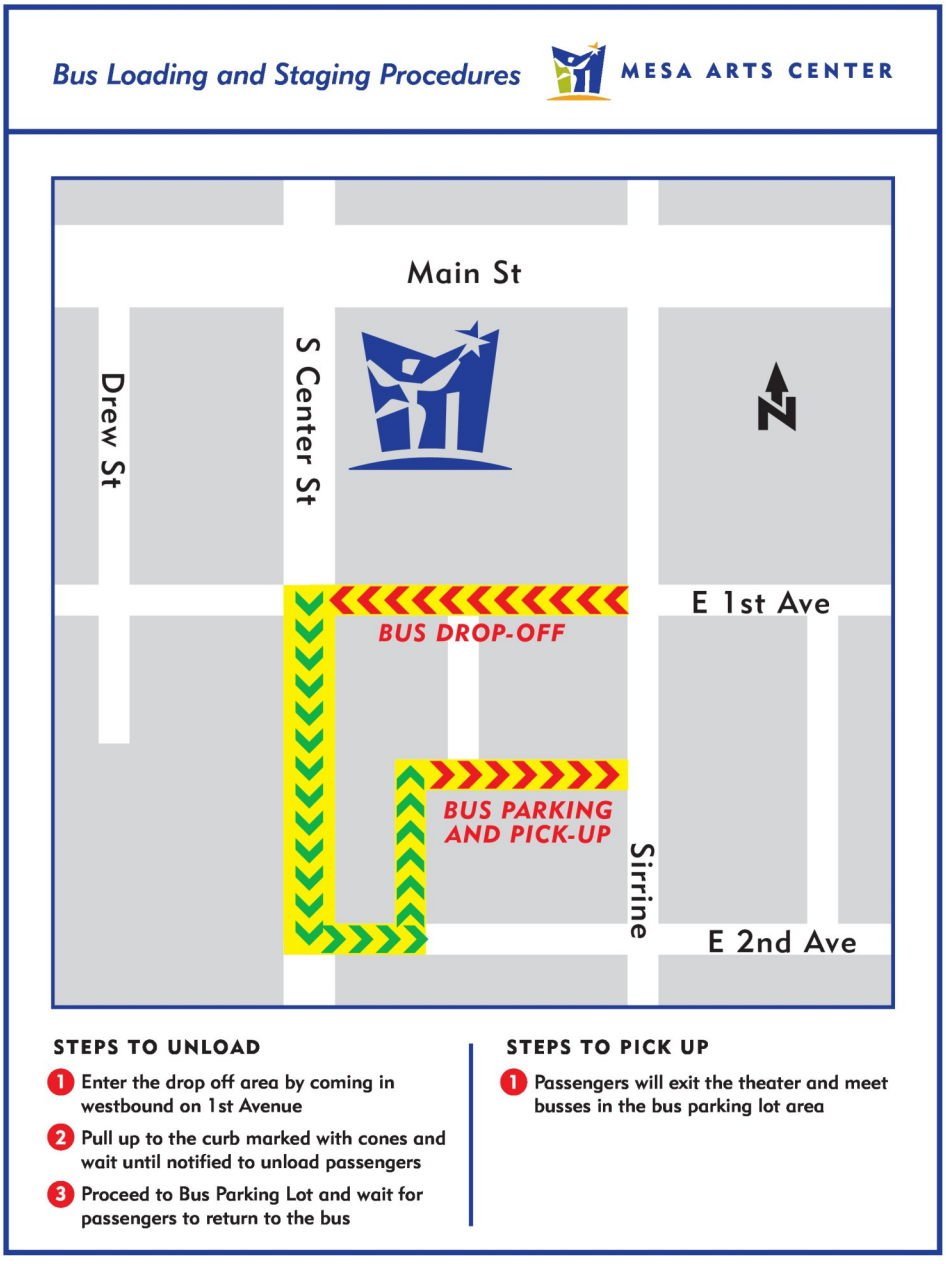
MESA ARTS CENTER MAP



PLEASE NOTE - We ask that buses arrive approximately 30 minutes before the performance begins to allow ample time to unload and seat students.

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THANK YOU!

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