

University of Nebraska - Lincoln

DigitalCommons@University of Nebraska - Lincoln

SciComm 2016 - Lincoln, Nebraska, September
23-24, 2016

SciComm - Effective Science Communication


9-24-2016

Eight-Legged Encounters: Using Organismal Biology to Bring Science Education to Families & Communities

Eileen A. Hebets

University of Nebraska-Lincoln, ehebets2@unl.edu

Follow this and additional works at: <http://digitalcommons.unl.edu/scicomm2016>

 Part of the [Life Sciences Commons](#), [Medicine and Health Sciences Commons](#), [Other Communication Commons](#), and the [Science and Technology Studies Commons](#)

Hebets, Eileen A., "Eight-Legged Encounters: Using Organismal Biology to Bring Science Education to Families & Communities" (2016). *SciComm 2016 - Lincoln, Nebraska, September 23-24, 2016*. 16.

<http://digitalcommons.unl.edu/scicomm2016/16>

This Article is brought to you for free and open access by the SciComm - Effective Science Communication at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in SciComm 2016 - Lincoln, Nebraska, September 23-24, 2016 by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.



Eight-Legged Encounters: Using Organismal Biology to Bring Science Education to Families & Communities

Eileen A. Hebets
University of Nebraska





ARACHNID???



A. H. Harris

Mini

PATH OF PREDATORS

A JOURNEY THROUGH THE LIVING ARACHNIDS

by Dr. Eileen A. Hebets, School of Biological Sciences,
University of Nebraska-Lincoln

Illustrations by Pawl Tisdale

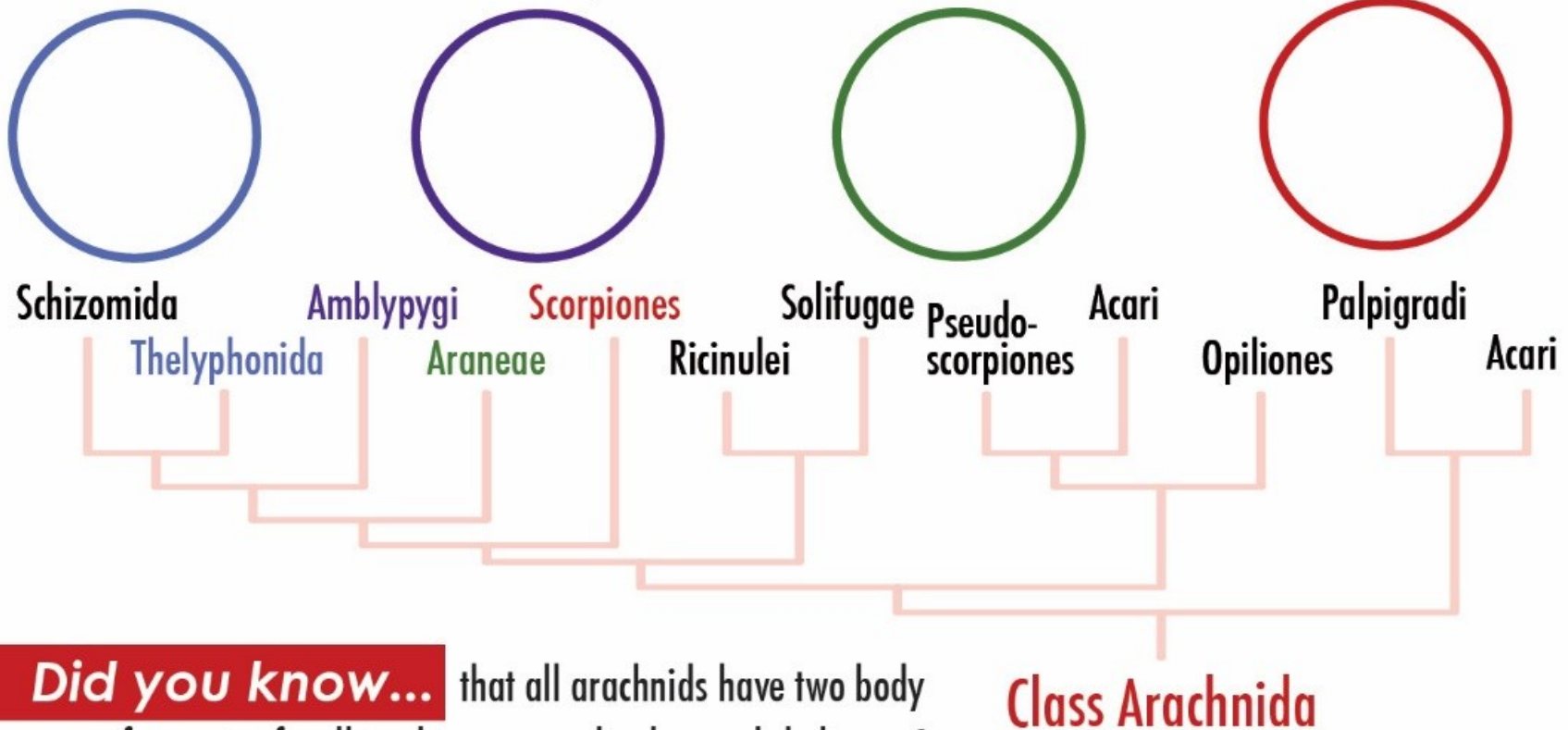
Funded in part by the National Science Foundation; the College of Arts and Sciences, UNL; and the Office of Research and Economic Development, UNL

Did you know...

that there are eleven major groups of living arachnids?
(i.e. eleven Orders in the Class Arachnida)!

Discover the wonderful world of arachnids with us!

Find four arachnid stations. Get a **STAMP** in every space after you visit each of the four stations and complete the associated activities.



Did you know...

that all arachnids have two body parts, four pair of walking legs, two pedipalps, and chelicerae?
(don't know what those words mean? LOOK THEM UP!)

AMBLYPYGIDS



LOOK

at the incredibly long 1st pair of legs on these arachnids (called antenniform legs).

DID YOU KNOW... that amblypygids can taste, touch, feel, smell, and listen with their antenniform legs?

PRETEND

you are an amblypygid and **REACH** your hand into an opening to see if you can **IDENTIFY** your prey by touch alone.

OBSERVE

the behavior of amblypygids interacting.

GRAB

a "leg" and face off against an opponent to see if you can win

Did you know... that amblypygids use long, thin hairs on their walking legs to detect the movement of air particles made by their opponent's leg waving



AT HOME- Grab a notebook and pencil and find a cozy spot outdoors. Sit down and close your eyes. Use your senses other than vision to explore the world around you. Describe what you hear, smell, taste, and touch - write it down. Do this at three different times of day. How does it change?

NINE

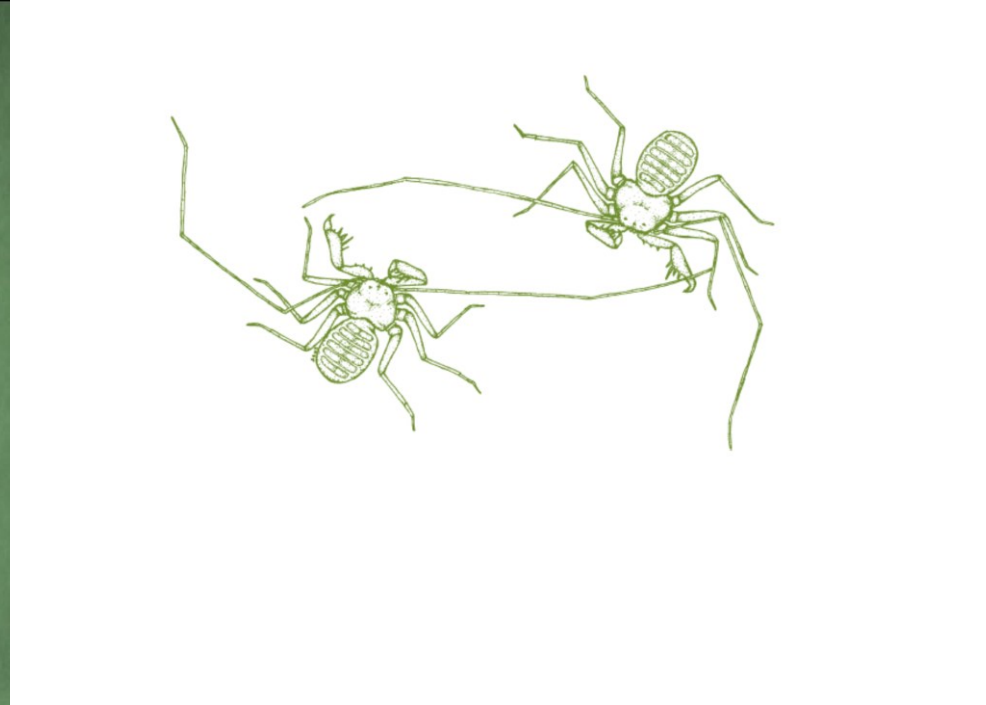
audience volunteers

GRAB

a “leg” and face off against an opponent to see if you can win the fight.

Did you know... that amblypygids use long, thin hairs on their walking legs (called trichobothria) to detect the movement of air particles made by their opponent’s leg waving?

AT HOME– Grab a notebook and pencil and find a cozy spot outdoors. Sit down and close your eyes. Use your senses other than vision to explore the world around you. Describe what you hear, smell, taste, and touch – write it down. Do this at three different times of day. How does it change?



How are they
communicating?



ORDER ARANEAE (SPIDERS)

NOTICE

all of the different ways that spiders use silk.

DID YOU KNOW... that spiders have more than seven different types of silk glands? A single spider web can be made of more than four types of silk or glue, each with distinct properties.

LOOK

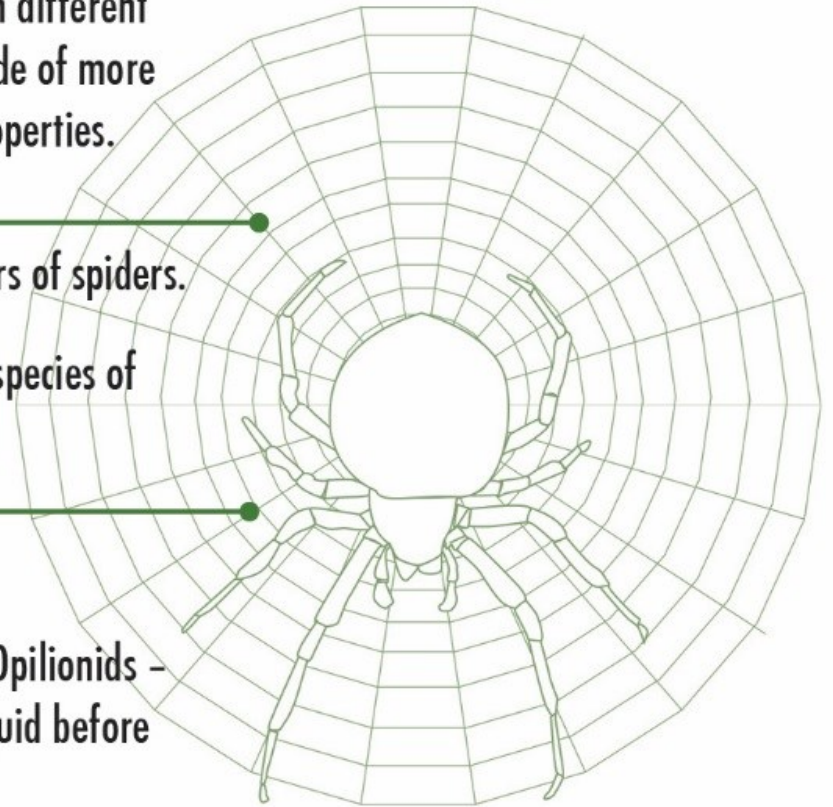
at the different shapes, sizes, and colors of spiders.

DID YOU KNOW... that there are more than 45,000 species of spider in the world?

EAT

like a spider!

DID YOU KNOW... that nearly all arachnids (except Opilionids – common name harvestmen) turn their prey into liquid before sucking it up in their mouths?



AT HOME – Take a walk outside and find three spider webs that have different shapes. Why do you think the webs are shaped differently? Can you find the spiders who live in the webs? Do the spiders differ in size, shape or color? How?

ARANEAE



Do It

1. Get a small container (bowl or cup) and place your prey item next to it on the table.
2. Use your chelicerae to capture your prey by picking it up and placing it in the container. (don't use your fingers!)
3. Secrete your digestive enzyme on your prey - pour a little bit of your enzyme in your bowl/cup.
4. Use your chelicerae to crush up the prey item until it is liquid.
5. Use your sucking stomach to suck up your liquefied food!

Adapted by Eileen A. Heberts from a UNL Arachnology Class project by Alissa Anderson, Mary Foshee, and Allison John (2012)





TURN ON

a UV light (black light) and observe how scorpions fluoresce.

ORDER SCORPIONES

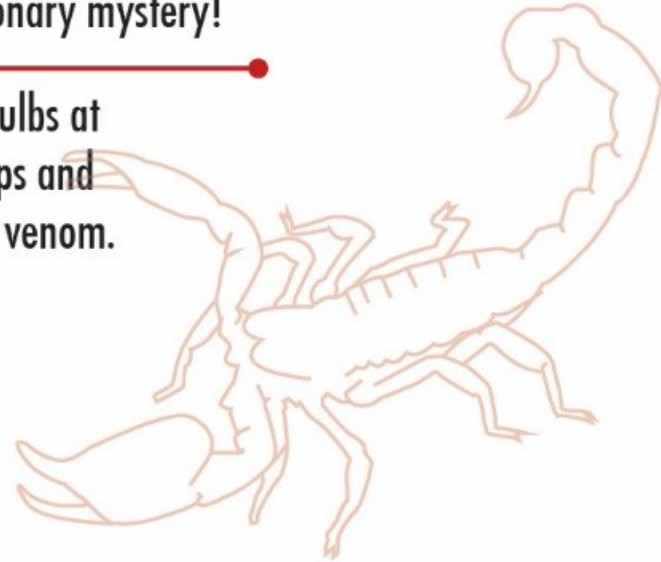
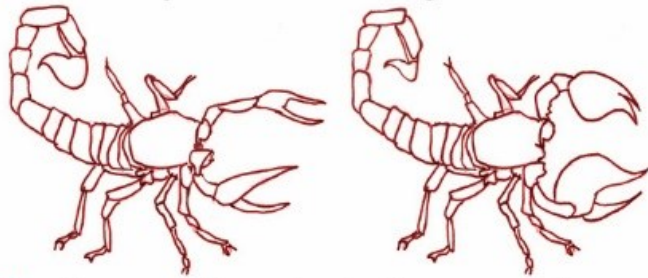
DID YOU KNOW... that the cuticle of all scorpions fluoresces and scientists still are not sure why? Maybe YOU can be the scientist to figure out this evolutionary mystery!

NOTICE

that some scorpions have BIG pedipalps and small bulbs at the end of their tail while others have small pedipalps and BIG bulbs at the end of their tails. The bulbs contain venom.

PREDICT

which scorpion is more dangerous.



DID YOU KNOW... that scorpions don't always use the venom in their tail to capture prey?

PUT ON SOME PINNERS (SCORPION PEDIPALPS) AND TRY TO CAPTURE THE PREY!

AT HOME- Search on the computer for research articles or websites about scorpion venom. Components of scorpion venom are being studied as potential treatments for a variety of human diseases and disorders. Can you find out which ones? What are some of the most promising treatments?



TAKE

a squirt bottle from the table and **GRAB** a cotton ball.

ORDER
THELYPHONIDA
(VINEGARROON)

SQUEEZE

the liquid from the bottle onto the cotton ball.

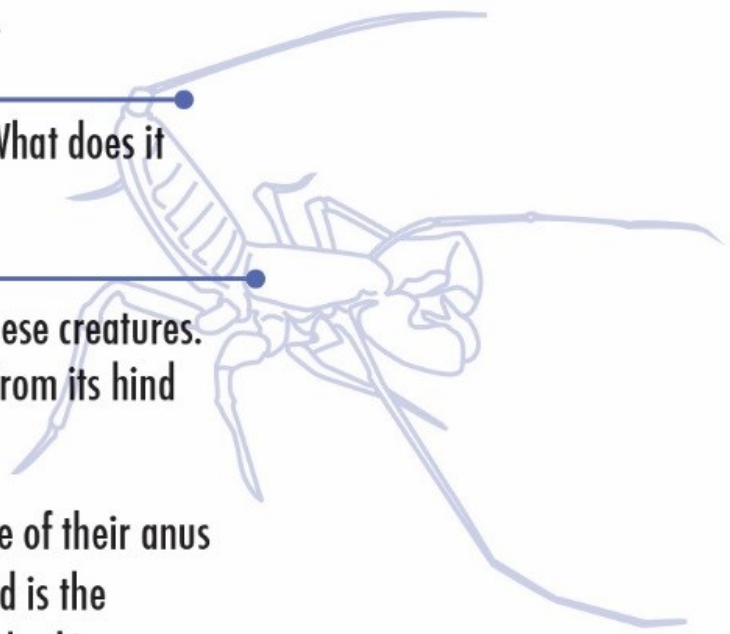
SMELL

the cotton ball. Do you recognize the smell? What does it remind you of?

IMAGINE

that you are a predator about to eat one of these creatures. A stream of vinegar-like liquid is shot at you from its hind end. Would you continue to pursue this prey?

DID YOU KNOW... that vinegaroons have glands on either side of their anus (their back end) that produce defensive chemicals? Acetic acid is the main component and they can spray as far as 80cm (>31 inches)!



AT HOME - Go outside and try to catch five arthropods (insects, arachnids, crustaceans, or centipedes and millipedes). Do any of them have an obvious defense? Are they camouflaged? Are they brightly colored, potentially warning predators off? Do they make a sound or produce a smell when startled?











THE UNIVERSITY OF TEXAS AT AUSTIN
K'NEX BUILD AND LEARN ZONE

THELY HO



EIGHT LEGGED ENCOUNTERS

ARANEAE





EIGHT LEGGED ENCOUNTERS

COME EXPLORE THE WORLD OF ARACHNIDS

**SUNDAY FEB.17
MORRILL HALL 1:30-4:30**

Sunday with a SCIENTIST
University of Nebraska State Museum

Led by Dr. Eileen Hebets from the UNL School of Biological Sciences.

Nebraska
LANDS

Image Credits: Supported by NSF DEB-08-21878; The State of Nebraska; University of Nebraska-Lincoln; The University of Nebraska State Museum; University of Nebraska-Lincoln; The University of Nebraska State Museum; University of Nebraska-Lincoln

PATH OF PREDATORS

A JOURNEY THROUGH THE LIVING ARACHNIDS by EILEEN A. HEBETS



Funded in part by the National Science Foundation

Illustrations by Pawl Tisdale

Grab
a pencil



GO

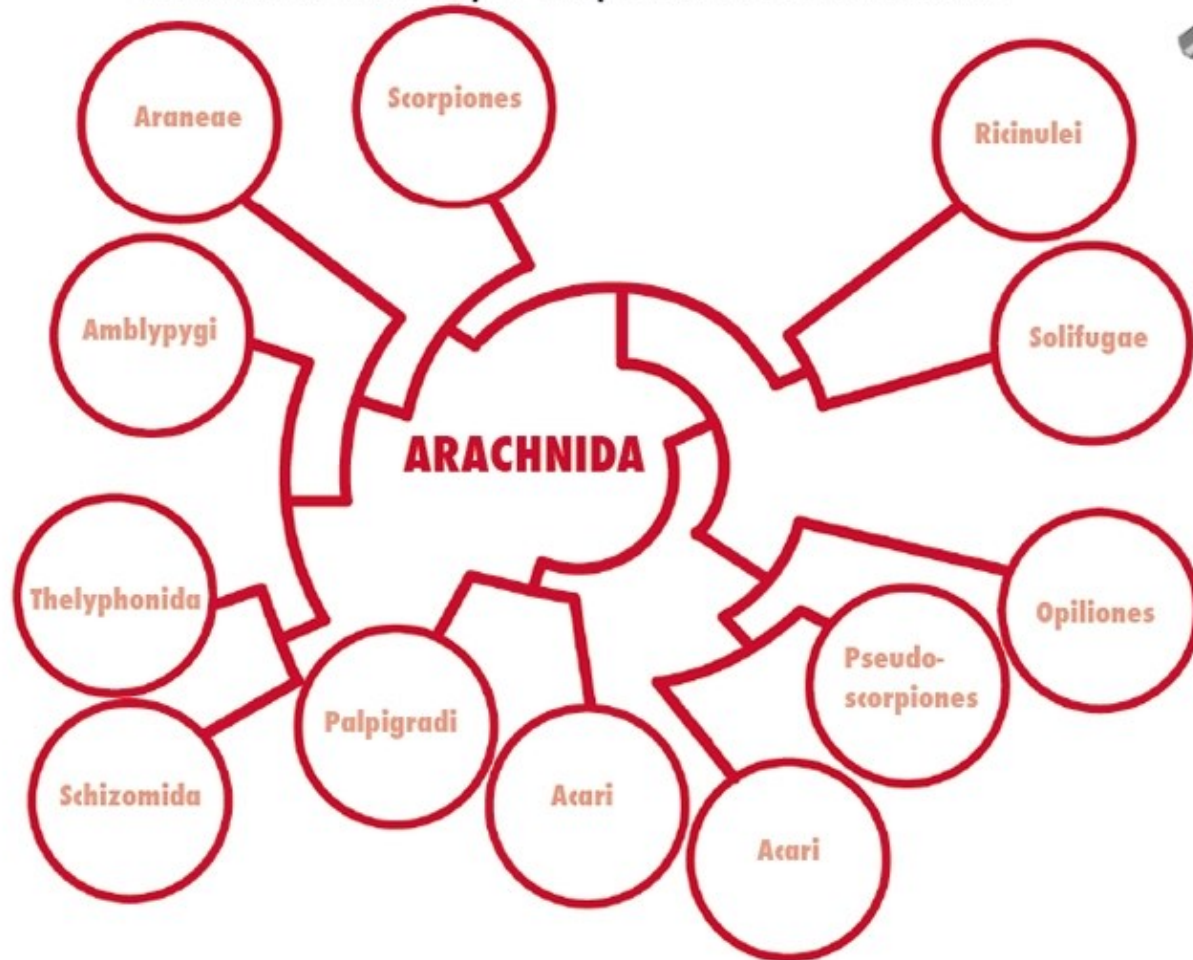
on a journey through
the exhibits

Discover

the wonderful world of
arachnids



Find all eleven stations. Place a stamp in the circle of the arachnid order as you complete the booklet activities.



Scorpiones

- ~ 1,700 species
- 6.3 to 8.3 inches
- Strongest pincers that ends in a "sting" (telson)
- Venom gland in telson
- Respiratory sensory organs on bottom of abdomen
- Raptorial pedipalps

02.17.2013 12:55

Palpigradi

- 85 species
- Less than 1/12 millimeter
- 4 pairs of legs, segment of palps, sensory function
- Attached to legs
- Pedipalps modified for burrowing

02.17.2013 12:55

- 1 to 2.5 inches
- Raptorial pedipalps
- Modified 1st legs (sensory function)
- Flattened 1st legs (sensory function)
- Flattened 1st legs (sensory function)
- Tail (phallus) (sensory function)

02.17.2013 12:55

Acari

- 85,000
- 0.33 to 0.8 inches
- Flattened body parts
- Some species have only 2 or 3 pairs of legs
- Chelicerae and pedipalps adapted for biting, sucking, sewing or sucking

02.17.2013 13:00

Prorhynchida

- 1,200 species
- 0.2 to 0.4 inches
- Raptorial pedipalps
- Six pairs of chelicerae
- Respiratory glands in the pedipalps

02.17.2013 12:55

Ricinulei

- 88 species
- 0.2 to 0.4 inches
- Body wider than long
- Caudal flagella - "tails" that can be raised over head
- 2nd pair of walking legs is elongated

02.17.2013 12:55

OPILIONES

- ~ 6,500 species
- 0.04 to 0.8 inches
- 0.8 to 6 inches

02.17.2013 12:55

Schizomida

- ~ 282 species
- Less than 0.2 to 0.4 inches
- 1st body segment (prothorax) with 2 legs
- No eyes
- Specialized palps, sensory function
- Specialized palps, sensory function

02.17.2013 12:55

Solifugae

- ~ 1100 species
- 0.2 to 6 inches
- Large scissor-like chelicerae
- Leg-like pedipalps that act as sensory structures
- Raptorial organs (Mallocoxi) sensory structures on 4th pair of walking legs

02.17.2013 12:56

Araneae

- ~ 41,200 described species
- 1.0 to 10 inches
- Six pairs of legs
- Two pairs of chelicerae
- Two pairs of eyes

02.17.2013 12:55

Diplopygi

- ~ 160 species
- 0.2 to 1.7 inches (body length)
- Raptorial pedipalps
- Elongate antenniform 1st legs (walk on only 6 legs)
- Flattened body

02.17.2013 12:55

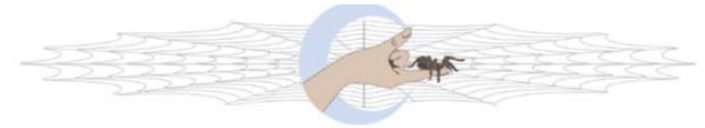
WHAT IS AN ARTHROPOD?



CREATE A CHELICERATE



CREATE A CHELICERATE



IN YOUR ZIPLOCK BAG:



CLAY

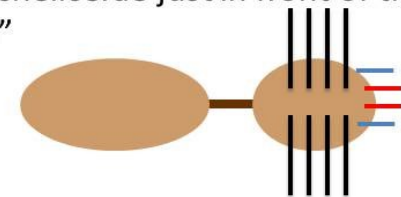


PIPE CLEANERS:
8x black = walking legs
2x red = chelicerae
2x blue = pedipalps



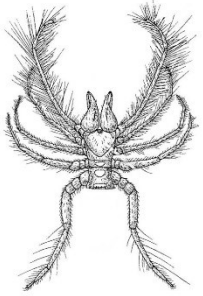
WOODEN STICK

- Separate your clay into 2 pieces.
- Use the wooden stick to connect the 2 pieces (body parts).
- Place 4 legs on each side of the *front* body part.
- Place 2 pedipalps just behind the “mouth”
- Place 2 chelicerae just in front of the “mouth”

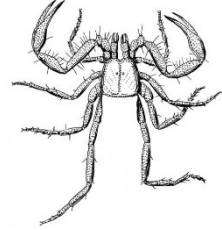




ASSEMBLE AN ARACHNID



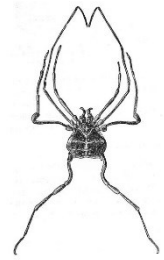
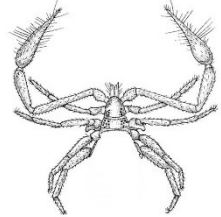
Order Solifugae



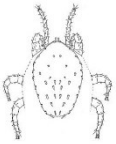
Order Scorpiones



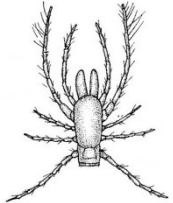
Order Pseudoscorpiones



Order Opiliones



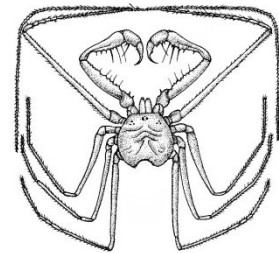
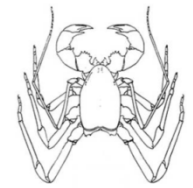
Order Acari



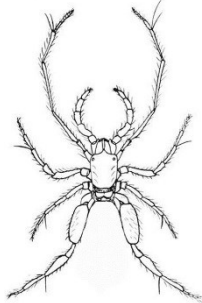
Order Palmaradi



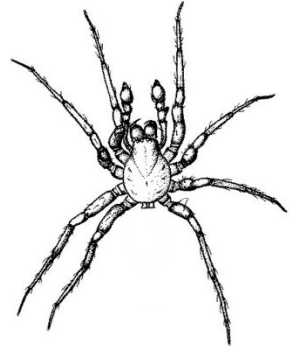
Order Thakubosida



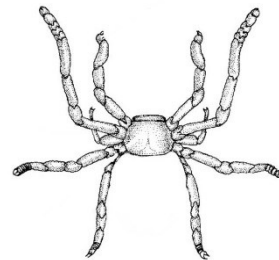
Order Amblypygi



Order Schizomida



Order Araneae



Order Ricinulei



TISSUE PAPER FLOWER



MICROSCOPE MADNESS



02.17.2013 13:52





Male or Female?

Can you determine if your specimens are males or females? Look at these pictures and figure it out!

	
Female pedipalp (look in front of the 1 st pair of legs)	Male pedipalp (specialized for sperm transfer)
	
Female epigynum, (genital opening, on the abdomen)	Male abdomen (with no epigynum)

Crazy structures!

Can you find these structures on the specimen under your microscope?







	
Spinnerets (used to extrude the silk)	Calamistrum (used to pull the silk from the spinnerets)
	
Cheliceral teeth (look in front of the head!)	Venom gland opening (in the chelicerae)



02.17.2013 13:52

What family is this?

Look at the eyes of the spider you have under the microscope. Can you identify its family based on these examples of eye arrangement?

		
Pholcidae Cellar spiders	Araneidae Orb-weaver spiders	Scytodidae Spitting spiders
		
Oxyopidae Lynx spiders	Agelenopsis Funnel-web spiders	Salticidae Jumping spiders

Eight-Legged Encounters Impact

Venue	# Participants	Date
Morrill Hall, Sunday with a Scientist	847	2013

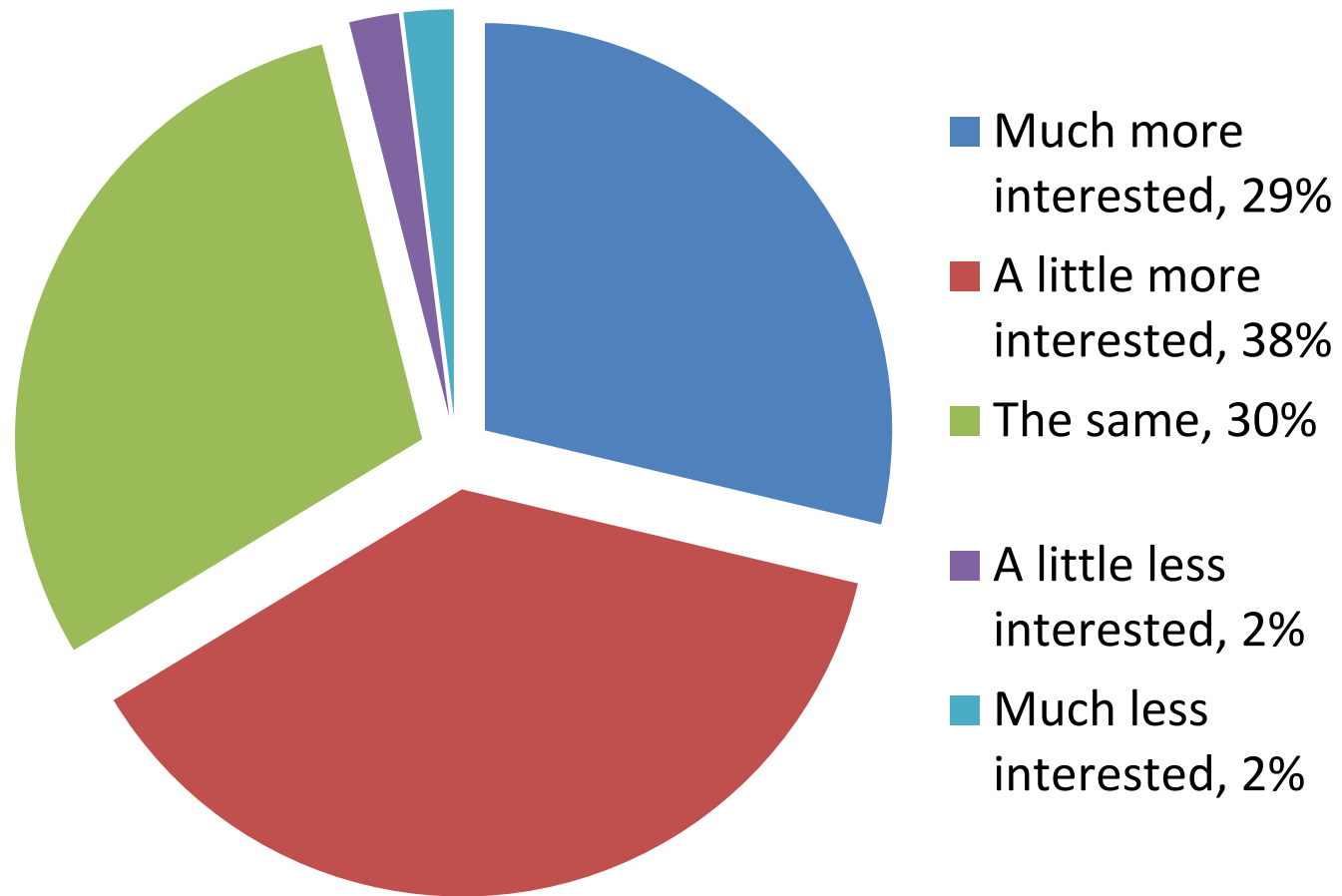


Figure 2. Change in interest in learning about scientific discoveries among adult respondents ($n = 63$).

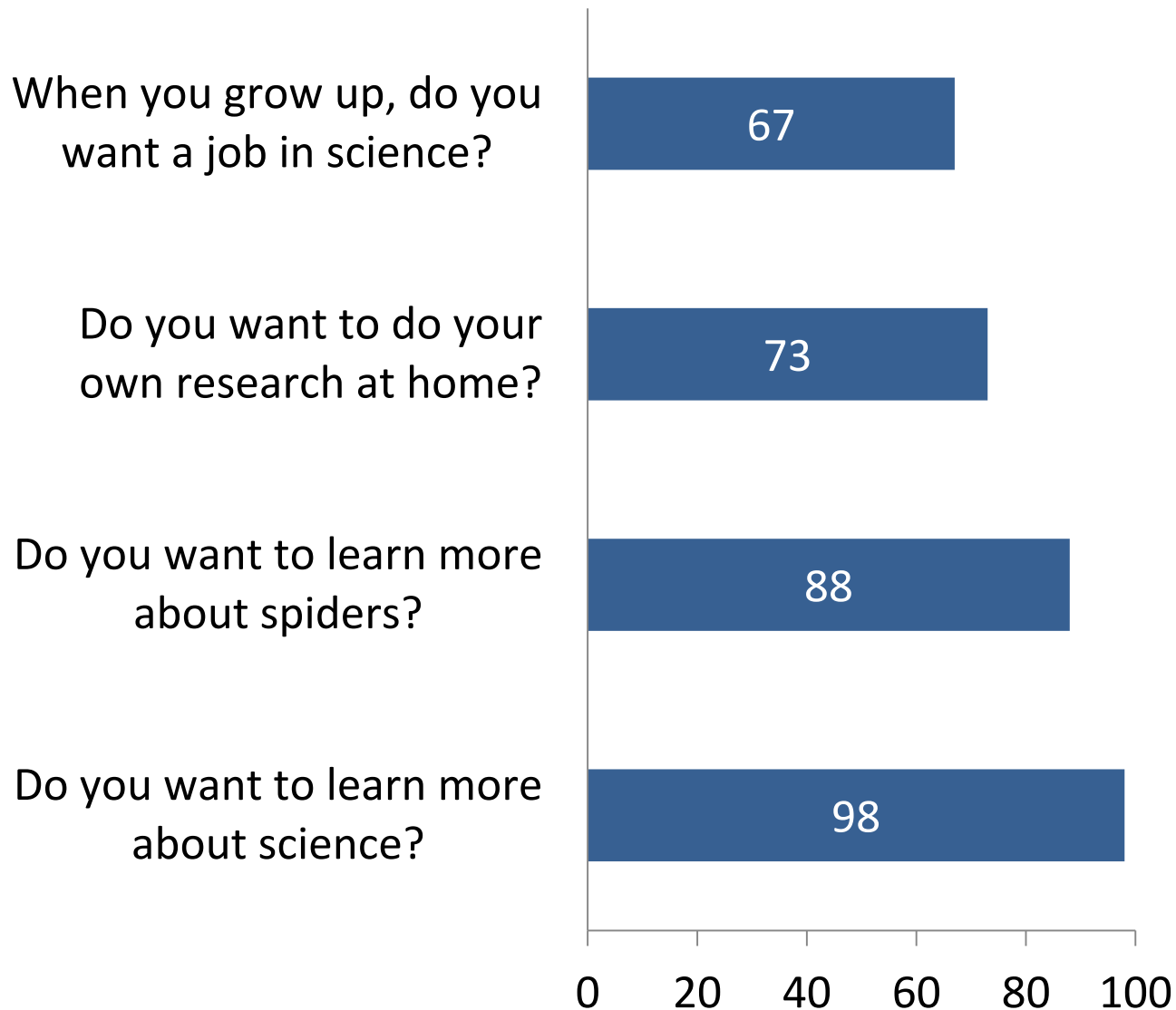
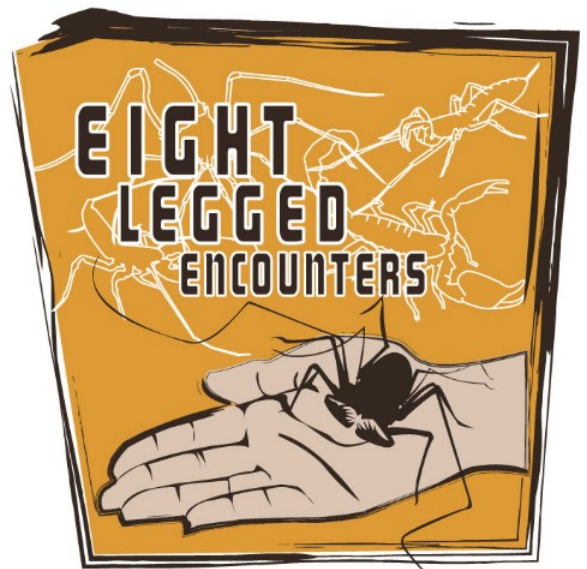


Figure 3. Youth's interest in science activities ($n = 42$). Respondents were 50% female, 50% male and ranged in age from 4 – 14 with a mean of 7.7.

Eight - Legged Encounters

Eight-Legged Encounters and all of its associated resources were developed for you - formal and informal science educators, caregivers, interested youth, arachnophobes, etc. It was developed with the goal of educating the public about the wonders of biology and the possibility of scientific discovery using a charismatic and engaging group of animals - Arachnids.



Our Story

Arachnids (spiders and their relatives) are ubiquitous, thriving in most habitable environments on our planet (including under water). They are tremendously diverse in their form, behavior, sensory systems, and general natural histories; making arachnid ecology and evolution fertile ground for teaching a breadth of Science, Technology, Engineering, and Math (STEM) knowledge content. The diversity of arachnid biology allows us to fluidly integrate concepts and knowledge from fields as disparate as anatomy, physiology, development, animal behavior, predator ecology, biomechanics, biomimetics, and bioinspired technologies (among others) into hands-on educational activities for audiences of all ages.

As a **Scientist, a Mother,** and an **Educator,** I often see the disconnect between youth and the world around them; between problem solving skills, observation skills, critical thinking, natural curiosity and the more traditional formal teaching programs experienced by many students. Youth are innately curious and tremendously creative and my aim is to leverage these traits for their own educational advancements in a fun and engaging manner.

Original Artwork is used throughout Eight-Legged Encounters as a way to draw participants. All artwork and design, including the brainstorming of many hands-on activities, is the result of a fantastic collaboration with an amazing local artist - Pawl Tisdale (<http://www.pawltisdale.com/>)

[Go to the gallery](#)



To Date, We Have Developed More Than 25 Modular Activity Stations Encompassing Arts And Crafts, Experiments, Games, And Other Hands-On Activities. The Activities Can Be Broken Up Into The Following Categories:

Classification And Taxonomy



These activities introduce the arachnids and their relatives. Participants discover the characteristics of the arthropods, create their own chelicerae, and explore the diversity within the arachnids.

[Learn More >](#)

Spiders And Silk



The spiders are an amazingly diverse group. Some of these stations investigate spider's various foraging strategies, including the many ways that spiders use silk. Others give participants a chance to hear spider sounds and watch spider dances. A read-aloud station is designed for younger participants.

[Learn More >](#)

Path Of Predators



The Path of Predators uses live animals to walk you through the 11 extant (living) arachnid orders. It includes an activity booklet that can be downloaded for print in addition to extra activities and games associated with each of the orders.

Hands On Science



These stations allow participants think like scientists with microscopes and real experiments testing how vibrations affect spider foraging success.

Hands On Science

These stations allow participants think like scientists with microscopes and real experiments testing how vibrations affect spider foraging success.



COMMUNITY EXPERIMENT
HANDS ON SCIENCE

This station engages participants in a hand's on spider feeding experiment that examines the influence of seismic



MICROSCOPE MADNESS!
HANDS ON SCIENCE

This station provides the audience an opportunity to take an up-close look at spiders - to examine body parts they



COMMUNITY EXPERIMENT

HOME / HANDS ON SCIENCE / COMMUNITY EXPERIMENT



COMMUNITY EXPERIMENT

Materials

Questions

Background

Procedure

Datasheets

GOAL: The goal of this station is to engage the participants in a hands-on foraging experiment that allows them to:

- Learn how to eye-shine for wolf spiders
- Catch their own spider
- Conduct a portion of an actual experiment
- Enter data into a spreadsheet
- Watch the results real-time
- Think about the evolution of sensory systems and associated communication.

OVERVIEW OF EXPERIMENT: You will need a darkened room with soil-filled plastic tubs scattered throughout. In each tub, place ~30 juvenile wolf spiders (these are very common throughout North America and can be collected easy at night during the warmer months using eye-shines to locate individual spiders). Participants are given a head-lamp, vial (pre-labeled with a green or blue sticker), and clipboard with background information, experimental instructions and data sheet, and a pencil. They are guided into the darkened room and shown how to use eye-shines to find wolf spiders. They are introduced to the fact that spiders, like many nocturnal mammals, have a retina (a light reflecting layer) that aids in night vision. Each participant will use their vial to collect their own spider.

Upon exiting the darkened room with their spider, participants will be guided to their



Download Activity as a PDF

RESULTS!

Use the links below to see the results of previous community experiments.

February 2013

September 2013

THANK YOU

Volunteers

Hebets Lab

UNL Biology Club

SBS Graduate Students

Arachnology Students

Prairie Hill Learning Center

Denver University Biology Club

CU Boulder Grad Students

UNL Faculty (Jeff Stevens, Rick Bevins, Alex Basolo, etc.)



Artist: Pawl Tisdale

Collaborators

CLCs (Kathie Phillips)

NET (Melanie Eirich)

Morrill Hall (Kathy French, Judy Diamond)

Mindy Anderson-Knott

Butterfly Pavilion

Denver Museum of Nature & Science (Paula Cushing)



Funding

NSF

UNL ORED

UNL CAS

UNL SBS



Cody & Jessie Storz

HEBETS LAB

HOME RESEARCH PUBLICATIONS PEOPLE PHOTOS & VIDEOS OUTREACH CONTACT US

The Hebets Lab

Where Arachnids Inspire D.R.E.A.M.S.

Learn More

