THE SKELETAL SYSTEM

A FACILITATOR'S GUIDE

Add strings and you have a model hand!

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The hands-on activity to go with the write up below is one of the activities from the ***Let's Talk Science Bone Zone kit*** *developed by the National Office of Let's Talk Science.*

Thank you for volunteering for Let's Talk Science! The following manual will help guide you through the workshop. Please read this manual before visiting the group you are working with.

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Important Notes

Introduction & Guidelines

- This manual is meant as a guide to help you prepare for your activity. The introduction includes questions that get at the curriculum link/science concept the workshop covers. You are not expected to memorize this manual. It is a guide and we want you to bring your own experiences and your style of teaching into it.

- As a general guideline, do not speak longer than the age of the students at one time.

- Most workshops fit well in a 1-hour time period but some like bridge building or some high school activities are a little longer.

- Practice your introduction and test out the activities beforehand so you can anticipate sections that may take more time or may be difficult for students.

- If you are working with a partner, work out roles and responsibilities before the visit.

Safety

As a Let's Talk Science volunteer, safety must be foremost in our minds during all activities. As STEM role models, volunteers must always also model safe science practices.

Always keep in mind the following precautions:

- Emphasize and demonstrate appropriate safety procedures throughout the presentation.
- Be professional but have fun.
- Keep workspaces clean to avoid tripping hazards.
- Allergens should have been checked before reserving the kit (e.g. allergies to latex).
- **Activity Specific Safety:** n/a

WHMIS

An overview of Canada's Workplace Hazardous Materials Information System (WHMIS) is included in these materials at the end of this manual where needed. No WHMIS sheets are included with this activity.

Overview of the Workshop

Grade Level and Curriculum Learning

Grade 5: *Organs systems are components of a larger system (the body) and as such, work together and affect one another to meet our basic needs. The choices we make affect our organ systems and in turn, our overall health*.

Materials if we are delivering materials to the school/community group

14 1-1.5 cm paper or plastic straw (for phalanges) (each student)
5 pieces of paper pr plastic straws 1/3 of a straw long (for metacarpals) (5 each student)
1 tape per student (unless the class has tape)
5 pieces of string of any colour 8 inches long each (per student)
sample of the model hand that is already prepared
Hand templates on cardstock (1 per student)
PowerPoint with photos

Materials if we NOT delivering materials to the school/community group

14 1-1.5 cm paper or plastic straw (for phalanges) (these could also be made by rolling paper but it will be trickier to feed the string through)
5 pieces of paper straws 1/3 of a straw long (for metacarpals) (these could also be made by rolling paper but it will be trickier to feed the string through)
5 pieces of string, twine, yard about 8 inches each
Piece of paper – cardstock is good but any paper will work
PowerPoint with photos

Timing of the Workshop

	Approx. Time (min)	Description
Introduction	5-7 minutes	Introduce yourself, find out what they already know, add in bits to fit with the curriculum learning
Activity 1	45-50	Building a Model Skeletal Hand
Wrap up	5 minutes	Discussion on their findings

Activity

Note: *The **questions** you might ask are in **bolded blue font**. Some things you might say are in blue font and the possible answers are in square brackets in black font. Actions are in purple font.*

Keep your introduction short. If you don't get through everything, it is okay. Pick the parts that are most relevant to the activity. You can bring in more of the learning in the wrap up (or maybe even as they are taping) if there is time. This activity will take a little longer then when we have volunteers in the classroom helping so keep the intro to 5 minutes if you can. The purpose of the skeletal system and how it links to the other systems are important curriculum learning so include those but things like the hinges and some other points could be reduced or removed if it is taking too long and the

students are restless. Practice your introduction to see how long it takes and then revise if needed.

Introduction

Hi everyone! We are Let's Talk Science volunteers. We come to schools and do hands-on activities. I study [simple terms] _____ at the University of Ottawa/Carleton University. I decided to study _____ because [when I was your age I loved… I think it's important to… I'm curious about…].

We're/I'm here today to talk about our skeletal system and make a model hand.
Ask the teacher if she/he can pick students to answer questions as you ask them. Also, you might not be able to hear the answers so the teacher might have to repeat the answers. If you cannot see the students because the camera doesn't extend to where they can see you on a screen, you'll have to rely on the teacher to know if the students are ready for the next step.

What is the skeletal system is made up of? [bones]

Use slide 1 as you would like throughout the introduction.

Does anyone know what our bones are made up of? [30% is living tissue, 45% is mineral deposits – mostly calcium (in the form of calcium phosphate); 25% of bone is water]

Our bodies cannot make calcium. It comes from our digestive system through the foods we eat. We must be sure to eat enough calcium each day to have healthy bones. Calcium also is absorbed (taken up like a sponge) better when we have Vitamin D in our bodies.

Does anyone know what foods are high in calcium? [milk, cheese, ice cream, spinach, salmon, tofu, yoghurt, etc.]

What do our bones do for our bodies? [various answers but run through some or all of what is below quickly)

1) **support and balance** – without bones we'd just be a pile of mush; our spine with the 26 vertebra helps give our body balance. Many animals have a straight spine because they can use their 4 legs to balance.
2) **protect our organs – what bones protect our organs and what organs do they protect?** [let the students answer: ribs protect heart (circulatory system) and lungs (respiratory system), skull protects your brain (nervous system) and backbone or spine protects the spinal cord (nervous system) and liver (partly our digestive system)
3) **movement** – bones provide structures for muscles to attach through tendons so we can move
4) **calcium storage** - bones are living and have their own blood vessels and nerves and they have a function – one of these is to store calcium - calcium is needed by our muscular system, nervous system, circulatory system and skeletal system.

What else in our body helps our body to move and are found where two bones come together? [joints]

Action: Have everyone move their body (while sitting) to see if they can identify different types of joints. Use the notes below to help guide the discussion but keep it short – just go through a couple like the hinge and ball and socket.

Guiding Notes:
Types of Joints

- ***Hinge:*** *allows back and forth movement to a certain spot like our knee, elbow, ankle – just like the hinge on a door*

- ***Ball and Socket Joint****: shoulder and hip (ball and a cup like). Shoulder joint is the most flexible in our bodies*
- ***Gliding Joints****: – two flat bones to slide over one another – bones in our wrists and feet*
- ***Condyloid Joint:*** *– head to nod 'yes' and fingers to bend*
- ***Pivot Joint:*** *allows us to move our head from side to side in a 'no' fashion*
- ***Saddle Joint:*** *allows the thumb to touch every finger*
- ***Sutures Joint:*** *in our skull – no movement*

Some people say they are double jointed because their joints move further than most. This is because the ligaments that run over their joints can stretch further than most people's.

Today, we are going to build a model of our hand, bones, ligaments, and tendons.

How many bones do we have in our body? [206 as adults, more than 300 as babies but some of them fuse together e.g. the soft spot in our skull that we have when we are born]

Of the 206 bones in your body, about half of them are in your hands and feet.

There are 26 bones in your feet (including your ankles) and 27 in your hands including your wrists. **How many bones do we have in one hand not including our wrists?** – count them using your own hand! [19 – 3 in each finger, 2 in the thumb, and 5 in the 'palm' of your hand].

What joins our bones together (aka, bones to other bones)? [ligaments – fibrous bands (like strong elastics) or sheets that hold our bones together]

What joins bone to muscle? [tendons – tough band of fibrous connective tissue]

Where are the muscles that help our fingers move? [forearms]

Have the students put one hand on their forearm and move their fingers so they can feel the muscles move as their fingers move.

Does anyone know what the bones in our fingers are called? [phalanges – pronounced "falanjeez" with a soft 'a' sound and long e sound]

Slide 2

What are the bones in our hands (where the palm of our hand is) called? [metacarpals— and the ones in our wrist which aren't in our model are called carpals]

For our model, we'll use short straws to represent phalanges and the longer straws for metacarpals. Don't call them straws anymore for the rest of the class – call them phalanges and metacarpals.

What do the strings represent in our model? [tendons and ligaments]

Where are the tendons? [from the metacarpals to the ends – where they would normally join to muscles]

Where are the ligaments? [connecting between phalanges with phalanges, as well as connecting between phalanges and metacarpals]

For the rest of the class don't call strings, strings; they are tendons and ligaments.

Model Hand

Have the teacher distribute a hand template and tape and have the students get out scissors and cut out the hand. If you are doing this with a group of students we didn't drop materials off to, have them trace their hand on a piece of paper and then cut it out. If their hands are small they could make it a little bigger than their own hand.

Have the teacher distribute metacarpals and phalanges or have a central place for students to come and pick up enough of each (if allowed). If you are doing this with a group of students we didn't drop materials off to, have them cut their straw pieces. They need 14 short pieces and 5 longer pieces.

Show the students how to tape each phalange and metacarpal being careful to keep the phalanges in the finger areas. They tape 3 phalanges to each finger and two in the thumb. The metacarpals are taped under each finger/thumb in the palm part of the paper hand.

While they are putting the bones on, have the teacher distribute the strings – 5 to each student. If you are doing this with a group of students we didn't drop materials off to, wait til they are done putting their bones on and then have them cut the string into 5 pieces if they haven't already cut their strings.

Show students how to put a knot in the string or tape it down to the end of the finger and then show them how to thread it through. This is the most difficult part of this activity. It does take some time and the teacher might have to help. If their string is fraying, they can cut a little off the end.

Give them a minute to try our their model hand.

Have them put their own hand flat on their desk and bend their middle finger inwards, leaving their wrist and fingers on the desk. Ask them to try to lift each finger, one at a time, without lifting the others off the desk. Almost all or maybe all of them won't be able to lift their ring finger without lifting other fingers off the desk.

Why do you think this would be? Hint, it has to do with tendons…[there is an inter-tendon connection between their ring finger and middle finger that inhibits the ring finger lifting when the middle finger is immobile and bent in the position it was when they were trying to lift their fingers without lifting the other fingers]

Wrap-Up

What is the purpose of the skeletal system again? What are the bones in your fingers called? In the palm of your hand?

If you have extra time, you can ask if they have any questions about university or being a student or about your research.

Thank you for having us in your class today.

Additional Information

Background Information n/a

WHMIS Sheets n/a