



Teachers in Residence

The Musculoskeletal System

Primary Level Lesson Plan



Centre for Research in Medical Devices

“Breaking Barriers”

THE PHILOSOPHY BEHIND OUR LESSON PLANS

Teachers participating in CÚRAM’s Teachers in Residence programme have developed a ‘learning module’ on MedTech in Ireland that links with multiple streams and themes in the primary and junior cycle curricula. The primary and secondary lesson plans were created **by teachers for teachers** and are accessible online to use in classrooms all over the world.

During their residencies, teachers developed the contents of the lesson plans by working directly with CÚRAM researchers, while learning about the medical device research being carried out at CÚRAM. Primary teachers were paired with secondary teachers to create plans covering five major themes: biomaterials, heart, brain, musculoskeletal system and stem cells. The partnership between the primary and secondary teachers ensured that the materials created follow a natural progression from one age group to the next.

The lesson plans were further designed and formatted by a Visual Artist who used various teaching methodologies to suit the multiple intelligences and range of learning styles and abilities present in classrooms. By using a range of teaching approaches we hope to engage all children at all levels whatever their natural talents or interests may be.

We hope that you and your students find these resources an enjoyable way to learn about our research centre and the MedTech industry!

Sincerely,

Dr. Sarah Gundy

Programme Manager-Teachers in Residence

Medical Devices & the Musculoskeletal System

Introduction Lesson

Primary School Curriculum Links

Strand:

Environmental Awareness and Care

Strand Unit:

Science and the Environment

Content Objectives:

- Appreciate the application of science and technology in familiar contexts.
- Examine some ways that science and technology have contributed positively to the use of the Earth's resources.
- Recognise the contribution of scientists to society.

Strand:

Living Things

Strand unit:

Human Life

Content Objectives:

- Develop a simple understanding of the structure of some of the body's major internal and external organs.
- Explore and investigate how people move, i.e. body supported by a skeleton actions of muscles, bones and joints.
- Recognise that physical growth has taken place since birth.

Learning Outcomes

Children should be enabled to:

1. Identify the main parts of the human skeleton and state the main functions of the musculoskeletal system.
2. Describe the general structure and action of muscles (working in opposition).
3. State the function of tendons and the relationship between these and bones.
4. Outline some of the problems arising in the musculoskeletal system and describe possible methods of treatment.
5. Appreciate what a medical device is.
6. Describe what a biomaterial is.
7. Construct a paper model of the human hand.
8. Problem-solve ways of how to fix a tendon that has been cut in the hand.
9. Demonstrate the relationships between bones, tendons and muscles by use of model.
10. Appreciate that the suitability of biomaterials are based on the properties of the biomaterials and their ability to match the original tissue.

Keywords & Definitions

	Keyword	Definition
1.	Bones	Make up the skeleton and provide support and protection to the body.
2.	Muscles	Tissues that contract to make the body move.
3.	Tendons	Connect muscle to bone.
4.	Contraction	Shortening of a muscle.
5.	Lengthening	Relaxing of a muscle.
6.	Medical Device	Used to diagnose, prevent, monitor and treat the effects of illness.
7.	Biomaterials	Material that can be engineered to assist the body to repair itself.
8.	Biomedical Engineering	The combination of engineering and medicine to help improve people's health.

Learning Activities

Children will:

- Complete The K and W parts of the KWL Chart.
- Engage in talk and discussion on the musculoskeletal system.
- Participate in group activities to construct their own model hand (see PowerPoint and hand out).
- Present their work to the class.

- Engage in talk and discussion on biomaterials and medical devices.
- Evaluate their work.
- Fill in the L Part of the KWL Chart.

Extra Info / Files

	Web Address	Brief Description
1.	www.youtube.com/watch?v=94Q-fvCAJzQ	Muscle Basics: What Athletes Need to Know About the Muscular System
2.	www.youtube.com/watch?v=0vLiPT_Otw	Bone Basics: How They Heal and How to Keep them Healthy
3.	www.youtube.com/watch?v=hdes6W76OOw	The Basic Science of Tendons and Tendinitis
4.	www.sheppardsoftware.com/health/anatomy/skeleton/Skeleton_game_2.htm	Game about the bones and their positions in the body
5.	theinteractivehand.worldsecuresystems.com/	Website exploring the hand including tendons and bones.
6.	www.innerbody.com/image/skel13.html	2D and 3D views of the hand

Resources

- Teacher Lesson Plan
- PowerPoint to guide lesson
- Interactive KWL
- Evaluation sheet
- One set of materials for each group constructing a medical device:
 - Hand template printed out on thick card paper
 - String
 - Straws (large)
 - Tape
 - Glue
 - Ribbon
 - Lollipop stick
 - Elastic band

Methodologies

- Talk and discussion
- Active learning
- Guided and discovery learning
- Collaborative learning
- Free exploration of materials
- Investigative approach

Assessment

- Self-assessment – evaluation sheet
- Teacher observation – construction of medical devices
- Teacher questioning – KWL, talk and discussion

Linkage and Integration

- **Maths** – problem solving
- **STEM** – I.T. / Engineering
- **Art** – construction
- **S.P.H.E.** – working together co-operatively
- **English** – oral language through talk and discussion and presenting their work

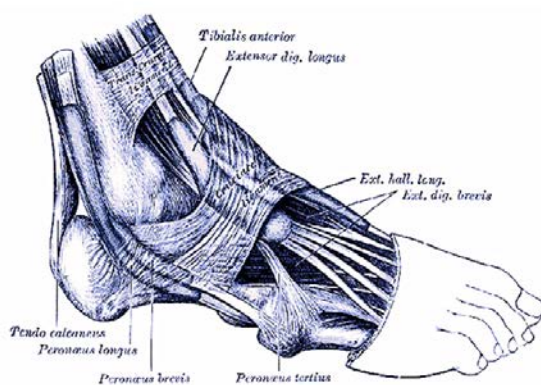
Differentiation by:

- Teaching style
- Support
- Task

Power Point Presentation – The Musculoskeletal System

Introducing the MUSCULOSKELETAL system

Slide 1



cúrom
Centre for Research in Medical Devices

Teachers in Residence Programme
Andrew Fogarty and Clive Monahan

Slide 2

Class discussion around the Musculoskeletal System

Why do you require a skeleton?

What is it made from?

Is it living tissue?

Can you name bones?

How does the skeleton allow for movement?

Explain the functions of muscles?

What are tendons?

What can go wrong with the musculoskeletal system?

K-W-L Chart

Topic:

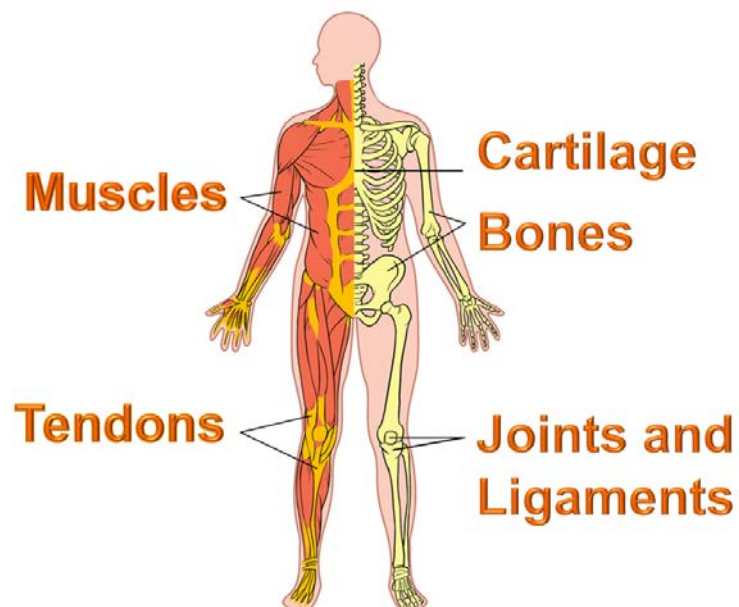
What I Know

What I Want to Know

What I Learned

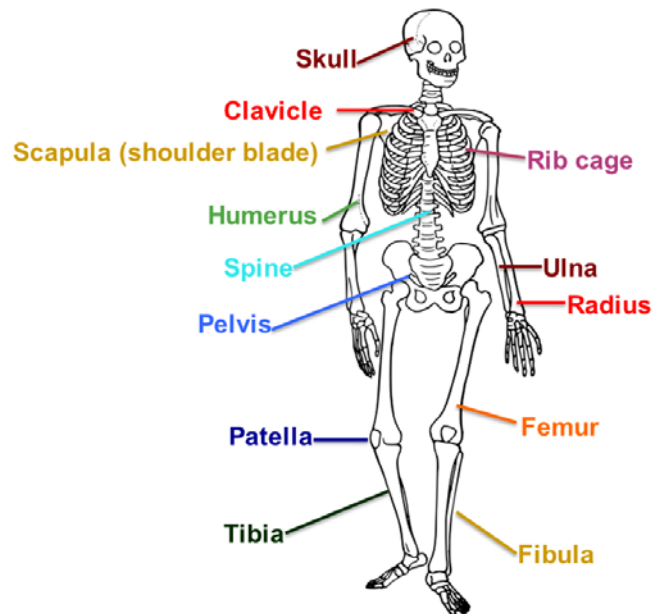
Slide 3

Musculoskeletal System



Slide 4

Bones-Human Skeleton



Slide 5

How many bones do you have?

You have:

300 bones at birth

206 bones by adulthood

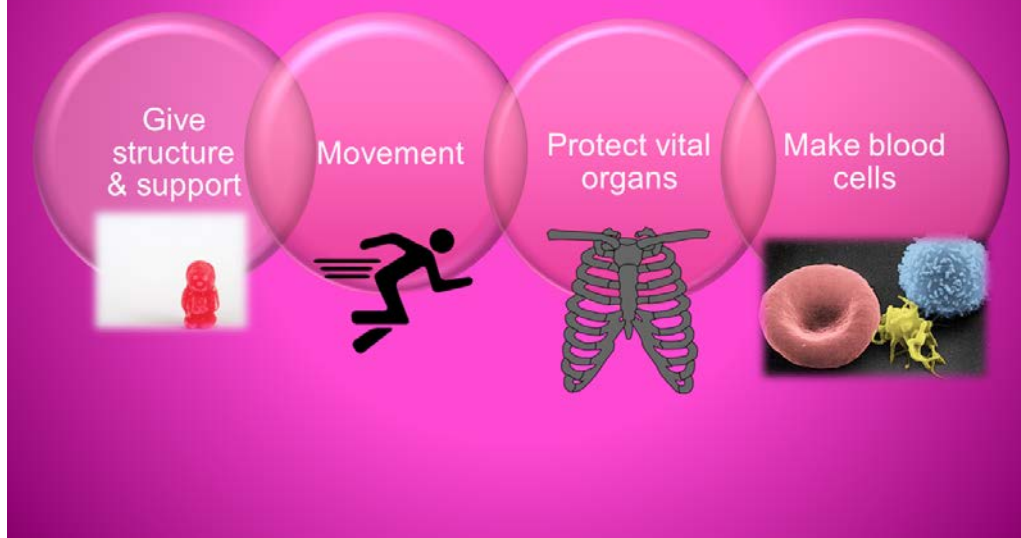


Where do they go?

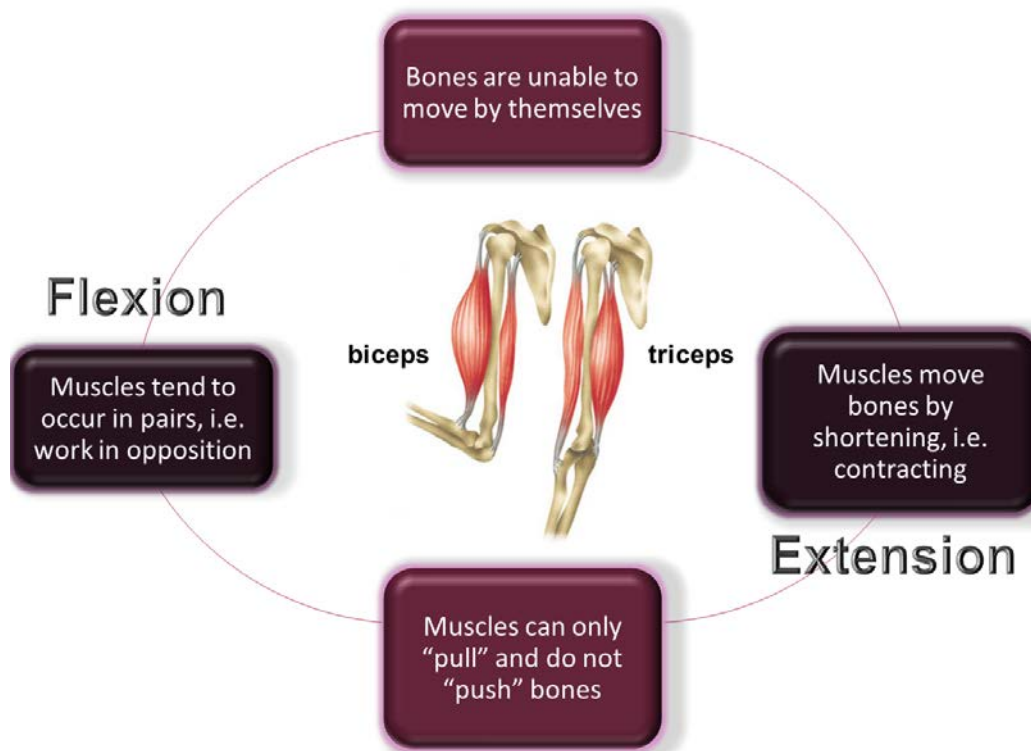


Slide 6

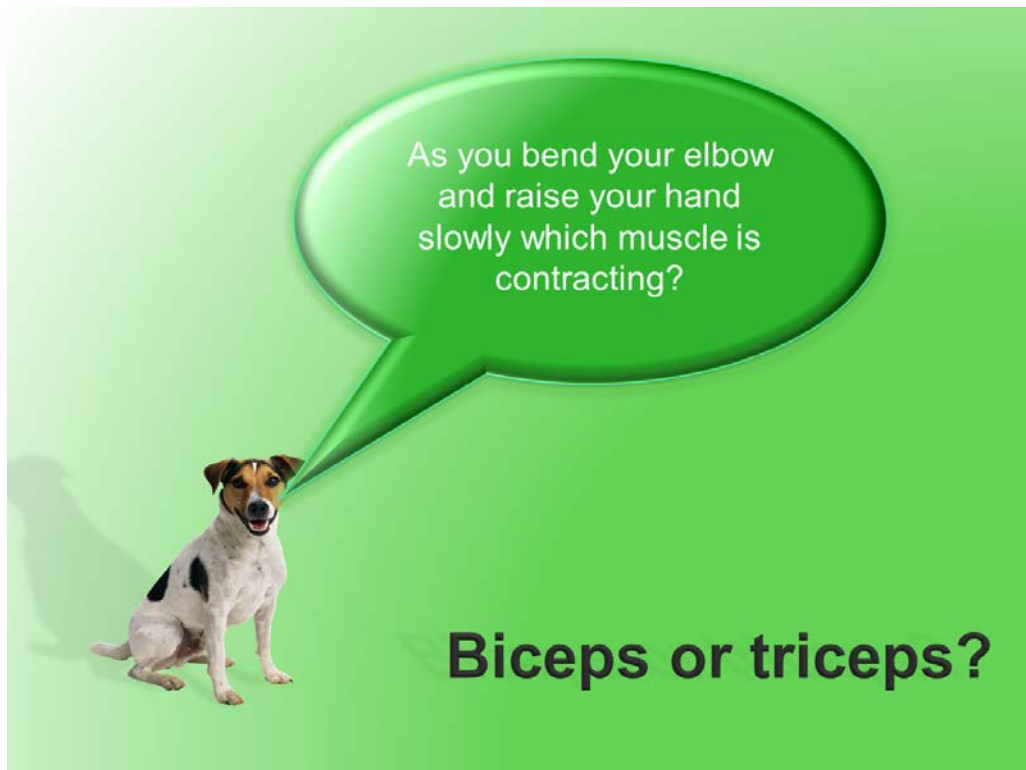
Bones-Functions



Slide 7



Slide 8



Slide 9



Slide 10

Do you have this tendon in your wrist?

Most people have it

14% of people do not have it

Was used by humans years ago to flex the wrist

Not needed anymore and can be removed

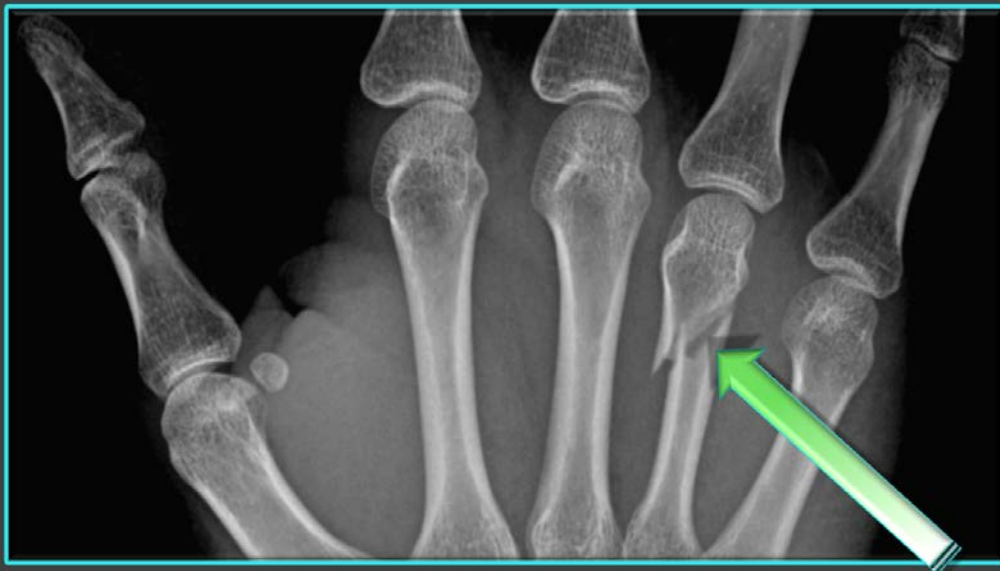
Can be used to replace damaged tendons



Palmaris Longus

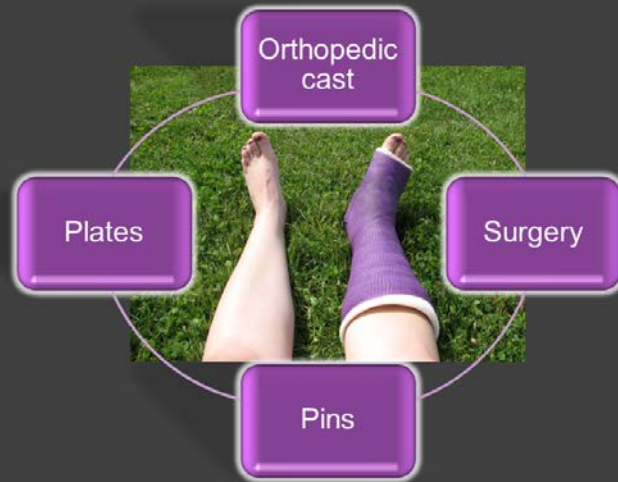
Slide 11

Broken Bones

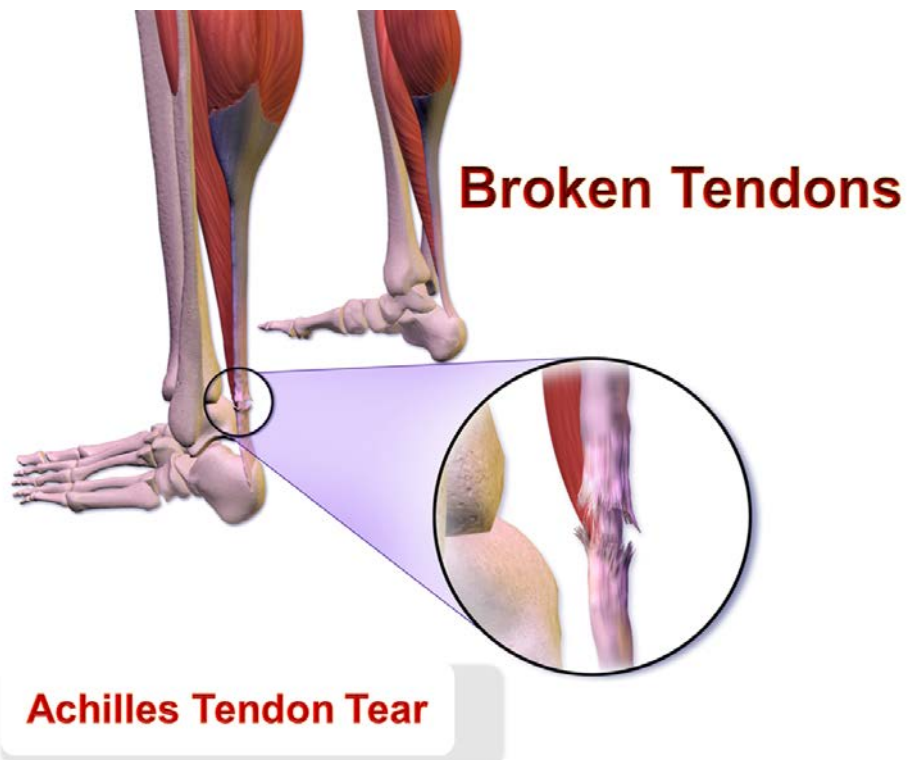


Slide 12

Broken Bones-Treatment

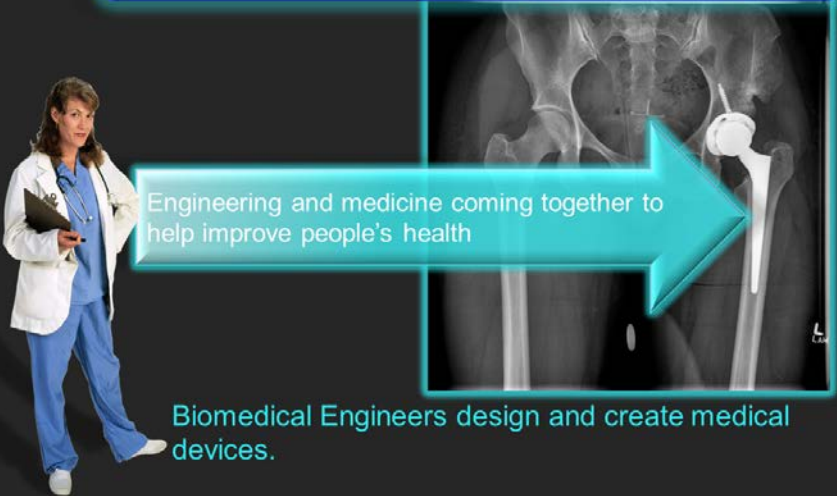


Slide 13



Slide 14

Biomedical Engineering



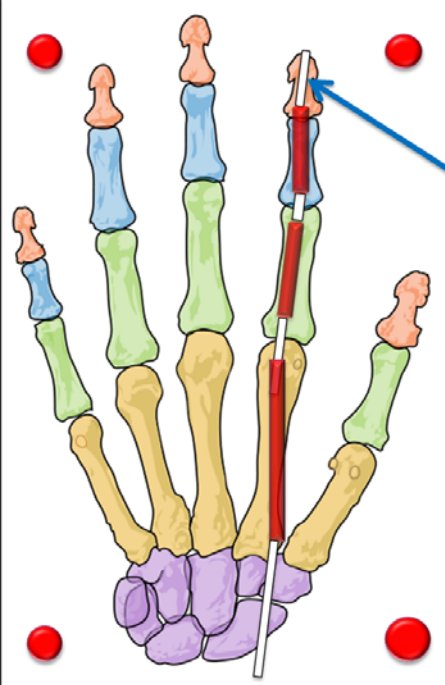
Engineering and medicine coming together to help improve people's health

Biomedical Engineers design and create medical devices.


Today **you** will be a Biomedical Engineer to repair damaged tendons.


Slide 15

Activity 1- Make a finger



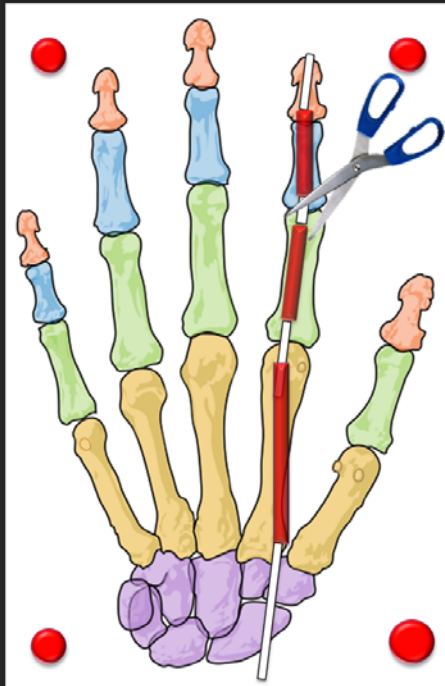
Tape the string to the tip of the finger here

Straws (Bones) 

String (Tendons) 

Make sure you leave enough space between the straws!

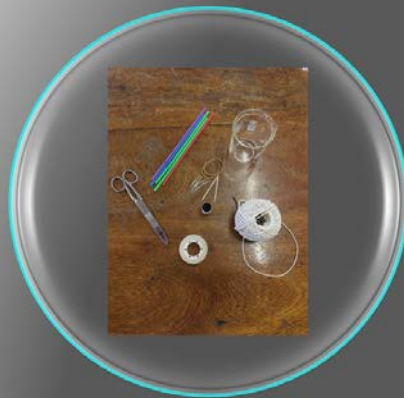
Slide 16



Activity 2- Damage and repair tendon

1. Use your scissors to cut one of your tendons
2. Repair your "tendon" using the biomaterials available in your Biomedical Engineering Kit

Slide 17



Paper hand cut-out

Straws

String

Paperclips

Rubber bands

Toothpicks

Thread

Scissors

Tape

Slide 18



Slide 19

References:

1. Human_skeleton_diagram.png via Wikimedia Commons
2. Achilles_Tendon_Tear.png via Wikimedia Commons
3. PL Tendon.png via Wikimedia Commons
4. Flexors and Extensors via www.flickr.com
5. Musculoskeletal System via www.flickr.com
6. Gray's Anatomy

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Slide 20

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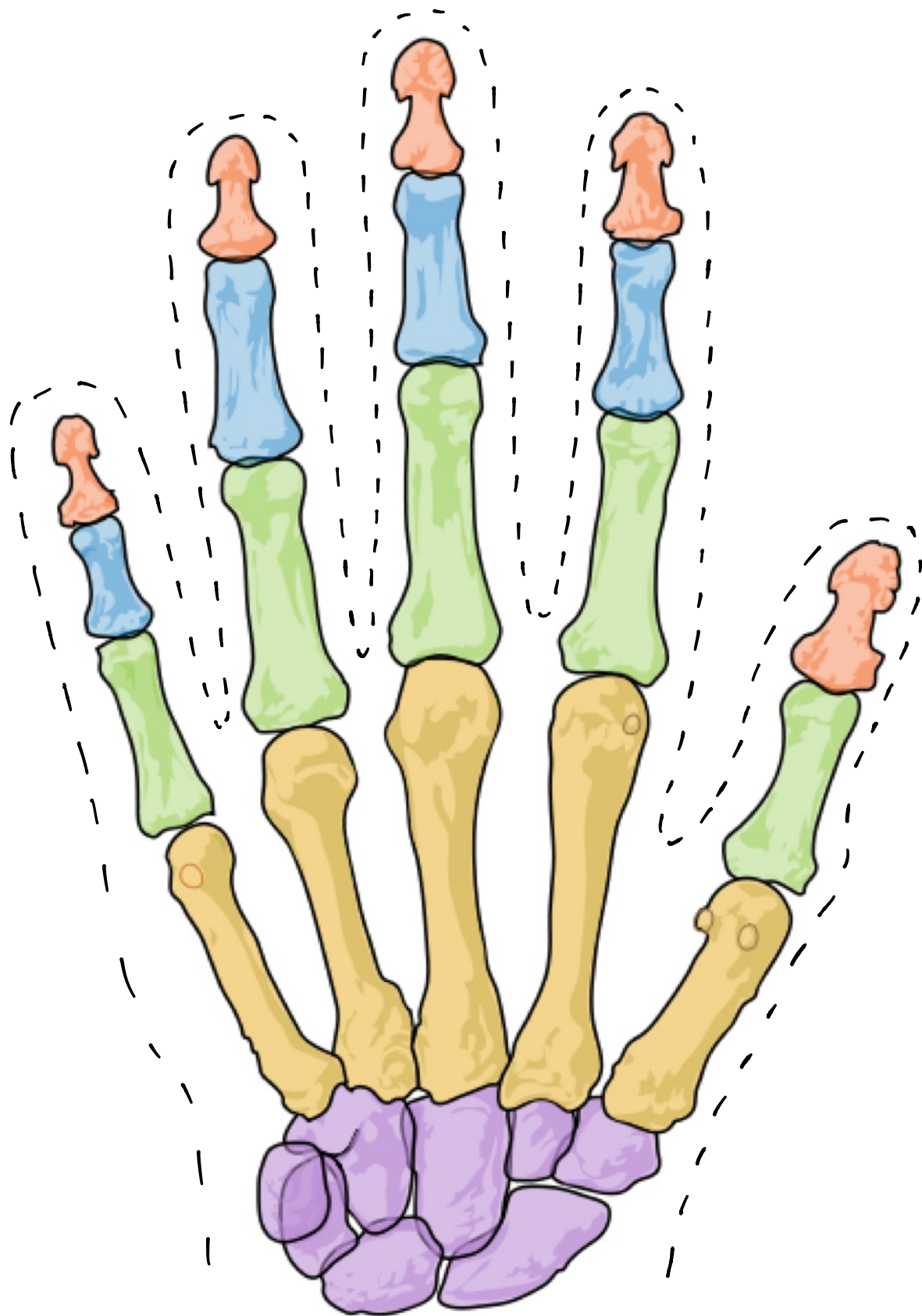
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K-W-L Chart

Topic: Musculoskeletal System

What I K now	What I W ant to Know	What I L earned



THE MUSCULOSKELETAL SYSTEM

Draw a picture of the medical device that you created.



Do you think your medical device is successful? Why or why not?

If you were building the medical device again, what would you do differently?

State three things that you learned today:

1. _____

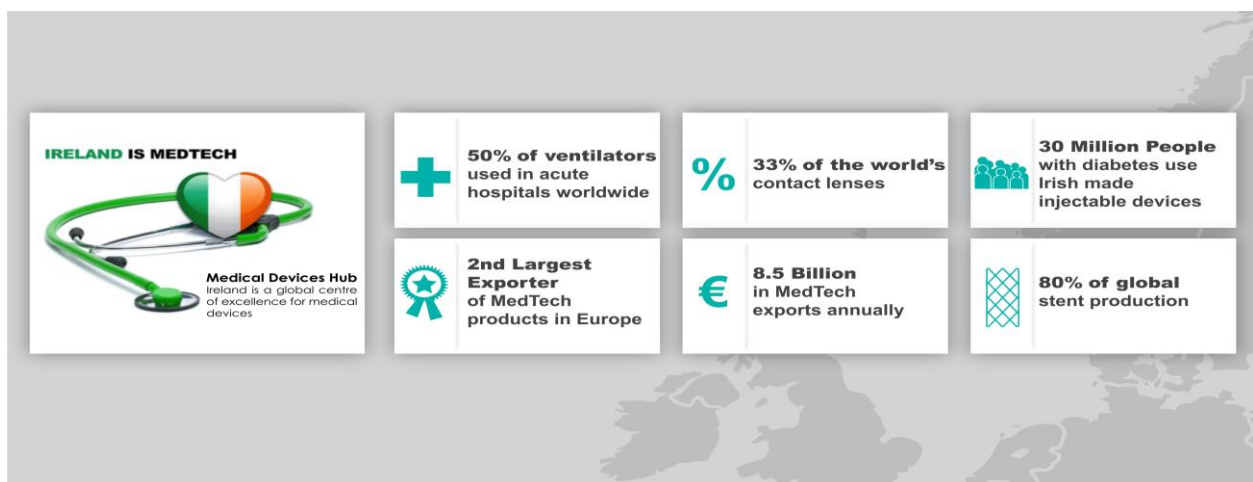
2. _____

3. _____

FACTS ABOUT MEDTECH IN IRELAND

- Ireland is the second largest exporter of MedTech products in Europe.
- Ireland's MedTech sector employs 29,000 people across 450 companies.
- Ireland has the highest number of people working in the MedTech industry than in any other European country, per head of population.
- 18 of the world's top 25 MedTech companies have a base in Ireland.
- Galway employs one third of the country's MedTech employees.

A wide range of products relevant to treating damaged musculoskeletal tissues are manufactured in Ireland. These include hip and knee implants, bone cement, and surgical blades used for cutting and shaping bones. In fact, 75% of global orthopaedic knee production comes from Ireland. Stryker is one of the world's leading MedTech companies producing medical devices to treat the musculoskeletal system. Stryker has four manufacturing sites and a Research and Development Innovation Centre based in Cork and Limerick. Zimmer Biomet, with facilities in Galway and Shannon, supplies hospitals and orthopaedic surgeons with implants for hips, knees, extremities, spine and trauma.



Source: IDA Ireland, 2017

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