# Teachers in Residence

## The Heart

### Primary Level Lesson Plan

Research Ireland Centre for Medical Devices

Taighde Éireann Research Ireland

# "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 devices 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.

All presentations, lesson plan booklets and optional resources are free to download at: https://curamdevices.ie/public-engagement/teachers/. 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

# Heart Lesson Plan

## 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:**

Materials

**Strand Unit:**

Properties and Characteristics of Materials

**Content Objectives:**

- Identify how materials are used, made or caused by humankind.
- Recognise that some materials decay naturally while others survive a long time in the environment.

**Strand:**
Living Things
**Strand Unit:**
Human Life
**Content Objective:**
Develop a simple understanding of the structure of some of the body's major external and internal organs.

## Learning Outcomes

**Children should be enabled to:**

1. Describe basic heart anatomy and function.
2. Appreciate how to keep their hearts healthy.
3. Develop an awareness of the conditions that can affect the heart.
4. Appreciate how a heart attack happens with the blockage of a coronary artery.
5. Appreciate what a medical device is.
6. Construct a large diagram of the four chambers of the heart.
7. Design a medical device to treat damage caused by a heart attack.
8. Understand the importance of using appropriate biomaterials to design medical devices.

# Keywords and Definitions

| | Keyword | Definition |
|---|---|---|
| 1. | **Blood Vessel** | A tube shaped structure that carries blood to all of the parts of the body. |
| 2. | **Artery** | Blood vessels that carry blood with oxygen away from the heart. |
| 3. | **Vein** | Blood vessels that carry blood without oxygen to the heart. |
| 4. | **Pulse** | The blood stopping and starting as it moves through the arteries. |
| 5. | **Coronary** | Relating to the heart and especially to the vessels that supply blood to the heart. |
| 6. | **Biomedical Engineering** | The combination of engineering and medicine to help improve people's health. |
| 7. | **Medical Device** | Any material, apparatus, software or other article that is used to: Diagnose, prevent, monitor or treat a disease or injury; Investigate, replace or modify a part or process of the body. |
| 8. | **Biomaterials** | Material that can be engineered to help the body to heal itself. |
| 9. | **Chamber** | The four different parts of the heart where blood enters and exits. |

| | | |
|---|---|---|
| 10. | **Right Atrium** | The chamber at the top right side of the heart where blood without oxygen enters. |
| 11. | **Right Ventricle** | The chamber at the bottom right side of the heart where blood without oxygen exits. |
| 12. | **Left Atrium** | The chamber at the top left side of the heart where blood with oxygen enters. |
| 13. | **Left Ventricle** | The chamber at the bottom left side of the heart where blood with oxygen exits. |

## Learning Activities

**Children will:**

- Engage in talk and discussion on the heart and how to keep their hearts healthy.
- Learn how to take their pulse.
- Participate in a group activity to construct a large diagram of the heart and repair it using a selection of materials.
- Present their work to the class.
- Evaluate their work by filling in the Exit Ticket.

## Extra Info / Files

| | Web Address | Brief Description |
|---|---|---|
| 1. | www.youtube.com/watch?v=_eVG45_iF9U | "How Your Heart Works" |

| | | |
|---|---|---|
| 2. | www.youtube.com/watch?v=huzs3Q4-CGc | "How Does the Heart "Work?" |
| 3. | kidshealth.org/en/kids/the-heart/heart-activities/?WT.ac=en-k-heart-center-h | Heart activities for kids |

## Resources Provided

- Teacher Lesson Plan
- PowerPoint to guide lesson
- Exit Ticket
- Optional: "How To Fix A Broken Heart"-A 9 minute animation created by CÚRAM Artist in Residence, Siobhan McGibbon, illustrating how the heart works, problems that can occur and treatments being developed by CÚRAM using biomaterials. The animation can be viewed using the following link: https://www.youtube.com/watch?v=4owpAvYFX8c.

## Materials Needed

- Large sheets of paper approximately 160cm in height x 160cm in width
    - **Note:** Alternatively smaller sheets of paper can be taped together, the back of a Twister game, or a white bed sheet can be used.
- Pencils
- Rubbers (in case of mistakes)
- Rulers or tape measures
- Red, blue, green and yellow markers

- Scissors
- Tape
- First aid gauze
- Cling film
- Aluminium foil
- White or blue tack
- Sponges
- Twister spinner or online Twister spinner (can be viewed using the following link: https://wheeldecide.com/wheels/board-games/twister-spinner/.

## Instructions

- For Activity 1 (Heart Twister):
    - Divide the class into groups of four or five depending on class size and amount of materials.
    - Each group is given a large sheet of paper, pencil, rubber, tape measure or ruler, and a set of red, blue, green and yellow markers.
    - Using the diagram on slide 17 in the PowerPoint presentation as a guide, the students draw a heart with their pencil on the large sheet of paper that is 120cm in width and 120cm in height. **Note:** The size of the heart can be adjusted depending on the age and size of the students.

    - Using the diagram on slide 18 in the PowerPoint presentation as a guide, the students divide the heart with their red and blue markers into four sections. Students should use blue lines on the right side because the blood does not have oxygen, and red lines on the left side because the blood has oxygen.
    - Using the diagram on slide 19 in the PowerPoint presentation as a guide, the students label the four chambers of the heart with their blue (right atrium), yellow (right ventricle), green (left atrium), and red (left ventricle) markers.
    - Each group choses one student within the group to go first.
    - Spin the Twister spinner for the groups of students.
    - The chosen students in each group place their hands or feet on the chamber of the heart determined by the spinner.
    - Keep spinning until someone falls, or until time runs out. (Example: Two minutes)
    - Repeat with the game with a new set of students from each group.

- For Activity 2 (Fix a Heart Attack):
    - Each group is given scissors, tape, and a "Biomedical Engineering Kit" containing any assortment of the following: First aid gauze, cling film, aluminium foil, white or blue tack, and/or sponges.

- Using the diagram on slide 22 in the PowerPoint presentation as a guide, the students draw damage on the left ventricle with their black markers.
- Using the materials available in the "Biomedical Engineering Kit", the students plan and build a medical device to treat the damage to the left ventricle caused by a heart attack.
- **Note:** The medical device must: 1) Feel the same as the heart, 2) Stretch with the beats of the heart, and 3) Be easy for the surgeon to use.

## Teachers' Tips

- Flashcards can be used to introduce new language for younger children at the beginning of the lesson.
- An extra Maths element can be brought into the lesson by having the students take their pulse for different amounts of time (10, 15, 20, and 30 seconds) and calculate their beats per minute, hour, day, year, and even average lifetime!
- The activities can be performed on separate days.
- There is no right or wrong answer to how the students fix their hearts. The idea is to get them thinking about what materials would be appropriate to maintain the beating of the heart.
- A possible talking point could be that the cling film stretches with the beats of the heart, but is not that easy for a surgeon to use.

## Methodologies

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

## Assessment

- Self-assessment – Exit Ticket
- Teacher observation – construction of heart and medical devices
- Teacher questioning – talk and discussion

## Linkage and Integration

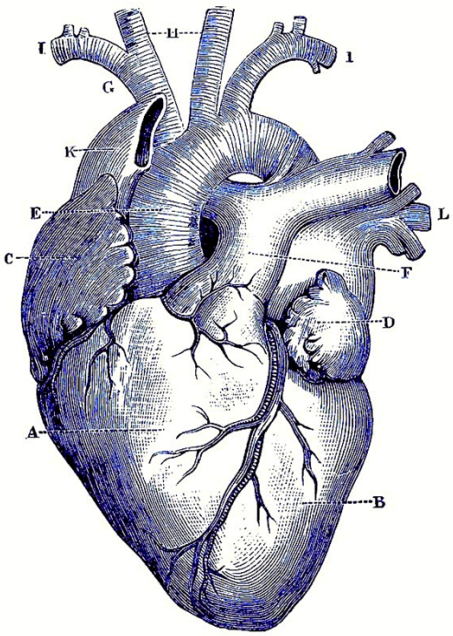
- **Maths** – problem solving
- **STEM** – I.T. / Engineering
- **Art** – construction
- **S.P.H.E.** – working together co-operatively
- **English** – oral language through talk and discussion and presenting their work

## Differentiation By:

- Teaching style
- Support
- Task

# PowerPoint Presentation - Heart


Slide 1

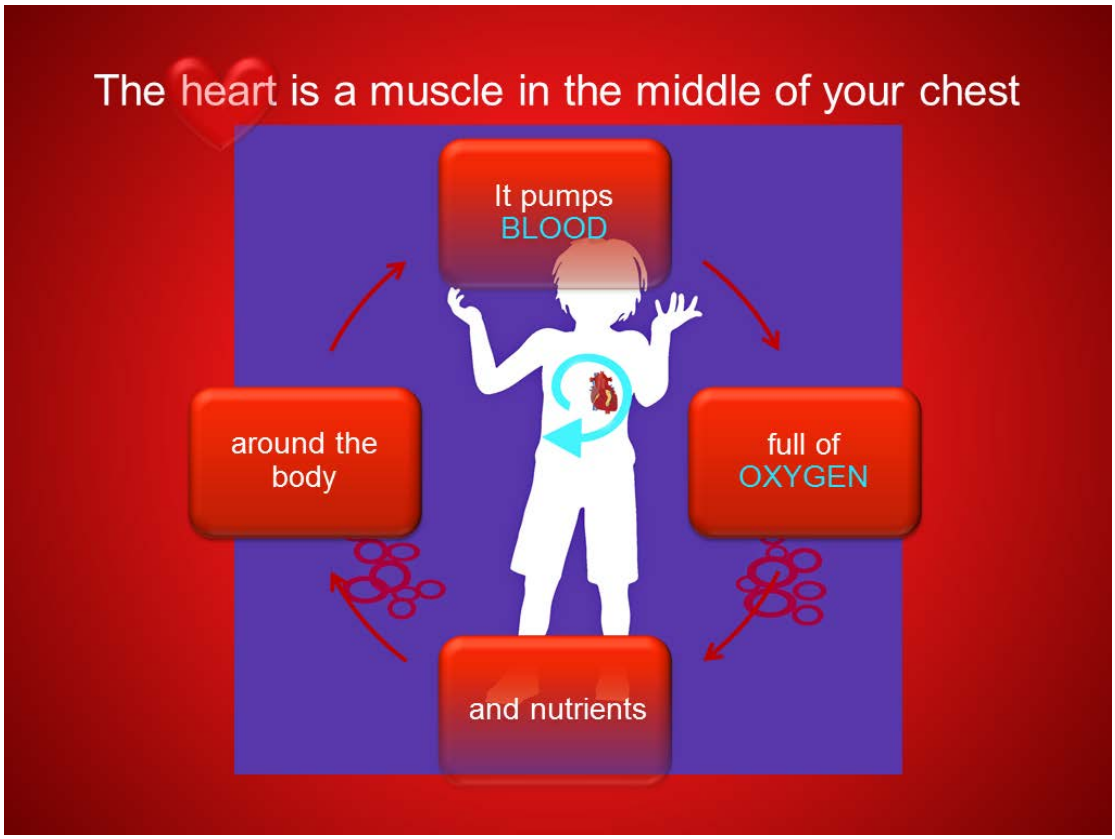



Centre for Research in Medical Devices

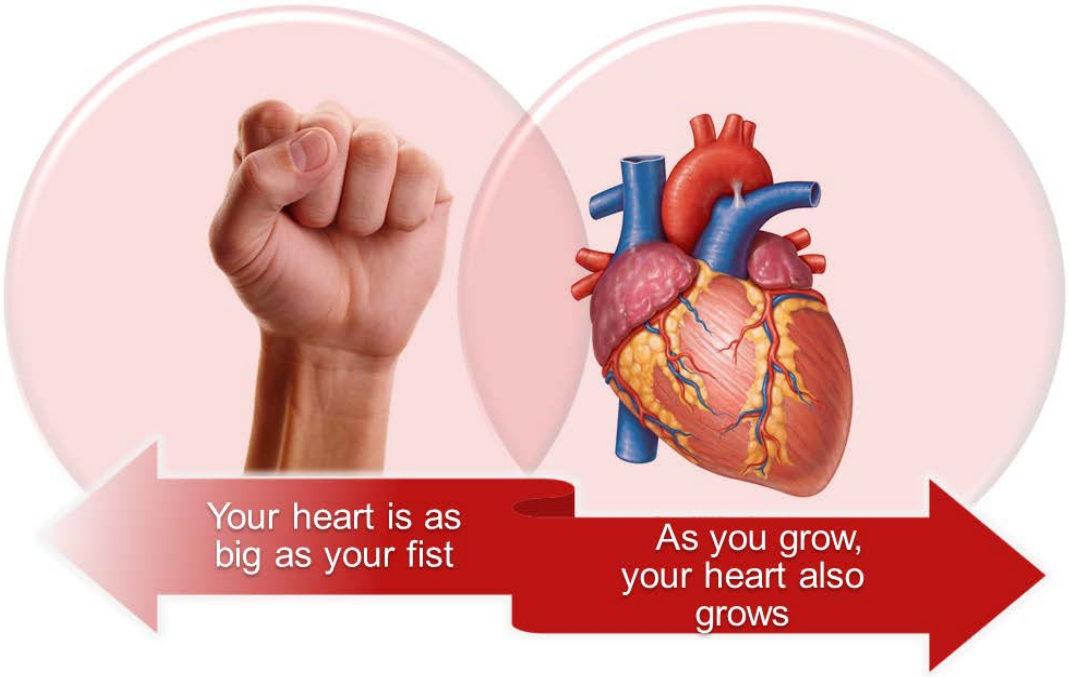
**Teachers in Residence Programme**
Deirdre Halleran and Sinéad Ní Mhullaoidh

Slide 2

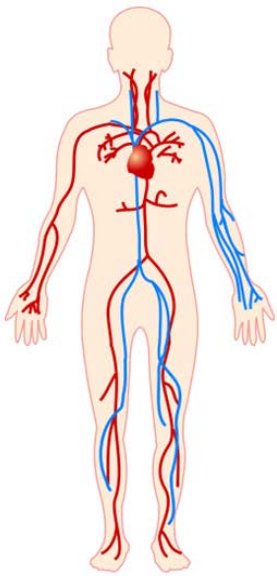

Slide 3




Slide 4




Slide 5

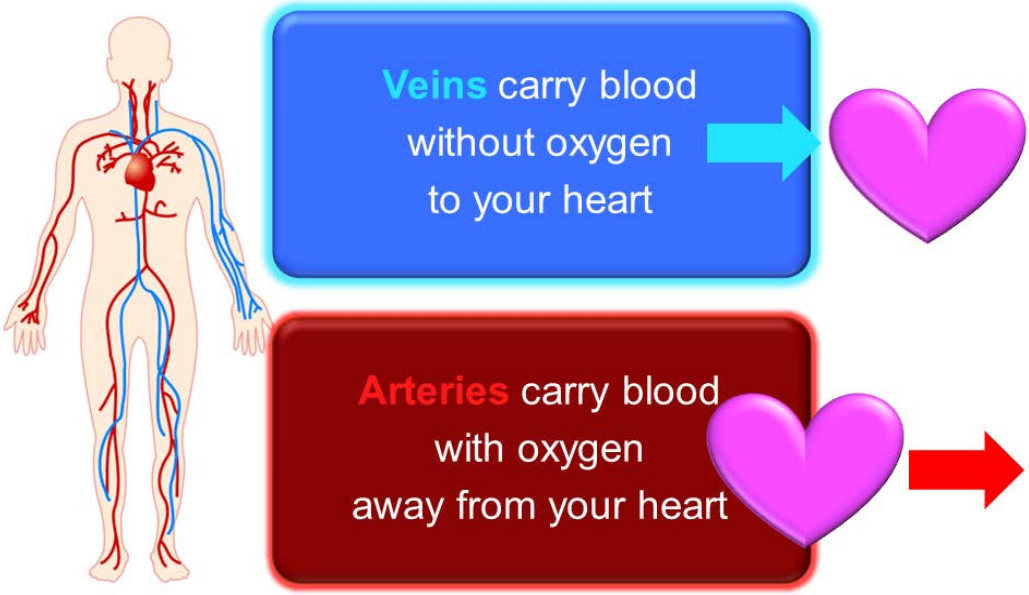


There are **blood vessels** in your body that are called **arteries** and **veins**

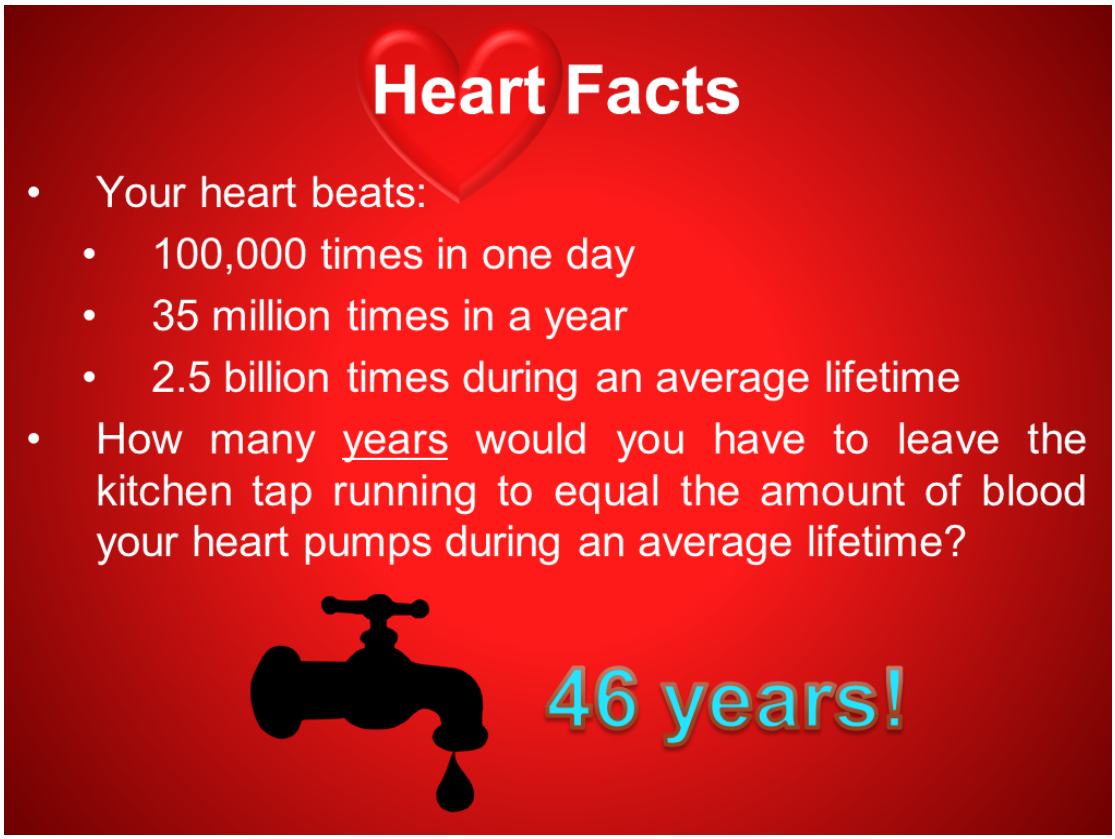
They connect your heart to all of the parts of your body

Each time your heart beats, it pumps blood to all of the parts of your body

Slide 6




Slide 7




Slide 8

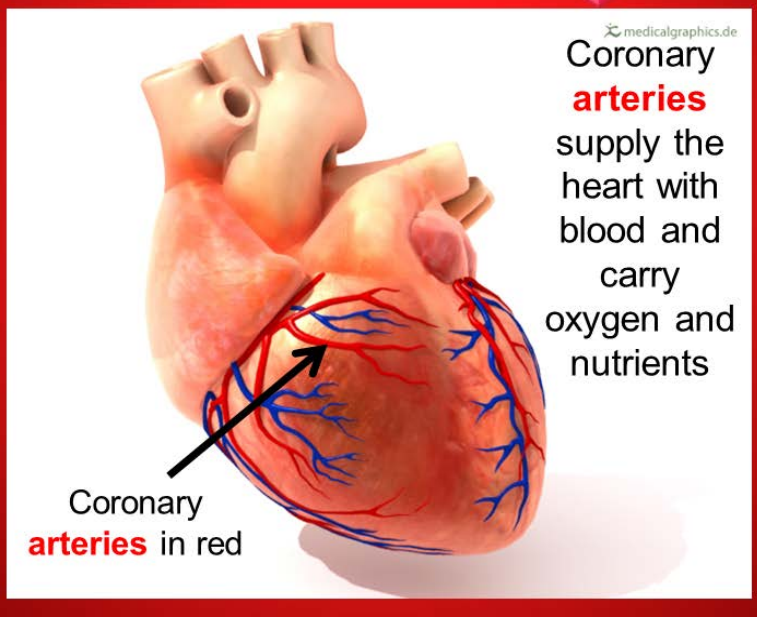
# Your Pulse

- Your pulse is blood stopping and starting as it moves through your arteries
- 90 to 120 beats per minute for kids
- 72 beats per minute for adults
- In general, fitter hearts have lower beats

Can you find your pulse?

Slide 9

# Healthy Heart

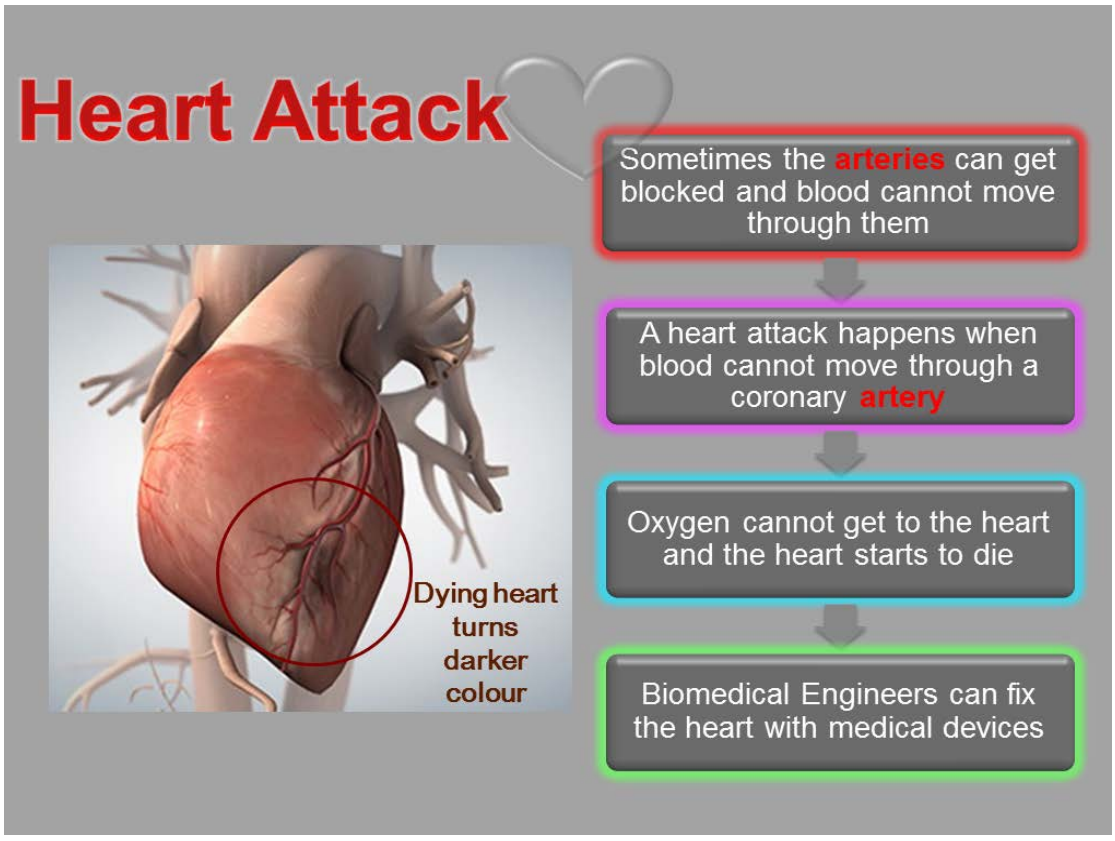



Slide 10

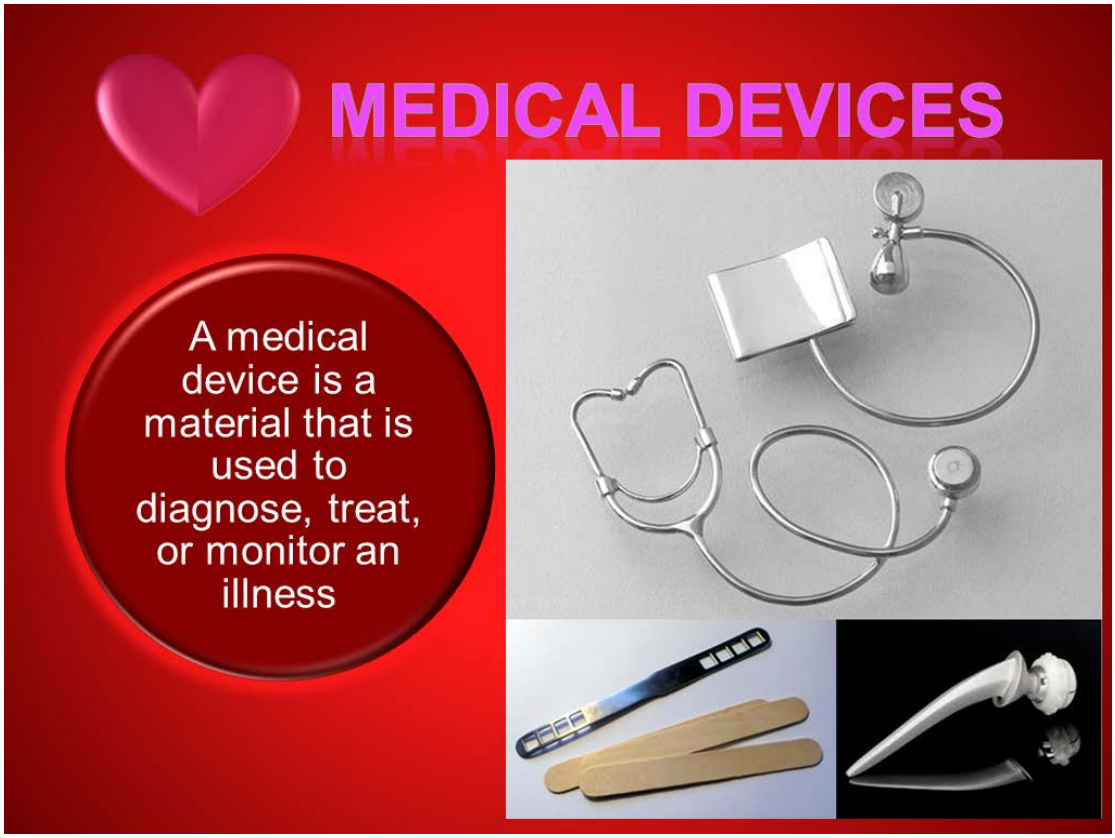

Slide 11


Slide 12

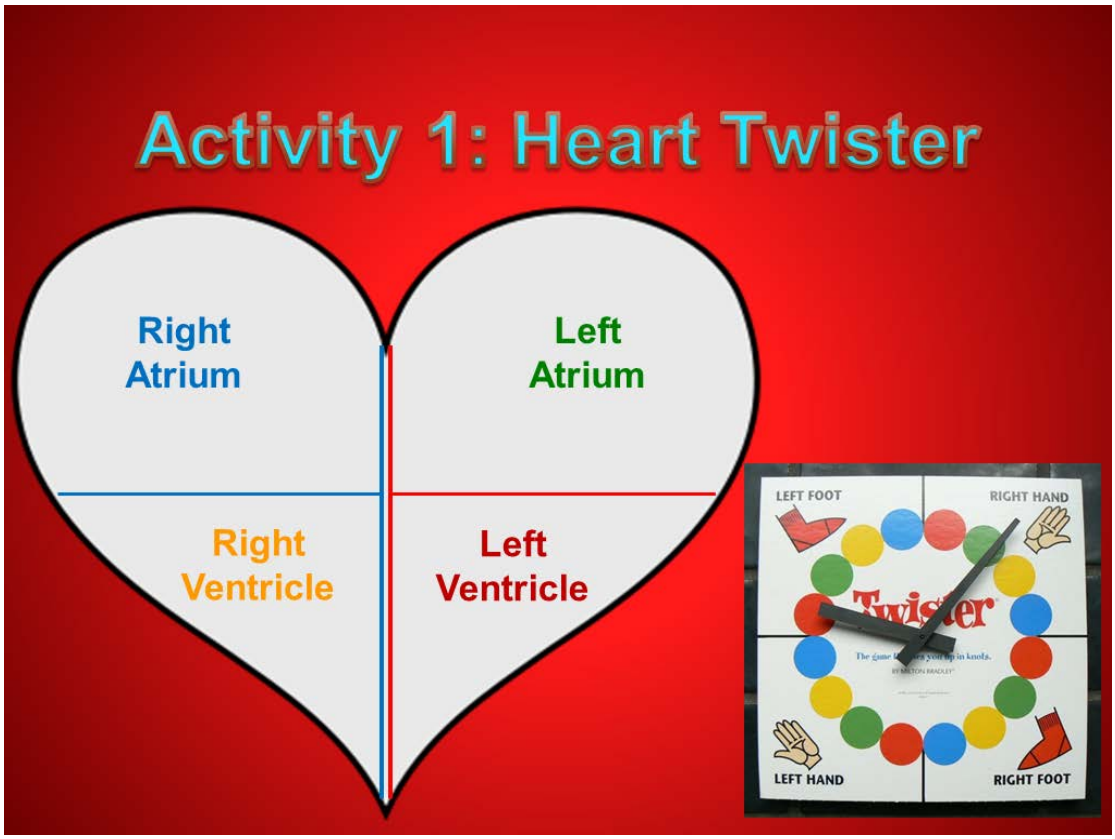

Slide 13



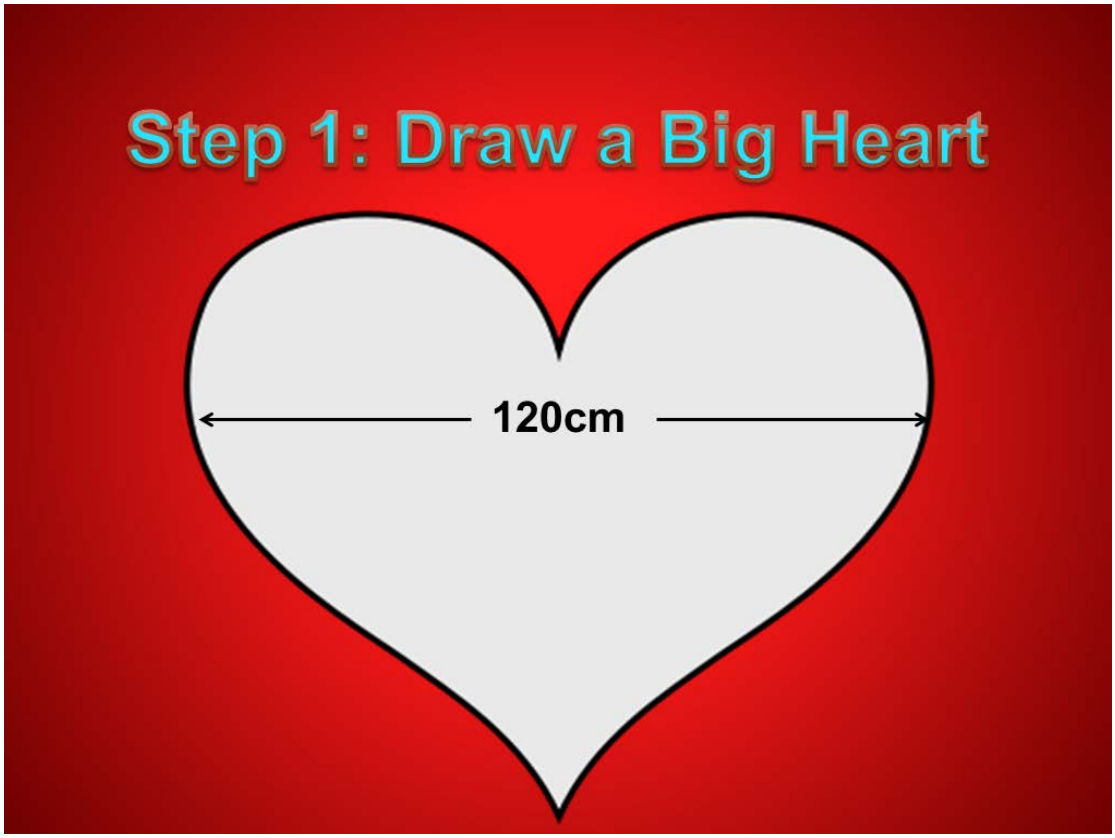

Slide 14



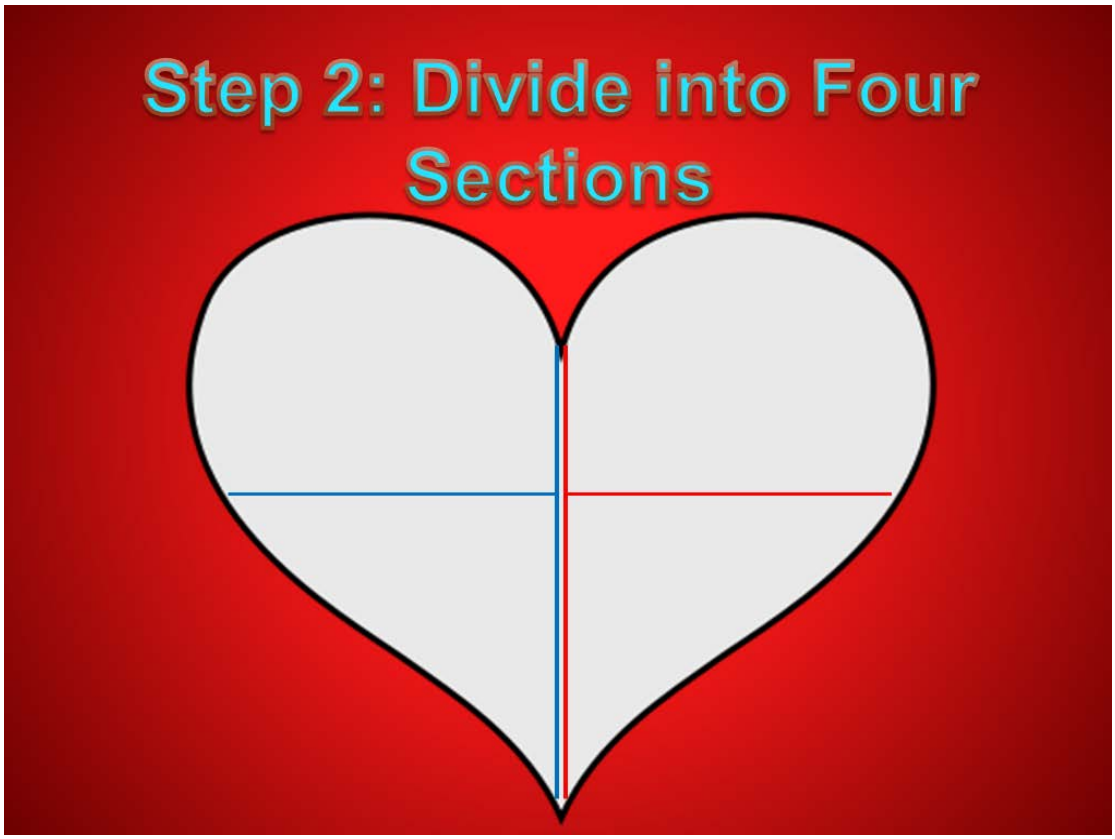

Slide 15



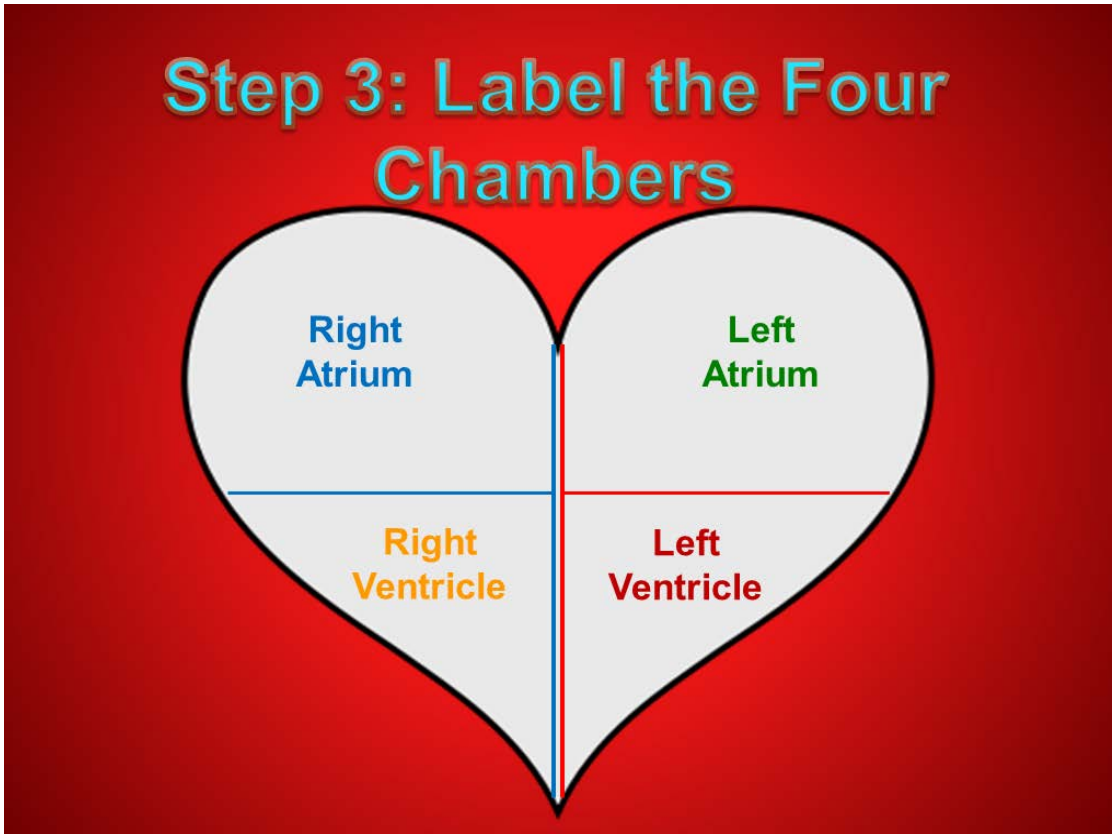

Slide 16



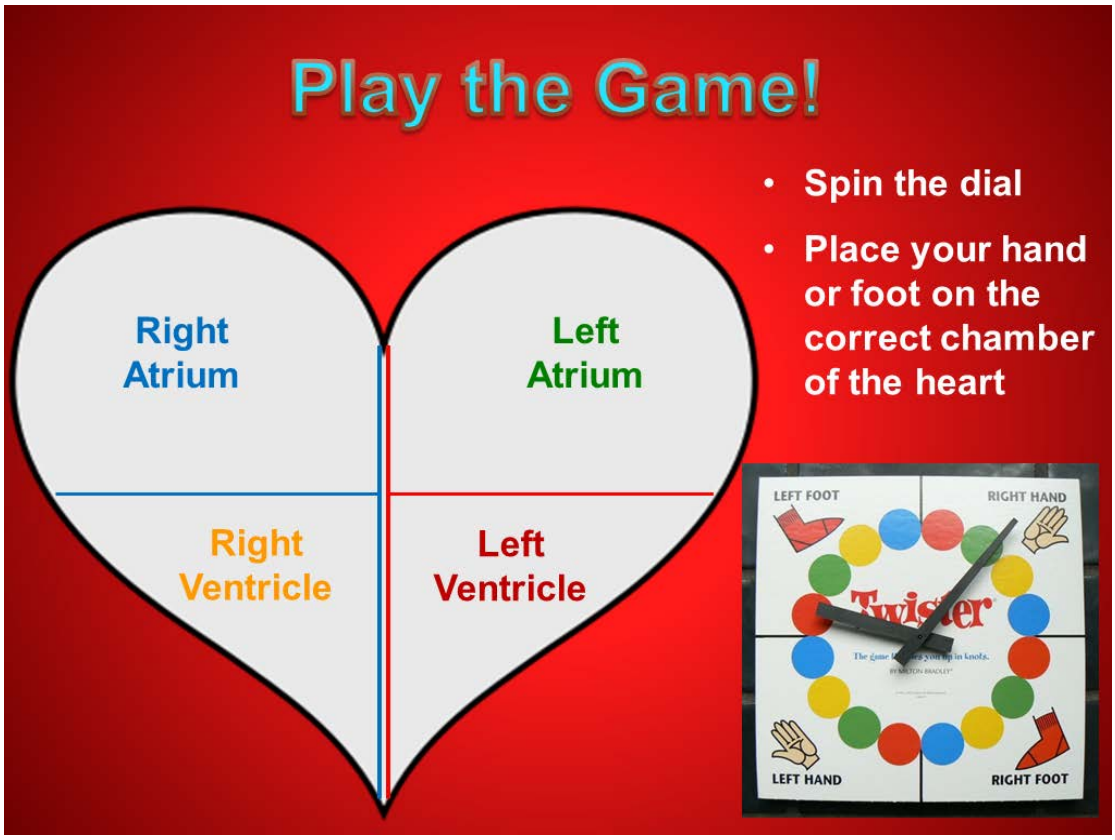

Slide 17



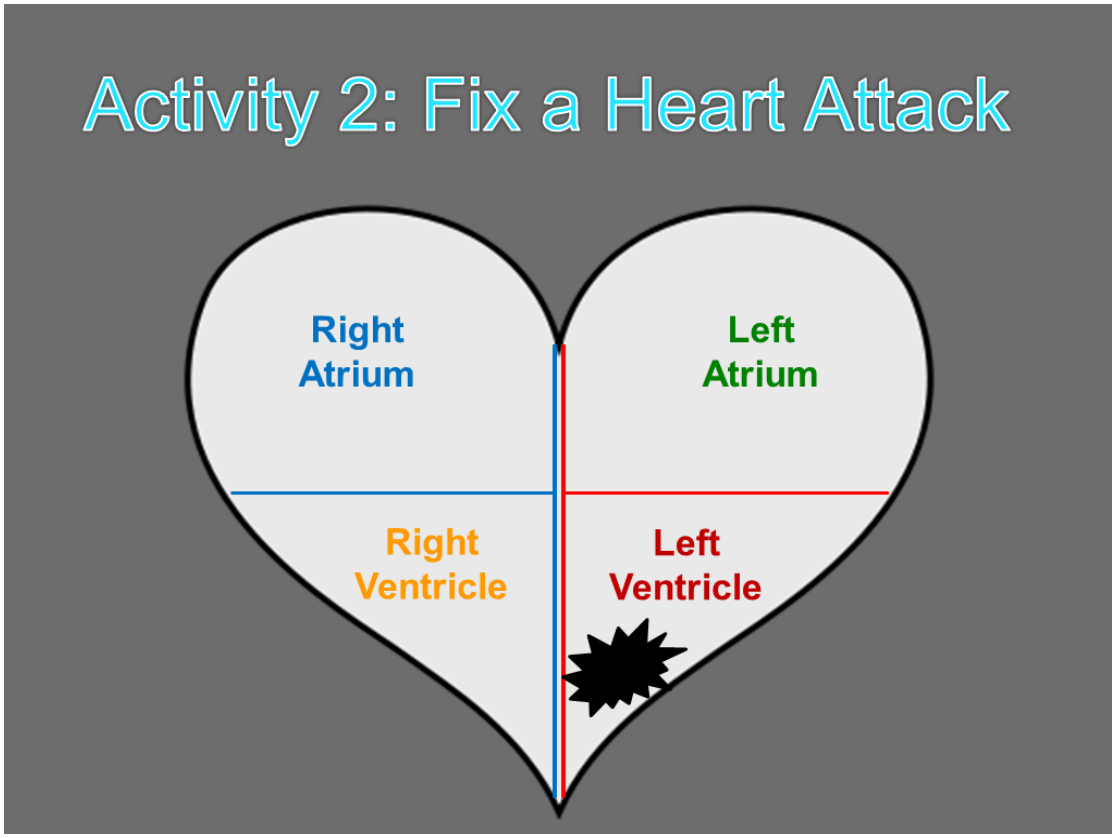

Slide 18



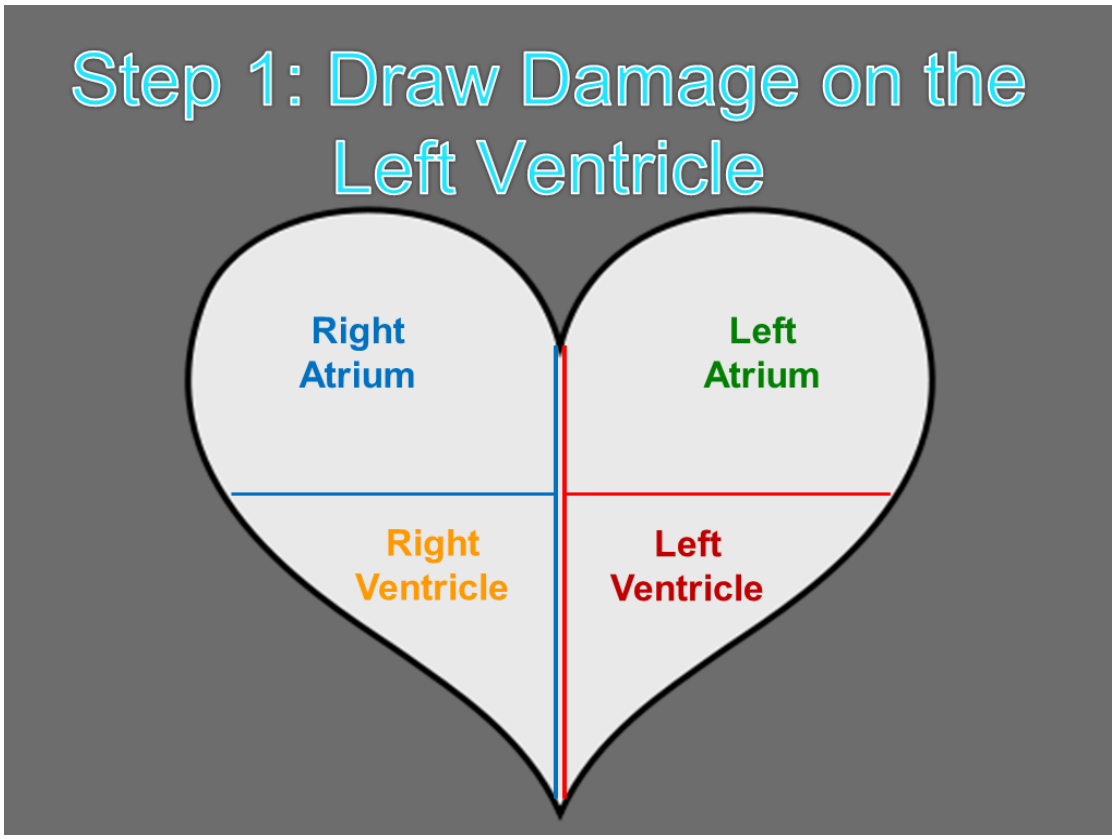

Slide 19



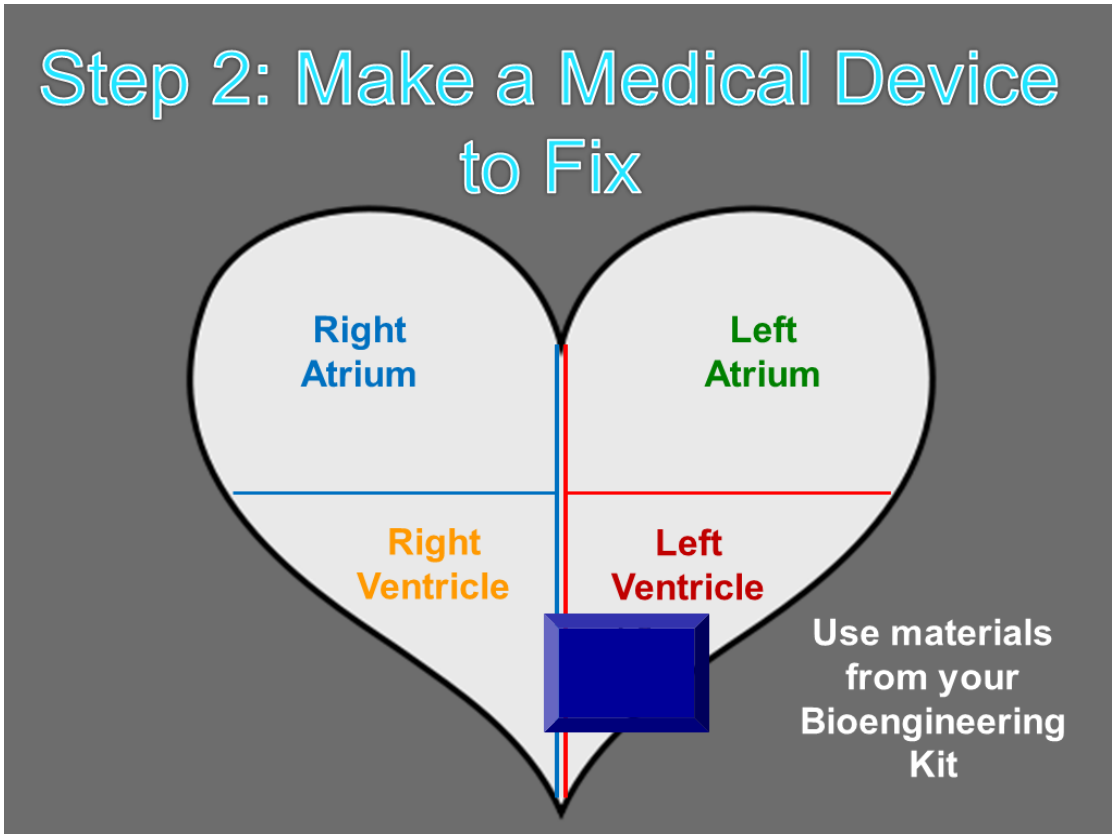

Slide 20



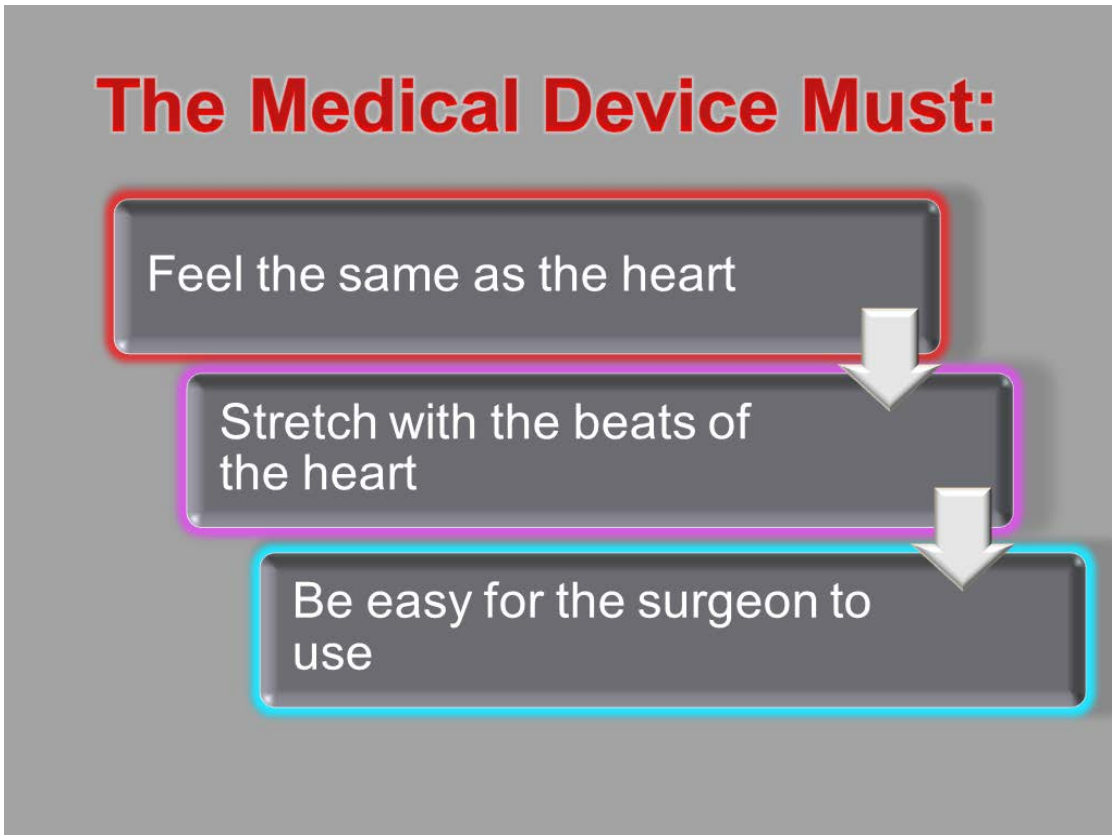

Slide 21



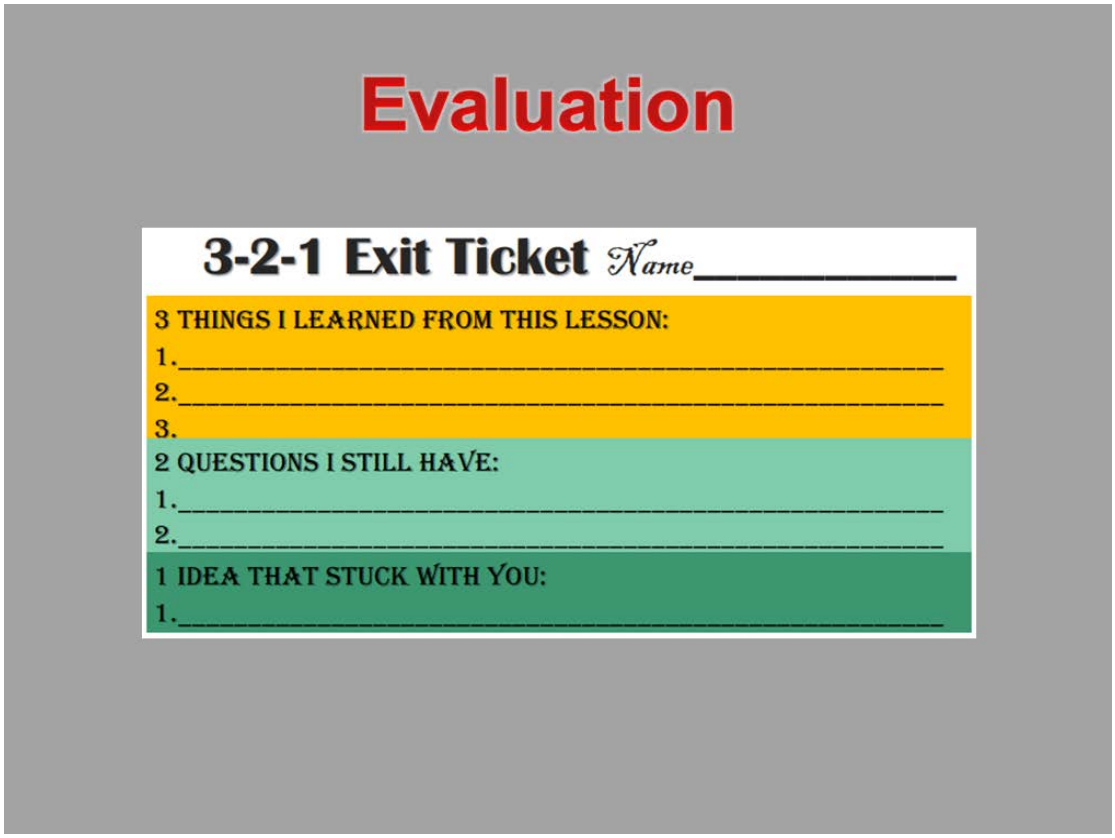

Slide 22




Slide 23




Slide 24




Slide 25


Slide 26

**References:**
1. Féach thárt: Eolaíocht, Rang 4, An Gúm
2. www.kidshealth.org
3. Gray's Anatomy
4. Pearson Education
5. svgsilh.com/image/1295981.html
6. commons.wikimedia.org
7. www.medicalgraphics.de

**Acknowledgements:**

Sincere thanks to all of the researchers who gave lectures and generously gave their time throughout the course.

Thanks also to all the participating teachers who very kindly shared ideas and resources.

Slide 27

This publication has emanated from research conducted with the financial support of Science Foundation Ireland (SFI) and is co-funded under the European Regional Development Fund under Grant Number 13/RC/2073.

This project has been funded by the European Union Seventh Framework Programme under Marie Curie Initial Training Networks (FP7-PEOPLE-2012-ITN) and Grant Agreement Number 317304 (AngioMatTrain). This project has also been funded by the European Union Horizon 2020 Programme (H2020-MSCA-ITN-2015) under the Marie Skłodowska-Curie Innovative Training Networks and Grant Agreement Numbers 676408 (BrainMatTrain) and 676338 (Tendon Therapy Train).


Slide 28

# 3-2-1 Exit Ticket *Name*_____

## 3 Things I learned from this lesson:

1._____

2._____

3.

## 2 Questions I still have:

1._____

2._____

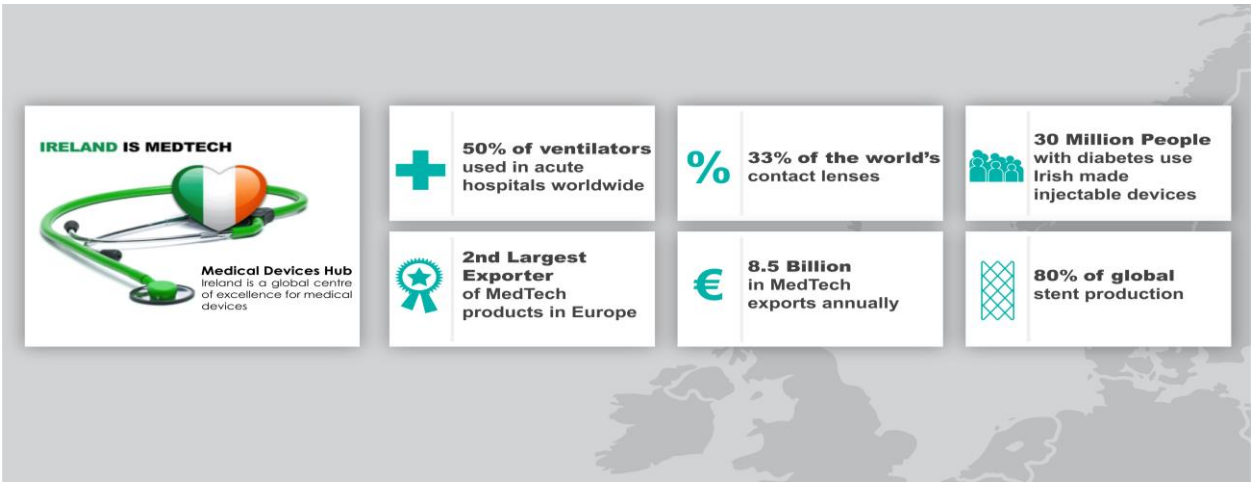
## 1 Idea that stuck with you:

1._____

# 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.

80% of global stent production is carried out in Ireland. The two largest employers within the Galway region are Medtronic and Boston Scientific, employing over 4000 individuals. Due to the influential presence of these two companies, many companies in Galway are involved in cardiology-related devices, particularly drug-eluting stents and their components, such as guide wires and balloon catheters. This has resulted in Galway becoming recognised for its specialisation in coronary devices, producing the highest levels of R&D and High Tech Innovation worldwide.




Source: IDA Ireland, 2017

# ACKNOWLEDGEMENTS

The participants of the 2017-2018 Teachers in Residence Programme: Vivienne Kelly, Louise Lynch, Mary McDonald, Anna McGuire, Sinéad O'Sullivan, Karen Conway, Claire Cunningham, Ali Donald, Anne Hession and Mairead McManus.

The participants of the 2016-2017 Teachers in Residence Programme: Colm Caomhánach, Thomas Flanagan, Andrew Fogarty, Deirdre Halleran, Ann McGreevy, Iseult Mangan, Sinead Molloy, Clive Monahan, Roisin Ni Bhriain and Carmel Rourke.

Niamh Burke and Rachel Duggan, the participants of the 2015-2016 Teachers in Residence Programme.

Sadie Cramer, the Visual Artist who designed the graphics and layouts of the lesson plans.

The researchers who lectured to and helped develop the lesson plans with the educators: Emmanuela Bovo, James Britton, Hector Capella, Joshua Chao, Ankit Chaturvedi, Paolo Contessotto, Mikey Creane, Marc Fernández, Cathal Ó Flatharta, Hakima Flici, Ana Fradinho, Silvia Cabre Gimenez, Jill McMahon, Luis Martins, Renza Spelat, Maura Tilbury, Alexander Trottier and Dimitrios Zeugolis.

Veronica McCauley and Kevin Davison, from the School of Education, and Matt Wallen, Principal of Knocknacarra Educate Together National School, who contributed to the development of the programme.

The individuals who presented to the educators about on-going outreach programmes: Claire Concannon, Muriel Grenon, Enda O'Connell, Jackie O'Dowd and Brendan Smith.

Nóirín Burke and all the staff at the National Aquarium for the workshops given to the primary students.

This publication has emanated from research conducted with the financial support of Science Foundation Ireland (SFI) and is co-funded under the European Regional Development Fund under Grant Number 13/RC/2073.

This project has been funded by the European Union Seventh Framework Programme under Marie Curie Initial Training Networks (FP7-PEOPLE-2012-ITN) and Grant Agreement Number 317304 (AngioMatTrain). This project has also been funded by the European Union Horizon 2020 Programme (H2020-MSCA-ITN-2015) under the Marie Skłodowska-Curie Innovative Training Networks and Grant Agreement Numbers 676408 (BrainMatTrain) and 676338 (Tendon Therapy Train).

Research Ireland Centre for Medical Devices

Research Ireland Centre for Medical Devices
Biomedical Sciences
University of Galway
Ireland

T +353 91 49 4432
E info@curamdevices.ie

www.curamdevices.ie

@CURAMdevices

HOST INSTITUTION
Ollscoil na Gaillimhe University of Galway

PARTNER INSTITUTIONS
University College Dublin Ireland's Global University
University of Limerick Ollscoil Luimnigh
RCSI University of Medicine and Health Sciences
nibrt National Institute for Bioprocessing Research and Training
UCC Coláiste na hOllscoile Corcaigh University College Cork, Ireland
DCU Ollscoil Chathair Bhaile Átha Cliath Dublin City University
TUS
Trinity College Dublin Coláiste na Tríonóide, Baile Átha Cliath The University of Dublin
Maynooth University National University of Ireland Maynooth
TU Dublin

FUNDED BY
Taighde Éireann Research Ireland