



Strength in Science

The Effects of Exercise on the Blood

Secondary Level Lesson Plan



SFI Research Centre for Medical Devices

‘Strength in Science’

Physical inactivity is one of the leading risk factors for poor health and is now identified by the World Health Organization (WHO) as the fourth leading risk factor for global mortality. In Ireland, physical inactivity is thought to be responsible for 8.8% of the burden of disease from coronary artery disease, and 10.9% of type 2 diabetes.

Currently, only 8% of female secondary students in Ireland receive the Department of Education and Skills (DES) recommended 60 minutes of Physical Education (PE) per week. The goal of the ‘Strength in Science’ project is to develop cross-curricular resources for science and PE teachers that are linked with the Junior Cycle Science and PE curricula that will **increase girls’ interest in both learning science and participating in exercise**. We hope to make science more personal and relevant to teenage girls by linking how the biology and physics involved in exercise affects their health.

The lesson plan kits present fun and unique ways to participate in exercise and the scientific effects that different exercises have on the body. The suggested activities can be used to teach the Health-Related Activity area of study in the Junior Cycle PE Curriculum. Alternatively, the videos and flyers can be used to complement activities in other PE areas of study such as Athletics, Gymnastics, and Dance. All lesson plan booklets, films, and optional resources are free to download at: <http://www.curamdevices.ie/curam/public-engagement/teachers-in-residence/>.

The kits were developed through collaboration between researchers, science teachers, PE teachers, fitness instructors, and Junior Cycle students. This is a pilot scheme and we are keen to receive your feedback so that we can improve the resources and make them as useful for teachers as possible. We are excited to hear how these kits “play out” in the sports hall setting!

Sincerely,

A handwritten signature in blue ink, appearing to read 'S. Gundy'.

Dr. Sarah Gundy

CÚRAM Teachers in Residence

Programme Manager

The Effects of Exercise on the Blood

Junior Cycle Physical Education Curriculum Links

Junior Cycle Syllabus in Physical Education (2003)

Area of study 5: Invasion games

Topics:

Attacking play

Defending play

Area of study 8: Health-related activity

Topics:

Health benefits of physical activity

Health-related fitness

Warm-up and cool-down

NCCA Junior Cycle Short Course in Physical Education (2016)

Strand 1: Physical activity for health and wellbeing

Strand 3: Individual and team challenges

Junior Cycle Science Curriculum Links

Strand One: The Nature of Science

Element:

Understanding About Science

Students should be able to:

1. *Appreciate* how scientists work and how scientific ideas are modified over time.

Element:

Science in Society

Students should be able to:

10. *Appreciate* the role of science in society; and its personal, social and global importance; and how society influences scientific research.

Strand Five: Biological World

Element:

Systems and Interactions

Students should be able to:

6. *Evaluate* how human health is affected by: inherited factors and environmental factors including nutrition; lifestyle choices.

Element:

Sustainability

Students should be able to:

9. *Discuss* medical, ethical, and societal issues.

Learning Outcomes

Students should be able to:

1. Make appropriate responses (relative to her/his own ability) to the particular problems posed by a game.
2. Gain experience of various degrees of competitive play.
3. Display an understanding of the dynamics of team efficiency.
4. Demonstrate an understanding of the effects of exercise on the body.
5. Show an understanding of the role of physical activity in establishing and maintaining health.
6. Plan for and participate in regular physical activity.
7. Know the different components of the blood.
8. Understand the functions of white blood cells, red blood cells, platelets, plasma, and cholesterol.
9. Understand how a clot forms in the blood.
10. Know one of the causes of a stroke – a clot blocking a blood vessel in the brain.

11. Understand how exercise can prevent a stroke through the release of nitric oxide which prevents clot formation.

Keywords and Definitions

	Keyword	Definition
1.	White Blood Cells	Cells in your blood that make up part of the immune system.
2.	Red Blood Cells	Cells in your blood that carry oxygen.
3.	Platelets	Components in the blood that are needed for clotting in order to control bleeding.
4.	Plasma	Liquid component of the blood that carries blood cells, nutrients and waste products.
5.	Cholesterol	A waxy substance in the blood used to build cells.
6.	Clot	A mass formed by platelets and fibrin in the blood to stop bleeding. When formed incorrectly inside an artery or vein, they can cause problems because they reduce blood flow to tissues.
7.	Stroke	The result of a clot forming in or traveling to a blood vessel in the brain which blocks oxygen and nutrients from reaching the brain.

Learning Activities

Students will:

- Watch a video discussing:
 - The different components of the blood.

- How a clot forms in the blood and prevents the supply of oxygen and nutrients to tissues.
- Current Irish research in treating diseases caused by clots formed in the blood.
- How exercise prevents the formation of clots forming in the blood.
- Perform exercises to keep their blood healthy.

Resources Provided

- Teacher lesson plan
- Short film "The Effects of Exercise on the Blood"
- Flyer for students "The Effects of Exercise on Your Blood"

Note: These resources will also complement any aerobic activities or lessons taught in P.E. classes.

Demonstration

Before the lesson, prepare a model of the blood in a clear container (that can hold 1 L) using the following recipe. If you would like to use a smaller container (500 mL), just halve all of the ingredients:

- 550 mL of water mixed with a few drops of yellow food colouring (plasma)
- 440 mL of red lentils (red blood cells)
- 6 mini white marshmallows (white blood cells)
- One teaspoon of jumbo oats (platelets)

Explain to the class the following information:

- The yellow liquid is plasma which makes up 55 % of the blood. It is a thick, clear, yellowish liquid that carries dissolved food and wastes.
- The red lentils are red blood cells which make up 44 % of the blood. They carry oxygen and carbon dioxide around the body and are produced in the bone marrow.
- The marshmallows are white blood cells which make up only 0.5 % of the blood. They are bigger than red blood cells and attack germs.

- The oats are platelets which make up 0.5 % of the blood. They are bits of cells that help blood clot.

Warm-Up

Platelet Tag

Equipment/Space Needed:

- Large hall
- Three sashes or scarves for three students to wear to make them distinctive

Instructions:

- Three students are designated as Platelets.
- The Platelets put on the sashes or scarves in order to make themselves known to the other students.
- The teacher says "Ready, steady, go!"
- The Platelets run after the other students and try to tag them.
- The students run around the hall and try not to be tagged by the Platelets
- If a student is tagged by a Platelet, he/she becomes a Platelet.
- The new Platelet links arms with the person who tagged him/her and they form a chain. (This chain is like a clot)
- The chain of Platelets continues to run after the students and tries to tag them.
- The chain of Platelets continues to grow (and the clot gets bigger) as they tag more students.
- The clot with the most number of students is designated as the winners.

Stretches

After the warm-up, get the students to perform dynamic stretches targeting the following muscle groups in preparation for the activities:

- Hamstrings
- Quadriceps
- Gastrocnemius and soleus (calves)

- Deltoids (shoulders)
- Biceps and triceps (upper arms)
- Trapezius (upper back)
- Pectoralis major and minor (chest)

Activity 1

Clot Cones

Equipment/Space Needed:

- Large hall
- 10-12 Footballs
- 10-12 Cones (per team)
- 10-12 Tennis balls (per team)
- **Note:** There must be the same number of tennis balls as cones.

Preparation:

- Line up 10-12 cones on one side of the width of the hall.
- Line up the other 10-12 cones on the opposite side of the width of the hall.
- The lines of cones are the lining of the blood vessels.
- Put a tennis ball on each cone. The tennis balls are the build-up of clots.
- The footballs are placed in the middle of the hall. The footballs are nitric oxide.

Instructions:

- Students are divided into two teams.
- One team lines up on one side of the hall in front of a line of cones.
- The other team lines up on the opposite side of the hall in front of the other line of cones.
- The teacher says "Ready, steady, go".
- The students try to knock the tennis balls off the opposing team's cones by kicking the footballs at them.

- The students also try to put the tennis balls that the opposing team knocked off back on top of their team's cones.
- The first team to knock all of the tennis balls off the opposing team's cones at the same time are the winners.

Activity 2

Nitric Oxide Knock-Out

Equipment/Space Needed:

- Large hall
- Note: You can see how the game is set up in the following video:
https://www.youtube.com/watch?v=SZIL5s0uksM&list=PLuRSRqkSoGObFWaqjX_N5dGmiJlZFXZwd&index=2

Instructions:

- The teacher divides the class into teams of 4.
- Three of the students from each team form a triangle by extending their arms and placing their palms on one another's shoulders.
- The triangle of students is designated as the Clot.
- The remaining student is designated as the Nitric Oxide.
- The Nitric Oxide student identifies one of the students making up the Clot as the person that he/she is going to tag.
- The teacher says "Ready, steady, go!"
- The other two students making up the clot work together to turn the student away to avoid him/her being tagged by the Nitric Oxide.
- The game is played until the Nitric Oxide tags the identified student from the Clot, or a predetermined amount of time is called.
- The students on a team switch roles and the game is played again.

Cool-Down

Stretches

Get the students to perform static stretches targeting the following muscle groups that were worked during the activities:

- Hamstrings
- Quadriceps
- Gastrocnemius and soleus (calves)
- Deltoids (shoulders)
- Biceps and triceps (upper arms)
- Trapezius (upper back)
- Pectoralis major and minor (chest)

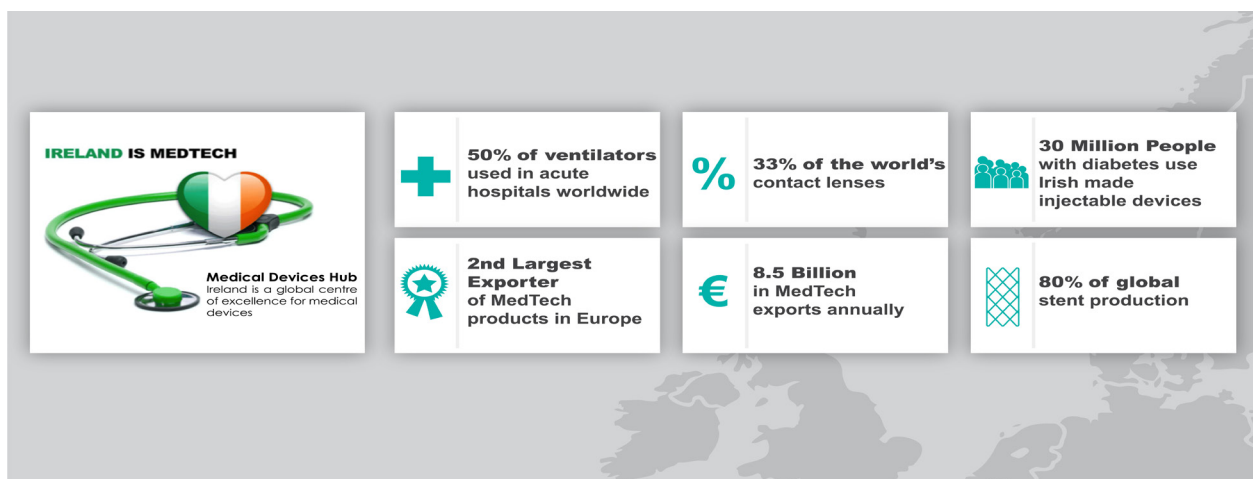
FACTS ABOUT STROKE AND MEDTECH IN IRELAND

- 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.
- 13 of the top 15 MedTech companies have operations in Ireland.
- Galway employs one third of the country's MedTech employees.

Each year, approximately 10,000 Irish people have a stroke with around 2,000 dying from the illness. This is more deaths than breast cancer, prostate cancer and bowel cancer combined. Stroke can happen at any age and one third of strokes happen in people under sixty-five years of age.

Strokes can be treated via thrombolysis which uses medicine to try and dissolve a blood clot in order to return the blood supply to the brain. Another treatment option is a thrombectomy, a radiologically guided procedure where doctors use a mesh device to physically remove the clot. The Galway-based company, Cerenovus, has designed the EMBOTRAP II Device to remove blood clots and restore blood flow in the brain. To see an animation on how the device works, visit:

https://players.brightcove.net/5716634431001/default_default/index.html?videoId=5789667625001



Source: IDA Ireland, 2017

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