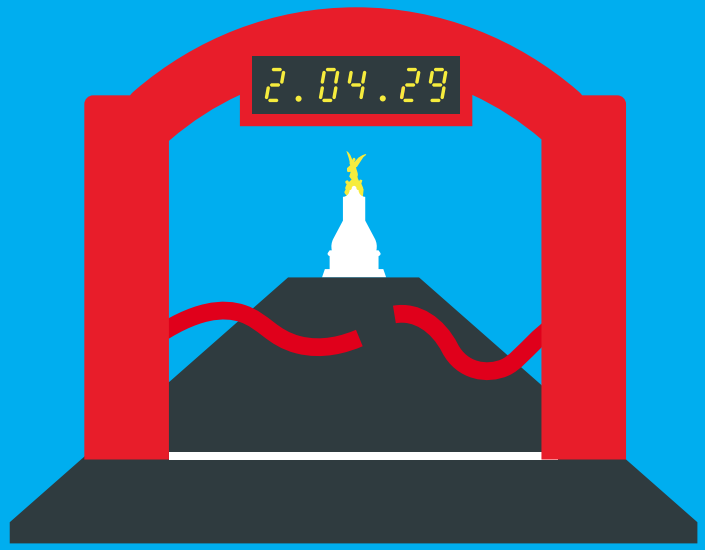
MAYOR OF LONDON

THE LONDON CURRICULUM

SCIENCE (BIOLOGY) KEY STAGE 3

# HEALTHY LONDON LIVING

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# THE LONDON CURRICULUM

## PLACING LONDON AT THE HEART OF LEARNING

**The capital is the home of innovations, events, institutions and great works that have extended the scope of every subject on the school curriculum. London lends itself to learning unlike anywhere else in the world. The London Curriculum aims to bring the national curriculum to life inspired by the city, its people, places and heritage.**

**To find out about the full range of free resources and events available to London secondary schools at key stage 3 please go to www.london.gov.uk/london-curriculum.**

### STEM in the London Curriculum

London provides numerous historical and contemporary cutting edge examples of scientists, engineers and mathematicians who have worked in their fields to create innovative solutions to problems throughout the world. Population growth, trade, communication, transport, health, food, water supply and many other aspects of life in London have driven technology-based innovations. London Curriculum science, maths, design & technology teaching resources aim to support teachers in helping their students to:

- **DISCOVER** the application of their subject knowledge to the life of the city.
- **EXPLORE** their neighbourhood and key sites around London, learning outside the classroom to see and understand how STEM subjects have shaped many aspects of the city.
- **CONNECT** their learning inside and outside the classroom, analysing situations and using their subject knowledge to create and present solutions.

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# HEALTHY LONDON LIVING OVERVIEW

## UNIT AIMS AND OBJECTIVES

The health of Londoners depends on the fight against disease in a bustling and highly populated city, as well choices they make themselves in relation to diet, exercise, drugs and alcohol. Drawing on a number of leading London medical and science centres, sporting events and venues, from the London School of Health & Tropical Medicine to the Virgin Money London Marathon, this unit introduces the key stage 3 science topics of nutrition and digestion, health and the skeletal and muscular systems. Each lesson offers students the chance to develop the skills required to work scientifically and to develop their awareness of socio-scientific issues. Following a visit to a museum, science centre or other venue to extend their learning, students will apply their understanding to their local area of London and the health of their school's student population and devise an intervention to improve this.


WILSON KIPSANG OF KENYA SETS THE ELITE MENS' COURSE RECORD, 2014
Roger Allan © Virgin Money London Marathon

## KEY STAGE 3 NATIONAL CURRICULUM

This unit addresses subject content requirements within the biology part of the key stage 3 national curriculum for science on:

### The skeletal and muscular systems

- the structure and functions of the human skeleton, to include support, protection, movement and making blood cells
- biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles
- the function of muscles and examples of antagonistic muscles

### Nutrition and digestion

- content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed
- calculations of energy requirements in a healthy daily diet
- the consequences of imbalances in the diet, including obesity, starvation and deficiency diseases
- the importance of bacteria in the human digestive system

### Health

- the effects of recreational drugs (including substance misuse) on behaviour, health and life processes

In covering this content, this unit also addresses some of the broader aims relating to working scientifically in the key stage 3 national curriculum for science, in ensuring that students:

### Scientific attitudes

- pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
- understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review

### Experimental skills and investigations

- ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- make predictions using scientific knowledge and understanding
- select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate
- use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- apply sampling techniques

### Analysis and evaluation

- apply mathematical concepts and calculate results
- present observations and data using appropriate methods, including tables and graphs
- interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- identify further questions arising from their results

### Measurement

- undertake basic data analysis including simple statistical techniques

# DISCOVER

**Using the historical data of John Snow, the contemporary work of the London School of Hygiene & Tropical Medicine and an investigation into hand washing, students will explore how scientists learn about disease in order to prevent it. In the context of sports and dance in the city, students will review how the body moves using the skeleton and muscles, before considering the impact of exercise on health. Students will look at the components of a healthy diet and relate this to training for the London Marathon and assess how needs change. They go on to consider obesity, a particular issue in London, and its impact on health, as well as nutritional deficiencies and their impact. By exploring some scenarios common to London hospitals, students are made aware of the role of health professionals. From that context they consider the impact of recreational drugs and alcohol on injury and disease.**

# LESSON 1
# GERM WARS

## BIG IDEA

The purpose of this lesson is for students to understand the need for, and means of, infection control, as well as what an epidemiological study is and how it can used in disease prevention, exploring both the roots of epidemiology in London and its continuation in the city today. Students also set up an experiment related to hand hygiene, which they follow up in lesson 4.

## LEARNING OBJECTIVES

Some students will be able to describe how the interpretation of data from epidemiological studies can be used to prevent both infectious and non-infectious disease.

Most students will be able to describe how the interpretation of data from epidemiological studies can be used to prevent infectious disease.

All students will be able to describe individual actions they can take to prevent the spread of infectious disease.

## RESOURCES

**Resource 1.1:** Snow's theories about cholera

**Resource 1.2:** Transcript of interviews

**Resource 1.3:** What's the source?

**Resource 1.4:** Infection control action plan

**Resource 1.5:** Career factfile

# LESSON 1
# GERM WARS

## YOU WILL ALSO NEED

- Agar plates
- Sticky tape
- Cotton buds (for swabbing)
- Optional: A variety of hand washes
- Access to a sink/sinks and hand wash
- Paper towels
- Incubator at 37C°
- Permanent markers or labels for agar plates
- Access to computers (for ICT data task)
- John Snow's data (see links provided)

## KEY WORDS

- Infectious
- Germ
- Virus
- Bacteria
- Sterile
- Aseptic
- Hygiene
- Infection control

## MATHEMATICAL SKILLS

- Finding patterns
- Spatial thinking

LESSON 1: GERM WARS

# SETTING THE SCENE

## John Snow: The birth of epidemiology

Epidemiology is the study of the patterns, causes and control of diseases in different population groups. John Snow is often considered one of the founding fathers of epidemiology because of his work on cholera, following an outbreak in London. He also contributed to public health more widely, including to anaesthesia and through engagement in public debates of the time.

He was born on 15 March 1813 in York. He was a surgeon-apothecary apprentice in Newcastle from the age of fourteen until he was twenty, and while there witnessed the first epidemic of cholera in the UK. After moving to London he became a member of the Royal College of Surgeons in 1838, graduated from the University of London in 1844 and was admitted to the Royal College of Physicians in 1850. He then set up general practice in Soho.

The second cholera epidemic in the UK began in 1848. It was generally thought that its cause was an atmospheric "effluence" or "miasma" i.e. an infection carried by the air. Snow's prior experience and studies made him doubt these theories. He treated many cholera patients and their first symptoms were digestive, such as diarrhoea. He realised this meant that the illness was caused by something that had entered the digestive system, rather than the respiratory system. In 1849 he published *On the Mode of Communication of Cholera* in which he put forward the theory that cholera was carried by water, with infected faeces. In 1853 when cholera returned he tested his hypothesis. He compared cholera mortality rates for two London populations – those whose water supply was drawn from sewage-contaminated sections of the Thames and those whose water came from uncontaminated sections.


DR JOHN SNOW MEMORIAL AND PUB, BROADWICK STREET

image by Justin Cormack 

On 30 August 1854, Snow was still carrying out these investigations, a cholera epidemic began near his home in Soho. It was a severe outbreak, with over 550 deaths in two weeks.

Snow analysed where people killed by cholera had previously lived and identified their drinking water sources through interviews with residents. This led him to believe that the water from a pump on Broad Street (now known as Broadwick Street) was the source of infection. He successfully persuaded the local council to remove its handle on 8 September 1854. Snow described this work, along with other continued studies, in the second edition of *On the Mode of Communication of Cholera*. His studies demonstrated overwhelming evidence for an infectious agent as Snow had proposed, but the theory was not widely accepted until the 1860s, after Snow's death. The infectious agent is now known as Vibrio cholerae.

FLORENCE NIGHTINGALE, 1860
Henry Hering © National Portrait Gallery, London, 1860

## Florence Nightingale: Infection Control Nurse

Nursing had its first infection control champion in Florence Nightingale. While she had no scientific understanding of infection prevention, her research into hospital sanitary problems made her a firm believer in pure air, pure water, light, effective drainage and cleanliness. She believed in preventive medicine including the importance of a healthy diet, and her theories were largely responsible for sanitary reform.

The importance of infection control in nursing was first identified by Florence Nightingale in 1854, during the Crimean war, when she served in a military hospital in Scutari, Italy. The conditions in the hospital were horrendous. Nightingale's observations led her to believe that improving hygiene would decrease the number of deaths. She was an infection control nurse although this was not yet a defined role. Today, nurses are key players in the promotion of infection control practices. Many infection control nurses work in London hospitals.

## Public health in the city today: London School of Hygiene & Tropical Medicine

The drive to understand and control disease through studying its patterns continues today across a number of cutting-edge institutions in London. The London School of Hygiene & Tropical Medicine is a world-leading centre for research and postgraduate education in public and global health; its mission is to improve health and health equity in the UK and worldwide. The School opened its doors to 11 students in 1899, as part of the Seamen's Hospital Society's Branch Hospital at the Royal Albert Dock. Today it has nearly 4000 students. Its staff, students and alumni work in more than 150 countries and are actively involved in a range of worldwide public health issues, including the recent Ebola crisis in West Africa.

LONDON SCHOOL OF HYGIENE & TROPICAL MEDICINE, 2003

image by Anne Koerber 

## LESSON 1: GERM WARS

# ACTIVITIES

HAND HOLDING A PETRI DISH


### STARTER: HOW CLEAN ARE YOUR HANDS?

This activity supports students' understanding of the importance of hygiene in public health and introduces the work of the London School of Hygiene & Tropical Medicine. This activity will need to be returned to in another lesson, once the bacterial colonies have had time to grow. There is a link made in lesson 4 to make this possible.

Introduce the School and its work in public health. Explain how its research has, for example, demonstrated the levels of E. coli and faecal matter on money and mobile phones (and it was found that Londoners had the highest levels of E. coli on their hands in the UK!).

**lshtm.ac.uk/newsevents/news/2011/global_handwashing_day_2011.html**

**lshtm.ac.uk/newsevents/news/2012/dirty_money.html**

Have pre-prepared agar dishes ready for students. Explain they are going to find out how clean their hands are by pressing their fingers gently on to an agar plate after removing the lid, and in another lesson examining what grows on them. After they have pressed their fingers onto the plate they should return the lid, then put two pieces of tape on either side of the lid of the plate and label it with their name. The plates are collected up and put in an incubator at 37°C. There should be visible colonies after two to three days.

Do not allow colonies to over-grow as this creates a biohazard, instead if you have growth before your planned lesson then cover the plates in loose cling-film and leave in the preparation room fridge (which will slow bacterial growth). If you are not familiar with it, please remind yourself of CLEAPSS guidance for schools' regarding microbiology (available through your school membership of CLEAPSS).

After students have prepared their agar plates, ensure they wash their hands.

## Differentiation

There is a chance here to allow students to come up with a question about bacterial colonies in their vicinity, remembering that they could look at size of growth but also numbers of different colony types. Example investigative questions are:

### 1. What is the best hand cleaner?

Students can test a number of hand cleaning agents, including alcohol rubs and washing foams, by cleaning their hands with the agent and then repeating the starter exercise using a second agar plate. Each plate will need to be labelled with the name of the student and also the name of the cleaning agent used. One student could wash with just water to see the effect of that.

Students could be extended to think about working scientifically, for example by considering control variables such as diffusion rate of the washing agents.

### 2. Where in the classroom is there the highest risk of picking up an infectious disease?

Students could also take swabs with cotton buds of places around the classroom that they think may have more or less bacterial colonies. The door handle or teacher's keyboard usually make good areas for investigation. If you are not familiar with it, please remind yourself of CLEAPSS guidance for schools regarding microbiology (available through your school membership of CLEAPSS). Swabs should not be taken for high-risk areas such as the school toilets. This free leaflet is provided as a summary for students but may require adaptation:

**science.cleapss.org.uk/Resource/SSS001-Microorganisms.pdf**

INFECTION CONTROL NURSE WASHING HIS HANDS
© Nata-lunata

## MAIN 1: STOP THE CHOLERA

The purpose of this activity is to allow students to work with real data and present it appropriately in order to see patterns that enable conclusions to be drawn. Students will be introduced to the study of epidemiology, given the chance to analyse historical data and develop spatial and mapping skills. This activity requires the use of computers but you could prepare paper resources (such as a print out of the map) beforehand, adapted as needed.

John Snow's data as a Google Fusion table:
**google.com/fusiontables/DataSource?docid=147wlDisDp6NnpNxHQpbnjAQ-iW4dR2MAmFdQxYc#rows:id=1**

In other formats:
**blog.rtwilson.com/john-snows-cholera-data-in-more-formats/**

Source: Robin Wilson, Southampton University via The Guardian:
**theguardian.com/news/datablog/2013/mar/15/john-snow-cholera-map**

Tell the students who John Snow was and provide some historical context. Explain that for the following exercise, the year is 1854. An outbreak of cholera started a fortnight ago in the local area and 550 people have died.

Ask students to work in groups (ideally of three) and prepare a telegram to the local council. The lead student assumes the role of John Snow, while the other two act as his research assistants. Provide students with:

- Resource 1.1: John Snow's theories about cholera (page 15)
- Access to the open data above which provides information that students can use to map the outbreak.
- Resource 1.2: Extracts from interviews with local residents. (page 16)

Students then have to work as a team to use this data to decide what they should tell the local council to do in their telegram.

Students should use the map and the interview data to conclude the pump at Broad Street is the source of infection and should be closed.

### Differentiation

To support students, a pre-prepared plotted map could be provided or displayed (e.g. **theguardian.com/news/datablog/interactive/2013/mar/15/cholera-map-john-snow-recreated**) or the map creating could be done as a class activity led by the teacher.

## MAIN 2: WHAT'S THE SOURCE?

Escherica Coli are bacteria that live in the lower intestine. There are several strains of E. coli that are harmless, but some can cause diarrhoea, blood and fluid loss, and dehydration. If untreated, an E. coli infection can sometimes progress to kidney failure. E. coli is transmitted through ingestion of food contaminated with faeces. In this activity students have to reach this conclusion through analysis of data.

In this activity, students work alone or in pairs in the role of scientific officers working at the Food Standards Agency (FSA): **food.gov.uk/the-website-of-the-food-standards-agency**

Explain to students the role of the FSA in ensuring that food we buy is as described and safe to eat. Students may have heard of FSA in relation to the controversy over horsemeat. In this scenario they need to determine what is the cause of an outbreak of E. coli.

Provide students with Resource 1.3: What's the source? (page 17), which provides data on the meals that five people ate before they became ill with E. coli infections. Knowing that E. coli is spread by contaminated food, through a process of cross-referencing they can identify what the likely source is. Students will need to eliminate food that is unlikely to be the source, i.e. cooked food. Following the activity, discuss how conclusive this is as evidence and what the FSA would do next (i.e. carry out tests on samples of the suspected food).

ESCHERICHIA COLI BACTERIA

## Plenary

Focusing on infectious disease, and taking what they have learnt in this lesson, students work individually in the role of an infection control nurse. After a discussion on the challenge of infection control in hospitals, they have to come up with an action plan for their local hospital, on what staff, visitors and patients need to do to prevent the spread of infectious disease. This is intended as a draft, which they will improve in lesson 4.

## Differentiation

To support students you can provide Resource 1.4: Infection control action plan (page 18) as a template for completing their action plan.

## Homework ideas

Students can be asked to research either John Snow or Florence Nightingale, and produce a factfile or podcast, or they could be asked to write an article to celebrate the anniversary of Snow or Nightingale's birth.

Alternatively they could research the job of an infection control nurse (or one of the other roles highlighted in this lesson, see Further reading for useful links), finding out what a typical day is like and what qualifications and training are needed, to produce a careers factfile or podcast. Resource 1.5: Career factfile (page 19) could be used as a template, and they could be collated on to the school's VLE/MLE.

## Assessment questions

1. How can epidemiology help us to prevent infectious disease?
2. Extend: How can epidemiology help us to prevent non-infectious disease?
3. How can you prevent infectious disease from spreading at home and school?
4. Why are infectious diseases a problem in hospitals?

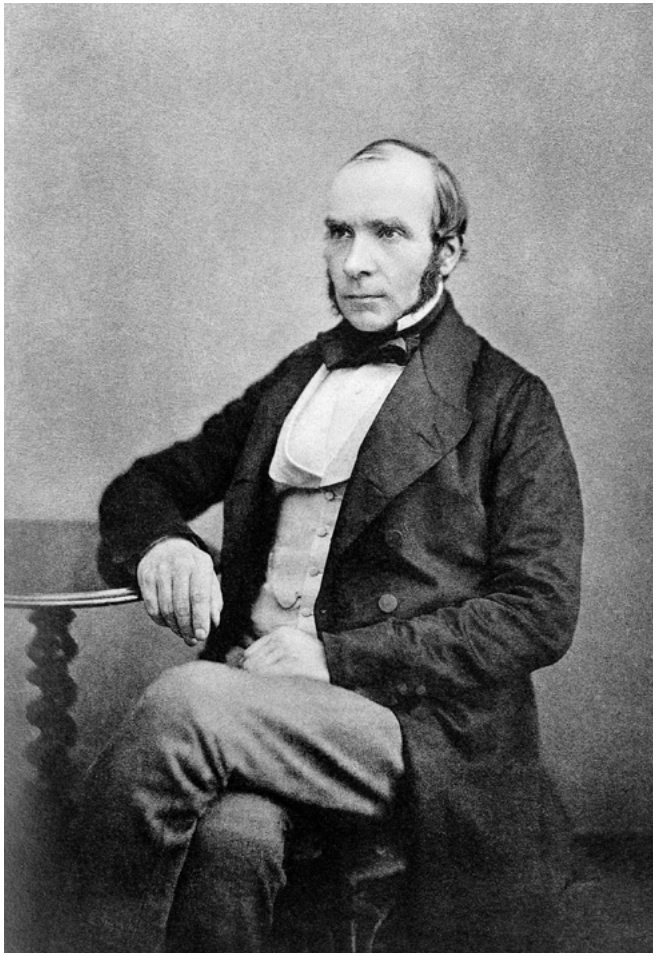
## Extension

What other places do you think infectious diseases would be a particular problem? Why?

5. How can you prevent infectious diseases from spreading in hospitals?

## LESSON 1: GERM WARS

# RESOURCE 1.1: JOHN SNOW'S THEORIES ABOUT CHOLERA



DR JOHN SNOW, 1856
Wellcome Library, London

Highlight any words or phrases you do not understand and check their meaning with your team, a dictionary or your teacher and write their definitions underneath.

"People think that cholera is spread by miasma in the air, but I do think this is true. I have studied diseases of the lungs and cholera is not one of them. I think it is spread by something people ingest, because it results in symptoms related to the digestive system – vomiting and diarrhoea. We have a problem in London with sewage in water – have you seen the Thames? I think there is something from sewage that is contaminating water and people contract cholera if they drink this contaminated water."

Definitions:

LESSON 1: GERM WARS

# RESOURCE 1.2: EXTRACTS FROM INTERVIEWS WITH LOCAL RESIDENTS

### Owner of local coffee shop in Soho:

"I'm a bit worried for business as I've had nine customers contract cholera. I've used water from the Broad Street pump to serve with meals, people like some water with the meals."

### Worker in Soho area:

"Oh I don't drink plain water, I like sherbet. We all do. It's our favourite drink for when you still need your senses about you! We mix this powder in to water we get from the Broad Street pump and it fizzes up to make a lovely drink. Try it, you'll like it."

### Proprietor of brewery in Soho:

"I have been worried because I cannot afford to lose workers, but I've been lucky. Guess the Reverend is wrong that drink is from the devil because God is protecting it! I do let my men drink water, they take it from the well we use to make the beer. I also know they drink the beer too, but I let it go because it keeps them happier workers!".

### Soho workhouse supervisor:

"We have 535 inmates and maybe only a handful has had this cholera you speak of. This is why God says we should not be idle! Of course we give them water, we have our own well here and any other water we need we get from Grand Junction Water Works."

### Factory manager:

"I am worried yes, we have had quite a few men be unwell and it's not good for me. I need my workers working... and alive. Sixteen men have died! It is thirsty work so I do keep water in tubs on hand for them to drink during the day, I get one of them to fill the tubs up in the morning from the Broad Street pump."

### Son of lady who lived away from Broad Street but died:

"Well actually my mother did like the water from the Broad Street pump, she liked the taste when she use to live around there. You know how women are they get stuck on a thing, she use to have bottles of it brought to her. My cousin was visiting and they both had some of that pump water for refreshment, and the next day they died. It is such a tragedy for our family to have lost them both the same day. What a terrible disease is this cholera! I'm scared I will catch it from their clothes and things."

## LESSON 1: GERM WARS

# RESOURCE 1.3: WHAT'S THE SOURCE?

The Food Standards Agency is an independent Government department, based in London. It's their job to use their expertise and influence so that people can trust that the food they buy and eat is safe and honestly described. You can find out more about the FSA on their website:

**food.gov.uk/about-us/about-the-fsa**

Imagine you are a scientific officer for the FSA and you have been called in to investigate this outbreak of E. coli in your local area. It is important you identify the potential source quickly to prevent further infections. You have been given information on the meal each of the five patients had before feeling ill. All the food has been brought either in the local market (M), or in the local supermarket (S) and the letters indicated what was brought from where.

Identify the likely source, stating reasons, and state and explain your next steps.

### Patient 1:

- Pork chops – roasted (S)
- Potatoes – roasted (M)
- Mixed salad: rocket, watercress and spinach (S)

### Patient 2:

- Lentils – boiled (S) with tomatoes and onions – shallow fried (M)
- Watercress salad (S)
- Spinach – steamed (S)

### Patient 3:

- Chicken nuggets – baked (S)
- Mixed salad – rocket, watercress and spinach (S)

### Patient 4:

- Lentil and spinach soup (S)
- Mixed salad – beetroot,watercress and rocket (S)
- Seeded brown bread (M)

### Patient 5:

- Sea bass – baked (S)
- Spinach – shallow fried (S)
- Potatoes – boiled (S)

## LESSON 1: GERM WARS

# RESOURCE 1.4: INFECTION CONTROL ACTION PLAN

INFECTION CONTROL NURSE


Imagine you are the Infection Control Nurse at your local hospital. You need to provide rules for others to follow, to ensure that infection is controlled in your hospital. Use this template to record your action plan.

### Hospital name

### Infection control nurse

### Rules for patients

### Rules for visitors

### Rules for staff

LESSON 1: GERM WARS

# RESOURCE 1.5: CAREER FACTFILE

## So you want to be a...

The purpose of your role would be:

You will need the following qualifications and training:

Some of the organisations you could work for are:

A typical day would consist of:

You would use these skills:

Other similar careers would be:

# LESSON 2
# ACTIVE LONDON

## BIG IDEA

The purpose of this lesson is for students to understand the skeletal and muscular systems of the body i.e the mechanics of how the body moves, using London's sporting and active life as a stimulus. They will learn about the levels and types of activity (i.e. exercise) that support good health and how that varies from person to person.

## LEARNING OBJECTIVES

Some students will understand basic biomechanics, and calculate the force required by the biceps to lift a weight using the concept of levers.

Most students will describe the function of muscles and give examples of antagonistic muscles.

All students will be able to describe the structure and function of the human skeleton and the importance of exercise.

## RESOURCES

**Resource 2.1A:** Human skeleton with label lines

**Resource 2.1B:** Human skeleton without labels

**Resource 2.1C:** Human skeleton labelled

**Resource 2.2:** Teaching notes – Muscle demonstration model

**Resource 2.3:** Teaching notes – How much force is needed?

**Resource 2.4:** Fit for what?

**Resource 2.5:** Simple fitness tests

**Resource 2.6:** Activity levels during the day

# LESSON 2
# ACTIVE LONDON

## YOU WILL ALSO NEED

- Pre-prepared model for muscle demonstration (see Resource 2.2: muscle demonstration model page 27)
- Small weights or objects e.g. tin cans or books
- Weighing scales
- Metre rulers
- Rulers
- Skipping rope or step (optional)
- Stopwatches
- Exercise mats (or suitable ground/floor)

## KEYWORDS

- Muscle
- Bone
- Skeleton
- Antagonistic
- Force
- Energy

## MATHEMATICAL SKILLS

- Multiplication
- Algebra (re-arranging equations)

## LESSON 2: ACTIVE LONDON

# SETTING THE SCENE

London is the home of world famous sporting venues, dance centres and sporting events.

Whether as a professional sports person or as an amateur there are many chances to get involved. Local parks run free fitness training; an increasingly popular way to get fit for all ages is Parkrun:

**parkrun.org.uk**

London's rivers and canals offer chances for canoeing and kayaking. In addition to local sport, the city houses some of the world's most iconic sports venues, such as the All England Lawn Tennis and Croquet Club at Wimbledon and Wembley Stadium, as well as the Queen Elizabeth Olympic Park and dance venues such as Sadler's Wells.

Central to the activities at all these exciting London venues is the biology of the human body. The function of muscles and skeleton and ensuring peak fitness is of paramount importance to the performance of athletes, dancers and sports people. The fluid and forceful movements of dancers, footballers and runners are possible because the human body obeys concrete mechanical principles, the study of which is called biomechanics.

WOMAN RUNNING IN THE MORNING, HYDE PARK

## LESSON 2: ACTIVE LONDON

# ACTIVITIES

### STARTER

Introduce the idea that through living processes (MRS GREN) we expend energy, and one of those is movement. Ask the class how we move and review the functions of the skeleton. Students label a diagram of the skeleton – Resource 2.1A: Human Skeleton – with label lines (page 27).

### Differentiation

Hand out the appropriate worksheet for students to either challenge or support. You can provide keywords to support labelling the diagram.

### MAIN 1: HOW MUCH WORK IS THAT?

Demonstrate how an antagonistic pair of muscles work using Resource 2.2: Teaching notes – muscle demonstration model (page 30). You could also use this video from the Wellcome Trust:
**bigpictureeducation.com/video-bone-biomechanics**

Go on to explain how to calculate the force applied by muscles (Resource 2.3: How much force is needed? (page 31), provides additional teacher information) before introducing the practical activity in which students calculate the force required to lift different weights. Depending on the scales used, students may need to convert mass to weight.

AVANT GARDE BIG DANCE
© Sadler's Wells

### Differentiation

Students can be extended by linking force applied to the energy used (*work done = force applied x distance applied for*).

To support students, weights/objects could be pre-labelled.

## MAIN ACTIVITY 2: FIT FOR WHAT?

Discuss the concept of "fitness" and draw out student ideas of what it means to be fit. It is important here to draw out the idea that the concept of fitness is relative to specific activities, using the discussion prompts in Resource 2.4: Fit for what? (page 32). Go on to discuss what type of fitness is needed to complete different activities in major sporting events in London, including the London Marathon and the 2012 Olympics, to dance and to walk to school.

Introduce the idea of recovery from activity as one measure of aerobic fitness. Students carry out a simple test of aerobic fitness in this way, as well as of muscle strength and endurance Resource 2.5: Simple fitness tests (page 33). It is best to get the whole class to take their resting pulse rate at the same time, while seated and while you model the process. For the rest of the activity students work in pairs so they can test and time each other. This part of the lesson needs some space, and could be carried out outside or in a sports hall. Ensure you are aware of any special needs of your class before carrying this activity out, having liaised with the PE department.

Students discuss how their fitness could be improved, drawing out ideas about 'cardio' exercise and 'weight' training and linking this to the earlier discussion about different activities. Depending on their interests, student can come up with three key things they could do to be more 'fit' for their chosen activity. Finally, they could compare Marathon training plans for beginners and decide which they think is better or why (for which there is no 'right' answer).

Virgin London Marathon Training Plan A:
**virginmoneylondonmarathon.com/en-gb/trainingplans/beginner-17-week-training-plan/**

Virgin London Marathon Training Plan B:
**london-marathon.s3.amazonaws.com/vmlm2014/stage/uploads/pdfs/MartinYellingsBeginnertrainingplan.pdf**

For explanation of types of runs:
**london-marathon.s3.amazonaws.com/vmlm2014/stage/uploads/pdfs/Howtousetheplans.pdf**

Source
**virginmoneylondonmarathon.com/en-gb/trainingplans/**


RUNNERS AT THE TOWER OF LONDON JUST PAST TOWER BRIDGE
Chris Raphael © Virgin Money London Marathon

## Differentiation

If students have access to smartphones/tablets they could take measurements to collect data on their speed, distance, time, acceleration, heart rate and breathing rate; which could then be collated and analysed using Excel.

iOS **itunes.apple.com/gb/app/sensorlog/id388014573?mt=8**

Android **play.google.com/store/apps/details?id=com.hfalan.activitylog&hl=en**

Depending on your class, you can extend and interest them by exploring other fitness tests. This video explores fitness tests carried out by athletes, such as Paula Radcliffe, as part of their training:

**bigpictureeducation.com/fitness-tests**

Resources and ideas provided by Wellcome Trust In the Zone box (sent to all schools prior to the 2012 London Olympics) could be used to provide a carousel of activities to assess lung capacity and changes to breathing rate in relation to exercise, or to the relationship between muscle size and strength. See:

**getinthezone.org.uk/schools/ages-11-19**

Students can discuss what genetic and lifestyle factors can affect lung capacity (including asthma and smoking).

## Plenary

Using think-pair-share gather the ideas of the class about the risks of a sedentary lifestyle. They should come up with obesity, joint stiffness, muscle atrophy and cardiovascular disease. Ask students to create a timeline of a typical day and identify when and how they are active, as an annotated graph of ‘activity level’ (measured qualitatively from sedentary, up to extremely active) versus time using Resource 2.6: Activity levels during the school day (page 34). Students then discuss this and come up with ways to increase their activity levels, for example by standing while talking with friends or doing stretches while watching TV.

## Homework ideas

Students research one of the London 2012 Olympic GB medal winners, and produce a summary of what training they did in preparation.

For the following lesson it is good if students bring in as many different food labels as they can.

## Assessment questions

1. What are the functions of the skeleton?
2. How do muscles work?
3. What does it mean to be fit?

## Extension

4. How does the meaning of fitness vary for different groups of people, or at different times for the same person? Why?
5. Is going running regularly enough to train for the marathon? What else is needed? Why?

## Further reading

Wellcome Trust's Big Picture on Exercise, Energy and Movement

**bigpictureeducation.com/exercise-energy-and-movement**

(Note that Big Picture is aimed at GCSE students but can provide useful stimuli and information for KS3).

Current physiology research collated by Wellcome Trust for In the Zone:

**getinthezone.org.uk/media/9492/itz-current-physiology-research.pdf**

Career information on sports science
UCL Institute of Health and Sports Science

**iseh.co.uk/**

The British Association of Sports and Exercise Sciences, About Sport and Exercise Science:

**bases.org.uk/About-Sport-and-Exercise-Science**

Routes to Practising as a Sport Exercise Psychologist:

**bases.org.uk/Routes-to-Practising-as-a-Sport-Exercise-Psychologist**

Exercise physiology:

**understanding-life.org/what-physiology/focus-on-sport**

Podcast – what is sports physiology?

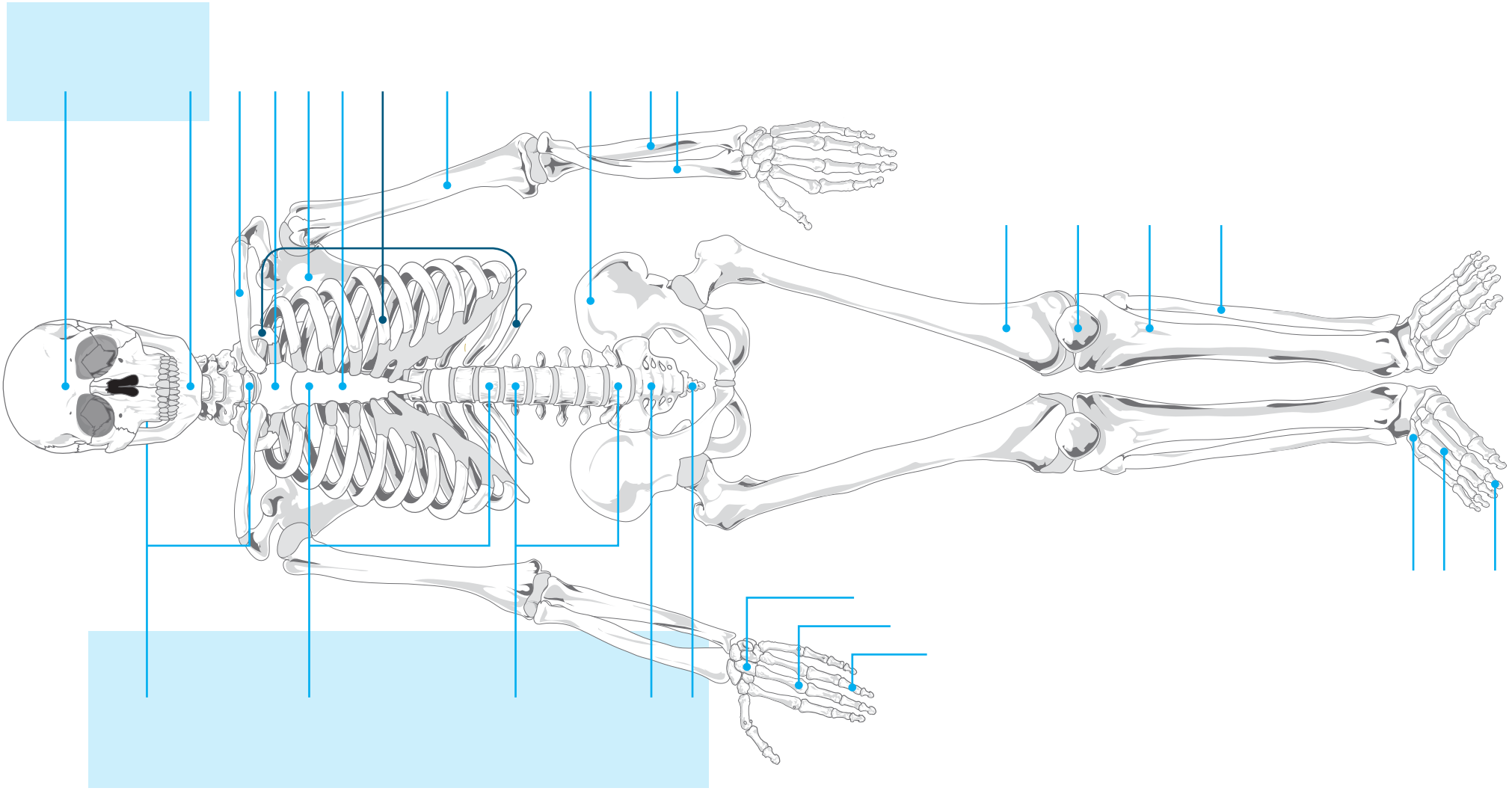
**understanding-life.org/resource/what-sports-physiology**

An example of public 'active spaces' in London:

**iseh.co.uk/research-and-education/population-health/camden-active-spaces**

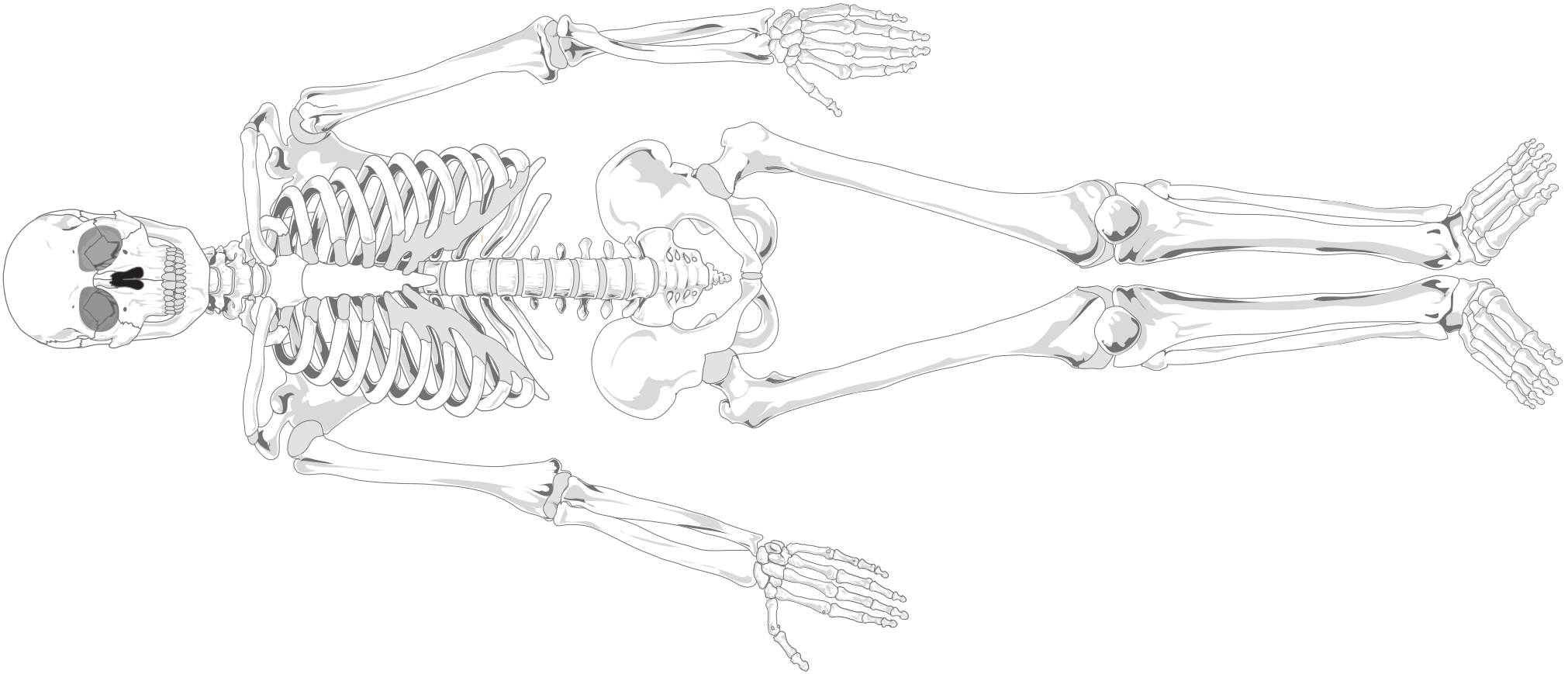
## LESSON 2: ACTIVE LONDON

# RESOURCE 2.1A: HUMAN SKELETON – WITH LABEL LINES



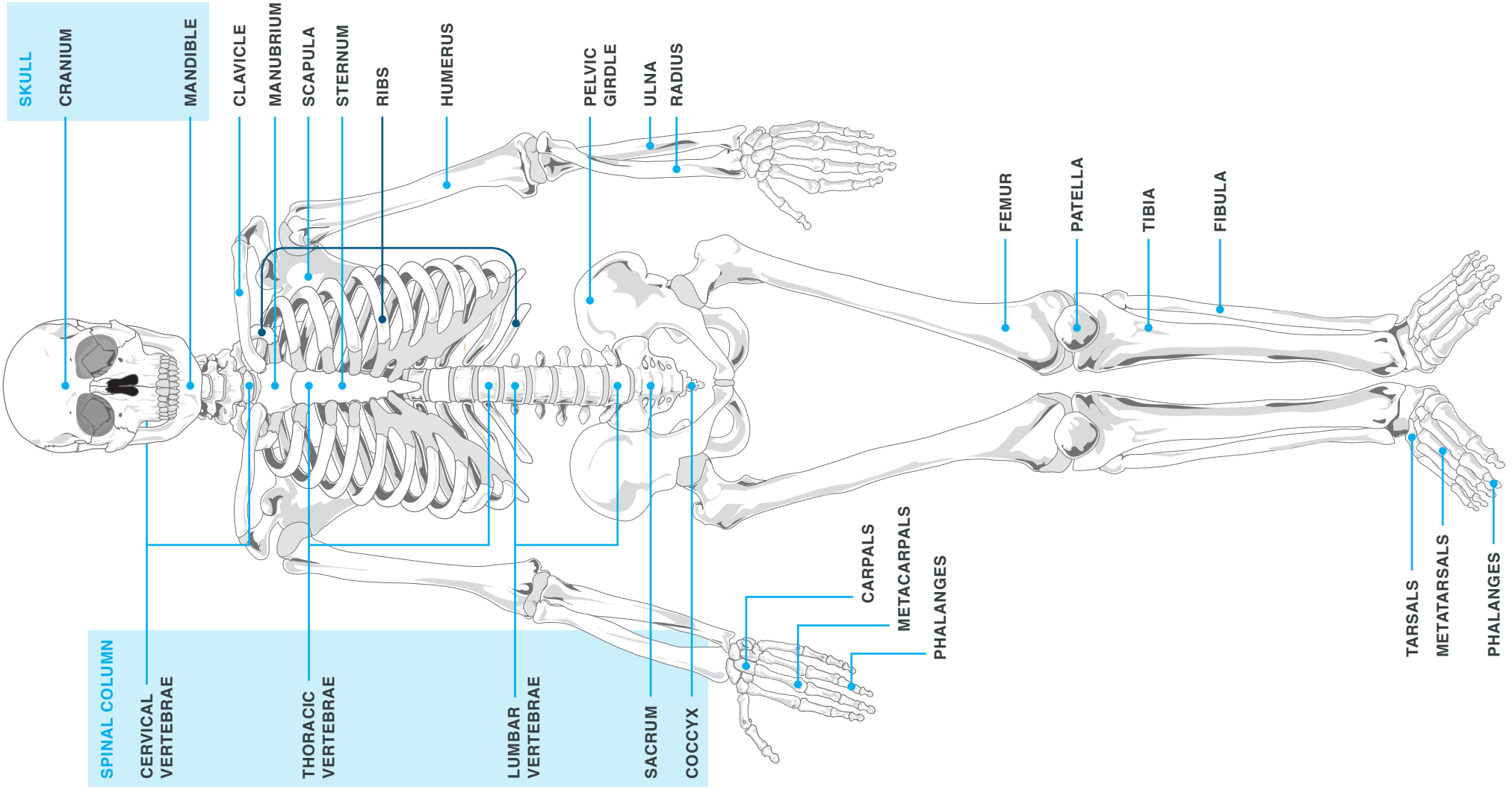
## LESSON 2: ACTIVE LONDON

# RESOURCE 2.1B: HUMAN SKELETON – WITHOUT LABELS



## LESSON 2: ACTIVE LONDON

# RESOURCE 2.1C: HUMAN SKELETON – LABELLED



## LESSON 2: ACTIVE LONDON

# RESOURCE 2.2: TEACHING NOTES – MUSCLE DEMONSTRATION MODEL

You can use the following model to demonstrate muscles working as antagonistic pairs. You could extend students by asking them about the limitations of the model (for example, not having tendons or ligaments represented). You may have other models in school that they could compare this one too.

A common misconception students may have is that muscles push and pull, in fact muscles contract which pulls on a joint. An antagonistic muscle contracts to pull the joint in the other way. In this way we are able to move. This model uses the elbow joint, which is something students are easily able to understand as they can also feel their biceps and triceps. Depending on your class you may wish to get them to construct a model themselves, having carried out an appropriate risk assessment.

You will need per model:

- Two lollipop sticks
- Two rubber bands
- Large paperclip
- Butterfly pin
- Bunsen burner, with safety mat
- Craft knife/scalpel
- Cutting mat
- Safety goggle

One lollipop stick represents the humerus, the other the ulna/radius. In each one make a hole (which can be done with a drill, or by heating an unbent large paperclip with a Bunsen burner and using the hot tip to then create a hole). The ulna/radius will also need another hole at the other end. Then you will need to make notches to hold the rubber bands in place (see diagram). The notches on the ulna/radius will need to be a bit wider than for the humerus, to stop the rubber bands coming off.

Each lollipop stick will end up looking like this:

Humerus:


Ulna/radius


Using a butterfly pin passing through hole 1 and hole 4, attach the two sticks together to create the elbow joint. Then place the rubber bands around the notches, with one rubber band connected from notch 6 to notch 2 (representing the biceps), and the other rubber band from notch 7 to notch 3 (representing the triceps).

By using the unbent paperclip passed through hole 5, you can represent a hand and demonstrate lifting and lowering a weight. (This could be substituted by a light weight such as sticky tack on a string).

## LESSON 2: ACTIVE LONDON

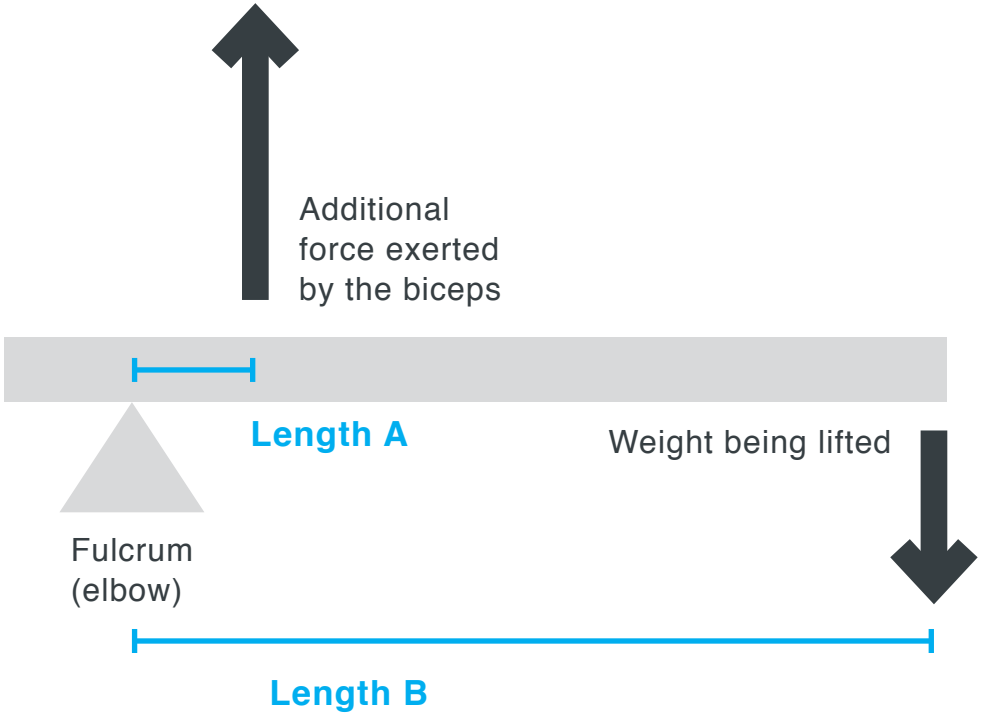
# RESOURCE 2.3: HOW MUCH FORCE IS NEEDED?

Using a model you can get students to identify how the arm is acting as a lever, with the elbow joint as a fulcrum. When lifting a weight, the biceps carries the load. What is happening can be simplified to a class 3 lever, in which the weight of the lower arm itself is discounted (therefore the force is termed 'additional'). If you were to include the weight of the lower arm, it would be acting at the point of the centre of gravity for the arm.

*Additional force x Length A = Length B x weight*

therefore,

$$\textit{Additional force} = \frac{\textit{Length B x Weight being lifted}}{\textit{Length A}}$$



## LESSON 2: ACTIVE LONDON

# RESOURCE 2.4: FIT FOR WHAT?

Discuss some of the following questions:

1. What does fitness mean?
2. Are there different types of fitness?
3. Is a good swimmer always a good runner? And vice versa?
4. What is the difference between a successful sprinter and a successful marathon runner? Who is more fit?
5. Tom Daley won a Bronze in the 10m platform diving at the London 2012 Olympic games. What types of fitness make him successful? How does that differ from a successful swimmer? How is it different?
6. Jessica Ennis is a track and field athlete who competes in heptathlons, which involve seven events over two days. She won Gold in the London 2012 Olympic games. The first day of a heptathlon comprises 100m Hurdles, High Jump, Shot Put and 200m. Day two comprises Long Jump, Javelin Throw and 800m. What different types of fitness are needed for each of these events?
7. Jessica Ennis has returned to competing after having a baby. How might pregnancy affect her fitness?
8. In the London 2012 Olympic games, Nicola Adams won the Gold in Women's (fly-weight) boxing. See: **olympic.org/videos/nicola-adams-makes-olympic-boxing-history** What sort of fitness is needed to be a successful boxer?

You can find further GB medal winners from London Olympics 2012 here:

**bbc.co.uk/sport/olympics/2012/medals/countries/great-britain**

INSIDE THE LONDON OLYMPIC STADIUM, 2013

LESSON 2: ACTIVE LONDON

# RESOURCE 2.5: SIMPLE FITNESS TESTS

You are going to carry out some simple fitness tests in pairs and record your results in the tables provided.

## Recovery from aerobic exercise

First, record your resting pulse following your teacher's instructions.

Then your teacher will direct you to carry out some aerobic exercise for five minutes. Your partner will time you.

Your teacher will direct you as to what to do. It may be:

- Skipping on the spot
- Stepping up and down
- Jumping jacks on the spot

Immediately after exercise, record your pulse rate and then continue to record it every minute afterwards until you get back to your resting pulse rate.

| TIME AFTER EXCERCISE / MIN | PULSE / BEATS PER MINUTE |
|---|---|
| Before excercise (resting pulse) | |
| 0 | |
| 1 | |
| 2 | |
| 3 | |
| 6 | |
| 5 | |

You can extend this table as required.

- Why do you think this is one valid measure of aerobic fitness?
- What are the limitations of this test?
- How can you make it more reliable?

## Muscle endurance

You are going to hold the basic plank position for as long as possible. Your partner will time you, the timer starts once you are in position.

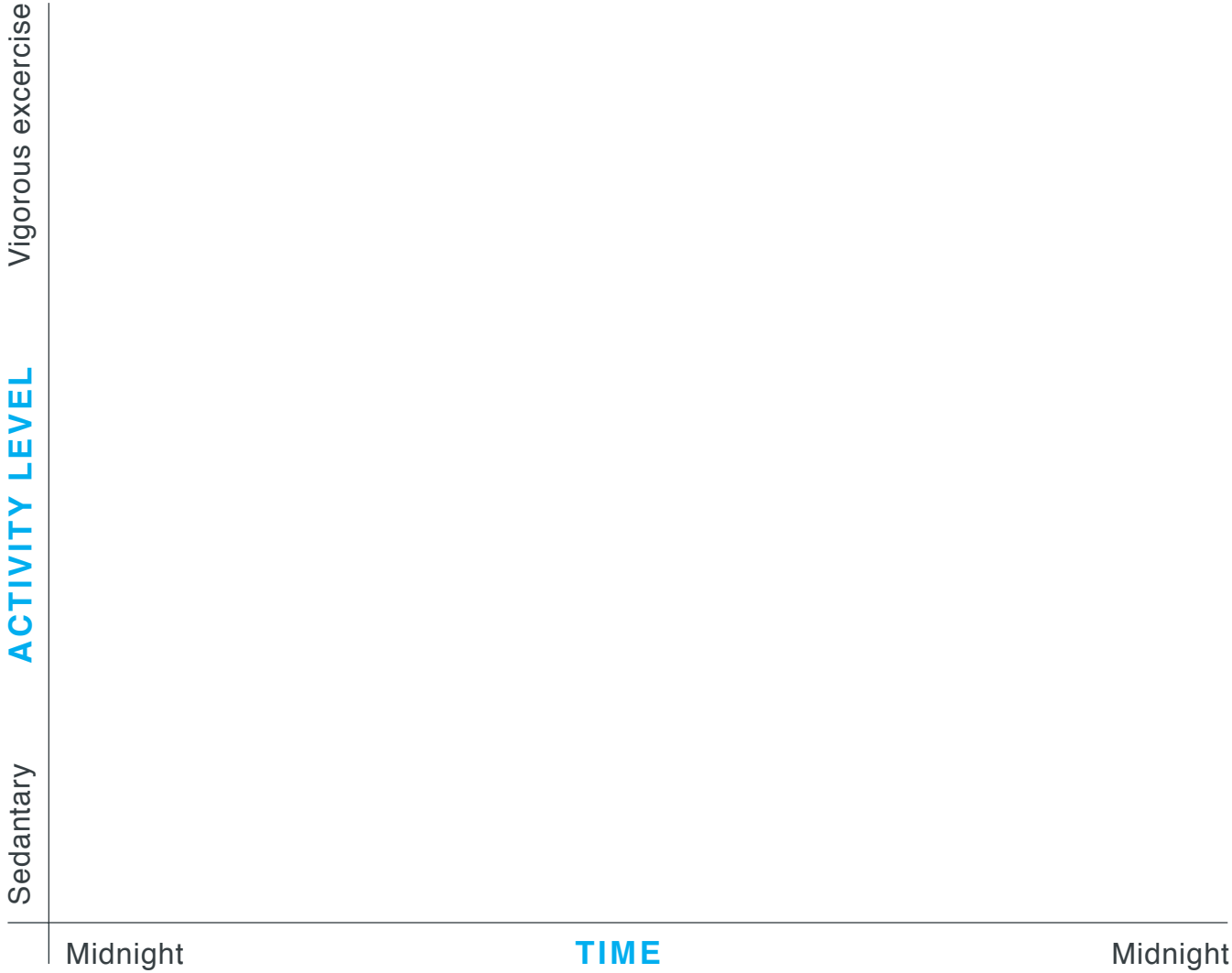
Start on elbows and knees, locking hands together so your forearms create a V-shape. Straighten your legs and raise your body so that the balls of your feet support you. Your feet should be hip-distance apart. Face the floor, with your gaze on your hands, being careful not to arch your back or stick your bottom in the air. You should feel muscles around your core working. If you feel pain in your lower back you should stop and tell your teacher.

**Time basic plank held for:** _____

- Why do you think this is one valid measure of muscle endurance?
- What are the limitations of this test?
- How would you test the endurance of other muscle groups?

## LESSON 2: ACTIVE LONDON

# RESOURCE 2.6: ACTIVITY LEVELS DURING THE DAY




Divide the x-axis so that it represents one day (24 hours).

Think of a normal school day and label key points in the day such as lunch, lesson times, travel home etc.

Think about your activity levels and draw a line graph to represent that.

Annotate your line graph with activities, such as sleeping, eating, playing a sport, watching TV etc.

# LESSON 3
# THE FUNCTION OF FOOD

## BIG IDEA

The purpose of this lesson is for students to understand what makes up a healthy diet, and the consequences of an unhealthy diet.

## LEARNING OBJECTIVES

Some students will describe the importance of bacteria in the human digestive system.

Some students will calculate the energy requirements to get to a healthy weight for someone who is overweight.

Most students will calculate the energy requirements for a healthy daily diet.

Most students will describe the consequence of imbalances in the diet.

All students will describe the components of a healthy diet and explain why each one is needed.

## RESOURCES

**Resource 3.1:** Components of a healthy meal

**Resource 3.2:** What's that for?

**Resource 3.3:** What's missing?

**Resource 3.4:** Energy needs

**Resource 3.5:** Basal metabolic rate and daily calorie need

# LESSON 3
# THE FUNCTION OF FOOD

## YOU WILL ALSO NEED

- Paper plates
- Food labels
- Calculators
- Access to computers
- Access to the internet

## KEYWORDS

- Calorie
- Joule
- Protein
- Fat
- Water
- Carbohydrate
- Deficiency
- Starvation
- Obesity
- Vitamin
- Mineral
- Gut bacteria
- Energy
- Basal
- Metabolic rate

## MATHEMATICAL SKILLS

- Addition
- Subtraction
- Division
- Multiplication

## LESSON 3: THE FUNCTION OF FOOD

# SETTING THE SCENE


VEGETABLE STALL AT BOROUGH MARKET, 2009


### London Health Commission and children

The London Health Commission was an independent inquiry established in September 2013 by the Mayor of London. It examined how London's health and healthcare can be improved for the benefit of the population. The Commission published its final report, Better Health for London, in October 2014.

The report highlighted that London has the highest proportion of obese children in all the regions of England. In London almost 1 in 3 children in Year 6 are overweight or obese. The risk of obesity is higher in deprived areas of London. As well as the physical health risks of obesity, such as diabetes and cardiovascular disease, obesity can also cause mental health problems. Children who are obese are more likely to be obese as adults. In simplistic terms, obesity is caused by a calorie surplus and therefore to tackle obesity either calorie intake needs to be reduced and/or calorie use increased. The previous lesson looked at activity levels as a means of calorie expenditure, and this lesson looks at calorie intake as well as what it means to have a healthy diet.

## LESSON 3: THE FUNCTION OF FOOD

# ACTIVITIES

### STARTER: A BALANCED DIET

Using a paper plate, students draw their dinner from the previous day. They are then shown Resource 3.1: Components of a healthy meal (page 41) and draw comparisons. They discuss in pairs what was healthy about their meal and how it could be improved.

### MAIN 1: WHAT'S THAT FOR?

Hand out Resource 3.2: What's that for? (page 42) and Resource 3.3: What's missing? (page 43) Ask students in pairs to diagnose the dietary deficiency and recommend an improved diet for each of the cases in Resource 3.3, using the information in Resource 3.2.

Students discuss what deficiencies they would expect in Londoners in modern times.

### Differentiation

Students can find out what the role of gut bacteria is in maintaining health.

In addition, students could be extended by looking at the impact of sugar intake and the development of diabetes (bearing in mind that the details of insulin action are covered in the KS4 curriculum).

### MAIN 2: TRAINING FOR THE MARATHON

Students discuss nutritional needs of training for and also of running the marathon, focusing on the importance of protein, carbohydrate and water. Students research online, looking at different meal training plans and identify potential problems. A good place to start is with these websites:

**virginmoneylondonmarathon.com/en-gb/training/nutrition/nutrition-and-hydration-facts**

**bbcgoodfood.com/howto/guide/what-eat-when-running-marathon**

There is a lot of active research in this area and some information on the internet is subjective, so this is an opportunity to get students to think about the reliability of their sources.

Based on their research, students come up with a meal plan for training days, rest days and the day of the Virgin Money London Marathon itself.

### Differentiation

Students could take one or more of the London 2012 Olympic events and, thinking about the differing needs, come up with a different balanced meal for the day before the event for the different athletes, thinking about the calorie intake required. To challenge students they could be asked to compare two very different events (e.g. weight lifting versus 10,000m race) and be asked to provide justification for the different meals.

## MAIN 3: HOW MANY CALORIES DO YOU NEED?

Introduce the idea that if you consume too many calories you will gain weight as the excess energy is stored as fat, and if you consume too few you will lose weight. If you need to maintain your weight you need to consume each day the amount of calories you would use. Ask students to discuss in pairs what they need energy for during the day. Show Resource 3.4: Energy needs (page 44) and ask students to discuss what would differ in the energy needs of the people featured (age – whether they are growing, gender – muscle mass, how active their job and lifestyle is and if they play any sport or exercise).

Then hand out Resource 3.5: Basal metabolic rate and daily calorie need (page 46) and ask students to calculate their own basal metabolic rate, which they can multiple using the formula shown to provide an estimate of their daily energy needs.

Thinking about how their daily energy need would be met over breakfast, lunch and dinner, students pick one meal to focus on. They then look at a number of food labels and come up with a balanced meal both in terms of the components required and the calories required, drawing these out on a new plate with annotations related to energy.

### Differentiation

You could provide students with average calorie expenditure for different levels of activity for their age group/gender (using an average weight for their age), if the calculations will be too difficult or time consuming.

To extend students, get them to calculate for a fictional person how many calories they should consume to lose weight in a safe way. They could combine a programme of increased exercise as well as reduced food intake. Be mindful that students may be conscious about their own weight.

### Plenary

Students can use this website to calculate the energy used by different forms of exercise and use this to see how long it would take to use up the energy in different foods eg salad, cheese, chocolate bar etc.

**extras.bhf.org.uk/Counter/flash_build/index.html**

### Differentiation

Students could be asked to say how many calories they think each activity/food pair represents.

### Homework ideas

Students should devise a survey to find out about the eating and exercise habits of others. This can then be used as a starting point for the Connect activity, but will need reviewing in the next lesson before use.

### Assessment questions

1. What are the components of a healthy diet?
2. What are the consequences of insufficient calorie intake?
3. What are the consequences of consuming too many calories?
4. What are the consequences of consuming too much sugar?
5. Why do we need good gut bacteria?
6. Do nutritional needs change when training? Why and how?

## Further reading

Wellcome Trust Big Picture Food and Diet issue

**bigpictureeducation.com/food**

Paper copies can be ordered (for free) for the classroom.

(Note that Big Picture is aimed at 16+ students but can provide useful stimuli and information for KS3).

**bhf.org.uk/heart-health/preventing-heart-disease/staying-active/exercise-calorie-calculator**

Better Health for London
London Health Commission, 2014

**londonhealthcommission.org.uk/better-health-for-london**

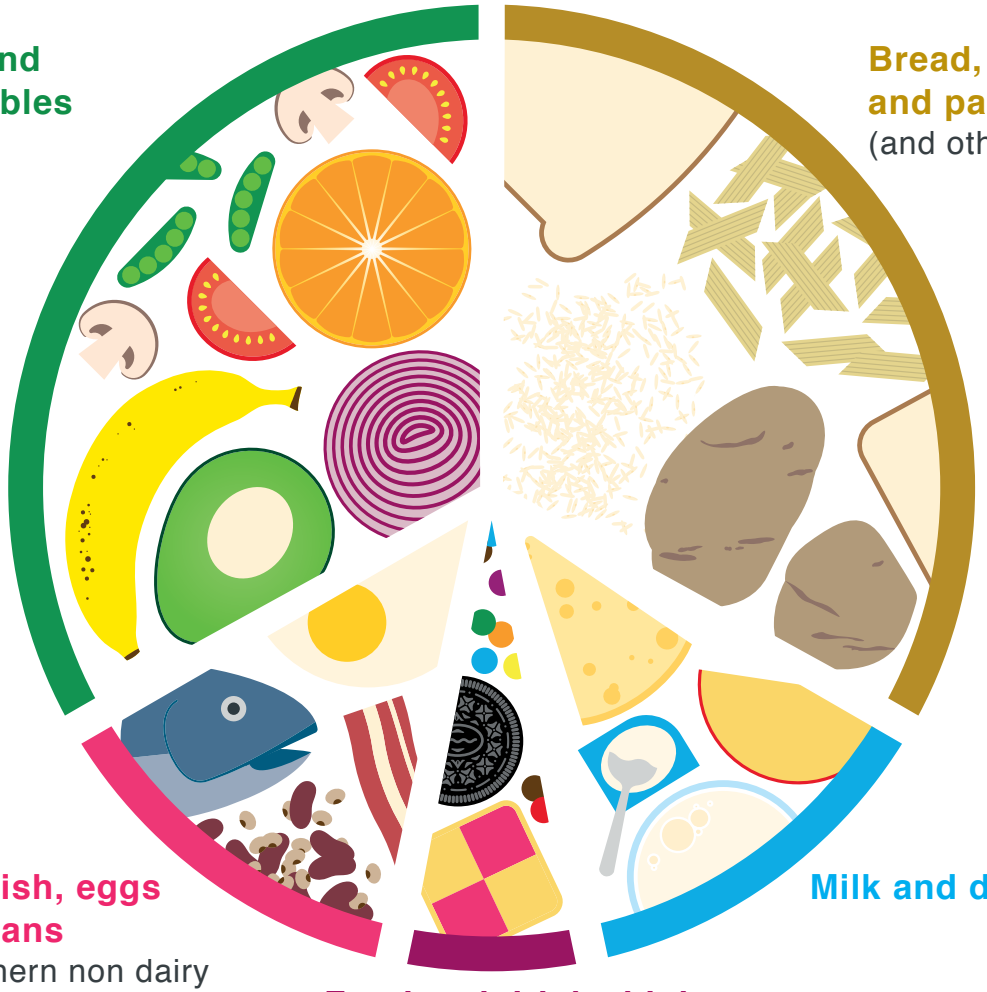
Look out for The Crunch, coming to your school next spring! The Crunch is an exciting year of activities, experiences and discussions about our food, our health and our planet.

In spring 2016 all primary and secondary schools and colleges in the UK will automatically receive The Crunch schools kits for free. Each kit is packed full of scientific equipment, teacher notes, videos, cross-curricular activities and specially commissioned short plays to help learners explore the links between our food, our health and our planet.

**thecrunch.wellcome.ac.uk/get-involved/schools-colleges**

LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.1: COMPONENTS OF A HEALTHY MEAL



## LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.2: WHAT'S THAT FOR?

| COMPONENT | FUNCTION IN THE BODY | EFFECT OF DEFICIENCY |
|---|---|---|
| **FAT** | To provide and store energy, also for body insulation | Weight loss if too little, weight gain if too much |
| **PROTEIN** | Growth and repair of body cells | Weak hair and nails<br>Kwashiorkor (swelling under the skin, weakness, reddish skin tone, swollen tummy) |
| **CARBOHYDRATE** | Energy | Weight loss if too little, weight gain if too much |
| **FIBRE** | Roughage to keep food moving through the gut | Constipation and potential bowel disease |
| **VITAMINS AND MINERALS** | Keep normal chemical reactions healthy | Vitamin C – scurvy (feeling tired and weak, swollen and bleeding gums, easily bruised skin)<br>Vitamin D – rickets (legs bow outwards in growing children)<br>Vitamin A – night blindness |
| **IRON** | | Anemia – too few red blood cells |
| **IODINE** | | Goitre – a swelling in the neck |

## LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.3: WHAT'S MISSING?

Dietary deficiencies in London have been linked historically to poverty and poor understanding of the importance of certain types of food. Using the table in Resource 3.2: What's that for? (page 42) work out what what the problem might be in each case below. What dietary changes would you have recommended?

### Case 1

A fleet of trade ships sailed from London to Sumatra in India to bring spices back to London. They left London in April 1601. The food for the crew consisted mainly of salt beef, cheese, fish, ale and biscuits. By August many of the sailors on the ship had bleeding gums, bruises and lacked energy. The ships were due to stop at Madagascar. What should the crew stock up on?

Diagnosis:

Recommended change to diet:

### Case 2

Cicely Williams (1893 – 1992) was one of the first female medical students at Oxford University, and studied afterwards at the London School of Hygiene & Tropical Medicine. In 1933 she was working as a medical officer in Ghana. While working there she notices that some of the babies that are weaned suddenly from their mothers' milk to the local diet of mainly cereals and potatoes became ill. They became weak, their skin developed a reddish tone and their stomachs became swollen. What is the disease that she has identified?

Diagnosis:

Recommended change to diet:

### Case 3

Samuel Gee, a doctor at Great Ormond Street Hospital during the Victorian Era recorded that around a third of the children he saw suffered from a condition that caused weak bones and bowed legs. What was the condition he was referring to? What would help Dr Gee's young patients?

Diagnosis:

Recommended change to diet:

## LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.4: ENERGY NEEDS

FIREFIGHTER TACKLING A BLAZE
image by Tim White ©

BIG DANCE
image by Claire Farmer

GIRL WATCHING TV
© Alex Traksel

## LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.4: ENERGY NEEDS CONTINUED

GIRL PLAYING ON A SWING
© Smauel Borges Photography

ALEX SCOTT, ENGLAND V MONTENEGRO, 2014
image by James Boyes

YOUNG BOY READING A BOOK
© Larisa Lofitskaya

LESSON 3: THE FUNCTION OF FOOD

# RESOURCE 3.5: BASAL METABOLIC RATE AND DAILY CALORIE NEED

There are 2 formulae used to calculate BMR, in [kcal / 24hrs] for men and women respectively:

## BMR for men

*66.47 + (13.7 x weight [kg])*
*+ (5 x size [cm]) – (6.8 x age [years])*

## BMR for women

*655.1 + (9.6 x weight [kg])*
*+ (1.8 x size [cm]) – (4.7 x age [years])*

Once you've calculated your BMR, this is then put into the Harris Benedict Formula, which estimates your total calorie intake required to maintain your current weight based on your activity levels. This is as follows:

## Little/no exercise

*BMR x 1.2 = Total calorie need*

## Light exercise

*BMR x 1.375 = Total calorie need*

## Moderate exercise (3-5 days/wk)

BMR x 1.55 = Total calorie need

## Very active (6-7 days/wk)

*BMR x 1.725 = Total calorie need*

## Extra active (very active & physical job)

*BMR x 1.9 = Total calorie need*

# LESSON 4
# EMERGENCY!

## BIG IDEA

Many patients that present in A&E do not have a disease but have become unwell due to the abuse of a substance such as alcohol. In this lesson, students learn the effects of recreational drugs and also how hospitals tackle this. A link is made back to the first lesson in order to consider infection control in hospitals.

## LEARNING OBJECTIVES

Some students will be able debate the social and economic implications of recreational drug use.

Most students will be able to identify the possible effects of extreme exercise on health and life process.

All students will be able to describe the effects of recreational drugs on behaviour, health and life processes.

## RESOURCES

**Resource 4.1:** Hospital medical staff

**Resource 4.2:** List of suggested websites for research

**Resource 4.3:** A&E Patients

## LESSON 4: EMERGENCY!

# SETTING THE SCENE

Alongside the prevention of disease through hygiene, diet and exercise, health in London also depends upon a responsive health service. The city's accident and emergency (A&E) departments are amongst the busiest in the country. A&E departments (also known as emergency departments or casualty) deal with life-threatening emergencies, such as loss of consciousness, breathing difficulties or severe bleeding or burns or scalds. Other reasons why people attend emergency departments include sporting injuries or health issues arising from alcohol or substance misuse.

Working alongside the NHS in emergencies and at events, such as the Virgin Money London Marathon, and providing first aid in their communities is the St John's Ambulance.  Every year more than 400,000 people learn to save a life through their training programmes, including hundreds of thousands of young people.


AMBULANCE PARKED OUTSIDE ACCIDENT AND EMERGENCY
© Yorkman

## LESSON 4: EMERGENCY!

# ACTIVITIES

### STARTER: STAYING ALIVE – FIRST AID

Introduce students to Dr's ABC (Danger, Response, Shout for help, Airway, Breathing, Circulation). Teach students the recovery position and get them to practice on each other if there is sufficient space.

**nhs.uk/video/pages/recovery-position.aspx**) Show the 'hard and fast video':

**nhs.uk/video/pages/vinnie-jones-how-to-perform-cpr.aspx**

Use this to get students to think about someone going in to hospital via A&E and get students to think-pair-share the different medical staff that work in a hospital. Then get them to match the different roles with titles Resource 4.1: Hospital medical staff (page 53).

### Differentiation

You could extend students by getting them to also discuss the non-medical staff that would work in a hospital.

ST JOHN'S AMBULANCE FIRST AIDERS AT THE LONDON MARATHON, 2014
image by Katie Chan ©

## MAIN 1: WHAT'S THE EFFECT?

Give teams of students a different substance to research (see list below) and produce a poster about the substance and its effect. These posters are then set up on display and students circulate to learn about the different substances.

Substances:

- Alcohol
- Caffeine
- Nicotine
- Cocaine
- Ecstasy
- Amphetamines
- Cannabis
- Heroin

### Differentiation

Support students by providing a list of websites to use for their research Resource 4.2: List of suggested websites for research (page 54).

## MAIN 2: WHAT'S HAPPENED?

Hand out Resource 4.3: A&E patients (page 55) which describes the symptoms of different people who have turned up at A&E. Ask students to discuss what has happened (which may or may not be related to substance abuse) to present with the symptoms they have. They have to decide first steps and whose role that would be, for example, should the patient be sent to a radiographer for an X-ray?

### Differentiation

To extend students get them to triage the patients, deciding who needs to be seen more urgently.

You can also extend students by getting them to consider the difficulties faced in A&E in terms of the behaviour of patients who come in with problems relating to substance abuse. You can also extend students by getting them to consider ethical and moral implications of treating patients presenting with substance abuse problems, for example with questions such as:

- Should NHS money be spent on those who arrive in A&E having been in an accident after getting drunk?
- Should NHS money be spent on treating patients with addiction?
- Should NHS money be spent on educating the public about the effects of drugs?

## Extension

- What does it mean to be ‘responsible’?
- Do people have real choice in what they do?
- Does making a drug illegal make people safer or in greater danger? Why?
- Is it okay for an athlete to use a performance-enhancing drug? Why?
- It is okay for a dancer to use a performance-enhancing drug? Why?
- Is it okay to use a performance-enhancing drug for an exam in school? Why?
- Should coffee be banned?

These questions give students the opportunity to explore socio-scientific issues. Students should be encouraged to take a scientific approach based on facts, data, information and evidence. Other approaches such as ethical or value based approaches can be used to analyse and understand problems and decision making. Students need to be aware of the different approaches and when to use. There is an opportunity to link back to the diet lesson in terms of socioeconomics and addiction (see further reading for Wellcome Trust resource on Addiction).

### MAIN 3: HOW CLEAN ARE YOUR HANDS?

Revisit the agar plates from Lesson 1.

Students write up their findings in relation the question they decided to investigate.

## Differentiation

Students can be supported by providing sentence starters.

Students can be extended by writing an evaluation of their experiment, including its limitations and what further investigations are required.

## Plenary

Dedicate time to peer review students’ survey of the food and exercise habits of their fellow students that they should have completed for homework from Lesson 3. If this is too challenging for students provide them with a survey you have created.

Students should be asking questions relating to the food groups, water consumption and physical activity. It is best to limit them to six questions (for the purpose of data collation later). It is important to review students’ surveys to ensure they are not asking inappropriate questions (e.g. relating to drug or alcohol use). Students need to also have determined how they are going to collect their data (e.g. use of tallies).

One team of students could survey what the type of food available in the canteen each day and the quantity sold of each item, by asking the canteen staff (this will require liaison with appropriate people in your school).

Considering the scenario of A&E and the results of their experiment, get students to review and re-draft their infection control action plan from Lesson 1.

## Homework ideas

Introduce the Explore visit that class will be making. Ask students to identify a number of enquiry questions that they would like to investigate on their visit, that will extend their understanding of the way science helps Londoners stay healthy. Depending on your chosen destination, examples might include:

- How have improvements in scientific understanding changed the way we treat illness?
- How could Londoners change their behaviour to improve their health?

Students could also carry out their survey, or this could be done after the Explore visit and the Connect lesson.

## Other suggestions

The London Ambulance Service (LAS) has many exciting careers options for Londoners.  To invite a paramedic to visit your school to talk about working for LAS please email mailto:ppi@lond-amb.nhs.uk or call 020 3069 0383. Alternatively use the online booking form:

**londonambulance.nhs.uk/getting_involved/schools/arrange_for_us_to_visit.aspx**

To find out more about careers in the London Ambulance Service please visit:

**londonambulance.nhs.uk/working_for_us.aspx**

## Further reading

**www.stem.org.uk/elibrary/resource/35288/making-a-difference-engineering-careers-in-medicine**

**nationalstemcentre.org.uk/elibrary/resource/9140/debate-kit-are-we-too-clean**

**nationalstemcentre.org.uk/elibrary/resource/501/physical-health-activity-sheets**

**bigpictureeducation.com/addiction**

(Note that Big Picture is aimed at students 16+ but can provide useful stimuli and information for KS3).

**fbs.leeds.ac.uk/performance2012/EducationalResources.php**

**londonlives.org/static/Hospitals.jsp**

**nhs.uk/NHSEngland/thenhs/nhshistory/Pages/NHShistory1948.aspx**

**sja.org.uk/sja/schools.aspx**

## Career information

This website is a fun and informative introduction for young people to careers in medicine.

**tasteofmedicine.com**

LESSON 4: EMERGENCY!

# RESOURCE 4.1: HOSPITAL MEDICAL STAFF

For more details and further information on any of the following roles, visit:

**nhscareers.nhs.uk/a-to-z**

| JOB TITLE | ROLE |
|---|---|
| **AUDIOLOGIST** | Assess hearing and balance function. |
| **CHIROPODIST/PODIATRIST** | Diagnose and treat abnormalities of the lower limbs. |
| **PHLEBOTOMIST** | Collect blood from patients for examination in laboratories, the results of which provide valuable information to diagnosing illness. |
| **LEARNING DISABILITIES NURSE** | Aim to improve the well-being and social inclusion of people to allow them to pursue a fulfilling life. |
| **PARAMEDIC** | Senior healthcare professional at an accident or a medical emergency. |
| **SPEECH AND LANGUAGE THERAPIST** | Assess and treat speech and communication problems in people of all ages and support people with swallowing problems. |
| **VASCULAR SCIENTIST** | Image and assess the blood flow of patients with diseases of the arteries and veins. |

LESSON 4: EMERGENCY!

# RESOURCE 4.2: LIST OF SUGGESTED WEBSITES FOR RESEARCH

**talktofrank.com/drugs-a-z**

**safe.met.police.uk/drugs_and_alcohol/get_the_facts.html**

**drugscope.org.uk/drugsearch**

**project6.org.uk/information-advice**

**nhs.uk/livewell/drugs/Pages/Drugshome.aspx**

**urban75.com/Drugs/helpline.html**

## LESSON 4: EMERGENCY!

# RESOURCE 4.3: A&E PATIENTS

| PATIENT 1 | PATIENT 2 | PATIENT 3 |
|---|---|---|
| A woman in her late twenties comes to A & E complaining of a serious headache. She is very upset and vomiting and is asking for strong pain killers. She says that the pain killers given to her last week by the GP were not strong enough and the headache has not gone away and the others she has been given are making her sick. | A middle aged woman is brought into A&E on a trolley from an ambulance. She has a cut to her hands and one on her face. She is shouting very loudly using poor language and saying that her bag has been stolen. She tries to stand up but is very unstable and needs to be helped back to the seat in the waiting area. | A young boy has been out jogging with his friends and has fallen over the edge of the pavement cutting his knees and elbows. He is complaining of intense pain in his arm and shoulder. |
| **PATIENT 4** | **PATIENT 5** | **PATIENT 6** |
| An elderly gentleman has been found on the floor at his home. He is conscious but his foot is at a strange angle to his body. He is having great difficulty breathing and has a very bad cough. | A teenage girl has been brought in to A&E on a trolley from school. She passed out in a lesson and has a cut on her forehead. She is thin and pale and is complaining of very bad stomach cramps. | A middle aged man waiting in A&E is very violently sick repeatedly. He says he started to feel ill in the middle of the night having been out to eat with friends. He is very pale has strong stomach cramps and is unable to even take a drink of water. He feels very faint. |

# EXPLORE

**A visit to a medical museum, a schools programme at a hospital or a London sporting or food growing venue will allow students the opportunity to explore the ways that science supports health in London past and present.**

# EXPLORE
# HEALTH IN THE CITY

## BIG IDEA

How can Londoners maintain and improve their health?

## LEARNING OBJECTIVES

Could compare and contrast the health benefits of given activities seen on the visit both contemporary and historical.

Should be able to explain how their chosen visit has been involved in the improvement of Londoners health through disease prevention and/or promotion of fitness.

Must ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience.

## EXPLORE: HEALTH IN THE CITY

# PRE-VISIT ACTIVITY

From the previous lesson, students will have identified some enquiry questions they want to investigate. Get students to discuss their questions in pairs and improve them, thinking about how well their question links to the venue and ensuring they have a mix of open and closed questions.

Many of the potential visit sites below run specific activities for schools. Students need to be encouraged to relate what they find at the visit to the connect lesson. In this final lesson they will be asked to summarise their learning from the unit in a report to the governing body of the school about how the health and wellbeing of the school population can be improved. Resource 5.1: Planning tool for presentation (page 68) could be used as a guide for information finding whilst on the visit.

### Homework

If not already done so, the survey of students' food and exercise habits can be carried out.

## EXPLORE: HEALTH IN THE CITY

# POSSIBLE MUSEUM VISITS

### Science Museum

**Exhibition Road, SW7 2DD**

**020 7942 4777**
**edbookings@sciencemuseum.ac.uk**

*Journeys Through Medicine* displays the wide diversity of ways that people have perceived health, using examples that range from prehistoric surgical tools to modern medical equipment.

*Who am I?* explores the way biomedical science is challenging our perceptions of our own identity, behaviour and origins.

You can see the most important piece of mould you'll ever see. There's an early sample of Penicillin in *Making the Modern World* along with one of the first X-ray machines and Crick and Watson's molecular model of DNA.

**sciencemuseum.org.uk/visitmuseum/plan_your_visit.aspx?suggestion=0**

EXHIBITION ROAD
© Olivia Woodhouse

OLD OPERATING THEATRE
image by Michael Reeve ©

### Old Operating Theatre Museum

**9a St. Thomas St, SE1 9RY**

**020 7188 2679**
**curator@thegarret.org.uk**

The Old Operating Theatre Museum is one of the most unusual museums in London. The operating theatre is the oldest in Europe and found in a unique space in the Herb Garret of St Thomas Church, and was part of old St Thomas Hospital.

**thegarret.org.uk**

## EXPLORE: HEALTH IN THE CITY

## POSSIBLE MUSEUM VISITS CONTINUED

### Barts Pathology Museum

**3rd Floor Robin Brook Centre, EC1A 7BE**

**020 7882 5555**
**bartspathology@qmul.ac.uk**

Barts Pathology Museum is based in St Bartholomews Hospital at West Smithfield and houses over 5,000 medical specimens on display over 3 mezzanine levels of the Victorian museum.

**qmul.ac.uk/bartspathology/about/index.html**

There is also has a virtual version of the museum for those who cannot visit:

**vpathmuseum.smd.qmul.ac.uk**

### Hunterian Museum

**35 – 43 Lincoln's Inn Fields, WC2A 3PE**

**020 7869 6566**
**museums@rcseng.ac.uk**

The Hunterian Museum is home to extensive collections of human and non-human anatomical and pathological specimens, models, instruments, painting and sculptures that reveal the art and science of surgery from the 17th century to the present day.

Classes from year 7 upwards are welcome to visit the Hunterian Museum. The museum staff are happy to provide free introductory tours of the museum to all UK-based schools. Tours must be booked in advance and can accommodate a maximum of 30 students plus accompanying staff (1:10).

**rcseng.ac.uk/museums/hunterian/learning/key-stages-3-and-4**

### Florence Nightingale Museum

**2 Lambeth Palace Rd, SE1 7EW**

**020 7620 0374**
**contact stephanie@florence-nightingale.co.uk**

The museum's collection spans the life of Florence Nightingale, the Crimean War and Florence's nursing legacy up to the present day. Due to the size of the museum there is a maximum group size of 15. Whilst one group is in the museum other members of the class can visit the mini museum in St Thomas' Hospital.

The mini museum shows how, over the years, medicines and operating techniques have advanced and new equipment has been invented, in some cases, thanks to the inspiration of staff within the Guy's and St Thomas' NHS Foundation Trust.

**florence-nightingale.co.uk**

## EXPLORE: HEALTH IN THE CITY

## POSSIBLE MUSEUM VISITS CONTINUED

### Royal London Museum

**Newark Street, E1 2AA**

**020 7377 7608**
**rlharchives@bartshealth.nhs.uk**

The Museum has sections on the history of the hospital since its foundation in 1740, Joseph Merrick (the 'Elephant Man'), and former London hospital nurses Edith Cavell and Eva Luckes. A showcase on forensic medicine features original material on the Whitechapel ('Jack the Ripper') murders and hospital surgeon and curator, Thomas Horrocks Openshaw who helped investigate. It also has a permanent exhibition of artefacts and archives relating to the hospital and the history of healthcare in the East End. Works of art, surgical instruments, medical and nursing equipment, uniforms, medals, and written archives and printed books are included.

The Museum is in three sections: the 18th, 19th and 20th centuries.

**bartshealth.nhs.uk/rlhmuseum#About-the-museum**

### Wellcome Collection

**183 Euston Road, NW1 2BE**

**020 7611 8361**
**youthprogrammes@**
**wellcomvecollection.org**

Wellcome Collection's school programme offers a range of free activities for 14–19 year olds, from study days and teacher events, to more in-depth projects.

Wellcome Collection is the free destination for the incurably curious, where you can enjoy exhibitions, events, and the world-famous Wellcome Library.

Consider what it means to be human through an intriguing mix of art, science, medicine and ideas.

**wellcomecollection.org/youth-and-schools-events**

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## EXPLORE: HEALTH IN THE CITY

# POSSIBLE OUTDOOR/SPORTING VISITS

HAMPTON HILL JUNIOR SCHOOL/
CAPITAL GROWTH

### Capital Growth Gardens

**020 7065 0902**
**capitalgrowth@sustainweb.org**

Capital Growth is London's largest food growing network, with over 2,000 gardens throughout the city, including a flagship site in The Regent's Park which schools are encouraged to visit.

Support is offered to people and groups who grow their own food in London, including discounted training, networking events, support with growing to sell and discounts on equipment. Joining is free and new ideas or offers of support are always most welcome. Find one near your school

**capitalgrowth.org**

### Queen Elizabeth Olympic Park

**Stratford, E20 2ST**

**0800 0722 110**
**customerservices@queen-elizabetholympicpark.co.uk**

School are encouraged to use the parklands, venues and waterways as an inspiring learning environment.

The links below provide a range of activities to try at different sites around the park.

**queenelizabetholympicpark.co.uk/~/media/qeop/files/public/learning%20trails/ks3%20physical%20education**

**queenelizabetholympicpark.co.uk/the-park/things-to-do/for-schools**

## EXPLORE: HEALTH IN THE CITY

# POSSIBLE HOSPITAL AND UNIVERSITY VISITS

### St George's University of London

**Cranmer Terrace, SW17 0RE**

**020 8266 6483**
**wp@sgul.ac.uk**

St George's University of London works with over 5,000 students, from more than 200 schools and colleges each year. St George's offers events and activities for year 2-13 students that are fun, practical and informative, giving students a real insight into the healthcare professions. These include experiments roadshows that put the science students learn in schools into real-life medical and health care contexts. Clinical skills taster days at St George's give a taster of the clinical skills practised by healthcare professionals.

**sgul.ac.uk/about-us/what-is-widening-participation/schools-and-colleges**

### Centre of the Cell

**Blizard Institute, 4 Newark St, E1 2AT**

**0207 7882 2562**

Centre of the Cell is a science education centre based at the Whitechapel Campus of Queen Mary, University of London. It is the first science education centre in the world to be located within working biomedical research laboratories. Centre of the Cell seeks to have a positive impact on the educational, career and health choices of the children, young people and families we work with.

**centreofthecell.org**

# CONNECT

**Students conduct a school based survey and compile a report presenting recommendations to improve health in the school community.**

# LESSON 5
# MAKING OUR SCHOOL MORE HEALTHY

## BIG IDEA

Students have constructed a survey to find out about the eating and/or exercise habits in the school. They carry this out (limiting it to their year group or a selection of classes). The survey may have links to the Explore lesson if they have visited some of the suggested venues. Following this, students produce a report to summarise what they have found and what steps need to be taken to improve health. This could involve looking at exercise opportunities and school dinners.

## LEARNING OBJECTIVES

Could produce a detailed and balanced report showing the benefits of making changes to an aspect of the school including details of the impact this change might have.

Could produce a cost analysis for suggested changes i.e. set up a business plan for the proposed change.

Should present answers to questions and enquiry carried out about health based on observations during the Explore lesson and other lessons in the unit.

Must use a variety of charts and graphs to represent the data they have collected on healthy living.

## RESOURCES

**Resource 5.1:** Planning tool for presentation

## LESSON 5: MAKING OUR SCHOOL MORE HEALTHY

# ACTIVITIES

### STARTER

Students should be encouraged to develop a series of success criteria for the presentation with the teacher. Hand out Resource 5.1: Planning tool for presentation (page 68).

CHEF SERVING LUNCH


### MAIN 1

Students write a report (in the style of a school newsletter) of what they found out on their trip in terms of how Londoners can be supported to be healthier. For more ideas see:

**nhs.uk/Livewell/fitness/Pages/free-fitness.aspx#park**

They produce a presentation aimed at your school governors, about what change they think could be realistically implemented and what impact they think it would have.

This might include some or all of the following:

1. How might the education of students in the younger years or in primary school be changed to promote healthy lives?
2. How might some of the local sporting facilities be better used by students at the school? This might include an awareness raising programme to encourage better use of local facilities that have been visited.
3. What changes could be implemented by the school regarding the promotion of healthy eating? In what ways might the school encourage better attitudes among students?

## Healthy Schools London

Healthy Schools London (HSL) is an awards scheme funded by the Mayor of London that supports and recognises school achievements in pupil health and wellbeing. Healthy Schools London is based on a whole-school approach, giving schools a framework for their activity with pupils, staff and the wider community. HSL encourages work around emotional health and wellbeing as well as promoting a healthy weight. Resilience is central to the Award scheme as well as physical activity, healthy eating and Personal Social Health & Economic Education (PSHEE). To date, more than two-thirds of London schools have signed up to HSL and more than 700 have earned an award.

**healthyschoolslondon.org.uk/about**

## LESSON 5: MAKING OUR SCHOOL MORE HEALTHY

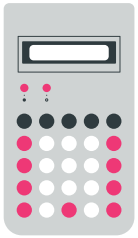
# RESOURCE 5.1: PLANNING TOOL FOR PRESENTATION

| WHAT IS THE TITLE OF THE PRESENTATION? | | | |
|---|---|---|---|
| Who is the presentation aimed at?<br>How are we going to get the presentation to them? | How can we make them take notice of this?<br>What is the main message we want to get across? | What graphical forms can we include in this presentation? | What images can we use from our visit? |
| What science have we learnt during the topic that needs to be included in this presentation? | What further research might we need to conduct? | What changes might be made to the health of students at the school as a result? | Are there any cost implications to the school in making this change? |

# LINKS TO OTHER LONDON CURRICULUM SUBJECTS

## STEM health theme

This unit is one of a set of three exploring the science and maths behind health in the city.



## MATHS

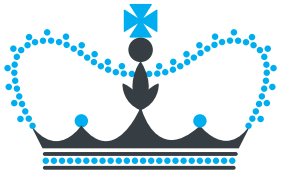
**Healthy London air** demonstrates how statistics are applied to the real life problem of securing good air quality in the city.

## SCIENCE – CHEMISTRY

**Healthy London water** explores the chemistry that helps meet the challenge of providing London with water that is fit to drink.

# LINKS TO OTHER LONDON CURRICULUM SUBJECTS

Health, sport and sporting venues in the city feature in a number of other London Curriculum units, creating the possibility of cross-curricular connections and visits.



## HISTORY

**Social reform in Victorian London** explores the legacy of an influential group of Victorian reformers, including Joseph Bazalgette, whose sewers virtually eliminated cholera in London.

## DANCE (PE)

**London dancing** explores London's diverse dance scene and features a wide range of dance styles and venues.

# CREDITS

The GLA would like to thank the following organisations for their contribution:

Our collaborators on
the London Curriculum

MUSEUM OF LONDON

wellcome trust

UCL
Institute of Education

Design **www.thirteen.co.uk**

Greater London Authority
City Hall
The Queen's Walk
London SE1 2AA

www.london.gov.uk
enquiries 020 7983 4100
minicom 020 7983 4458

‘The idea of using London as a teaching resource has never been explored much before, so both students and teachers are excited about it’

**Key stage 3 teacher**

‘It makes me feel proud to be a Londoner’

**Key stage 3 student**