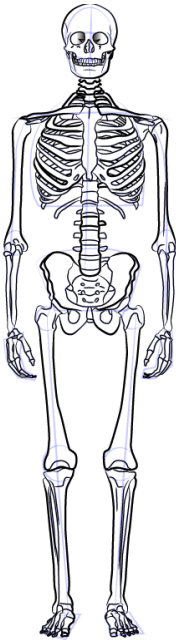


# Muscular Skeletal System

Right down the different types of joints you know and what type of movement is available at that joint for example: Hinge joint allows flexion and extension.

| Type of Joint | Movement available at that joint. |
|---------------|-----------------------------------|
|               |                                   |
|               |                                   |
|               |                                   |
|               |                                   |

Label the skeleton and muscles with what you remember from previous studies!



## Muscle Contraction

Antagonistic Pairs Explanation



Agonist

Antagonist

Sporting Example

## Types of muscle contraction

Isotonic:

Concentric:

Isometric:

Eccentric:

## Planes of movement:

Planes of Movement

Frontal

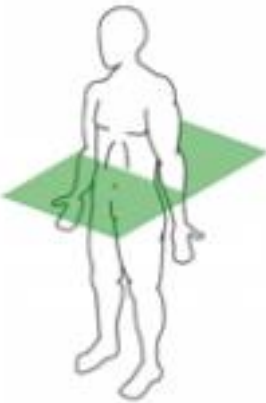
Sagittal

Transverse

Transverse

Frontal

Sagittal





A-level physical education

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review

January 2020 Volume 15 Number 2

## How TV commercialised sport

The influence of the golden triangle

## Classifying concussion

How to identify this high-profile injury

## Levers, planes and axes

Essential exam tips



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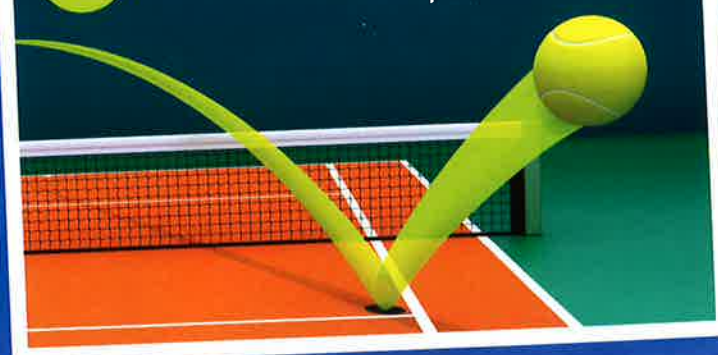
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**7** Levers, planes and axes explained



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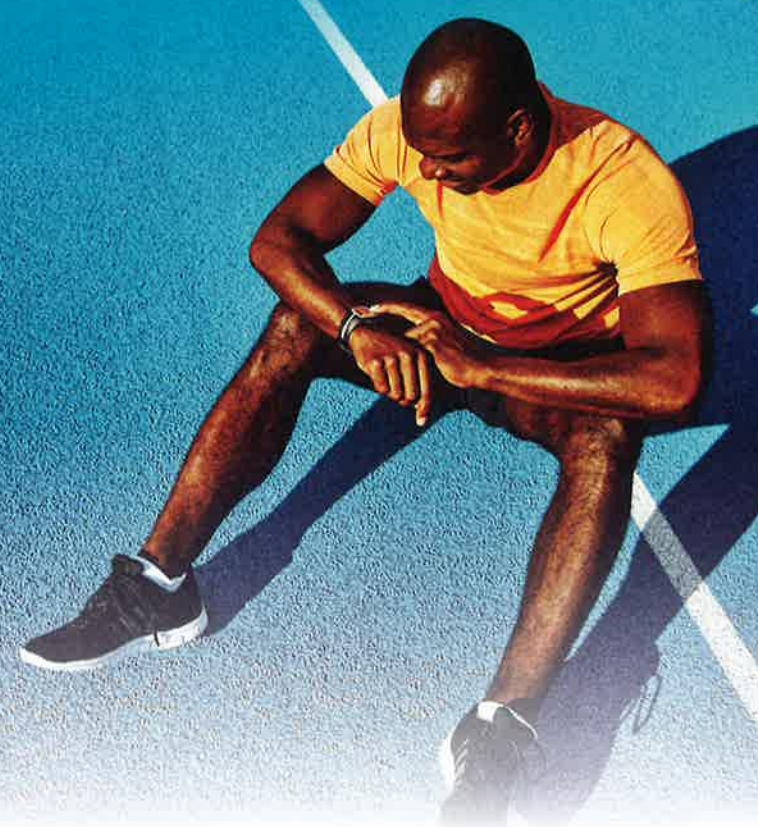
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**12** How does the body  
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### Poster: media influences on sport

Print out and display this issue's centre pages



### Exam-style questions

Check your answers to the questions on  
pp. 10 and 21

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# The golden triangle

## How television commercialised sport

Charlie Esson examines the influence of television on sport and sponsorship

### Exam links

The **golden triangle** is a key topic area for all the major exam boards:

**AQA** Paper 1 (sport and society) and Paper 2 (sport and society and technology in sport)

**Edexcel** Component 2 (psychological and social principles of physical education)

**OCR** Component 3 (sociocultural issues in physical activity and sport)

The three corners of the golden triangle are the media, sponsorship and sport (Figure 1). The triangle shows that the three factors are all interdependent. One factor influences the other two and vice versa. There are several different ways in which they influence one another. Box 1 provides examples of different types of media and how they cover sport

### Key term

**Sponsorship** Provision of money and/or support for a commercial return.

### Sport + television = profit

Consider Sky Sports, the most dominant subscription television sports brand in the UK and Ireland. Sky has played a major role in the increased commercialisation of sport

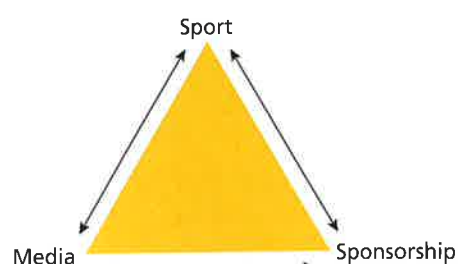


Figure 1 The golden triangle

since its launch in 1990. For the company to exist, it must generate enough revenue in order to cover its own costs and be profitable. The majority of its revenue comes in two forms:

### Subscriptions and pay-per-view

Sky Sports receives subscription and pay-per-view income from major sports events. For example, a subscriber may pay £50 per month for a Sky TV package. In the case of boxing, many fights operate a pay-per-view system whereby an individual pays to view a specific fight or event.

### Television advertising

A company, such as Gillette, will pay a specific amount to advertise its brand

### Box 1

#### How the media covers sport

**Terrestrial television** Free to air — the traditional method for broadcasting television. In the UK, a TV licence is required — but no subscription.

**Satellite television** Usually a subscription product — television delivered via a dish using signals relayed by satellites, e.g. Sky Sports.

**Pay-per-view** A television service where viewers pay a fee in order to watch a particular programme, film or sports event. Boxing matches are regularly on pay-per-view.

**Radio** Dedicated sports stations are devoted entirely to sport (e.g. talkSPORT, BBC Radio 5 Live Sports Extra). Local and regional radio stations also cover sport, e.g. county-based stations such as BBC Radio Suffolk or BBC Radio Lancashire.

**Written press** This element of the media has a long history of sports coverage. National newspapers (e.g. 'broadsheets' such as the *Guardian* and 'tabloids' such as the *Sun*) have sports sections. Dedicated magazines focus solely on sport e.g. *Runner's World*, *Boxing News*, *FourFourTwo*.

**Internet** Provides widespread coverage of sport through sites and social media (e.g. Twitter).

and products for 30 seconds during the half-time interval of a football match. The cost of a 30-second advert will vary depending on the number of anticipated viewers, the type of sport, the type of advertiser and the team that's playing. For example, a Premier League game between Chelsea and Arsenal will have a different price to a Championship game involving Barnsley and Brentford.

The emergence of satellite television has had both positive and negative impacts on English football:

### Positive impacts

- Increased revenues to football clubs via payments made by media companies, which provide coverage of more matches for the fans to watch.
- Increased wages/transfer fees are paid to recruit/retain the best players. Player recruitment is improved via the ability to provide lucrative contracts,

thereby increasing standards of performance (e.g. four of the eight Champions League quarter-finalists in the 2018/19 season were Premier League clubs).

- Increased funding for player development (e.g. at grassroots level and in academies).
- Increased funding for facility development (e.g. funding the latest artificial pitches for training).

### Negative changes

- Football clubs develop an overreliance on television income.
- Inequalities in funding become evident, as the big clubs get richer and the lower-league clubs get poorer, leading to situations such as Bury FC's expulsion from the Football League in 2019.
- Too much media control of football (e.g. television companies dictate when and what time fixtures take place, which can be a negative for both players and supporters).
- The price of satellite subscriptions means some people cannot afford them, so cannot access the matches on TV.
- Advertising breaks can disrupt the viewing experience.

Television revenues can be used to improve facilities, e.g. by building artificial pitches



### Where does the money go?

Once a broadcaster has secured the rights to show a sport on television, it will pay a sum of money to the sports organisation that holds the rights to the sport. This organisation must then determine how the money is distributed. Figure 2 shows how the two major forms of revenue for a broadcaster will flow into a sport, in this case using the example of a tennis tournament. Not all of the money goes to the players, but a large portion of it will.

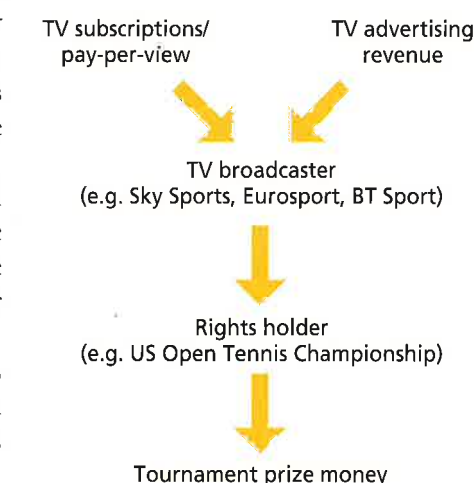


Figure 2 How TV money moves through a sport





Harry Kane earns £200,000 per week playing for Tottenham Hotspur

In the case of the Premier League (rights holder), the league gives the majority of television revenue to the clubs. The clubs then pay their staff wages, including the players, who often earn massive amounts. In the 2018/19 season, Alexis Sanchez was reportedly on £500,000 a week at Manchester United, Mesut Ozil was on £350,000 a week at Arsenal, and Harry Kane was on £200,000 a week at Tottenham Hotspur. The clubs can also use their TV income to invest into their community programmes, youth academies and facilities.

In the case of an international match, the broadcasters will pay the sport's governing body. For an England cricket test series (e.g. the 2019 Ashes), Sky Sports will pay the England and Wales Cricket Board (ECB), which is the sport's national governing body. Some of this revenue will go to the players and some will be invested into the sport by the ECB. It can do this in a number of ways:

- Provide grants to cricket clubs so they can improve their facilities and buy equipment.
- Subsidise the cost of coaching courses to encourage more coaches to become qualified.
- Provide equipment for schools.
- Employ more ECB coaches to work with elite players.

### Why is football richer?

Football has more potential than other sports to generate television

viewers, and therefore the rights holders can generally charge more than other sports. For example, in the case of a Manchester football derby (City vs United) compared with a rugby union East Midlands derby (Leicester vs Northampton), more people will watch the football match on TV (Table 1), so broadcasters will have to pay the Premier League more to show the football match than they will have to pay Premiership Rugby for its product.

Table 1 Football on TV vs rugby on TV

| Football   | Rugby   |
|--|---|
| The title race between Manchester City and Liverpool helped to deliver 12% growth for Sky Sports' UK audiences in the 2018/19 season | Television audiences for Premiership rugby have risen by 40% following its move to BT Sport in 2013                                     |
| 1.7 million people watched Liverpool vs Arsenal on BT Sport  | Approximately 800,000 people watch Premiership rugby on TV or live in the stadium each weekend  |
| Approximately 70% of the UK population watched the Premier League last season on Sky Sports, BT Sport or BBC                         | The 2018/19 Premiership rugby season had a combined season audience of 7.88 million, compared with 6.14 million for the previous season |

The more people who watch the game, the more the broadcasters can charge for an advertisement slot during the commercial breaks. BT Sport can charge a company in excess of £10,000 for a 30-second advert during a major Premier League football match. In comparison, for a Premiership rugby game, they may only charge £500.

### The effects of sponsorship

The media promotes sponsorship and provides exposure for companies that sponsor sports teams.

When a company sponsors a sports team, it will often have its brand or name visible on the players' shirts. For example, Chevrolet sponsors Manchester United, with reports in 2014 indicating that Chevrolet would pay the club £28 million per year until the end of the contract. General Motors, the group that owns Chevrolet, will have decided that the

exposure of its brand to Manchester United's audience will generate more sales of its automotive products and will therefore be a positive investment.

Compare this to the sponsorship of a Premiership rugby team. Allianz have the stadium naming rights and are the primary shirt sponsor for Saracens rugby club. The deal is thought to be worth approximately £1.5 million per year — significantly less than the Chevrolet–United deal. This is because Manchester United are exposed to a much greater global audience than Saracens, predominantly through televised matches and also through the other strands of media such as the internet, radio and newspapers.

### Positives and negatives

Exam questions on the golden triangle often have 'Discuss' as the command word. This requires you to make balanced arguments/statements about

the positives and negatives of different components of the triangle, e.g. the effects of the media and sponsorship on sport.

### Controversial sponsors

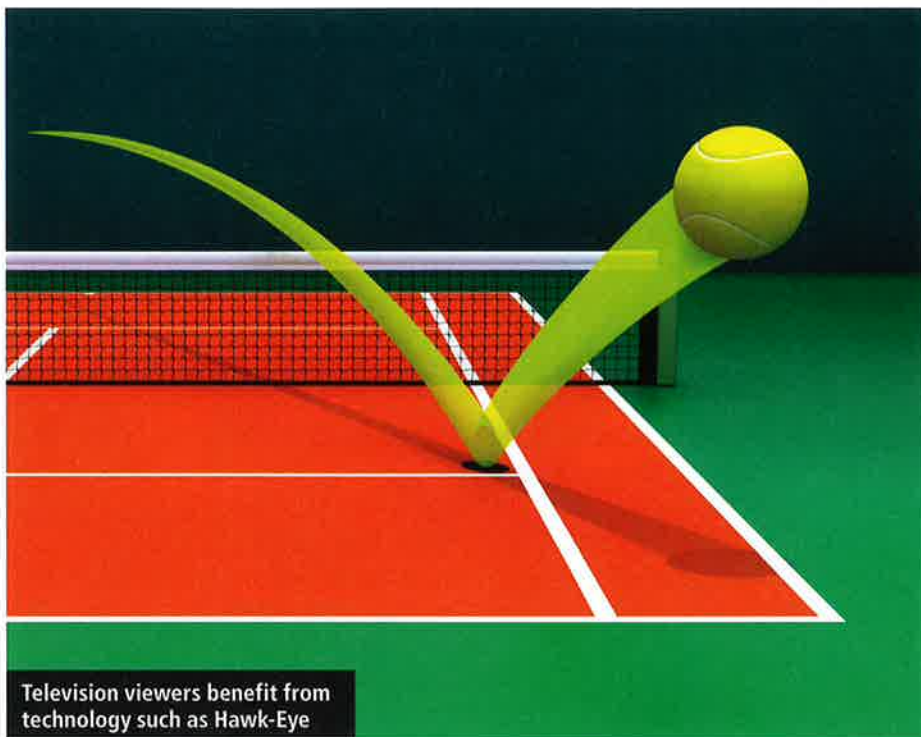
In 2012, the New Zealand All Blacks agreed to make AIG their main shirt sponsor. This upset many fans and former players,<sup>3</sup> as they saw it as compromising the tradition of the 'all black' jersey. However, on the positive side, the money used from this endorsement can be used to grow the game in New Zealand and fund grassroots rugby.

Emirates owns the naming rights to Arsenal's football stadium. 'The Emirates Stadium' sounds more commercial and less traditional than the name of the club's old ground, Highbury. However, the money from this sponsorship can be used to pay high transfer fees and buy top-level players. Is it only a matter of



More people will watch football's Manchester derby than rugby union's East Midlands derby





time before 'sacred' grounds such as Twickenham, Wembley, Lord's and the All England Club (Wimbledon) compromise their names in search of sponsorship revenue? If so, the money could be used to enhance their facilities and put more funding into grassroots sport.

Companies that produce unhealthy products can sponsor sports teams or individuals. The fast food chain McDonald's was a major sponsor of London 2012. Partnering with the Olympics provides a benefit to McDonald's image, as the event is aligned with the ideals of sport and healthy living.

#### Popularity means profit

Popular sports, such as men's football, dominate television coverage. In the case of Sky Sports, popular sports will often feature on the Main Event channel. This brings disproportionate income to already wealthy sports such as football. Meanwhile, less popular sports, disability sports and most women's sports do not get the same level of coverage. Therefore, these sports struggle to develop. On a Saturday or Sunday afternoon, the Main Event channel will often

broadcast major domestic football matches, rather than international fixtures for sports such as netball or hockey.

However, the increased number of sports channels has led to more professionalism in women's sport. While the coverage of women's sport is often inferior to men's sport, the increased number of TV channels has allowed, for example, women's cricket to be broadcast. Consequently, English women's cricket has become professional through the establishment of the Kia Super League.

Televised sports produce the majority of high-profile sports stars and celebrities. Golfer Justin Rose has significant wealth due to his career earnings. When he won the 2019 Farmers Insurance Open at Torrey Pines, he received almost \$1.28 million for the victory and surpassed \$50 million for career earnings in the USA.

#### Technology and scheduling

Televised events can affect the entertainment value for viewers and spectators. TV viewers can benefit from technology such as Hawk-Eye,

and can record, pause and rewind to suit their viewing needs.

The power of television companies means they can manipulate the start time and duration of events. Traditional kick-off times do not always apply, leading to football matches being played on Sunday evenings rather than Saturday afternoons. Many spectators prefer to go to a stadium during the afternoon and not the evening.

Matches can be slower paced for the spectators in the stadium. Half-time breaks are longer due to TV advertising, and the use of television match officials creates more stoppage time.

#### The pressure of professionalism

Funding by the media has made sports more professional, and greater coverage of sport has increased performance levels. However, media scrutiny also places more pressure on individuals to perform. A televised match can help to inform journalists working for newspapers, radio and online, but in turn this can lead to heavy criticism of poor performance, and possible social media abuse from fans.

See pp. 16–17 for a downloadable poster highlighting the positive and negative effects of the media on sport.

#### Key points

- The golden triangle comprises three interdependent components (sport, sponsorship and the media).
- Media coverage of sport consists of a wide variety of different types, with subscription and pay-per-view offerings and social media companies becoming increasingly involved as the twenty-first century progresses.
- Exam questions linked to the golden triangle often have 'Discuss' as a command word. These questions require a balanced answer containing points outlining the positives and negatives of any of the relationships between different elements of the triangle stated in the question.

Charlie Esson teaches PE at Stamford School.

# Levers, planes and axes

Anna Snook shows you how to approach this essential exam topic

#### Exam links

Levers, planes and axes is a key topic across all A-level specifications.

The topic of levers, planes and axes provides hands-on, to the point, right-or-wrong content. It is fairly easy to learn the facts for assessment objective (AO) 1, and then apply them for AO2. There isn't a great deal of AO3 analysis either. If you studied PE at GCSE, you may not have seen this topic within your specification, but this year your GCSE PE peers will be studying it, so you may be able to find yourself a younger study buddy.

If you are aspiring to a career as a physiotherapist, osteopath, chiropractor or similar profession, levers, planes and axes will become part of your daily language, given that this is how we describe the direction of movement. For example, if you have an injury that means you cannot bend your elbow, you will be described as having limited or no movement in the sagittal plane.

The three components can be summarised as:

- **Levers:** all movement is as a result of one of three lever systems.
- **Planes:** movement occurs within one of three planes (directions).
- **Axes:** all rotation is around one of three axes.

#### The lever systems

The three lever systems indicate that movement can occur as a result of muscular contraction (**effort/force**) around a **fulcrum** point (joint) in order to move a **resistance** (this could be body weight, or a mass such as a ball). All three lever systems have three common features:

- fulcrum (pivot point)
- resistance (load)
- effort (force)

#### Key terms

**Effort/force** Applied by muscles to create movement at a joint.

**Fulcrum/pivot** The pivot point around which movement occurs or mass is supported, e.g. the skeletal joint.

**Resistance/load** Mass of resistance to effort or force.

You will be required to draw each lever system (Figure 1), ensuring that you correctly identify the feature in the middle:

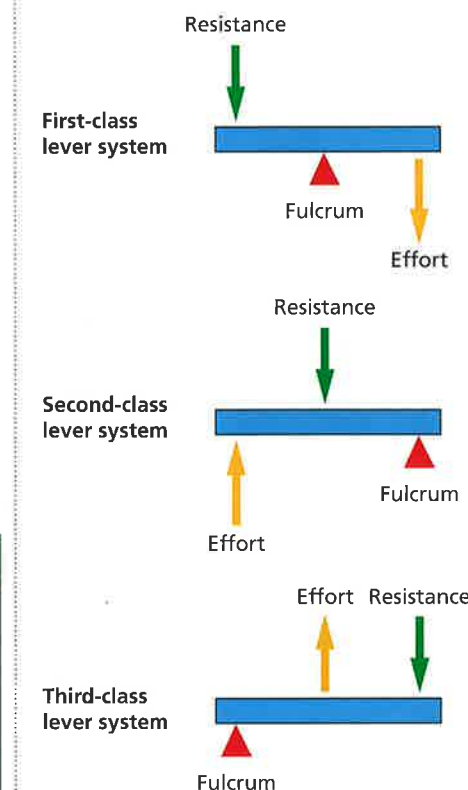
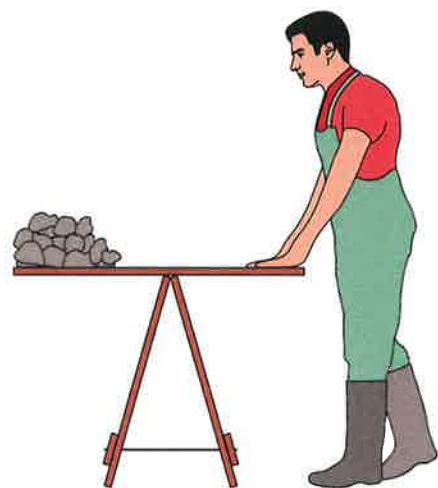


Figure 1 Lever systems





**Figure 2** First-class lever system

- In a first-class lever system, this is the *fulcrum*.
- In a second-class lever system, this is the *resistance*.
- In a third-class lever system, this is the *effort*.

A useful rhyme to use to remember this is '1 2 3, F R E'.

#### Key exam points for lever systems

- It is important to get the feature in the middle correct (hence 1 2 3, F R E).
- The lever image can be reversed, meaning that the features on each end can be swapped over. However, the layouts shown in Figure 1 are the most frequently used.
- The fulcrum is always under the line, as is the pivot point
- Resistance is always above the line, and is now commonly drawn as a downwards arrow, as this indicates the effect of gravity on a mass.

#### First-class lever systems

This lever system is most like a see-saw in action, with the fulcrum in the middle (Figure 2). It is exclusive to the action of the triceps brachii, i.e. elbow extension. It is also relevant to the nod of the head,



**Figure 3** Second-class lever system

but this is not a good example of a sporting action, so is rarely used. When the triceps contract concentrically, they cause elbow extension (sagittal plane, transverse axis). This is common in shooting in netball or basketball, or in a line out throw in rugby. Imagine the triceps contracting (effort/force) when holding a ball ready to shoot (resistance/load). This contraction opens the angle of the elbow joint (the fulcrum) to release (shoot) the ball.

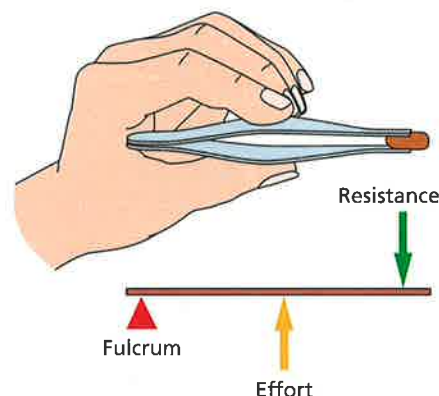
#### Exam tip

Remember that elbow flexion is a third-class lever system — only elbow extension is a first-class lever system.

#### Second-class lever systems

This lever system is most like a wheelbarrow, with the fulcrum at one end, the resistance in the form of load 'in the wheelbarrow', and the effort applied upwards at one end (Figure 3). Remember that you don't need to draw the body parts, just the line and three component parts.

This lever system solely applies to the ankle joint, i.e. plantarflexion and dorsiflexion movements.



**Figure 4** Third-class lever system

#### Third-class lever systems

In this lever system, the fulcrum is again at one end, but this time the effort is in the middle. Think of tweezers or tongs — the load is whatever you are moving/pulling (Figure 3).

For a sporting example, think of a hockey stick with the fulcrum at the end of the handle, held by the left hand. The effort is the right hand in the middle, and the load is the ball on the end of the stick. Most joints and joint actions in the body use the third-class lever system.

#### Mechanical advantage

*Mechanical advantage* describes what a lever system can do best. Each lever system has a mechanical advantage and disadvantage. For AQA, you need to know these for all three lever systems. For OCR you only need to know the mechanical advantages for the second-class lever system.

Mechanical advantage depends on distance between fulcrum and effort (known as *effort arm* or *force arm*) in comparison to the distance between the fulcrum and resistance (known as *resistance arm*) (Figure 5).

Remember the equation:

$$\text{Mechanical advantage} = \frac{\text{Effort arm}}{\text{Resistance arm}}$$

#### Second-class advantages and disadvantages

In second-class lever systems, the force arm is longer than the resistance arm. Therefore the mechanical advantage is that you can generate large amounts of force to overcome a resistance/heavy

weight. Therefore you can reduce the amount of effort needed in order to move a heavy weight. The mechanical disadvantages are the limited range and speed of movement.

You see this in the wheelbarrow example in Figure 3, where you can lift heavy loads but only over a short distance. You can only lift the wheelbarrow handles so far, or you will tip the wheelbarrow up and over the fulcrum point (the wheel).

An example of this in the body is coming up onto your toes, in plantarflexion. You can lift your whole body weight onto the ball of your foot (the fulcrum), owing to the contraction of the gastrocnemius muscle. In fact, you could add even more weight, like a barbell. But there is a limited range of movement as you come up onto the ball of your foot. So you can overcome large mass, but over a limited range of movement due to the long force arm and short resistance arm.

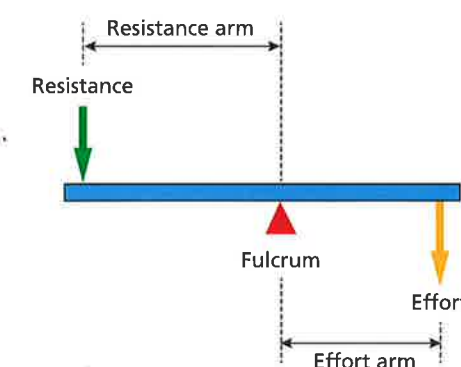
In terms of AO2, the second-class lever system has a longer force arm (fulcrum to effort) and so a hurdler, for example, can apply minimal force to generate enough height to clear the hurdle.

#### Third-class levers

In third-class lever systems, the effort arm is much shorter than the resistance arm, therefore:

$$\frac{\text{Effort arm}}{\text{Resistance arm}} = \text{Less than 1}$$

The force arm is short in this lever system, but the resistance arm is long. So the mechanical advantage is that you



**Figure 5** Effort arm and resistance arm in a first-class lever system

#### Exam tip

A03 questions for this topic are unlikely, but can occur. If an exam question has a higher mark value, it is likely to carry only 1 or 2 marks for A01 responses and a few more for A02, with the most marks allocated for A03 responses.

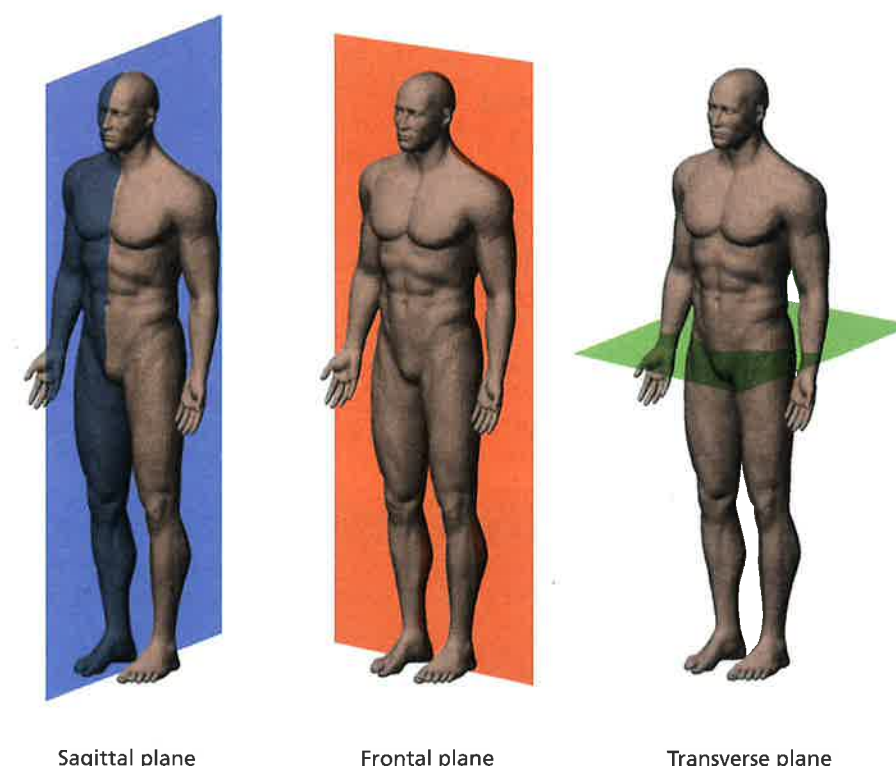
You could be asked to analyse the movements possible at joints, with reference to levers, planes and axes. You should state the type of joint, the movements that can occur and the plane within and axis around, the muscles responsible and the type of muscular contraction occurring. When you break longer prose-based questions down like this, there is a lot to say and get rewarded for. You can then apply this to real sporting movements, linking in the mechanical advantage.

can move a resistance quickly and over a large range of movement.

#### Three planes of movement

All movement is through a plane (and around an axis). The three planes (Figure 6) are:

- The **sagittal plane**, dividing the left and right side of the body equally.
- The **frontal plane**, dividing the front and back of the body equally.
- The **transverse plane**, dividing the top and bottom of the body equally.



**Figure 6** The three planes of movement

'Transverse' means side-to-side/lying across.

You will most likely be examined on flexion and extension movements, as most movements involve flexion and extension in some form, e.g. walking, running, squats, joint curls, extensions. Flexion and extension movements occur in the sagittal plane.

All abduction and adduction movements occur in the frontal plane. Imagine someone in front of you lifting their arms to the side, e.g. in a lateral dumbbell raise in weightlifting or to hold the crucifix position on the rings in gymnastics. The whole body could even move, for example in a cartwheel in gymnastics.

Any rotation, twisting or turning movements occur within the transverse plane. This could be the whole body (e.g. a pirouette in dance) or just around one joint (e.g. an overarm bowl in cricket or a forehand racquet stroke in tennis, where the shoulder joint internally or medially rotates).

#### The three axes of rotation

Any twisting, turning or rotation movements occur around a central axis.

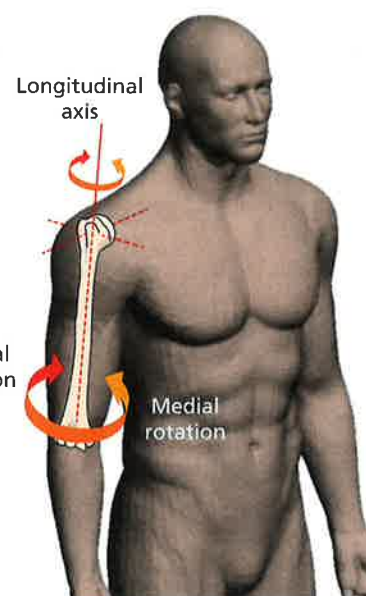


## Exam-style questions

- Describe the mechanical advantage of the second-class lever system (1 mark)
- A netballer is about to execute a netball shot. Their elbows are bent in preparation. Identify the lever system operating at the elbow. (1 mark)
- Identify the plane, axis and lever system operating at the ankle joint when a performer is in the downward phase of a squat. (3 marks)
- Sketch and label a third-class lever system. (2 marks)
- Draw the force arm (FA) and resistance arm (RA) onto each of the lever systems in Figure 1. Note the mechanical advantage of each being the longest arm.
- Differentiate between the lever systems operating at the elbow joint in flexion and extension. (4 marks)
- Analyse the movements possible at ball-and-socket joints such as the shoulder. (6 marks)

PEReviewExtras

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**Figure 7** Rotation at the shoulder joint

Or it can be isolated to a joint, as in the example of median (internal) and lateral (external) rotation at the ball-and-socket shoulder joint shown in Figure 7. This occurs in bowling and in tennis racquet strokes.

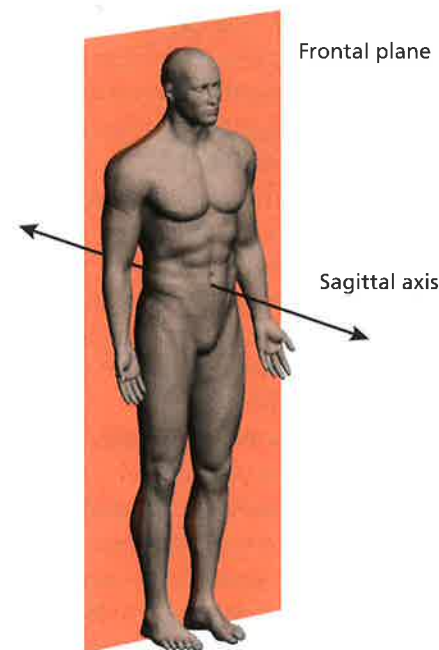
### Planes and axes

Each plane is paired with an axis (Table 1):

- The sagittal plane is paired with the transverse (side-to-side) axis.
- The frontal plane is paired with the sagittal/frontal axis.
- The transverse plane is paired with the longitudinal axis.

Movement occurs through a plane and around an axis, as in the case of movements in the frontal plane around the sagittal/frontal axis, such as abduction and adduction movements (Figure 8).

In this case, you can think of the sagittal/frontal axis as the pin in the



**Figure 8** Movement through the frontal plane around the sagittal/frontal axis

middle of a Catherine wheel on Bonfire Night. The Catherine wheel spins around this central axis. Now imagine a performer cartwheeling — it's much the same.

With the sagittal plane and transverse axis, you can imagine a table footballer. You can rotate the player forward and backward, but not twist or turn or move forward or backward. This is the most common feature, applying to all flexion and extension movements.

This just leaves the transverse plane and longitudinal axis (like the Earth spinning round on its axis). You may see this axis described as the *vertical axis* due to its vertical position. Rotational movements occur in the transverse plane and around the longitudinal axis.

### Key points

- The triceps brachii (elbow extension) provide an example of a first-class lever system.
- Ankle joint movements provide an example of a second-class lever system.
- Other joints and joint actions are third-class lever systems.

Anna Snook teaches PE at Wycombe High School.

# Exam tips for levers, planes and axes

Anna Snook provides exam advice and revision tips, linking with the 'Exam focus' on pp. 7–10



For assessment objective 2 (application), examiners will ask you to do one of two things:

- Give an example from a sport of movement(s) that may occur.
- Using a picture provided, identify the joint movement or lever system operating, or the plane and axis.

Here are some tips to help with answering these questions.

### Systems and advantage

If you have to give an example of movements that occur at a joint, name the joint. It is a common mistake for students to leave the joint (e.g. elbow joint) unnamed.

In one short, concise sentence, provide the following information:

- the joint and joint movement
- the action
- the sport
- the muscle responsible (the agonist)
- the plane/axis

For example:

Elbow extension when shooting in netball, caused by the contraction of the triceps brachii (agonist) in the sagittal plane, around the transverse axis.

If the question gives you a sporting action with a table that you have to fill in, check the column titles. Yes, it's obvious, but they do change (especially the last column), so there may be subtle differences to what you were expecting.

**Table 1**

| Joint action    | Main agonist    | Antagonist     |
|-----------------|-----------------|----------------|
| Elbow extension | Triceps brachii | Biceps brachii |

**Table 2**

| Joint action     | Main agonist     | Type of joint    |
|------------------|------------------|------------------|
| Shoulder flexion | Anterior deltoid | Latissimus dorsi |

With the pressure on during the exam, make sure you double check. Tables 1 and 2 show how changes to one of the columns could catch you out — it could also say 'Type of muscular contraction' or 'Lever system in operation'.

Mechanical advantage questions are most commonly asked on the second-class lever system (in fact, that's all you need to know about for OCR exams). For AQA, you need to know the mechanical advantage and mechanical disadvantage of all three lever systems — but AQA questions still seem to mostly ask about the second-class lever system.

If you are asked to identify a lever system, write out the full name, e.g. 'first-class lever system', not '1st' or some other abbreviation. Write the full name of each part, e.g. 'fulcrum', not 'F'.

If you need to, draw out all three lever systems on your notes page or extra paper. Identify and add on the force arm and resistance arm, then select the one you are required to write about in your actual answer.

If comparing joint types, know that the elbow, knee and ankle are hinge

joints and therefore (much like a door hinge) only allow flexion and extension movements. The shoulder and hip joints are ball-and-socket joints. These are the joints that can do everything, i.e. move in all three planes and around all three axes.

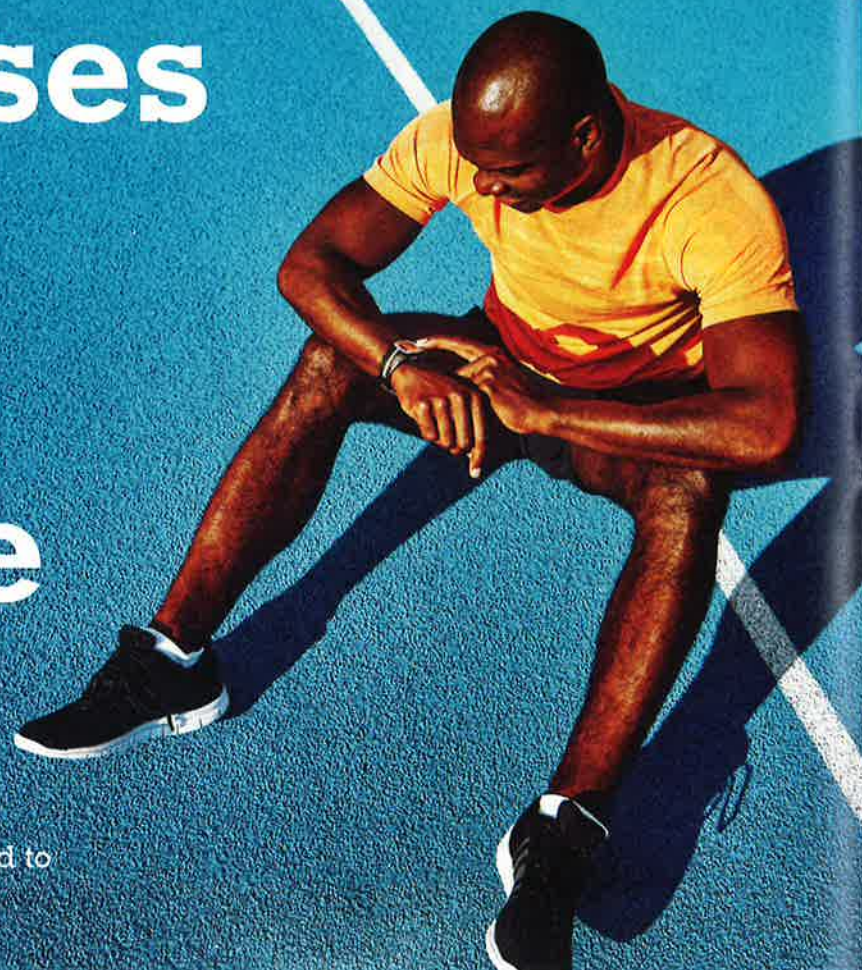
### Revision tips

- Rather than learning the lever systems in order, try thinking of the application first. For example, with a bicep curl, identify the joint, joint type, articulating bones, agonist, antagonist, lever system and mechanical advantage. This will help you learn things more effectively, meaning they stick in your long-term memory so you will be able to recall them under the pressure of the exam.
- Learn this information alongside muscle action and articulating bones to bring the skeletal system and mechanics of movement to life.
- Learn axis of rotation alongside angular momentum.

Anna Snook teaches PE at Wycombe High School.



# Responses of the body to exercise



Mark Thompson explains what you need to know about responses to exercise

## Exam links

All the major exam boards require you to be able to explain how the cardiovascular and respiratory systems change to meet the demands of exercise

When we begin exercise, the body has to adjust quickly to the new demands placed upon it. This is known as the *response*, and involves immediate and short-term changes made by the body.

How the body responds to exercise depends on the intensity, duration and frequency of the exercise taking place. In sports like football, netball and rugby, the body will continually respond to the dynamic and varying demands placed on it. In sport or exercise that is more consistent and continuous, like steady-state jogging or cycling, the responses are less dynamic. However, whatever

the nature of the sport or exercise, the body will respond to help the performer.

The cardiovascular response to exercise has intrigued physiologists for many years.

Stone and Liang 1984

Chemical, mechanical and thermal stimuli affect alterations in **metabolic**, **cardiovascular** and **ventilator function** to meet the increased demands that starting exercise puts on the body and its systems (Burton, Stokes and Hall 2004).

As the muscles start to work due to the exercise that has begun, the body's systems, particularly

the cardiovascular and respiratory systems (often referred to as the cardiorespiratory system when discussed together), increase their activity to meet the demands of the working muscles. This involves providing them with oxygen and nutrients (e.g. glucose) but also the removal of carbon dioxide and other waste products like lactic acid. Laughlin (1999) stated that in the main, the cardiorespiratory effects of exercise are related to supplying required oxygen and nutrients to the working muscles.

## Responses to exercise

Specific responses are:

- increased heart rate
- increased stroke volume
- increased cardiac output
- redistribution of blood
- increased blood pressure
- increased breathing rate and depth (respiratory rate)

## Key terms

**Metabolic** Involving chemical reactions.

**Cardiovascular** Involving the heart, blood and blood vessels.

**Ventilator function** Breathing.

## Increased heart rate

Heart rate increases as we begin to exercise. The increase depends on the intensity of the exercise. The higher the intensity, the higher the heart rate up to when maximum is reached. Approximate maximum heart rate equal  $220 - \text{age (in years)}$ . So for an 18 year old, maximum heart rate would be  $220 - 18 = 202$  beats per minute (bpm).

When exercising, the adrenal gland increases production of adrenaline and noradrenaline. These hormones directly affect the heart and the ability to transport oxygen and carbon dioxide throughout the body. They influence the sympathetic nerves to stimulate the heart to beat faster (increased heart rate) and more forcefully (increased stroke volume).

Sympathetic nerves are responsible for the adaptations the body makes when starting and maintaining exercise. The parasympathetic nerves are responsible for our return to rest after exercise and bringing the body back down to normal resting levels.

## Increased stroke volume

Stroke volume is the volume of blood pumped out by the ventricles of the heart per contraction. It increases as exercise intensity increases. The cardiac muscles in the walls of the heart contract more forcefully, pumping more blood out per contraction. As we start exercising, venous return (the volume of blood returning to the heart in the veins) increases, leading to an increase in stroke volume.

Starling's law states that an increased venous return causes greater diastolic filling of the heart. The cardiac muscle of the heart is therefore stretched, leading to a more forceful contraction that increases the ejection fraction.

## Key term

**Ejection fraction** The percentage of blood pumped out by the left ventricle per beat.

## Increased cardiac output

As stroke volume and heart rate increase due to the demands of exercise, cardiac output therefore increases. This is the volume of blood pumped by the heart ventricles in 1 minute and is calculated by stroke volume (ml)  $\times$  heart rate (bpm) to give a numerical value in litres per minute.

As maximal intensity is reached, stroke volume and heart rate reach their max, therefore maximal cardiac output is reached and a plateau occurs. Maximal cardiac output depends on factors such as age and fitness levels.

At rest, cardiac output is the same for trained and untrained performers. However, maximum cardiac output will be significantly higher in trained performers, allowing them to cope with and maintain higher levels of exercise. The cardiac output of

distance runner Eilish McColgan or cyclist Geraint Thomas will be much higher than the average person's, allowing them to reach and maintain higher intensities of exercise because they will be able to work aerobically for longer.

## Redistribution of blood

At the beginning of exercise, blood is redistributed to the areas that now need it — the working muscles. As the skeletal muscles require more oxygen, they require an increase in blood supply, as oxygen is carried by the protein haemoglobin in the red blood cells. This redirection is known as the **vascular shunt mechanism** and ensures more blood goes to the working muscles and the heart, as the heart muscle requires oxygen for energy to beat



At the beginning of exercise, blood is redistributed to the areas that need it



faster (increased HR) and to pump with more force (increased stroke volume). Less blood is transported to the digestive system as this area is not now a priority, hence one of the reasons why it is suggested not to eat a heavy meal too soon before exercise. Vasodilation, the widening of the blood vessels, increases blood flow into the capillaries surrounding the muscles, hearts and lungs. Vasoconstriction, the narrowing of the blood vessels, reduces blood flow in the capillaries to non-essential organs (during exercise this is areas like the intestines and kidneys).

### Increased blood pressure

Blood pressure increases as blood is forced out of the heart at a higher force to get it to the working muscles

quicker — much like the increased pressure within a hose pipe when you want more water. The pressure increases as more blood is pumped out of the heart at a faster rate under higher pressure to provide the working muscles with the extra oxygen and nutrients they now require.

### Increased breathing rate and depth

Ventilation increases abruptly in the initial stages of exercise and is then followed by a more gradual increase.

Burton, Stokes and Hall 2004

When we begin exercise, we start to breathe quicker and deeper. This allows us to get more oxygen into the cardiovascular system, and remove more carbon dioxide. Sympathetic nerves stimulate our respiratory muscles to contract quicker and

## Key term



**VO<sub>2</sub> max** The maximal amount of oxygen that can be breathed in and utilised by the body per minute.

stronger. These muscles include the external and internal intercostal muscles and the diaphragm.

The rate of increase is proportional to exercise intensity. Hoefs suggested that, at rest, breathing rate is around 14 breaths per minute, but can increase to around 32. When a performer reaches their maximum work rate, this upper limit is the VO<sub>2</sub> max.

### Other responses to exercise

■ **Reduced affinity of haemoglobin for oxygen:** known as the *Bohr shift*. When we start exercising, the increase of blood carbon dioxide and a decrease in blood pH results in a reduced affinity of the protein haemoglobin (in our red blood cells) for oxygen. This means that oxygen is more readily available for the working muscles.

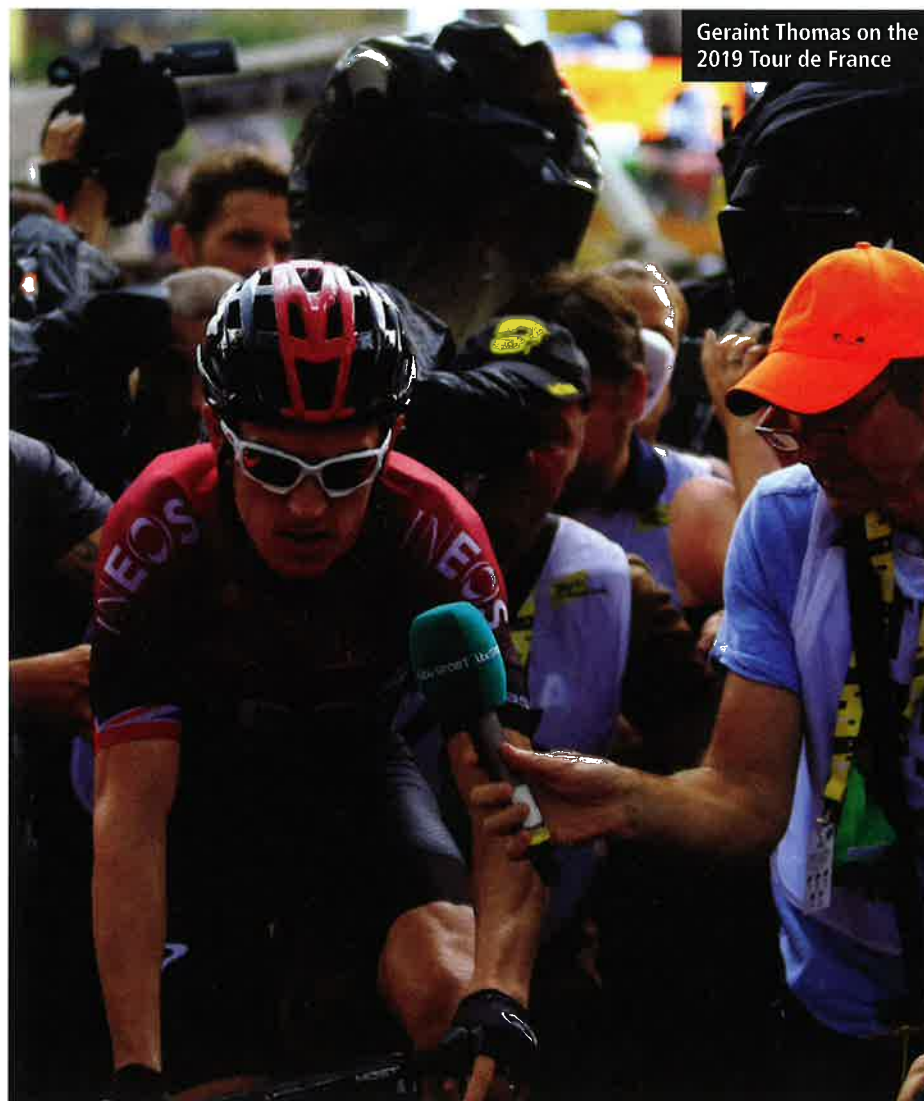
■ **Increased muscle and skin temperature:** as activity increases, this causes an increase in temperature. Increased skin temperature (vasodilation of the blood vessels) allows the body to give off heat and regulate temperature effectively.

■ **Anticipatory rise in heart rate:** this is the small increase in heart rate due to the thought of exercise (the anticipation).

■ **Increased stimulation of calcium uptake in the bones:** during exercise, calcium uptake in the bones is increased.

■ **Increased muscle pliability:** the increase in temperature and activity means the muscles are more pliable, meaning they are more flexible and elastic.

■ **Sweating:** the sweating response is the body's cooling system. Exercise increases temperature, so sweating helps to cool us down and prevent overheating that could lead to heatstroke or hyperthermia.



Geraint Thomas on the 2019 Tour de France



Distance runner Eilish McColgan will have a much higher cardiac output than the average person

### Getting ready

How can we help our bodies respond to exercise optimally and effectively?

### Warm-up

'Warming up' is seen as a safe and effective way of preparing the body for

exercise to minimise the risk of injury and ensure optimal performance from the onset of activity (e.g. the start of the game or race). It is used as a way of safely and gradually increasing the body's responses in preparation for the game or main exercise about to be undertaken. An effective warm-up involves three stages:

- A 'pulse raiser' to steadily increase the activity of the cardiovascular and respiratory systems.
- Stretching of the muscles.
- Rehearsal of the activity about to be performed.

### Hydration

Being hydrated and maintaining hydration is critical. Dehydration has been shown to increase blood viscosity (thickness). Thicker blood means the heart has to work harder to pump it around the body, and the

maximum amount of oxygen that can be provided to the working muscles is reduced. Dehydration also affects the body's temperature regulation, putting performers at a higher risk of heatstroke and hyperthermia, along with negatively affecting performance levels through impaired concentration levels, fatigue and possible cramp.

### Conclusion

Responses to exercise are largely consistent for all of us. Fit or unfit, our bodies will respond to exercise. However, the level of response and ability to keep responding to higher demands of exercise is where differences lie and where elite athletes flourish.

Mark Thompson teaches PE at Roundhay School, Leeds.

## Resources



Burton, D. A., Stokes, K. and Hall, G. (2004) 'Physiological effects of exercise', *Continuing Education in Anaesthesia, Critical Care & Pain*, Vol. 4, No. 6, pp. 185–188.

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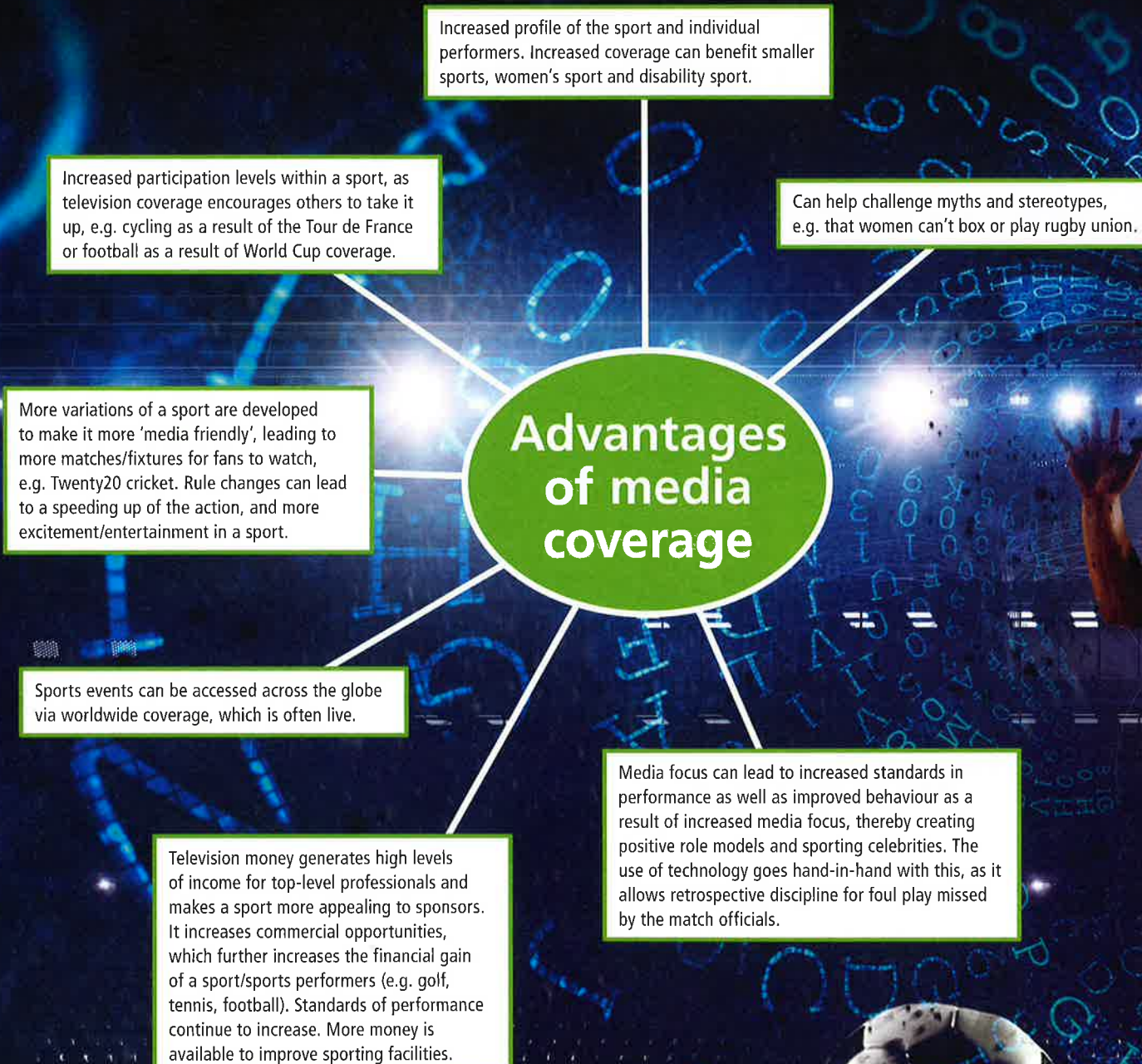


# Media influence on sport

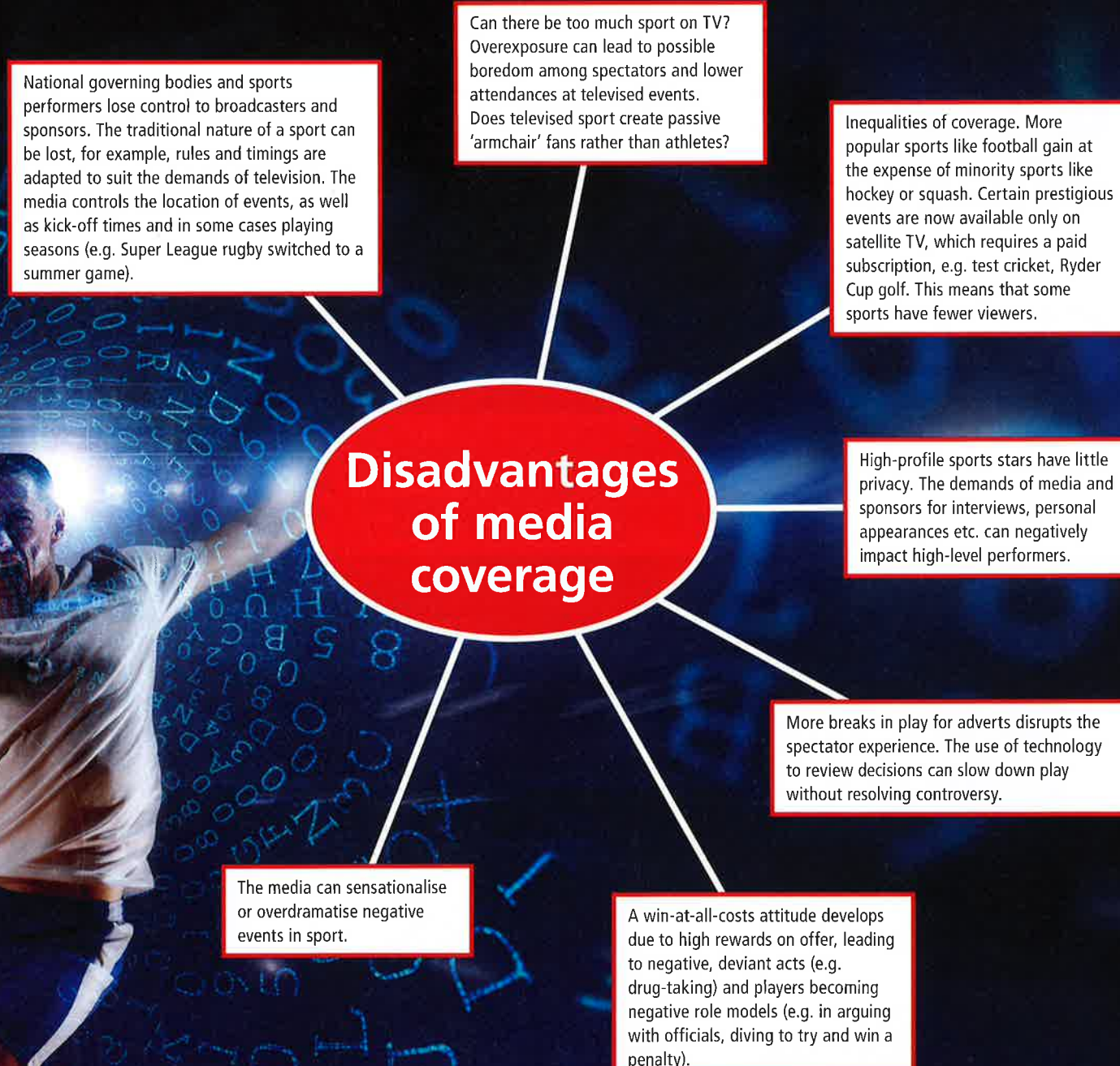
## Positive and negative effects

Charlie Esson summarises the advantages and disadvantages associated with media coverage of sport

### Advantages of media coverage



### Disadvantages of media coverage



PEReviewExtras

Download this poster at  
[www.hoddereducation.co.uk/perreviewextras](http://www.hoddereducation.co.uk/perreviewextras)

Charlie Esson teaches PE at Stamford School.



# Concussion

## Injury prevention and rehabilitation

Adam Morton explores the high-profile topic of concussion

### Exam links

**AQA**, **Edexcel** and **OCR** all require knowledge of 'classifying injuries', 'injury prevention' and 'rehabilitation from injury', with the OCR specification mentioning concussion specifically.

Concussion, defined as a traumatic brain injury, has in recent years become an increasingly prominent issue in sport. High-profile cases such as those of Alex Danson, Shontayne Hape and Loris Karius (see the case studies in Boxes 1–3) have all served to raise awareness of concussion. However, as the

tragic death of several young rugby players has demonstrated, while concussion affects athletes at all levels, young people playing contact sports are at greater risk. Although many would argue that governing bodies have still not done enough to protect players, there have been changes in several sports with, for example, the introduction of head injury assessments (HIAs) and the trialling of new tackle laws in rugby.

The issue has also been prominent in American football. The 2015 film *Concussion*, starring Will Smith, highlighted the long-term consequences of repeated head injuries and documented how retired players have

sued the National Football League (NFL), accusing the governing body of failing to warn and protect players. The NFL agreed an out-of-court settlement of more than \$1 billion.

Ex-footballer and *Match of the Day* pundit Alan Shearer also presented a BBC documentary entitled *Dementia, Football and Me* in which he investigated possible links between heading a football, brain injury and mental illness.

### Classifying injuries

Sports injuries involve a loss of structure or function of part of the body, usually along with pain experienced by the



A rugby player goes off for a HIA

athlete, which impairs or prevents them from training or competing. Injuries are classified according to their aetiology (the event causing the injury), with **acute injuries** occurring instantaneously and **chronic injuries** developing over a period of time. Injuries can be further classified as hard-tissue (bone) or soft-tissue (muscle, tendon or ligament) injuries depending on the tissue affected.

Concussion is usually the result of impact to the head but can also be caused by impact elsewhere on the body, the force of which shakes the spongy brain matter against the hard inner walls of the cranium.

While concussion is the most common and usually least serious form of traumatic brain injury, the severity of

the resultant swelling varies significantly. Repeated concussions are particularly dangerous, especially when the injured athlete has failed to recover fully from a previous concussion. Young people are particularly susceptible to this form of 'concussion upon concussion'. Known as *second impact syndrome*, it can cause long-term damage to the brain and has been fatal in some cases.

### Injury prevention

Reducing the risk of concussion involves addressing several of the same categories of risk factor (intrinsic and extrinsic) as the prevention of musculoskeletal injuries (e.g. muscle strains or ligament sprains).

### Intrinsic risks

Intrinsic risk factors are specific to the individual and include the following:

- **Individual variables:** children, those who have suffered a previous concussion and those participating in contact sports are at greater risk of concussion.
- **Training effects:** training to prevent injury is known as 'prehabilitation'. Sport-specific conditioning can reduce the risk of concussion by helping an athlete

### Key terms

**Acute injuries** Result from sudden impact or stress on the body (e.g. fractures, strains and sprains).

**Chronic injuries** Result from repeated stress on the body over a period of time (e.g. stress fractures and tendonitis).

### Box 1 Alex Danson

Two years after captaining the gold medal-winning GB hockey team at the 2016 Rio Olympics, Alex Danson suffered a concussion when she accidentally hit her head against a concrete wall on holiday. After suffering severe headaches and sensitivity to light and noise, she was hospitalised following seizures and sickness. She told the BBC:

'My memory, concentration and ability to read or look at screens was zero... One of the hardest parts in all of this, aside from the physical trauma, has been losing my identity. Going from leading my country, aspiring to qualify for the Tokyo Olympics to just trying to get through a day.'

### Box 2 Shontayne Hape

After retiring from professional rugby due to several serious concussions, Shontayne Hape told the *New Zealand Herald*:

'Things got so bad I couldn't even remember my PIN number... My memory was shot... The specialist explained that my brain was so traumatised, had swollen so big, that even just getting a tap to the body would knock me out. I had to retire immediately... This is an issue people, particularly young players, need to know about. More people need to speak out about it... Most players won't, though, for fear of being thought of as soft or because of the financial pressures.'

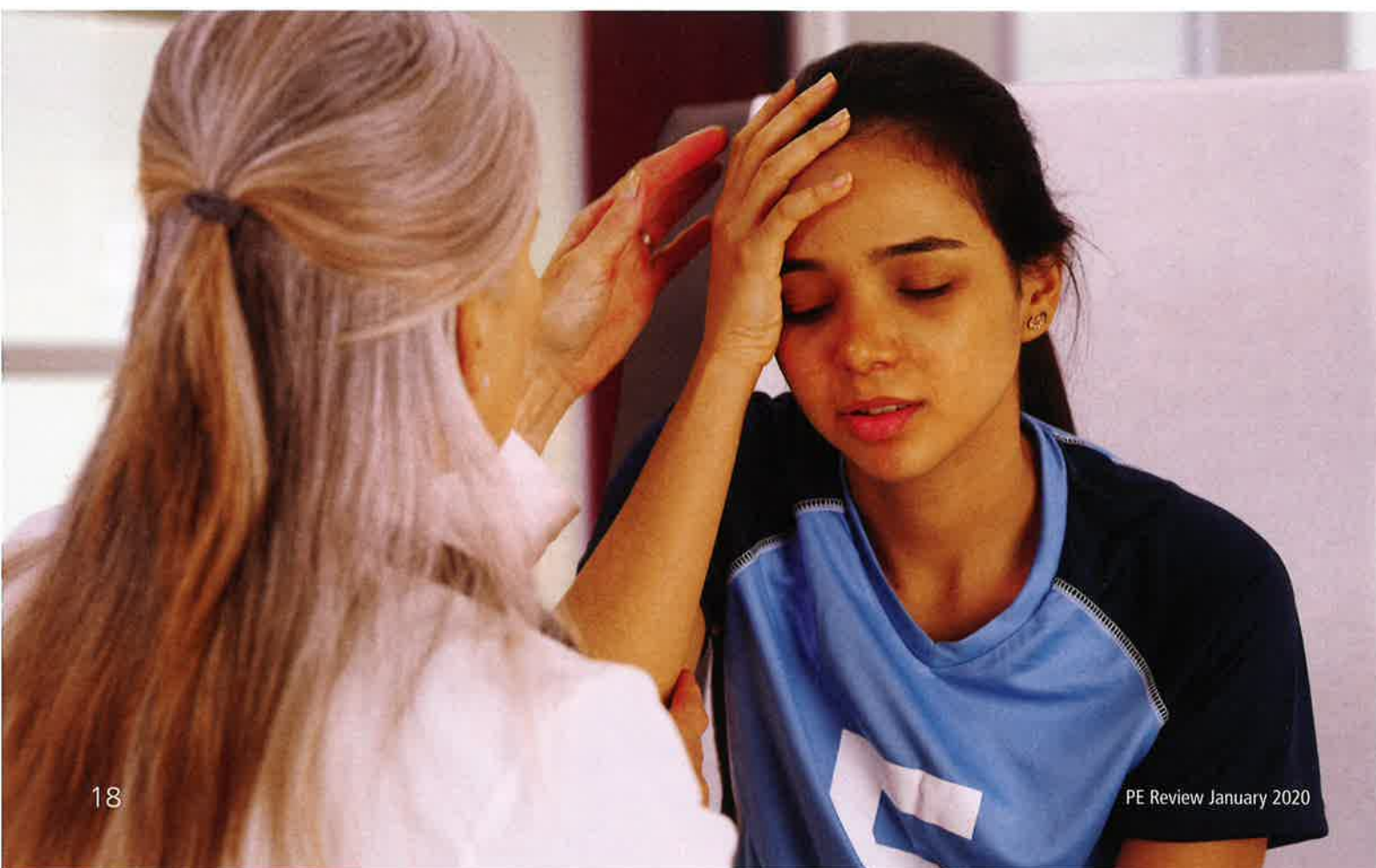
Read the full interview at [www.tinyurl.com/y5dpeckw](http://www.tinyurl.com/y5dpeckw)

to maintain safe technique for longer, reduce contact and better absorb impact forces.

### Extrinsic risks

Extrinsic risk factors are dependent on the situation and can often be controlled to reduce the risk of concussion:

- **Protective equipment:** ensuring that players wear the correct protective equipment is often part of the rules or laws of a game (i.e. wearing a gumshield and headguard in amateur boxing).
- **Technique and training:** teaching the correct and safe techniques reduces injury risk (e.g. tackling in rugby).





## Box 3 Loris Karius

While playing for Liverpool in the 2018 Champions League final against Real Madrid, goalkeeper Loris Karius was deemed at fault for two goals as Liverpool lost 3–1. It was later revealed that the goalkeeper may have suffered a concussion following a collision earlier in the game. Even a slight impairment of vision, concentration or reaction time, which are common symptoms of concussion, could have affected Karius's performance and contributed to the errors he made.

- **Appropriate level of activity:** fatigue can lead to impaired decision-making and technique, both of which can increase the risk of concussion. This means that inappropriate intensity, duration or frequency of activity all increase the risk of concussion. Similarly, balanced competition (e.g. age, weight or gender-specific categories) ensures that sports can be played more safely.
- **Warming up:** increasing physiological and psychological readiness to perform reduces injury risk.

## Rehabilitation

Treatments to accelerate recovery depend on the nature and severity of the injury. They range from conservative

management options such as **physiotherapy**, ultrasound and massage to invasive surgical treatment used for more severe injuries. Contemporary recovery and rehabilitation techniques include the use of **cryotherapy**, **hyperbaric chambers**, oxygen tents and ice baths.

Lower-cost treatments also exist that athletes can use at home. These include icing an injury, anti-inflammatory drugs, contrast therapy (alternating hot and cold treatment) and the wearing of compression garments.

## Diagnosing concussion

An injury must first be recognised and correctly diagnosed before the beginning of a rehabilitation or recovery

## Key terms

**Physiotherapy** Involves the use of exercise, movement, stretching and massage to treat injury.

**Cryotherapy** Involves exposure to extremely low temperatures (–120°C) to reduce inflammation and accelerate recovery.

**Hyperbaric chambers** Provide oxygen at greater than normal pressure. The additional oxygen promotes recovery.

## Box 4 The six Rs

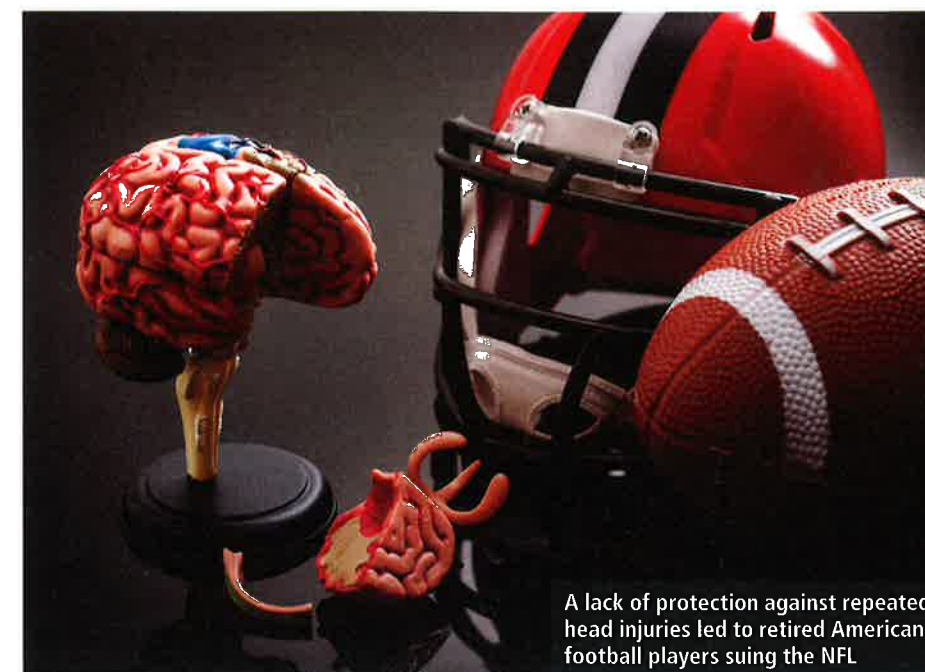
World Rugby's 'Recognise and Remove' concussion management protocol:

- Recognise the signs and symptoms of concussion.
- Remove the player from play immediately if concussion is suspected.
- Refer the player to qualified medical staff once removed.
- Rest the player from all exercise until symptom-free.
- Recover fully, following the Graduated Return To Play (G RTP) protocol.
- Return to play once the G RTP protocol is complete and cleared by qualified medical staff.

programme. The recognition of concussion follows the SALTAPS protocol, which can be used to assess any sporting injury. It involves the following steps

- see
- ask
- look
- touch
- active
- passive
- strength

In the case of concussion, the first three stages of assessment (see,



A lack of protection against repeated head injuries led to retired American football players suing the NFL

ask, look) would reveal one or more of the commonly recognised signs and symptoms of concussion. These include headaches, dizziness, memory disturbance, nausea (feeling or being sick), poor concentration, sensitivity to light and noise, depression and balance problems.

It is important to note that while a loss of consciousness (i.e. being knocked out) is a clear indicator that concussion has been suffered, most incidences of concussion do not involve a loss of consciousness. Concussion can still occur even if you have not been knocked out.

If concussion is suspected, it should be treated immediately by removal from play, followed by rest, both of which are common features of the generic procedures for management of soft-tissue injuries. These are variously referred to as RICE (rest, ice, compression, elevation), PRICE (protection, rest, ice, compression, elevation) or POLICE (protection, optimal loading, ice, compression, elevation). In the case of suspected concussion, however, compression should not be used.

## Concussion in rugby

Growing concerns over concussion have led to World Rugby developing and promoting recognition and correct

treatment at all levels of the game, from the professional level to schools and club games.

The Rugby Football Union's Headcase programme aims to educate players, coaches and officials about the 'six Rs' of World Rugby's 'Recognise and Remove' concussion management protocol (Box 4). Alongside the introduction of the six Rs has been the development of the Graduated Return To Play (G RTP) protocol, which ensures that a player who has suffered concussion is symptom-free before progressively increasing their participation in exercise and training.

## Exam-style questions

- 1 Identify four ways in which injuries can be classified. (4 marks)
- 2 Explain how different risk factors can be managed to reduce the likelihood of injury. (6 marks)
- 3 Describe a recognised concussion management protocol. (6 marks)
- 4 Outline a commonly used procedure for the management of soft-tissue injuries. (4 marks)
- 5 Name two methods used to recover and rehabilitate from injury. Explain the physiological reasons for why they are beneficial. (4 marks)

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[www.hoddereducation.co.uk/perereviewextras](http://www.hoddereducation.co.uk/perereviewextras)

The G RTP protocol specifies a minimum rest and recovery period of 23 days to allow the brain to recover before returning to play. While elite performers with higher levels of medical support may return sooner than this, this is only possible if they successfully pass through the various stages of the G RTP protocol. This involves an initial period of rest until completely symptom-free, followed by the gradual reintroduction of exercise, sport-specific training and contact training (where appropriate) before re-entering competition. At each stage the athlete must remain symptom-free before the intensity and duration of exercise is increased.

## Conclusion

Concussion is an important issue in sport today, and there is much that can be learned about the classification of injuries, injury prevention and rehabilitation from injuries through a consideration of concussion. More significantly, an understanding of the causes of concussion, the signs and symptoms and how to respond to suspected concussion might help protect those you play with, coach or officiate from further injury. Here the national governing bodies for football (the FA) and rugby (the RFU) both agree on the most important guideline for concussion: 'If in doubt, sit them out.'

## Key points

- Concussion is a serious brain injury that can result in fatality.
- World Rugby launched a 'Recognise and Remove' campaign involving the six Rs.
- The recognition of concussion follows the SALTAPS protocol.
- Intrinsic risk factors of concussion are specific to the individual and include individual variables and training effects.
- Extrinsic risk factors of concussion are dependent upon the situation and can often be controlled to reduce the risk of concussion, for example wearing protective equipment.

Adam Morton teaches PE at Mill Hill School, London.



Goalkeeper Loris Karius suffered a suspected concussion in the 2018 Champions League final



# The evolution of sport

## Pre-industrial Britain

John Ireland explores the social and cultural factors that have shaped the characteristics of and participation in sport



Exam links

AQA Paper 1 (sport and society)

Edexcel Component 2 (psychological and social principles of physical education)

OCR Component 3 (sociocultural issues in physical activity and sport)

The afternoon of 14th July 2019 produced multiple classic sporting spectacles, with the England cricket team, inspired by Ben Stokes, requiring a ‘super over’ to defeat New Zealand in the ICC Cricket World Cup final. On the same day, Novak Djokovic overcame Roger Federer during an epic Wimbledon tennis final, and Lewis Hamilton was victorious in Formula One’s British Grand Prix. *The Times* newspaper declared: ‘This is sport at its best.’

Although sport has always provided excitement, its presentation at elite level has been enhanced by commercialism and advanced technology. Increased media attention has had a global impact on sport, influencing participation and performance. However, sporting stakeholders were collaborating as far back as the mid-eighteenth century to begin a trail towards the unimaginable standards of athletic competition enjoyed today. The forces of history on the evolution of sport are significant.

**Social class and sport**

In pre-industrial Britain the lower classes and the upper classes pursued separate activities, adopting contrasting codes of conduct (Table 1).

The lower classes participated in *popular recreation*, including such activities as mob football, cheese rolling, wrestling and other contests of strength. The upper classes participated in their own sports and pastimes through *courtly behaviour* — examples included shooting, hunting and real tennis. The classes sometimes came together when a gentleman became patron to a lower-class performer. A patron offered a type of sponsorship by standing wagers (bets) on contests, and performers were paid from these wagers, marking the earliest forms of professionalism.

The lower classes had little time or energy for play, as most daylight time was taken up by working. Their lives were controlled by **seasonal time**, not by the clock. They had no

prospects and could not escape their lowly origin. However, on holy days and festivals, opportunities arose for pastimes, bringing whole villages together for social occasions. Various **ethnic games** took place and different forms of ‘football’ emerged. For example, the Ashbourne mob game took place every Shrove Tuesday.

Life in the lower classes was short and harsh. Public hangings attracted large crowds. There was no police force to maintain law and order, and local sheriffs often inflicted unjust punishments. Cruel sports were acceptable, e.g. bear-baiting, dog-fighting and cock-fighting.

The lives of lower-class women were just as harsh as those of men. Women had few rights and were

regarded as the weaker gender, serving the needs of their husbands. Activities reflected this lowly status — during festivals women may have competed in a ‘smock race’, a short running dash with the winner being awarded a smock or basic dress. Participation opportunities were also limited for upper-class women. Archery was considered appropriate, and women later played tennis on the lawns of large country houses.

### Origins of modern sports

#### Mob football

The origins of mob football are unclear. Connections have been made with pagan rituals, and some sources claim the head of a Danish nobleman was brandished in some kind of a game after an invasion had been repelled.

Goals or targets were often positioned miles apart. The ball was an animal bladder, which was forced through marauding throngs of participants, over fields and often through rivers. The mob could not be

controlled, and villagers barricaded their houses as the game passed by. Serious injury was common, and fatalities occurred frequently.

These games were the forerunners of association and rugby football. The gentry would rarely involve themselves as participants, but they could do so, whereas the lower orders were strictly excluded from courtly pastimes.

#### Real tennis

Real (or royal) tennis originated in France. It required great skill, and participation was exclusively the preserve of the gentry. Cheaper interpretations involving racquets, bats or hands were also called tennis, to be played against pub or church walls by those not eligible to play real tennis.

#### Foot racing

The gentry travelled in horse drawn coaches, and employed *running footmen* to guard against accidents on the poorly maintained roads. These footmen sometimes covered 60 miles

Key terms

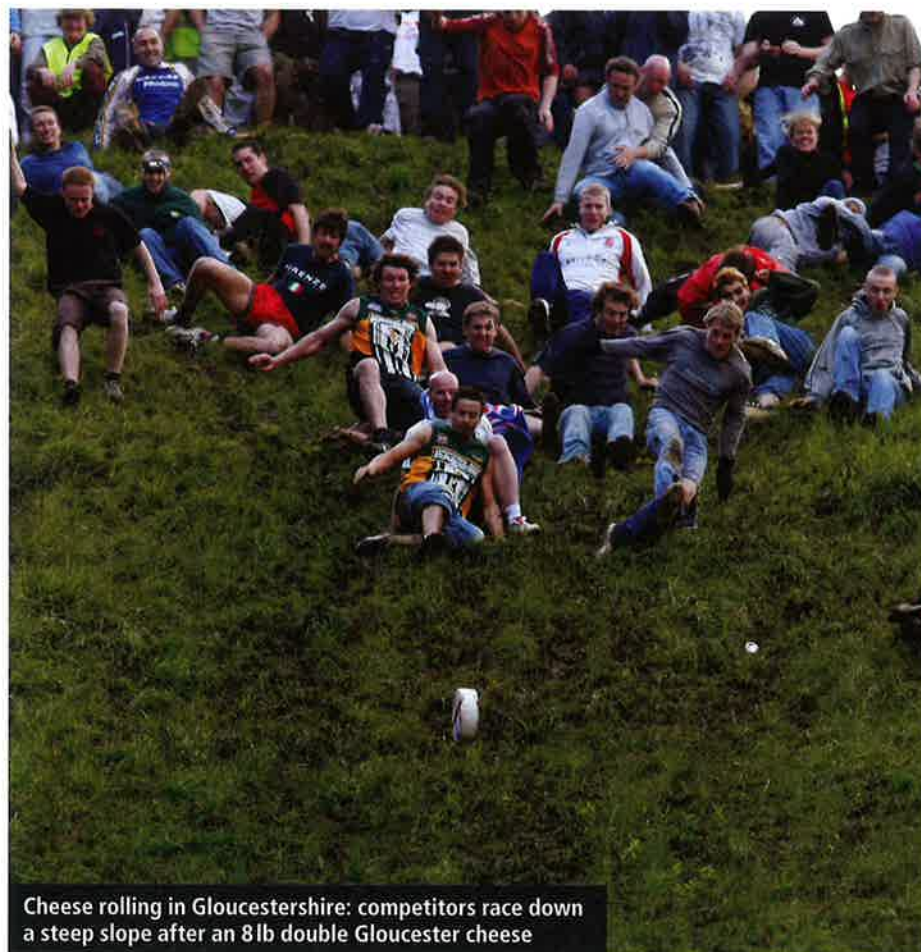
Seasonal time Work starting at sunrise and ending at sunset.

Ethnic games Activities unique to one area, e.g. cheese rolling (Gloucestershire) or tar-barrel carrying (Devon).

Table 1 Characteristics of pre-industrial sports and pastimes associated with class

|                | Lower-class activities  | Upper-class activities  |
|----------------|---|---|
| Location       | Local. Confined within a village, or in the area around it, as people did not have the ability to travel  | Dispersed. Sometimes short distances of travel to courts or area of the ‘hunt’  |
| Engagement     | Violent — participation was often fuelled by alcohol  | A code of etiquette prevailed among players. Killing foxes and game was perceived to be fair  |
| Spectators     | Crowds of spectators took the form of a drunken, rowdy mob with an aggressive nature  | Spectators took the form of an audience. Real tennis was played in front of a gallery. Onlooker behaviour was dignified                   |
| Laws and rules | Rules, if any, were unwritten — the lower classes were illiterate   | Written rules brought sophistication, protocol and a manner of etiquette. The upper classes were educated                                 |
| Frequency      | Took place only on feast days or holy days, which provided a holiday for working men  | Could take place at any time — the gentry had limitless leisure time  |
| Technology     | No pitches or official boundaries, e.g. markings and goals  | Courts, nets and racquets for real tennis<br>Guns and ammunition for shooting<br>Resources such as hounds and horses required for hunting |
| Finance        | The lower classes were poor. There was no money to support games and pastimes.  | The gentry were rich. They had money for equipment and resources  |
| Rural          | Both kinds of activities took place in the countryside. Britain had an agrarian economy. Urbanisation began at the outset of the Industrial Revolution (1750) |   |





Cheese rolling in Gloucestershire: competitors race down a steep slope after an 8lb double Gloucester cheese



Tar-barrel carrying in Ottery St Mary, Devon

in a day. This was before the invention of the bicycle or the advent of the railways.

The upper classes would issue challenges to each other in the form of races between their footmen over set distances. A foot race of 22 miles took place at Windsor Park in 1712, and foot racing attracted large crowds. Betting was common — setting wagers not only gave opportunities to display 'sport at its best' but was also a chance for patrons to show off their wealth.

By the end of the eighteenth century, races had spread across the country, and Captain Robert Barclay Allardice was a renowned athlete of the day. He gained national fame and fortune by walking 1,000 miles in 1,000 hours for 1,000 guineas. He was also a fine runner, winning a 1-mile race at Eastbourne.

These activities led to the development of *pedestrianism* (walking and running as racing or endurance events).

#### Rowing

Aquatic activities also attracted betting. Before the Industrial Revolution, few bridges spanned the River Thames, and the wealthy employed 'watermen' to row them across the river. This quickly developed into racing challenges. By 1715, a competition for watermen was organised over a stretch of river from London Bridge to the White Swan at Chelsea. The winner was handsomely paid and received the prestigious Doggett's Coat and Badge. These activities marked the beginning of competitive rowing.

#### Cricket

Village cricket was played from the early 1700s. The first written rules were implemented in 1727, and the game took recognisable shape in 1774 when the size of the equipment was regulated, a six-ball over was introduced and it became illegal to knock a fielder down as a catch was attempted.

Patrons often employed servants and gardeners who were noted cricketers, so they were effectively paid to play. From the outset, the upper classes played alongside employees, with the former always taking the role of captain. This coexistence of amateur and professional players prevailed in English county cricket until 1963.

The game became more sophisticated, for example care was taken when sowing and rolling pitches. Large crowds watched and placed bets, and purses of £5,000 (equivalent to £500,000 today) were awarded to winning teams.

#### Pugilism

Bare-knuckled fighting also featured in pre-industrial Britain, with matches taking place at fairs and festivals throughout the country. The first reported contest was between a footman and a butcher in 1681. Encounters were lawless, and eye-gouging and grappling were acceptable. James Figg is recognised as the first British champion (in 1719), who despite an unsavoury image mixed with high society and was sponsored by the Earl of Peterborough.

Pugilism was known for match-fixing, particularly when high betting stakes were involved. There was no police force to maintain order, and those suspected of throwing a fight were often pursued by an angry crowd.

With the introduction of the Broughton Rules (1743) the origins of modern boxing become evident, but it wasn't until 1867, in post-industrial England, that John Graham Chambers drew up a definitive list of rules for boxing. They were called the Queensberry Rules after the Marquess of Queensberry, providing respectability to the sport.

#### Education and lifestyle

##### The lower classes

The lower classes received no formal education and were almost all illiterate. This situation remained

Archery was considered an appropriate activity for upper-class women



unchanged until beyond the mid-nineteenth century.

However, the **industrial revolution** that began in the eighteenth century brought opportunities for the lower-class population. Labourers left the land and migrated to developing settlements of industry. Rural depopulation began, and urban growth gathered momentum as mechanisation developed. The British empire was expanding, and an industrial economy overtook the agrarian system.

Despite these opportunities, industrial workers were little more than slaves in mines and factories.

#### Key terms

**Industrial Revolution** Development and invention of machinery, which increased industrial production.

Living conditions were cramped and squalid. Health was generally poor, infant mortality was high and life expectancy was below 30. The working week extended to 80 hours over 6 days, with few public holidays. There was no time or space to play sport, and it was not until the second half of the nineteenth century that quality of life improved and opportunities for leisure and sport emerged (Table 2).



**Table 2** Working-class life in relation to sporting development

| 1750–1850 (pre-industrial period)  | 1850–1900 (post-industrial period)  |
|--|---|
| Migration to developing industrial areas, causing uncontrolled growth of urban settlements | Town planning with amenities, e.g. gaslight and sewage systems  |
| Squalid living conditions  | Improved living conditions  |
| Disease and high mortality   | Healthier living conditions   |
| Largely illiterate, no formal education  | Beginnings of formal education  |
| Six-day working week   | Working week reduced to 57 hours. Saturday becomes a half day of work   |
| Controlled by machine time   | Increased holiday entitlement, e.g. annual holiday  |
| No time or energy for recreation   | Opportunity and time to play sport  |
| No facilities  | Facilities provided by industrialists for workers   |
|  | Growth of professionalism. Sport regarded as 'an end in itself', providing distraction, consolation and entertainment |

As a consequence of this deprivation, 15 million people left Britain in the nineteenth century, with most emigrating to Australia and America. Migrants took with them games and traditions enjoyed in the British countryside. These countries provided opportunities to those who were brave, resilient and hard-working. In consequence, sports

evolved differently, and their cultural influence would eventually spread to British sport in the last quarter of the twentieth century.

Without a hierarchical class structure, Australia and the USA had no reason to view professionalism as vulgar, and did not place amateurism on the plinth of purity, which led to the commercialisation of their sports.

**Table 3** The three stages of public schools

| 1790–1828: bullying and brutality   | 1828–1842: social control and influence of games  | 1842–1914: cult of athleticism   |
|---|---|--|
| Schools were spartan and known for bullying and brutality   | A time of change in society, e.g. cruel sports banned. Formation of police force. Thomas Arnold was the prime mover in public school reform                                       | A strong trend for compulsory team games symbolised the philosophy of athleticism, producing the leaders required for the expanding British empire |
| Narrow, tedious curriculum  | The curriculum was broadened  | Sport had priority over academic work  |
| Boys organised recreation for themselves to relieve boredom. Activities reflected popular culture, ranging from the childlike to the barbaric | Games were encouraged as an agent of social control, being played 'hard but fair'   | Schools adopted official versions of games and drew up strict rules  |
| Facilities were crude and often natural, e.g. bathing in rivers   | Severity of punishments was reduced   | Former pupils unified codes and set up governing bodies  |
|   | Participation aimed to produce Christian gentlemen e.g. production of a strong soul in a strong body (muscular Christianity). House systems were adopted to introduce competition | The amateur ethos was established — sport regarded as a means to an end  |
|   | Sixth-formers were granted responsibilities and entrusted with organisation   |  |

## Key term

**Cultural borrowing** Taking examples of good practice from other countries.

Through **cultural borrowing**, Britain followed their leads.

## The upper classes

The gentry sent their sons to public schools such as Winchester (founded in 1382), Eton (1440), Rugby (1567) and Harrow (1571). At this time schools were spartan and the treatment of the boys was brutal. Bullying and floggings were commonplace.

Games were not overseen by masters. Boys came from far afield, bringing with them their own customs and traditions. Mixing of activities made the public schools a melting pot in which games were adapted. Games like the Eton wall game emerged. They reflected popular culture, including bare-knuckled fighting and mob activities — football at Charterhouse was similar to mob football.

Boys were out of control and reform was urgently needed. Reform came in three stages (Table 3), during which public school sport became codified, dignified and the principle agent of social control.

## Key points

- Social class and sport: each class system had its own sports. Working classes indulged in popular recreation. The gentry adopted a courtly approach.
- Law and order: lawlessness and brutality during play. Bloodsports as pastimes.
- Gender: limited opportunities in sport and education for women.
- Education: upper classes had access to public school education. Illiteracy prevailed among working classes.
- Lifestyle: upper classes had leisure time for sports and betting. Squalid existence and debilitating working conditions for labouring classes — no energy, space or time to play.

**John Ireland** is an experienced teacher, and author of teaching and learning resources for A-level PE.



## Exam links

Research methods and data collection linked to health and exercise patterns are important skills for all A-level exam boards.

**A**t the Centre for Diet and Activity Research (CEDAR), in the School of Clinical Medicine at the University of Cambridge, we are conducting population-level research looking at the influences on what we eat and how much physical activity we do. We are developing and evaluating public-health interventions, and helping shape public-health practice and policy based on the findings of our research.

The Get Others Active (GoActive) study is now coming to a close. For the last 2 years we have been collecting information on physical activity from nearly 3,000 young people. Children tend to exercise less as they become

adolescents and remain physically inactive once they become adults. A lack of physical activity among young people can result in them becoming obese, developing mental health problems and suffering from poor bone development, and puts them at greater risk of developing long-term health problems, including diabetes and cancer.

GoActive was designed to increase physical activity in young people in year 9 (aged 13 to 14). Its aim was to include all students in a particular targeted year group, and to appeal

to students who did not do a lot of exercise, were shy or were not happy with their relationship with others at school. The main aim of this study was to find out whether the GoActive programme helped to increase physical activity of year 9 students when in the school environment.

## Aims and methods

The GoActive study was a **cluster-randomised control trial** designed to assess the effectiveness of the GoActive programme in increasing adolescents' physical activity levels. The study was implemented in 16 schools across Essex and Cambridgeshire, with eight schools receiving the GoActive programme, and eight remaining as control schools. Measurements assessing physical activity, **body composition** and **psychosocial** factors were obtained at four different time points.

## Key terms

**Adolescent** A young person who is developing into an adult.

**Cluster-randomised control trial** A type of randomised controlled trial in which groups of subjects (as opposed to individual subjects) are randomised.



## Key terms

**Body composition** In physical fitness, body composition is used to describe the percentages of fat, bone, water and muscle in human bodies.

**Psychosocial** The psychosocial approach looks at individuals in the context of the combined influence that psychological factors and the surrounding social environment have on their physical and mental wellness, and their ability to function.

A key aim of GoActive was to increase physical activity through increased peer support, self-efficacy, self-esteem and friendship quality, and it was implemented using a tiered leadership system. Tutor groups chose two weekly activities each. Mentors (older adolescents in the school) and peer-leaders (two per class) encouraged students to try these. During the study, students gained points for trying new activities, and were entered into inter-class competition.

Both qualitative and quantitative data were collected, which provided a large data set and many interesting findings.

### Quantitative data

Quantitative data on students' age, gender, ethnicity, family socioeconomic position, shyness and physical activity were collected from self-reported questionnaires. Quantitative process evaluation data were collected in post-intervention questionnaires.

### Qualitative data

Qualitative data were collected from all eight intervention schools towards the end of the intervention. Individual

## Key term

**Self-reported questionnaire** A self-report study is a type of survey, questionnaire or poll in which respondents read the question and select a response by themselves without interference. A self-report is any method that involves asking a participant about their feelings, attitudes, beliefs etc.

and group interviews were conducted by our qualitative researcher. Participants were grouped by level of participation and sampled to aim for a mix of genders. Interviews were recorded and transcribed verbatim (i.e. everything that was said was noted).

### Feedback

Participants reflected on a number of key GoActive components, including their enjoyment of the intervention (i.e. the amount of fun they had with the programme), competition, choice and novelty. It was found that many of the components overlapped and impacted upon enjoyment and participation.

Participants described the sessions as an opportunity to socialise with their form group and with other students they wouldn't usually socialise with, as illustrated by the comments below:

**Researcher** 'Two months ago, would you have spoken to these people in your form group?'

**Participant** 'No, not really, I normally keep my head down and read my book or something in form. But it's kind of quite fun, it's something different, and I think, because we're all on the same team as such, we all kind of get along and want to play.'

Some students noted that GoActive sessions helped with behavioural management and keeping a class focused on a task:

**Participant** 'When our form misbehave loads then we have to do silent reading, but as soon as GoActive came into place, they started misbehaving less and less... So I think, because they're enjoying it they stopped messing about so they could go out and do more fun things in form.'

Students preferred engaging in GoActive sessions and having something to do rather than traditional form-time activities (e.g. sitting and talking, reading or personal reflection):

**Participant** 'I like trying new things and I find [the intervention] really fun...and it's better than just sitting there and doing nothing, because that's what we always do in form.'

### Boys and girls

Some elements of GoActive were favoured more by different subgroups, for example boys preferred the class competition compared to girls and the general consensus from the focus groups was that the competitive element of the activities was a source of fun for boys. The GoActive programme aimed to avoid the stigmatisation of targeting particular groups. One boy commented:

**Participant** 'In our form we've done competitions against other forms, so the boys from one form and the boys from another form, we went into the sports hall and played dodgeball, that was fun.'

However, the results showed that many girls did not enjoy competition, and interview discussions revealed that it was a deterrent to participation. Questionnaire data suggested that boys liked choosing new activities more than girls. It was found from interviews that students were shy and displayed apathy towards suggesting an activity, therefore choice was limited among the year 9 students.

Girls seemed to be more interested in trying out different activities as opposed to boys. A class vote to decide an activity choice usually resulted in one person or a small group (usually boys) deciding the activity for the class. On most occasions football was the chosen sport. When girls were able to choose the activity, it was found that not many students participated, suggesting that the solution may be to have separate

## Resources

For more information about the GoActive project and an introductory video, go to [www.tinyurl.com/y3t85wz6](http://www.tinyurl.com/y3t85wz6)

activities for boys and girls. Two girls described their experience:

**Participant 1** 'We tried yoga, but there was only a few people that actually wanted to do it, and everyone else kind of just took the mick and just sat on the floor.'

**Participant 2** 'We tried Zumba, but... there were about three people that were really going for it, but then nobody else was.'

### Leadership

In relation to the in-class year 9 leaders, the study results indicated that boys preferred having leaders more than girls, but focus group discussions revealed the implementation of leaders was low:

**Participant** 'Ours was a bit confusing because no one really wanted to be the leader, I don't know why but, yeah, no one wanted to do it.'

It appeared that teachers had to resort to selecting the new class leaders each week. Students who were considered 'good' at a particular activity were the first to be selected by the teacher, which some participants said meant they were less likely to volunteer themselves, as they did not feel they had sufficient skills:

**Participant** 'I don't know, I don't normally get too involved with those things, and...I feel like there's more people...that might have done better in doing it.'

The provision of in-class leaders was supposed to promote autonomy, but instead may have led to feelings of embarrassment and fear of judgement.

The components used in the GoActive programme, including mentorship, flexibility and choice are commonly used in health-promotion interventions. Students indicated that the impact of the intervention

## Key term

**Autonomy** Being in control of your own life.

The study enabled participants to engage in a wide variety of activities, from dodgeball to Zumba



could have been enhanced by earlier integration of the intervention and direct incorporation into the timetable. However, this would go against the programme's aims of developing autonomy in participants and flexibility across different school settings.

### Conclusion

This study is a novel contribution to the field and it is possible that the intervention was experienced differently by other subgroups, e.g. participants from a lower socioeconomic position, but the focus groups were not set up to explore these differences. The large sample size of the quantitative data and the in-depth findings from the qualitative data provide insights into mechanisms of

complex interventions within a multi-faceted environment.

In conclusion, this study showed that mentorship and autonomy were liked in principle, but implementation issues impacted upon student satisfaction. Different elements of the intervention were favoured by some more than others, e.g. competition was liked by boys but disliked by girls. For adolescents, there is a need to include an in-depth school-led design and implementation of activity choice provision and novelty, and improved mentorship training when designing future interventions.

**Sofie Armitage** is a GoActive research assistant based in the School of Clinical Medicine at the University of Cambridge.



# The evolution of sport

## Post-industrial Britain

John Ireland looks at the links between social class and sport



### Exam links

- AQA** Paper 1 (sport and society)
- Edexcel** Component 2 (psychological and social principles of physical education)
- OCR** Component 3 (sociocultural issues in physical activity and sport)

As the Industrial Revolution gained momentum, wealth was no longer a hereditary right of birth. The middle classes were aspirational and sought to copy the lifestyles of the upper classes. They sent their sons to public schools, and this generation gave strong direction to sports development.

Public school old boys were expected to fill key roles in society.

They became industrialists, army officers, vicars and leaders of the British empire. With these outcomes in mind, the public schools promoted sport in order to develop boys' character and moral integrity. Games were seen as more important than the academic curriculum, and were made compulsory. Boys and masters became obsessed with team games, which became integral to public school life.

Universities also had a hand in sporting evolution. Populated by middle- and upper-class former public school boys, universities unified rules of play, and former students were involved in establishing the first sporting governing bodies.

### Cricket, football and rugby

Cricket had long been established in rural England. The rules were codified and commonly understood. Eton played Harrow for the first time in 1805. This match took place at Lord's over three days and once attracted a crowd of 20,000 — the fixture survives today as a limited-over match. Such social events gave opportunities for schools to show themselves off and attract more pupils and funding.

Football, due to its rustic peasant origins, caused consternation among masters. However, schools brought order to play. The spread of the railways allowed the possibility of reliable and convenient travel,

enabling the organisation of fixtures between schools. However, difficulties occurred in inter-school fixtures because every school had a different variation of the game. For example, Charterhouse favoured the dribbling game (later the basis of association football) while Rugby preferred the handling game (which developed into rugby football).

Football at this time was unrecognisable compared to the game played today. Rather than 4-4-2 or 4-3-3, formations were more like 8-1-1, with eight players dribbling from the back. The game was physical — it was within the rules to barge the goalkeeper before shooting at goal. Both the FA Cup and the first international match (Scotland vs England) took place in 1872. These events stimulated considerable interest, particularly among the increasingly liberated working classes, creating a reluctant fusion of class interests.

Crowds in post-industrial times were emotive and sometimes volatile. The situation remains unchanged in modern times — sporting events have always required policing.

When the Football Association (FA) committed to the dribbling game, Blackheath resigned their membership and elected to pursue the handling game. In consequence, the Rugby Football Union (RFU) was established in 1871. Three lawyers who were former pupils at Rugby School drew up the first laws of the game. The first rugby teams were based around London and the game was rooted in middle-class values. Southern control would later become a major source of acrimony between the social classes within rugby.

### Amateurs and professionals

Sport had made an important transition. It had changed from unsophisticated popular recreation, initiated in rural counties, to sophisticated rational recreation enjoyed in urban and suburban locations connected by railways (Figure 1). The advent of organised professionalism caused sport to become a business.

Professional players of today are skilful, dedicated and mentally attuned. Today 'professional' is a byword for excellence. Amateur

participants are regarded as performing at a lower standard than those who make a living out of sport.

In the nineteenth century, the definition was not so simple. The emergence of open professionalism was an acrimonious issue. Many sports, such as athletics, opposed professionalism, believing that payment would lead to corruption and the destruction of moral Christian values laid down by the amateur principle.

Professionals then were simply paid to play. They were considered inferior to gentleman amateurs in terms of social class. Amateurs were not paid a wage, but made money by claiming 'expenses'. At this time they were just as skilful as professionals.

### Professionalism in cricket

Cricket is the best example of this ambiguity. County cricket teams comprised gentleman amateurs and working-class professionals. The latter were employed to perform strenuous tasks, e.g. fast bowling (overarm bowling had been legalised in 1864) and maintenance of kit and grounds. Amateurs occupied more glamorous roles, e.g. batting. They played when it suited and used separate changing rooms from professionals.

Class distinction was paramount. Amateurs entered the field of play through different gates to emphasise class superiority. Professionals endured third-class rail travel and second-rate hotel accommodation. Gentleman amateurs were addressed as 'Mister' and always captained the team — until the 1950s the England cricket captain was required to be an amateur. It was thought that the 'gentleman' amateurs had greater powers of leadership and diplomacy — a legacy of public school aspiration

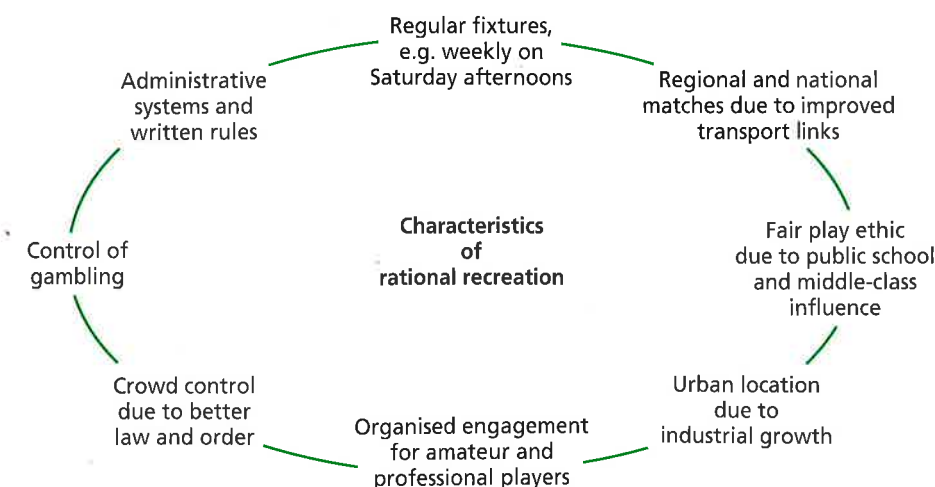


Figure 1 The development of sport in post-industrial Britain

[www.hoddereducation.co.uk/pereview](http://www.hoddereducation.co.uk/pereview)



and preparation. Although the relationship between amateurs and professionals was discriminatory, the factions coexisted functionally.

The leading player in these times was W. G. Grace, who enjoyed a long career as an amateur. However, Grace was invariably paid more than the professionals. It was socially acceptable for amateurs to receive lavish remuneration under the guise of compensation for travel and accommodation in the best hotels.

### Professionalism in football

By 1870, tradesmen were granted Saturday afternoon holidays. The weekend was born and the working classes sought sporting entertainment. The concept of sport being a source of entertainment was alien to the middle and upper classes, who up until then perceived only intrinsic benefits of games.

Working-class spectators preferred the endeavours of skilled professionals. As leisure time and wages increased, they were willing to pay for entertainment.

Association football found itself at the centre of a dilemma. After gaining popularity among the working classes, some clubs had discreetly moved towards paying players. This practice was called 'veiled professionalism'. Although there was great resistance from those who adhered to the amateur ethos, the mass demand for payment could not be ignored. Ironically, it was the introduction of the amateur-based FA Cup that accelerated the onset of open professionalism. Working-class clubs used gate money to pay wages to signed players.

### Regulated professionalism

The FA gave way and allowed professionalism in 1885. The transition was overseen by Charles Alcock, often referred to as 'the father of modern sport'. His management ensured minimum conflict between clubs remaining

amateur and those opting for a professional future — this amicability was not achieved in other sports.

Professional clubs required an income stream, and prosperity was dependent on spectator attendance. Football crowds were different from cricket enthusiasts. They tended to be parochial, partisan and rowdy. Stadiums were built in urban centres so railway links could be utilised. Stadium terraces were packed every week, and the development of the mechanical turnstile allowed clubs to monitor profits.

Players were regulated and owned by the clubs, and wages were managed accordingly. Until the abolition of the maximum wage in 1961, a football player earned about the same as a skilled tradesman. Transfer was possible only when it suited the club who held the signature of the player. The FA in turn controlled the clubs, ensuring profits were shared between league members.

### Professionalism in rugby

As in football, veiled professionalism occurred in rugby in the north of England. For some time this indiscretion remained undetected until it became obvious that teams in the region contained disproportionate numbers of working-class players.

Breakdown came in 1895. Members from the north who worked in heavy

industry such as manufacturing and coal mining could not afford to lose wages for missing morning shifts on Saturday in order to play. Permission was sought from the RFU for compensatory payment to be made to those with work commitments. The amateur ethos, ingrained in the sport's governing body, was placed under threat, and the request was refused.

In consequence, disenchanted teams broke away from the RFU and formed the Northern Union, which authorised broken-time payments to working-class members. The split was acrimonious — the RFU did not allow defecting teams to return, and players suspected of appearing in the Northern Union received lifetime bans.

As with football, the professional game became dependent on spectator attendance. Although initially successful, many clubs could not sustain the financial outlay and disbanded. The Northern Union changed the game's rules to attract larger attendances. It could be argued that this was the first attempt by a team sport to consider entertainment as a priority. Eventually the two codes developed into rugby league (the Northern Union) and rugby union (the Rugby Football Union).

One hundred years after the split, rugby union finally became professional in 1995.

### Education and women

Links between the growth of education and development relating to sport are highly significant. As literacy improved, the working classes began to understand written rules and read news items about their teams. This added to the momentum behind sporting interest.

During the mid-nineteenth century, women of all classes were dependent on men. They were expected to merely marry and have children. Prospects and opportunities



The spread of the railways allowed for reliable and convenient travel to away fixtures

were restricted by the conventions of society, and education was thought important for boys but not for girls.

By 1870, society was beginning to change. The Elementary Education Act made schooling available to the masses, including girls. Physical education was permitted for girls in 1873, and made compulsory for girls in schools within the London School Board.

### Buss, Beale and Österberg

Frances Mary Buss was a great innovator and believer in exercise. She taught at the North London Collegiate School, which became the model for girls' schools throughout the UK and overseas. Girls engaged in physical training, which followed the lines of drill and instruction.

Women from the upper classes could attend newly founded girls' public schools, which copied their counterparts by including games on the curriculum. For example, cricket was taught at several girls' public schools in England, and hockey and lacrosse were often seen as female preserves in these institutions. Dorothea Beale became principal of Cheltenham Ladies' College in 1858 and was an advocate of sport coexisting with academic study.

In her role as superintendent for the London School Board, Martina

Bergman-Österberg implemented the teaching of Swedish gymnastics in girls' schools. She became concerned with the unsuitability of teaching working-class girls in London, observing that they lived in an environment of malnutrition, neglect and dreadful living conditions. As a consequence, Österberg's interest shifted towards teaching middle-class women to become physical training instructors in schools. For this purpose she founded the first women's PE college at Dartford in London.

The work of these educators not only encouraged female participation in sport and PE, but also contributed to the wider movement of campaigners who were committed to bringing the entitlement of study, work, property ownership and the vote to women. However, male-dominated society still refused to take women's participation in sport seriously until well into the twentieth century.

### The spread of sport

In the last quarter of the nineteenth century, sport played a crucial role in the British empire. Its fundamental purpose was to transmit honourable values, associated with a morality code broadcast by British rule.

Values of amateurism were impressed upon the colonies. Cricket and rugby flourished in New Zealand,

Australia and South Africa. Sport was used as an 'agent of enlightenment' in the Cook Islands, Tonga and Fiji, and cricket and hockey became dominant on the Indian subcontinent, and in the West Indies. Tennis was played throughout the empire, though it was perceived as a game for elite society.

Sport was spread through military personnel, administrators, diplomats and skilled workers. Schools were founded for the sons of local elites, with the curriculum and focus on sport mirroring British public schools.

Pierre de Coubertin, founder of the Olympic movement, was inspired by the approach of British public schools to sport. He subscribed to the philosophy of muscular Christianity and the underpinning ethos that moral discipline could be developed through sport. This ideal became central to the Olympic philosophy:

“The important thing in life is not the triumph but the struggle, the essential thing is not to have conquered but to have fought well.”

Although the Olympic ideal has a different complexion in the twenty-first century, measures are still taken to try and ensure the fight for victory is fair.

### Key points

- Sophistication: development of rational recreation.
- Social class and sport: upper classes defined by amateurism. Working classes defined by professionalism.
- Transport: the spread of the railways allowed growth of organised sports fixtures.
- Law and order: introduction of the police force.
- Gender: changing status of women brought opportunities in education and sport.
- Education: the role of public schools and universities in the growth of modern sport. Provision of education for the working class.
- Expansion: spread and export of British sport within the empire and beyond.

John Ireland is an experienced teacher, and author of teaching and learning resources for A-level PE.





# We Are Undefeatable

**S**port England has launched a campaign aimed at supporting leading health charities in a bid to help people with long-term health conditions overcome barriers to being active.

Sport England chief executive Tim Hollingsworth said:

‘We are very proud to support our charity partners in delivering this new campaign because we know with the right support, sport and physical activity has the ability to change the lives of people living with long-term health conditions for the better. This campaign forms part of a longer-term drive by Sport England to change cultural and social norms around long-term health conditions and physical activity.’

The We Are Undefeatable campaign aims to support the one in four people in England who have a long-term health condition such as diabetes, cancer, arthritis or Parkinson’s. The main aim is to help these people build physical activity into their lives.

As part of the campaign, Sport England is collaborating with 15 health and social care charities, including Age UK, Alzheimer’s Society, British Red Cross, Macmillan Cancer Support and the Stroke Association.

## Research and challenges

According to the Department of Health, the number of people with long-term health conditions in England is expected to rise from 15 million to 18 million by 2025. In 2019, DJS Research surveyed 1,303 people aged 18 and over who were living with long-term health conditions. The research showed that:

- 69% of people living with long-term health conditions would like to be more active
- 66% say being more physically active would help manage or improve their



condition, with improved mood and wellbeing seen as the biggest benefit (52%)

- 24% of people with a long-term health condition feared that physical activity would make their health issues worse
- 44% would like more help and advice on how to be more active.

The survey also revealed that people with long-standing health concerns feel they face some unique barriers. Of the people surveyed, 36% cited lack of energy as the main barrier to increasing physical activity. Two in five (40%) reported that pain caused by their health condition prevented them from increasing the amount of physical activity they do,

and 28% reported that the unpredictable nature of their condition made it hard to commit to a routine.

We Are Undefeatable recognises these unique barriers. It aims to show the stories of men and women living with a variety of conditions getting active in ways that suit their needs.

## How will the campaign work?

Research shows that even small amounts of activity can make a significant difference to health and wellbeing. We Are Undefeatable is supported by £3 million of Sport England/National Lottery funding, and the campaign’s promotional materials feature a cast of real people with a variety of health conditions trying to reach out to others in similar positions to themselves.

The campaign’s promotional film aims to portray a more realistic view of getting active, including unconventional exercises and the unique struggles and successes experienced by real people with real health conditions.

Other promotional materials include a 60-second TV ad, radio spots, social media and sponsored searches that drive people to visit the website:

[www.weareundefeatable.co.uk](http://www.weareundefeatable.co.uk)

Fourteen ‘social spots’ concentrate on individuals from the main film, such as Simone, aged 33, who was born with a congenital heart defect that led to a stroke at 19, but now tries to walk 2 miles every day after being encouraged by her doctor, and plays *Just Dance* with her partner. Simone has seen a real improvement in her health and wellbeing.

Campaign support packs are also being distributed to every GP surgery and community pharmacy in England as part of a wider programme to support healthcare professionals to promote physical activity to their patients.

Get more from this issue of PE REVIEW, with **free** online resources. See page 1 and [www.hoddereducation.co.uk/pereviewextras](http://www.hoddereducation.co.uk/pereviewextras)

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# ANABOLIC STEROIDS

## WHAT ARE THEY?

Synthetic hormones that resemble testosterone and increase protein synthesis and muscle growth.  
They can be taken in tablet, capsule, cream and commonly solution (for injection)

## BENEFITS

- Increased muscle mass and strength
  - Increased speed of recovery
- Increased intensity and duration of training
- Improved performance and more chance of winning

## PROHIBITED IN AND OUT OF COMPETITION

Easily detected with a urine sample

## WHAT SPORTS?

Maximal and explosive strength based sports. Sprinters, throwers, baseball and rugby. Also common in the weight lifting and the body building world.

## RISKS

- Irritability, aggression and mood swings
  - Liver damage and potential heart failure
- Acne and hormonal imbalances
- Disqualification, bans and fines if detected





# ERYTHROPOIETIN (EPO)

## WHAT ARE THEY?

A naturally produced hormone that is responsible for producing red blood cells. This can be synthetically made (RhEPO) and injected to increase red blood cell count and oxygen carrying capacity.

## BENEFITS

- Increased red blood cell and haemoglobin count
- Increased oxygen transport and aerobic capacity
- Increased duration before lactate threshold
- Increased intensity and duration of performance before fatigue.

## PROHIBITED IN AND OUT OF COMPETITION

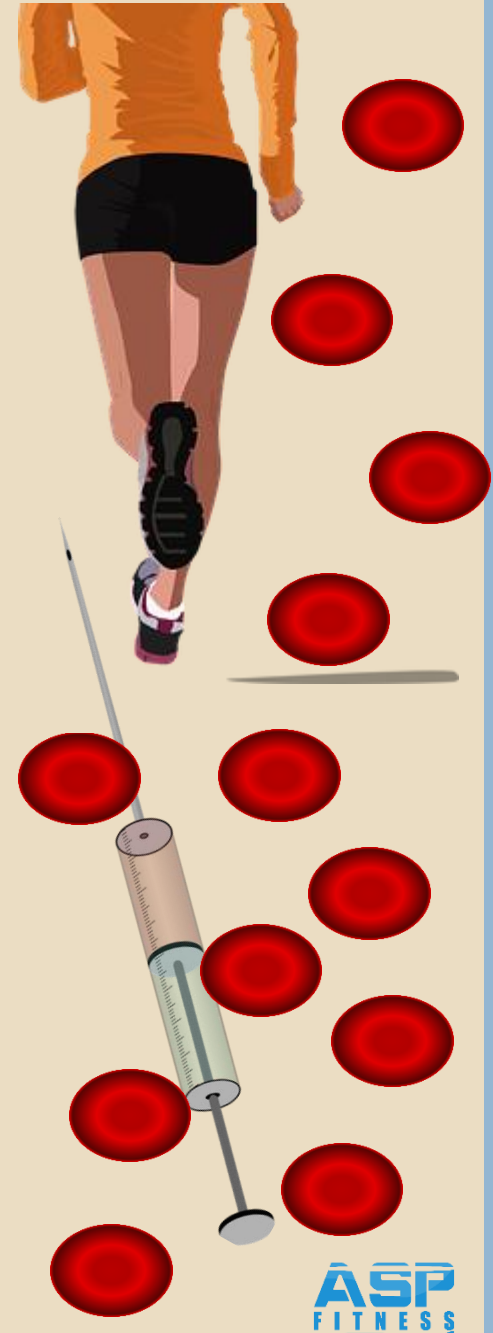
Hard to detect through blood or urine samples as naturally in the body

## WHAT SPORTS?

Aerobic sports: long distance running, cycling. Possibly some team sports such as football and Aussie rules

## RISKS

- Increased blood viscosity
- Decreased cardiac output
- Risk of blood clots and heart failure
- Decreased natural production of EPO
- Bans, fines and tarnished reputation if detected





# HUMAN GROWTH HORMONE

## WHAT ARE THEY?

A synthetic product mimicking the naturally produced growth hormone. It increases protein synthesis for muscle growth, repair and recovery. It can increase fat metabolism and lean mass. There is a decline in natural growth hormone with age.

## BENEFITS

- Increased muscle mass and strength
  - Increased fat metabolism and decreased fat mass
- Increased blood glucose levels
  - Increased speed of recovery
- Increased intensity and duration of training (and therefore performance)

## PROHIBITED IN AND OUT OF COMPETITION

Hard to detect through blood or urine samples as naturally in the body

## WHAT SPORTS?

Strength based performers, maximal and explosive strength athletes: power lifters, body builders, sprinters and throwers

## RISKS

- Abnormal bone and muscle development
- Enlargement of the vital organs which can lead to organ failure
- Increased risk of some cancers and diabetes
  - Bans, fines and tarnished reputation if detected





# BLOOD DOPING

## WHAT IS IT?

An illegal method of increasing red blood cell content. Blood is removed from the athlete and frozen around 4 weeks before competition. The body naturally replaces the blood removed and 2 hours before the event the removed red blood cells are infused back into the body.

## BENEFITS

- Increases total blood volume, red blood cell count and oxygen carrying capacity
- Increased intensity and duration of performance before fatigue
  - Delays lactate threshold
  - Improved performance
- Increased aerobic capacity (5-13% increase in  $\text{VO}_2 \text{ max}$ )

## PROHIBITED IN AND OUT OF COMPETITION

Hard to detect through blood as athletes own blood is used

## WHAT SPORTS?

Endurance performers such as cyclists (Tour De France).

## RISKS

- Increased blood viscosity
- Decreased cardiac output
- Increased risk of heart failure and blood clots
  - Risk of infection, HIV, hepatitis if shared needles
- Ban, fines and tarnished reputations if caught





# INTERMITTENT HYPOXIC TRAINING

## WHAT IS IT?

A process where athletes live at sea level and train under hypoxic conditions. This means level travelling, disruption to training and cost for athletes/teams. Altitude training without the altitude!

## BENEFITS

- Potential to increase red blood cells, haemoglobin volume and oxygen carrying capacity.
- Increased Intensity and duration before fatigue.
- Stimulates muscles to adapt and increase mitochondrial density and buffering capacity.

## LEGAL

## WHAT SPORTS?

Endurance performers such as marathon runners and triathletes. Boxers

## RISKS

- Any benefit is quickly lost once IHT ends
- Motivation can be lost and training patterns effected
- Training in hypoxic conditions is tough and normal training rates may not be reached
  - Decreased immune system
  - Dehydration





# INTERMITTENT HYPOXIC TRAINING

## HOW IS IT DONE?

IHT can be performed with aerobic and HIT training where a mask is worn that restricts the amount of oxygen (air) that can be inspired.

The mask can be removed in the rest interval.

An altitude generator can reduce the oxygen percentage down to 9.5%. This mimics conditions of an altitude of 6000m.

## PROGRAMMES

- 4-8 weeks of high-intensity work intervals of 1-3 minutes or aerobic work intervals of 15-40 minutes under hypoxic conditions. Relief intervals would be under normal conditions and last 1-40 minutes.

9.5 to 14% oxygen

Hypoxic exposure may be more beneficial than training.





# COOLING AIDS



## WHAT ARE THEY?

Aids such as ice vests and cold towel wraps can be used pre event to reduce core body temperature. This reduces thermal strain and allows a sustained intensity and speed for an increased duration. Also used to treat injuries and post event to reduce DOMS.

## BENEFITS

- Reduce core body temperature
- Decrease sweating, dehydration and early fatigue
- Decreased injury pain and reduced swelling
  - Increased speed of recovery
    - Decreased DOMS

## LEGAL

## WHAT SPORTS?

Used by endurance performers in hot/warm climates

## RISKS

- Can be difficult to perceive exercise intensity
  - Potential ice burns and pain
  - Can mask complicated injuries
- Chest pain and reduced efficiency in elderly
  - Dangerous for individuals with heart conditions (when used at chest region)





A-level physical education

# pe

# review

January 2020 Volume 15 Number 2



## How TV commercialised sport

The influence of the golden triangle

## Classifying concussion

How to identify this high-profile injury

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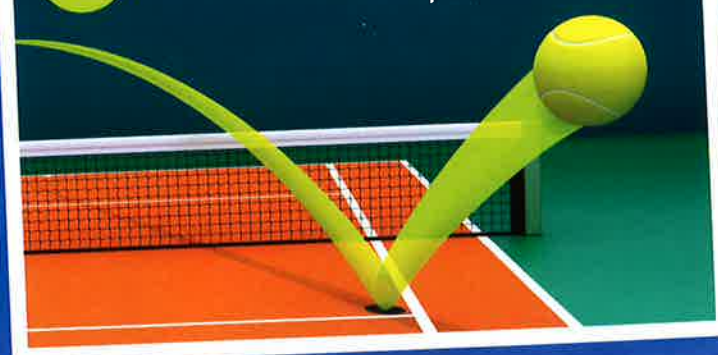
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commercialised sport



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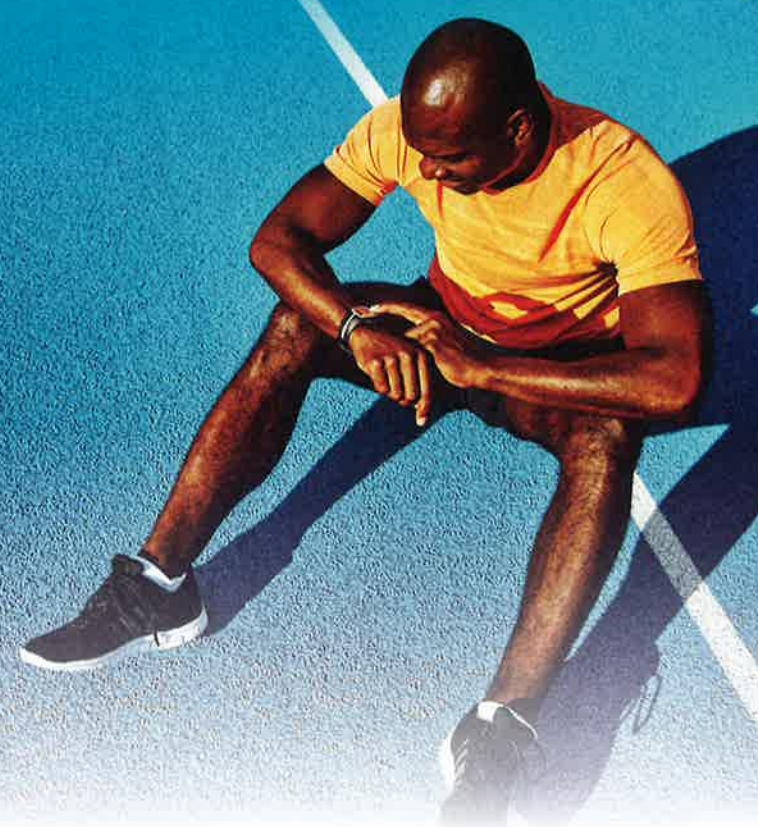
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**12** How does the body  
respond to exercise?



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### Poster: media influences on sport

Print out and display this issue's centre pages



### Exam-style questions

Check your answers to the questions on  
pp. 10 and 21

...and more

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# The golden triangle

## How television commercialised sport

Charlie Esson examines the influence of television on sport and sponsorship

### Exam links

The **golden triangle** is a key topic area for all the major exam boards:

**AQA** Paper 1 (sport and society) and Paper 2 (sport and society and technology in sport)

**Edexcel** Component 2 (psychological and social principles of physical education)

**OCR** Component 3 (sociocultural issues in physical activity and sport)

The three corners of the golden triangle are the media, sponsorship and sport (Figure 1). The triangle shows that the three factors are all interdependent. One factor influences the other two and vice versa. There are several different ways in which they influence one another. Box 1 provides examples of different types of media and how they cover sport

### Key term

**Sponsorship** Provision of money and/or support for a commercial return.

### Sport + television = profit

Consider Sky Sports, the most dominant subscription television sports brand in the UK and Ireland. Sky has played a major role in the increased commercialisation of sport

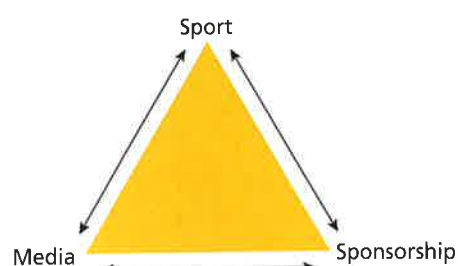


Figure 1 The golden triangle

since its launch in 1990. For the company to exist, it must generate enough revenue in order to cover its own costs and be profitable. The majority of its revenue comes in two forms:

### Subscriptions and pay-per-view

Sky Sports receives subscription and pay-per-view income from major sports events. For example, a subscriber may pay £50 per month for a Sky TV package. In the case of boxing, many fights operate a pay-per-view system whereby an individual pays to view a specific fight or event.

### Television advertising

A company, such as Gillette, will pay a specific amount to advertise its brand

### Box 1

#### How the media covers sport

**Terrestrial television** Free to air — the traditional method for broadcasting television. In the UK, a TV licence is required — but no subscription.

**Satellite television** Usually a subscription product — television delivered via a dish using signals relayed by satellites, e.g. Sky Sports.

**Pay-per-view** A television service where viewers pay a fee in order to watch a particular programme, film or sports event. Boxing matches are regularly on pay-per-view.

**Radio** Dedicated sports stations are devoted entirely to sport (e.g. talkSPORT, BBC Radio 5 Live Sports Extra). Local and regional radio stations also cover sport, e.g. county-based stations such as BBC Radio Suffolk or BBC Radio Lancashire.

**Written press** This element of the media has a long history of sports coverage. National newspapers (e.g. 'broadsheets' such as the *Guardian* and 'tabloids' such as the *Sun*) have sports sections. Dedicated magazines focus solely on sport e.g. *Runner's World*, *Boxing News*, *FourFourTwo*.

**Internet** Provides widespread coverage of sport through sites and social media (e.g. Twitter).

and products for 30 seconds during the half-time interval of a football match. The cost of a 30-second advert will vary depending on the number of anticipated viewers, the type of sport, the type of advertiser and the team that's playing. For example, a Premier League game between Chelsea and Arsenal will have a different price to a Championship game involving Barnsley and Brentford.

The emergence of satellite television has had both positive and negative impacts on English football:

### Positive impacts

- Increased revenues to football clubs via payments made by media companies, which provide coverage of more matches for the fans to watch.
- Increased wages/transfer fees are paid to recruit/retain the best players. Player recruitment is improved via the ability to provide lucrative contracts,

thereby increasing standards of performance (e.g. four of the eight Champions League quarter-finalists in the 2018/19 season were Premier League clubs).

- Increased funding for player development (e.g. at grassroots level and in academies).
- Increased funding for facility development (e.g. funding the latest artificial pitches for training).

### Negative changes

- Football clubs develop an overreliance on television income.
- Inequalities in funding become evident, as the big clubs get richer and the lower-league clubs get poorer, leading to situations such as Bury FC's expulsion from the Football League in 2019.
- Too much media control of football (e.g. television companies dictate when and what time fixtures take place, which can be a negative for both players and supporters).
- The price of satellite subscriptions means some people cannot afford them, so cannot access the matches on TV.
- Advertising breaks can disrupt the viewing experience.

Television revenues can be used to improve facilities, e.g. by building artificial pitches



### Where does the money go?

Once a broadcaster has secured the rights to show a sport on television, it will pay a sum of money to the sports organisation that holds the rights to the sport. This organisation must then determine how the money is distributed. Figure 2 shows how the two major forms of revenue for a broadcaster will flow into a sport, in this case using the example of a tennis tournament. Not all of the money goes to the players, but a large portion of it will.

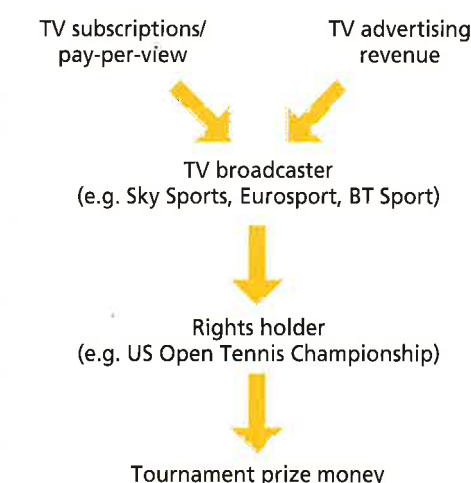


Figure 2 How TV money moves through a sport





Harry Kane earns £200,000 per week playing for Tottenham Hotspur

In the case of the Premier League (rights holder), the league gives the majority of television revenue to the clubs. The clubs then pay their staff wages, including the players, who often earn massive amounts. In the 2018/19 season, Alexis Sanchez was reportedly on £500,000 a week at Manchester United, Mesut Ozil was on £350,000 a week at Arsenal, and Harry Kane was on £200,000 a week at Tottenham Hotspur. The clubs can also use their TV income to invest into their community programmes, youth academies and facilities.

In the case of an international match, the broadcasters will pay the sport's governing body. For an England cricket test series (e.g. the 2019 Ashes), Sky Sports will pay the England and Wales Cricket Board (ECB), which is the sport's national governing body. Some of this revenue will go to the players and some will be invested into the sport by the ECB. It can do this in a number of ways:

- Provide grants to cricket clubs so they can improve their facilities and buy equipment.
- Subsidise the cost of coaching courses to encourage more coaches to become qualified.
- Provide equipment for schools.
- Employ more ECB coaches to work with elite players.

### Why is football richer?

Football has more potential than other sports to generate television

viewers, and therefore the rights holders can generally charge more than other sports. For example, in the case of a Manchester football derby (City vs United) compared with a rugby union East Midlands derby (Leicester vs Northampton), more people will watch the football match on TV (Table 1), so broadcasters will have to pay the Premier League more to show the football match than they will have to pay Premiership Rugby for its product.

Table 1 Football on TV vs rugby on TV

| Football   | Rugby   |
|--|---|
| The title race between Manchester City and Liverpool helped to deliver 12% growth for Sky Sports' UK audiences in the 2018/19 season | Television audiences for Premiership rugby have risen by 40% following its move to BT Sport in 2013                                     |
| 1.7 million people watched Liverpool vs Arsenal on BT Sport  | Approximately 800,000 people watch Premiership rugby on TV or live in the stadium each weekend  |
| Approximately 70% of the UK population watched the Premier League last season on Sky Sports, BT Sport or BBC                         | The 2018/19 Premiership rugby season had a combined season audience of 7.88 million, compared with 6.14 million for the previous season |

The more people who watch the game, the more the broadcasters can charge for an advertisement slot during the commercial breaks. BT Sport can charge a company in excess of £10,000 for a 30-second advert during a major Premier League football match. In comparison, for a Premiership rugby game, they may only charge £500.

### The effects of sponsorship

The media promotes sponsorship and provides exposure for companies that sponsor sports teams.

When a company sponsors a sports team, it will often have its brand or name visible on the players' shirts. For example, Chevrolet sponsors Manchester United, with reports in 2014 indicating that Chevrolet would pay the club £28 million per year until the end of the contract. General Motors, the group that owns Chevrolet, will have decided that the

exposure of its brand to Manchester United's audience will generate more sales of its automotive products and will therefore be a positive investment.

Compare this to the sponsorship of a Premiership rugby team. Allianz have the stadium naming rights and are the primary shirt sponsor for Saracens rugby club. The deal is thought to be worth approximately £1.5 million per year — significantly less than the Chevrolet–United deal. This is because Manchester United are exposed to a much greater global audience than Saracens, predominantly through televised matches and also through the other strands of media such as the internet, radio and newspapers.

### Positives and negatives

Exam questions on the golden triangle often have 'Discuss' as the command word. This requires you to make balanced arguments/statements about

the positives and negatives of different components of the triangle, e.g. the effects of the media and sponsorship on sport.

### Controversial sponsors

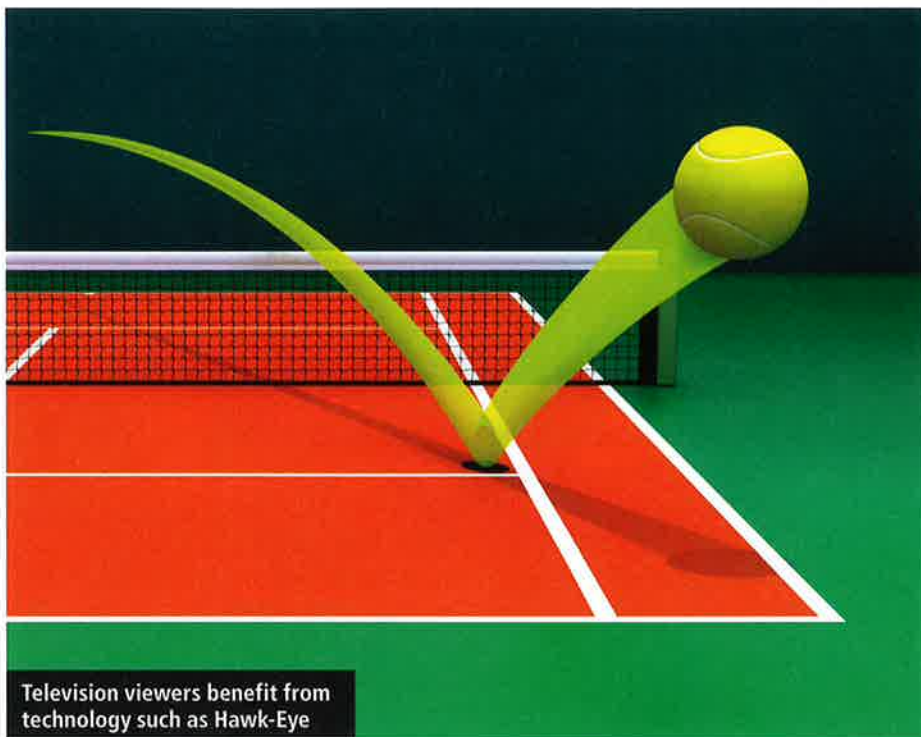
In 2012, the New Zealand All Blacks agreed to make AIG their main shirt sponsor. This upset many fans and former players,<sup>3</sup> as they saw it as compromising the tradition of the 'all black' jersey. However, on the positive side, the money used from this endorsement can be used to grow the game in New Zealand and fund grassroots rugby.

Emirates owns the naming rights to Arsenal's football stadium. 'The Emirates Stadium' sounds more commercial and less traditional than the name of the club's old ground, Highbury. However, the money from this sponsorship can be used to pay high transfer fees and buy top-level players. Is it only a matter of



More people will watch football's Manchester derby than rugby union's East Midlands derby





time before 'sacred' grounds such as Twickenham, Wembley, Lord's and the All England Club (Wimbledon) compromise their names in search of sponsorship revenue? If so, the money could be used to enhance their facilities and put more funding into grassroots sport.

Companies that produce unhealthy products can sponsor sports teams or individuals. The fast food chain McDonald's was a major sponsor of London 2012. Partnering with the Olympics provides a benefit to McDonald's image, as the event is aligned with the ideals of sport and healthy living.

#### Popularity means profit

Popular sports, such as men's football, dominate television coverage. In the case of Sky Sports, popular sports will often feature on the Main Event channel. This brings disproportionate income to already wealthy sports such as football. Meanwhile, less popular sports, disability sports and most women's sports do not get the same level of coverage. Therefore, these sports struggle to develop. On a Saturday or Sunday afternoon, the Main Event channel will often

broadcast major domestic football matches, rather than international fixtures for sports such as netball or hockey.

However, the increased number of sports channels has led to more professionalism in women's sport. While the coverage of women's sport is often inferior to men's sport, the increased number of TV channels has allowed, for example, women's cricket to be broadcast. Consequently, English women's cricket has become professional through the establishment of the Kia Super League.

Televised sports produce the majority of high-profile sports stars and celebrities. Golfer Justin Rose has significant wealth due to his career earnings. When he won the 2019 Farmers Insurance Open at Torrey Pines, he received almost \$1.28 million for the victory and surpassed \$50 million for career earnings in the USA.

#### Technology and scheduling

Televised events can affect the entertainment value for viewers and spectators. TV viewers can benefit from technology such as Hawk-Eye,

and can record, pause and rewind to suit their viewing needs.

The power of television companies means they can manipulate the start time and duration of events. Traditional kick-off times do not always apply, leading to football matches being played on Sunday evenings rather than Saturday afternoons. Many spectators prefer to go to a stadium during the afternoon and not the evening.

Matches can be slower paced for the spectators in the stadium. Half-time breaks are longer due to TV advertising, and the use of television match officials creates more stoppage time.

#### The pressure of professionalism

Funding by the media has made sports more professional, and greater coverage of sport has increased performance levels. However, media scrutiny also places more pressure on individuals to perform. A televised match can help to inform journalists working for newspapers, radio and online, but in turn this can lead to heavy criticism of poor performance, and possible social media abuse from fans.

See pp. 16–17 for a downloadable poster highlighting the positive and negative effects of the media on sport.

#### Key points

- The golden triangle comprises three interdependent components (sport, sponsorship and the media).
- Media coverage of sport consists of a wide variety of different types, with subscription and pay-per-view offerings and social media companies becoming increasingly involved as the twenty-first century progresses.
- Exam questions linked to the golden triangle often have 'Discuss' as a command word. These questions require a balanced answer containing points outlining the positives and negatives of any of the relationships between different elements of the triangle stated in the question.

Charlie Esson teaches PE at Stamford School.

# Levers, planes and axes

Anna Snook shows you how to approach this essential exam topic

#### Exam links

Levers, planes and axes is a key topic across all A-level specifications.

The topic of levers, planes and axes provides hands-on, to the point, right-or-wrong content. It is fairly easy to learn the facts for assessment objective (AO) 1, and then apply them for AO2. There isn't a great deal of AO3 analysis either. If you studied PE at GCSE, you may not have seen this topic within your specification, but this year your GCSE PE peers will be studying it, so you may be able to find yourself a younger study buddy.

If you are aspiring to a career as a physiotherapist, osteopath, chiropractor or similar profession, levers, planes and axes will become part of your daily language, given that this is how we describe the direction of movement. For example, if you have an injury that means you cannot bend your elbow, you will be described as having limited or no movement in the sagittal plane.

The three components can be summarised as:

- **Levers:** all movement is as a result of one of three lever systems.
- **Planes:** movement occurs within one of three planes (directions).
- **Axes:** all rotation is around one of three axes.

#### The lever systems

The three lever systems indicate that movement can occur as a result of muscular contraction (**effort/force**) around a **fulcrum** point (joint) in order to move a **resistance** (this could be body weight, or a mass such as a ball). All three lever systems have three common features:

- fulcrum (pivot point)
- resistance (load)
- effort (force)

#### Key terms

**Effort/force** Applied by muscles to create movement at a joint.

**Fulcrum/pivot** The pivot point around which movement occurs or mass is supported, e.g. the skeletal joint.

**Resistance/load** Mass of resistance to effort or force.

You will be required to draw each lever system (Figure 1), ensuring that you correctly identify the feature in the middle:

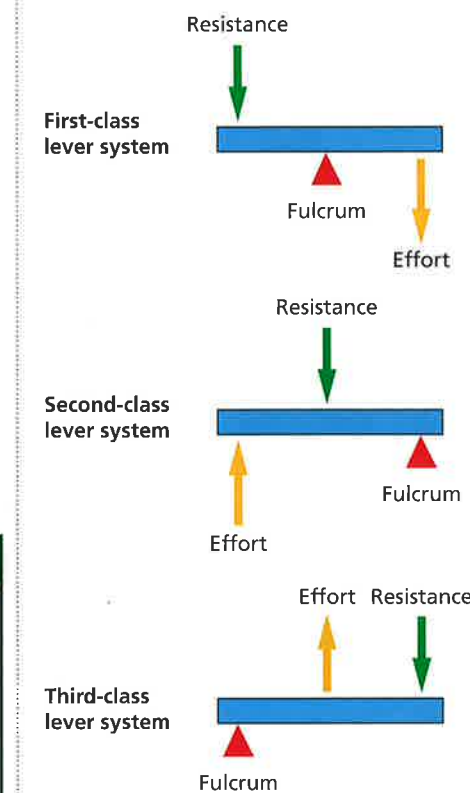
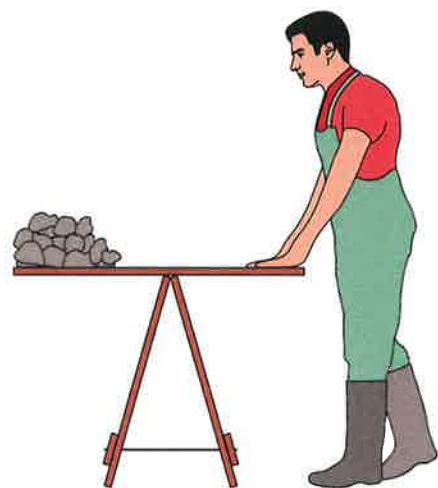


Figure 1 Lever systems





**Figure 2 First-class lever system**

- In a first-class lever system, this is the *fulcrum*.
- In a second-class lever system, this is the *resistance*.
- In a third-class lever system, this is the *effort*.

A useful rhyme to use to remember this is '1 2 3, F R E'.

#### Key exam points for lever systems

- It is important to get the feature in the middle correct (hence 1 2 3, F R E).
- The lever image can be reversed, meaning that the features on each end can be swapped over. However, the layouts shown in Figure 1 are the most frequently used.
- The fulcrum is always under the line, as is the pivot point
- Resistance is always above the line, and is now commonly drawn as a downwards arrow, as this indicates the effect of gravity on a mass.

#### First-class lever systems

This lever system is most like a see-saw in action, with the fulcrum in the middle (Figure 2). It is exclusive to the action of the triceps brachii, i.e. elbow extension. It is also relevant to the nod of the head,



**Figure 3 Second-class lever system**

but this is not a good example of a sporting action, so is rarely used. When the triceps contract concentrically, they cause elbow extension (sagittal plane, transverse axis). This is common in shooting in netball or basketball, or in a line out throw in rugby. Imagine the triceps contracting (effort/force) when holding a ball ready to shoot (resistance/load). This contraction opens the angle of the elbow joint (the fulcrum) to release (shoot) the ball.

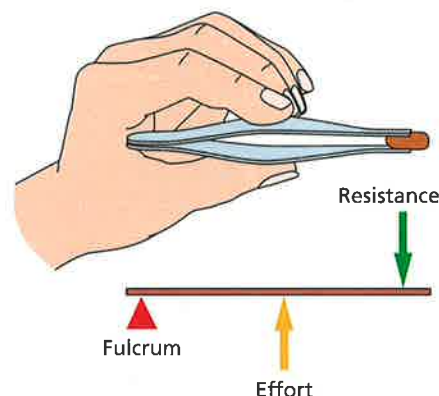
#### Exam tip

Remember that elbow flexion is a third-class lever system — only elbow extension is a first-class lever system.

#### Second-class lever systems

This lever system is most like a wheelbarrow, with the fulcrum at one end, the resistance in the form of load 'in the wheelbarrow', and the effort applied upwards at one end (Figure 3). Remember that you don't need to draw the body parts, just the line and three component parts.

This lever system solely applies to the ankle joint, i.e. plantarflexion and dorsiflexion movements.



**Figure 4 Third-class lever system**

#### Third-class lever systems

In this lever system, the fulcrum is again at one end, but this time the effort is in the middle. Think of tweezers or tongs — the load is whatever you are moving/pulling (Figure 3).

For a sporting example, think of a hockey stick with the fulcrum at the end of the handle, held by the left hand. The effort is the right hand in the middle, and the load is the ball on the end of the stick. Most joints and joint actions in the body use the third-class lever system.

#### Mechanical advantage

*Mechanical advantage* describes what a lever system can do best. Each lever system has a mechanical advantage and disadvantage. For AQA, you need to know these for all three lever systems. For OCR you only need to know the mechanical advantages for the second-class lever system.

Mechanical advantage depends on distance between fulcrum and effort (known as *effort arm* or *force arm*) in comparison to the distance between the fulcrum and resistance (known as *resistance arm*) (Figure 5).

Remember the equation:

$$\text{Mechanical advantage} = \frac{\text{Effort arm}}{\text{Resistance arm}}$$

#### Second-class advantages and disadvantages

In second-class lever systems, the force arm is longer than the resistance arm. Therefore the mechanical advantage is that you can generate large amounts of force to overcome a resistance/heavy

weight. Therefore you can reduce the amount of effort needed in order to move a heavy weight. The mechanical disadvantages are the limited range and speed of movement.

You see this in the wheelbarrow example in Figure 3, where you can lift heavy loads but only over a short distance. You can only lift the wheelbarrow handles so far, or you will tip the wheelbarrow up and over the fulcrum point (the wheel).

An example of this in the body is coming up onto your toes, in plantarflexion. You can lift your whole body weight onto the ball of your foot (the fulcrum), owing to the contraction of the gastrocnemius muscle. In fact, you could add even more weight, like a barbell. But there is a limited range of movement as you come up onto the ball of your foot. So you can overcome large mass, but over a limited range of movement due to the long force arm and short resistance arm.

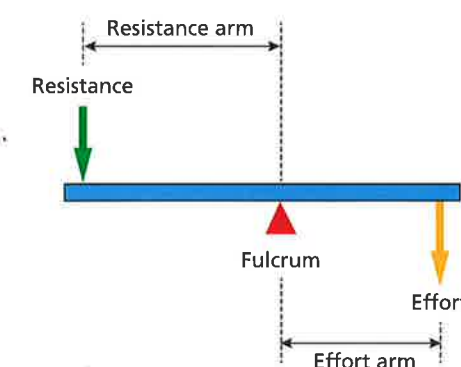
In terms of AO2, the second-class lever system has a longer force arm (fulcrum to effort) and so a hurdler, for example, can apply minimal force to generate enough height to clear the hurdle.

#### Third-class levers

In third-class lever systems, the effort arm is much shorter than the resistance arm, therefore:

$$\frac{\text{Effort arm}}{\text{Resistance arm}} = \text{Less than 1}$$

The force arm is short in this lever system, but the resistance arm is long. So the mechanical advantage is that you



**Figure 5 Effort arm and resistance arm in a first-class lever system**

#### Exam tip

A03 questions for this topic are unlikely, but can occur. If an exam question has a higher mark value, it is likely to carry only 1 or 2 marks for A01 responses and a few more for A02, with the most marks allocated for A03 responses.

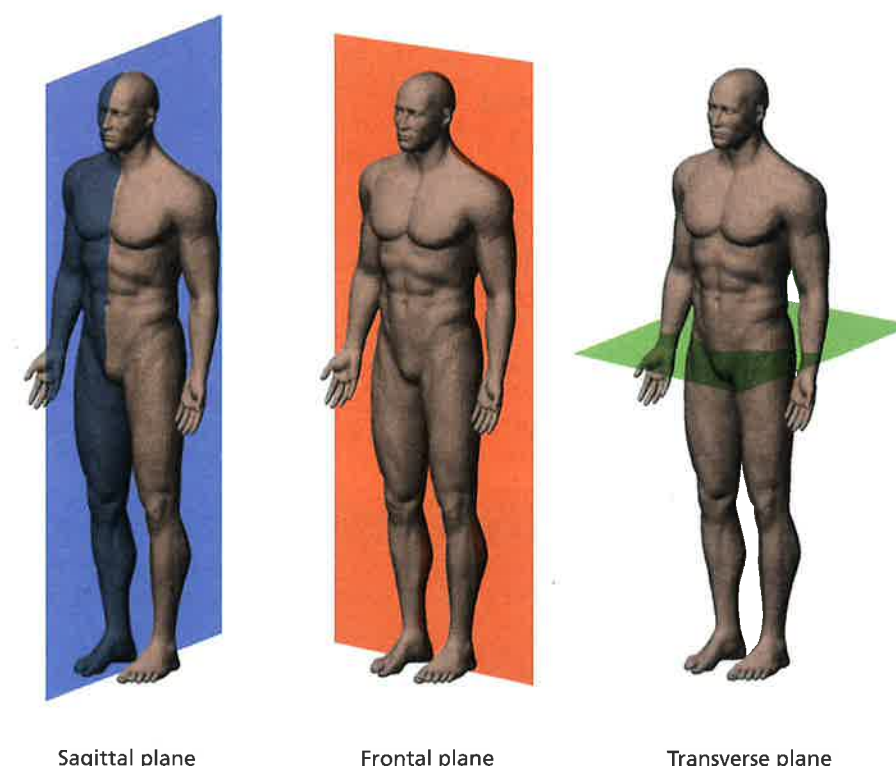
You could be asked to analyse the movements possible at joints, with reference to levers, planes and axes. You should state the type of joint, the movements that can occur and the plane within and axis around, the muscles responsible and the type of muscular contraction occurring. When you break longer prose-based questions down like this, there is a lot to say and get rewarded for. You can then apply this to real sporting movements, linking in the mechanical advantage.

can move a resistance quickly and over a large range of movement.

#### Three planes of movement

All movement is through a plane (and around an axis). The three planes (Figure 6) are:

- The **sagittal plane**, dividing the left and right side of the body equally.
- The **frontal plane**, dividing the front and back of the body equally.
- The **transverse plane**, dividing the top and bottom of the body equally.



**Figure 6 The three planes of movement**

'Transverse' means side-to-side/lying across.

You will most likely be examined on flexion and extension movements, as most movements involve flexion and extension in some form, e.g. walking, running, squats, joint curls, extensions. Flexion and extension movements occur in the sagittal plane.

All abduction and adduction movements occur in the frontal plane. Imagine someone in front of you lifting their arms to the side, e.g. in a lateral dumbbell raise in weightlifting or to hold the crucifix position on the rings in gymnastics. The whole body could even move, for example in a cartwheel in gymnastics.

Any rotation, twisting or turning movements occur within the transverse plane. This could be the whole body (e.g. a pirouette in dance) or just around one joint (e.g. an overarm bowl in cricket or a forehand racquet stroke in tennis, where the shoulder joint internally or medially rotates).

#### The three axes of rotation

Any twisting, turning or rotation movements occur around a central axis.

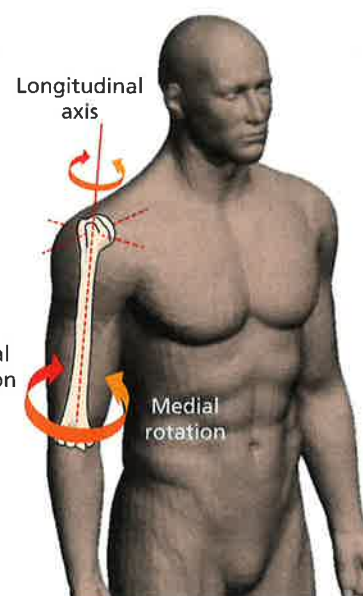


## Exam-style questions

- Describe the mechanical advantage of the second-class lever system (1 mark)
- A netballer is about to execute a netball shot. Their elbows are bent in preparation. Identify the lever system operating at the elbow. (1 mark)
- Identify the plane, axis and lever system operating at the ankle joint when a performer is in the downward phase of a squat. (3 marks)
- Sketch and label a third-class lever system. (2 marks)
- Draw the force arm (FA) and resistance arm (RA) onto each of the lever systems in Figure 1. Note the mechanical advantage of each being the longest arm.
- Differentiate between the lever systems operating at the elbow joint in flexion and extension. (4 marks)
- Analyse the movements possible at ball-and-socket joints such as the shoulder. (6 marks)

PEReviewExtras

Check your answers at  
[www.hoddereducation.co.uk/perereviewextras](http://www.hoddereducation.co.uk/perereviewextras)



**Figure 7** Rotation at the shoulder joint

Or it can be isolated to a joint, as in the example of median (internal) and lateral (external) rotation at the ball-and-socket shoulder joint shown in Figure 7. This occurs in bowling and in tennis racquet strokes.

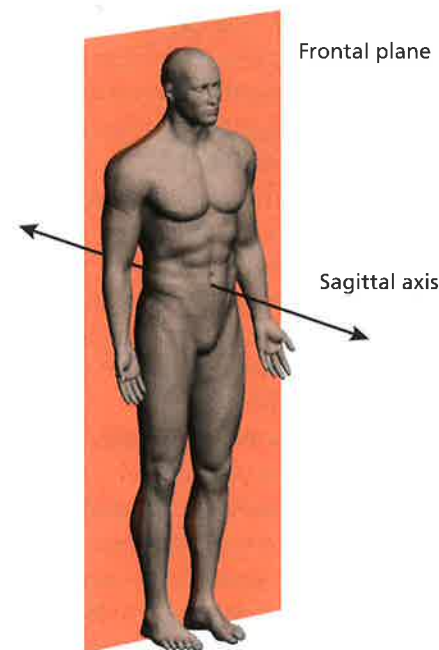
### Planes and axes

Each plane is paired with an axis (Table 1):

- The sagittal plane is paired with the transverse (side-to-side) axis.
- The frontal plane is paired with the sagittal/frontal axis.
- The transverse plane is paired with the longitudinal axis.

Movement occurs through a plane and around an axis, as in the case of movements in the frontal plane around the sagittal/frontal axis, such as abduction and adduction movements (Figure 8).

In this case, you can think of the sagittal/frontal axis as the pin in the



**Figure 8** Movement through the frontal plane around the sagittal/frontal axis

middle of a Catherine wheel on Bonfire Night. The Catherine wheel spins around this central axis. Now imagine a performer cartwheeling — it's much the same.

With the sagittal plane and transverse axis, you can imagine a table footballer. You can rotate the player forward and backward, but not twist or turn or move forward or backward. This is the most common feature, applying to all flexion and extension movements.

This just leaves the transverse plane and longitudinal axis (like the Earth spinning round on its axis). You may see this axis described as the *vertical axis* due to its vertical position. Rotational movements occur in the transverse plane and around the longitudinal axis.

### Key points

- The triceps brachii (elbow extension) provide an example of a first-class lever system.
- Ankle joint movements provide an example of a second-class lever system.
- Other joints and joint actions are third-class lever systems.

Anna Snook teaches PE at Wycombe High School.

# Exam tips for levers, planes and axes

Anna Snook provides exam advice and revision tips, linking with the 'Exam focus' on pp. 7–10



For assessment objective 2 (application), examiners will ask you to do one of two things:

- Give an example from a sport of movement(s) that may occur.
- Using a picture provided, identify the joint movement or lever system operating, or the plane and axis.

Here are some tips to help with answering these questions.

### Systems and advantage

If you have to give an example of movements that occur at a joint, name the joint. It is a common mistake for students to leave the joint (e.g. elbow joint) unnamed.

In one short, concise sentence, provide the following information:

- the joint and joint movement
- the action
- the sport
- the muscle responsible (the agonist)
- the plane/axis

For example:

Elbow extension when shooting in netball, caused by the contraction of the triceps brachii (agonist) in the sagittal plane, around the transverse axis.

If the question gives you a sporting action with a table that you have to fill in, check the column titles. Yes, it's obvious, but they do change (especially the last column), so there may be subtle differences to what you were expecting.

**Table 1**

| Joint action    | Main agonist    | Antagonist     |
|-----------------|-----------------|----------------|
| Elbow extension | Triceps brachii | Biceps brachii |

**Table 2**

| Joint action     | Main agonist     | Type of joint    |
|------------------|------------------|------------------|
| Shoulder flexion | Anterior deltoid | Latissimus dorsi |

With the pressure on during the exam, make sure you double check. Tables 1 and 2 show how changes to one of the columns could catch you out — it could also say 'Type of muscular contraction' or 'Lever system in operation'.

Mechanical advantage questions are most commonly asked on the second-class lever system (in fact, that's all you need to know about for OCR exams). For AQA, you need to know the mechanical advantage and mechanical disadvantage of all three lever systems — but AQA questions still seem to mostly ask about the second-class lever system.

If you are asked to identify a lever system, write out the full name, e.g. 'first-class lever system', not '1st' or some other abbreviation. Write the full name of each part, e.g. 'fulcrum', not 'F'.

If you need to, draw out all three lever systems on your notes page or extra paper. Identify and add on the force arm and resistance arm, then select the one you are required to write about in your actual answer.

If comparing joint types, know that the elbow, knee and ankle are hinge

joints and therefore (much like a door hinge) only allow flexion and extension movements. The shoulder and hip joints are ball-and-socket joints. These are the joints that can do everything, i.e. move in all three planes and around all three axes.

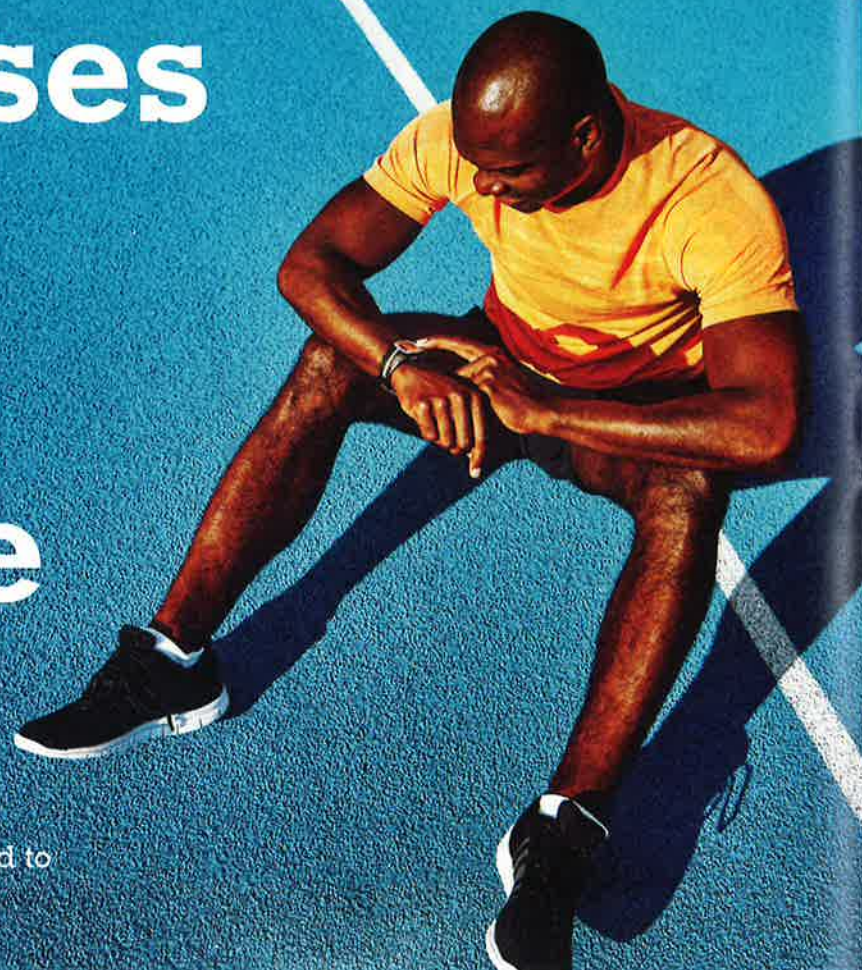
### Revision tips

- Rather than learning the lever systems in order, try thinking of the application first. For example, with a bicep curl, identify the joint, joint type, articulating bones, agonist, antagonist, lever system and mechanical advantage. This will help you learn things more effectively, meaning they stick in your long-term memory so you will be able to recall them under the pressure of the exam.
- Learn this information alongside muscle action and articulating bones to bring the skeletal system and mechanics of movement to life.
- Learn axis of rotation alongside angular momentum.

Anna Snook teaches PE at Wycombe High School.



# Responses of the body to exercise



Mark Thompson explains what you need to know about responses to exercise

## Exam links

All the major exam boards require you to be able to explain how the cardiovascular and respiratory systems change to meet the demands of exercise

When we begin exercise, the body has to adjust quickly to the new demands placed upon it. This is known as the *response*, and involves immediate and short-term changes made by the body.

How the body responds to exercise depends on the intensity, duration and frequency of the exercise taking place. In sports like football, netball and rugby, the body will continually respond to the dynamic and varying demands placed on it. In sport or exercise that is more consistent and continuous, like steady-state jogging or cycling, the responses are less dynamic. However, whatever

the nature of the sport or exercise, the body will respond to help the performer.

The cardiovascular response to exercise has intrigued physiologists for many years.

Stone and Liang 1984

Chemical, mechanical and thermal stimuli affect alterations in **metabolic**, **cardiovascular** and **ventilator function** to meet the increased demands that starting exercise puts on the body and its systems (Burton, Stokes and Hall 2004).

As the muscles start to work due to the exercise that has begun, the body's systems, particularly

the cardiovascular and respiratory systems (often referred to as the cardiorespiratory system when discussed together), increase their activity to meet the demands of the working muscles. This involves providing them with oxygen and nutrients (e.g. glucose) but also the removal of carbon dioxide and other waste products like lactic acid. Laughlin (1999) stated that in the main, the cardiorespiratory effects of exercise are related to supplying required oxygen and nutrients to the working muscles.

## Responses to exercise

Specific responses are:

- increased heart rate
- increased stroke volume
- increased cardiac output
- redistribution of blood
- increased blood pressure
- increased breathing rate and depth (respiratory rate)

## Key terms

**Metabolic** Involving chemical reactions.

**Cardiovascular** Involving the heart, blood and blood vessels.

**Ventilator function** Breathing.

## Increased heart rate

Heart rate increases as we begin to exercise. The increase depends on the intensity of the exercise. The higher the intensity, the higher the heart rate up to when maximum is reached. Approximate maximum heart rate equal  $220 - \text{age (in years)}$ . So for an 18 year old, maximum heart rate would be  $220 - 18 = 202$  beats per minute (bpm).

When exercising, the adrenal gland increases production of adrenaline and noradrenaline. These hormones directly affect the heart and the ability to transport oxygen and carbon dioxide throughout the body. They influence the sympathetic nerves to stimulate the heart to beat faster (increased heart rate) and more forcefully (increased stroke volume).

Sympathetic nerves are responsible for the adaptations the body makes when starting and maintaining exercise. The parasympathetic nerves are responsible for our return to rest after exercise and bringing the body back down to normal resting levels.

## Increased stroke volume

Stroke volume is the volume of blood pumped out by the ventricles of the heart per contraction. It increases as exercise intensity increases. The cardiac muscles in the walls of the heart contract more forcefully, pumping more blood out per contraction. As we start exercising, venous return (the volume of blood returning to the heart in the veins) increases, leading to an increase in stroke volume.

Starling's law states that an increased venous return causes greater diastolic filling of the heart. The cardiac muscle of the heart is therefore stretched, leading to a more forceful contraction that increases the ejection fraction.

## Key term

**Ejection fraction** The percentage of blood pumped out by the left ventricle per beat.

## Increased cardiac output

As stroke volume and heart rate increase due to the demands of exercise, cardiac output therefore increases. This is the volume of blood pumped by the heart ventricles in 1 minute and is calculated by stroke volume (ml)  $\times$  heart rate (bpm) to give a numerical value in litres per minute.

As maximal intensity is reached, stroke volume and heart rate reach their max, therefore maximal cardiac output is reached and a plateau occurs. Maximal cardiac output depends on factors such as age and fitness levels.

At rest, cardiac output is the same for trained and untrained performers. However, maximum cardiac output will be significantly higher in trained performers, allowing them to cope with and maintain higher levels of exercise. The cardiac output of

distance runner Eilish McColgan or cyclist Geraint Thomas will be much higher than the average person's, allowing them to reach and maintain higher intensities of exercise because they will be able to work aerobically for longer.

## Redistribution of blood

At the beginning of exercise, blood is redistributed to the areas that now need it — the working muscles. As the skeletal muscles require more oxygen, they require an increase in blood supply, as oxygen is carried by the protein haemoglobin in the red blood cells. This redirection is known as the **vascular shunt mechanism** and ensures more blood goes to the working muscles and the heart, as the heart muscle requires oxygen for energy to beat



At the beginning of exercise, blood is redistributed to the areas that need it



faster (increased HR) and to pump with more force (increased stroke volume). Less blood is transported to the digestive system as this area is not now a priority, hence one of the reasons why it is suggested not to eat a heavy meal too soon before exercise. Vasodilation, the widening of the blood vessels, increases blood flow into the capillaries surrounding the muscles, hearts and lungs. Vasoconstriction, the narrowing of the blood vessels, reduces blood flow in the capillaries to non-essential organs (during exercise this is areas like the intestines and kidneys).

### Increased blood pressure

Blood pressure increases as blood is forced out of the heart at a higher force to get it to the working muscles

quicker — much like the increased pressure within a hose pipe when you want more water. The pressure increases as more blood is pumped out of the heart at a faster rate under higher pressure to provide the working muscles with the extra oxygen and nutrients they now require.

### Increased breathing rate and depth

Ventilation increases abruptly in the initial stages of exercise and is then followed by a more gradual increase.

Burton, Stokes and Hall 2004

When we begin exercise, we start to breathe quicker and deeper. This allows us to get more oxygen into the cardiovascular system, and remove more carbon dioxide. Sympathetic nerves stimulate our respiratory muscles to contract quicker and

### Key term



**VO<sub>2</sub> max** The maximal amount of oxygen that can be breathed in and utilised by the body per minute.

stronger. These muscles include the external and internal intercostal muscles and the diaphragm.

The rate of increase is proportional to exercise intensity. Hoefs suggested that, at rest, breathing rate is around 14 breaths per minute, but can increase to around 32. When a performer reaches their maximum work rate, this upper limit is the VO<sub>2</sub> max.

### Other responses to exercise

■ **Reduced affinity of haemoglobin for oxygen:** known as the *Bohr shift*. When we start exercising, the increase of blood carbon dioxide and a decrease in blood pH results in a reduced affinity of the protein haemoglobin (in our red blood cells) for oxygen. This means that oxygen is more readily available for the working muscles.

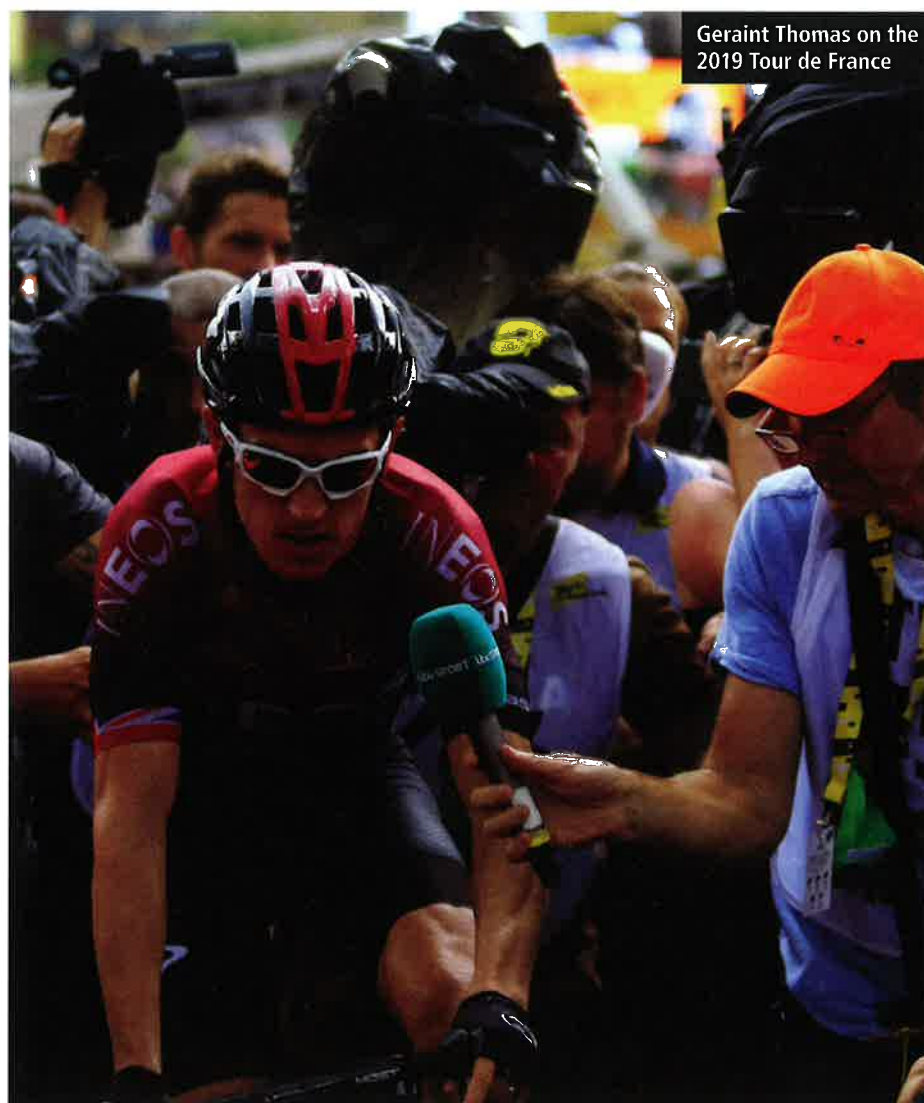
■ **Increased muscle and skin temperature:** as activity increases, this causes an increase in temperature. Increased skin temperature (vasodilation of the blood vessels) allows the body to give off heat and regulate temperature effectively.

■ **Anticipatory rise in heart rate:** this is the small increase in heart rate due to the thought of exercise (the anticipation).

■ **Increased stimulation of calcium uptake in the bones:** during exercise, calcium uptake in the bones is increased.

■ **Increased muscle pliability:** the increase in temperature and activity means the muscles are more pliable, meaning they are more flexible and elastic.

■ **Sweating:** the sweating response is the body's cooling system. Exercise increases temperature, so sweating helps to cool us down and prevent overheating that could lead to heatstroke or hyperthermia.



Geraint Thomas on the 2019 Tour de France



Distance runner Eilish McColgan will have a much higher cardiac output than the average person

### Getting ready

How can we help our bodies respond to exercise optimally and effectively?

### Warm-up

'Warming up' is seen as a safe and effective way of preparing the body for

exercise to minimise the risk of injury and ensure optimal performance from the onset of activity (e.g. the start of the game or race). It is used as a way of safely and gradually increasing the body's responses in preparation for the game or main exercise about to be undertaken. An effective warm-up involves three stages:

- A 'pulse raiser' to steadily increase the activity of the cardiovascular and respiratory systems.
- Stretching of the muscles.
- Rehearsal of the activity about to be performed.

### Hydration

Being hydrated and maintaining hydration is critical. Dehydration has been shown to increase blood viscosity (thickness). Thicker blood means the heart has to work harder to pump it around the body, and the

maximum amount of oxygen that can be provided to the working muscles is reduced. Dehydration also affects the body's temperature regulation, putting performers at a higher risk of heatstroke and hyperthermia, along with negatively affecting performance levels through impaired concentration levels, fatigue and possible cramp.

### Conclusion

Responses to exercise are largely consistent for all of us. Fit or unfit, our bodies will respond to exercise. However, the level of response and ability to keep responding to higher demands of exercise is where differences lie and where elite athletes flourish.

Mark Thompson teaches PE at Roundhay School, Leeds.

### Resources



Burton, D. A., Stokes, K. and Hall, G. (2004) 'Physiological effects of exercise', *Continuing Education in Anaesthesia, Critical Care & Pain*, Vol. 4, No. 6, pp. 185–188.

Hoefs, J. 'Response of the Respiratory System to Exercise', *Livestrong*, [www.tinyurl.com/y4g5r5dv](http://www.tinyurl.com/y4g5r5dv)

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Stone, H. and Liang, I. Y. S. (1984) 'Cardiovascular response and control during exercise', *American Review of Respiratory Disease*, Vol. 129, pp. 13–16.



# Media influence on sport

## Positive and negative effects

Charlie Esson summarises the advantages and disadvantages associated with media coverage of sport

### Advantages of media coverage

- Increased profile of the sport and individual performers. Increased coverage can benefit smaller sports, women's sport and disability sport.
- Can help challenge myths and stereotypes, e.g. that women can't box or play rugby union.
- Increased participation levels within a sport, as television coverage encourages others to take it up, e.g. cycling as a result of the Tour de France or football as a result of World Cup coverage.
- More variations of a sport are developed to make it more 'media friendly', leading to more matches/fixtures for fans to watch, e.g. Twenty20 cricket. Rule changes can lead to a speeding up of the action, and more excitement/entertainment in a sport.
- Sports events can be accessed across the globe via worldwide coverage, which is often live.
- Television money generates high levels of income for top-level professionals and makes a sport more appealing to sponsors. It increases commercial opportunities, which further increases the financial gain of a sport/sports performers (e.g. golf, tennis, football). Standards of performance continue to increase. More money is available to improve sporting facilities.
- Media focus can lead to increased standards in performance as well as improved behaviour as a result of increased media focus, thereby creating positive role models and sporting celebrities. The use of technology goes hand-in-hand with this, as it allows retrospective discipline for foul play missed by the match officials.

### Disadvantages of media coverage

- National governing bodies and sports performers lose control to broadcasters and sponsors. The traditional nature of a sport can be lost, for example, rules and timings are adapted to suit the demands of television. The media controls the location of events, as well as kick-off times and in some cases playing seasons (e.g. Super League rugby switched to a summer game).
- Can there be too much sport on TV? Overexposure can lead to possible boredom among spectators and lower attendances at televised events. Does televised sport create passive 'armchair' fans rather than athletes?
- Inequalities of coverage. More popular sports like football gain at the expense of minority sports like hockey or squash. Certain prestigious events are now available only on satellite TV, which requires a paid subscription, e.g. test cricket, Ryder Cup golf. This means that some sports have fewer viewers.
- High-profile sports stars have little privacy. The demands of media and sponsors for interviews, personal appearances etc. can negatively impact high-level performers.
- More breaks in play for adverts disrupts the spectator experience. The use of technology to review decisions can slow down play without resolving controversy.
- A win-at-all-costs attitude develops due to high rewards on offer, leading to negative, deviant acts (e.g. drug-taking) and players becoming negative role models (e.g. in arguing with officials, diving to try and win a penalty).
- The media can sensationalise or overdramatise negative events in sport.

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Download this poster at  
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Charlie Esson teaches PE at Stamford School.



# Concussion

## Injury prevention and rehabilitation

Adam Morton explores the high-profile topic of concussion

### Exam links

**AQA**, **Edexcel** and **OCR** all require knowledge of 'classifying injuries', 'injury prevention' and 'rehabilitation from injury', with the OCR specification mentioning concussion specifically.

Concussion, defined as a traumatic brain injury, has in recent years become an increasingly prominent issue in sport. High-profile cases such as those of Alex Danson, Shontayne Hape and Loris Karius (see the case studies in Boxes 1–3) have all served to raise awareness of concussion. However, as the

tragic death of several young rugby players has demonstrated, while concussion affects athletes at all levels, young people playing contact sports are at greater risk. Although many would argue that governing bodies have still not done enough to protect players, there have been changes in several sports with, for example, the introduction of head injury assessments (HIAs) and the trialling of new tackle laws in rugby.

The issue has also been prominent in American football. The 2015 film *Concussion*, starring Will Smith, highlighted the long-term consequences of repeated head injuries and documented how retired players have

sued the National Football League (NFL), accusing the governing body of failing to warn and protect players. The NFL agreed an out-of-court settlement of more than \$1 billion.

Ex-footballer and *Match of the Day* pundit Alan Shearer also presented a BBC documentary entitled *Dementia, Football and Me* in which he investigated possible links between heading a football, brain injury and mental illness.

### Classifying injuries

Sports injuries involve a loss of structure or function of part of the body, usually along with pain experienced by the



A rugby player goes off for a HIA

athlete, which impairs or prevents them from training or competing. Injuries are classified according to their aetiology (the event causing the injury), with **acute injuries** occurring instantaneously and **chronic injuries** developing over a period of time. Injuries can be further classified as hard-tissue (bone) or soft-tissue (muscle, tendon or ligament) injuries depending on the tissue affected.

Concussion is usually the result of impact to the head but can also be caused by impact elsewhere on the body, the force of which shakes the spongy brain matter against the hard inner walls of the cranium.

While concussion is the most common and usually least serious form of traumatic brain injury, the severity of

the resultant swelling varies significantly. Repeated concussions are particularly dangerous, especially when the injured athlete has failed to recover fully from a previous concussion. Young people are particularly susceptible to this form of 'concussion upon concussion'. Known as *second impact syndrome*, it can cause long-term damage to the brain and has been fatal in some cases.

### Injury prevention

Reducing the risk of concussion involves addressing several of the same categories of risk factor (intrinsic and extrinsic) as the prevention of musculoskeletal injuries (e.g. muscle strains or ligament sprains).

### Intrinsic risks

Intrinsic risk factors are specific to the individual and include the following:

- **Individual variables:** children, those who have suffered a previous concussion and those participating in contact sports are at greater risk of concussion.
- **Training effects:** training to prevent injury is known as 'prehabilitation'. Sport-specific conditioning can reduce the risk of concussion by helping an athlete

### Key terms

**Acute injuries** Result from sudden impact or stress on the body (e.g. fractures, strains and sprains).

**Chronic injuries** Result from repeated stress on the body over a period of time (e.g. stress fractures and tendonitis).

### Box 1 Alex Danson

Two years after captaining the gold medal-winning GB hockey team at the 2016 Rio Olympics, Alex Danson suffered a concussion when she accidentally hit her head against a concrete wall on holiday. After suffering severe headaches and sensitivity to light and noise, she was hospitalised following seizures and sickness. She told the BBC:

'My memory, concentration and ability to read or look at screens was zero... One of the hardest parts in all of this, aside from the physical trauma, has been losing my identity. Going from leading my country, aspiring to qualify for the Tokyo Olympics to just trying to get through a day.'

### Box 2 Shontayne Hape

After retiring from professional rugby due to several serious concussions, Shontayne Hape told the *New Zealand Herald*:

'Things got so bad I couldn't even remember my PIN number... My memory was shot... The specialist explained that my brain was so traumatised, had swollen so big, that even just getting a tap to the body would knock me out. I had to retire immediately... This is an issue people, particularly young players, need to know about. More people need to speak out about it... Most players won't, though, for fear of being thought of as soft or because of the financial pressures.'

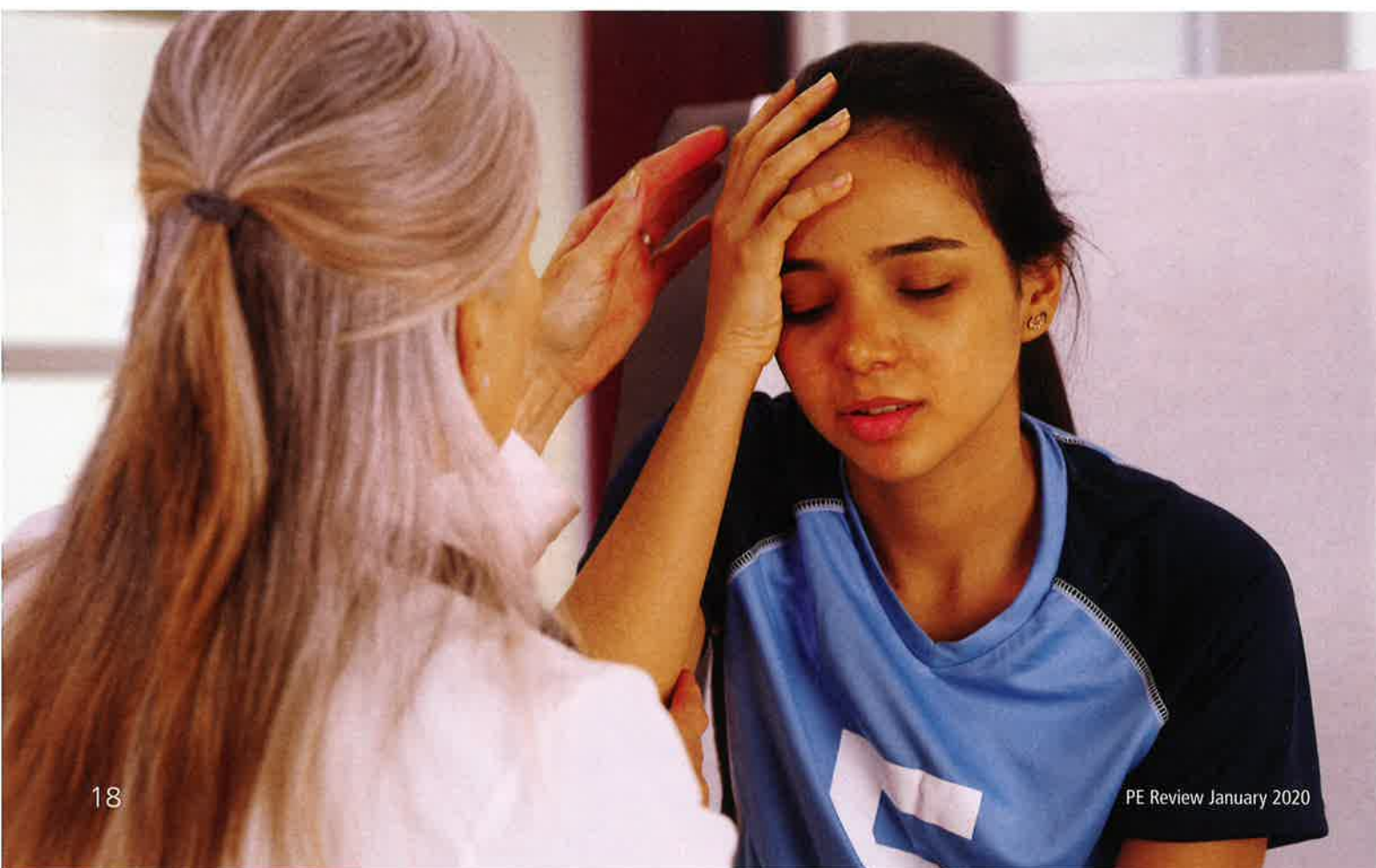
Read the full interview at [www.tinyurl.com/y5dpeckw](http://www.tinyurl.com/y5dpeckw)

to maintain safe technique for longer, reduce contact and better absorb impact forces.

### Extrinsic risks

Extrinsic risk factors are dependent on the situation and can often be controlled to reduce the risk of concussion:

- **Protective equipment:** ensuring that players wear the correct protective equipment is often part of the rules or laws of a game (i.e. wearing a gumshield and headguard in amateur boxing).
- **Technique and training:** teaching the correct and safe techniques reduces injury risk (e.g. tackling in rugby).





## Box 3 Loris Karius

While playing for Liverpool in the 2018 Champions League final against Real Madrid, goalkeeper Loris Karius was deemed at fault for two goals as Liverpool lost 3–1. It was later revealed that the goalkeeper may have suffered a concussion following a collision earlier in the game. Even a slight impairment of vision, concentration or reaction time, which are common symptoms of concussion, could have affected Karius's performance and contributed to the errors he made.

- **Appropriate level of activity:** fatigue can lead to impaired decision-making and technique, both of which can increase the risk of concussion. This means that inappropriate intensity, duration or frequency of activity all increase the risk of concussion. Similarly, balanced competition (e.g. age, weight or gender-specific categories) ensures that sports can be played more safely.
- **Warming up:** increasing physiological and psychological readiness to perform reduces injury risk.

## Rehabilitation

Treatments to accelerate recovery depend on the nature and severity of the injury. They range from conservative

management options such as **physiotherapy**, ultrasound and massage to invasive surgical treatment used for more severe injuries. Contemporary recovery and rehabilitation techniques include the use of **cryotherapy**, **hyperbaric chambers**, oxygen tents and ice baths.

Lower-cost treatments also exist that athletes can use at home. These include icing an injury, anti-inflammatory drugs, contrast therapy (alternating hot and cold treatment) and the wearing of compression garments.

## Diagnosing concussion

An injury must first be recognised and correctly diagnosed before the beginning of a rehabilitation or recovery

## Key terms

**Physiotherapy** Involves the use of exercise, movement, stretching and massage to treat injury.

**Cryotherapy** Involves exposure to extremely low temperatures (–120°C) to reduce inflammation and accelerate recovery.

**Hyperbaric chambers** Provide oxygen at greater than normal pressure. The additional oxygen promotes recovery.

## Box 4 The six Rs

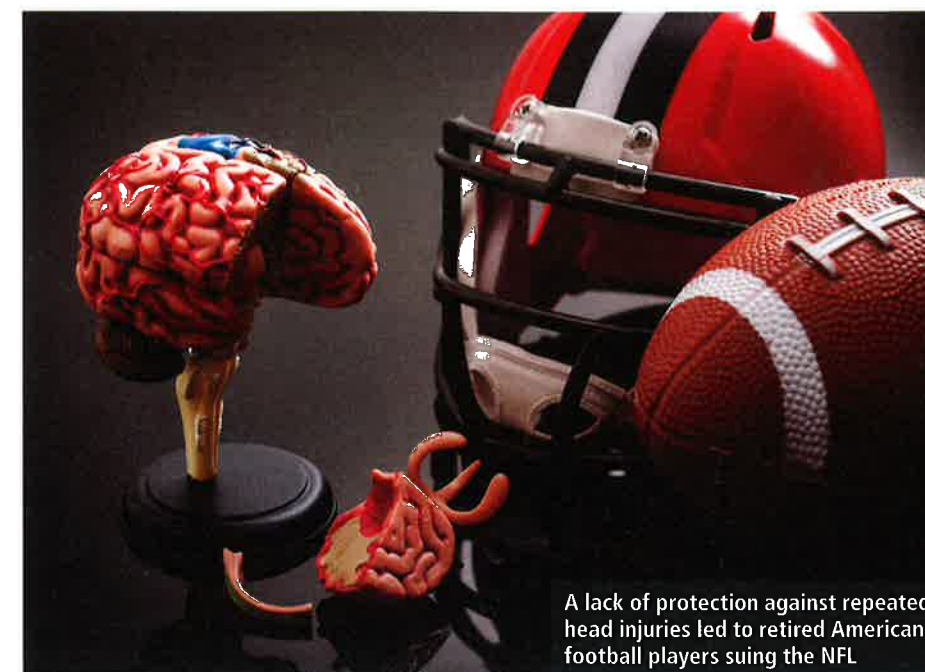
World Rugby's 'Recognise and Remove' concussion management protocol:

- Recognise the signs and symptoms of concussion.
- Remove the player from play immediately if concussion is suspected.
- Refer the player to qualified medical staff once removed.
- Rest the player from all exercise until symptom-free.
- Recover fully, following the Graduated Return To Play (G RTP) protocol.
- Return to play once the G RTP protocol is complete and cleared by qualified medical staff.

programme. The recognition of concussion follows the SALTAPS protocol, which can be used to assess any sporting injury. It involves the following steps

- see
- ask
- look
- touch
- active
- passive
- strength

In the case of concussion, the first three stages of assessment (see,



A lack of protection against repeated head injuries led to retired American football players suing the NFL

ask, look) would reveal one or more of the commonly recognised signs and symptoms of concussion. These include headaches, dizziness, memory disturbance, nausea (feeling or being sick), poor concentration, sensitivity to light and noise, depression and balance problems.

It is important to note that while a loss of consciousness (i.e. being knocked out) is a clear indicator that concussion has been suffered, most incidences of concussion do not involve a loss of consciousness. Concussion can still occur even if you have not been knocked out.

If concussion is suspected, it should be treated immediately by removal from play, followed by rest, both of which are common features of the generic procedures for management of soft-tissue injuries. These are variously referred to as RICE (rest, ice, compression, elevation), PRICE (protection, rest, ice, compression, elevation) or POLICE (protection, optimal loading, ice, compression, elevation). In the case of suspected concussion, however, compression should not be used.

## Concussion in rugby

Growing concerns over concussion have led to World Rugby developing and promoting recognition and correct

treatment at all levels of the game, from the professional level to schools and club games.

The Rugby Football Union's Headcase programme aims to educate players, coaches and officials about the 'six Rs' of World Rugby's 'Recognise and Remove' concussion management protocol (Box 4). Alongside the introduction of the six Rs has been the development of the Graduated Return To Play (G RTP) protocol, which ensures that a player who has suffered concussion is symptom-free before progressively increasing their participation in exercise and training.

## Exam-style questions

- 1 Identify four ways in which injuries can be classified. (4 marks)
- 2 Explain how different risk factors can be managed to reduce the likelihood of injury. (6 marks)
- 3 Describe a recognised concussion management protocol. (6 marks)
- 4 Outline a commonly used procedure for the management of soft-tissue injuries. (4 marks)
- 5 Name two methods used to recover and rehabilitate from injury. Explain the physiological reasons for why they are beneficial. (4 marks)

PEReviewExtras

Check your answers at  
[www.hoddereducation.co.uk/perereviewextras](http://www.hoddereducation.co.uk/perereviewextras)

The G RTP protocol specifies a minimum rest and recovery period of 23 days to allow the brain to recover before returning to play. While elite performers with higher levels of medical support may return sooner than this, this is only possible if they successfully pass through the various stages of the G RTP protocol. This involves an initial period of rest until completely symptom-free, followed by the gradual reintroduction of exercise, sport-specific training and contact training (where appropriate) before re-entering competition. At each stage the athlete must remain symptom-free before the intensity and duration of exercise is increased.

## Conclusion

Concussion is an important issue in sport today, and there is much that can be learned about the classification of injuries, injury prevention and rehabilitation from injuries through a consideration of concussion. More significantly, an understanding of the causes of concussion, the signs and symptoms and how to respond to suspected concussion might help protect those you play with, coach or officiate from further injury. Here the national governing bodies for football (the FA) and rugby (the RFU) both agree on the most important guideline for concussion: 'If in doubt, sit them out.'

## Key points

- Concussion is a serious brain injury that can result in fatality.
- World Rugby launched a 'Recognise and Remove' campaign involving the six Rs.
- The recognition of concussion follows the SALTAPS protocol.
- Intrinsic risk factors of concussion are specific to the individual and include individual variables and training effects.
- Extrinsic risk factors of concussion are dependent upon the situation and can often be controlled to reduce the risk of concussion, for example wearing protective equipment.

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Goalkeeper Loris Karius suffered a suspected concussion in the 2018 Champions League final



# The evolution of sport

## Pre-industrial Britain

John Ireland explores the social and cultural factors that have shaped the characteristics of and participation in sport



Exam links

AQA Paper 1 (sport and society)

Edexcel Component 2 (psychological and social principles of physical education)

OCR Component 3 (sociocultural issues in physical activity and sport)

The afternoon of 14th July 2019 produced multiple classic sporting spectacles, with the England cricket team, inspired by Ben Stokes, requiring a ‘super over’ to defeat New Zealand in the ICC Cricket World Cup final. On the same day, Novak Djokovic overcame Roger Federer during an epic Wimbledon tennis final, and Lewis Hamilton was victorious in Formula One’s British Grand Prix. *The Times* newspaper declared: ‘This is sport at its best.’

Although sport has always provided excitement, its presentation at elite level has been enhanced by commercialism and advanced technology. Increased media attention has had a global impact on sport, influencing participation and performance. However, sporting stakeholders were collaborating as far back as the mid-eighteenth century to begin a trail towards the unimaginable standards of athletic competition enjoyed today. The forces of history on the evolution of sport are significant.

**Social class and sport**

In pre-industrial Britain the lower classes and the upper classes pursued separate activities, adopting contrasting codes of conduct (Table 1).

The lower classes participated in *popular recreation*, including such activities as mob football, cheese rolling, wrestling and other contests of strength. The upper classes participated in their own sports and pastimes through *courtly behaviour* — examples included shooting, hunting and real tennis. The classes sometimes came together when a gentleman became patron to a lower-class performer. A patron offered a type of sponsorship by standing wagers (bets) on contests, and performers were paid from these wagers, marking the earliest forms of professionalism.

The lower classes had little time or energy for play, as most daylight time was taken up by working. Their lives were controlled by **seasonal time**, not by the clock. They had no

prospects and could not escape their lowly origin. However, on holy days and festivals, opportunities arose for pastimes, bringing whole villages together for social occasions. Various **ethnic games** took place and different forms of ‘football’ emerged. For example, the Ashbourne mob game took place every Shrove Tuesday.

Life in the lower classes was short and harsh. Public hangings attracted large crowds. There was no police force to maintain law and order, and local sheriffs often inflicted unjust punishments. Cruel sports were acceptable, e.g. bear-baiting, dog-fighting and cock-fighting.

The lives of lower-class women were just as harsh as those of men. Women had few rights and were

regarded as the weaker gender, serving the needs of their husbands. Activities reflected this lowly status — during festivals women may have competed in a ‘smock race’, a short running dash with the winner being awarded a smock or basic dress. Participation opportunities were also limited for upper-class women. Archery was considered appropriate, and women later played tennis on the lawns of large country houses.

### Origins of modern sports

#### Mob football

The origins of mob football are unclear. Connections have been made with pagan rituals, and some sources claim the head of a Danish nobleman was brandished in some kind of a game after an invasion had been repelled.

Goals or targets were often positioned miles apart. The ball was an animal bladder, which was forced through marauding throngs of participants, over fields and often through rivers. The mob could not be

controlled, and villagers barricaded their houses as the game passed by. Serious injury was common, and fatalities occurred frequently.

These games were the forerunners of association and rugby football. The gentry would rarely involve themselves as participants, but they could do so, whereas the lower orders were strictly excluded from courtly pastimes.

#### Real tennis

Real (or royal) tennis originated in France. It required great skill, and participation was exclusively the preserve of the gentry. Cheaper interpretations involving racquets, bats or hands were also called tennis, to be played against pub or church walls by those not eligible to play real tennis.

#### Foot racing

The gentry travelled in horse drawn coaches, and employed *running footmen* to guard against accidents on the poorly maintained roads. These footmen sometimes covered 60 miles

Key terms

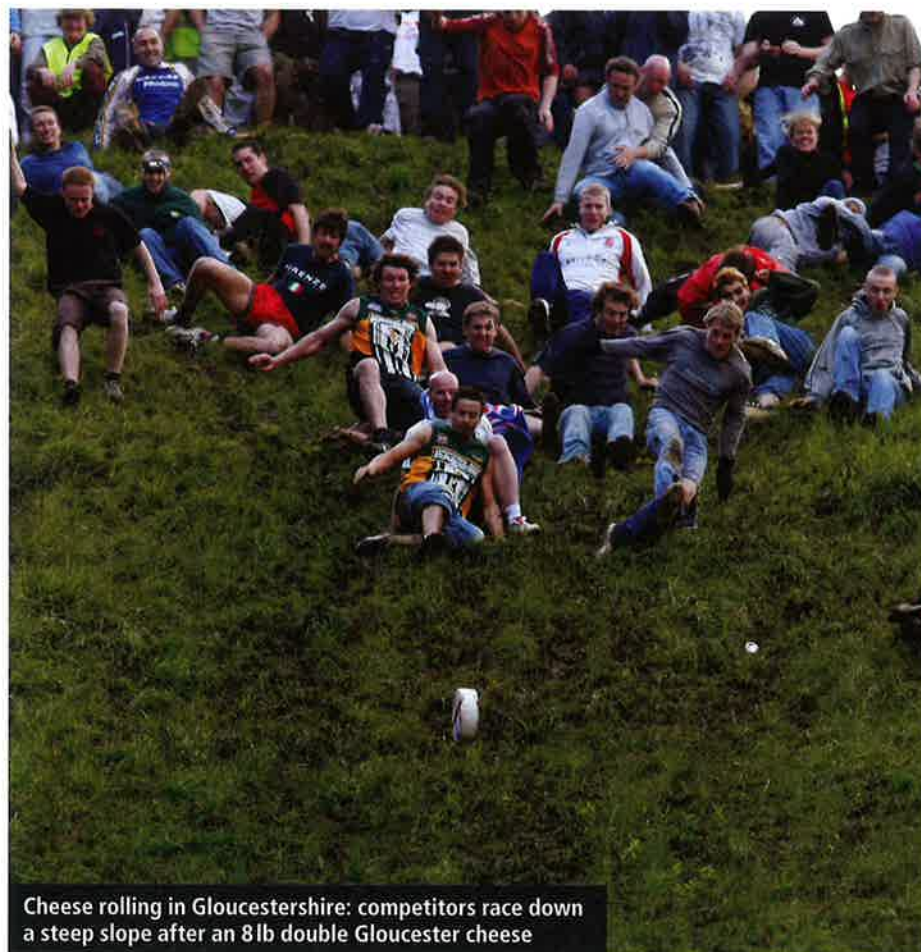
Seasonal time Work starting at sunrise and ending at sunset.

Ethnic games Activities unique to one area, e.g. cheese rolling (Gloucestershire) or tar-barrel carrying (Devon).

Table 1 Characteristics of pre-industrial sports and pastimes associated with class

|                | Lower-class activities  | Upper-class activities  |
|----------------|---|---|
| Location       | Local. Confined within a village, or in the area around it, as people did not have the ability to travel  | Dispersed. Sometimes short distances of travel to courts or area of the ‘hunt’  |
| Engagement     | Violent — participation was often fuelled by alcohol  | A code of etiquette prevailed among players. Killing foxes and game was perceived to be fair  |
| Spectators     | Crowds of spectators took the form of a drunken, rowdy mob with an aggressive nature  | Spectators took the form of an audience. Real tennis was played in front of a gallery. Onlooker behaviour was dignified                   |
| Laws and rules | Rules, if any, were unwritten — the lower classes were illiterate   | Written rules brought sophistication, protocol and a manner of etiquette. The upper classes were educated                                 |
| Frequency      | Took place only on feast days or holy days, which provided a holiday for working men  | Could take place at any time — the gentry had limitless leisure time  |
| Technology     | No pitches or official boundaries, e.g. markings and goals  | Courts, nets and racquets for real tennis<br>Guns and ammunition for shooting<br>Resources such as hounds and horses required for hunting |
| Finance        | The lower classes were poor. There was no money to support games and pastimes.  | The gentry were rich. They had money for equipment and resources  |
| Rural          | Both kinds of activities took place in the countryside. Britain had an agrarian economy. Urbanisation began at the outset of the Industrial Revolution (1750) |   |





Cheese rolling in Gloucestershire: competitors race down a steep slope after an 8lb double Gloucester cheese



Tar-barrel carrying in Ottery St Mary, Devon

in a day. This was before the invention of the bicycle or the advent of the railways.

The upper classes would issue challenges to each other in the form of races between their footmen over set distances. A foot race of 22 miles took place at Windsor Park in 1712, and foot racing attracted large crowds. Betting was common — setting wagers not only gave opportunities to display 'sport at its best' but was also a chance for patrons to show off their wealth.

By the end of the eighteenth century, races had spread across the country, and Captain Robert Barclay Allardice was a renowned athlete of the day. He gained national fame and fortune by walking 1,000 miles in 1,000 hours for 1,000 guineas. He was also a fine runner, winning a 1-mile race at Eastbourne.

These activities led to the development of *pedestrianism* (walking and running as racing or endurance events).

#### Rowing

Aquatic activities also attracted betting. Before the Industrial Revolution, few bridges spanned the River Thames, and the wealthy employed 'watermen' to row them across the river. This quickly developed into racing challenges. By 1715, a competition for watermen was organised over a stretch of river from London Bridge to the White Swan at Chelsea. The winner was handsomely paid and received the prestigious Doggett's Coat and Badge. These activities marked the beginning of competitive rowing.

#### Cricket

Village cricket was played from the early 1700s. The first written rules were implemented in 1727, and the game took recognisable shape in 1774 when the size of the equipment was regulated, a six-ball over was introduced and it became illegal to knock a fielder down as a catch was attempted.

Patrons often employed servants and gardeners who were noted cricketers, so they were effectively paid to play. From the outset, the upper classes played alongside employees, with the former always taking the role of captain. This coexistence of amateur and professional players prevailed in English county cricket until 1963.

The game became more sophisticated, for example care was taken when sowing and rolling pitches. Large crowds watched and placed bets, and purses of £5,000 (equivalent to £500,000 today) were awarded to winning teams.

#### Pugilism

Bare-knuckled fighting also featured in pre-industrial Britain, with matches taking place at fairs and festivals throughout the country. The first reported contest was between a footman and a butcher in 1681. Encounters were lawless, and eye-gouging and grappling were acceptable. James Figg is recognised as the first British champion (in 1719), who despite an unsavoury image mixed with high society and was sponsored by the Earl of Peterborough.

Pugilism was known for match-fixing, particularly when high betting stakes were involved. There was no police force to maintain order, and those suspected of throwing a fight were often pursued by an angry crowd.

With the introduction of the Broughton Rules (1743) the origins of modern boxing become evident, but it wasn't until 1867, in post-industrial England, that John Graham Chambers drew up a definitive list of rules for boxing. They were called the Queensberry Rules after the Marquess of Queensberry, providing respectability to the sport.

#### Education and lifestyle

##### The lower classes

The lower classes received no formal education and were almost all illiterate. This situation remained

Archery was considered an appropriate activity for upper-class women



unchanged until beyond the mid-nineteenth century.

However, the **industrial revolution** that began in the eighteenth century brought opportunities for the lower-class population. Labourers left the land and migrated to developing settlements of industry. Rural depopulation began, and urban growth gathered momentum as mechanisation developed. The British empire was expanding, and an industrial economy overtook the agrarian system.

Despite these opportunities, industrial workers were little more than slaves in mines and factories.

#### Key terms

**Industrial Revolution** Development and invention of machinery, which increased industrial production.

Living conditions were cramped and squalid. Health was generally poor, infant mortality was high and life expectancy was below 30. The working week extended to 80 hours over 6 days, with few public holidays. There was no time or space to play sport, and it was not until the second half of the nineteenth century that quality of life improved and opportunities for leisure and sport emerged (Table 2).



**Table 2** Working-class life in relation to sporting development

| 1750–1850 (pre-industrial period)  | 1850–1900 (post-industrial period)  |
|--|---|
| Migration to developing industrial areas, causing uncontrolled growth of urban settlements | Town planning with amenities, e.g. gaslight and sewage systems  |
| Squalid living conditions  | Improved living conditions  |
| Disease and high mortality   | Healthier living conditions   |
| Largely illiterate, no formal education  | Beginnings of formal education  |
| Six-day working week   | Working week reduced to 57 hours. Saturday becomes a half day of work   |
| Controlled by machine time   | Increased holiday entitlement, e.g. annual holiday  |
| No time or energy for recreation   | Opportunity and time to play sport  |
| No facilities  | Facilities provided by industrialists for workers   |
|  | Growth of professionalism. Sport regarded as 'an end in itself', providing distraction, consolation and entertainment |

As a consequence of this deprivation, 15 million people left Britain in the nineteenth century, with most emigrating to Australia and America. Migrants took with them games and traditions enjoyed in the British countryside. These countries provided opportunities to those who were brave, resilient and hard-working. In consequence, sports

evolved differently, and their cultural influence would eventually spread to British sport in the last quarter of the twentieth century.

Without a hierarchical class structure, Australia and the USA had no reason to view professionalism as vulgar, and did not place amateurism on the plinth of purity, which led to the commercialisation of their sports.

**Table 3** The three stages of public schools

| 1790–1828: bullying and brutality   | 1828–1842: social control and influence of games  | 1842–1914: cult of athleticism   |
|---|---|--|
| Schools were spartan and known for bullying and brutality   | A time of change in society, e.g. cruel sports banned. Formation of police force. Thomas Arnold was the prime mover in public school reform                                       | A strong trend for compulsory team games symbolised the philosophy of athleticism, producing the leaders required for the expanding British empire |
| Narrow, tedious curriculum  | The curriculum was broadened  | Sport had priority over academic work  |
| Boys organised recreation for themselves to relieve boredom. Activities reflected popular culture, ranging from the childlike to the barbaric | Games were encouraged as an agent of social control, being played 'hard but fair'   | Schools adopted official versions of games and drew up strict rules  |
| Facilities were crude and often natural, e.g. bathing in rivers   | Severity of punishments was reduced   | Former pupils unified codes and set up governing bodies  |
|   | Participation aimed to produce Christian gentlemen e.g. production of a strong soul in a strong body (muscular Christianity). House systems were adopted to introduce competition | The amateur ethos was established — sport regarded as a means to an end  |
|   | Sixth-formers were granted responsibilities and entrusted with organisation   |  |

## Key term

**Cultural borrowing** Taking examples of good practice from other countries.

Through **cultural borrowing**, Britain followed their leads.

## The upper classes

The gentry sent their sons to public schools such as Winchester (founded in 1382), Eton (1440), Rugby (1567) and Harrow (1571). At this time schools were spartan and the treatment of the boys was brutal. Bullying and floggings were commonplace.

Games were not overseen by masters. Boys came from far afield, bringing with them their own customs and traditions. Mixing of activities made the public schools a melting pot in which games were adapted. Games like the Eton wall game emerged. They reflected popular culture, including bare-knuckled fighting and mob activities — football at Charterhouse was similar to mob football.

Boys were out of control and reform was urgently needed. Reform came in three stages (Table 3), during which public school sport became codified, dignified and the principle agent of social control.

## Key points

- Social class and sport: each class system had its own sports. Working classes indulged in popular recreation. The gentry adopted a courtly approach.
- Law and order: lawlessness and brutality during play. Bloodsports as pastimes.
- Gender: limited opportunities in sport and education for women.
- Education: upper classes had access to public school education. Illiteracy prevailed among working classes.
- Lifestyle: upper classes had leisure time for sports and betting. Squalid existence and debilitating working conditions for labouring classes — no energy, space or time to play.

**John Ireland** is an experienced teacher, and author of teaching and learning resources for A-level PE.



## Exam links

Research methods and data collection linked to health and exercise patterns are important skills for all A-level exam boards.

**A**t the Centre for Diet and Activity Research (CEDAR), in the School of Clinical Medicine at the University of Cambridge, we are conducting population-level research looking at the influences on what we eat and how much physical activity we do. We are developing and evaluating public-health interventions, and helping shape public-health practice and policy based on the findings of our research.

The Get Others Active (GoActive) study is now coming to a close. For the last 2 years we have been collecting information on physical activity from nearly 3,000 young people. Children tend to exercise less as they become

adolescents and remain physically inactive once they become adults. A lack of physical activity among young people can result in them becoming obese, developing mental health problems and suffering from poor bone development, and puts them at greater risk of developing long-term health problems, including diabetes and cancer.

GoActive was designed to increase physical activity in young people in year 9 (aged 13 to 14). Its aim was to include all students in a particular targeted year group, and to appeal

to students who did not do a lot of exercise, were shy or were not happy with their relationship with others at school. The main aim of this study was to find out whether the GoActive programme helped to increase physical activity of year 9 students when in the school environment.

## Aims and methods

The GoActive study was a **cluster-randomised control trial** designed to assess the effectiveness of the GoActive programme in increasing adolescents' physical activity levels. The study was implemented in 16 schools across Essex and Cambridgeshire, with eight schools receiving the GoActive programme, and eight remaining as control schools. Measurements assessing physical activity, **body composition** and **psychosocial** factors were obtained at four different time points.

## Key terms

**Adolescent** A young person who is developing into an adult.

**Cluster-randomised control trial** A type of randomised controlled trial in which groups of subjects (as opposed to individual subjects) are randomised.



## Key terms



**Body composition** In physical fitness, body composition is used to describe the percentages of fat, bone, water and muscle in human bodies.

**Psychosocial** The psychosocial approach looks at individuals in the context of the combined influence that psychological factors and the surrounding social environment have on their physical and mental wellness, and their ability to function.

A key aim of GoActive was to increase physical activity through increased peer support, self-efficacy, self-esteem and friendship quality, and it was implemented using a tiered leadership system. Tutor groups chose two weekly activities each. Mentors (older adolescents in the school) and peer-leaders (two per class) encouraged students to try these. During the study, students gained points for trying new activities, and were entered into inter-class competition.

Both qualitative and quantitative data were collected, which provided a large data set and many interesting findings.

### Quantitative data

Quantitative data on students' age, gender, ethnicity, family socioeconomic position, shyness and physical activity were collected from self-reported questionnaires. Quantitative process evaluation data were collected in post-intervention questionnaires.

### Qualitative data

Qualitative data were collected from all eight intervention schools towards the end of the intervention. Individual

## Key term



**Self-reported questionnaire** A self-report study is a type of survey, questionnaire or poll in which respondents read the question and select a response by themselves without interference. A self-report is any method that involves asking a participant about their feelings, attitudes, beliefs etc.

and group interviews were conducted by our qualitative researcher. Participants were grouped by level of participation and sampled to aim for a mix of genders. Interviews were recorded and transcribed verbatim (i.e. everything that was said was noted).

### Feedback

Participants reflected on a number of key GoActive components, including their enjoyment of the intervention (i.e. the amount of fun they had with the programme), competition, choice and novelty. It was found that many of the components overlapped and impacted upon enjoyment and participation.

Participants described the sessions as an opportunity to socialise with their form group and with other students they wouldn't usually socialise with, as illustrated by the comments below:

**Researcher** 'Two months ago, would you have spoken to these people in your form group?'

**Participant** 'No, not really, I normally keep my head down and read my book or something in form. But it's kind of quite fun, it's something different, and I think, because we're all on the same team as such, we all kind of get along and want to play.'

Some students noted that GoActive sessions helped with behavioural management and keeping a class focused on a task:

**Participant** 'When our form misbehave loads then we have to do silent reading, but as soon as GoActive came into place, they started misbehaving less and less... So I think, because they're enjoying it they stopped messing about so they could go out and do more fun things in form.'

Students preferred engaging in GoActive sessions and having something to do rather than traditional form-time activities (e.g. sitting and talking, reading or personal reflection):

**Participant** 'I like trying new things and I find [the intervention] really fun...and it's better than just sitting there and doing nothing, because that's what we always do in form.'

### Boys and girls

Some elements of GoActive were favoured more by different subgroups, for example boys preferred the class competition compared to girls and the general consensus from the focus groups was that the competitive element of the activities was a source of fun for boys. The GoActive programme aimed to avoid the stigmatisation of targeting particular groups. One boy commented:

**Participant** 'In our form we've done competitions against other forms, so the boys from one form and the boys from another form, we went into the sports hall and played dodgeball, that was fun.'

However, the results showed that many girls did not enjoy competition, and interview discussions revealed that it was a deterrent to participation. Questionnaire data suggested that boys liked choosing new activities more than girls. It was found from interviews that students were shy and displayed apathy towards suggesting an activity, therefore choice was limited among the year 9 students.

Girls seemed to be more interested in trying out different activities as opposed to boys. A class vote to decide an activity choice usually resulted in one person or a small group (usually boys) deciding the activity for the class. On most occasions football was the chosen sport. When girls were able to choose the activity, it was found that not many students participated, suggesting that the solution may be to have separate

## Resources



For more information about the GoActive project and an introductory video, go to [www.tinyurl.com/y3t85wz6](http://www.tinyurl.com/y3t85wz6)

activities for boys and girls. Two girls described their experience:

**Participant 1** 'We tried yoga, but there was only a few people that actually wanted to do it, and everyone else kind of just took the mick and just sat on the floor.'

**Participant 2** 'We tried Zumba, but... there were about three people that were really going for it, but then nobody else was.'

### Leadership

In relation to the in-class year 9 leaders, the study results indicated that boys preferred having leaders more than girls, but focus group discussions revealed the implementation of leaders was low:

**Participant** 'Ours was a bit confusing because no one really wanted to be the leader, I don't know why but, yeah, no one wanted to do it.'

It appeared that teachers had to resort to selecting the new class leaders each week. Students who were considered 'good' at a particular activity were the first to be selected by the teacher, which some participants said meant they were less likely to volunteer themselves, as they did not feel they had sufficient skills:

**Participant** 'I don't know, I don't normally get too involved with those things, and...I feel like there's more people...that might have done better in doing it.'

The provision of in-class leaders was supposed to promote autonomy, but instead may have led to feelings of embarrassment and fear of judgement.

The components used in the GoActive programme, including mentorship, flexibility and choice are commonly used in health-promotion interventions. Students indicated that the impact of the intervention

## Key term



**Autonomy** Being in control of your own life.

The study enabled participants to engage in a wide variety of activities, from dodgeball to Zumba



could have been enhanced by earlier integration of the intervention and direct incorporation into the timetable. However, this would go against the programme's aims of developing autonomy in participants and flexibility across different school settings.

### Conclusion

This study is a novel contribution to the field and it is possible that the intervention was experienced differently by other subgroups, e.g. participants from a lower socioeconomic position, but the focus groups were not set up to explore these differences. The large sample size of the quantitative data and the in-depth findings from the qualitative data provide insights into mechanisms of

complex interventions within a multi-faceted environment.

In conclusion, this study showed that mentorship and autonomy were liked in principle, but implementation issues impacted upon student satisfaction. Different elements of the intervention were favoured by some more than others, e.g. competition was liked by boys but disliked by girls. For adolescents, there is a need to include an in-depth school-led design and implementation of activity choice provision and novelty, and improved mentorship training when designing future interventions.

Sofie Armitage is a GoActive research assistant based in the School of Clinical Medicine at the University of Cambridge.



# The evolution of sport

## Post-industrial Britain

John Ireland looks at the links between social class and sport



### Exam links

- AQA** Paper 1 (sport and society)
- Edexcel** Component 2 (psychological and social principles of physical education)
- OCR** Component 3 (sociocultural issues in physical activity and sport)

As the Industrial Revolution gained momentum, wealth was no longer a hereditary right of birth. The middle classes were aspirational and sought to copy the lifestyles of the upper classes. They sent their sons to public schools, and this generation gave strong direction to sports development.

Public school old boys were expected to fill key roles in society.

They became industrialists, army officers, vicars and leaders of the British empire. With these outcomes in mind, the public schools promoted sport in order to develop boys' character and moral integrity. Games were seen as more important than the academic curriculum, and were made compulsory. Boys and masters became obsessed with team games, which became integral to public school life.

Universities also had a hand in sporting evolution. Populated by middle- and upper-class former public school boys, universities unified rules of play, and former students were involved in establishing the first sporting governing bodies.

### Cricket, football and rugby

Cricket had long been established in rural England. The rules were codified and commonly understood. Eton played Harrow for the first time in 1805. This match took place at Lord's over three days and once attracted a crowd of 20,000 — the fixture survives today as a limited-over match. Such social events gave opportunities for schools to show themselves off and attract more pupils and funding.

Football, due to its rustic peasant origins, caused consternation among masters. However, schools brought order to play. The spread of the railways allowed the possibility of reliable and convenient travel,

enabling the organisation of fixtures between schools. However, difficulties occurred in inter-school fixtures because every school had a different variation of the game. For example, Charterhouse favoured the dribbling game (later the basis of association football) while Rugby preferred the handling game (which developed into rugby football).

Football at this time was unrecognisable compared to the game played today. Rather than 4-4-2 or 4-3-3, formations were more like 8-1-1, with eight players dribbling from the back. The game was physical — it was within the rules to barge the goalkeeper before shooting at goal. Both the FA Cup and the first international match (Scotland vs England) took place in 1872. These events stimulated considerable interest, particularly among the increasingly liberated working classes, creating a reluctant fusion of class interests.

Crowds in post-industrial times were emotive and sometimes volatile. The situation remains unchanged in modern times — sporting events have always required policing.

When the Football Association (FA) committed to the dribbling game, Blackheath resigned their membership and elected to pursue the handling game. In consequence, the Rugby Football Union (RFU) was established in 1871. Three lawyers who were former pupils at Rugby School drew up the first laws of the game. The first rugby teams were based around London and the game was rooted in middle-class values. Southern control would later become a major source of acrimony between the social classes within rugby.

### Amateurs and professionals

Sport had made an important transition. It had changed from unsophisticated popular recreation, initiated in rural counties, to sophisticated rational recreation enjoyed in urban and suburban locations connected by railways (Figure 1). The advent of organised professionalism caused sport to become a business.

Professional players of today are skilful, dedicated and mentally attuned. Today 'professional' is a byword for excellence. Amateur

participants are regarded as performing at a lower standard than those who make a living out of sport.

In the nineteenth century, the definition was not so simple. The emergence of open professionalism was an acrimonious issue. Many sports, such as athletics, opposed professionalism, believing that payment would lead to corruption and the destruction of moral Christian values laid down by the amateur principle.

Professionals then were simply paid to play. They were considered inferior to gentleman amateurs in terms of social class. Amateurs were not paid a wage, but made money by claiming 'expenses'. At this time they were just as skilful as professionals.

### Professionalism in cricket

Cricket is the best example of this ambiguity. County cricket teams comprised gentleman amateurs and working-class professionals. The latter were employed to perform strenuous tasks, e.g. fast bowling (overarm bowling had been legalised in 1864) and maintenance of kit and grounds. Amateurs occupied more glamorous roles, e.g. batting. They played when it suited and used separate changing rooms from professionals.

Class distinction was paramount. Amateurs entered the field of play through different gates to emphasise class superiority. Professionals endured third-class rail travel and second-rate hotel accommodation. Gentleman amateurs were addressed as 'Mister' and always captained the team — until the 1950s the England cricket captain was required to be an amateur. It was thought that the 'gentleman' amateurs had greater powers of leadership and diplomacy — a legacy of public school aspiration

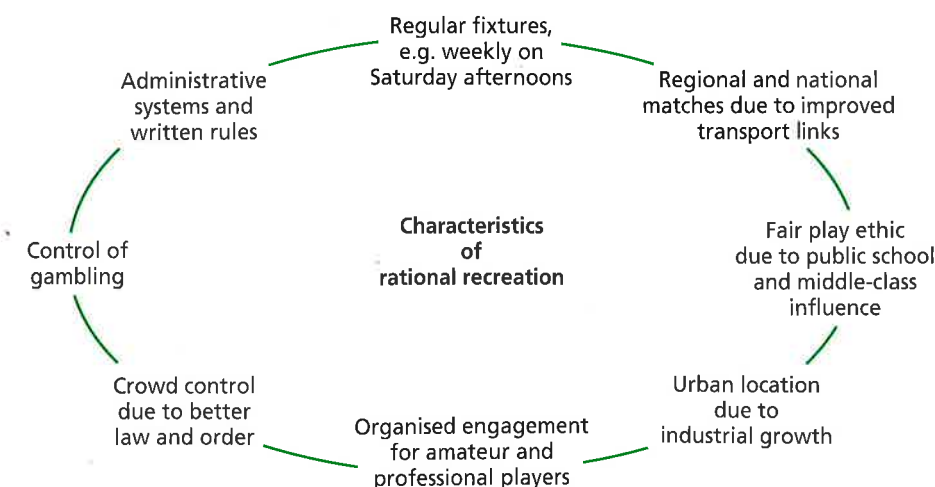


Figure 1 The development of sport in post-industrial Britain



and preparation. Although the relationship between amateurs and professionals was discriminatory, the factions coexisted functionally.

The leading player in these times was W. G. Grace, who enjoyed a long career as an amateur. However, Grace was invariably paid more than the professionals. It was socially acceptable for amateurs to receive lavish remuneration under the guise of compensation for travel and accommodation in the best hotels.

### Professionalism in football

By 1870, tradesmen were granted Saturday afternoon holidays. The weekend was born and the working classes sought sporting entertainment. The concept of sport being a source of entertainment was alien to the middle and upper classes, who up until then perceived only intrinsic benefits of games.

Working-class spectators preferred the endeavours of skilled professionals. As leisure time and wages increased, they were willing to pay for entertainment.

Association football found itself at the centre of a dilemma. After gaining popularity among the working classes, some clubs had discreetly moved towards paying players. This practice was called 'veiled professionalism'. Although there was great resistance from those who adhered to the amateur ethos, the mass demand for payment could not be ignored. Ironically, it was the introduction of the amateur-based FA Cup that accelerated the onset of open professionalism. Working-class clubs used gate money to pay wages to signed players.

### Regulated professionalism

The FA gave way and allowed professionalism in 1885. The transition was overseen by Charles Alcock, often referred to as 'the father of modern sport'. His management ensured minimum conflict between clubs remaining

amateur and those opting for a professional future — this amicability was not achieved in other sports.

Professional clubs required an income stream, and prosperity was dependent on spectator attendance. Football crowds were different from cricket enthusiasts. They tended to be parochial, partisan and rowdy. Stadiums were built in urban centres so railway links could be utilised. Stadium terraces were packed every week, and the development of the mechanical turnstile allowed clubs to monitor profits.

Players were regulated and owned by the clubs, and wages were managed accordingly. Until the abolition of the maximum wage in 1961, a football player earned about the same as a skilled tradesman. Transfer was possible only when it suited the club who held the signature of the player. The FA in turn controlled the clubs, ensuring profits were shared between league members.

### Professionalism in rugby

As in football, veiled professionalism occurred in rugby in the north of England. For some time this indiscretion remained undetected until it became obvious that teams in the region contained disproportionate numbers of working-class players.

Breakdown came in 1895. Members from the north who worked in heavy

industry such as manufacturing and coal mining could not afford to lose wages for missing morning shifts on Saturday in order to play. Permission was sought from the RFU for compensatory payment to be made to those with work commitments. The amateur ethos, ingrained in the sport's governing body, was placed under threat, and the request was refused.

In consequence, disenchanted teams broke away from the RFU and formed the Northern Union, which authorised broken-time payments to working-class members. The split was acrimonious — the RFU did not allow defecting teams to return, and players suspected of appearing in the Northern Union received lifetime bans.

As with football, the professional game became dependent on spectator attendance. Although initially successful, many clubs could not sustain the financial outlay and disbanded. The Northern Union changed the game's rules to attract larger attendances. It could be argued that this was the first attempt by a team sport to consider entertainment as a priority. Eventually the two codes developed into rugby league (the Northern Union) and rugby union (the Rugby Football Union).

One hundred years after the split, rugby union finally became professional in 1995.

### Education and women

Links between the growth of education and development relating to sport are highly significant. As literacy improved, the working classes began to understand written rules and read news items about their teams. This added to the momentum behind sporting interest.

During the mid-nineteenth century, women of all classes were dependent on men. They were expected to merely marry and have children. Prospects and opportunities



The spread of the railways allowed for reliable and convenient travel to away fixtures

were restricted by the conventions of society, and education was thought important for boys but not for girls.

By 1870, society was beginning to change. The Elementary Education Act made schooling available to the masses, including girls. Physical education was permitted for girls in 1873, and made compulsory for girls in schools within the London School Board.

### Buss, Beale and Österberg

Frances Mary Buss was a great innovator and believer in exercise. She taught at the North London Collegiate School, which became the model for girls' schools throughout the UK and overseas. Girls engaged in physical training, which followed the lines of drill and instruction.

Women from the upper classes could attend newly founded girls' public schools, which copied their counterparts by including games on the curriculum. For example, cricket was taught at several girls' public schools in England, and hockey and lacrosse were often seen as female preserves in these institutions. Dorothea Beale became principal of Cheltenham Ladies' College in 1858 and was an advocate of sport coexisting with academic study.

In her role as superintendent for the London School Board, Martina

Bergman-Österberg implemented the teaching of Swedish gymnastics in girls' schools. She became concerned with the unsuitability of teaching working-class girls in London, observing that they lived in an environment of malnutrition, neglect and dreadful living conditions. As a consequence, Österberg's interest shifted towards teaching middle-class women to become physical training instructors in schools. For this purpose she founded the first women's PE college at Dartford in London.

The work of these educators not only encouraged female participation in sport and PE, but also contributed to the wider movement of campaigners who were committed to bringing the entitlement of study, work, property ownership and the vote to women. However, male-dominated society still refused to take women's participation in sport seriously until well into the twentieth century.

### The spread of sport

In the last quarter of the nineteenth century, sport played a crucial role in the British empire. Its fundamental purpose was to transmit honourable values, associated with a morality code broadcast by British rule.

Values of amateurism were impressed upon the colonies. Cricket and rugby flourished in New Zealand,

Australia and South Africa. Sport was used as an 'agent of enlightenment' in the Cook Islands, Tonga and Fiji, and cricket and hockey became dominant on the Indian subcontinent, and in the West Indies. Tennis was played throughout the empire, though it was perceived as a game for elite society.

Sport was spread through military personnel, administrators, diplomats and skilled workers. Schools were founded for the sons of local elites, with the curriculum and focus on sport mirroring British public schools.

Pierre de Coubertin, founder of the Olympic movement, was inspired by the approach of British public schools to sport. He subscribed to the philosophy of muscular Christianity and the underpinning ethos that moral discipline could be developed through sport. This ideal became central to the Olympic philosophy:

“The important thing in life is not the triumph but the struggle, the essential thing is not to have conquered but to have fought well.”

Although the Olympic ideal has a different complexion in the twenty-first century, measures are still taken to try and ensure the fight for victory is fair.

### Key points

- Sophistication: development of rational recreation.
- Social class and sport: upper classes defined by amateurism. Working classes defined by professionalism.
- Transport: the spread of the railways allowed growth of organised sports fixtures.
- Law and order: introduction of the police force.
- Gender: changing status of women brought opportunities in education and sport.
- Education: the role of public schools and universities in the growth of modern sport. Provision of education for the working class.
- Expansion: spread and export of British sport within the empire and beyond.

John Ireland is an experienced teacher, and author of teaching and learning resources for A-level PE.





# We Are Undefeatable

**S**port England has launched a campaign aimed at supporting leading health charities in a bid to help people with long-term health conditions overcome barriers to being active.

Sport England chief executive Tim Hollingsworth said:

‘We are very proud to support our charity partners in delivering this new campaign because we know with the right support, sport and physical activity has the ability to change the lives of people living with long-term health conditions for the better. This campaign forms part of a longer-term drive by Sport England to change cultural and social norms around long-term health conditions and physical activity.’

The We Are Undefeatable campaign aims to support the one in four people in England who have a long-term health condition such as diabetes, cancer, arthritis or Parkinson’s. The main aim is to help these people build physical activity into their lives.

As part of the campaign, Sport England is collaborating with 15 health and social care charities, including Age UK, Alzheimer’s Society, British Red Cross, Macmillan Cancer Support and the Stroke Association.

## Research and challenges

According to the Department of Health, the number of people with long-term health conditions in England is expected to rise from 15 million to 18 million by 2025. In 2019, DJS Research surveyed 1,303 people aged 18 and over who were living with long-term health conditions. The research showed that:

- 69% of people living with long-term health conditions would like to be more active
- 66% say being more physically active would help manage or improve their



condition, with improved mood and wellbeing seen as the biggest benefit (52%)

- 24% of people with a long-term health condition feared that physical activity would make their health issues worse
- 44% would like more help and advice on how to be more active.

The survey also revealed that people with long-standing health concerns feel they face some unique barriers. Of the people surveyed, 36% cited lack of energy as the main barrier to increasing physical activity. Two in five (40%) reported that pain caused by their health condition prevented them from increasing the amount of physical activity they do,

and 28% reported that the unpredictable nature of their condition made it hard to commit to a routine.

We Are Undefeatable recognises these unique barriers. It aims to show the stories of men and women living with a variety of conditions getting active in ways that suit their needs.

## How will the campaign work?

Research shows that even small amounts of activity can make a significant difference to health and wellbeing. We Are Undefeatable is supported by £3 million of Sport England/National Lottery funding, and the campaign’s promotional materials feature a cast of real people with a variety of health conditions trying to reach out to others in similar positions to themselves.

The campaign’s promotional film aims to portray a more realistic view of getting active, including unconventional exercises and the unique struggles and successes experienced by real people with real health conditions.

Other promotional materials include a 60-second TV ad, radio spots, social media and sponsored searches that drive people to visit the website:

[www.weareundefeatable.co.uk](http://www.weareundefeatable.co.uk)

Fourteen ‘social spots’ concentrate on individuals from the main film, such as Simone, aged 33, who was born with a congenital heart defect that led to a stroke at 19, but now tries to walk 2 miles every day after being encouraged by her doctor, and plays *Just Dance* with her partner. Simone has seen a real improvement in her health and wellbeing.

Campaign support packs are also being distributed to every GP surgery and community pharmacy in England as part of a wider programme to support healthcare professionals to promote physical activity to their patients.

Get more from this issue of PE REVIEW, with **free** online resources. See page 1 and [www.hoddereducation.co.uk/pereviewextras](http://www.hoddereducation.co.uk/pereviewextras)

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