16. "FITT" PRINCIPLE

LUCY OSBORN

TO SUCCESSFULLY ACHIEVE OVERLOAD DURING TRAINING, YOU MUST INCREASE A COMBINATION OF THE FOLLOWING

FREQUENCY - HOW OFTEN YOU TRAIN

For Example – Professional footballers will train most days of the week to improve their fitness levels, whereas amateur players may only train once.

INTENSITY – HOW HARD YOU ACTUALLY TRAIN

For Example – To achieve aerobic benefit you need to consistently work at 60-80% of maximum heart rate. Rugby players will wear heart rate monitors during training to make sure that they achieve this.

TIME – HOW LONG YOU ACTUALLY TRAIN FOR

For Example – To achieve aerobic benefit, exercise sessions needs to be for at least 20 minutes. Marathon runners will usually go for extended training runs of at least an hour in length.

TYPE – THE METHOD OF TRAINING YOU USE

For Example – To improve in swimming, performers will usually use interval training sessions in the pool, but will also use weight training sessions in the gym to build muscle.

17. AEROBIC AND ANAEROBIC ENERGY SYSTEMS

CHARLOTTE WITTS

AEROBIC

- This is used for physical exercise that takes place over a long period of time. 20minutes – 2 hours
- It uses oxygen as its main source of energy.
- The intensity should be 60-85% of your max heart rate (220 – AGE)

Marathon runners use their aerobic energy system.

Mo Farah would also use his aerobic system when running the 10,000m or Jodie Stimpson would use hers when doing a triathlon

ANAEROBIC

- This is used for physical activities that take place over a short period of time. 0 – 2 minutes
- Limited energy can be produced in the muscles without using oxygen, but this causes a build up of lactic acid
- The intensity should be around 85-90% of your max hear rate (220 – AGE)

Usain Bolt uses his anaerobic energy system when sprinting the 100m

So does Lionel Messi sprinting down the pitch with the ball to score

18. IMPORTANCE OF A WARM UP AND COOL DOWN

SPENCER BARROWMAN

WHY WARM UP?

- Decreases the likelihood of injury or muscle soreness
- Speeds up the delivery of oxygen to the working muscles
- Improves the speed and strength of muscle contractions
- Increases muscle temperature so muscles become more flexible
- Helps you focus your mind on the upcoming game or activity

WHY COOL DOWN?

- Light exercise after hard training will help flush oxygen through the working muscles to speed up the removal of lactic acid
- Light exercise will help to prevent blood pooling in the veins which can cause dizziness
- Light exercise enables you to gradually reduce both your heart and breathing rates back to a comfortable level
- Decreases the likelihood of injury or muscle soreness

HOW TO WARM UP

1. Pulse raising activity

2. Static and Dynamic stretching

3. Sport Specific Activity

19. HEART RATE

LAURA CARMONA

- **Heart rate,** or **heart pulse**, is the speed of the heartbeat measured by the number of poundings of the heart per unit of time

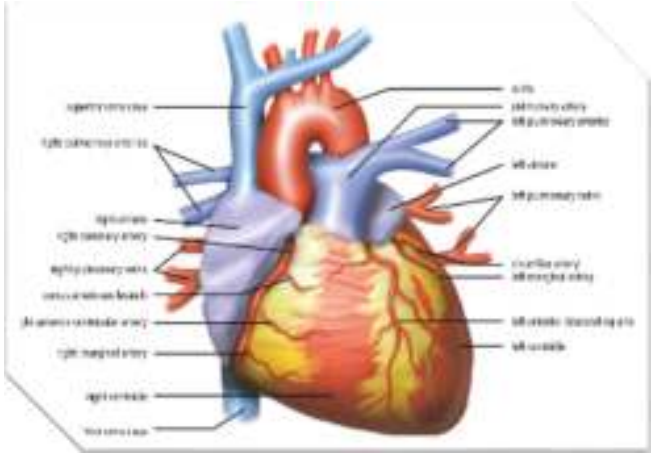
- **What's a normal heart rate?**

Most adults have a resting heart rate of 60-100 beats per minute (bpm).

The fitter you are, the lower your resting heart rate is likely to be. For example, athletes may have a resting heart rate of 40-60 bpm or lower.

- **Finding your pulse**

You can find your pulse in places where an artery passes close to your skin, such as your wrist or neck.



- **Exercise and your pulse**

If you check your pulse while you're exercising or immediately afterwards, it may give you an indication of your fitness level. A heart rate monitor is also useful for recording your heart rate when resting and during exercise.

- Aerobic activities such as walking, running and swimming are good types of exercise because they increase your heart rate.

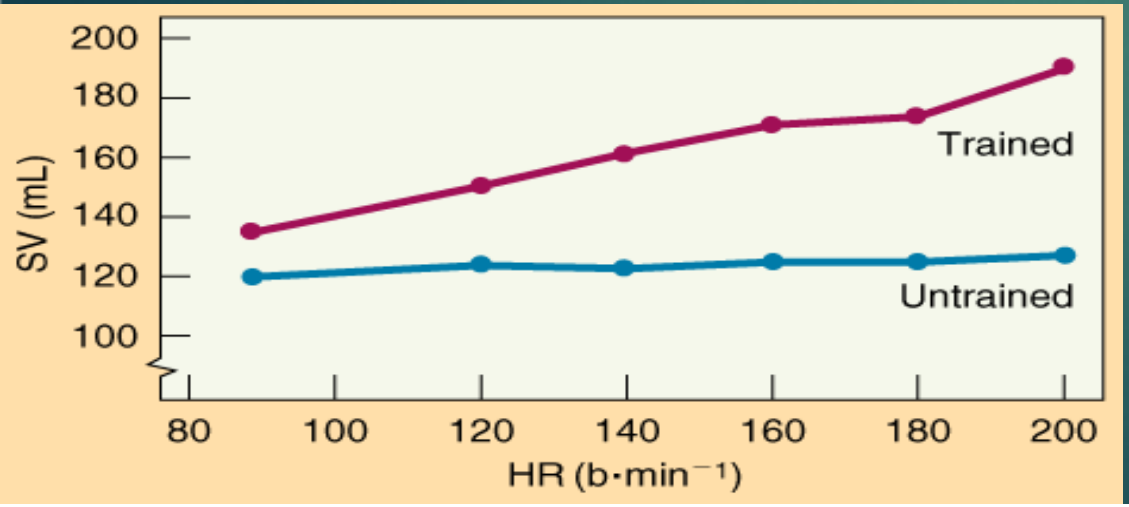
20. STROKE VOLUME

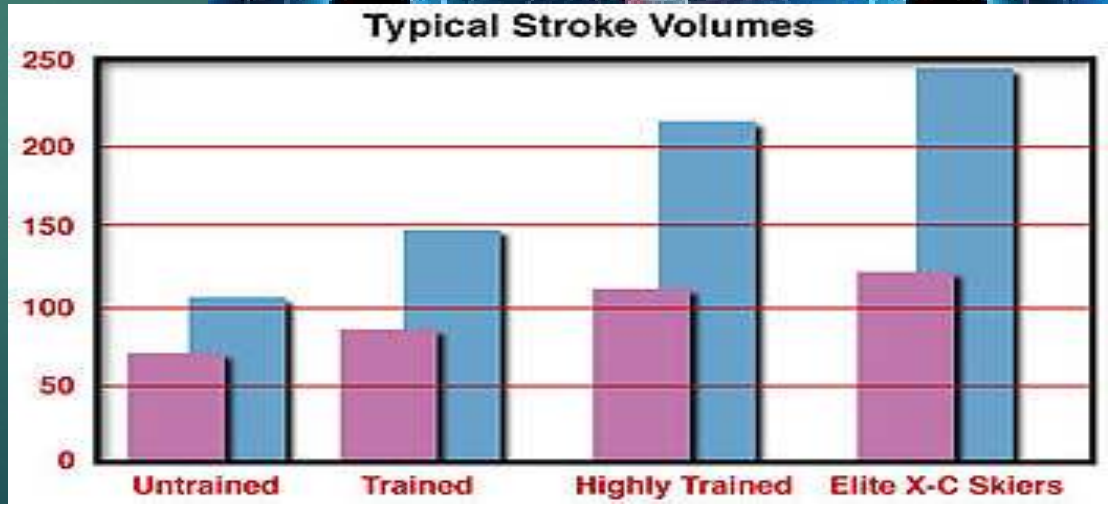
CALLUM WILSON

Stroke Volume is a measurement of the volume of blood (ml) leaving the left ventricle of the heart in one contraction (beat).

$$\text{Stroke Volume} = \frac{\text{Cardiac Output}}{\text{Heart Rate}}$$

A short term effect of exercise would be an **INCREASE** in Stroke Volume. This is because when you participate in physical activity there is a demand for oxygen by working muscles around the body; in order to carry out this the heart distributes more blood to the muscles. This increase will then enable you to carry out the exercise you are participating in for longer.





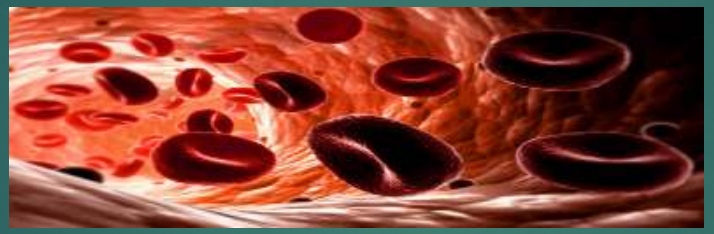
21. CARDIAC OUTPUT

LUCY OSBORN

CARDIAC OUTPUT is the volume of blood pumped by the heart per minute and is the product of the amount of blood per heart beat (called the stroke volume) times the number of heart beats in a minute (heart rate).

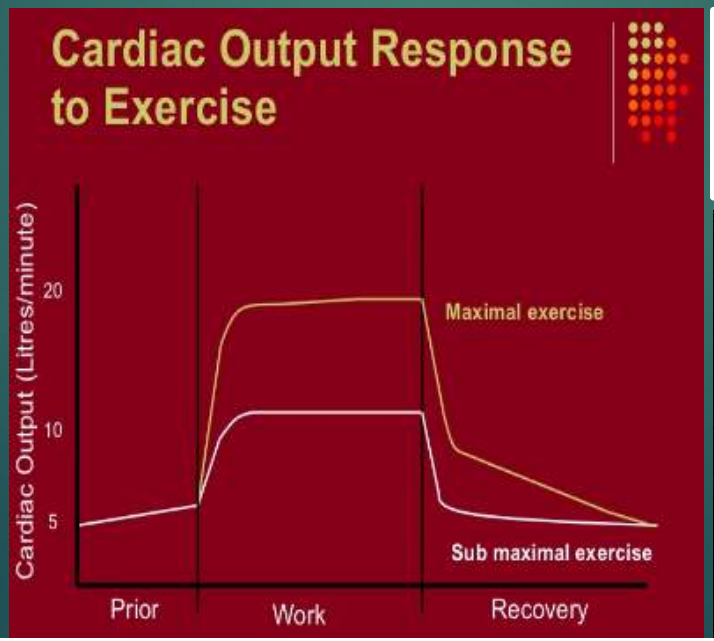
Cardiac Output in mL/min

= Heart Rate (beats/min) X Stroke Volume (mL/beat)

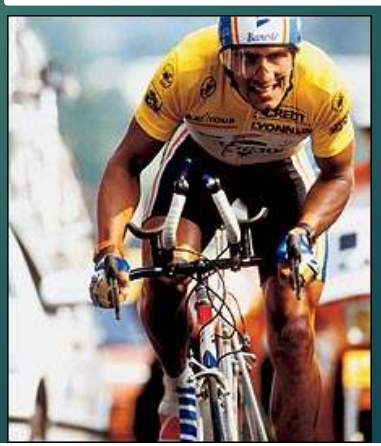


For an average size adult (70 kg) at rest, the flow of blood from the heart into circulation would be about 5 litres per minute.

The TOTAL volume of blood in the circulatory system of an average person is also about 5 litres, so therefore the ENTIRE volume of blood within the circulatory system is pumped by the heart each minute when at rest.



During intense exercise, CARDIAC OUTPUT can increase to over 30l/min, although this is only true if you are very fit!



Miguel Indurain, who won the Tour de France in five successive years had a resting heart rate of 28 beats per minute and could increase his cardiac output to 50 litres per minute and his heart rate to 220 beats per minute!!!

22. BREATHING RATE

RENATO ESPIRITO SANTO

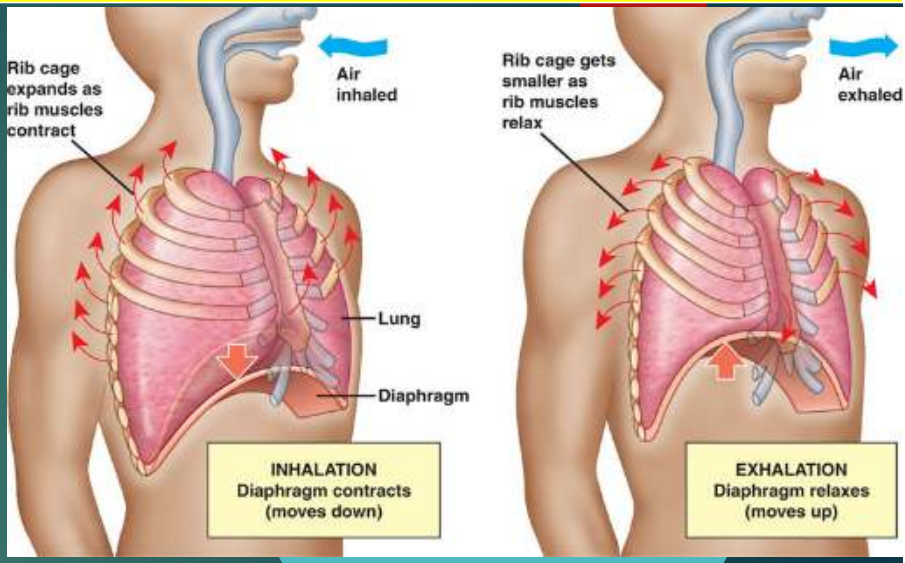
BREATHING RATE (or Respiratory rate) is measured by counting the number of breaths a person takes in a one-minute period

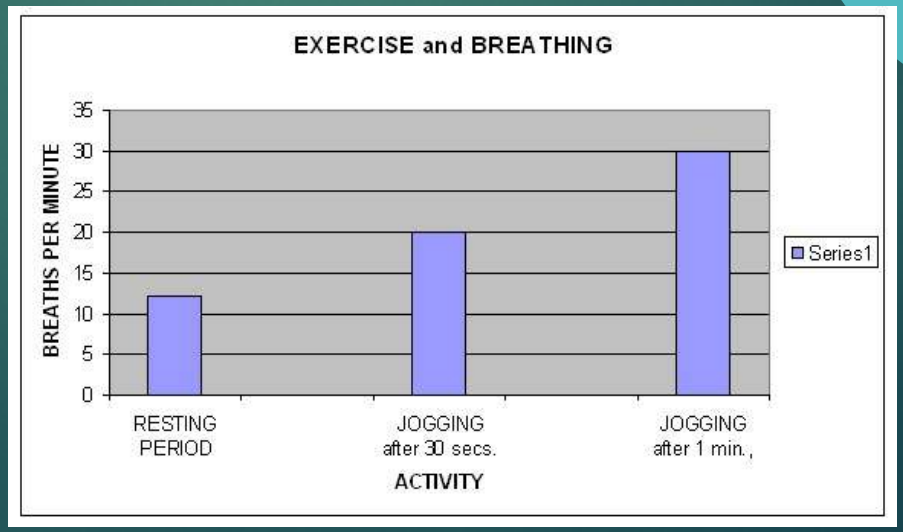
The number of breaths we take per minute is a sign of how often the brain is telling our bodies to breathe.

If the oxygen level in the blood is low, or alternately if the carbon dioxide level in the blood is high, our body is instructed to breathe more often.

FOR EXAMPLE, having a severe infection increases the carbon dioxide produced in the body, so even if there's a normal level of oxygen in the blood, the brain instructs the body to breathe more often to clear the carbon dioxide

A normal breathing rate for an adult at rest is 8 to 16 breaths per minute. For an infant, a normal rate is up to 44 breaths per minute

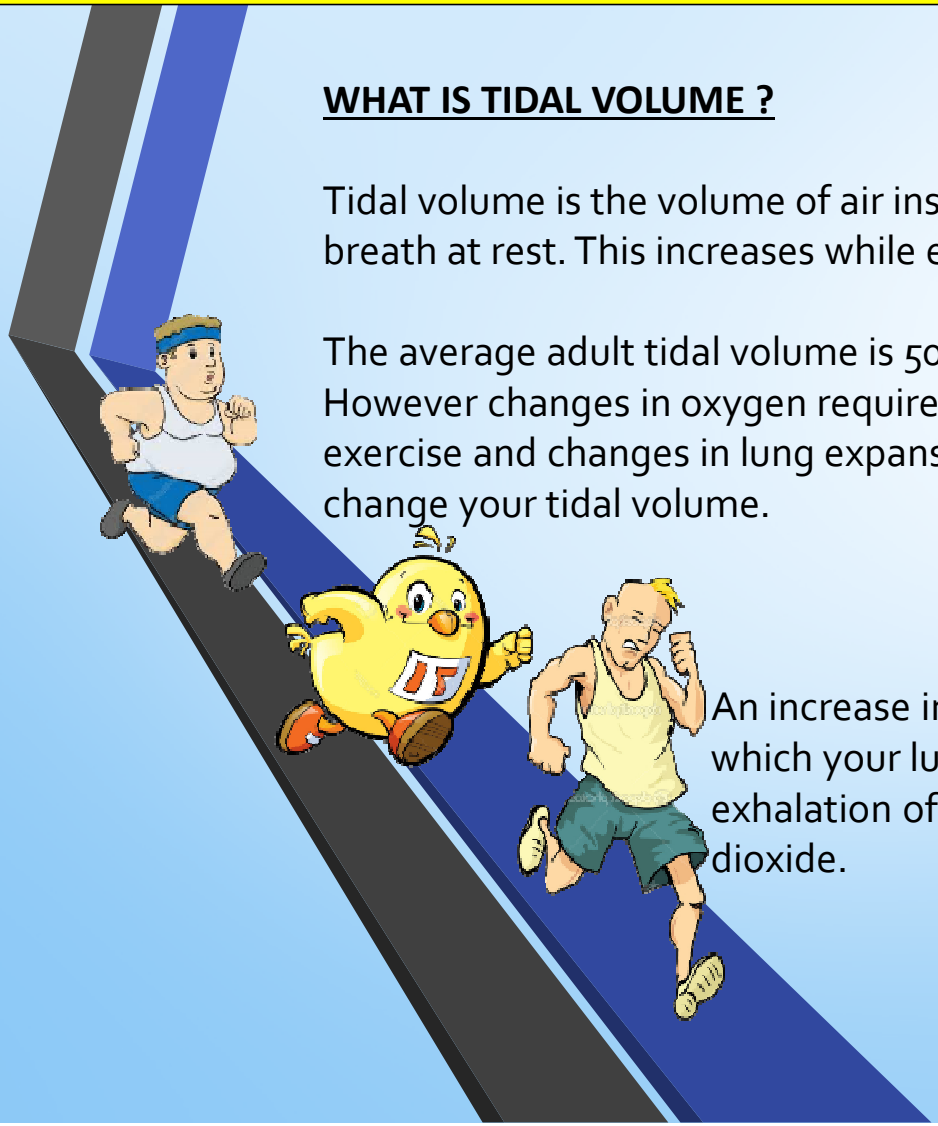




Your blood picks up oxygen as it travels through the lungs. As your level of activity increases, your breathing rate increases to bring more air (oxygen) into your lungs so that your lungs can pump more oxygen into your blood and out to your muscles.

23. TIDAL VOLUME

ABI TODD



WHAT IS TIDAL VOLUME ?

Tidal volume is the volume of air inspired or expired per breath at rest. This increases while exercising

The average adult tidal volume is 500ml per breath. However changes in oxygen requirements such as during exercise and changes in lung expansion/ contraction can change your tidal volume.

An increase in tidal volume is one way in which your lungs can accommodate the exhalation of the increase in carbon dioxide.

For example: when running long distances your tidal volume increases as the respiratory system is being affected by the oxygen requirements of the working muscles.

Exercise causes an increase in tidal volume because you need more oxygen. It is necessary to meet the oxygen's requirements as an increase in breathing rate (respiration) alone is not sufficient

24. MINUTE VOLUME

LIAM BLOOMER

Definition:
Your minute volume is the amount of air that is inspired or expired per minute (ml/min).

Measuring your minute volume:

STEP 1

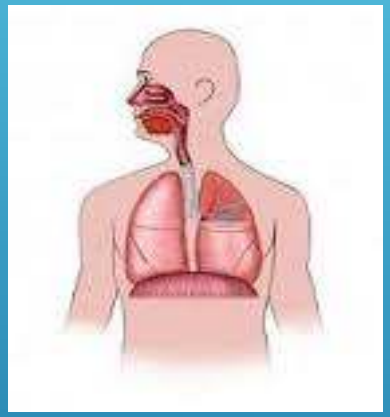
Calculate a person's tidal volume. This is the amount of air that they inhale and exhale in a normal breath. This calculation is usually determined by having the individual blow into a device that measures respiration, known as a respirometer. The average tidal volume for a person at rest is approximately 50 ML.

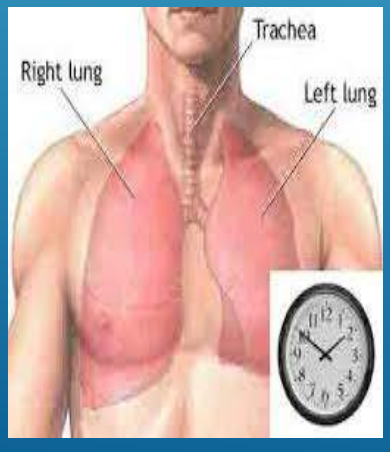
STEP 2

Count the number of times a person breathes in 1 minute. One breath would be an inhalation plus an exhalation.

STEP 3

Multiply the tidal volume BY the number of breaths in a minute to find the minute volume. For instance, if a person's tidal volume is 50 mL and they breathe 15 times in a minute (50 x 15) their minute volume is 750 ml/min





Minute volume = Tidal Volume x Frequency

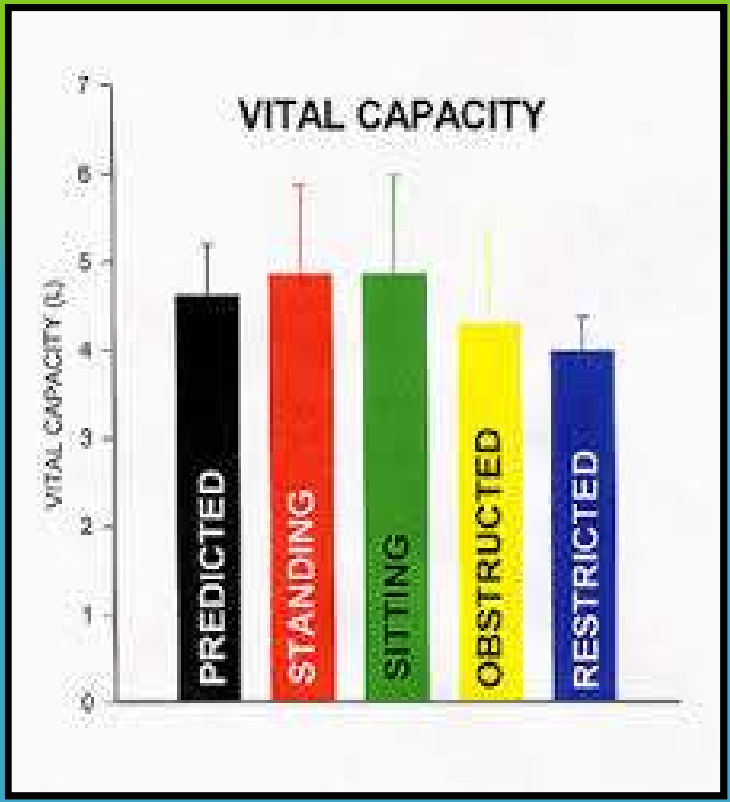
Minute ventilation ($\tilde{V}_E$)

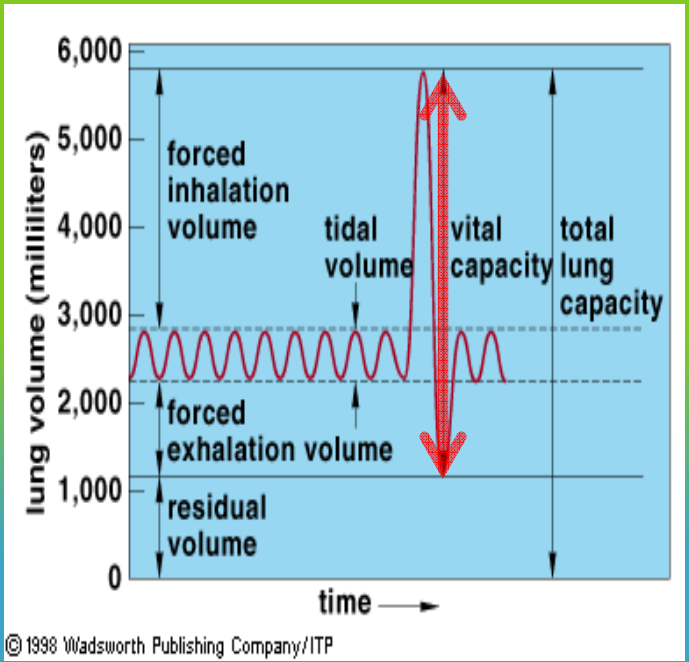
- In healthy person ($\tilde{V}_{Emax}$)
  - At rest: 5-10LPM
  - During exercise in untrained person ~ 100LPM
  - During exercise in trained person ~ 200LPM

25. VITAL CAPACITY

BECKS HALFORD

The maximum amount of air that can be forcibly exhaled after maximal inspiration (ml).





The increase in your vital capacity is a long term effect of exercise and enables us to uptake more oxygen which therefore increases our energy levels.

26. HYPERTROPHY

CHARLOTTE WITTS

Hypertrophy is the enlargement of a tissue or organ due to an increase in the size of its cells.

You can experience hypertrophy of muscle fibres.

This means the muscles get both bigger and stronger.

Doing anaerobic exercises like weight lifting can cause hypertrophy – this increases the size of fast twitch muscles.

You can also experience cardiac hypertrophy.

This means the size of the heart increases, reducing the risk of disease.
It also makes it stronger and healthier.

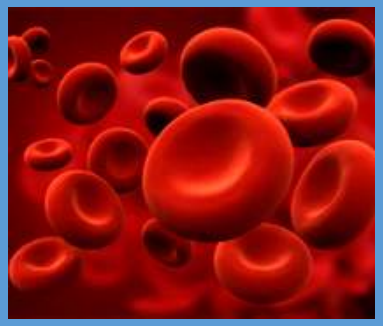
Doing regular exercise over a long period of time can cause cardiac hypertrophy as it is a long term effect of exercise.

27. HAEMOGLOBIN AND RED BLOOD CELLS

OLLIE HUMPHRIES

Red Blood Cells – Red Blood Cells are located in the blood, and their role is to transport oxygen around the body. This is vital when participating in sporting activity because when you exercise, your muscles require oxygen to work.

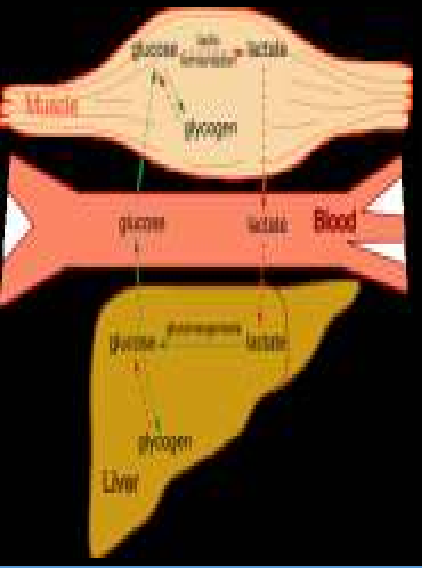
Features of a Red Blood Cell	Reason
Small Size	Lets red blood cells pass through narrow capillaries
Flattened disc shape	Provides a large surface area, allowing rapid diffusion of oxygen
Contains **Haemoglobin**	**Haemoglobin** absorbs oxygen in the lungs and releases oxygen in the rest of the body
Does not contain a nucleus	Increases amount of space inside the cell for haemoglobin

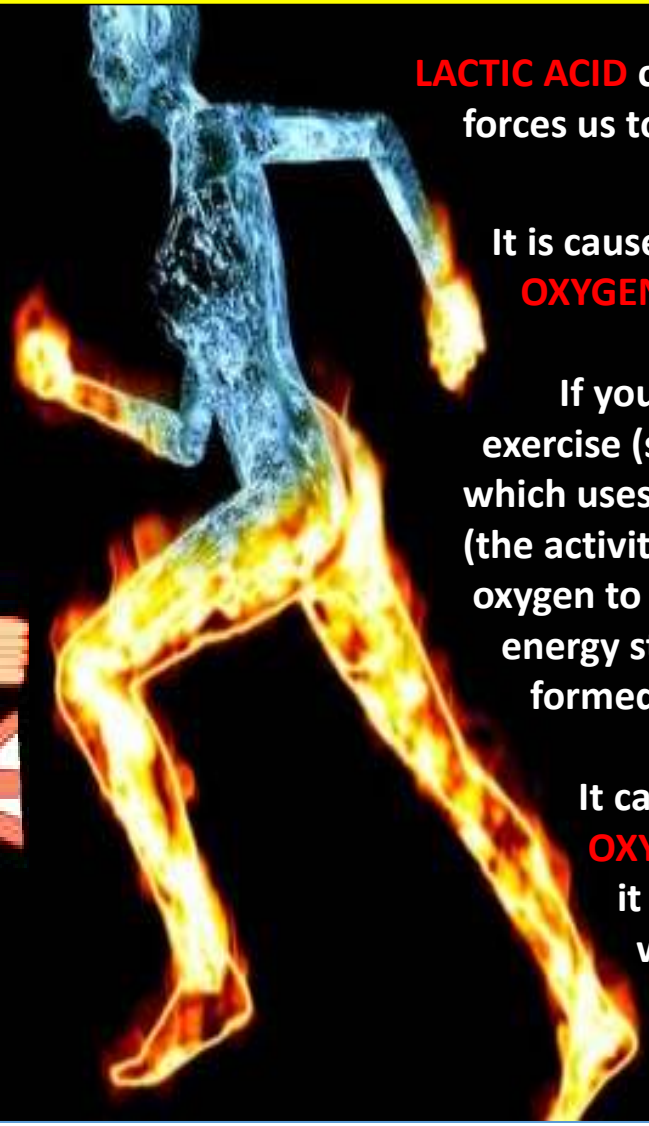


Haemoglobin - Haemoglobin molecules are containers inside red blood cells that are specially designed to carry oxygen. All red blood cells are packed full of thousands of haemoglobin containers which carry the oxygen (inhaled in the lungs) around the body to the working muscles for it to be converted into energy.

28. LACTIC ACID

JOSH WHITLOCK





LACTIC ACID causes muscle pain which forces us to stop or reduce activity

It is caused by an **ABSENCE OF OXYGEN** in the working muscles.

If you take part in **ANAEROBIC** exercise (sprinting or weight-lifting) which uses energy from other sources (the activity is too fast to process oxygen to create energy), when this energy store runs out, lactic acid is formed.

It can only be **REMOVED WITH OXYGEN** which helps to convert it into waste products which we remove easily

29. SHORT TERM EFFECTS OF EXERCISE ON THE RESPIRATORY SYSTEM

DECLAN MANNION

Breathing rate increases because muscles demand more oxygen

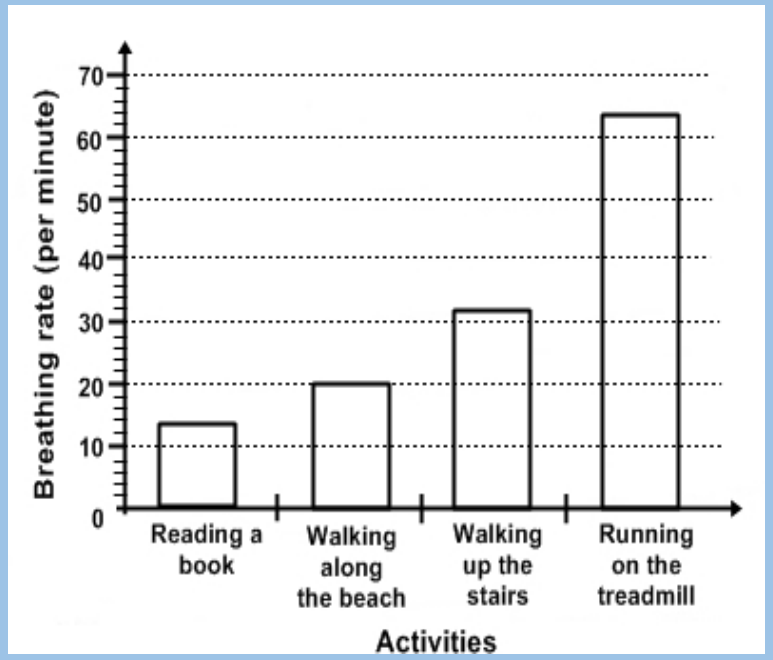
Minute volume increases. This is used to measure how much air is passed through the lungs each minute

Breathing process involves two different actions: Inspiration and Expiration

When you stop exercising your breathing rate will initially drop rapidly and then it will drop slowly to resting breathing rate

Increase in carbon dioxide levels

Tidal volume increases to allow more air to pass to the lungs



30. SHORT TERM EFFECTS OF EXERCISE ON THE CV SYSTEM

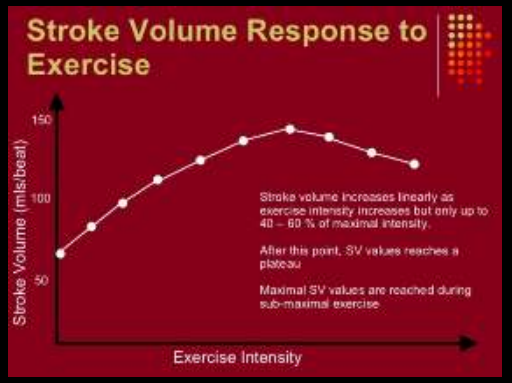
AARON M-BEGLEY

HEART RATE INCREASES

The number of times your heart beats in a minute increases.

The optimum training zone to improve cardio vascular endurance is 70-80% of your max heart rate.
(MAX HEART RATE=220-AGE)

STROKE VOLUME INCREASES



The amount of blood pumped by the left ventricle of the heart per beat/contraction increases.

For example , Usain Bolt's stroke volume will increase when he runs the 200m.

CARDIAC OUTPUT INCREASES

The amount of blood pumped by the heart each minute increases.

For example when a footballer plays a football match their cardiac output will increase.

VASCULAR SHUNT OCCURS

This is the redistribution of blood to areas of the body which have a higher demand for oxygen from areas with a lower demand.

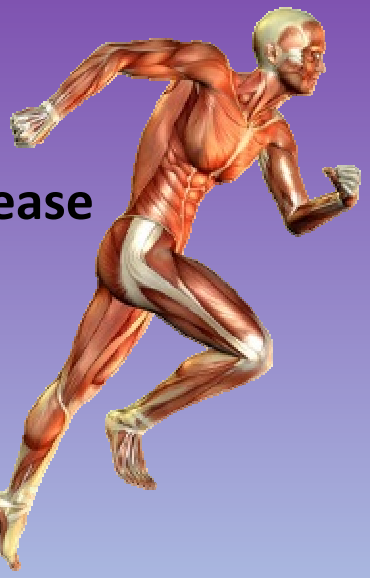
For example , when an athlete runs a 1500m race ,more blood is directed to the working muscle groups in their legs and away from some internal organs with a lower demand

31. SHORT TERM EFFECTS OF EXERCISE ON THE MUSCULAR SYSTEM

IMOGEN GREEN

The short term effects of exercise are :

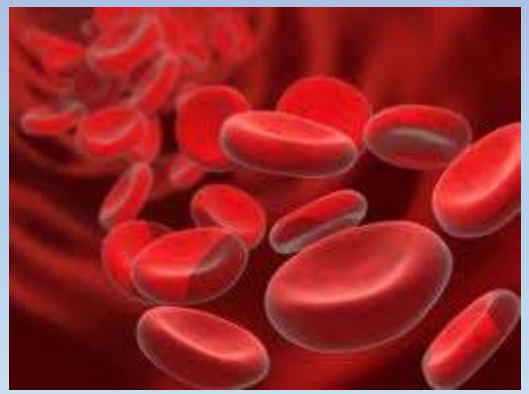
- **Muscles contract more often**
- **Blood flow to the muscles increase**
- **Muscle temperature rises**



When your muscles regularly contract they increase in temperature and become more flexible. This increase in flexibility enables performers to perform more complex movements (i.e. stretch) and will help reduce the likelihood of damage or injury to muscles.

Blood flow to the muscles increase because your muscles are working harder and therefore need more oxygen to carry out respiration.

This means that more blood needs to flow to these areas, so your heart has to beat more frequently and more powerfully.



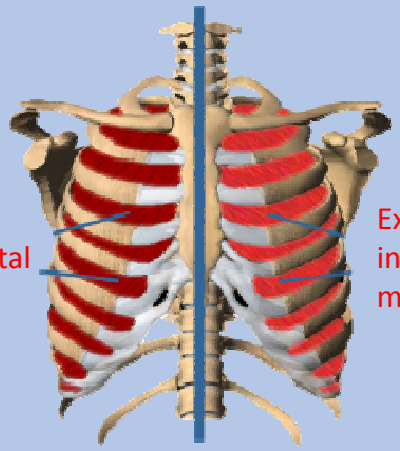
Your muscles contract more often because during exercise your muscles need to facilitate a greater number of movements that when at rest.
For example, running across a netball court as opposed to standing still.

32. LONG TERM EFFECTS OF EXERCISE ON THE RESPIRATORY SYSTEM

JEM SMITH

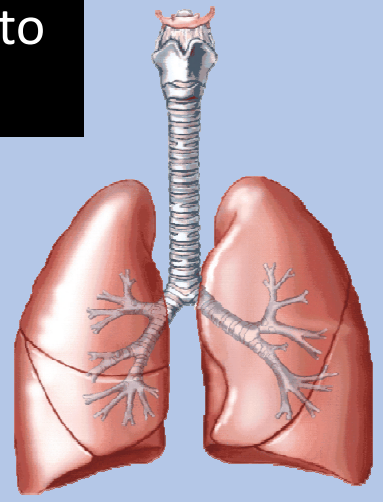
Increased strength of diaphragm and intercostal muscles

This allows for greater expansion of the thoracic (chest) capacity.



Increased ability of the lungs to extract oxygen from the air.

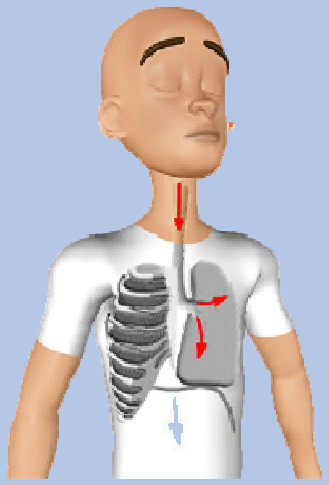
Exercising increases your heart's capacity to pump more blood into your lungs, enabling more oxygen to be distributed to your tissues.



Increased vital capacity

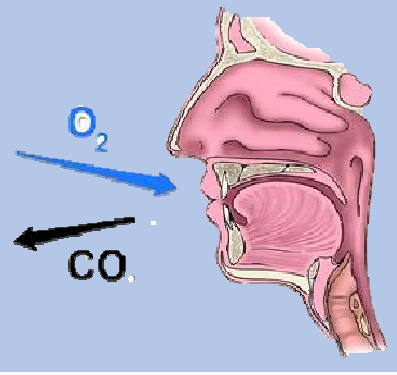
Maximum amount of air that can forcibly be exhaled after maximal inspiration.

This enables us to uptake more oxygen which will improve our energy levels



Increased amount of oxygen delivered to and carbon dioxide removed from the body

When your vital capacity increases, it allows you to remove more carbon dioxide. When exercising your Tidal Volume also increases and therefore allows more oxygen to be delivered to the working muscles.



33. LONG TERM EFFECTS OF EXERCISE ON THE CV SYSTEM

ABI TODD

Cardiac output increases. This is the amount of blood pumped by the heart each minute

An increase in blood volume and haemoglobin levels which help to carry oxygen. This means more oxygen is available thus meaning you can work harder for longer.

The size and strength of the heart increases, known to be hypertrophy

Increase in stroke volume while at rest and during exercise, therefore enabling you to uptake more oxygen and increase energy levels.

One can dream...

Reduced risk of heart related disease as there is a decrease in resting blood pressure

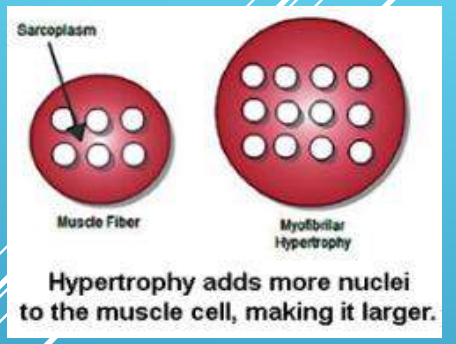
A lower resting heart rate and a quicker recovery rate

Practical example: Exercising on a long term basis allows us to train our cardiovascular system to be more efficient. This will help us to work harder for longer periods such as being able to run a marathon

34. LONG TERM EFFECTS OF EXERCISE ON THE MUSCULAR SYSTEM

SAM KEWLEY

- Increased numbers of mitochondria means an increase in the rate of energy production.
- The muscles, bones and ligaments become stronger to cope with the additional stresses and impact put through them.
- The amount of myoglobin within skeletal muscle increases, which allows more Oxygen to be stored within the muscle, and transported to the mitochondria.
- Muscles are capable of storing a larger amount of glycogen for energy.
- Your muscles will experience hypertrophy and become bigger and stronger.



35. SLOW TWITCH AND FAST TWITCH MUSCLE FIBRES

SAM GRIMWOOD

SLOW TWITCH FIBRES

Muscle fibres that can be used for a long period of time and rely on oxygen as their main energy source

Slow twitch fibres are best suited for endurance sports, including cycling, marathon running and long distance triathlons

The slow twitch fibres are more efficient at using oxygen to generate more fuel for long and extended muscle contractions over a long time. They work slower than fast twitch fibres and take longer to fatigue

FAST TWITCH FIBRES

Muscle fibres that contract quickly to provide strength and speed for a short period of time

Fast twitch fibres are best suited for short bursts of activity such as sprints, pole vaulting and cross fit-style events

Because fast twitch fibres use the anaerobic energy system to create fuel, they are much better at generating short bursts of strength or speed than slow twitch fibres. However, on the downside, they fatigue more quickly.
Having more fast twitch fibres can be an asset for a sprinter as they will need to quickly generate a lot of force in order to run faster.

36. VASCULAR SHUNT

LEON GRAHAM

A VASCULAR SHUNT occurs during exercise.
This is a process whereby oxygenated blood is directed away from inactive muscle groups or internal organs towards active muscles which require oxygen to work

Before walking

- Grandpa Smurf is going for a walk
- Walking is a form of exercise
- The main muscles he is using to walk are in his legs
- These muscles require more oxygen to work than inactive muscles
- A Vascular shunt will redirect blood flow to these areas of the body which need more oxygen

During and shortly after walking

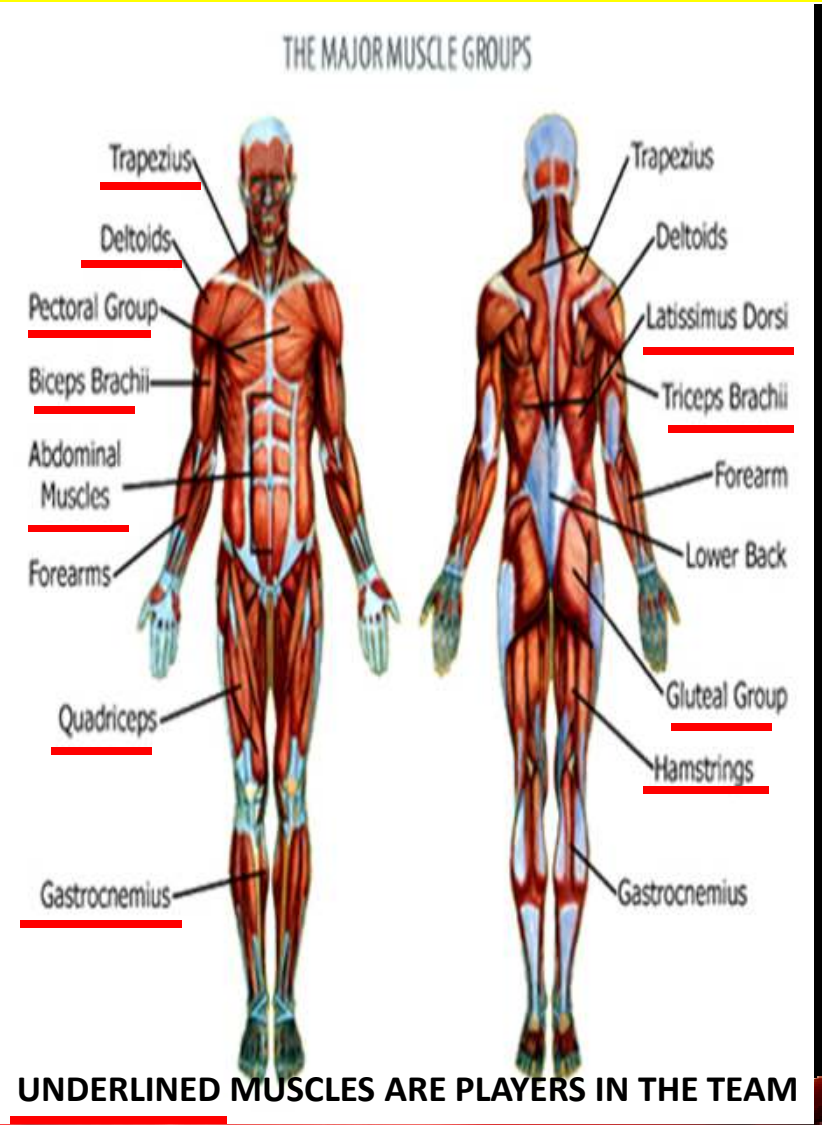
- **Areas where less blood is needed**
- **Areas where more blood is needed**

SPORTING EXAMPLE

When an athlete performs a bench press, blood flow will be **directed away** from inactive leg muscles and there will be **increased blood- flow** to the **working** upper body **muscles.**

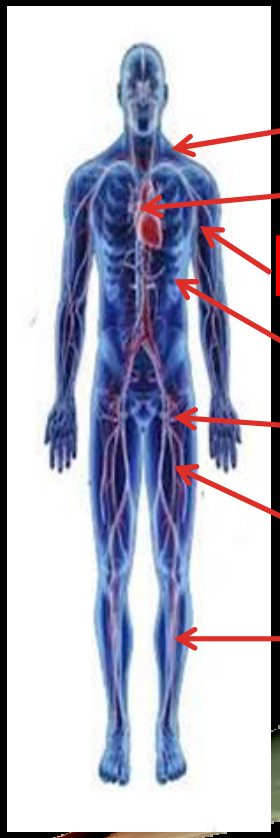
37. MAJOR MUSCLE GROUPS IN THE BODY

WILL DONALDSON



UNDERLINED MUSCLES ARE PLAYERS IN THE TEAM

The muscular system is responsible for the movement of the human body. Attached to the bones of the skeletal system are about 700 named muscles that make up roughly half of a person's body weight.



TREMMEL (Swansea)

PAULINHO (Spurs) **D**EMICHELIS (Man City)

BAINES (Everton) **T**OURE (Liverpool)

LALLANA (Liverpool) **A**RTETA (Arsenal)

GOUFFRAN (Newcastle)

QUINN (Hull) **H**AZARD (Chelsea)

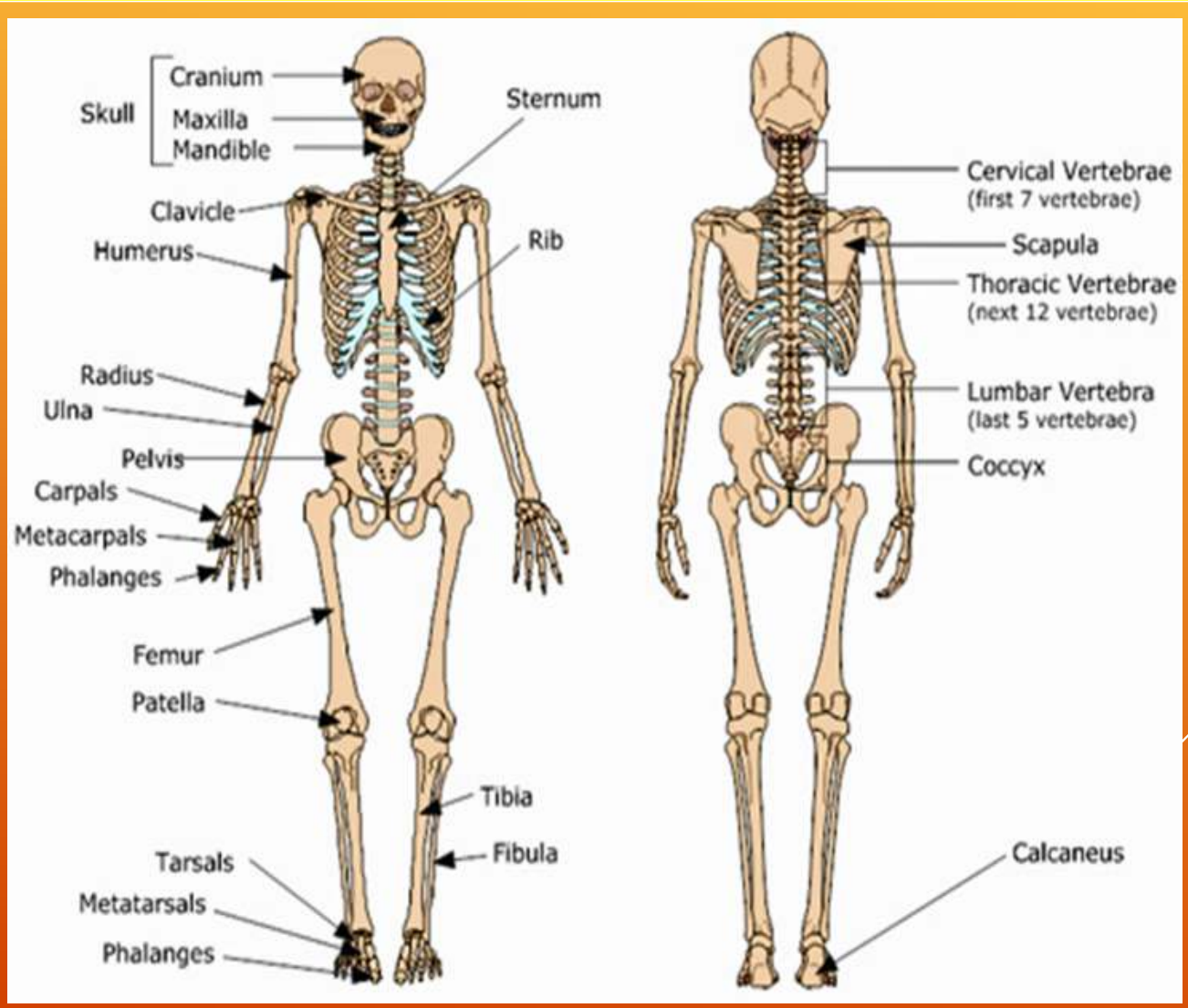
GIROUD (Arsenal)

HOW CAN YOU REMEMBER THE MUSCLES?

TRY MANAGING MUSCLE ROVERS!!

38. MAJOR BONES OF THE SKELETAL SYSTEM

RENATO ESPIRITO SANTO



BONES UNITED

39. HEALTH SCREENING

GEORGE BOWYER

Definition

Health Screenings are tests that look for diseases before you have symptoms. Screening tests can identify certain conditions earlier and therefore make them easier to treat.

Health screening is an essential part of the fitness testing and training process for both sport and general exercise

The following are typical health screening measurements:

- Body mass index (BMI)
- Blood pressure
- Cholesterol
- Glucose
- Resting heart rate
- Hydration
- Flexibility

Heart rate

When screening heart rate it is important to be familiar with the factors that effect it including:

- Stress
- Illness
- Time of day
- Caffeine
- Food
- Alcohol
- Altitude
- Temperature
- Cardiac drift