**ATAR HUMAN BIOLOGY**

**UNIT 1**

**Task 2 – Extended Response**

**Weighting 10%**

**Conditions**

Time for the task:

* Part 1: one week to research topic and complete notes. These are to be handed in **prior** to the in-class validation.
* Part 2: one hour for in-class validation – extended response exam style questions **without notes**.

## **Factors affecting the functioning of the human body research assignment**

**Part 1: Research notes (7% weighting)**

**Carry out research on the following diseases affect the functioning of the circulatory system and prepare a set of notes on the information. The notes should be no more than two sides of A4 and will be marked on content and organisation.**

**For Atherosclerotic Disease research and write notes on the following:**

* Explanation of how the person could have developed the disease.
* Description of the disease and its effects on the body.
* Symptoms a person may have if they have the disease.
* Explanation of how the main methods used to diagnose the disease are carried out. This should include observations, simple tests, two scans and two complex procedures.
* Explanation of the treatment methods available and their effects. Research should include medical treatments, surgical treatments and lifestyle treatments/changes.

**For heart arrhythmia research and write notes on the following:**

* Explanation of how the person could have developed the disease.
* Description of the disease and its effects on the body.
* Symptoms a person may have if they have the disease.
* Explanation of how the main methods used to diagnose the disease are carried out. This should include observations, simple tests, two scans and two complex procedures.
* Explanation of the treatment methods available and their effects. Research should include medical treatments, surgical treatments including implants and lifestyle treatments/changes.

**Part 2: In-class assessment (93% weighting)**

* You will be given specific examination style questions based on the topic you have researched.
* Notes will not be allowed for this task.

Atheriosclerotic disease

You usually won't have atherosclerosis symptoms until an artery is so narrowed or clogged that it can't supply adequate blood to your organs and tissues.

**Symptoms**

chest pain or pressure (angina), you may have signs and symptoms such as sudden numbness or weakness in your arms or legs, difficulty speaking or slurred speech, temporary loss of vision in one eye, or drooping muscles in your face. These signal a transient ischemic attack (TIA), which, if left untreated, may progress to a stroke. You may have symptoms of peripheral artery disease, such as leg pain when walking (claudication). You develop high blood pressure or kidney failure.

**Causes**

The damage may be caused by:

* High blood pressure
* High cholesterol
* High triglycerides, a type of fat (lipid) in your blood
* Smoking and other sources of tobacco
* Insulin resistance, obesity or diabetes
* Inflammation from diseases, such as arthritis, lupus or infections, or inflammation of unknown cause

Once the inner wall of an artery is damaged, blood cells and other substances often clump at the injury site and build up in the inner lining of the artery.

Over time, fatty deposits (plaque) made of cholesterol and other cellular products also build up at the injury site and harden, narrowing your arteries. The organs and tissues connected to the blocked arteries then don't receive enough blood to function properly.

Eventually, pieces of the fatty deposits may break off and enter your bloodstream.

In addition, the smooth lining of the plaque may rupture, spilling cholesterol and other substances into your bloodstream. This may cause a blood clot, which can block the blood flow to a specific part of your body, such as occurs when blocked blood flow to your heart causes a heart attack. A blood clot can also travel to other parts of your body, blocking flow to another organ.

**Diagnosis**

During a physical exam, your doctor may find signs of narrowed, enlarged or hardened arteries, including:

* A weak or absent pulse below the narrowed area of your artery
* Decreased blood pressure in an affected limb
* Whooshing sounds (bruits) over your arteries, heard using a stethoscope

Depending on the results of the physical exam, your doctor may suggest one or more diagnostic tests, including:

* **Blood tests.** Lab tests can detect increased levels of cholesterol and blood sugar that may increase the risk of atherosclerosis. You'll need to go without eating or drinking anything but water for nine to 12 hours before your blood test.
* **Doppler ultrasound.**  ultrasound device (Doppler ultrasound) to measure your blood pressure at various points along your arm or leg. These measurements can help your doctor gauge the degree of any blockages, as well as the speed of blood flow in your arteries.
* **Ankle-brachial index.** This test can tell if you have atherosclerosis in the arteries in your legs and feet.

Your doctor may compare the blood pressure in your ankle with the blood pressure in your arm. This is known as the ankle-brachial index. An abnormal difference may indicate peripheral vascular disease, which is usually caused by atherosclerosis.

* **Electrocardiogram (ECG).** An electrocardiogram records electrical signals as they travel through your heart. An ECG can often reveal evidence of a previous heart attack. If your signs and symptoms occur most often during exercise, your doctor may ask you to walk on a treadmill or ride a stationary bike during an ECG.
* **Stress test.** A stress test, also called an exercise stress test, is used to gather information about how well your heart works during physical activity.

Because exercise makes your heart pump harder and faster than it does during most daily activities, an exercise stress test can reveal problems within your heart that might not be noticeable otherwise.

An exercise stress test usually involves walking on a treadmill or riding a stationary bike while your heart rhythm, blood pressure and breathing are monitored.

In some types of stress tests, pictures will be taken of your heart, such as during a stress echocardiogram (ultrasound) or nuclear stress test. If you're unable to exercise, you may receive a medication that mimics the effect of exercise on your heart.

* **Cardiac catheterization and angiogram.** This test can show if your coronary arteries are narrowed or blocked.

A liquid dye is injected into the arteries of your heart through a long, thin tube (catheter) that's fed through an artery, usually in your leg, to the arteries in your heart. As the dye fills your arteries, the arteries become visible on X-ray, revealing areas of blockage.

* **Other imaging tests.** Your doctor may use ultrasound, a computerized tomography (CT) scan or magnetic resonance angiography (MRA) to study your arteries. These tests can often show hardening and narrowing of large arteries, as well as aneurysms and calcium deposits in the artery walls.

## **Treatment**

Lifestyle changes, such as eating a healthy diet and exercising, are often the most appropriate treatment for atherosclerosis. Sometimes, medication or surgical procedures may be recommended as well.

### Medications

Various drugs can slow — or even reverse — the effects of atherosclerosis. Here are some common choices:

* **Cholesterol medications.** Aggressively lowering your low-density lipoprotein (LDL) cholesterol, the "bad" cholesterol, can slow, stop or even reverse the buildup of fatty deposits in your arteries. Boosting your high-density lipoprotein (HDL) cholesterol, the "good" cholesterol, may help, too.

statins and fibrates, statins have additional effects that help stabilize the lining of your heart arteries and prevent atherosclerosis.

* **Anti-platelet medications.** Your doctor may prescribe anti-platelet medications, such as aspirin, to reduce the likelihood that platelets will clump in narrowed arteries, form a blood clot and cause further blockage.
* **Beta blocker medications.**  They lower your heart rate and blood pressure, reducing the demand on your heart and often relieve symptoms of chest pain. Beta blockers reduce the risk of heart attacks and some heart rhythm problems.
* **Angiotensin-converting enzyme (ACE) inhibitors.** These medications may help slow the progression of atherosclerosis by lowering blood pressure and producing other beneficial effects on the heart arteries. ACE inhibitors can also reduce the risk of recurrent heart attacks.
* **Calcium channel blockers.** These medications lower blood pressure and are sometimes used to treat angina.
* **Water pills (diuretics).** High blood pressure is a major risk factor for atherosclerosis. Diuretics lower blood pressure.

### Surgical procedures

* **Angioplasty and stent placement.** In this procedure, your doctor inserts a long, thin tube (catheter) into the blocked or narrowed part of your artery. A second catheter with a deflated balloon on its tip is then passed through the catheter to the narrowed area.

The balloon is then inflated, compressing the deposits against your artery walls. A mesh tube (stent) is usually left in the artery to help keep the artery open.

* **Endarterectomy.** In some cases, fatty deposits must be surgically removed from the walls of a narrowed artery. When the procedure is done on arteries in the neck (the carotid arteries), it's called a carotid endarterectomy.
* **Fibrinolytic therapy.** If you have an artery that's blocked by a blood clot, your doctor may use a clot-dissolving drug to break it apart.
* **Bypass surgery.** Your doctor may create a graft bypass using a vessel from another part of your body or a tube made of synthetic fabric. This allows blood to flow around the blocked or narrowed artery.

## **Lifestyle and home remedies**

Lifestyle changes can help you prevent or slow the progression of atherosclerosis.

* **Stop smoking.** Smoking damages your arteries. If you smoke or use tobacco in any form, quitting is the best way to halt the progression of atherosclerosis and reduce your risk of complications.
* **Exercise most days of the week.** Regular exercise can condition your muscles to use oxygen more efficiently.

Physical activity can also improve circulation and promote development of new blood vessels that form a natural bypass around obstructions (collateral vessels). Exercise helps lower blood pressure and reduces your risk of diabetes.

Aim to exercise at least 30 minutes most days of the week. If you can't fit it all into one session, try breaking it up into 10-minute intervals.

You can take the stairs instead of the elevator, walk around the block during your lunch hour, or do some situps or pushups while watching television.

* **Eat healthy foods.** A heart-healthy diet based on fruits, vegetables and whole grains — and low in refined carbohydrates, sugars, saturated fat and sodium — can help you control your weight, blood pressure, cholesterol and blood sugar.

Try substituting whole-grain bread in place of white bread; grabbing an apple, a banana or carrot sticks as a snack; and reading nutrition labels as a guide to controlling the amount of salt and fat you eat. Use monounsaturated fats, such as olive oil, and reduce or eliminate sugar and sugar substitutes.

* **Lose extra pounds and maintain a healthy weight.** If you're overweight, losing as few as 5 to 10 pounds (about 2.3 to 4.5 kilograms) can help reduce your risk of high blood pressure and high cholesterol, two of the major risk factors for developing atherosclerosis.

Losing weight helps reduce your risk of diabetes or control your condition if you already have diabetes.

* **Manage stress.** Reduce stress as much as possible. Practice healthy techniques for managing stress, such as muscle relaxation and deep breathing.

If you have high cholesterol, high blood pressure, diabetes or another chronic disease, work with your doctor to manage the condition and promote overall health.

## **Alternative medicine**

It's thought that some foods and herbal supplements can help reduce your high cholesterol level and high blood pressure, two major risk factors for developing atherosclerosis. With your doctor's OK, you might consider these supplements and products:

* Barley
* Black tea
* Calcium
* Cocoa
* Cod liver oil
* Fish oil
* Folic acid
* Garlic
* Green tea
* Vitamin C

You can also practice relaxation techniques, such as yoga or deep breathing, to help you relax and reduce your stress level. These practices can temporarily reduce your blood pressure, reducing your risk of developing atherosclerosis.

**What causes asthma?**

The exact causes of asthma are not known. The risk of getting asthma partly depends on genetics. Asthma can run in families.

Asthma can be allergic or non-allergic. Allergic asthma is more common in families with asthma and allergies.  
Children’s risk of getting asthma seems to be increased by mothers smoking while pregnant, people smoking around babies or young children, air pollution from traffic or industry, mouldy houses, and being born premature or with a low birth weight.  
Adults can develop asthma over  time  from indoor air pollution at work or home (for example, by breathing fumes that irritate the lungs, or breathing in dusts that they are allergic to).  
Athletes can develop asthma after very intensive training over several years, especially while breathing air that is polluted, cold or dry.

Symptoms of an attack  
**Airways tighten up.**Inside the wall of each airway there is a thin layer of muscle. When it contracts, it makes the airway narrower – reliever medicines work by relaxing these muscles in the airways.  
**Airways thicken up.**The lining of the tubes gets swollen and inflamed, leaving less space to breathe through – preventer medicines work by reducing the inflammation that causes the swelling  
**Airways fill up.**The inside of the tubes can get blocked by mucus  
– preventer medicines reduce mucus.

The most common symptoms of asthma are:

* wheezing – a high-pitched sound coming from the chest while breathing
* a feeling of not being able to get enough air or being short of breath
* a feeling of tightness in the chest
* coughing.

Severe asthma attacks can be life-threatening. Work with your doctor to determine what to do when your signs and symptoms worsen — and when you need emergency treatment. Signs of an asthma emergency include:

* Rapid worsening of shortness of breath or wheezing
* No improvement even after using a quick-relief inhaler, such as albuterol
* Shortness of breath when you are doing minimal physical activity

## **Diagnosis**

### Physical exam

To rule out other possible conditions — such as a respiratory infection or chronic obstructive pulmonary disease (COPD) — your doctor will do a physical exam and ask you questions about your signs and symptoms and about any other health problems.

### Tests to measure lung function

You may also be given lung (pulmonary) function tests to determine how much air moves in and out as you breathe. These tests may include:

* **Spirometry.** This test estimates the narrowing of your bronchial tubes by checking how much air you can exhale after a deep breath and how fast you can breathe out.
* **Peak flow.** A peak flow meter is a simple device that measures how hard you can breathe out. Lower than usual peak flow readings are a sign your lungs may not be working as well and that your asthma may be getting worse. Your doctor will give you instructions on how to track and deal with low peak flow readings.

Lung function tests often are done before and after taking a medication called a bronchodilator (brong-koh-DIE-lay-tur), such as albuterol, to open your airways. If your lung function improves with use of a bronchodilator, it's likely you have asthma.

### Additional tests

Other tests to diagnose asthma include:

* **Methacholine challenge.** Methacholine is a known asthma trigger that, when inhaled, will cause mild constriction of your airways. If you react to the methacholine, you likely have asthma. This test may be used even if your initial lung function test is normal.
* **Nitric oxide test.** This test, though not widely available, measures the amount of the gas, nitric oxide, that you have in your breath. When your airways are inflamed — a sign of asthma — you may have higher than normal nitric oxide levels.
* **Imaging tests.** A chest X-ray and high-resolution computerized tomography (CT) scan of your lungs and nose cavities (sinuses) can identify any structural abnormalities or diseases (such as infection) that can cause or aggravate breathing problems.
* **Allergy testing.** This can be performed by a skin test or blood test. Allergy tests can identify allergy to pets, dust, mold and pollen. If important allergy triggers are identified, this can lead to a recommendation for allergen immunotherapy.
* **Sputum eosinophils.** This test looks for certain white blood cells (eosinophils) in the mixture of saliva and mucus (sputum) you discharge during coughing. Eosinophils are present when symptoms develop and become visible when stained with a rose-colored dye (eosin).
* **Provocative testing for exercise and cold-induced asthma.** In these tests, your doctor measures your airway obstruction before and after you perform vigorous physical activity or take several breaths of cold air.

## **Treatment**

Prevention and long-term control are key in stopping asthma attacks before they start. Treatment usually involves learning to recognize your triggers, taking steps to avoid them and tracking your breathing to make sure your daily asthma medications are keeping symptoms under control. In case of an asthma flare-up, you may need to use a quick-relief inhaler, such as albuterol.

### Medications

The right medications for you depend on a number of things — your age, symptoms, asthma triggers and what works best to keep your asthma under control.

Preventive, long-term control medications reduce the inflammation in your airways that leads to symptoms. Quick-relief inhalers (bronchodilators) quickly open swollen airways that are limiting breathing. In some cases, allergy medications are necessary.

**Long-term asthma control medications,** generally taken daily, are the cornerstone of asthma treatment. These medications keep asthma under control on a day-to-day basis and make it less likely you'll have an asthma attack. Types of long-term control medications include:

* **Inhaled corticosteroids.** These anti-inflammatory drugs include fluticasone (Flonase, Flovent HFA), budesonide (Pulmicort Flexhaler, Rhinocort), flunisolide (Aerospan HFA), ciclesonide (Alvesco, Omnaris, Zetonna), beclomethasone (Qnasl, Qvar), mometasone (Asmanex) and fluticasone furoate (Arnuity Ellipta).

You may need to use these medications for several days to weeks before they reach their maximum benefit. Unlike oral corticosteroids, these corticosteroid medications have a relatively low risk of side effects and are generally safe for long-term use.

* **Leukotriene modifiers.** These oral medications — including montelukast (Singulair), zafirlukast (Accolate) and zileuton (Zyflo) — help relieve asthma symptoms for up to 24 hours.

In rare cases, these medications have been linked to psychological reactions, such as agitation, aggression, hallucinations, depression and suicidal thinking. Seek medical advice right away for any unusual reaction.

* **Long-acting beta agonists.** These inhaled medications, which include salmeterol (Serevent) and formoterol (Foradil, Perforomist), open the airways.

Some research shows that they may increase the risk of a severe asthma attack, so take them only in combination with an inhaled corticosteroid. And because these drugs can mask asthma deterioration, don't use them for an acute asthma attack.

* **Combination inhalers.** These medications — such as fluticasone-salmeterol (Advair Diskus), budesonide-formoterol (Symbicort) and formoterol-mometasone (Dulera) — contain a long-acting beta agonist along with a corticosteroid. Because these combination inhalers contain long-acting beta agonists, they may increase your risk of having a severe asthma attack.
* **Theophylline.** Theophylline (Theo-24, Elixophyllin, others) is a daily pill that helps keep the airways open (bronchodilator) by relaxing the muscles around the airways. It's not used as often now as in past years.

**Quick-relief (rescue) medications** are used as needed for rapid, short-term symptom relief during an asthma attack — or before exercise if your doctor recommends it. Types of quick-relief medications include:

* **Short-acting beta agonists.** These inhaled, quick-relief bronchodilators act within minutes to rapidly ease symptoms during an asthma attack. They include albuterol (ProAir HFA, Ventolin HFA, others) and levalbuterol (Xopenex).

Short-acting beta agonists can be taken using a portable, hand-held inhaler or a nebulizer — a machine that converts asthma medications to a fine mist — so that they can be inhaled through a face mask or a mouthpiece.

* **Ipratropium (Atrovent).** Like other bronchodilators, ipratropium acts quickly to immediately relax your airways, making it easier to breathe. Ipratropium is mostly used for emphysema and chronic bronchitis, but it's sometimes used to treat asthma attacks.
* **Oral and intravenous corticosteroids.** These medications — which include prednisone and methylprednisolone — relieve airway inflammation caused by severe asthma. They can cause serious side effects when used long term, so they're used only on a short-term basis to treat severe asthma symptoms.

If you have an asthma flare-up, a quick-relief inhaler can ease your symptoms right away. But if your long-term control medications are working properly, you shouldn't need to use your quick-relief inhaler very often.

Keep a record of how many puffs you use each week. If you need to use your quick-relief inhaler more often than your doctor recommends, see your doctor. You probably need to adjust your long-term control medication.

**Allergy medications** may help if your asthma is triggered or worsened by allergies. These include:

* **Allergy shots (immunotherapy).** Over time, allergy shots gradually reduce your immune system reaction to specific allergens. You generally receive shots once a week for a few months, then once a month for a period of three to five years.
* **Omalizumab (Xolair).** This medication, given as an injection every two to four weeks, is specifically for people who have allergies and severe asthma. It acts by altering the immune system.

### Bronchial thermoplasty

This treatment — which isn't widely available nor right for everyone — is used for severe asthma that doesn't improve with inhaled corticosteroids or other long-term asthma medications.

Generally, over the span of three outpatient visits, bronchial thermoplasty heats the insides of the airways in the lungs with an electrode, reducing the smooth muscle inside the airways. This limits the ability of the airways to tighten, making breathing easier and possibly reducing asthma attacks.

Inhaled medicine must be delivered to the lungs in an adequate dose. To ensure effective delivery a number of devices have been developed.

Metered dose inhalers

One of the standard inhaler devices is the pressurised metered dose inhaler (pMDI), commonly known as a ‘puffer’. Correct use of pMDIs requires co-ordination and good timing between activation (pressing down on the inhaler) and inhalation. There are also breath-activated pMDIs that can help overcome the problems with timing and co-ordination.

Most adults and children older than about 7 years can be taught to use pMDIs correctly but technique can deteriorate over time. You should check your technique with your pharmacist or doctor periodically.

pMDIs should be washed regularly. The metal canister should be removed and the plastic casing washed by rinsing the mouthpiece through the top and the bottom under warm running water for at least 30 seconds. Next, wash the mouthpiece cover. These should be allowed to dry in the air (NOT with a towel or tissue) before being put back together.

Most MDIs should be washed at least weekly; Intal and Tilade inhalers should be washed and air-dried every day to avoid blocking.

Spacers

Spacers are excellent devices to help improve delivery of inhaled medication to the lungs.

A spacer is a plastic device which acts as a holding chamber for medication for the few seconds that might elapse between activating your pMDI and breathing in the medicine. By putting one end of the spacer in your mouth and attaching your pMDI to the other end of the spacer, you can inhale your medication effectively without having to press the pMDI and breathe at exactly the same time.

Spacers are usually recommended for children of all ages. A spacer may be recommended for adults who:

* have poor co-ordination when using pMDIs;
* are taking inhaled corticosteroids by pMDI, as spacers can help to reduce adverse effects such as oral thrush; or
* need to administer reliever medication for acute asthma.

Because using a spacer improves the effectiveness of the medication, their use has meant very few people now need nebulisers.

Spacers should be washed monthly, otherwise performance can be adversely affected. They should be washed in warm water with kitchen detergent (do not rinse) and left to drain and air dry. Do not dry your spacer with a cloth or tissue as this produces static build-up that makes the medication stick to the sides. If this happens your lungs will not receive the full dose. The mouthpiece should be wiped clean of detergent.

Correct use of a spacer is important so you should check your technique with your doctor or pharmacist regularly.

Breath-activated dry-powder inhalers

These come in a variety of forms (e.g. Turbuhaler, Accuhaler, Aerolizer and Rotahaler) and they work by releasing the medication only when you breathe in.

These devices usually require less co-ordination than pMDIs, but they do require a certain level of inspiratory breath to activate them.

Nebulisers

A nebuliser is a machine that bubbles air (or, in an emergency, oxygen) through a solution of a medication (such as a reliever medication) to create a vapour that can be breathed in through a mouthpiece or a face mask. In general, nebulisers are used only for emergencies or for very severe asthma.

Choosing a device

Selection of the type of device is often a personal preference; some people prefer a pressurised MDI to a breath-activated device and vice versa. However, the individual device you use can depend on the medicine you're taking, as medication manufacturers often present their medicine in their own type of device. For example, if you're taking Bricanyl, Pulmicort or Oxis, and you prefer a breath-activated device, you will receive a Turbuhaler, but if you prefer a breath-activated device and you're taking Serevent or Flixotide you will receive an Accuhaler.

Heart Arrthy

## **Diagnosis**

To diagnose a heart arrhythmia, your doctor will review your symptoms and your medical history and conduct a physical examination. Your doctor may ask about — or test for — conditions that may trigger your arrhythmia, such as heart disease or a problem with your thyroid gland. Your doctor may also perform heart-monitoring tests specific to arrhythmias. These may include:

* **Electrocardiogram (ECG).** During an ECG, sensors (electrodes) that can detect the electrical activity of your heart are attached to your chest and sometimes to your limbs. An ECG measures the timing and duration of each electrical phase in your heartbeat.
* **Holter monitor.** This portable ECG device can be worn for a day or more to record your heart's activity as you go about your routine.
* **Event monitor.** For sporadic arrhythmias, you keep this portable ECG device available, attaching it to your body and pressing a button when you have symptoms. This lets your doctor check your heart rhythm at the time of your symptoms.
* **Echocardiogram.** In this noninvasive test, a hand-held device (transducer) placed on your chest uses sound waves to produce images of your heart's size, structure and motion.
* **Implantable loop recorder.** This device detects abnormal heart rhythms and is implanted under the skin in the chest area.

If your doctor doesn't find an arrhythmia during those tests, he or she may try to trigger your arrhythmia with other tests, which may include:

* **Stress test.** Some arrhythmias are triggered or worsened by exercise. During a stress test, you'll be asked to exercise on a treadmill or stationary bicycle while your heart activity is monitored. If doctors are evaluating you to determine if coronary artery disease may be causing the arrhythmia, and you have difficulty exercising, then your doctor may use a drug to stimulate your heart in a way that's similar to exercise.
* **Tilt table test.** Your doctor may recommend this test if you've had fainting spells. Your heart rate and blood pressure are monitored as you lie flat on a table. The table is then tilted as if you were standing up. Your doctor observes how your heart and the nervous system that controls it respond to the change in angle.
* **Electrophysiological testing and mapping.** In this test, doctors thread thin, flexible tubes (catheters) tipped with electrodes through your blood vessels to a variety of spots within your heart. Once in place, the electrodes can map the spread of electrical impulses through your heart.

In addition, your cardiologist can use the electrodes to stimulate your heart to beat at rates that may trigger — or halt — an arrhythmia. This allows your doctor to see the location of the arrhythmia and what may be causing it.

## **Treatment**

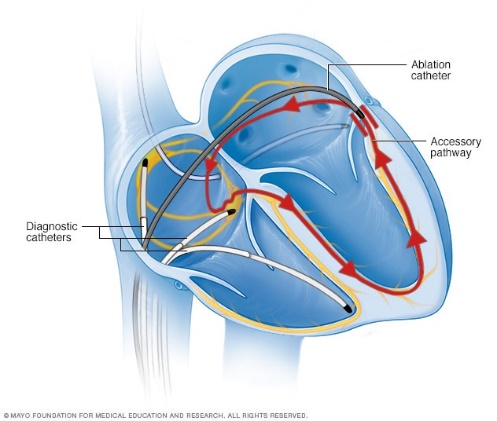
If you have an arrhythmia, treatment may or may not be necessary. Usually, it's required only if the arrhythmia is causing significant symptoms or if it's putting you at risk of a more serious arrhythmia or arrhythmia complication.

### Treating slow heartbeats

If slow heartbeats (bradycardias) don't have a cause that can be corrected, doctors often treat them with a pacemaker because there aren't any medications that can reliably speed up your heart.

A pacemaker is a small device that's usually implanted near your collarbone. One or more electrode-tipped wires run from the pacemaker through your blood vessels to your inner heart. If your heart rate is too slow or if it stops, the pacemaker sends out electrical impulses that stimulate your heart to beat at a steady rate.

### Treating fast heartbeats

* [](https://www.mayoclinic.org/-/media/kcms/gbs/patient-consumer/images/2013/08/26/11/08/my00706_ds00290_ds00291_ds00923_im04059_r7_cathablationthu_jpg.jpg)

### Cardiac catheter ablation

For fast heartbeats (tachycardias), treatments may include one or more of the following:

* **Vagal maneuvers.** You may be able to stop an arrhythmia that begins above the lower half of your heart (supraventricular tachycardia) by using particular maneuvers that include holding your breath and straining, dunking your face in ice water, or coughing.

These maneuvers affect the nervous system that controls your heartbeat (vagus nerves), often causing your heart rate to slow. However, vagal maneuvers don't work for all types of arrhythmias.

* **Medications.** For many types of tachycardia, you may be prescribed medication to control your heart rate or restore a normal heart rhythm. It's very important to take any anti-arrhythmic medication exactly as directed by your doctor in order to minimize complications.

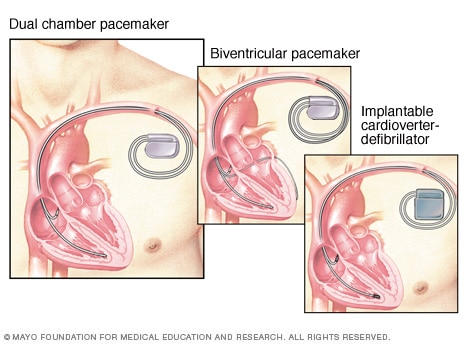
If you have atrial fibrillation, your doctor may prescribe blood-thinning medications to help keep dangerous blood clots from forming.

* **Cardioversion.** If you have a certain type of arrhythmia, such as atrial fibrillation, your doctor may use cardioversion, which can be conducted as a procedure or by using medications.

In the procedure, a shock is delivered to your heart through paddles or patches on your chest. The current affects the electrical impulses in your heart and can restore a normal rhythm.

* **Catheter ablation.** In this procedure, your doctor threads one or more catheters through your blood vessels to your heart. Electrodes at the catheter tips can use heat, extreme cold or radiofrequency energy to damage (ablate) a small spot of heart tissue and create an electrical block along the pathway that's causing your arrhythmia.

### Implantable devices

* [](https://www.mayoclinic.org/-/media/kcms/gbs/patient-consumer/images/2013/08/26/10/32/ds00290_im02119_r7_pacemakersdefibrillatorsthu_jpg.jpg)

### Pacemakers, defibrillator

Treatment for heart arrhythmias also may involve use of an implantable device:

* **Pacemaker.** A pacemaker is an implantable device that helps control abnormal heart rhythms. A small device is placed under the skin near the collarbone in a minor surgical procedure. An insulated wire extends from the device to the heart, where it's permanently anchored.

If a pacemaker detects a heart rate that's abnormal, it emits electrical impulses that stimulate your heart to beat at a normal rate.

* **Implantable cardioverter-defibrillator (ICD).** Your doctor may recommend this device if you're at high risk of developing a dangerously fast or irregular heartbeat in the lower half of your heart (ventricular tachycardia or ventricular fibrillation). If you have had sudden cardiac arrest or have certain heart conditions that increase your risk of sudden cardiac arrest, your doctor may also recommend an ICD.

An ICD is a battery-powered unit that's implanted under the skin near the collarbone — similar to a pacemaker. One or more electrode-tipped wires from the ICD run through veins to the heart. The ICD continuously monitors your heart rhythm.

If it detects an abnormal heart rhythm, it sends out low- or high-energy shocks to reset the heart to a normal rhythm. An ICD doesn't prevent an abnormal heart rhythm from occurring, but it treats it if it occurs.

### Surgical treatments

In some cases, surgery may be the recommended treatment for heart arrhythmias:

* **Maze procedure.** In the maze procedure, a surgeon makes a series of surgical incisions in the heart tissue in the upper half of your heart (atria) to create a pattern or maze of scar tissue. Because scar tissue doesn't conduct electricity, it interferes with stray electrical impulses that cause some types of arrhythmia.

The procedure is effective, but because it requires surgery, it's usually reserved for people who don't respond to other treatments or for those who are having heart surgery for other reasons.

* **Coronary bypass surgery.** If you have severe coronary artery disease in addition to arrhythmias, your doctor may perform coronary bypass surgery. This procedure may improve the blood flow to your heart.

Heart rhythm problems (heart arrhythmias) occur when the electrical impulses that coordinate your heartbeats don't work properly, causing your heart to beat too fast, too slow or irregularly.

Heart arrhythmias (uh-RITH-me-uhs) may feel like a fluttering or racing heart and may be harmless. However, some heart arrhythmias may cause bothersome — sometimes even life-threatening — signs and symptoms.

Heart arrhythmia treatment can often control or eliminate fast, slow or irregular heartbeats. In addition, because troublesome heart arrhythmias are often made worse — or are even caused — by a weak or damaged heart, you may be able to reduce your arrhythmia risk by adopting a heart-healthy lifestyle.

## **Symptoms**

Arrhythmias may not cause any signs or symptoms. In fact, your doctor might find you have an arrhythmia before you do, during a routine examination. Noticeable signs and symptoms don't necessarily mean you have a serious problem, however.

Noticeable arrhythmia symptoms may include:

* A fluttering in your chest
* A racing heartbeat (tachycardia)
* A slow heartbeat (bradycardia)
* Chest pain
* Shortness of breath
* Lightheadedness or dizziness
* Sweating
* Fainting (syncope) or near fainting

### When to see a doctor

Arrhythmias may cause you to feel premature or extra heartbeats, or you may feel that your heart is racing or beating too slowly. Other signs and symptoms may be related to your heart not pumping effectively due to the fast or slow heartbeat. These include shortness of breath, weakness, dizziness, lightheadedness, fainting or near fainting, and chest pain or discomfort.

Seek urgent medical care if you suddenly or frequently experience any of these signs and symptoms at a time when you wouldn't expect to feel them.

Ventricular fibrillation is one type of arrhythmia that can be deadly. It occurs when the heart beats with rapid, erratic electrical impulses. This causes pumping chambers in your heart (the ventricles) to quiver uselessly instead of pumping blood. Without an effective heartbeat, blood pressure plummets, cutting off blood supply to your vital organs.

A person with ventricular fibrillation will collapse within seconds and soon won't be breathing or have a pulse. If this occurs, follow these steps:

* Call 911 or the emergency number in your area.
* If there's no one nearby trained in cardiopulmonary resuscitation (CPR), provide hands-only CPR. That means uninterrupted chest compressions at a rate of 100 to 120 a minute until paramedics arrive. To do chest compressions, push hard and fast in the center of the chest. You don't need to do rescue breathing.
* If you or someone nearby knows CPR, begin providing it if it's needed. CPR can help maintain blood flow to the organs until an electrical shock (defibrillation) can be given.
* Find out if an automated external defibrillator (AED) is available nearby. These portable defibrillators, which can deliver an electric shock that may restart heartbeats, are available in an increasing number of places, such as in airplanes, police cars and shopping malls. They can even be purchased for your home.

No training is required. The AED will tell you what to do. It's programmed to allow a shock only when appropriate.

## **Causes**[Normal heartbeat](https://www.mayoclinic.org/-/media/kcms/gbs/patient-consumer/images/2013/08/26/10/42/hb7_heartelectricalthu_jpg.jpg)

### Normal heartbeat

Many things can lead to, or cause, an arrhythmia, including:

* A heart attack that's occurring right now
* Scarring of heart tissue from a prior heart attack
* Changes to your heart's structure, such as from cardiomyopathy
* Blocked arteries in your heart (coronary artery disease)
* High blood pressure
* Overactive thyroid gland (hyperthyroidism)
* Underactive thyroid gland (hypothyroidism)
* Smoking
* Drinking too much alcohol or caffeine
* Drug abuse
* Stress
* Certain medications and supplements, including over-the-counter cold and allergy drugs and nutritional supplements
* Diabetes
* Sleep apnea
* Genetics

### What's a normal heartbeat?

Your heart is made up of four chambers — two upper chambers (atria) and two lower chambers (ventricles). The rhythm of your heart is normally controlled by a natural pacemaker (the sinus node) located in the right atrium. The sinus node produces electrical impulses that normally start each heartbeat.

From the sinus node, electrical impulses travel across the atria, causing the atria muscles to contract and pump blood into the ventricles.

The electrical impulses then arrive at a cluster of cells called the atrioventricular node (AV node) — usually the only pathway for signals to travel from the atria to the ventricles.

The AV node slows down the electrical signal before sending it to the ventricles. This slight delay allows the ventricles to fill with blood. When electrical impulses reach the muscles of the ventricles, they contract, causing them to pump blood either to the lungs or to the rest of the body.

In a healthy heart, this process usually goes smoothly, resulting in a normal resting heart rate of 60 to 100 beats a minute.

### Types of arrhythmias

Doctors classify arrhythmias not only by where they originate (atria or ventricles) but also by the speed of heart rate they cause:

* **Tachycardia (tak-ih-KAHR-dee-uh).** This refers to a fast heartbeat — a resting heart rate greater than 100 beats a minute.
* **Bradycardia (brad-e-KAHR-dee-uh).** This refers to a slow heartbeat — a resting heart rate less than 60 beats a minute.

Not all tachycardias or bradycardias mean you have heart disease. For example, during exercise it's normal to develop a fast heartbeat as the heart speeds up to provide your tissues with more oxygen-rich blood. During sleep or times of deep relaxation, it's not unusual for the heartbeat to be slower.

### Tachycardias in the atria

Tachycardias originating in the atria include:

* **Atrial fibrillation.** Atrial fibrillation is a rapid heart rate caused by chaotic electrical impulses in the atria. These signals result in rapid, uncoordinated, weak contractions of the atria.

The chaotic electrical signals bombard the AV node, usually resulting in an irregular, rapid rhythm of the ventricles. Atrial fibrillation may be temporary, but some episodes won't end unless treated.

Atrial fibrillation may lead to serious complications such as stroke.

* **Atrial flutter.** Atrial flutter is similar to atrial fibrillation. The heartbeats in atrial flutter are more-organized and more-rhythmic electrical impulses than in atrial fibrillation. Atrial flutter may also lead to serious complications such as stroke.
* **Supraventricular tachycardia.** Supraventricular tachycardia is a broad term that includes many forms of arrhythmia originating above the ventricles (supraventricular) in the atria or AV node.
* **Wolff-Parkinson-White syndrome.** In Wolff-Parkinson-White syndrome, a type of supraventricular tachycardia, there is an extra electrical pathway between the atria and the ventricles, which is present at birth. However, you may not experience symptoms until you're an adult. This pathway may allow electrical signals to pass between the atria and the ventricles without passing through the AV node, leading to short circuits and rapid heartbeats.

### Tachycardias in the ventricles

Tachycardias occurring in the ventricles include:

* **Ventricular tachycardia.** Ventricular tachycardia is a rapid, regular heart rate that originates with abnormal electrical signals in the ventricles. The rapid heart rate doesn't allow the ventricles to fill and contract efficiently to pump enough blood to the body. Ventricular tachycardia can often be a medical emergency. Without prompt medical treatment, ventricular tachycardia may worsen into ventricular fibrillation.
* **Ventricular fibrillation.** Ventricular fibrillation occurs when rapid, chaotic electrical impulses cause the ventricles to quiver ineffectively instead of pumping necessary blood to the body. This serious problem is fatal if the heart isn't restored to a normal rhythm within minutes.

Most people who experience ventricular fibrillation have an underlying heart disease or have experienced serious trauma, such as being struck by lightning.

* **Long QT syndrome.** Long QT syndrome is a heart disorder that carries an increased risk of fast, chaotic heartbeats. The rapid heartbeats, caused by changes in the electrical system of your heart, may lead to fainting, and can be life-threatening. In some cases, your heart's rhythm may be so erratic that it can cause sudden death.

You can be born with a genetic mutation that puts you at risk of long QT syndrome. In addition, several medications may cause long QT syndrome. Some medical conditions, such as congenital heart defects, may also cause long QT syndrome.

### Bradycardia — A slow heartbeat

Although a heart rate below 60 beats a minute while at rest is considered bradycardia, a low resting heart rate doesn't always signal a problem. If you're physically fit, you may have an efficient heart capable of pumping an adequate supply of blood with fewer than 60 beats a minute at rest.

In addition, certain medications used to treat other conditions, such as high blood pressure, may lower your heart rate. However, if you have a slow heart rate and your heart isn't pumping enough blood, you may have one of several bradycardias, including:

* **Sick sinus syndrome.** If your sinus node, which is responsible for setting the pace of your heart, isn't sending impulses properly, your heart rate may be too slow (bradycardia), or it may speed up (tachycardia) and slow down intermittently. Sick sinus syndrome can also be caused by scarring near the sinus node that's slowing, disrupting or blocking the travel of impulses.
* **Conduction block.** A block of your heart's electrical pathways can occur in or near the AV node, which lies on the pathway between your atria and your ventricles. A block can also occur along other pathways to each ventricle.

Depending on the location and type of block, the impulses between the upper and lower halves of your heart may be slowed or blocked. If the signal is completely blocked, certain cells in the AV node or ventricles can make a steady, although usually slower, heartbeat.

Some blocks may cause no signs or symptoms, and others may cause skipped beats or bradycardia.

### Premature heartbeats

Although it often feels like a skipped heartbeat, a premature heartbeat is actually an extra beat. Even though you may feel an occasional premature beat, it seldom means you have a more serious problem. Still, a premature beat can trigger a longer lasting arrhythmia — especially in people with heart disease.

Premature heartbeats are commonly caused by stress, strenuous exercise or stimulants, such as caffeine or nicotine.