ID : 16111

HUMAN PHYSIOLOGY

QUESTION NO : 1

The immune response is how your body recognizes and defends itself against bacteria , virus and substances that appear foreign harmful . Immunology is one of the branch of biology which is the study of our protection from foreign macromolecules or invading organisms and our responses to them . These invaders include viruses , bacteria , protozoa or even larger parasites . In addition , we develop immune responses against our own protein (and other molecules ) in autoimmunity and against our own aberrant cells in tumor immunity . Organisms must find a means of defense against antigens otherwise bacteria , fungi ,and viruses would replicate out a means of defense can be categorized into first second and third lines of defense

# . Immunity to HIV

### ****IntroductioN****

* HIV is a retrovirus and made of double stranded RNA enclosed within a glycosylated capsid
* Target cells for HIV are any cell expressing both CD4 and CCR5 or CXCR4(chemokine receptors)
* HIV has evolved to use these receptors to infect the “central command” of the immune system and by so doing ultimately disables the immune response
* Infection is persistent and chronic and there is only one known case of someone being cured of HIV infection
* The prevalence of HIV (numbers of people infected) in sub-Sahara Africa vary from 6-30%, with southern Africa bearing the brunt of infections
* Household surveys in South Africa have shown that on average approximately 15% of people are infected, with women between the ages of 22-26 years with the highest prevalence
* Antenatal testing shows that around 29% of pregnant women are infected
* With the advent of antiretroviral treatment in the public sector, mother to child transmission of HIV has been reduced to between 1-5% of babies born to HIV infected mothers
* HIV prevalence in males appears to peak at a later age than females, at around 30-35 year olds
* Understanding immunity to HIV is important for devising potential vaccine strategies as well as appreciating immunopathogenesis

### ****Stages of HIV Infection****

* Routes of HIV infection are predominantly through mucosal surfaces: male and female genital tracts, rectal surfaces and gut surfaces (perinatal infection)
* Acquisition of HIV can also be directly through the bloodstream from injection drug users
* Whatever the route of infection, there has been a defined stage of infection based on laboratory diagnosis
* The tools for measuring HIV infection in a diagnostic laboratory can be found within Immunopaedia **here**
* shows testing for HIV infection.
* Fiebig staging is a 6-stage classification system that was formulated for staging early HIV infection based on the different times viral markers and host antibody responses emerge.
* The system was named after the paper’s first author
* After transmission of HIV to a new host:

(1), there is dissemination of the virus to lymphoid tissues

(2) a rapid increase in viraemia in the acute phase (measured as Fiebig stage I). The fall in peak viraemia is thought to be due to the initial immune control

(3) and viral load declines to a set point.

A decline in CD4+ T cells coincides with the increase in viral load.

HIV-specific [CD8](https://www.immunopaedia.org.za/glossary/cd8/)+ Cytotoxic [T cell](https://www.immunopaedia.org.za/glossary/t-cell/) responses are thought to reduce systemic viral load and an increase in CD4+ T cells is often observed.

HIV-specific binding antibodies appear after the reduction of viraemia, but antibodies are detectable by ELISA only later in acute infection (4, Fiebig stage III onwards).

During chronic infection, CD4+ T cells decline slowly and viral load remains relatively stable.

Neutralising antibodies begin to appear only after about 3-6 months and continued HIV replication

Immune evasion exhausts the immune system leading to opportunistic infection and AIDS.

Let’s look at each of these four stages in closer detail:

### 1) ****HIV Transmission.****

* Infection is a “rare” event.
* In 80% of cases, transmission is thought to be established by a single virus
* All microorganisms that penetrate the epithelial surfaces are met immediately by cells and molecules that can mount an innate immune response (Figure 3)
* Epidermal Langerhans’ cells are a subset of dendritic cells found in the squamous epithelium of the female vagina and male inner foreskin and are the first immune cells to contact HIV during heterosexual contact.
* They express surface CD207 (langerin) that captures virus by binding to gp120, which induces internalisation and degradation of virus particles.
* Activated Langerhans’ cells migrate to draining lymph nodes for antigen presentation to CD4+ and CD8+ T cells.
* In the process, CD4+ T cells can also become infected by virus bound to the [Langerhans cell](https://www.immunopaedia.org.za/glossary/langerhans-cell/) surface (trans-infection).
* Langerhans’ cells may also express CD4 and CCR5 and can become infected themselves.
* Activated Langerhans’ cells produce pro-inflammatory cytokines [IL-1](https://www.immunopaedia.org.za/glossary/il-1/), [IL-6](https://www.immunopaedia.org.za/glossary/il-6/) and [TNF-α](https://www.immunopaedia.org.za/glossary/tnf/) that can cause fever.
* Dilation and increased permeability of the blood vessels during inflammation leads to increased local blood flow

### 2) ****HIV Dissemination****

* Afferent lymphatic vessels drain fluid from the tissues and carry antigen bearing cells from infected tissues to the lymph nodes where they are trapped (Figure 4)
* Follicles expand as B lymphocytes proliferate to form germinal centres and the entire lymph node enlarges (lymphadenopathy)
* HIV infected CD4+ T cells, activated in genital draining lymph nodes, migrate to mucosal tissues such as the gut and skin.
* Dissemination of virus results in increased viral replication, mainly in lymph organs and leads to high viral loads in peripheral blood.
* There is also a rapid depletion of CD4+ T cells, particularly in the gut lymphoid tissues.
* Tissue macrophages express CD4 and CCR5 receptors and also become infected.
* [Dendritic cells](https://www.immunopaedia.org.za/glossary/dendritic-cells/) are CD4 negative but can capture HIV on surface CD209 (DC-SIGN) molecules and mediate trans-infection of CCR5-bearing CD4+ T cells

### 3) ****Control of Viraemia****

* The partial resolution of peak viral load observed during the acute stage of HIV infection is associated with robust T cell immunity (Figure 5).
* Tissue dendritic cells engulf virus detected in extracellular spaces and present viral peptides by both [HLA](https://www.immunopaedia.org.za/glossary/hla/) class I and II molecules in the lymph nodes to CD8+ and CD4+ T cells, respectively.
* Activated HIV-specific CD8+ cytotoxic T lymphocytes impart viral control by killing HIV infected cells and reducing viral replication.
* This response is not sufficient to eradicate the virus, but reduces viral load and allows CD4+ T helper [lymphocyte](https://www.immunopaedia.org.za/glossary/lymphocyte/) numbers to increase.
* The absolute CD4+ count does not however return to baseline levels but remains reduced.

### 4) ****Seroconversion****

* A multitude of immunological events have occured prior to seroconversion, many of them resulting in the clinical symptoms of acute retroviral syndrome.
* Antibodies to HIV (seroconversion) only begin to appear in peripheral blood 4-6 weeks after transmission, but in rare instances can take up to 3 months.
* In order for HIV-specific antibodies to be generated there must be sufficient presentation of HIV antigens to B lymphocytes (Figure 6)
* This is achieved by capture of viral particles and proteins on the surface of follicular dendritic cells located in the lymphoid follicles ([B cell](https://www.immunopaedia.org.za/glossary/b-cell/) zone) of the lymph node.
* In addition, HIV-specific CD4+ helper T cells are required to provide activation signals for B cells to differentiate into plasma cells.

QUESTION NO 2

Explain any medical condition of lymph nodes ?

The lymphatic system is a network of tiny vessels and small, bean-shaped organs called lymph nodes that carry lymph throughout the body. Lymph is a clear, colorless fluid that contains a few blood cells. It starts in many organs and tissues. The lymphatic system is part of your immune system. It helps protect and maintain the fluid balance of your body by filtering and draining lymph and waste products away from each body region. The lymphatic system also helps the body fight infection.

How Lymphedema Happens

During surgery for cancer, nearby lymph nodes are often removed. This disrupts the flow of lymph, which can lead to swelling. This is lymphedema. Lymphedema can affect one or both arm, the head and neck, the belly, the genitals, or the legs. Swelling can worsen and become severe. Skin sores or other problems can develop. Affected areas are also more likely to become infected.

Often during breast cancer treatment, some or all of the lymph nodes under the arm are treated with radiation. The lymph nodes under the arm are also called the axillary lymph nodes. They drain the lymphatic vessels from the upper arms, from most of the breast, and from the chest, neck, and underarm area.

When many lymph nodes under the arm have been removed, a woman is at higher risk of lymphedema for the rest of her life. Radiation treatments to the under arm lymph nodes can cause scarring and blockages that further increase the risk of lymphedema. Lymphedema may occur right after surgery or radiation, or months or even years later.

Types of Lymphedema

There are several types of lymphedema:

* A mild type of lymphedema can occur within a few days after surgery and usually lasts a short time.
* Lymphedema can also occur about 4 to 6 weeks after surgery or radiation and then go away over time.
* The most common type of lymphedema is painless and may slowly develop 18 to 24 months or more after surgery. It does not get better without treatment.

Lymphedema can happen any time after surgery or radiation to the lymph nodes. The risk continues for the rest of the person's life. Lymphedema can’t be cured, but it can be managed. Any swelling should be checked by a healthcare provider right away.

There's no way to know who will and won't get lymphedema, but there are things that can be done to help prevent it.

Can lymphedema be prevented?

Women treated for breast cancer who have good skin care and who exercise after treatment are less likely to develop lymphedema. Newer types of lymph node surgery have also helped decrease lymphedema risk. But there is no sure way to prevent lymphedema.

Symptoms of Lymphedema

The main symptom of lymphedema after breast cancer treatment is swelling of the arm on the side where lymph nodes have been removed. The amount of swelling may vary. Some people may have severe swelling (edema) with the affected arm being several inches larger than the other arm. Others will have a milder form of edema with the affected arm being slightly larger than the other arm.

Other symptoms of lymphedema may include:

* Feeling of fullness, heaviness, or tightness in the arm, chest, or armpit area
* Bra, clothing, or jewelry don't fit as normal
* Aching or new pain in the arm
* Trouble bending or moving a joint, such as the fingers, wrist, elbow, or shoulder
* Swelling in the hand
* Thickening of or changes in the skin
* Weakness in the arm

If you notice any of these symptoms, see your healthcare provider right away. Treatment needs to be started right away to keep lymphedema from getting worse.

How is lymphedema diagnosed?

There are no tests for lymphedema. Instead, your healthcare provider will ask about your medical history and give you a physical exam. You’ll be asked about:

* Past surgeries you’ve had
* Any problems after your surgeries
* When the swelling started
* If you’ve had severe swelling (edema) in the past
* What medicines you’re taking
* What other health conditions you have, such as high blood pressure, heart disease, or diabetes

Imaging tests, measures of volume, blood tests, and other tests may be used to diagnose lymphedema.

Treatment for Lymphedema

Treatment depends on how severe the problem is. Treatment includes ways to help prevent and manage the condition, and may include:

* Exercise. Exercise helps improve lymph drainage. Specific exercises will be advised by your doctor or physical therapist.
* Bandages. Wearing a compression sleeve or elastic bandage may help to move fluid, and prevent the buildup of fluid.
* Diet and weight management. Eating a healthy diet and controlling body weight is an important part of treatment.
* Keeping the arm raised. Raising the arm above the level of the heart when possible lets gravity help drain the fluid.
* Preventing infection. It’s important to protect the skin in the affected area from drying, cracking, infection and skin breakdown. Your healthcare provider will advise you about how to care for your skin and nails to help prevent problems.
* Massage therapy. Massage by someone trained in lymphedema treatment can help move fluid out of the swollen area

QUESTION NO :3

# Electrocardiogram (ECG)

**An electrocardiogram (ECG) is a simple test that can be used to check your heart's rhythm and electrical activity.**

Sensors attached to the skin are used to detect the electrical signals produced by your heart each time it beats.

These signals are recorded by a machine and are looked at by a doctor to see if they're unusual.

An ECG may be requested by a heart specialist (cardiologist) or any doctor who thinks you might have a problem with your heart, including your GP.

The test can be carried out by a specially trained healthcare professional at a hospital, a clinic or at your GP surgery.

Despite having a similar name, an ECG isn't the same as an echocardiogram, which is a scan of the heart.

## When an ECG is used

An ECG is often used alongside other tests to help diagnose and monitor conditions affecting the heart.

It can be used to investigate symptoms of a possible heart problem, such as chest pain palpitations (suddenly noticeable heartbeats), dizziness and shortness of breath

An ECG can help detect:

* **Arrhythmia**  where the heart beats too slowly, too quickly, or irregularly
* **coronary heart disease** – where the heart's blood supply is blocked or interrupted by a build-up of fatty substances
* [**heart attacks**](https://www.nhs.uk/conditions/heart-attack/) – where the supply of blood to the heart is suddenly blocked
* [**cardiomyopathy**](https://www.nhs.uk/conditions/cardiomyopathy/) – where the heart walls become thickened or enlarged

A series of ECGs can also be taken over time to monitor a person already diagnosed with a heart condition or taking medication known to potentially affect the heart.

## How an ECG is carried out

There are several different ways an ECG can be carried out. Generally, the test involves attaching a number of small, sticky sensors called electrodes to your arms, legs and chest. These are connected by wires to an ECG recording machine.

You don't need to do anything special to prepare for the test. You can eat and drink as normal beforehand.

Before the electrodes are attached, you'll usually need to remove your upper clothing, and your chest may need to be shaved or cleaned. Once the electrodes are in place, you may be offered a hospital gown to cover yourself.

The test itself usually only lasts a few minutes, and you should be able to go home soon afterwards or return to the ward if you're already staying in hospital.

**Types of ECG**

There are 3 main types of ECG:

* **a resting ECG** – carried out while you're lying down in a comfortable position
* **a stress or exercise ECG** – carried out while you're using an exercise bike or treadmill
* **an ambulatory ECG** – the electrodes are connected to a small portable machine worn at your waist so your heart can be monitored at home for 1 or more days

The type of ECG you have will depend on your symptoms and the heart problem suspected.

For example, an exercise ECG may be recommended if your symptoms are triggered by physical activity, whereas an ambulatory ECG may be more suitable if your symptoms are unpredictable and occur in random, short episodes.

Our doctors use several types of electrocardiograms (EKG) to check for a variety of cardiac (heart) or pulmonary (lung) conditions. The types of EKG we use at Stanford include:

Cardiopulmonary exercise test (CPET): A cardiopulmonary exercise test (CPET) is an evaluation of the cardiopulmonary system. This test is used to detect any cardiac or pulmonary diseases. Learn more about a cardiopulmonary exercise test.

Exercise EKG (stress test): A stress test (also called treadmill test or exercise EKG) is given while a patient walks on a treadmill or pedals a stationary bicycle to monitor the heart during stress ir exercise. Breathing and blood pressure rates are also monitored. A stress test may be used to detect  artery disease and/or to determine safe levels of exercise following a heart attack or heart surgery

Holter monitor: The Holter monitor is a type of electrocardiogram (ECG or EKG) used to monitor the ECG tracing continuously for a period of 24 hours or longer. Electrodes (small, plastic patches) are placed at certain locations on the chest, arms, and legs. When the electrodes are connected to an ECG machine by lead wires, the electrical activity of the heart is measured, interpreted, and printed out for the physician's information and further interpretation. Learn more about a holter monitor.

Resting 12-lead EKG: This type of electrocardiogram is the standard test for measuring your heart’s electrical function. Performed while you are lying still, this EKG records your heart’s electrical activity from 12 electrodes (sticky patches) on your chest, arms, and legs at the same time. A resting 12-lead EKG can be part of a routine checkup to screen for heart conditions before any signs or symptoms develop.

Signal-averaged electrocardiogram: A signal-averaged electrocardiogram is a more detailed type of electrocardiogram (ECG or EKG). During this procedure, multiple ECG tracings are obtained over a period of approximately 20 minutes in order to capture abnormal heartbeats which may occur only intermittently. Learn more about a signal-averaged electrocardiogram



QUESTION :NO 4

Give different medical ways of management of kidney stones.

Diagnosis

If your doctor suspects that you have a kidney stone, you may have diagnostic tests and procedures, such as:

* **Blood testing.** Blood tests may reveal too much calcium or uric acid in your blood. Blood test results help monitor the health of your kidneys and may lead your doctor to check for other medical conditions.
* **Urine testing.** The 24-hour urine collection test may show that you're excreting too many stone-forming minerals or too few stone-preventing substances. For this test, your doctor may request that you perform two urine collections over two consecutive days.
* **Imaging.** Imaging tests may show kidney stones in your urinary tract. High-speed or dual energy computerized tomography (CT) may reveal even tiny stones. Simple abdominal X-rays are used less frequently because this kind of imaging test can miss small kidney stones.

Ultrasound, a noninvasive test that is quick and easy to perform, is another imaging option to diagnose kidney stones.

* **Analysis of passed stones.** You may be asked to urinate through a strainer to catch stones that you pass. Lab analysis will reveal the makeup of your kidney stones. Your doctor uses this information to determine what's causing your kidney stones and to form a plan to prevent more kidney stones

Treatment for kidney stones varies, depending on the type of stone and the cause.

### Small stones with minimal symptoms

Most small kidney stones won't require invasive treatment. You may be able to pass a small stone by:

* **Drinking water.** Drinking as much as 2 to 3 quarts (1.8 to 3.6 liters) a day will keep your urine dilute and may prevent stones from forming. Unless your doctor tells you otherwise, drink enough fluid — ideally mostly water — to produce clear or nearly clear urine.
* **Pain relievers.** Passing a small stone can cause some discomfort. To relieve mild pain, your doctor may recommend pain relievers such as ibuprofen (Advil, Motrin IB, others) or naproxen sodium (Aleve).
* **Medical therapy.** Your doctor may give you a medication to help pass your kidney stone. This type of medication, known as an alpha blocker, relaxes the muscles in your ureter, helping you pass the kidney stone more quickly and with less pain. Examples of alpha blockers include tamsulosin (Flomax) and the drug combination dutasteride and tamsulosin (Jalyn).

### Large stones and those that cause symptoms

**Parathyroid glandsOpen pop-up dialog box**

Kidney stones that are too large to pass on their own or cause bleeding, kidney damage or ongoing urinary tract infections may require more-extensive treatment. Procedures may include:

* **Using sound waves to break up stones.** For certain kidney stones — depending on size and location — your doctor may recommend a procedure called extracorporeal shock wave lithotripsy (ESWL).

ESWL uses sound waves to create strong vibrations (shock waves) that break the stones into tiny pieces that can be passed in your urine. The procedure lasts about 45 to 60 minutes and can cause moderate pain, so you may be under sedation or light anesthesia to make you comfortable.

ESWL can cause blood in the urine, bruising on the back or abdomen, bleeding around the kidney and other adjacent organs, and discomfort as the stone fragments pass through the urinary tract.

* **Surgery to remove very large stones in the kidney.** A procedure called percutaneous nephrolithotomy (nef-row-lih-THOT-uh-me) involves surgically removing a kidney stone using small telescopes and instruments inserted through a small incision in your back.

You will receive general anesthesia during the surgery and be in the hospital for one to two days while you recover. Your doctor may recommend this surgery if ESWL is unsuccessful.

* **Using a scope to remove stones.** To remove a smaller stone in your ureter or kidney, your doctor may pass a thin lighted tube (ureteroscope) equipped with a camera through your urethra and bladder to your ureter.

Once the stone is located, special tools can snare the stone or break it into pieces that will pass in your urine. Your doctor may then place a small tube (stent) in the ureter to relieve swelling and promote healing. You may need general or local anesthesia during this procedure.

* **Parathyroid gland surgery.** Some calcium phosphate stones are caused by overactive parathyroid glands, which are located on the four corners of your thyroid gland, just below your Adam's apple. When these glands produce too much parathyroid hormone (hyperparathyroidism), your calcium levels can become too high and kidney stones may form as a result.

Hyperparathyroidism sometimes occurs when a small, benign tumor forms in one of your parathyroid glands or you develop another condition that leads these glands to produce more parathyroid hormone. Removing the growth from the gland stops the formation of kidney stones. Or your doctor may recommend treatment of the condition that's causing your parathyroid gland to overproduce the hormone.

### Prevention

Prevention of kidney stones may include a combination of lifestyle changes and medications.

### Lifestyle changes

You may reduce your risk of kidney stones if you:

* **Drink water throughout the day.** For people with a history of kidney stones, doctors usually recommend drinking enough fluids to pass about 2.1 quarts (2 liters) of urine a day. Your doctor may ask that you measure your urine output to make sure that you're drinking enough water.

If you live in a hot, dry climate or you exercise frequently, you may need to drink even more water to produce enough urine. If your urine is light and clear, you're likely drinking enough water.

* **Eat fewer oxalate-rich foods.** If you tend to form calcium oxalate stones, your doctor may recommend restricting foods rich in oxalates. These include rhubarb, beets, okra, spinach, Swiss chard, sweet potatoes, nuts, tea, chocolate, black pepper and soy products.
* **Choose a diet low in salt and animal protein.** Reduce the amount of salt you eat and choose nonanimal protein sources, such as legumes. Consider using a salt substitute, such as Mrs. Dash.
* **Continue eating calcium-rich foods, but use caution with calcium supplements.** Calcium in food doesn't have an effect on your risk of kidney stones. Continue eating calcium-rich foods unless your doctor advises otherwise.

Ask your doctor before taking calcium supplements, as these have been linked to increased risk of kidney stones. You may reduce the risk by taking supplements with meals. Diets low in calcium can increase kidney stone formation in some people.

Ask your doctor for a referral to a dietitian who can help you develop an eating plan that reduces your risk of kidney stones.

### Small stones with minimal symptoms

Most small kidney stones won't require invasive treatment. You may be able to pass a small stone by:

* **Drinking water.** Drinking as much as 2 to 3 quarts (1.8 to 3.6 liters) a day will keep your urine dilute and may prevent stones from forming. Unless your doctor tells you otherwise, drink enough fluid — ideally mostly water — to produce clear or nearly clear urine.
* **Pain relievers.** Passing a small stone can cause some discomfort. To relieve mild pain, your doctor may recommend pain relievers such as ibuprofen (Advil, Motrin IB, others) or naproxen sodium (Aleve).
* **Medical therapy.** Your doctor may give you a medication to help pass your kidney stone. This type of medication, known as an alpha blocker, relaxes the muscles in your ureter, helping you pass the kidney stone more quickly and with less pain. Examples of alpha blockers include tamsulosin (Flomax) and the drug combination dutasteride and tamsulosin (Jalyn).

### Large stones and those that cause symptoms

**Parathyroid glandsOpen pop-up dialog box**

Kidney stones that are too large to pass on their own or cause bleeding, kidney damage or ongoing urinary tract infections may require more-extensive treatment. Procedures may include:

* **Using sound waves to break up stones.** For certain kidney stones — depending on size and location — your doctor may recommend a procedure called extracorporeal shock wave lithotripsy (ESWL).

ESWL uses sound waves to create strong vibrations (shock waves) that break the stones into tiny pieces that can be passed in your urine. The procedure lasts about 45 to 60 minutes and can cause moderate pain, so you may be under sedation or light anesthesia to make you comfortable.

ESWL can cause blood in the urine, bruising on the back or abdomen, bleeding around the kidney and other adjacent organs, and discomfort as the stone fragments pass through the urinary tract.

* **Surgery to remove very large stones in the kidney.** A procedure called percutaneous nephrolithotomy involves surgically removing a kidney stone using small telescopes and instruments inserted through a small incision in your back.

You will receive general anesthesia during the surgery and be in the hospital for one to two days while you recover. Your doctor may recommend this surgery if ESWL is unsuccessful.

* **Using a scope to remove stones.** To remove a smaller stone in your ureter or kidney, your doctor may pass a thin lighted tube (ureteroscope) equipped with a camera through your urethra and bladder to your ureter.

Once the stone is located, special tools can snare the stone or break it into pieces that will pass in your urine. Your doctor may then place a small tube (stent) in the ureter to relieve swelling and promote healing. You may need general or local anesthesia during this procedure.

* **Parathyroid gland surgery.** Some calcium phosphate stones are caused by overactive parathyroid glands, which are located on the four corners of your thyroid gland, just below your Adam's apple. When these glands produce too much parathyroid hormone (hyperparathyroidism), your calcium levels can become too high and kidney stones may form as a result.

Hyperparathyroidism sometimes occurs when a small, benign tumor forms in one of your parathyroid glands or you develop another condition that leads these glands to produce more parathyroid hormone. Removing the growth from the gland stops the formation of kidney stones. Or your doctor may recommend treatment of the condition that's causing your parathyroid gland to overproduce the hormone.

* **stones.** Along with suggesting a diet lower in salt and protein, your doctor may recommend that you drink more fluids so that you produce a lot more urine,. If that alone doesn't help, your doctor may also prescribe a medication that increases the solubility of cystine in your urine.