ecturer Name: - Zara Tehsin | Subject Name: - Biology

hapter No: -1- Respiration | Class: - 2 year

**hort question answers**

**.. What are risk factors and causes of TB?**

**isk factors:** Anyone can get tuberculosis, but certain factors can increase risk of this disease. These factors include:

- Weakened immune system
- Poverty and substance abuse
- Living conditions

1. **Weakened immune system:** A healthy immune system often successfully fights TB bacteria, but body have effective defense if its resistance is low. Several diseases and medications can weaken your immune system, including:

- HIV/AIDS
- Malnutrition etc.

2. **Poverty and substance abuse:** it includes several factors. Some of them are as below

- **Lack of medical care.** Living in a remote area, lack access to the medical
- **Substance abuse.** Use of alcohol weakens the immune system and makes body more sensitive to tuberculosis.
- **Tobacco use.** Using tobacco greatly increases the risk of getting TB.

3. **Living conditions**: Poor nutrition and living in crowded, unsanitary conditions are main causes and are high risk of tuberculosis infection.

**auses:** Tuberculosis is caused by bacteria that spread from person to person through microscopic droplets released into the air. his can happen when someone with the untreated, active form of tuberculosis coughs, speaks, sneezes, spits, laughs or sings. lthough tuberculosis is contagious/ transmissible, it's not easy to catch.

**. What are the sign and symptoms of otitis media?**

**ymptoms**: The onset of signs and symptoms of ear infection is usually rapid. There are different sign and symptoms in childs and dults.

**hildren**: Signs and symptoms common in children include:

- Ear pain, especially when lying down
- Tugging or pulling at an ear
- Difficulty in sleeping
- Irritability
- Difficulty hearing or responding to sounds
- Loss of balance

- Fever of 100 F (38 C) or higher
- Drainage of fluid from the ear
- Headache
- Loss of appetite

**Adults:** Common signs and symptoms in adults include:

- Ear pain
- Drainage of fluid from the ear
- Diminished hearing

3. **Difference between Hemoglobin vs Myoglobin**

| Haemoglobin | Myoglobin |
|---|---|
| • Haemoglobin transports oxygen in blood | • Myoglobin transports or stores oxygen in muscles. |
| • Haemoglobin consists of several polypeptide chains. | • Myoglobin consists of a single polypeptide chain |
| • Haemoglobin concentration in red blood cell is very high. | • While myoglobin has low concentration. |
| • Haemoglobin initially binds oxygen difficulty. | • At the beginning, myoglobin binds oxygen molecules very easily and lately become saturated. This binding process is very rapid in myoglobin than in haemoglobin. |
| • Haemoglobin is a tetrameric protein because haemoglobin can bind four oxygen molecules, so called tetramer | • Myoglobin is a monomeric protein because Myoglobin can bind one oxygen molecule so called monomer |
| • Haemoglobin can bind and relieve of both oxygen and carbon dioxide | • While the myoglobin Do not. |

4. **What are multiple factors effecting oxygen carrying capacity of blood?**

There are multiple factors effecting oxygen carrying capacity of blood. These include:

- Iron levels,
- The number of red blood cells (the less RBCs, the less oxygen carrying capacity).
- Diseases which may damage either the Red blood cells or the hemoglobin which is the component which carries the oxygen.
- Hydration level of the person, the less water, the less blood volume the less capacity to carry oxygen.
- Carbon dioxide levels.
- Blood pH,
- Body temperature,
- Environmental factors and diseases can all affect oxygen's carrying capacity and delivery.

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**Long Questions Answer**

1. **Describe the structure of human respiratory system.**

Ans: The human respiratory system is a series of organs responsible for taking in oxygen and expelling carbon dioxide. The primary organs of the respiratory system are lungs, which carry out this exchange of gases as we breathe.

**The Pathway**

- Nose
- Pharynx
- Larynx
- Trachea
- Bronchi,
- Bronchiole
- Alveoli
- Lungs

**Nose and Nasal Cavity**
The nose and nasal cavity form the main external opening for the respiratory system and are the first section of the body's airway. It is the respiratory tract through which air moves.
**Structure**: The nose is a structure of the face made of cartilage, bone, muscle, and skin that supports and protects the anterior portion of the nasal cavity. The nasal cavity is a hollow space within the nose and skull that is lined with hairs and mucus membrane.
**Functions**: The function of the nasal cavity is

1. To warm, moisturize, and filter air entering the body before it reaches the lungs.
2. Hairs and mucus lining the nasal cavity help to trap dust, mold, pollen and other environmental contaminants before they can reach the inner portions of the body.
3. Air exiting the body through the nose returns moisture and heat to the nasal cavity before being exhaled into the environment.
4. Beneath the mucous membrane, there are Blood capillaries which help to warm up the air to about 30°C depending upon the external temperature.

**Pharynx**
The pharynx, also known as the throat, Pharynx is a common passage for both the respiratory and digestive system. It leads into the larynx (voice box).
**Larynx**
The larynx, also known as the voice box, is a short section of the airway that connects the pharynx and the trachea. The larynx is in the anterior portion of the neck, just inferior to the hyoid bone and superior to the trachea.

**Structure**: Several cartilage structures make up the larynx and give it its structure. The epiglottis is one of the cartilage pieces of the larynx and serves as the cover of the larynx during swallowing. In addition to cartilage, the larynx contains special structures known as vocal cords.

**Functions**: vocal cords allow the body to produce the sounds of speech and singing. The vocal cords are folds of mucous membrane that vibrate to produce vocal sounds. The tension and vibration speed of the vocal folds can be changed to change the pitch that they produce.

**Trachea:** The trachea, or windpipe is the passage way for air receives from the larynx to the lungs.
**Structure**: The trachea, or windpipe, is a 5-inch long tube and 2cm wide. It is made of C-shaped hyaline cartilage rings lined with ciliated epithelium. The trachea connects the larynx to the bronchi and allows air to pass through the neck and into the thorax. The rings of cartilage making up the trachea allow it to remain open to air always. The open end of the cartilage rings appears posteriorly toward the esophagus, allowing the esophagus to expand into the space occupied by the trachea to accommodate masses of food moving through the esophagus.
**Functions**: The main function of the trachea is to provide a clear airway for air to enter and exit the lungs. In addition, the epithelium lining the trachea produces mucus that traps dust and other contaminants and prevents it from reaching the lungs. Cilia on the surface of the epithelial cells move the mucus superiorly toward the pharynx where it can be swallowed and digested in the gastrointestinal tract.

**Bronchi**: A bronchus, is an airway in the respiratory tract that conducts air into the lungs. There is a right bronchus and a left bronchus and these bronchi branch into smaller bronchi which branch into smaller tubes, known as bronchioles.

**Bronchioles**: Within your lungs, the main airways (bronchi) branch off into smaller and smaller passageways, the smallest of which are called bronchioles.

**Structure**: As the airway splits into the tree-like branches of the bronchi and bronchioles, the structure of the walls of the airway begins to change.

**Functions**: The main function of the bronchi and bronchioles is to carry air from the trachea into the lungs. Smooth muscle tissue in their walls helps to regulate airflow into the lungs. When greater volumes of air are required by the body, such as during exercise, the smooth muscle relaxes to dilate the bronchi and bronchioles. The increased airway provides less resistance to airflow and allows more air to pass into and out of the lungs. The smooth muscle fibers can contract during rest to prevent hyperventilation. The bronchi and bronchioles also use the mucus and cilia of their epithelial lining to trap and move dust and other contaminants away from the lungs.

**Alveoli**: bronchioles end up into the spongy tissues containing many capillaries and around 30 million tiny sacs known as alveoli. The alveoli are cup-shaped structures found at the end of the terminal bronchioles and surrounded by capillaries. The alveoli are lined with thin simple squamous epithelium that allows air entering the alveoli to exchange its gases with the blood passing through the capillaries.

**Lungs**: The lungs are a pair of large, spongy organs found in the thorax located below to the heart and superior to the diaphragm. Each lung is surrounded by a pleural membrane that provides the lung with space to expand as well as a negative pressure space relative to the body's exterior. The negative pressure allows the lungs to passively fill with air as they relax. The left and right lungs are slightly different in size and shape due to the heart presence at the left side of the body. The left lung is therefore slightly smaller than the right lung and is made up of 2 lobes while the right lung has 3 lobes.

**Q#2: DESCRIBE THE MECHANISM OF BREATHING IN MAN.**

1. Voluntary respiration
2. Involuntary respiration

1. **Voluntary respiration**: it is any type of respiration that is under conscious control. The motor cortex within the cerebral cortex of the brain controls voluntary respiration (the ascending respiratory pathway). Voluntary respiration may be dominated by aspects of involuntary respiration, such as chemoreceptor stimulus, and hypothalamus stress response. Voluntary respiration is needed to perform higher functions, such as voice control forced breathing, singing, sneezing and coughing.
2. **Involuntary respiration: it** is any form of respiratory control that is not under direct, conscious control. Breathing is required to sustain life, so involuntary respiration allows it to happen when voluntary respiration is not possible, such as during sleep. Involuntary respiration also has metabolic functions that work even when a person is conscious. Involuntary respiration is controlled by the respiratory centers of the upper brainstem along with the cerebellum. This region of the brain controls many involuntary and metabolic functions besides the respiratory system, including certain aspects of cardiovascular function and involuntary muscle movements (in the cerebellum).

**Breathing mechanism:** Breathing is a mechanical process consisting of two phases:

1. Inspiration or inhalation or intake of fresh air in to the lungs.
2. Expiration or exhalation or out push of foul and consumed air out of the lungs.

Breathing is associated with the existence of life itself. The lungs themselves can neither take air in nor push it out. Therefore, man breath by pull push mechanism. The chest-wall and the diaphragm acts as a large pump in moving air into and out of the lungs. In man during ordinary breathing, 500ml of air moves in and out of the lungs with each breath.

Mechanism of breathing: We know that breathing consists of two phases namely

1. Breathing in or inspiration
2. Breathing out or expiration.

**Breathing in or inspiration:** In man, inspiration is active process. During inspiration, the intercostal muscles between the ribs contract and pull the ribs forward and outward, pushing the sternum farther away from the vertebral column. By the contraction of the intercostal muscles and of the diaphragm, the size of the thorax as a whole is increased and the pleural cavities within it are therefore enlarged. Since the pleural cavities are closed therefore their enlargement tends to create partial vacuum within them. The lungs are elastic and communicate with the atmosphere through the air passages (trachea, bronchi). As soon as the pressure ıround the lungs is lowered, the air rushes into them through the trachea and bronchi. In this way, the lungs expand to fill the pleural cavities and the pressure on the inside and outside of the thorax are equalized. Thus, the mechanism of human breathing s a suction-pump mechanism. The lungs are made to expand and contract by movements of the ribs and diaphragm.

**Breathing out or expiration:** Expiration in man is normally a passive process. In severe muscular exercise, however, the expiration also becomes active. During expiration, the intercostal muscles of the ribs relax, the ribs move downward and inward. Thus, the ize of the chest cavity is reduced from side to side. The sternum comes to its original position, decreasing the size of the chest cavity from front to back. At the same time muscles of the diaphragm relax and so the diaphragm assumes its dome shaped position. Thus, with the relaxation of the muscles of diaphragm and of the intercostal muscles, the size of the thorax as a whole is decreased. This reduction in the size of the thorax exerts pressure on the lungs. The lungs themselves are very elastic and tend to return to their original size. When the lungs are pressed, the foul air inside them is expelled or expiration occurs.

**Q#3: describe the role of respiratory pigments in transport and storage of respiratory gases.**

Ans: Respiratory gases transported within the various regions of body by the mean of blood. Oxygen transported from lungs to tissues and CO2 transported from tissues to lungs.

**Transport of Oxygen in the Blood:** Although oxygen dissolves in blood, only a small amount of oxygen is transported this way. Only 3 percent of oxygen in the blood is dissolved directly into the blood itself or plasma. Most oxygen, 97 percent, is bound to a protein called hemoglobin and carried to the tissues.

Oxygen is one of the substances transported with the help of red blood cells. The red blood cells contain a pigment called **haemoglobin**, each molecule of which binds four oxygen molecules forming **Oxyhaemoglobin**. Hemoglobin, or Hb, is a protein molecule found in red blood cells (erythrocytes). The oxygen molecules are carried to individual cells in the body tissue where they are released. The binding of oxygen is a **reversible reaction**.

$Hb + 4O_2$ $Hb.4O_2$


The four 'disks' in the diagram of haemoglobin are the parts of the molecule where the oxygen molecules bind, while the four folded 'sausage shapes' represent polypeptide chains. At high oxygen concentrations oxyhaemoglobin forms, but at low oxygen concentrations Oxyhaemoglobin dissociates to haemoglobin and oxygen. The balance can be shown by an oxygen dissociation curve for Oxyhaemoglobin.

**Hemoglobin:**

**Oxygen carrying capacity:** The potential oxygen carrying capacity of blood is determined by the total haemoglobin concentration. Atmospheric gas is inhaled through the airway and into the lungs. It consists mainly of nitrogen (79.04%), oxygen (20.93%), and carbon dioxide (0.03%), along with other trace elements and water vapour. In the atmosphere these elements exert as a partial pressure (measured in millimeters of mercury (mmHg) or Torr).

**artial pressure:** it is the overall pressure exerted by a specific gas; the total pressure of a system being the sum of all the partial ressures. In the lungs, partial pressure of gases is part of what drives diffusion of these gases into the pulmonary capillary network: .e. the higher the partial pressure of a gas in the lungs the larger the volume of gas that can be dissolved within the blood**.**

he ability of a gas to be dissolved within the blood also affects how much of the gas can be transported in the blood. Oxygen is oorly soluble within blood while carbon dioxide is easily dissolved within blood. Therefore, two factors that allows oxygen to enter he bloodstream from the lungs and carbon dioxide to exit the bloodstream into the lungs. these factors are

1. the partial pressure of the gases
2. ability to dissolve within blood

)xygen carrying capacity of blood is directly proportional to partial pressure of oxygen $PO_2$. Hemoglobin has an oxygen inding capacity of 1.34 mL $O_2$ per gram, which increases the total blood oxygen capacity seventy-fold compared to dissolved xygen in blood. The mammalian hemoglobin molecule can bind (carry) up to four oxygen molecules.

**rterial blood oxygen carrying capacity**: it 20ml/100ml of blood (100% saturated) which is achieved at 100 mmHg $PO_2$ this is ecause the amount of haemoglobin is 15 gm/100ml of blood. Since the 1 gm Hb can combine with 1.34 ml of $O_2$, THEREFORE .00ML BLOOD COMBINES WITH 20ML $O_2$ (100% saturated). Normally each 100ml of arterial blood contains 19.4 ml $O_2$ (i.e. it is 97% aturated): $PO_2$ is 95 mmHg).

**enous blood oxygen carrying capacity**: venous blood contains 14.4 ml $O_2$ (i.e. it is 74% saturated): $PO_2$ is 40 mmHg). Thus, 5ml of )$_2$ is released to the tissues by each 100ml blood.

**t Exercise:** During exercise the need of oxygen is greatly increased in the tissues so more oxygen is released by the arterial blood o the tissues. The venous blood that leaves an active tissue has only 4.4 ml $O_2$ per 100ml of blood (i.e. it is 20% saturated): $PO_2$ is .8 mmHg). Compared to the CO2, oxygen is relatively less dissolvable in the blood, therefore a small amount of O2 is transported n dissolved state in the plasma. Normally each 100ml blood contain 0.29ml O2 ($PO_2$ is 95 mmHg) and is capacity may increase up o o.3ml/100 ml blood at 100 mmHg $PO_2$. While the 100ml of venous blood has 0.112 ml of dissolved $O_2$ (PO2 is 40 mmHg). Thus, ).17 of 02 is transported by each blood through the tissues per cycle in the dissolved state.

**arbon dioxide in the blood:** Haemoglobin can also bind carbon dioxide, but to a lesser extent. Carbaminohaemoglobin forms. ome carbon dioxide is carried in this form to the lungs from respiring tissues.

ransportation of CO2: Carbon dioxide molecules are transported in the blood from body tissues to the lungs by one of three nethods:

1. Dissolution directly into the blood
2. Binding to hemoglobin
3. Carried as a bicarbonate ion

.. **As a bicarbonate ion**: most carbon dioxide molecules (70 percent) are carried as part of the bicarbonate buffer system. In this system, carbon dioxide diffuses into the red blood cells. Carbonic anhydrase (CA) within the red blood cells quickly converts the carbon dioxide into carbonic acid ($H_2CO_3$). When carbon dioxide diffuses into the blood plasma and then into the red blood cells (erythrocytes) in the presence of the catalyst carbonic anhydrase most $CO_2$ reacts with water in the erythrocytes and the following dynamic equilibrium is established

$H_2O + CO_2$ $H_2CO_3$

arbonic acid, $H_2CO_3$, dissociates to form hydrogen ions and hydrogencarbonate ions. This is also a reversible reaction and ndissociated carbonic acid, hydrogen ions and hydrogencarbonate ions exist in dynamic equilibrium with one another

$$H_2CO_3 \quad H^+ + HCO_3^-$$

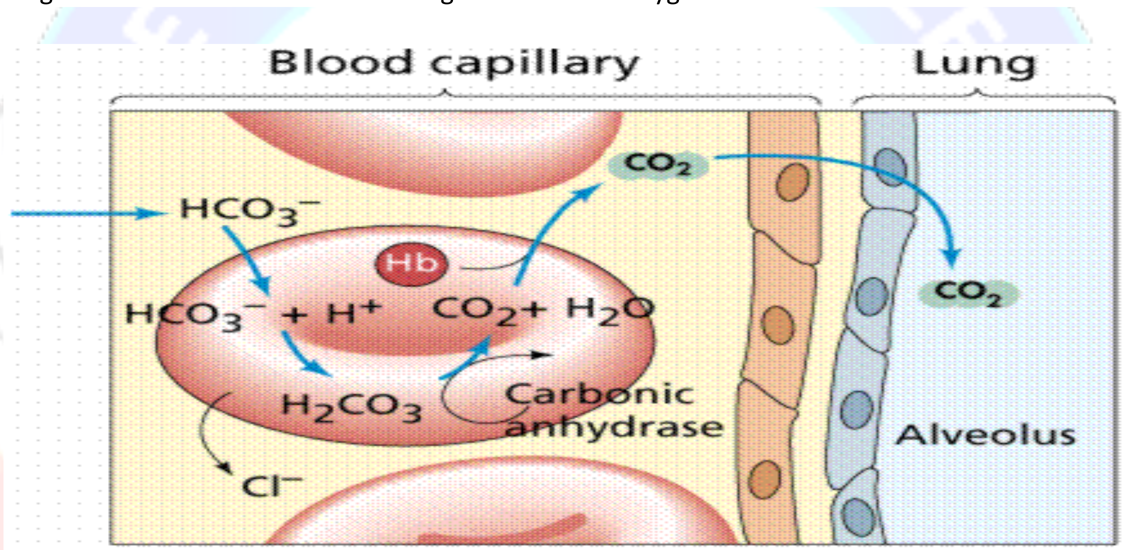
nside the erythrocytes negatively charged $HCO_3^-$ ions diffuse from the cytoplasm to the plasma. This is balanced by diffusion of :hloride ions, $Cl^-$, in the opposite direction, maintaining the balance of negative and positive ions either side. This is called the **chloride shift**' or **hamburger's phenomena**. When the blood reaches the lungs, the bicarbonate ion is transported back into the ed blood cell in exchange for the chloride ion. The $H^+$ ion dissociates from the hemoglobin and binds to the bicarbonate ion. This produces the carbonic acid intermediate, which is converted back into carbon dioxide through the enzymatic action of Carbonic icid. The carbon dioxide produced is expelled through the lungs during exhalation.

The dissociation of carbonic acid increases the acidity of the blood (decreases its pH). Hydrogen ions, $H^+$, then react with oxyhaemoglobin to release bound oxygen and reduce the acidity of the blood. This buffering action allows large quantities of carbonic acid to be carried in the blood without major changes in blood PH.

$Hb.4O_2 + H^+$ $HHb+ + 4O_2$

Note: ($Hb.4O_2$ is sometimes written $HbO_8$.)

It is this reversible reaction that accounts for the Bohr effect. Carbon dioxide is a waste product of respiration and its concentration is high in the respiring cell and so it is here that haemoglobin releases oxygen.




Now the haemoglobin is strongly attracted to carbon dioxide molecules. Carbon dioxide is removed to reduce its concentration in the cell and is transported to the lungs were its concentration is lower. This process is continuous since the oxygen concentration is always higher than the carbon dioxide concentration in the lungs. The opposite is true in respiring cells.

**Benefit of bicarbonate:** The benefit of the bicarbonate buffer system is that carbon dioxide is "soaked up" into the blood with little change to the pH of the system. This is important because it takes only a small change in the overall pH of the body for severe injury or death to result. The presence of this bicarbonate buffer system also allows for people to travel and live at high altitudes. When the partial pressure of oxygen and carbon dioxide change at high altitudes, the bicarbonate buffer system adjusts to regulate carbon dioxide while maintaining the correct pH in the body.

2. **Dissolved in blood:** secondly, carbon dioxide is more soluble in blood than is oxygen. About 5 to 7 percent of all carbon dioxide is dissolved in the plasma.
3. **As carbooxyhaemoglobin:** carbon dioxide can bind to plasma proteins or can enter red blood cells and bind to hemoglobin. This form transports about 23 percent of the carbon dioxide. When carbon dioxide binds to hemoglobin, a molecule called Carbaminohaemoglobin is formed. Binding of carbon dioxide to hemoglobin is reversible. Therefore, when it reaches the lungs, the carbon dioxide can freely dissociate from the hemoglobin and be expelled from the body.

4. **State the causes, symptoms, and treatments of any one disorder of lower respiratory tract.**

**Lower Respiratory Tract Infection:** The lower respiratory tract begins from the trachea and ends in the lungs.

There are two LRT'S given in the book

1. Pneumonia
2. Tuberculosis

Pneumonia: Pneumonia is a lung infection that can make you very sick. You may cough, run a fever, and have a hard time breathing. For most people, pneumonia can be treated at home. It often clears up in 2 to 3 weeks. But older adults, babies, and people with other diseases can become very ill. They may need to be in the hospital.

**Symptoms:** The signs and symptoms of pneumonia vary from mild to severe, depending on factors such as the type of germ causing the infection, and your age and overall health. Mild signs and symptoms often are like those of a cold or flu, but they last longer.

Signs and symptoms of pneumonia may include as per type of germ in person:

**Viral pneumonia:** person with viral pneumonia experiences

- Chest pain when you breathe or cough
- Confusion or changes in mental awareness (in adults age 65 and older)
- Cough, which may produce phlegm
- Fatigue
- Fever, sweating and shaking chills
- Lower than normal body temperature (in adults older than age 65 and people with weak immune systems)
- Nausea, vomiting or diarrhea
- Shortness of breath

**Mycoplasma pneumonia:** the person may experience violent coughing.

Newborns and infants may not show any sign of the infection. Or they may vomit, have a fever and cough, appear restless or tired and without energy, or have difficulty breathing and eating.

**Causes**

**Pneumonia and your lungs:** Many germs can cause pneumonia. The most common are bacteria and viruses in the air we breathe. Your body usually prevents these germs from infecting your lungs. But sometimes these germs can overpower your immune system, even if your health is generally good.

- **Bacteria.** The most common cause of bacterial pneumonia is Streptococcus pneumoniae. This type of pneumonia can occur on its own or after one had a cold or the flu. It may affect one part (lobe) of the lung, a condition called lobar pneumonia.
- **Bacteria-like organisms.** Mycoplasma pneumoniae also can cause pneumonia. It typically produces milder symptoms than do other types of pneumonia. Walking pneumonia is an informal name given to this type of pneumonia, which typically isn't severe enough to require bed rest.

- **Fungi.** This type of pneumonia is most common in people with chronic health problems or weakened immune systems, and in people who have inhaled large doses of the organisms. The fungi that because it can be found in soil or bird droppings and vary depending upon geographic location.
- **Viruses.** Some of the viruses that cause colds and the flu can cause pneumonia. Viruses are the most common cause of pneumonia in children younger than 5 years. Viral pneumonia is usually mild. But in some cases, it can become very serious.

**Risk factors**: Pneumonia can affect anyone. But the two age groups at highest risk are:

- Children who are 2 years old or younger
- People who are age 65 or older

Other risk factors include:

- **Being hospitalized.** You're at greater risk of pneumonia if you're in a hospital intensive care unit, especially if you're on a machine that helps you breathe (a ventilator).
- **Chronic disease.** You're more likely to get pneumonia if you have asthma, chronic obstructive pulmonary disease (COPD) or heart disease.
- **Smoking.** Smoking damages your body's natural defenses against the bacteria and viruses that cause pneumonia.
- **Weakened or suppressed immune system.** People who have HIV/AIDS, who've had an organ transplant, or who receive chemotherapy or long-term steroids are at risk.