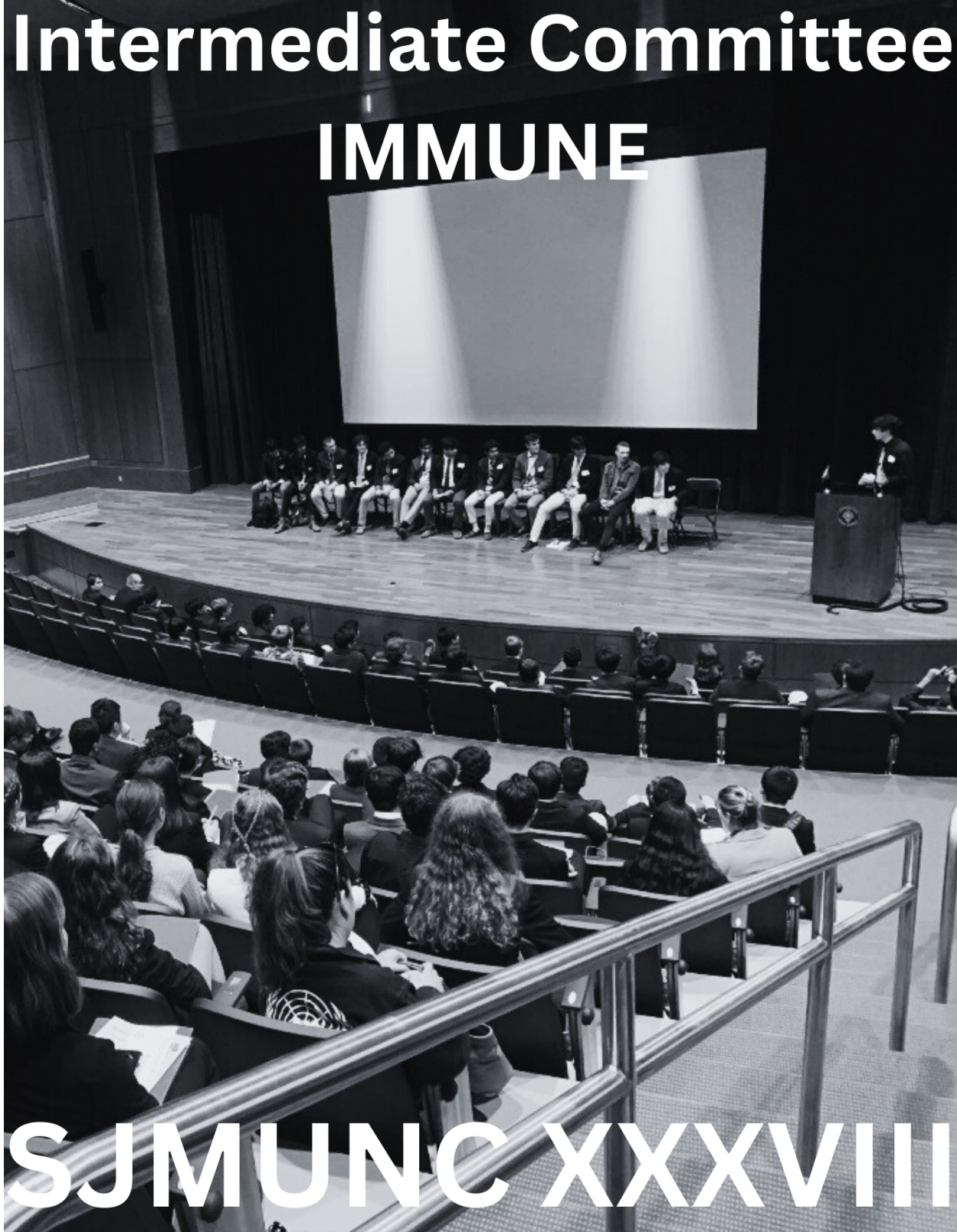


Intermediate Committee IMMUNE



SJMUNC XXXVIII

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Letters from the Chairs:

Hello Delegates,

My name is Aadi Jagannathan, and I'm a sophomore at Saint John's. I'd like to take this moment to welcome you to SJMUNC and express that it is truly my distinct honor to be your co-chair for this committee.

This is my second year of doing MUN at Saint John's but my first year co-chairing, so to some extent, I'm figuring things out just as much as you may be. Despite this, you should never hesitate to reach out to myself or Ryan regarding any questions, concerns, or confusions regarding this committee because at the end of the day, that's how you learn.

As for our committee, Ryan and I are very excited to present to you a particularly abstract scenario that we both believe will incite some interesting debates. This committee will challenge not only your diplomatic and communicative abilities but also your analytical, problem-solving, and even mathematical capabilities as you rush to efficiently solve a problem not as representatives from different countries, but as bodily systems, each with their own strengths and vulnerabilities, yet all dependent on each other for survival.

As somewhat of a science enthusiast myself, this committee has me very excited from a biological standpoint to see the ways in which you are able to use the strengths of your particular position for the collective good not of a nation or even the world, but something infinitely more complex: the human body.

May the odds be ever in your favor,

Aadi Jagannathan

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Statement of the Problem

A potential threat has breached the left hip area, sparking a concerning chain of events. After the body endured a particularly large abrasion in the same region, many otherwise healthy cells began exhibiting abnormal behavior. Instead of dying or healing as usual, these cells have started to attack and control their neighboring cells. Unlike typical tumor growth, where cells rapidly divide uncontrollably, these infected cells take a different approach by removing healthy cells' ability to function by severely limiting the amount of nutrients that get delivered to them. The nature of this infection is unlike anything previously encountered, and its mechanisms remain shrouded in mystery.

Adding to the complexity, the disease seems to alter the pH of the affected regions. In all infected areas, the pH level has dropped to a level that is no longer viable for optimal cell function, even in cells that have not been directly exposed to the infection. This pH shift has had a devastating impact on the skin cells in these regions, weakening them significantly. As a result, the tissue between various layers of skin has begun to dissolve, making the skin increasingly vulnerable. This development sets a dangerous precedent, showing that infection is not always obvious.

History of the Problem

Doctors have determined from the patient's injury reports that the patient, now unconscious, suffered a deep abrasion to his hip, which cut through three layers of skin and made

him very susceptible to infection in the minutes before he was transported to the hospital. Who knows what could have entered his body in that time...

In the first hours following the injury, an unknown infection spread from the left hip down through the thigh and to the knee, and continued advancing through the leg. Shortly after, it began to move toward the pelvis and the sacrum (tailbone), showing signs of spreading upward through the body, particularly in the direction of the spinal cord, which connects directly to the brain. The exact development of this disease remains unknown, and bodily defense mechanisms are on high alert as they scramble to find a solution to halt its progress before it becomes a major threat.

If the infection continues to spread unbounded, the consequences could be fatal. With almost the entire hip area completely infected, the patient only has a matter of time before these cells reach more essential bodily systems, particularly the circulatory and nervous systems. Loss of either one of these systems and the organs that come with them (particularly the brain and heart) would be an endgame for the body and victory for the infection, further increasing the urgency for a specialized response.

The most baffling aspect of the infection is the abject lack of precedent, as this type of infection has never been seen before. For fear of misdiagnosing and misprescribing potentially fatal drugs to the patient, all doctors can do is keep the patient stable and breathing as the infection spreads. Responsibility for responding to and eliminating the disease from the body belongs solely to the body itself, and will require efficient communication and resolution between cells and bodily systems to be successful.

Possible Solutions

Reports from various parts of the body are scattered; no definitive cause of the disease has been traced. Despite the fact that a large abrasion closely preceded the introduction of this mystery disease, there is no definitive evidence that this event was what introduced the disease into the body. By sending specialized cells to investigate and report their findings, a consensus can be reached about the identification of this disease. Additionally, by understanding more about this disease and how it works, offensive cells and immune responses can become better coordinated to address the problem.

The more information that is gathered about the disease, the better equipped the immune system will be to respond. With an increased understanding of its nature, the body's defensive cells—such as offensive immune cells and other response mechanisms—can be better coordinated to take action. These immune cells can be trained to recognize the unique markers of the disease, distinguish it from healthy tissue, and mount a more effective offense. In the same way that specialized cells gather intelligence, the immune system can be honed to act with precision, targeting the infection without overreacting and harming surrounding healthy tissue. Only by understanding the disease's intricacies can the body's immune responses be optimized, ensuring that its efforts to combat the disease are both efficient and effective.

Ultimately, the goal is to bridge the gap between knowledge and action. By gathering more data through specialized investigations, the immune system can develop a comprehensive strategy for treating and neutralizing the disease, protecting the body from further harm while restoring its natural balance.

Once the disease is understood—its patterns, vulnerabilities, and weaknesses identified—interventions can be designed and implemented. However, this process is not without

significant risks. Given the unique nature of the infection, any treatment or removal effort must be carried out with extreme caution. There is a fine line between targeting the infected cells and harming healthy ones. Since the disease is capable of manipulating surrounding cells and potentially using them as carriers, any action taken must be carefully controlled to avoid extra damage.

The challenge lies in isolating the infected cells without disrupting the overall balance of the body's cellular functions. Imprecise or overzealous actions could lead to further complications, including the potential destruction of vital tissue or the increase in the disease's spread. Therefore, while eradication is the ultimate goal, the approach must be methodical, strategic, and thoroughly tested to ensure that healthy cells are not caught in the crossfire, causing unintended harm or triggering more widespread damage. The delicate balance of targeting the disease without destabilizing the body's broader cellular structure requires the highest level of precision and caution, making the effort to combat this disease a complex and painstaking process.

Bloc Positions:

Cardiovascular System

The Cardiovascular System is a network of veins, arteries, and blood vessels that is responsible for transporting nutrients, hormones, and waste around the body. Alongside acting as the body's primary distribution and communication system, it is directly responsible for the transport of red and white blood cells to infection sites, and its efficiency is imperative for a quick and smooth response to infections. A failing Cardiovascular System compromises the integrity of all bodily functions and productivity.

Digestive System

The Digestive System breaks down food into nutrients that provide energy for the body. Digestive organs such as the liver play a key role in detoxifying potentially infected cells, but the primary purpose of the digestive system remains the continued nourishment of cells throughout the body with nutrients they need to continue working. A failing Digestive System limits the flow of such nutrients and risks malnutrition and dysfunction across the whole body.

Nervous System

The Nervous System is the body's command center, controlling functions such as thoughts, movement, and senses. Making use of both its communicative and reasoning-based aspects, a coordinated attack on the infection will require effective communication to and from the Nervous System. A failing Nervous System reduces productivity by failing to keep the rest of the body updated with important information about the attack. An infected Nervous System would also take far longer to transmit instructions to bodily systems, commensurately slowing the body's immune response.

Immune System

The Immune System is the body's primary line of defense. Making use of a very specific arsenal of cells, the Immune system is geared towards the tactical targeting and removal of intruders, infections, and degraded cells from within the body. Using these cells will be crucial in the removal of the infection once and for all. However, the Immune System relies heavily on

other systems to give it direction and energy. A failing Immune System does not take advantage of the resources that they have available to fight off the attack.

Renal System

The Renal System filters harmful substances that may exist in the blood and excrement in order to keep the rest of the body safe. Through the use of the kidney, the Renal system also has the capability of extracting essential salts and nutrients from waste before forcing it out of the body. These collected molecules could potentially go back to other body systems for increased energy in fighting the infection. A failing Renal System increases the speed of infection and disease, allowing the rest of the body to become exposed.

Respiratory System:

The respiratory system is directly concerned with the exchange of gases in and out of the body in order to not only provide oxygen for the production of energy, but also filter out waste carbon dioxide. Without a fully functional respiratory system, the body would have no efficient way of generating energy for its organs and would be forced to rely on lesser energy pathways, which can only be maintained for so long. As such, a functional respiratory system is paramount for the maintenance of any immune response to this infection.

Character Positions:

Heart (Cardiovascular)

The heart is responsible for maintaining the circulation of oxygenated blood and nutrients throughout the body, sustaining the functionality of all organs and cells. It is generally very

durable but vulnerable to specific disruptions caused by stress, infection, or lack of oxygen. If weakened, its reduced pumping capacity compromises every other system at once. Preservation of stable heart function is a critical priority in any coordinated response to disease.

Red Blood Cell (Cardiovascular)

Primarily responsible for transporting oxygen from the lungs to the rest of the body while simultaneously carrying carbon dioxide back to the lungs to be exhaled. Mainly produced in the bone marrow and transported through arteries and veins, although severely limited in their ability to navigate through small blood vessels. Due to their lack of a nucleus, they are unable to quickly replicate—preservation of red blood cell count is of primary importance.

White Blood Cell (Cardiovascular)

Directly responsible for fighting infection and disease. The body's most abundant source of defense. White Blood Cells identify and attack potential threats while creating antibodies that protect the body from future threats. White Blood Cell levels are paramount: without them, the body is not able to protect itself.

Blood Vessels (Cardiovascular)

The blood vessels are the pathways through which blood cells can transport across the body to deliver nutrients and oxygen to the hard-working organs. As one may expect, compromised blood vessels can pose a serious issue, as blood vessels will have to take longer, less efficient paths to specific organs, reducing organ efficiency substantially. Even worse,

corrupted vessels may also kill or even corrupt blood cells that dare venture through them, reducing blood cell counts throughout the body.

Capillaries (Cardiovascular)

The capillaries are specialized blood vessels (see above) geared toward the transportation of fluids and gases. However, they are more delicate than normal vessels, meaning that they are easier to infiltrate and easier to corrupt as a whole. As with the regular vessels, corrupted capillaries can limit the supply of fluids and oxygen the body gets, and if this effect is exacerbated, the body will lose oxygen altogether and shut down.

Stomach (Digestive)

The stomach is a primary organ of digestion, breaking down food into usable nutrients that power the immune system and all bodily functions. Its highly acidic environment also destroys many pathogens before they can spread through the body, acting as a frontline barrier. However, the stomach is vulnerable to infection itself and can be weakened by disease, stress, or malnutrition. Without proper stomach function, the rest of the immune system may lack the energy and resources needed to sustain prolonged defense.

Liver (Digestive)

The liver functions as the body's detoxification hub, filtering blood to remove toxins, waste, and harmful substances introduced by infection or medication. It also produces important proteins and stores energy for use during prolonged illness. However, it is vulnerable to

overload: when pathogens, drugs, or toxins accumulate beyond its processing capacity, the liver itself can fail, spreading dysfunction to the entire body. In any disease response, protecting liver function is essential to maintaining energy and balance.

Small Intestine (Digestive)

The small intestine is the primary site of nutrient absorption, ensuring that energy and essential resources reach the body's cells to support immune defense. Its extensive surface area makes it highly efficient but also vulnerable to invasion by pathogens. A damaged or inflamed small intestine drastically reduces nutrient intake, weakening the entire immune system. When functioning properly, it sustains the body's long-term ability to fight and recover from disease.

Large Intestine (Digestive)

The large intestine is responsible for absorbing water and electrolytes while housing a diverse microbiome of bacteria that play a crucial role in immune function. These bacteria compete with harmful pathogens, helping defend the body indirectly. The large intestine also helps form and expel waste, preventing toxins from building up. However, imbalances in the gut microbiome or infection in this region can lead to severe disruptions, weakening both digestion and immune defense simultaneously.

Lactic Acid Bacteria (Digestive)

Lactic Acid Bacteria promote gut health and immune support, running the fermentation process in the digestive tract. Responsible for ensuring proper functionality of the digestive system, which is important to deliver nutrients and energy to all cells in the system. Severely

limited in their ability to move throughout the body, these bacteria are kept in the digestive tract only.

Pancreas (Digestive/Endocrine)

The pancreas serves a dual role in digestion and the regulation of blood sugar. It produces enzymes that break down food into usable nutrients, while also releasing insulin and glucagon to balance energy levels. During infection, stable blood sugar is essential to sustain immune cell activity. However, pancreatic dysfunction—whether through inflammation, infection, or autoimmune attack—can quickly destabilize the body’s energy supply, weakening the overall defense system.

Appendix (Digestive/Immune)

Long dismissed as vestigial, the appendix plays an important role in hosting beneficial gut bacteria and supporting immune function. It acts as a reservoir for the microbiome, helping repopulate the large intestine after disruption. Its location at the junction of the small and large intestines makes it vulnerable to infection and inflammation, which can become life-threatening if untreated. While not essential for survival, the appendix provides valuable backup to digestive and immune stability.

Prefrontal Cortex (Nervous)

The prefrontal cortex is the body’s “executive decision-maker.” It is responsible for planning, evaluating risks, and making calculated choices regarding how the body should

respond to threats. While it does not directly fight disease, its ability to weigh immediate dangers against long-term stability makes it extremely important in coordinating immune responses.

Hypothalamus (Nervous)

The hypothalamus regulates internal balance by controlling body temperature, hunger, thirst, and hormone release. It is the central command for initiating fever, fatigue, and appetite changes that support the immune system's fight. An overactive hypothalamus can push the body into dangerous fevers or stress-hormone imbalances, weakening the overall defense effort.

Amygdala (Nervous)

The amygdala is the body's alarm system, responsible for processing threats and triggering emotional responses such as fear and urgency. It primes the body for action by activating fight-or-flight responses, often speeding up decision-making. However, while its vigilance helps identify dangers early, its influence can lead to overreactions or misinterpretations, exhausting resources on perceived threats that may not be immediately dangerous. The amygdala is a strong voice for rapid, aggressive measures against disease.

Cerebellum (Nervous)

The cerebellum coordinates movement and balance, ensuring that the body remains functional even during illness. It helps regulate motor responses like coughing, sneezing, and shivering. While not directly responsible for fighting pathogens, the cerebellum ensures that the body's responses are precise and efficient. Damage or disruption to the cerebellum causes clumsiness or slowed reflexes, which can reduce the effectiveness of these natural defenses.

Spinal Cord (Nervous)

The spinal cord is the main communication highway between the brain and the rest of the body, transmitting messages that allow for coordinated responses. It ensures that reflexes, pain signals, and movement commands reach the necessary regions in time. Damage or disruption to the spinal cord severely limits the body's ability to respond, leaving defense mechanisms disorganized. Though not directly fighting disease, the spinal cord's role in fast communication is essential to a unified defense.

Brain Stem (Nervous)

Similar to the spinal cord, the brain stem serves as a communicator between the brain and the rest of the body, connecting the spinal cord and the rest of the body. However, it also has the unique ability to send signals regulating the heartbeat and transport of blood, ensuring a consistent, not erratic, flow of blood from the heart, even in times of crisis. It also serves as a line of defense for the body's airways, sending signals regarding the intake of necessary gases and expulsion of unpleasant ones.

Killer T Cell (Immune)

Killer T Cells directly attack and destroy cells that are infected with viruses, cancerous cells, and other foreign cells by triggering programmed cell death in the target cell. Acts as the body's "hitman," eliminating threats within the body. Killer T Cells are very selective and should

not attack unless completely certain that a cell is a threat. Otherwise, their energy will be depleted, unable to attack again for a long time.

Macrophage (Immune)

The body's waste management system. Responsible for engulfing and digesting microorganisms, clearing out debris and dead cells, and stimulating other cells involved in immune function. Necessary to begin the restoration process in areas that have been affected by disease or damage. Macrophages are much larger than normal cells and are extremely vulnerable; protection in dangerous areas is necessary.

Platelet (Immune)

Platelets are responsible for preventing and stopping bleeding. If a blood vessel is damaged, the platelets are responsible for creating clots before too much blood is lost. Certain viruses can reduce platelet count, limiting the body's ability to form proper clots.

Regulatory T Cell (Immune)

The main job of Regulatory T Cells is to maintain balance and prevent the immune system from overreacting. Regulatory T Cells suppress immune responses against the body's own tissues, helping prevent autoimmune issues. Additionally, they are responsible for regulating other immune cells, such as the Killer T Cells and the B Cells. Some cancers and viruses,

however, can “recruit” Regulatory T Cells to suppress anti-tumor immune response, essentially hijacking their regulatory functionality.

Natural Killer (NK) Cell (Immune)

NK Cells mainly target infected cells by recognizing changes on the cell’s surface. Similar to Killer T Cells, NK Cells release granzymes, which activate programmed cell death. Certain viruses can stop the movement of NK Cells through the bloodstream, severely limiting their effectiveness in protecting many parts of the body at once.

B Cell (Immune)

B Cells are the “medics” for the various other offensive cells in the body (White Blood Cells, Killer T Cells, and NK Cells). They produce antibodies, binding specific antigens on pathogens in order to mark them for destruction. Additionally, B Cells prevent toxins or block viruses from entering cells. Many B Cells require T Cells to function fully, calling on them for help. Dysfunction in T Cell signaling can heavily impair B Cell response.

Memory T Cells (Immune)

Memory T Cells are responsible for mediating a faster response upon interaction with an antigen. These cells can help to protect against subsequent infections with the same pathogen. This cell is utilized to recognize patterns in pathogen behavior and regulate response. Memory T

cells are effective against pathogens they have previously encountered, but they greatly struggle against entirely new pathogens.

Spleen (Immune)

The spleen filters the blood, removing old red blood cells and pathogens while serving as a hub for immune cell activation. It stores reserves of white blood cells and platelets, enabling rapid deployment during infection or injury. However, because of its filtering role, the spleen is highly vulnerable to direct infection and damage. Loss of spleen function leaves the body slower to respond to bacterial invasion, making its protection crucial in disease defense.

Dendritic Cell (Immune)

Dendritic Cells act as the “gatekeepers” of the immune system, primarily responsible for identifying pathogens in the body. Additionally, Dendritic cells release cytokines that are responsible for determining the strength of immune responses. Overactive or improperly regulated Dendritic Cells can contribute to autoimmune diseases by preventing self-antigens in a way that activates T Cells against the body’s own cells.

Bone Marrow (Immune)

Bone marrow is the body’s production center for red blood cells, white blood cells, and platelets. It supplies the building blocks of circulation and immunity, replenishing the forces needed to fight disease. Damage from infection, toxins, or cancer can cripple bone marrow function, leading to immune collapse and anemia. Because it underpins every other system, bone marrow is one of the most critical assets to preserve in any coordinated defense.

Thymus (Immune)

The thymus is the training ground for T cells, teaching them to distinguish between the body's own tissues and foreign invaders. This education is vital for preventing autoimmune disease and ensuring precise targeting of pathogens. The thymus is most active in childhood and gradually shrinks with age, reducing the body's capacity to generate new immune responses. Without proper thymic function, the immune system risks either failing to defend effectively or attacking itself.

Microglia (Nervous/Immune)

Microglia are the immune cells of the brain and spinal cord, constantly scanning for pathogens and damaged neurons. They engulf invaders and release inflammatory signals, protecting the nervous system from infection. However, overactive microglia can damage healthy tissue, contributing to neurodegenerative disease. Their balance is critical: underactive microglia leave the brain vulnerable, while overactivity risks harming the very system they protect.

Kidney (Renal)

The kidneys filter blood, removing waste products and balancing fluids, electrolytes, and pH levels critical for sustaining life. During infection, they prevent the buildup of harmful byproducts that would otherwise weaken immune cells and tissue function. However, kidneys are highly vulnerable to both toxins and overwork, and many infections can impair kidney function directly. A failure of the kidneys disrupts balance across the whole body, leaving it vulnerable to collapse.

Bladder (Renal/Excretory)

The bladder stores urine for safe elimination, preventing toxic waste products from lingering in the body. As part of the urinary tract, it is a common target for bacterial infection, which can spread upward to the kidneys if unchecked. While not directly involved in immune regulation, bladder health ensures the efficient removal of harmful byproducts that otherwise weaken the body's resistance to disease.

Lungs (Respiratory)

The lungs provide oxygen necessary for cellular energy and remove carbon dioxide, keeping the blood in balance. They are also one of the most vulnerable entry points for pathogens, which can spread rapidly through the respiratory tract and bloodstream. Inflammation, fluid buildup, or infection in the lungs directly compromises oxygen delivery, weakening every system simultaneously. Protecting lung function is critical in any fight against respiratory or systemic disease.

Diaphragm (Respiratory)

The diaphragm is a muscle directly concerned with the expansion and contraction of the lungs. In order to sustain the efficient intake of oxygen, the diaphragm must be strong enough to work continuously, requiring a constant stream of oxygen and nutrients, which usually isn't much of a problem. However, as the infection begins to expand up the spinal cord, it may be worth noting that the diaphragm might become a target...

Skin

The skin is the body's largest organ and its first line of defense against external threats. It acts as a physical and chemical barrier, preventing pathogens from entering while regulating temperature and fluid balance. The skin also hosts beneficial microbes that help deter harmful organisms. Maintaining the integrity of the skin is essential to preventing widespread infection and preserving homeostasis.

Rib Cage

The rib cage serves not only as the body's structural foundation but also as an active participant in immunity. It houses bone marrow, where blood and immune cells are born, and releases minerals that regulate nerve and muscle function. When bones are weakened by disease or nutrient deficiency, both structure and immunity suffer. In times of infection, bone health determines how well the body can produce reinforcements and maintain strength.

Lymph Node

Lymph nodes are the immune system's regional command centers. They filter lymphatic fluid, trapping pathogens and presenting them to immune cells for recognition and destruction. Swelling indicates active defense, as white blood cells gather to respond. However, if lymph nodes become blocked or infected, immune coordination suffers, allowing pathogens to spread unchecked.