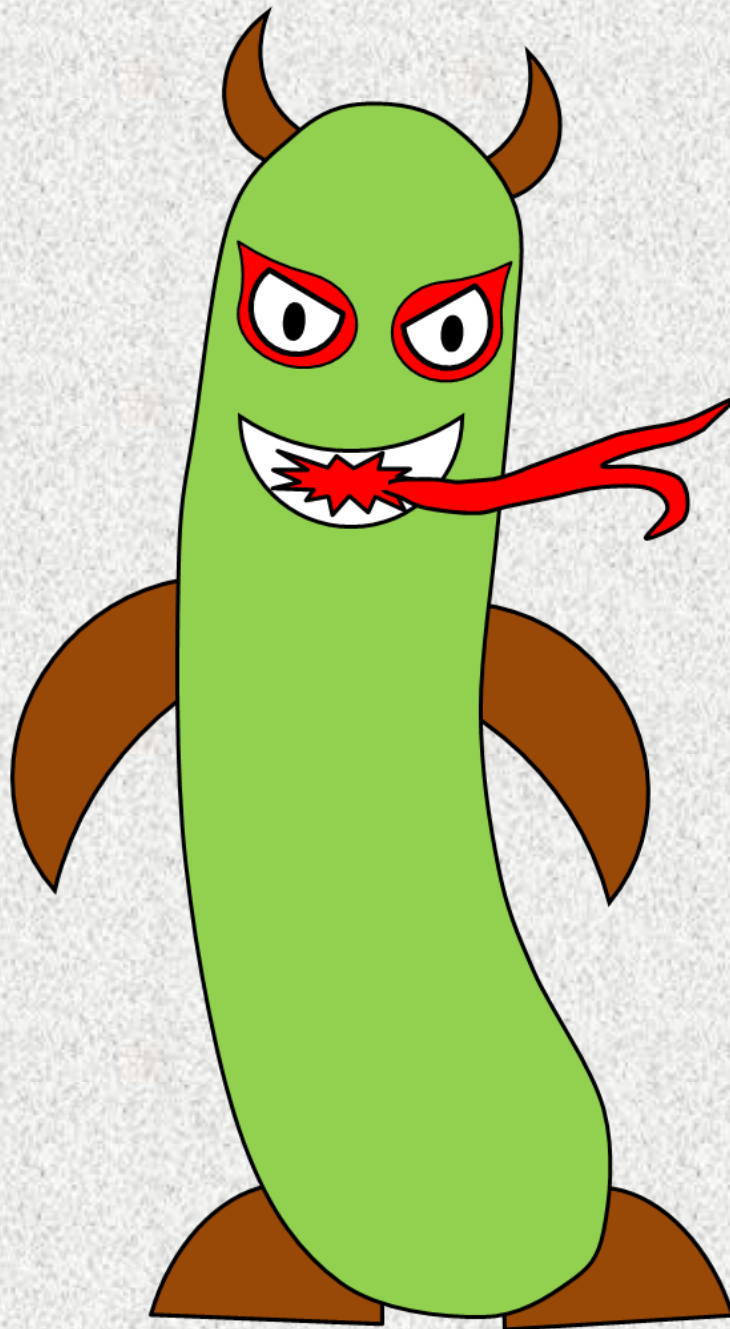


The Immunocytes against The Mycos

The importance of our TH1 army



Juan Carlos Aldave, MD
Allergy and Clinical Immunology

Around us, in the environment, there are many microbes that can harm us, causing illness or even death.

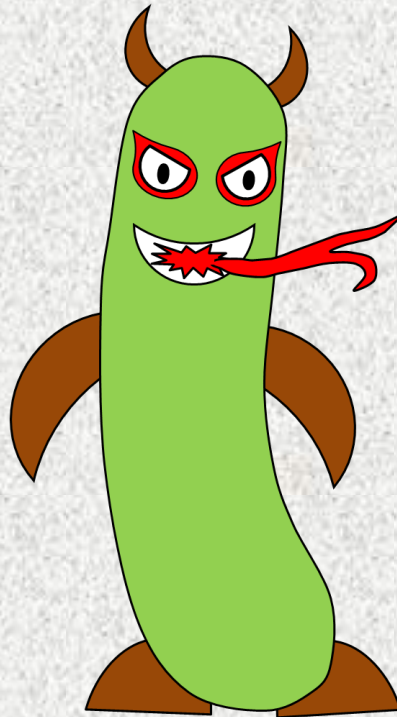
There are 4 major groups of microbes: viruses, bacteria, fungi and parasites. We are exposed to these threats since birth, so we need to have many cells and molecules to defend our bodies.

We will call “immune system” to our body defenses, and “**immunocytes**” to the immune cells that protect us.

In this little book I will show you how our immunocytes fight and defend us from a very dangerous enemy: **Mycobacterium tuberculosis**, the microbe that causes tuberculosis.

Chapter 1:

Mycobacterium tuberculosis



The enemy *Mycobacterium tuberculosis*, which we will call only Myco, is a microbe that belongs to the kingdom of bacteria. The Myco is very little; it measures 0.5 x 5 micrometers, equivalent to a millimeter divided into 200 pieces.

Despite being so small, the Mycos are very dangerous microbes that can invade our organs such as the lungs or the brain.

The most frequent infection caused by the Mycos is pulmonary tuberculosis. Sick people can spread the disease to other individuals by their respiratory fluids through cough or sneezing.

The Mycos kill more than one million people around the world every year. These awful microbes take advantage of any weakness

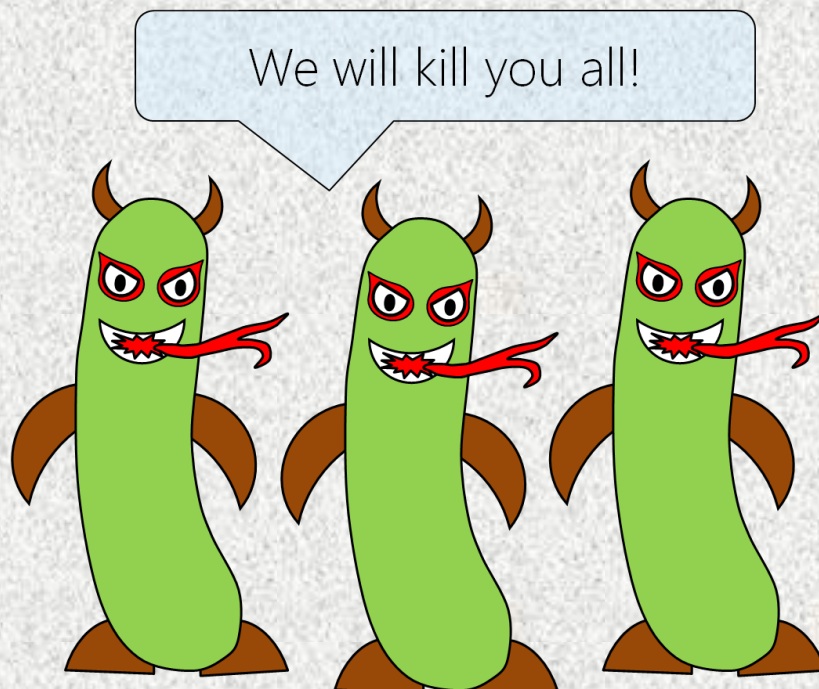
in our body to try to invade us. Therefore, we need to have strong protective mechanisms inside us.

In the next chapter I will show you how the cells that line our mucosal tissues work as our first defensive barrier against the invasion by the Mycos.

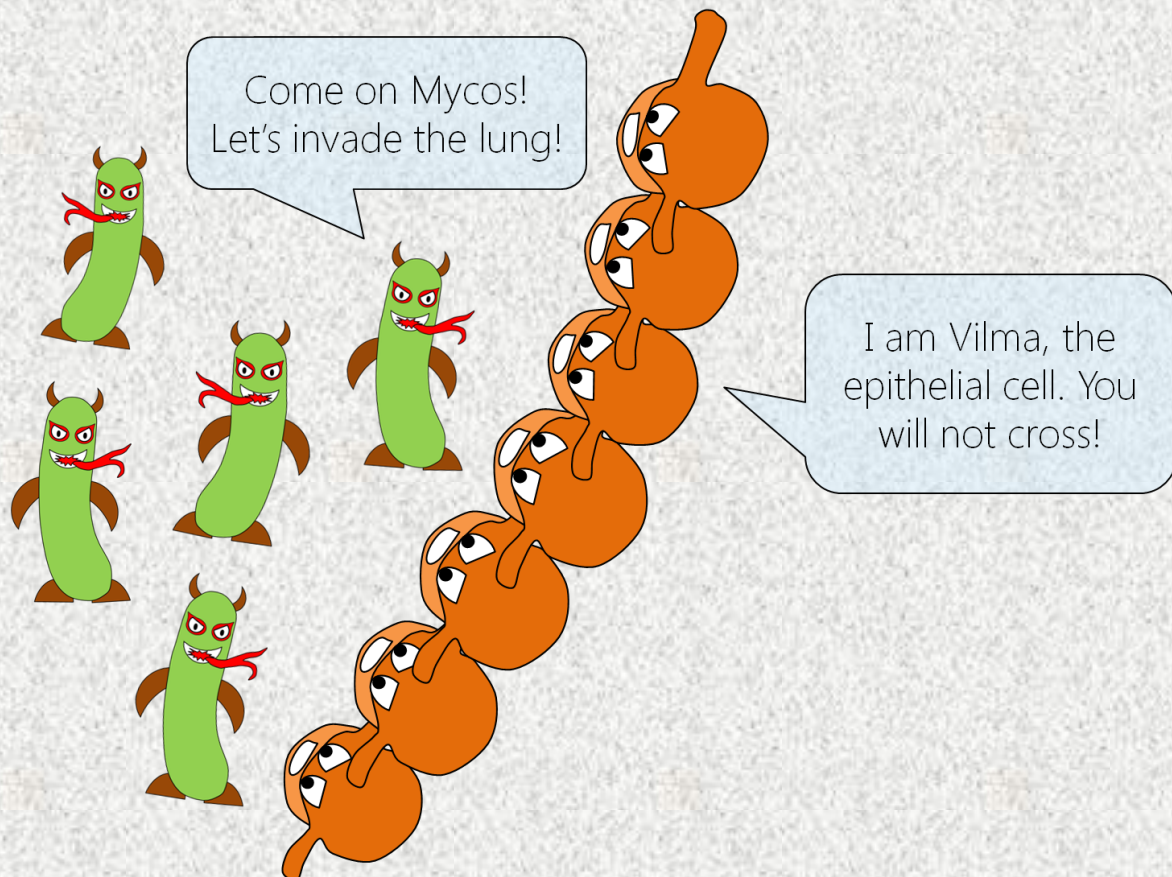
Please answer the following questions:

1. What is the size of Mycobacterium tuberculosis?
_____ micrometers, equivalent to a millimeter divided into _____ pieces.
2. Why is the Myco so dangerous to us?

3. How many individuals are killed every year by the Mycos?



Chapter 2: Our first defensive barrier against the Mycos



The Mycos are powerful microbes that kill millions of people around the world. All of us are at risk to be attacked by The Mycos.

Fortunately, we have an entire army of immunocytes that defend us. Our first protective barrier against the Myco attack is composed by the cells that cover our respiratory mucosa, also called epithelial cells. Our epithelial cells act as a wall that blocks the Myco invasion to the lungs.

Moreover, our epithelial cells are capable to produce mucus that traps the Mycos, together with toxic substances anti-Mycos called

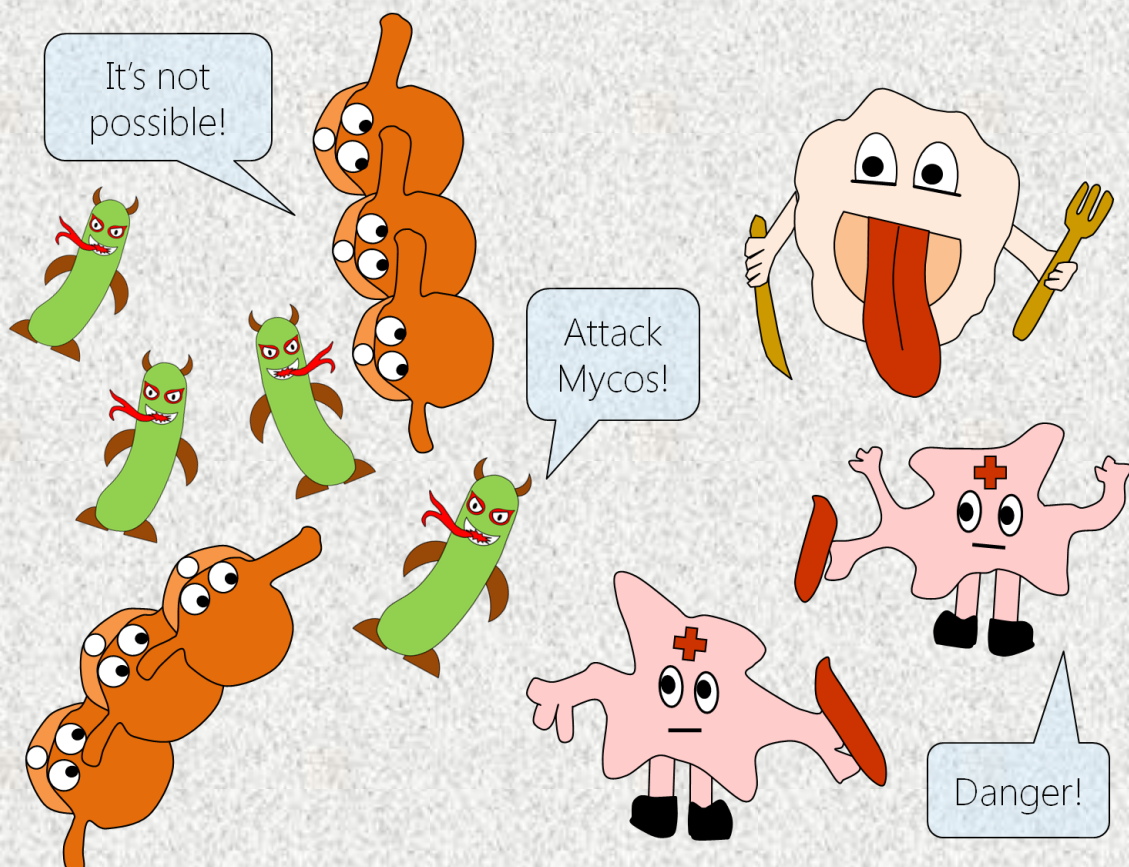
“antimicrobial peptides”. We will call Vilma to one of our epithelial cells.

Most times our epithelial cell barrier is sufficient to block the Myco attack. However, in some cases, the Mycos reproduce and cross the barrier. When such threatening event occurs, we need our immunocytes to defend us. I will show you this battle in the next chapters.

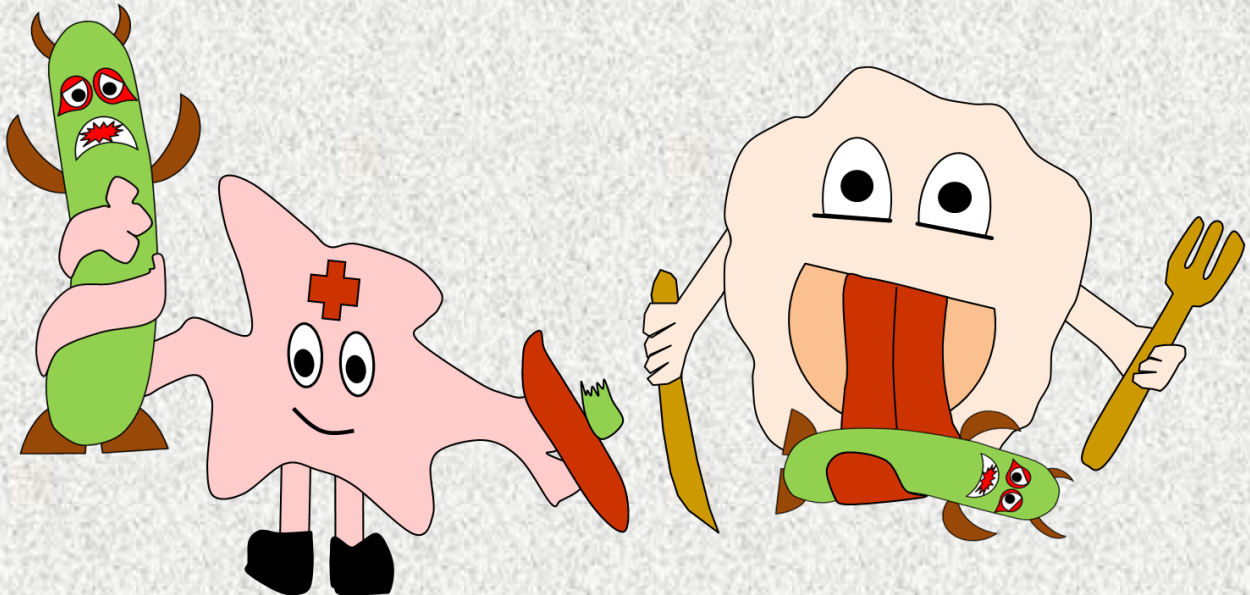
Let’s help Vilma to solve the following questions:

1. How do Vilma and her friends defend us from the attack?

2. What are the “antimicrobial peptides”?



Chapter 3: Bertha and Fefon start the battle



At times the ugly Mycos reproduce and cross the epithelial barrier of our respiratory mucosa, resulting in a menace to our lungs.

To combat the invading Mycos we have a second protective barrier below the epithelial cells. This barrier is formed by two immunocytes that are able to detect the Myco attack and start the battle: Bertha the dendritic cell and Fefon the macrophage.

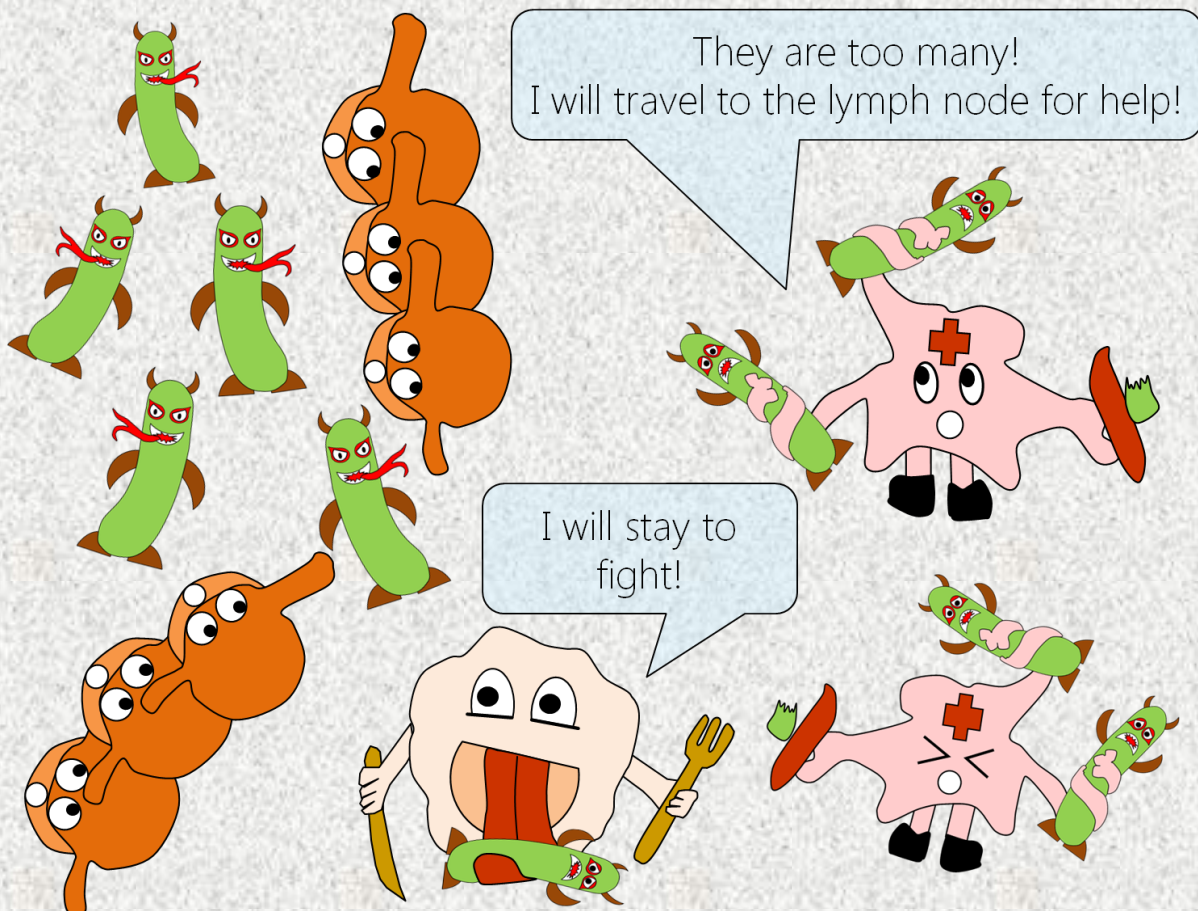
Bertha catches the aggressive Mycos and eats them in a process called "phagocytosis". After eating some Mycos, Bertha cuts them into small pieces. These pieces will be utilized to activate the commanders of the anti-Myco army: our TH1 lymphocytes.

While Bertha travels to find and activate the TH1 lymphocytes, Fefon and his friends the macrophages fight with energy to contain the Myco attack.

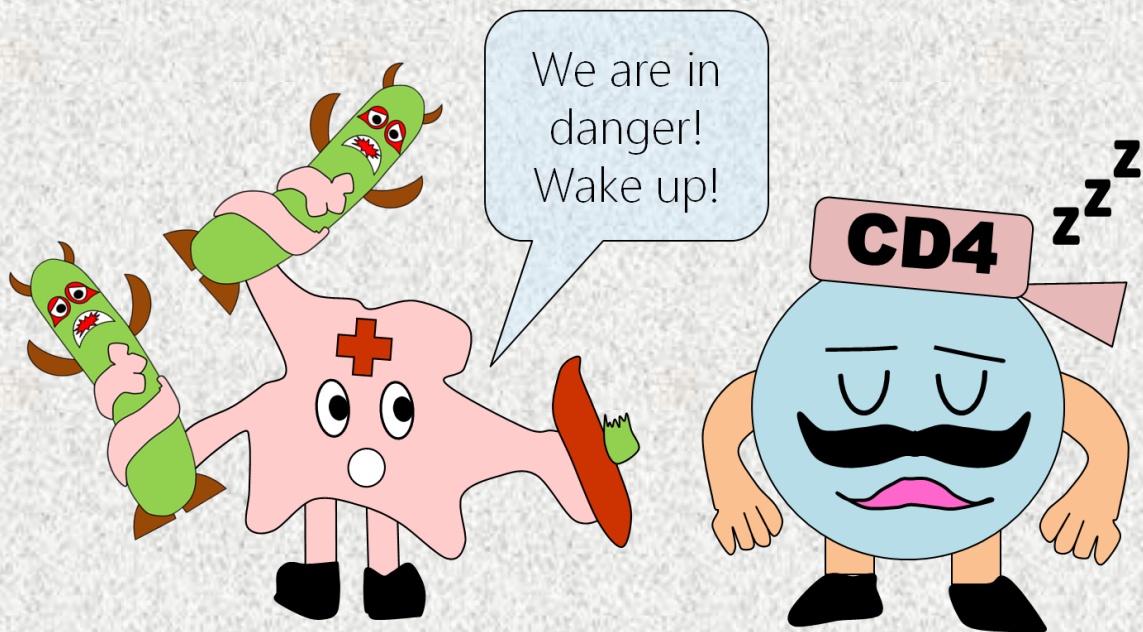
Let's help Bertha to solve the following questions:

1. What is the name of our cells that detect the Myco attack?
_____ the dendritic cell and _____ the big macrophage.
2. What is the response of Bertha when she encounters the invading Mycos?

3. What is the response of Fefon when he encounters the aggressive Mycos?



Chapter 4: Waking up our TH1 commanders



Felix is our T CD4 lymphocyte. His principal work is to collaborate with the other immunocytes to activate them and improve their function.

Well, after eating some Mycos and cutting them into pieces, Bertha travels from the site of infection to the lymph nodes to wake Felix. Our lymph nodes are bean-shaped organs that serve as headquarters of our immunocytes.

When Felix identifies the Myco fragments, he specializes and converts into Felicon, our CD4 TH1 lymphocyte, the commander of our anti-Myco army.

In the next chapter we will see how Felicon travels from the lymph nodes to the place of infection to promote the total elimination of the invader Mycos.

Please help Felicon to solve the following problems:

1. Where does the encounter between Felix and Bertha occur?

2. What are the lymph nodes?

3. What happens when Felix identifies the Myco fragments presented by Bertha?

4. What is the name of the commander of our anti-Myco army?



Chapter 5: Felicon, the commander TH1



Felicon is our TH1 lymphocyte, the commander of our anti-Myco army. He belongs to the group of T CD4 lymphocytes.

Felicon develops in the lymph nodes after identifying the Myco fragments presented by Bertha, our dendritic cell.

To execute his function Felicon travels to the body sites where the Mycos are invading. Once there he makes two very important actions:

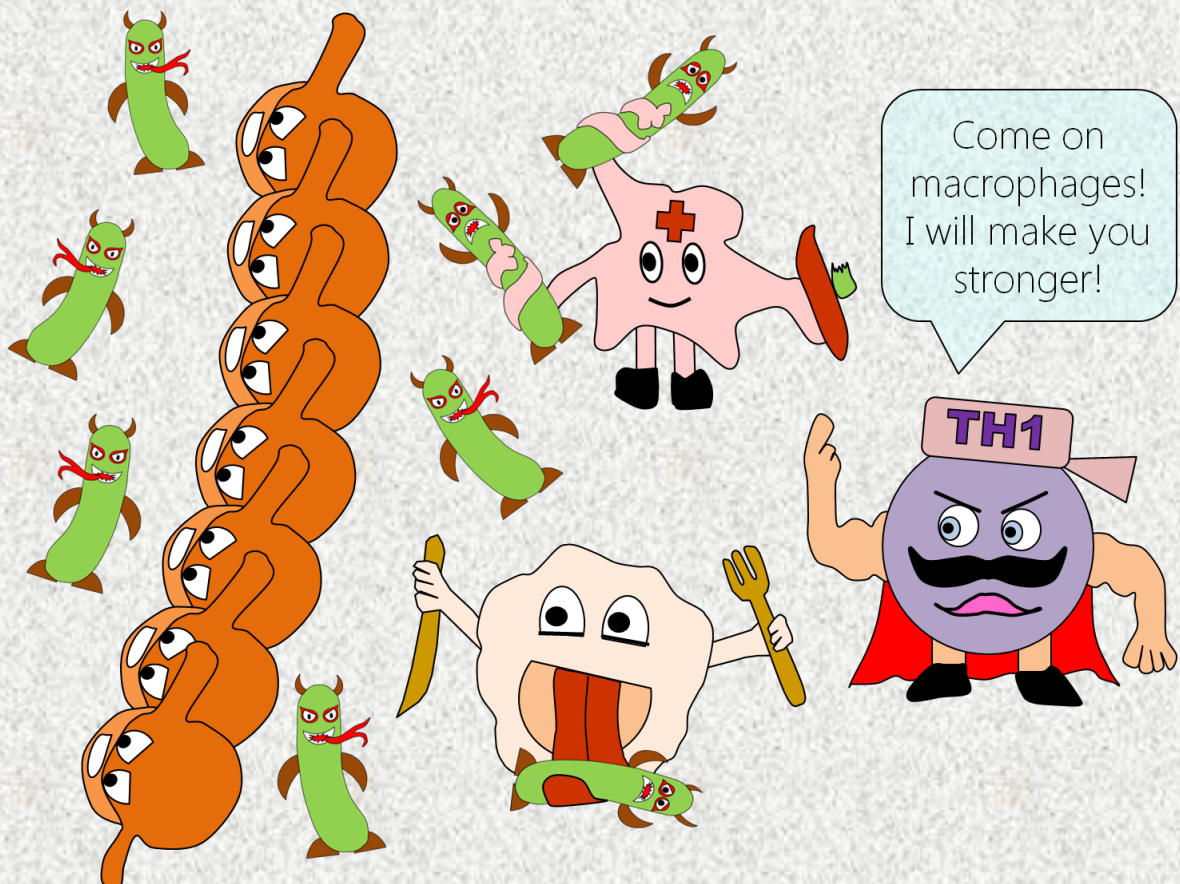
- He stimulates epithelial cells to produce substances that weaken the Mycos, called "antimicrobial peptides".
- He empowers our best warriors against the Mycos for the final battle: the macrophages.

Please solve the following questions about our commander Felicon, the TH1 lymphocyte:

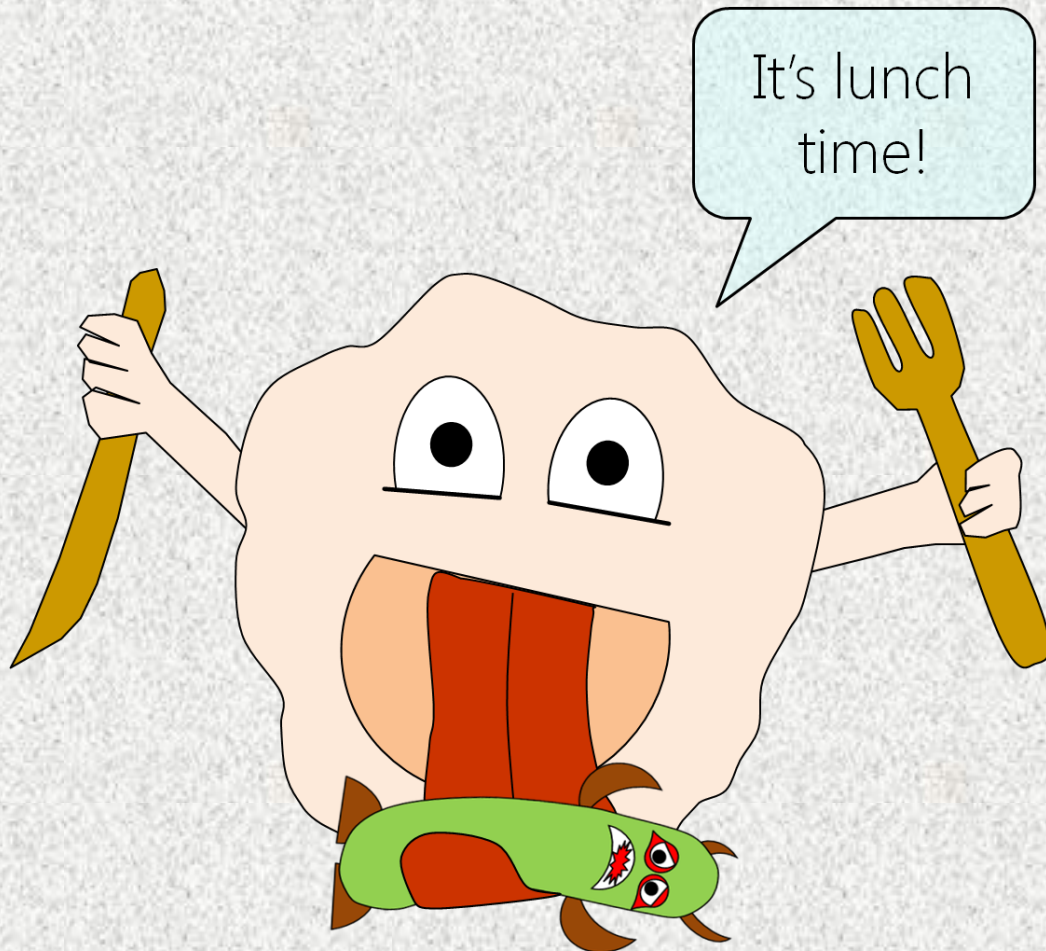
1. Who activates Felix to convert into Felicon, our TH1 lymphocyte?

_____, the dendritic cell.

2. What are the functions of our TH1 lymphocytes?



Chapter 6: The attack of Fefon the macrophage



Fefon and his friends macrophages are our best warriors against the Mycos. Fefon has the weapons to destroy these enemies.

During the beginning of the infection, Fefon and his friends contain the Myco invasion. However, they need some help to completely eliminate the Mycos. Felicon, our TH1 lymphocyte, provides this help. He arrives to the infection site and produces some substances called interleukins that give Fefon more energy and power.

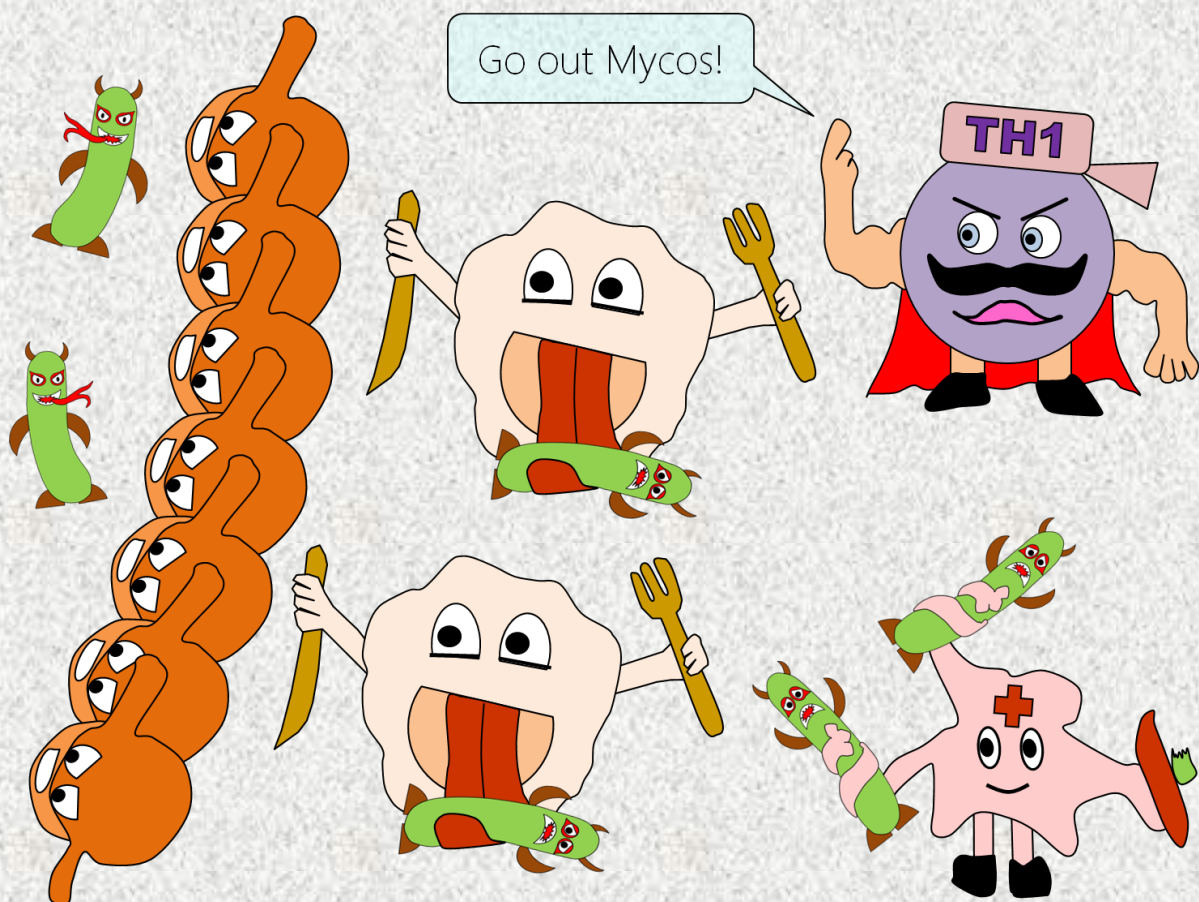
When Fefon gets stronger, he eats all the Mycos and destroys them by producing very toxic substances. Thus, Fefon and Felicon help each other to totally eradicate the infection.

Let's help Fefon to solve the following questions:

1. Why are our macrophages so important?

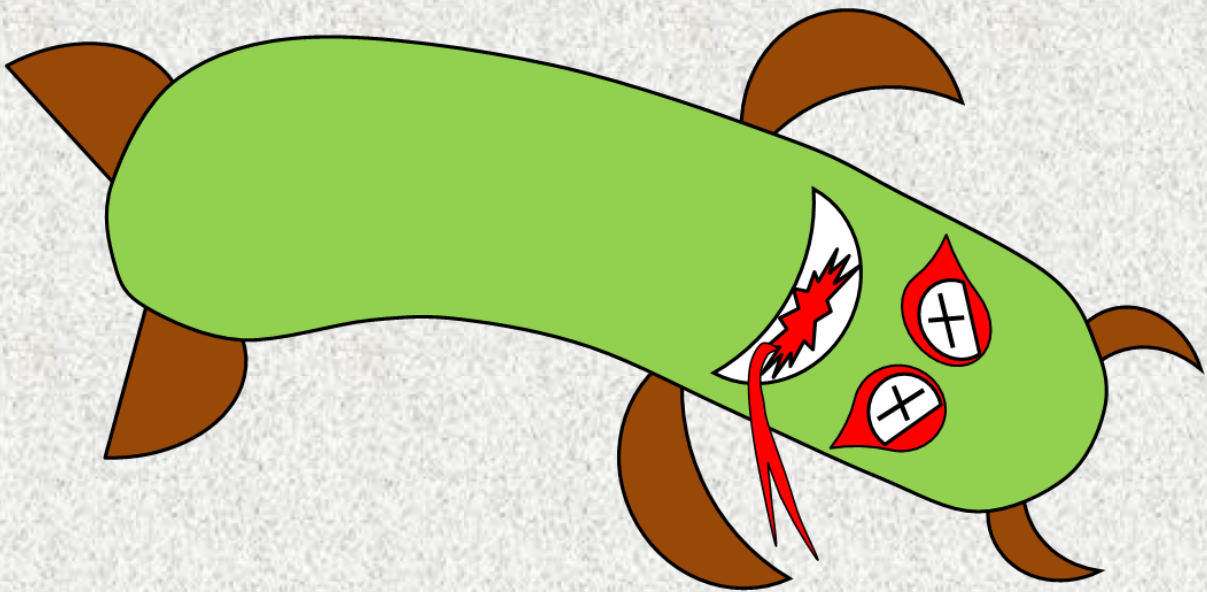
2. Which immunocyte empowers the macrophages?
_____, our TH1 lymphocyte.

3. How does Fefon fight against the Mycos?



Chapter 7:

The death of the Mycos



The cooperative work of our epithelial cells (Vilma), our dendritic cells (Bertha), our TH1 lymphocytes (Felicon) and our macrophages (Fefon) allows us to survive against most of the Myco infections. The action of each of our immunocytes is essential to repel the attacks of the Mycos, and hence to preserve our lives.

Therefore, it is very important that our defense system (immune system) functions properly. We should have a healthy lifestyle to make our immune system stronger. A proper lifestyle includes a healthy diet, frequent exercise, sufficient sleep, and avoidance of toxic substances such as cigarette smoke or alcoholic beverages.

If our immune system weakens, the Mycos will take advantage to cause severe infections such as pulmonary tuberculosis, putting us at risk of death.

Nobody is exempt of risk to get tuberculosis. If we get tuberculosis, we need to promptly receive medications that kill the Mycos. These medications are called “antituberculosis drugs”, such as Isoniazid, Rifampin, Pyrazinamide, or Ethambutol.

When should you suspect pulmonary tuberculosis?

- Cough for several weeks
- Fever
- Weight loss
- General malaise.

If you, a relative or a friend have these symptoms, go promptly to a medical center to get help.

Let’s end this beautiful book by answering the next questions:

1. Which immunocytes protect us from the dangerous Mycos?

2. What happens when our immune system is weakened?

3. What are the “antituberculosis drugs”?

4. When should you suspect pulmonary tuberculosis?

In this little book we have learned how our immunocytes protect us from infections caused by the dangerous Mycos (Mycobacterium tuberculosis).

Do not miss the following sticker book, where I will show you how our immunocytes fight against the big worm *Ascaris lumbricoides*.

Juan Carlos Aldave, MD

Allergy and Clinical Immunology

Contributors:

- Dr. Juan Félix Aldave Pita.
- Bertha Alicia Becerra Sánchez.

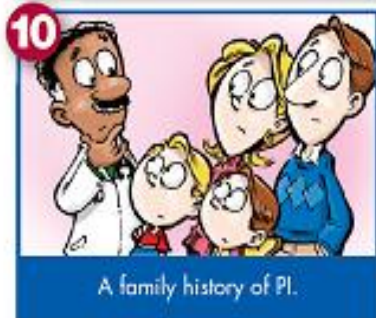
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"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life". John 3:16

10 Warning Signs of Primary Immunodeficiency

Primary Immunodeficiency (PI) causes children and adults to have infections that come back frequently or are unusually hard to cure. 1:500 persons are affected by one of the known Primary Immunodeficiencies. **If you or someone you know is affected by two or more of the following Warning Signs, speak to a physician about the possible presence of an underlying Primary Immunodeficiency.**



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Orders:

Jirón Domingo Cueto 371, Of. 301, Lince, LIMA 14

Lima, Peru

Phones: +51 948-323-720

+51 988-689-472

jucapul_84@hotmail.com

funny.immunology@gmail.com

www.alergomed.org/immunocytes