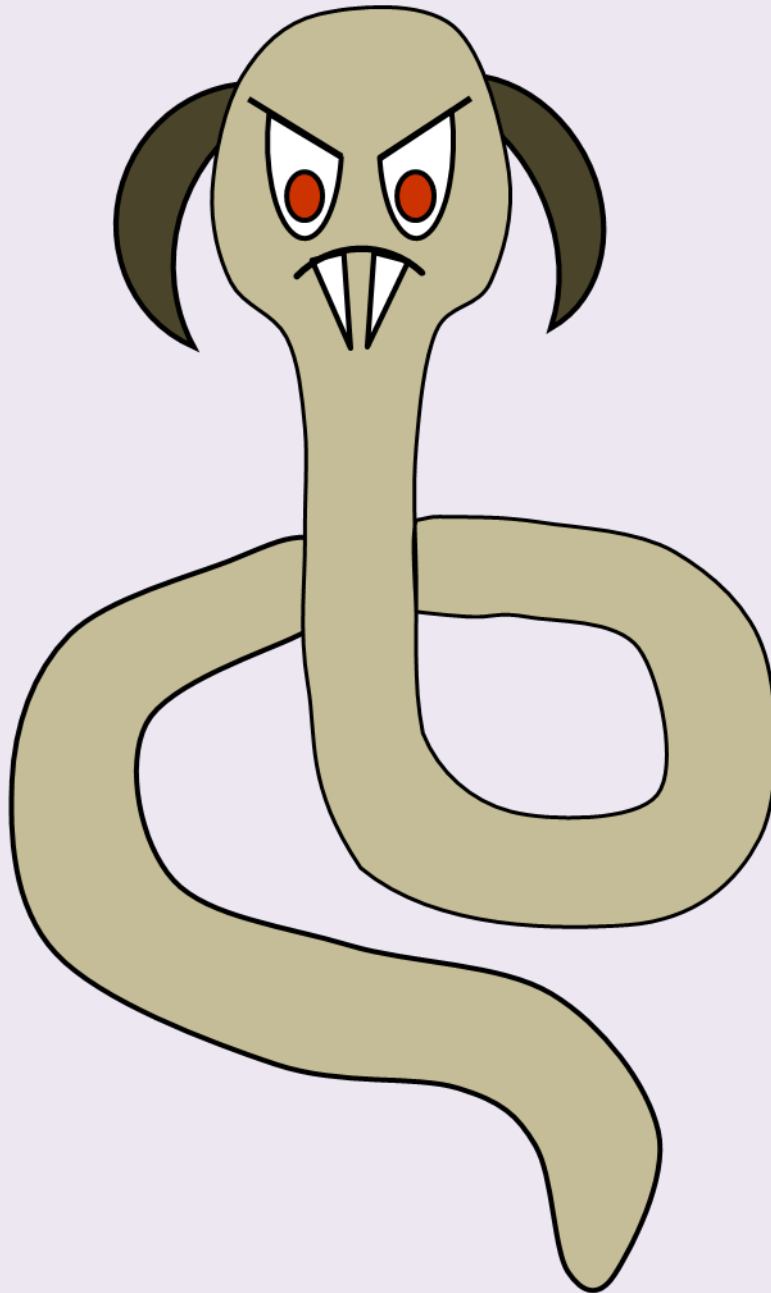


The Immunocytes against the Ascaron

The importance of our TH2 army



Juan Carlos Aldave, MD
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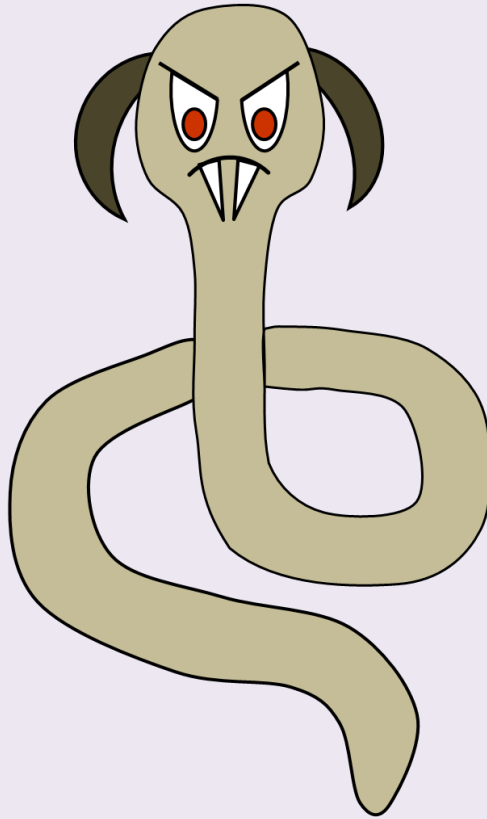
Around us, in the environment, there are many germs that can harm us, causing illness or even death.

There are 4 major groups of germs: 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 contagious germ: the big worm *Ascaris lumbricoides*.

Chapter 1: The enemy Ascaron



The enemy *Ascaris lumbricoides*, which we will call only Ascaron, is a worm that belongs to the family of the helminths. It measures up to 35 centimeters long, fifty thousand times larger than our immunocytes.

The Ascaron and its friends are very contagious worms that like to live in our small intestine, causing complaints such as abdominal pain, loss of appetite and malnutrition. The Ascaron can cross through the intestinal wall and reach our blood and other organs such as the lungs or the liver. When the Ascaron passes through the lungs it can generate symptoms similar to asthma or pneumonia.

The Ascaron reproduces in our gut by laying millions of eggs, which are expelled from our intestines in the feces to infect other human beings. The eggs of the Ascaron are tiny, invisible to our eyes. We can be infected by eating these eggs through contaminated foods or beverages. The eggs reach our small intestine, where they develop into larvae and adult worms.

The Ascaron and its friends infect millions of people worldwide, especially in places with poor hygiene. The Ascaron learns to hide inside our intestines to avoid the attack from our immune cells. There, the Ascaron feeds from what we eat, and reproduces.

In the following chapters we will see how our immune cells defend us against the Ascaron invasion.

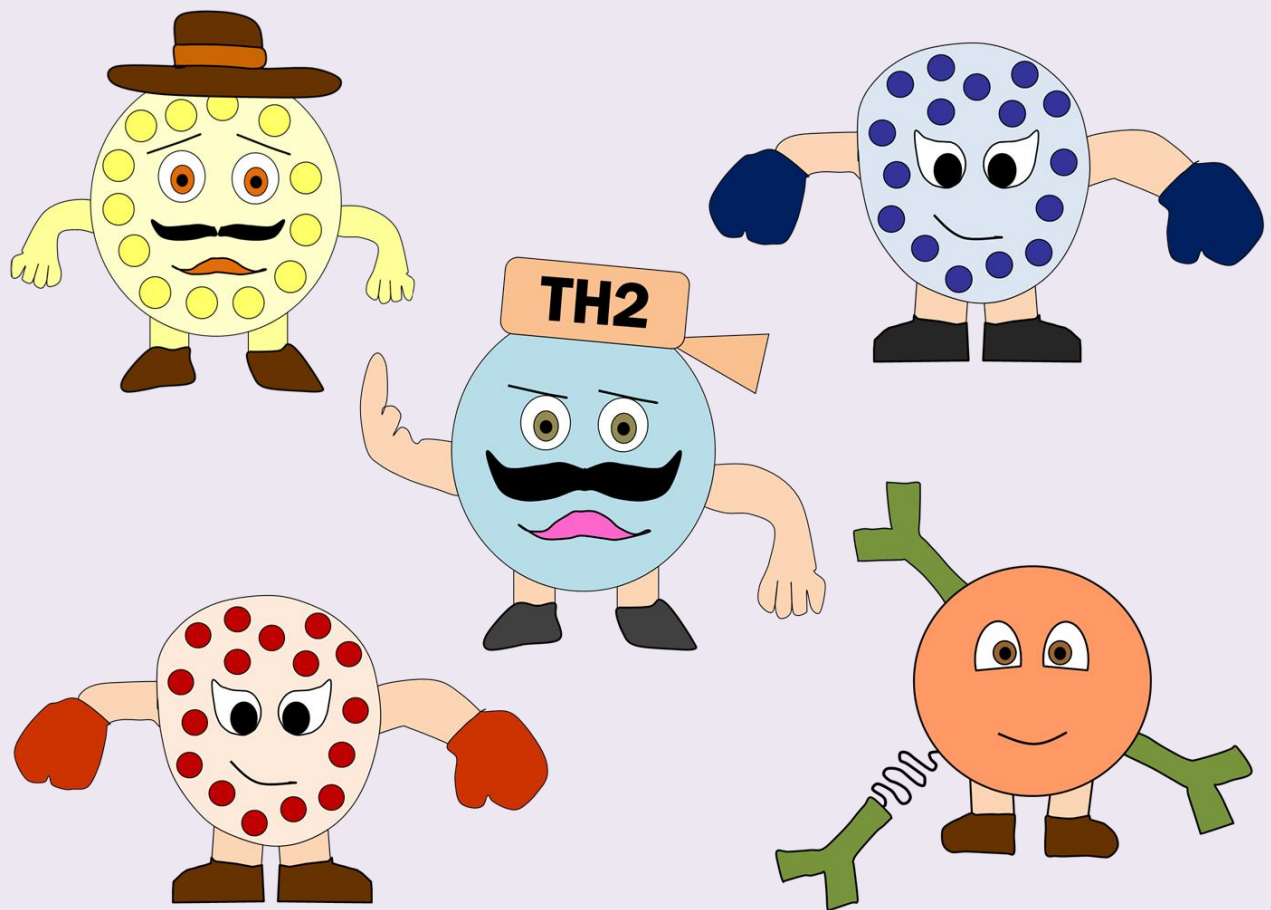
Please answer the following questions about this large and contagious worm:

1. What is the size of the Ascaron (*Ascaris lumbricoides*)?

2. How can we be infected by the Ascaron?

3. Which organ of our body is the preferred living place for the Ascaron?

Chapter 2: The immunocytes against the Ascaron



In the previous chapter we learnt that the Ascaron is a very large and contagious worm. To eliminate the Ascaron, we need a whole group of immunocytes called the TH2 army.

The TH2 army is commanded by our CD4 TH2 lymphocyte, who directs the other immunocytes to expel the Ascaron from our gut or to kill it in our tissues.

Our other immunocytes involved in the elimination of the Ascaron are the B lymphocytes, the eosinophils, the mast cells and the basophils.

Complementing our immunocytes, we have a very important type of antibody to defend us against the Ascaron. This antibody is called immunoglobulin E.

In the next chapters we will meet each of the immunocytes of our TH2 army. Please answer the following questions:

1. True or false? The cell battalion responsible to kill the Ascaron is our TH2 army _____
2. Which immunocytes belong to the TH2 army?



Chapter 3: Feliciano, the CD4 TH2 lymphocyte



In the book "The Immunocytes" we met Felix, our T CD4 lymphocyte. His main function is to collaborate with the other immunocytes to activate them or enhance their action.

When Felix detects the Ascaron attack, he wakes up and converts into Feliciano, our CD4 TH2 lymphocyte, the commander of our anti-Ascaron army.

Feliciano heads the TH2 army by producing substances called interleukins, which function as information messages. For example:

- Interleukins number 4 and number 13 stimulate the B lymphocytes to produce immunoglobulin E.
- Interleukin 5 calls the eosinophils to fight.
- Interleukin 3 attracts the basophils for the battle.
- Interleukin 9 activates the mast cells to generate inflammation.

Therefore, Feliciano brings together and strengthens our TH2 army to attack the Ascaron everywhere.

In the next chapter we will meet Moli, our B lymphocyte. Let's help Feliciano to solve the following questions:

1. What happens when Felix detects the attack from the Ascaron?

2. What is the name of the commander of our anti-Ascaron army?

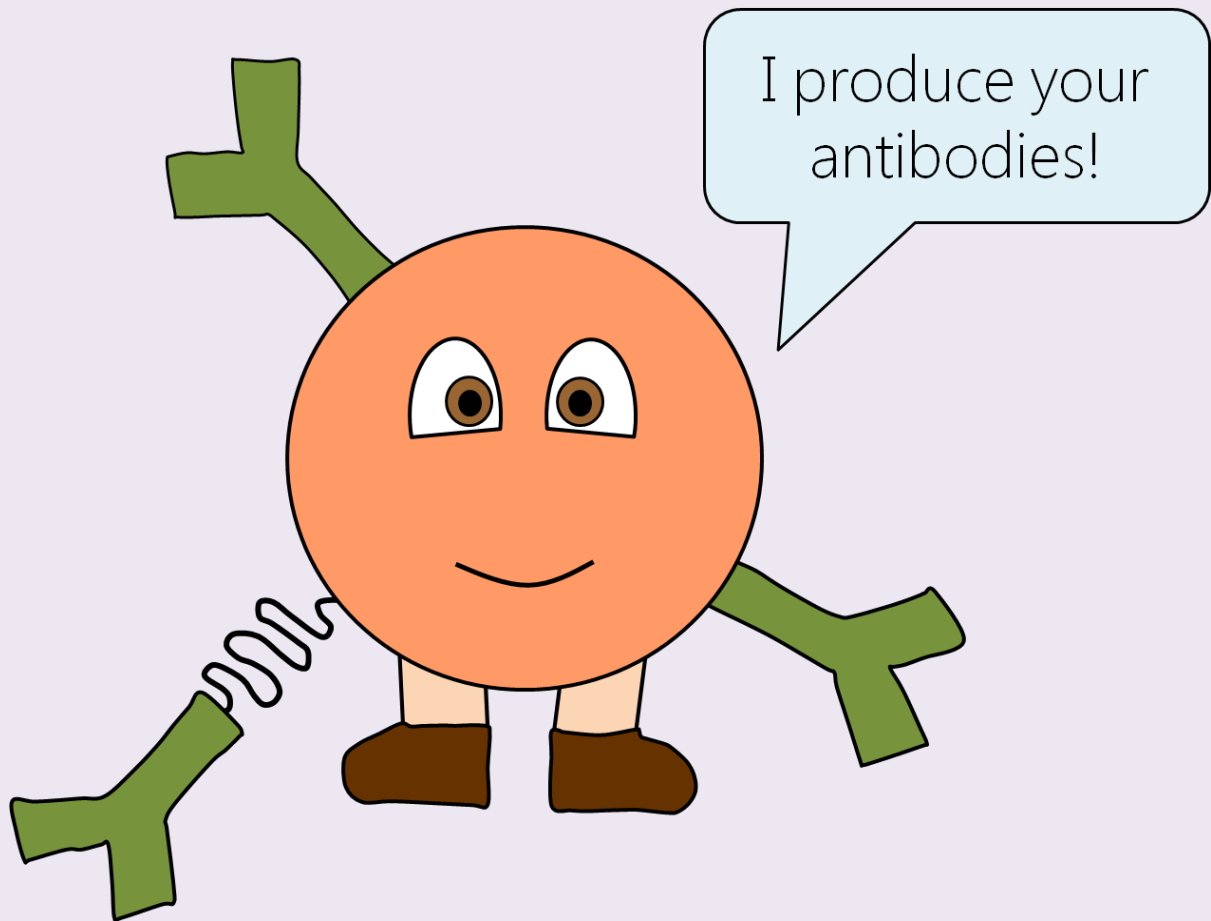
3. What are the interleukins?

4. Use arrows to connect the effect of the interleukins produced by Feliciano:

IL-3	Activates the mast cells to generate inflammation
IL-4	Calls the eosinophils to fight
IL-5	Attracts the basophils for the battle
IL-9	Increases the production of immunoglobulin E

Chapter 4:

Moli, the B lymphocyte



Moli is our B lymphocyte. His main function is to fabricate antibodies, also called immunoglobulins. Our immunoglobulins are extremely valuable proteins that defend us against microbes. We have 5 big classes of immunoglobulins: IgG, IgA, IgM, IgD e IgE.

During the battle against the Ascaron, Feliciano helps Moli to produce big amounts of immunoglobulin E. This antibody class

stimulates our mastocytes, basophils and eosinophils to attack and destroy the big worm.

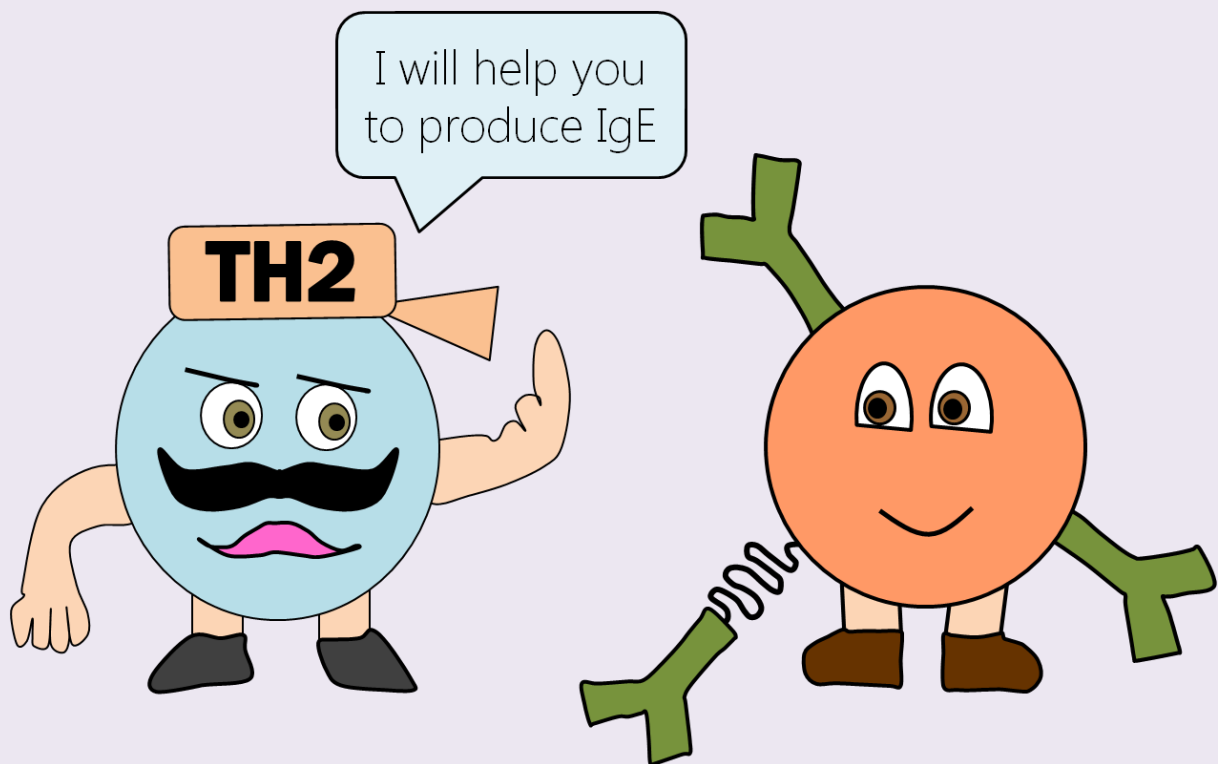
In the next chapter we will meet a new immunocyte of our anti-Ascarón army: Lenar the eosinophil.

Let's help Moli to solve the following questions:

1. What is the main job of Moli?

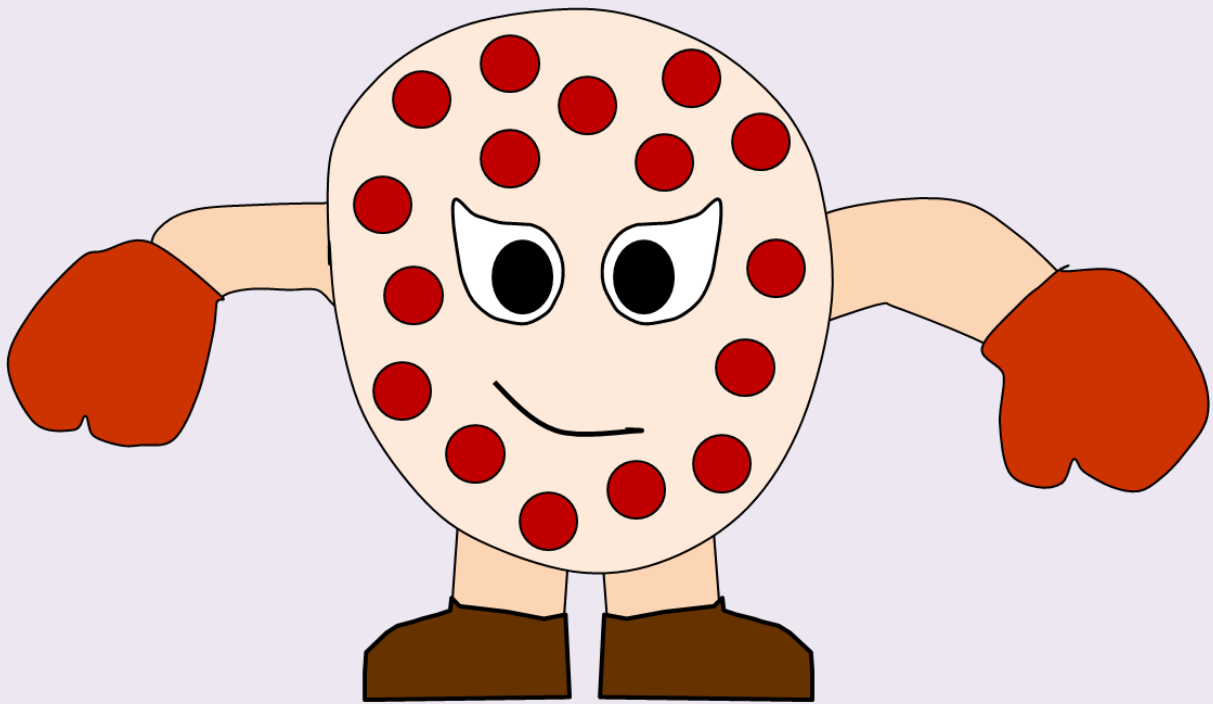
2. Who helps Moli to produce big amounts of immunoglobulin E?

3. What is the function of our immunoglobulin E?



Chapter 5:

Lenar, the eosinophil



The eosinophils are specialized immunocytes that fight against worms such as the Ascaron. Like the other immunocytes, our eosinophils are born in the bone marrow with a size of 10 micrometers, equivalent to one millimeter divided by one hundred.

The eosinophils travel through our blood for 3 days before migrating into our tissues where they live some days more. Their main function is to kill parasitic worms by throwing powerful toxic substances.

We will name Lenar to our friend eosinophil. Lenar is very important to defend us against the attack of the Ascaron.

Feliciano, our TH2 lymphocyte, has the ability to attract and activate Lenar through the production of interleukin number 5.

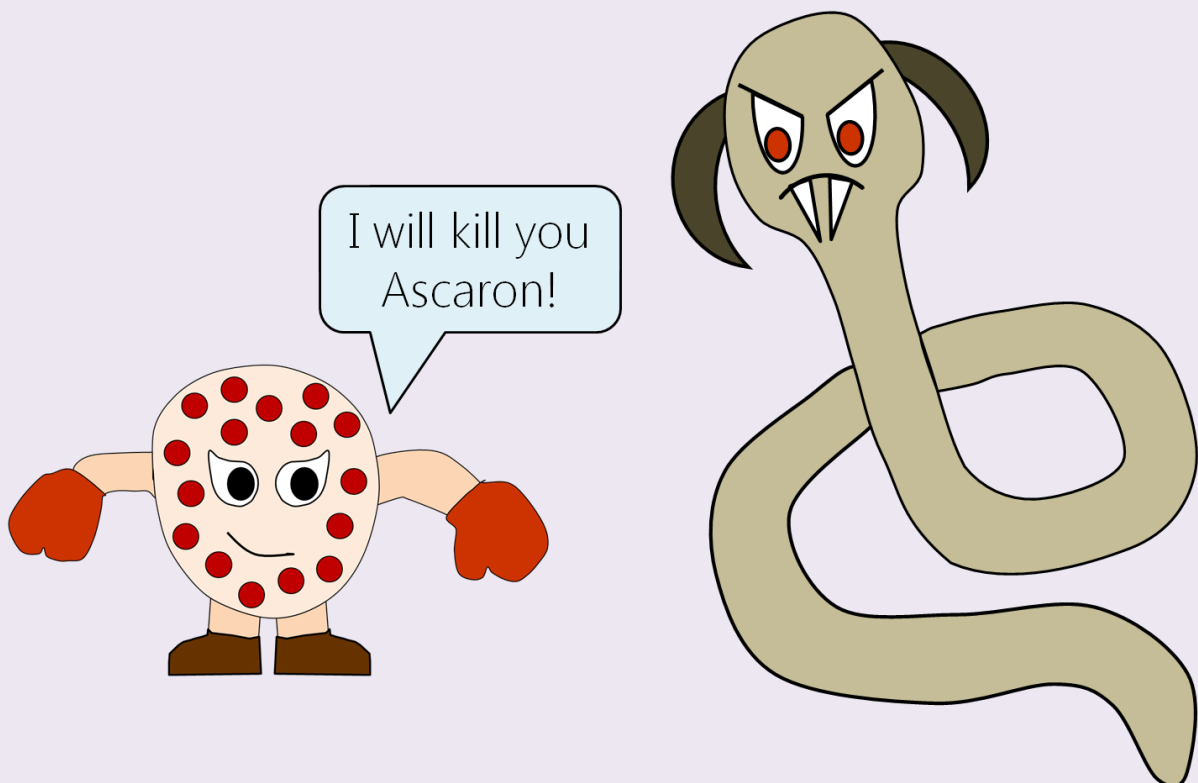
Sometimes the eosinophils activate inappropriately to innocuous stimuli and generate unnecessary damage in our tissues, for example, in some allergic diseases.

Let's help Lenar to answer the following questions:

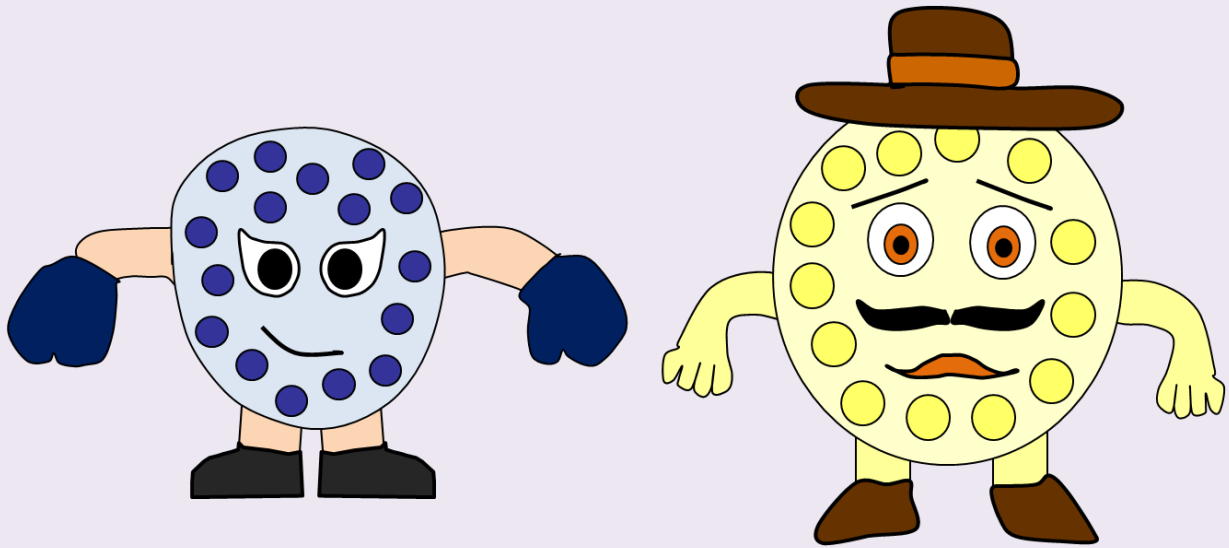
1. What is the main function of our friend Lenar, the powerful eosinophil?

2. Which immunocyte has the ability to attract and activate Lenar?

_____, our TH2 lymphocyte, through the production of _____.



Chapter 6: Beto the basophil, and Kike the mast cell



Beto is our basophil friend. His main function is to fight against some parasites such as ticks or the worm Ascaron. Beto has a friend named Kike, the mast cell. Beto lives in our blood and Kike in our tissues like the skin, the nasal mucosa and the intestines. The functions of these two immunocytes are quite similar.

When the Ascaron invades us, Beto and Kike are capable to produce substances that alert other immunocytes about the invasion. One of these substances is named 'histamine'. As a result, other immunocytes can reach the battle.

Beto and Kike boost our TH2 army to kill the Ascaron. However, when they activate to harmless stimuli, both immunocytes can

generate damage in our healthy tissues. This occurs in several allergic diseases.

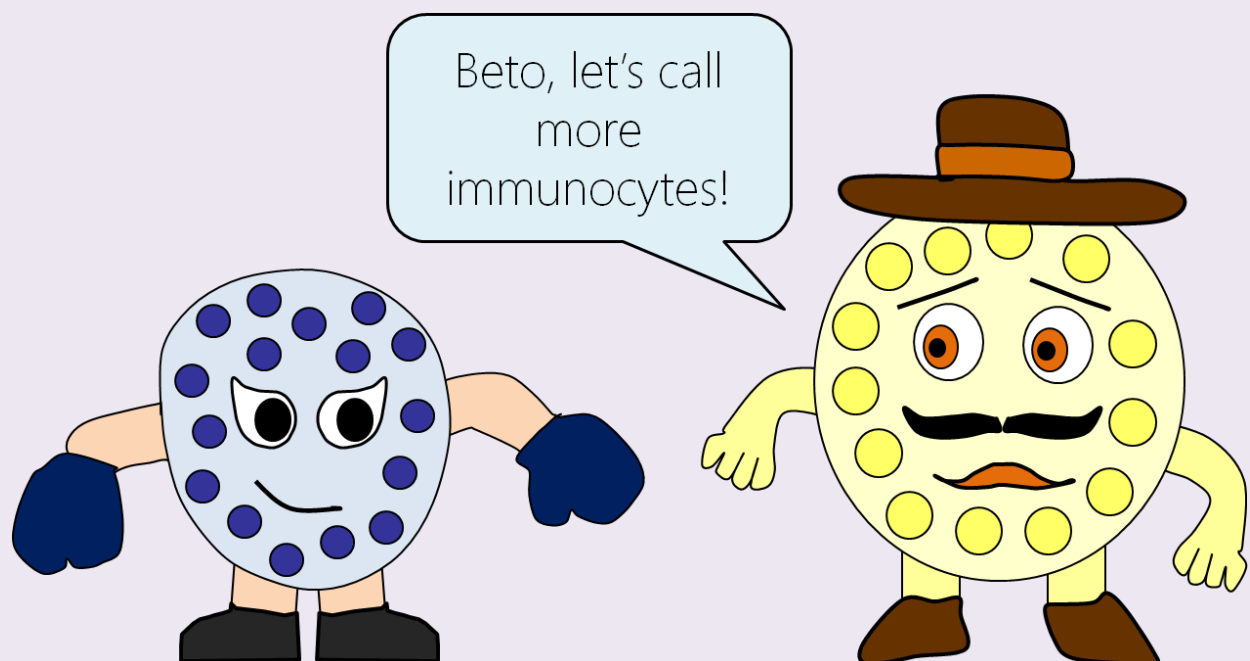
Feliciano, our TH2 lymphocyte, has the ability to attract and activate Beto and Kike through the production of interleukins number 3 and 9.

Please help Beto and Kike to solve these questions:

1. What is the main function of Beto and Kike?

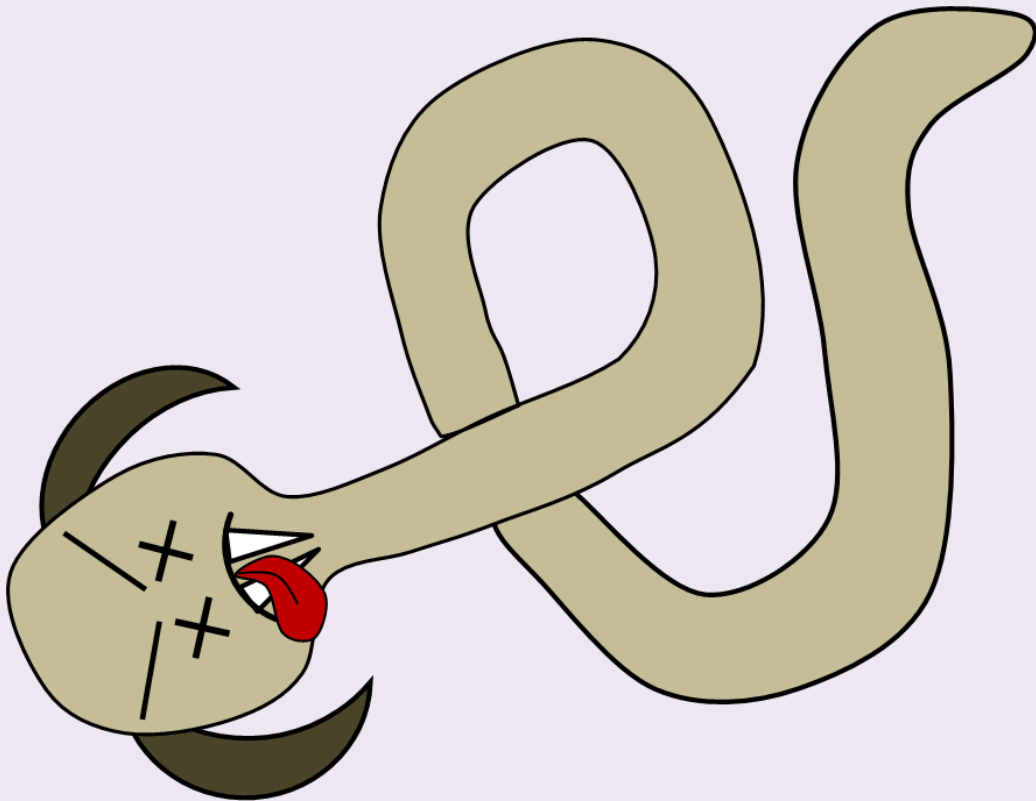
2. Which immunocyte can attract and activate Beto and Kike?

3. What happens when our basophils and mast cells activate to harmless stimuli?



Chapter 7:

The death of the Ascaron



Our immunocytes are very little compared with the worm Ascaron. Nevertheless, the cooperative work of our TH2 army, conformed by Feliciano, Moli, Lenar, Beto and Kike, allows us to defend against most of the invasions by this big worm.

Therefore, it is very important that our defense system (immune system) functions properly. If our immune system weakens, the Ascaron and other germs will take advantage to generate infections, putting us at risk of disease or even death.

A good hygiene and a healthy diet are important to prevent infections by the Ascaron.

When the Ascaron and his friends invade us despite the efforts of our immunocytes, there are medications that can help us to kill the worms. These drugs are called "antihelmintic drugs" since the Ascaron is classified as a helminth worm.

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

1. Which immunocytes protect us from the Ascaron?

2. What happens when our immune system is weakened?

3. What are the antihelmintic drugs?



In this little book we have learned how
our immunocytes protect us from
infections caused by the big worm
Ascaris lumbricoides.

Do not miss the following sticker book,
where I will show you how our
immunocytes fight against the dangerous
enemy *Streptococcus pneumoniae*.

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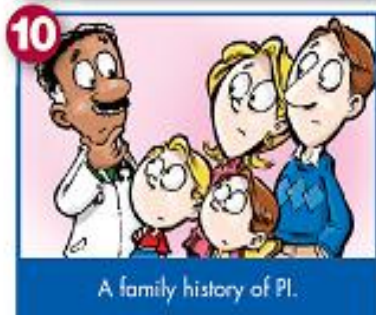
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"For God so loved the world that he gave his one and only Son, that whoever believes in him shall not perish but have eternal life". John 3:16

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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