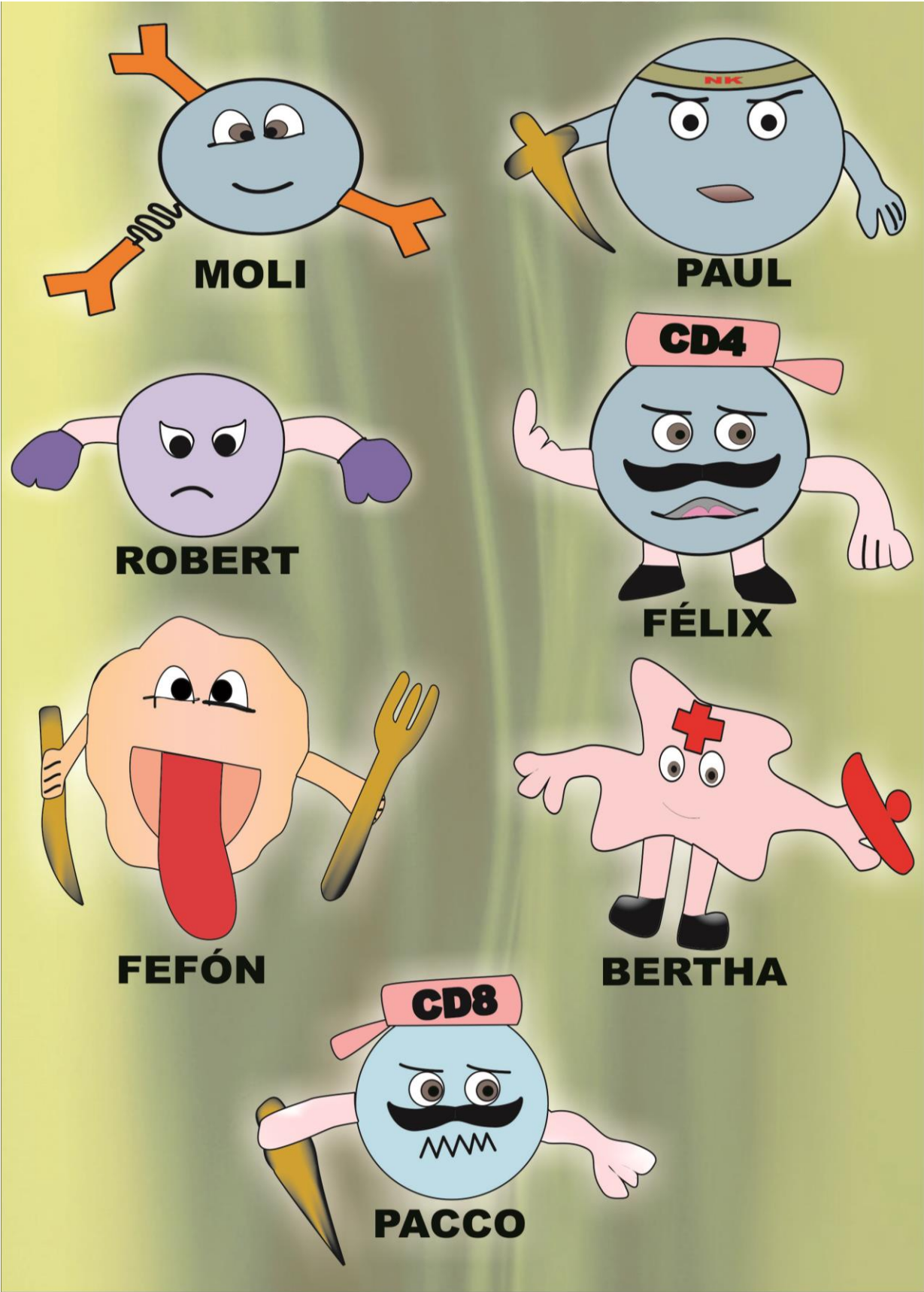


# THE IMMUNOCYTES

Educational sticker book about our defense cells



**Juan Carlos Aldave Becerra, MD**  
Allergy and Clinical Immunology

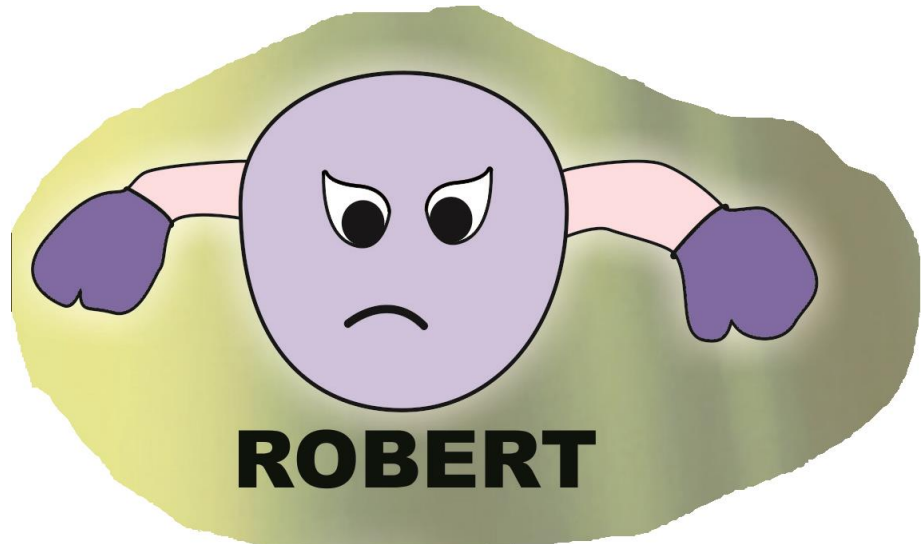
Around us, in the environment, there are many microbes that can harm us, causing illness or even death.

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 teach you about the life and function of seven of our most important immunocytes.

# Robert, the neutrophil



The first immune cells that we will meet are neutrophils, which represent the most abundant immunocytes in our blood. Similar to the other immunocytes, neutrophils are born in the bone marrow with a size of 10 micrometers, that is, a hundredth of a pinhead.

Neutrophils have a very short life, from 6 hours to 4 days, so they need to be renewed permanently from the bone marrow. Once in the blood, neutrophils circulate through our body patrolling for warning signals. We will call these warning signals as "inflammation".

Many microbes can generate inflammation and damage in our body tissues. Neutrophils rapidly detect inflammation and go out of the blood into the injured tissue to fight. They

fight by eating microbes or releasing toxic substances. Neutrophils usually die during the battle, so we can consider them "war heroes".

Our neutrophils are very important to defend us against bacteria and fungi. We will name one of our neutrophils. We will call him Robert.

Please solve the following questions to keep in mind the importance of our neutrophils:

1. Which are the most abundant immune cells in our blood?

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2. How long do neutrophils live?

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3. Against what microbes the neutrophil Robert is very important?

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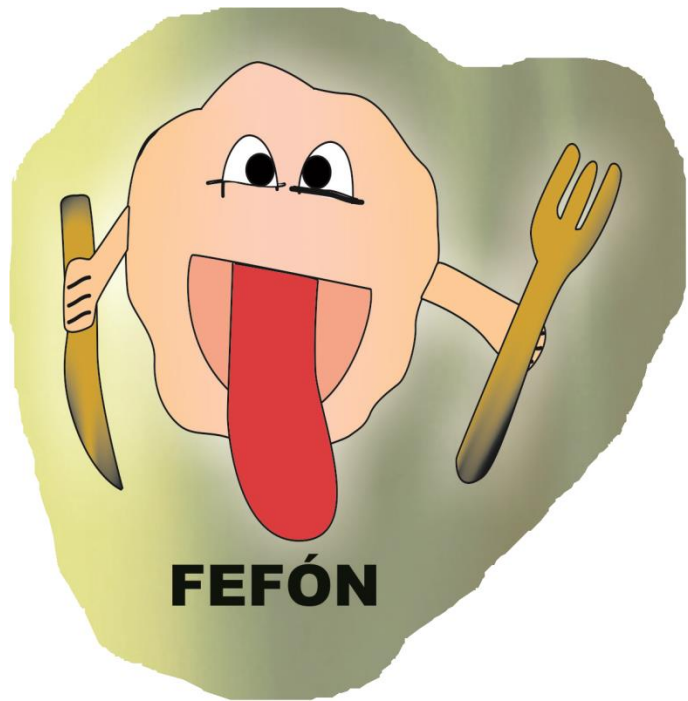
4. How do neutrophils kill microbes?

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5. Why neutrophils are called as "war heroes"?

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# Fefon, the macrophage



The second group of immunocytes that we will study are the macrophages. Macrophages originate in the bone marrow and live in several tissues of our body. When circulating in the blood they are called monocytes.

Macrophages live several months, depending on the tissues in which they reside and on the microbes that they find.

The main function of macrophages is to eat microbes and destroy them; therefore they are also called phagocytes ("eating cells"). Macrophages are the "big phagocytes", with a size of 20 micrometers, twice the size of neutrophils. Neutrophils are the "small phagocytes".

Following the detection of a dangerous microorganism, the macrophage traps, eats and destroys it. Furthermore, the big phagocyte sends warning signals to other cells, which are recruited to the infection site to help in the battle. That is, macrophages are capable of generating inflammation.

Our macrophages are very important to defend us against the bacteria and fungi living inside or outside our cells. We will name Fefon to our hungry macrophage.

Please answer the following review questions on macrophages:

1. Where are macrophages born?

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2. How do you call macrophages when they are circulating in the blood?

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3. What is the size of the macrophage Fefon?

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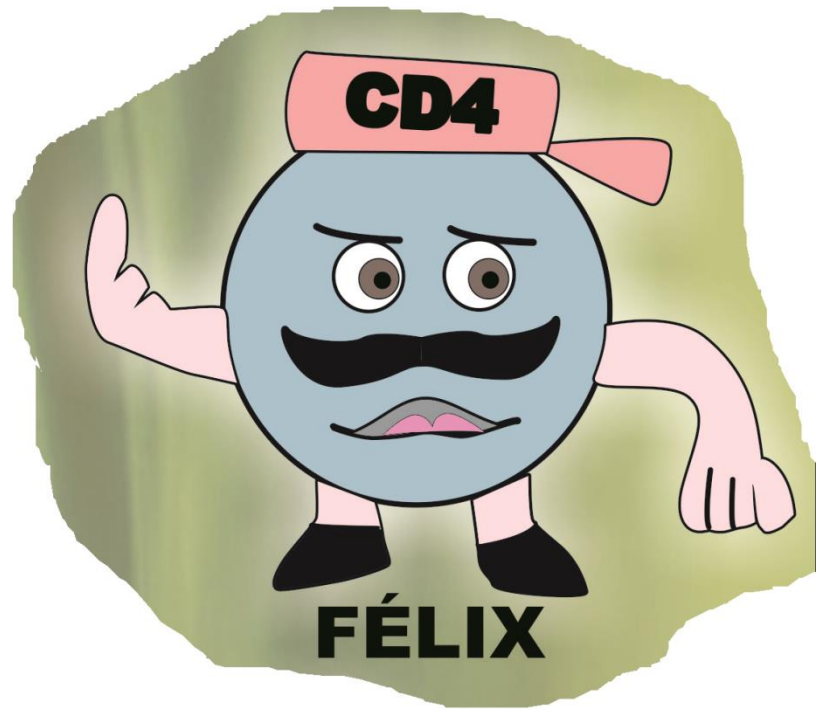
4. What is the main function of macrophages?

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5. Against what microbes macrophages are important?

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# Felix, the T CD4 lymphocyte



The T CD4 lymphocytes, also called T helper cells, are the commanders of the immunocyte army. Their role is to collaborate with the other immune cells for an optimal function. For example, if a macrophage requires collaboration to destroy an ingested microbe, the T helper cell appears to help the phagocyte. If a B lymphocyte wants to produce better antibodies, the T CD4 lymphocyte collaborates with him to achieve the goal.

T CD4 lymphocytes originate in the bone marrow and complete their development in the thymus, a lymphoid organ located in the thorax, near to the heart and lungs. T helper

cells can live many months or years, even throughout our life.

When a T CD4 lymphocyte encounters a microbe, he can "clone" himself to form a battalion of identical cells. This phenomenon is called "clonal expansion".

After a battle between immunocytes and microbes, T helper cells are capable to remember the germ forever, so that our immune system can respond faster and stronger against a repeated infection. This process is known as "memory".

Our T CD4 lymphocytes are essential to defend us against all types of microbes (viruses, bacteria, parasites and fungi). Let me introduce you our friend Felix, the T CD4 lymphocyte.

Please solve the following questions to check if you have understood the importance of our T CD4 lymphocytes:

1. How T CD4 lymphocytes are also named?

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2. What is the main function of CD4 T lymphocytes?

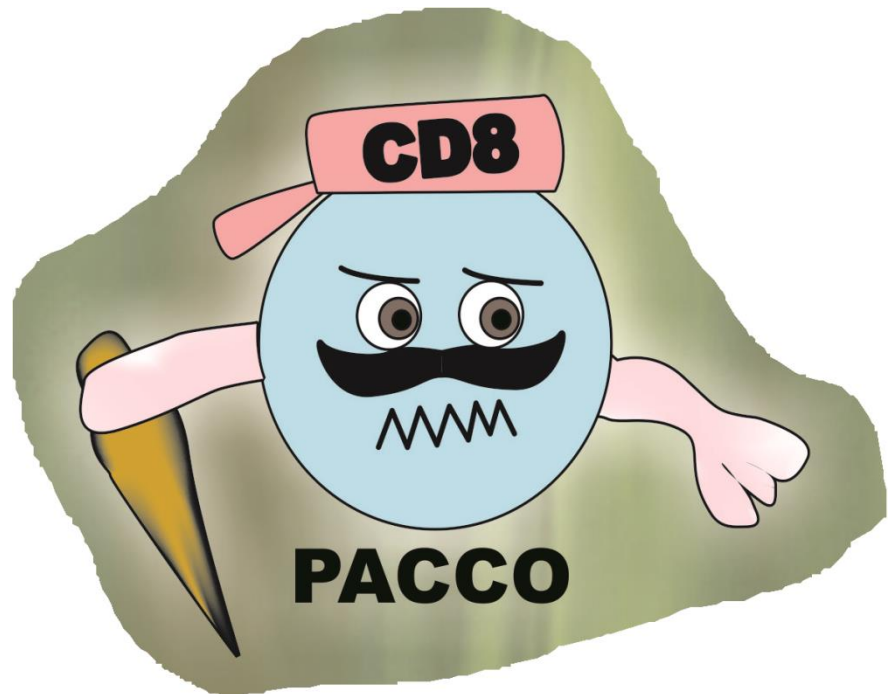
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3. From what kind of microbes we are protected by T helper cells?

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# Pacco, the T CD8 lymphocyte



T CD8 lymphocytes are also known as cytotoxic T cells because they are capable to kill other cells directly. When a T CD8 lymphocyte finds a cell infected by a virus or a malignant tumor cell, the T lymphocyte destroys it.

T CD8 lymphocytes, similar to their T CD4 relatives, are born in the bone marrow and complete their development in the thymus, with a size of around 8 micrometers. Cytotoxic T cells have a prolonged life, from months to years.

When a T CD8 lymphocyte finds a microbe, he can "clone" himself to form a brigade of identical cells. This process is called "clonal expansion".

After a battle between immunocytes and microbes, T cytotoxic cells are capable to remember the germ forever, so that they can fight faster and stronger against a repeated infection. This phenomenon is known as "memory".

Our T CD8 lymphocytes are very important to defend us against viral infections and cancer. We will name Pacco to our powerful cytotoxic T cell.

Let's help Pacco to resolve the following questions:

1. How T CD8 lymphocytes are also named?

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2. What is the main function of CD8 T lymphocytes?

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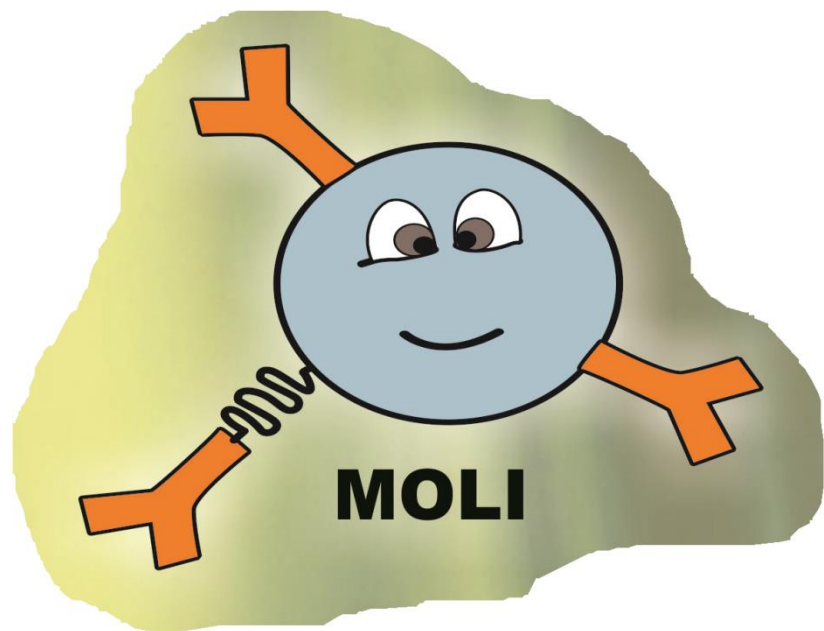
3. From what kind of dangers we are protected by our T cytotoxic cells?

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4. How long is the lifetime of Pacco, our T CD8 cell?

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# Moli, the B lymphocyte



The fifth group of immunocytes that we will meet are B lymphocytes. Our B cells are born in the bone marrow, as well as the other immunocytes. They measure around 8 micrometers, similar to the size of T lymphocytes, and can live several months to years. B lymphocytes can evolve into bigger cells, named plasma cells, which measure 14 micrometers.

The principal function of our B lymphocytes and plasma cells is to produce antibodies, also called immunoglobulins (Ig). There are 5 different classes of immunoglobulins: IgG, IgA, IgM, IgD and IgE. Antibodies are molecules that protect us

from many types of bacteria, viruses and parasites, representing an essential support to our immunocytes.

When B lymphocytes need to improve their antibody production, they request help from the T CD4 lymphocyte.

Similar to T cells, our B lymphocytes are capable to "clone" and form an army of identical cells. They can also develop "memory" after fighting against microbes.

Let me introduce you to Moli, our brave B lymphocyte. Please help Moli to answer the following questions:

1. Where are B lymphocytes born?

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2. What is the principal function of Moli?

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3. From what kind of microbes we are protected by B lymphocytes?

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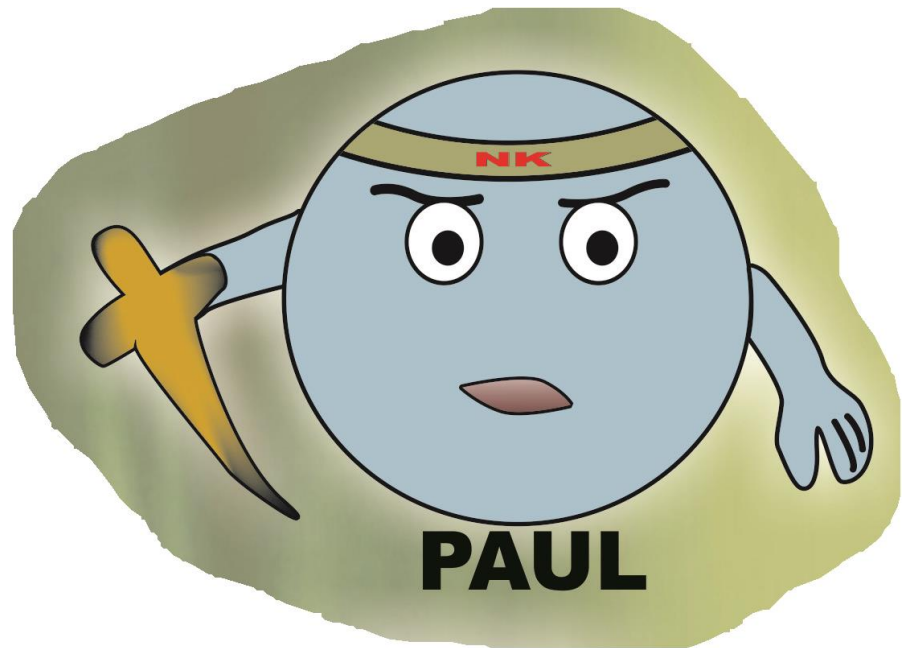
4. ¿How many classes of immunoglobulins do we have?

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5. ¿Why do we say that B lymphocytes can have "memory"?

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# Paul, the NK lymphocyte



Do you remember T CD8 lymphocytes, our immunocytes that can destroy cells infected by viruses and malignant tumor cells? Well, we have another group of immunocytes that complement the actions of T CD8 cells. These are our "natural killer" (NK) lymphocytes. NK cells are always ready to kill other cells.

When NK lymphocytes encounter healthy cells, they are "switched off" by an inhibitor. However, as soon as they find a cancer cell or a virus-infected cell, they wake up and extend their deadly attack, destroying the sick cell.

NK lymphocytes, like our other immunocytes, originate in the bone marrow. They measure around 8 micrometers and can live several months to years. Unlike T and B cells, NK lymphocytes are not able to develop "memory" neither "clonal expansion" after fighting against microbes.

Our NK cells defend us against viral infections and cancer. We will name one of our NK lymphocytes. We will call him Paul.

Please solve the following questions about Paul:

1. Where are NK lymphocytes born?

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2. What is the main function of Paul, our NK cell?

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3. ¿What are the similarities between NK lymphocytes and T CD8 lymphocytes?

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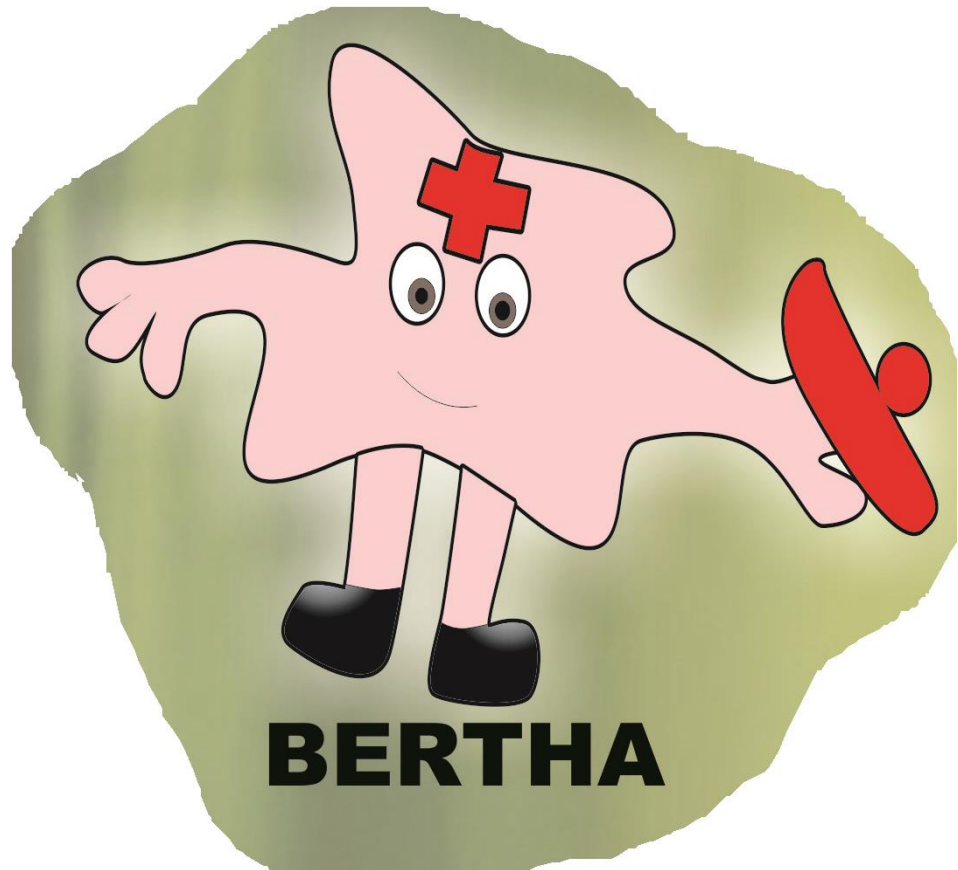
4. ¿What are the differences between NK lymphocytes and T cells?

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5. From what dangers do NK lymphocytes protect us?

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# *Bertha, the dendritic cell*



To achieve an optimal function, T lymphocytes need to be activated by other cells. The main cells that can turn on T lymphocytes are dendritic cells. Dendritic cells are so called because they have extensions (dendrites) that allow them to trap molecules more easily.

Dendritic cells form a network under our skin and mucous membranes. They detect and capture invading microbes, and process them into small fragments that are then presented

to T lymphocytes. Some dendritic cells can also assist in the development and activation of B lymphocytes

Like the rest of our immunocytes, dendritic cells are born in the bone marrow with a size of about 15 micrometers. They can live up to several years.

Bertha is our beautiful dendritic cell. Please help Bertha to solve the next questions:

1. Where are dendritic cells born?

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2. Why they are called "dendritic" cells?

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3. What is the principal function of Bertha, our dendritic cell?

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4. Which lymphocytes are activated by dendritic cells?

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In this little book we have learned about the life and function of seven of our most important immunocytes.

Do not miss the following sticker books, where I will show you how our immunocytes fight against various harmful microbes.

**Juan Carlos Aldave, MD**

Allergy and Clinical Immunology

### Contributors:

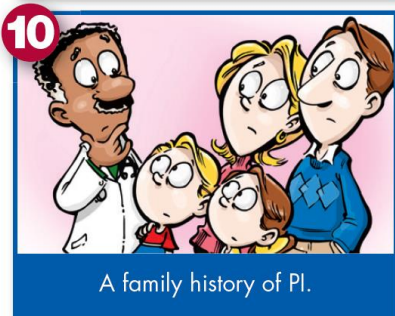
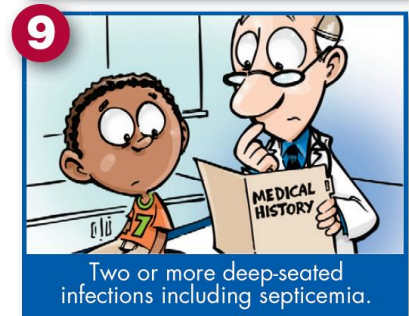
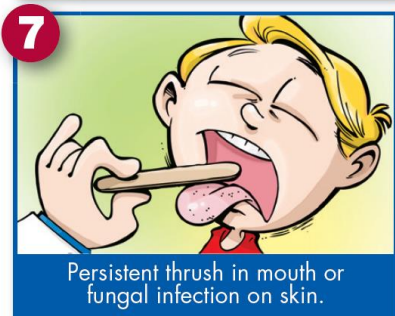
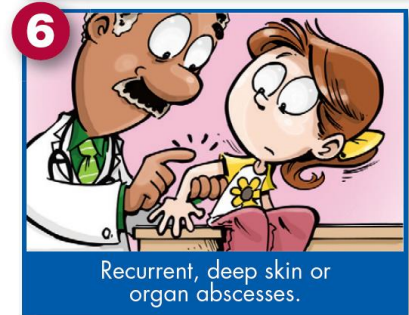
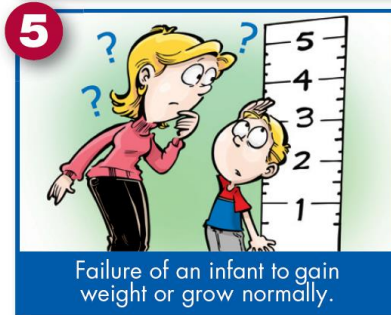
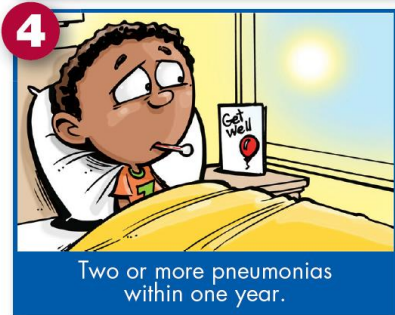
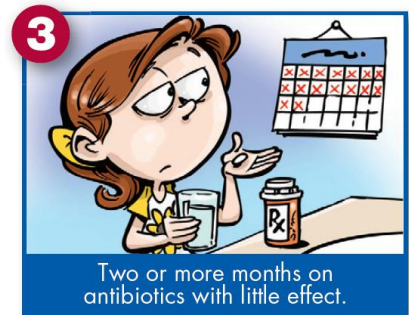
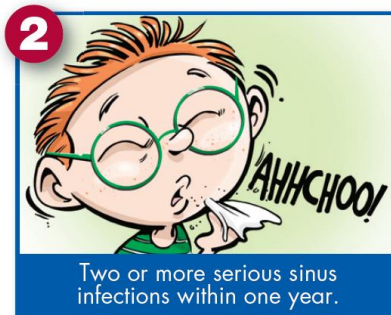
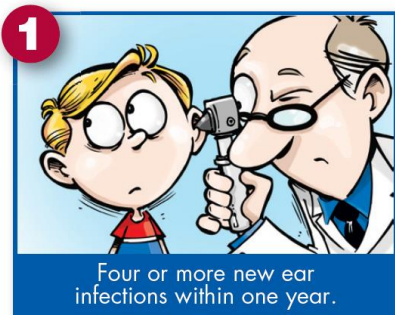
- Dr. Juan Félix Aldave Pita.
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# 10 Warning Signs of Primary Immunodeficiency

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.**



"This book was made possible, in part, by a grant provided by the Jeffrey Modell Foundation WIN Program)"

[www.INFO4PI.org](http://www.INFO4PI.org)

**Series:** Funny Immunology to save lives.

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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](mailto:jucapul_84@hotmail.com)

[funny.immunology@gmail.com](mailto:funny.immunology@gmail.com)

[www.alergomed.org/immunocytes](http://www.alergomed.org/immunocytes)