



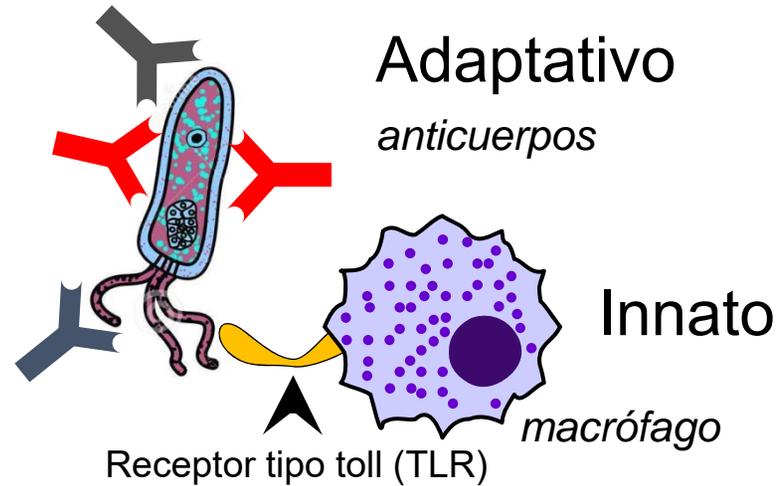
# ***“Antígenos e inmunógenos”***

Leandro J. Carreño, PhD

Programa de Inmunología  
Instituto de Ciencias Biomédicas  
Facultad de Medicina  
Universidad de Chile

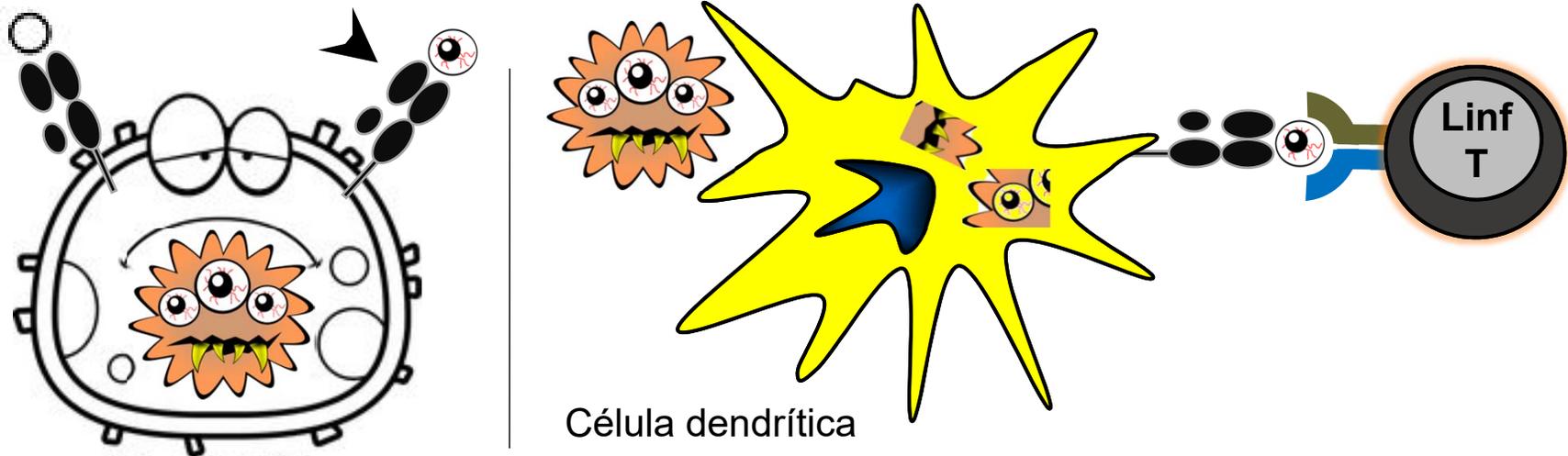
# El sistema inmune tiene dos tipos de reconocimiento específico: Directo e indirecto

Directo



Indirecto

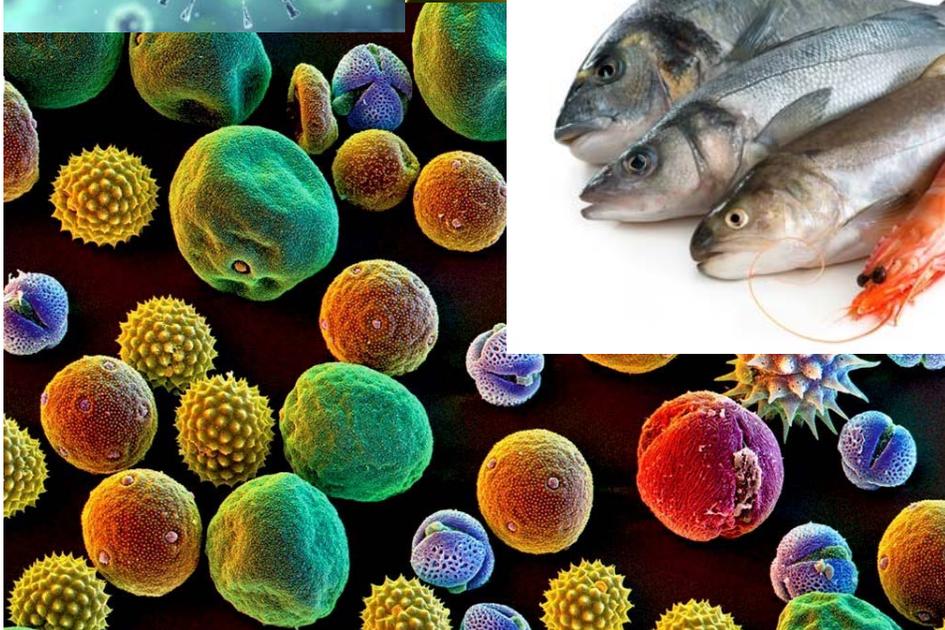
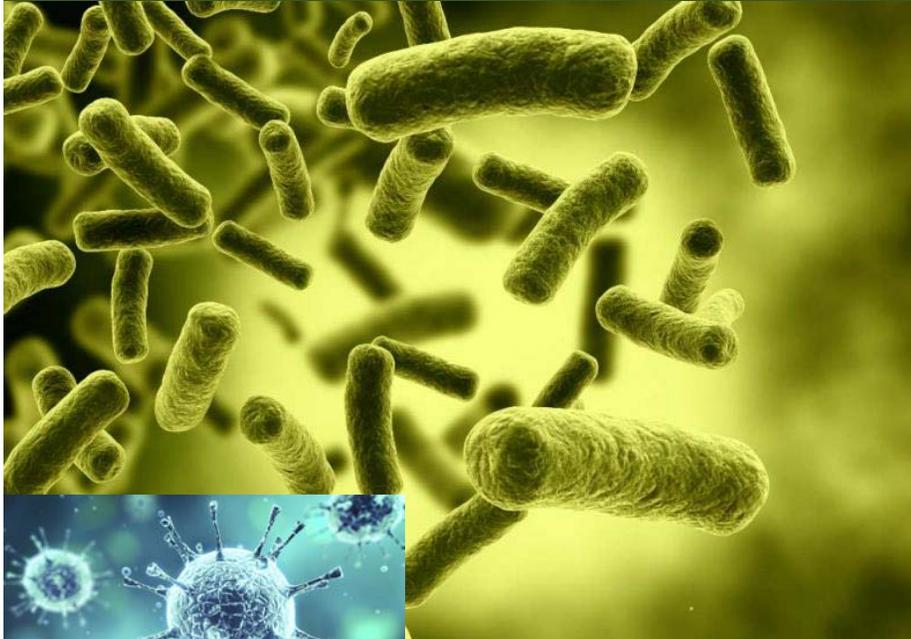
(procesamiento y presentación de antígenos)



# Expansión clonal



# Antígeno o inmunógeno?



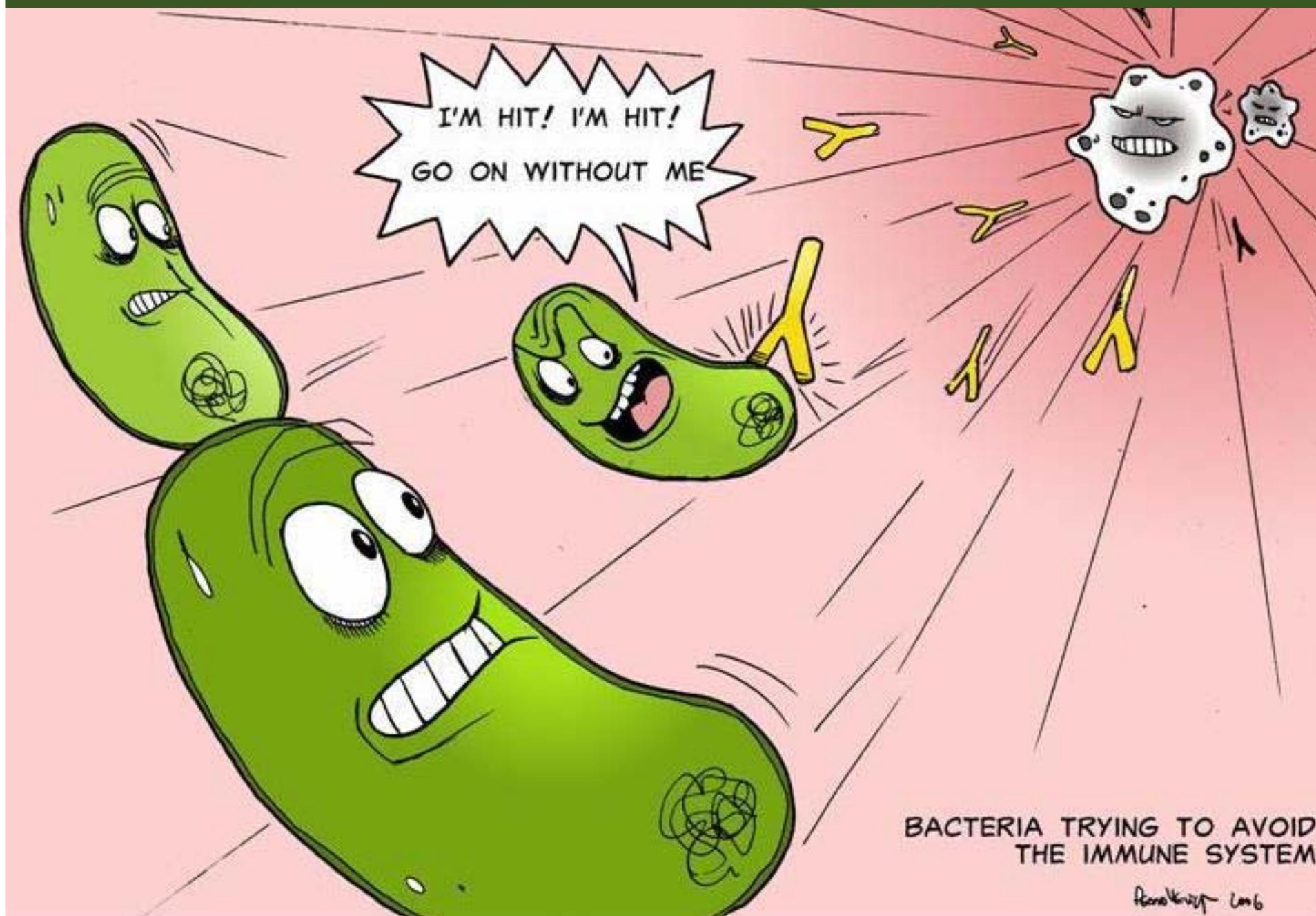
# Palabras claves de esta clase

- *Antígeno, inmunógeno, hapteno*
- *Criterios para la inmunogenicidad*
  - *Clasificación de antígenos*
  - *Determinante antigénico*
    - *Epitope/o, Paratopo*
    - *Superantígeno*

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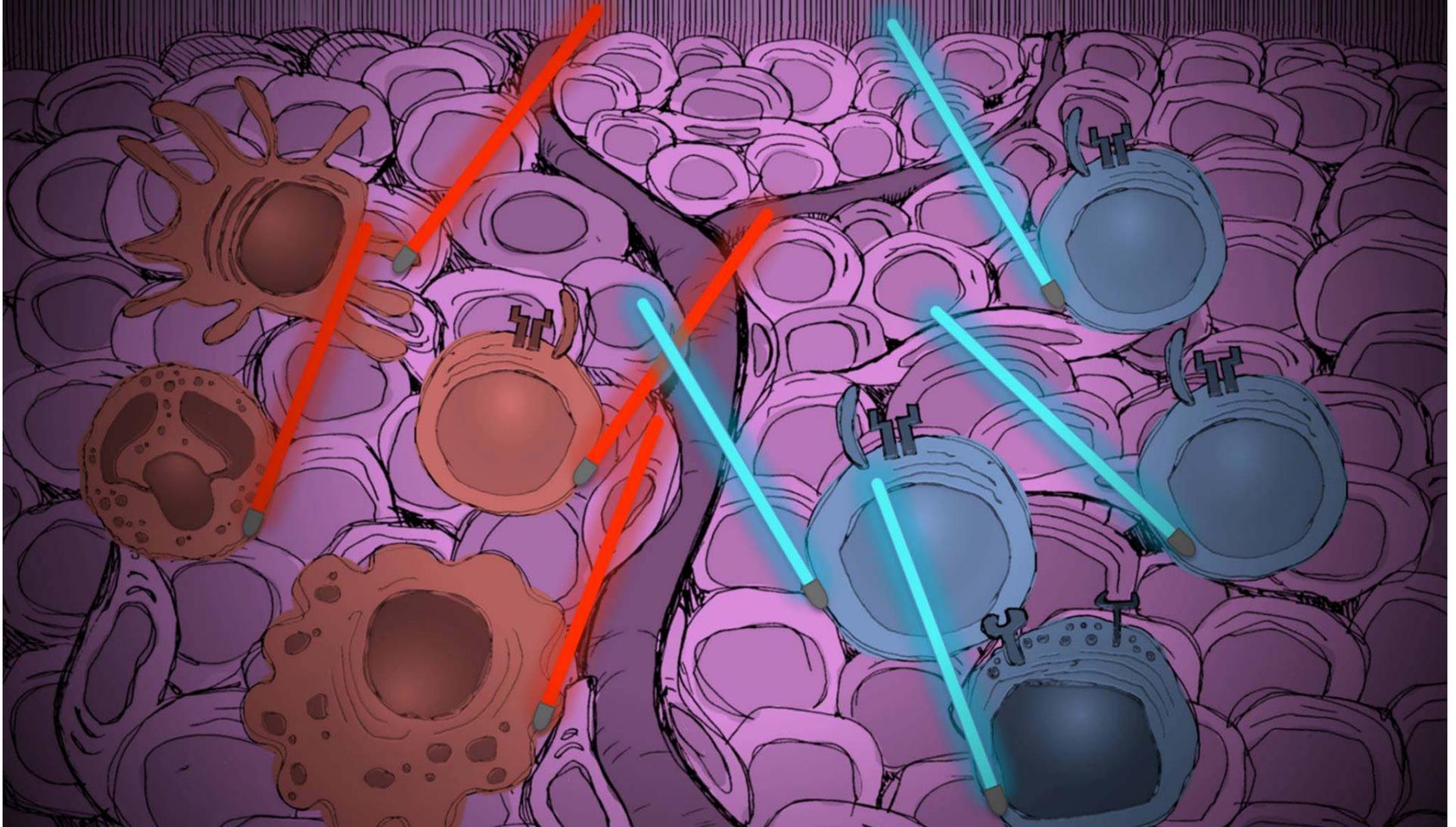
# Respuesta inmune humoral



Respuesta inmune celular

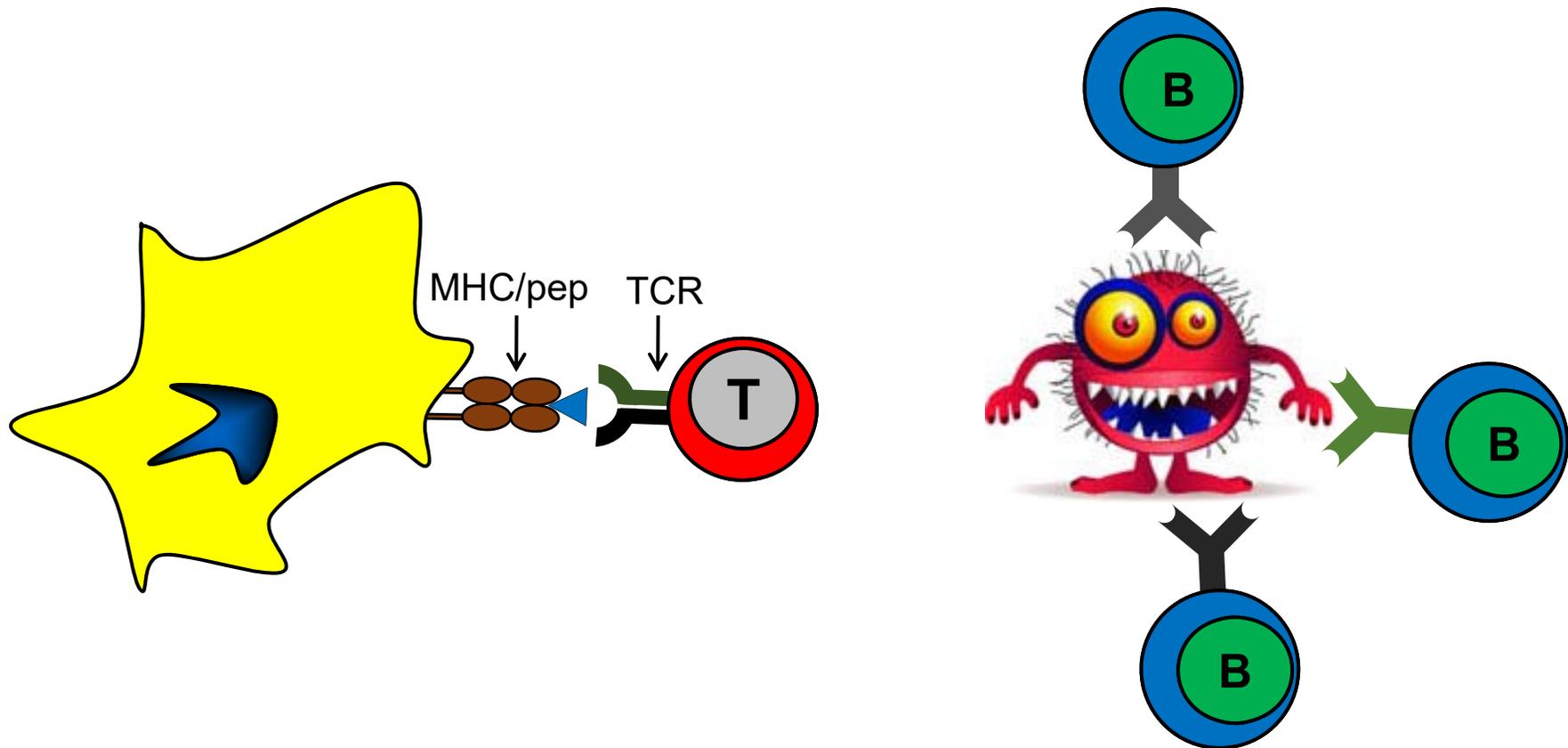
# TUMOR WARS

THE LYMPHOCYTE AWAKENS



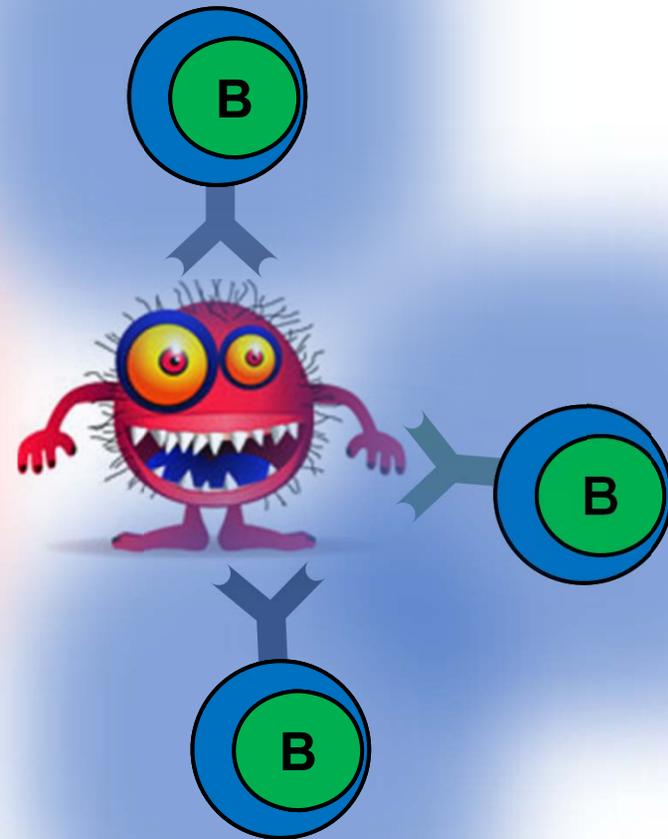
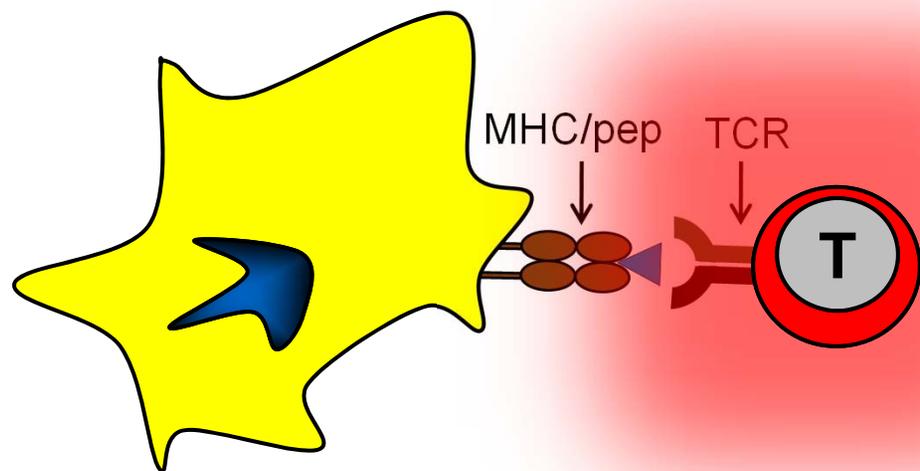
# Que es un antígeno?

*Antigen is any agent capable of binding specifically to components of immune response such as lymphocytes and antibodies.*



# Que es un inmunógeno?

*Immunogen is any agent capable of inducing an immune response*

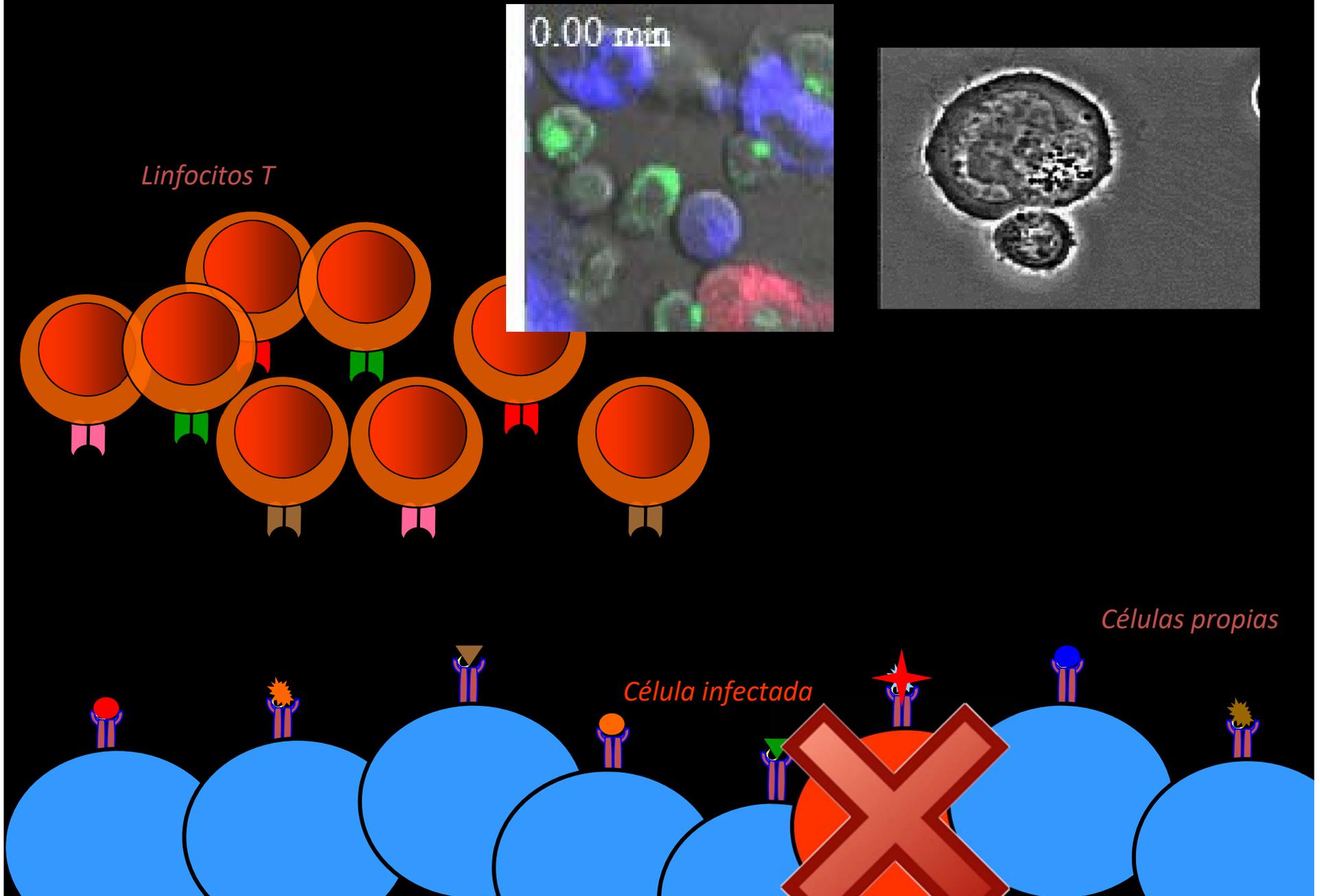


## Discusión con la clase

*All immunogens are antigens, but not  
all antigens need to be  
immunogens*

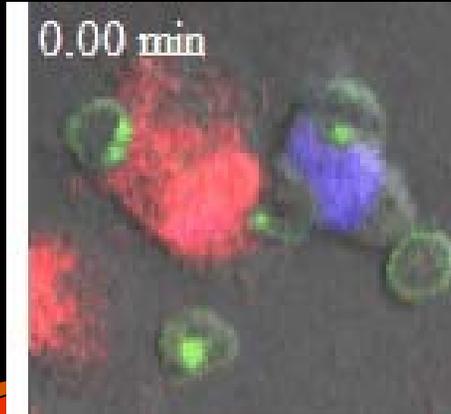
*For simplicity, both antigens and immunogens are usually referred to as antigens*

# Respuesta inmune celular en condiciones normales



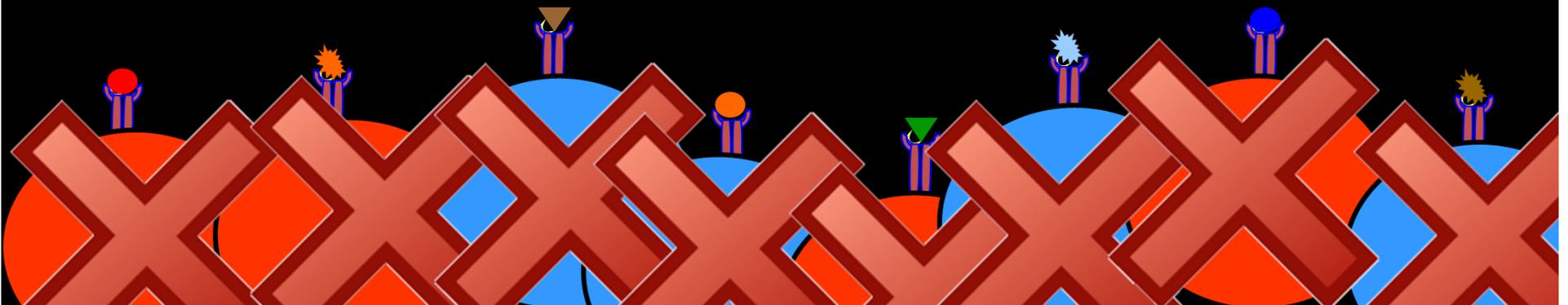
# Activación sin control de linfocitos T

*Linfocitos T*

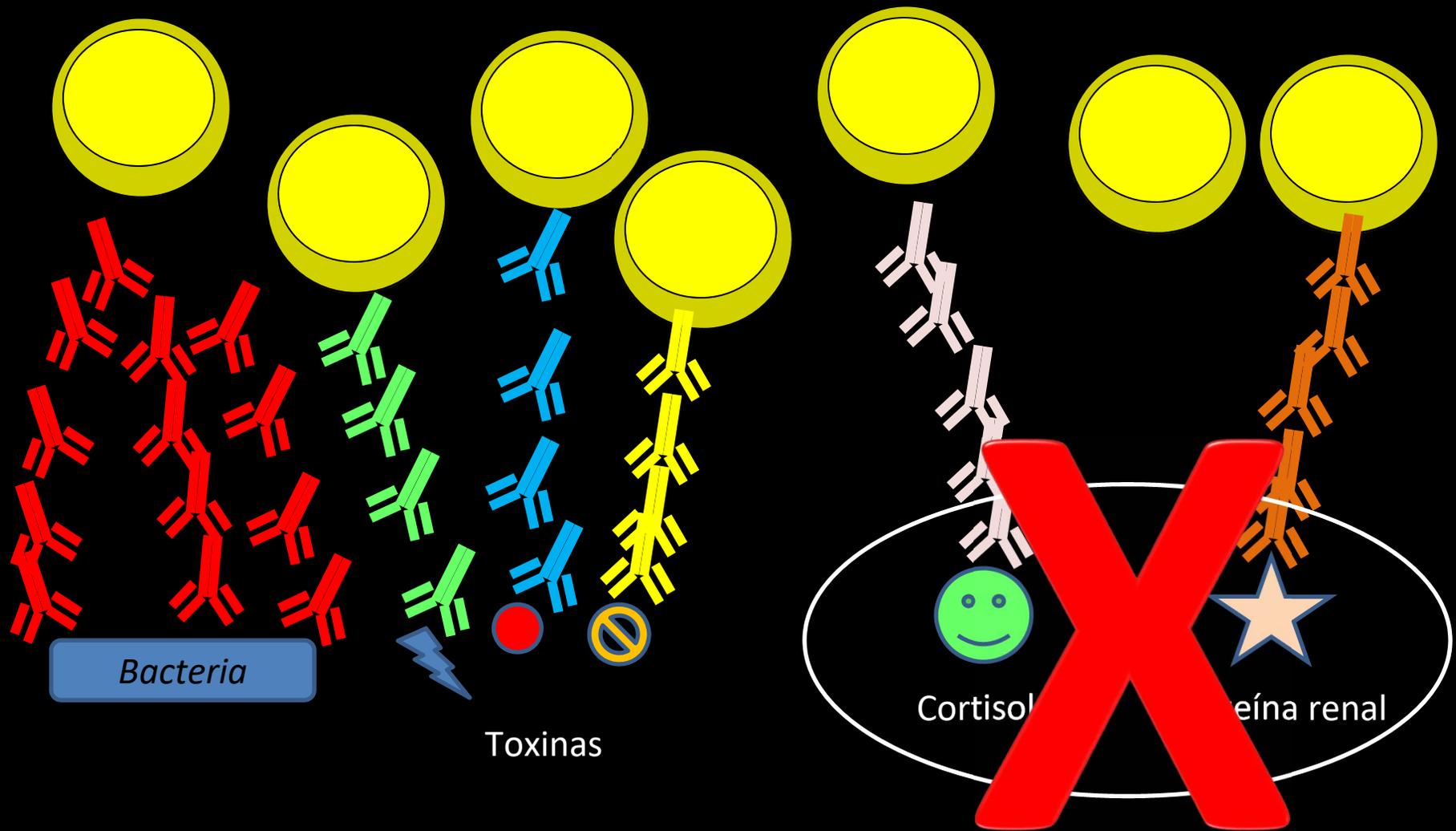


**AUTOINMUNIDAD!!!**

*Células propias*



# Activación sin control de linfocitos B



# Los linfocitos B y T poseen receptores específicos que les permiten reconocer antígenos

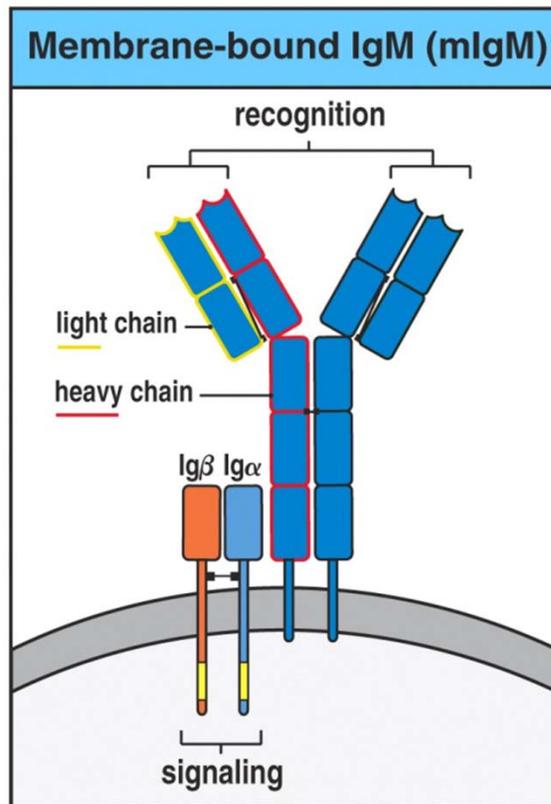
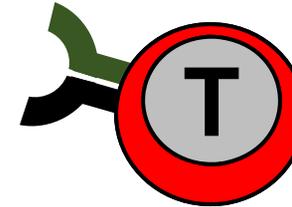
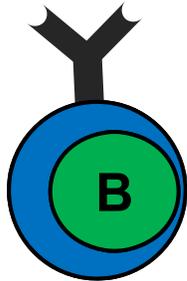


Figure 6-8 Immunobiology, 6/e. (© Garland Science 2005)

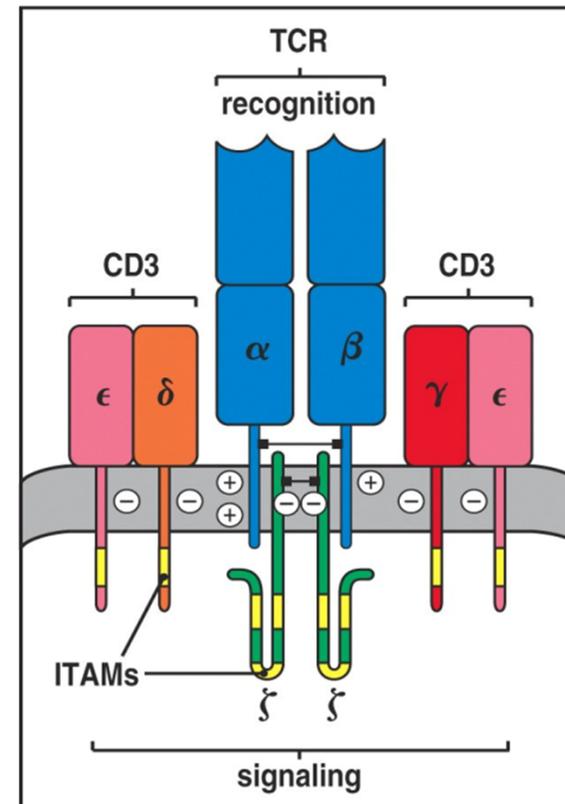
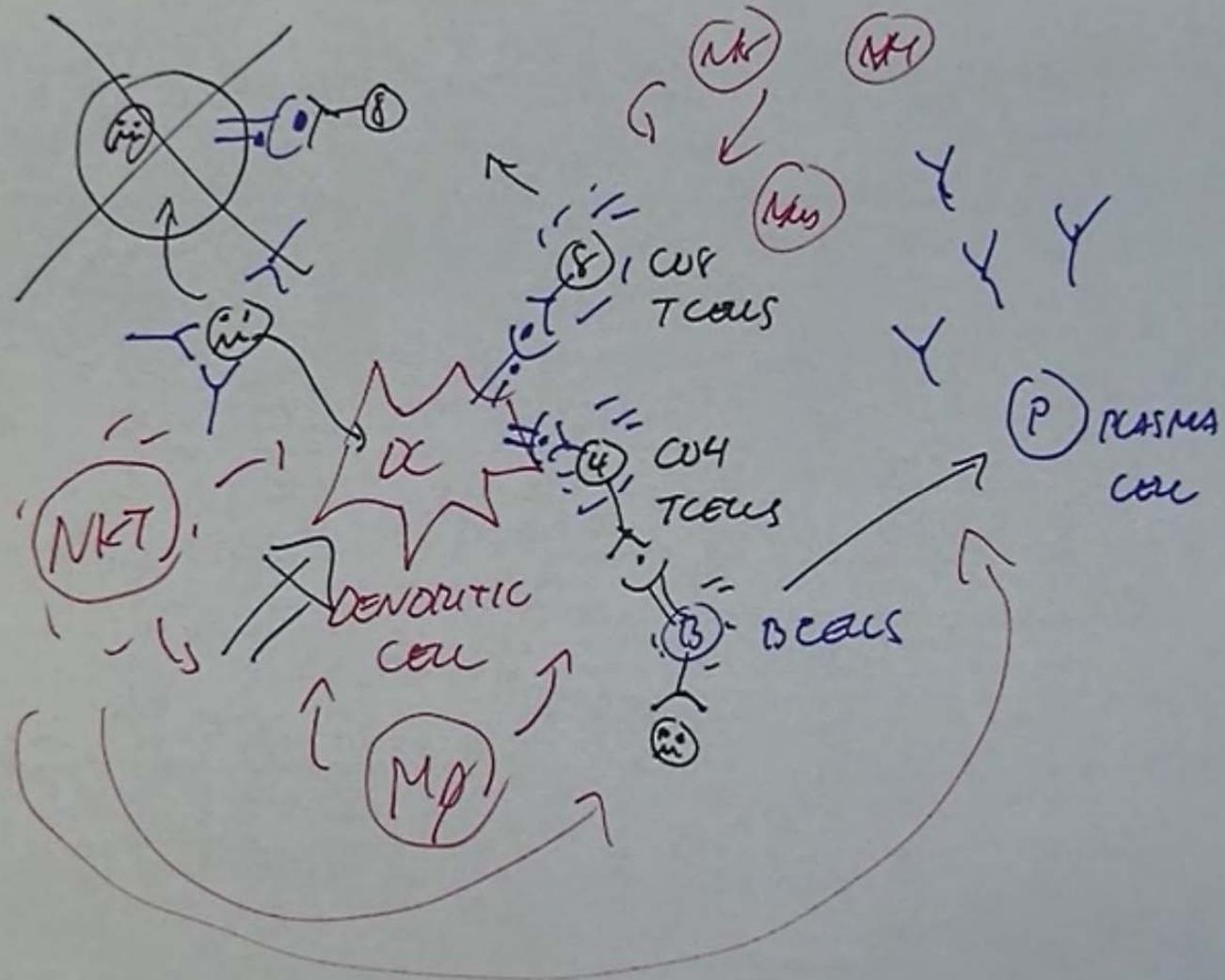
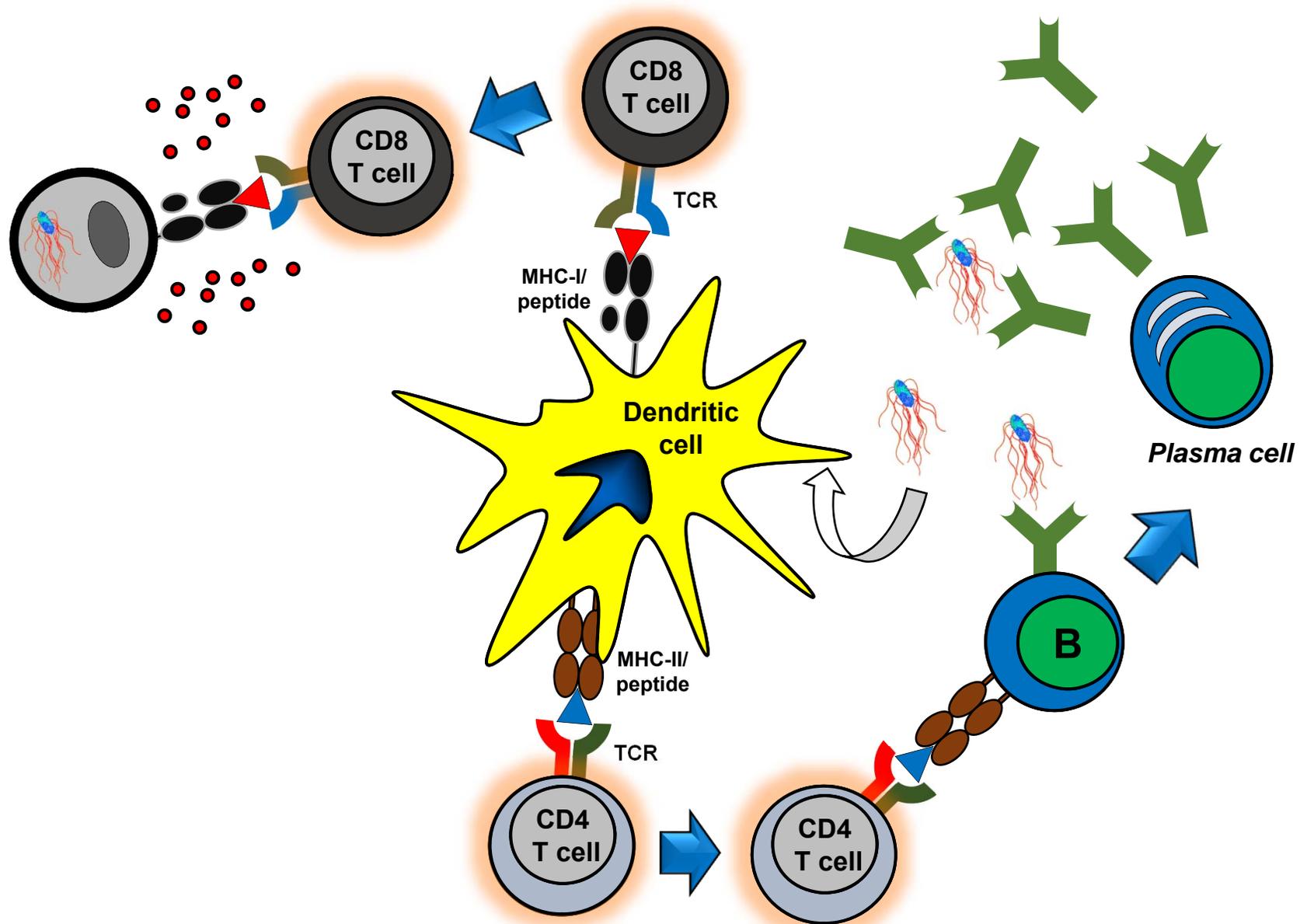


Figure 6-9 Immunobiology, 6/e. (© Garland Science 2005)

# La respuesta inmune en la pizarra



# La respuesta inmune animada



## Discusión (no pelea) con la clase

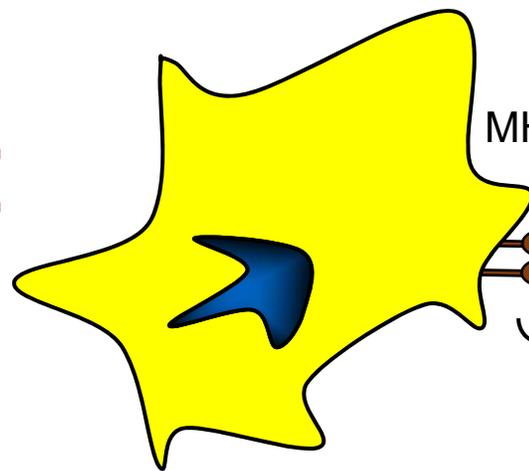
*Puede un antígeno no inmunógeno volverse inmunógeno y viceversa?*

# Los linfocitos T requieren de 2 señales para activarse

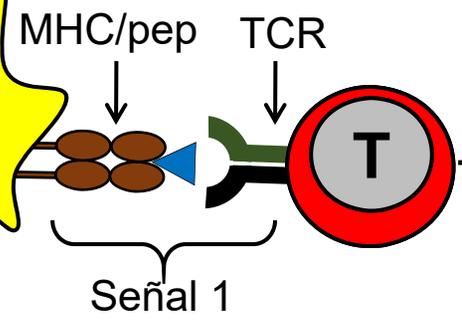
En ausencia de señales de peligro la célula dendrítica no activa linfocitos T naive

ANTIGENO  
(señal 1) ✓

SEÑAL DE  
PELIGRO  
(señal 2) ✗

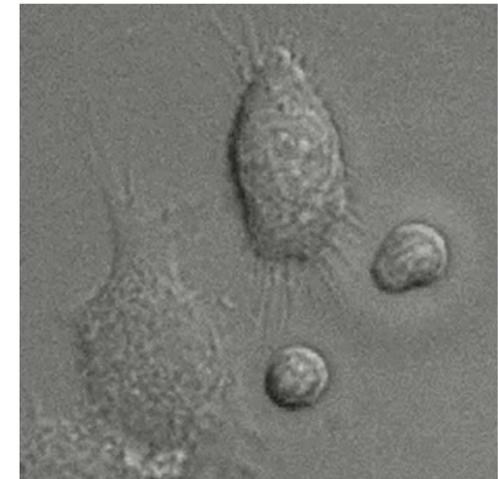


Célula dendrítica inmadura



(proximas clases...)

- Anergia
- Muerte
- Tolerancia



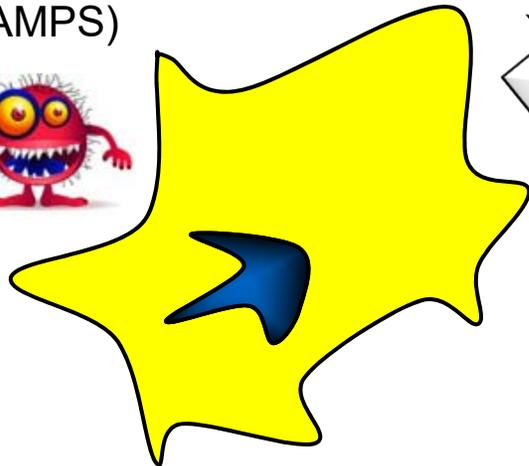
# Los linfocitos T requieren de 2 señales para activarse

En presencia de señales de peligro la célula dendrítica activa linfocitos T naive

ANTIGENO  
(señal 1) ✓

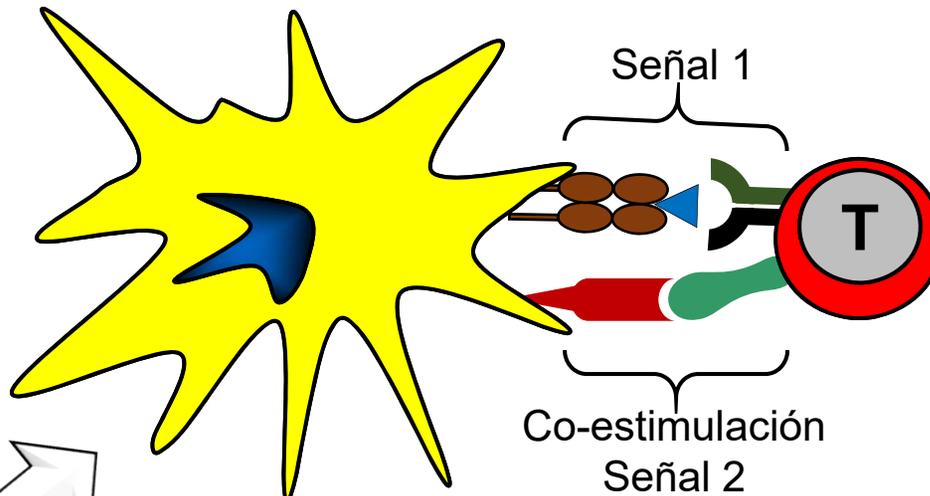
SEÑAL DE  
PELIGRO  
(señal 2) ✓

Señal de peligro  
(PAMPS)

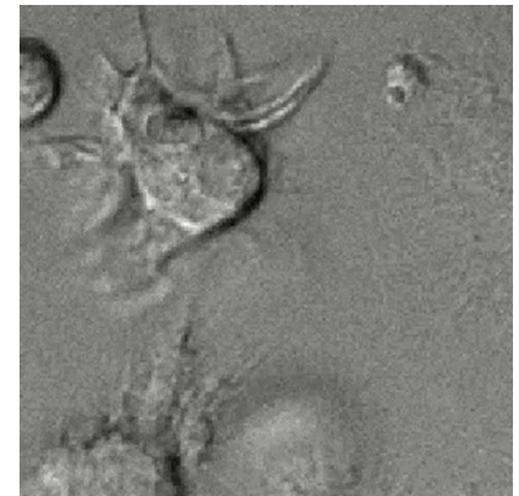


Célula dendrítica  
inmadura

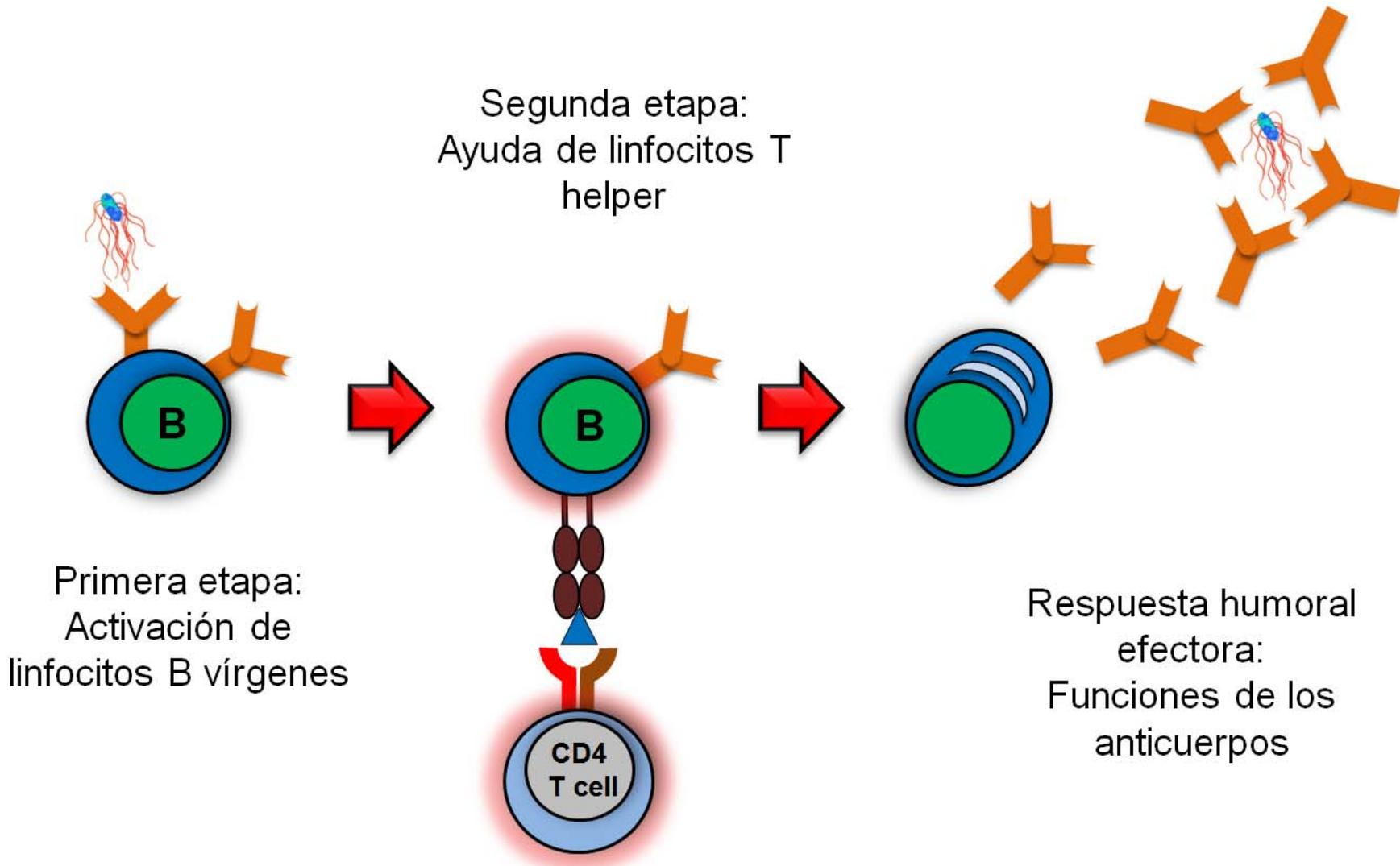
Célula dendrítica madura



Aumento MHC Clase I y Clase II  
Disminución de la capacidad de fagocitosis  
Aumento moléculas coestimuladoras  
Secreción de citoquinas  
Migración hacia linfonodos



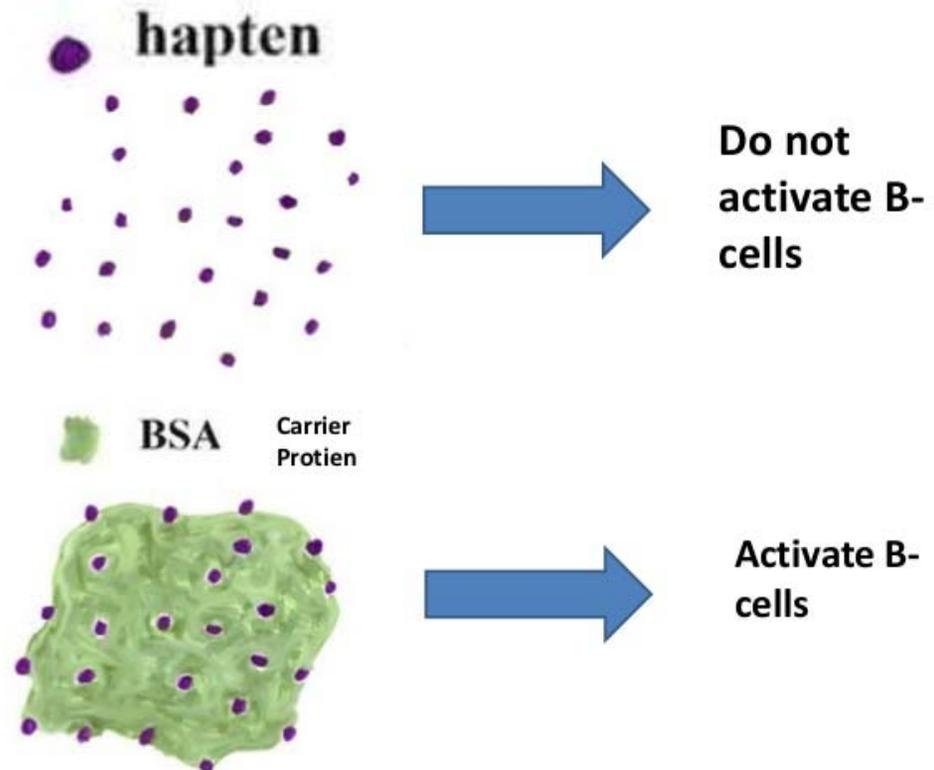
# Etapas de la Inmunidad humoral



# Hapteno

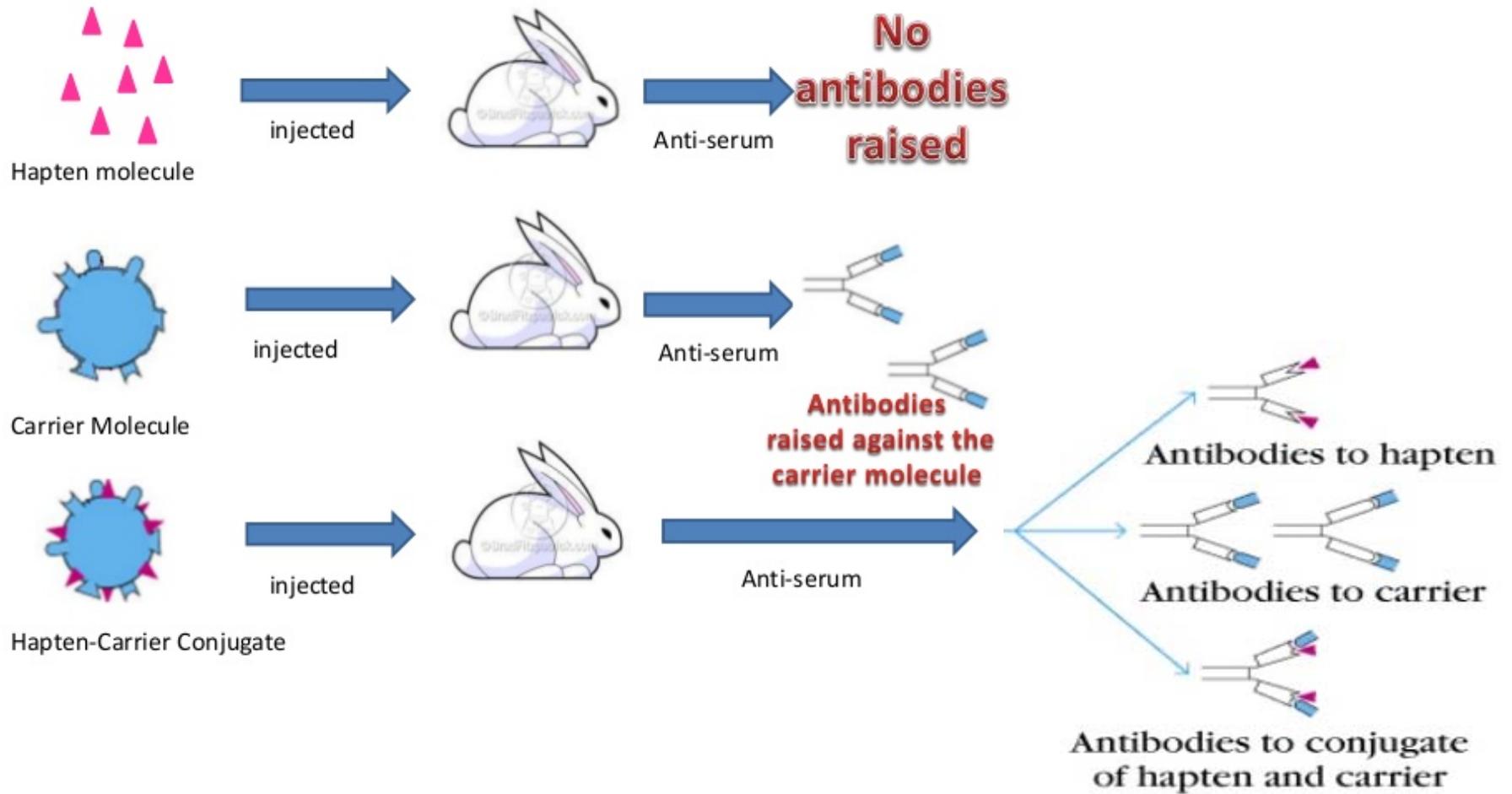
*Small foreign molecule that is not antigenic. Must be coupled to a carrier molecule to be antigenic*

*Once antibodies are formed they will recognize the hapten*



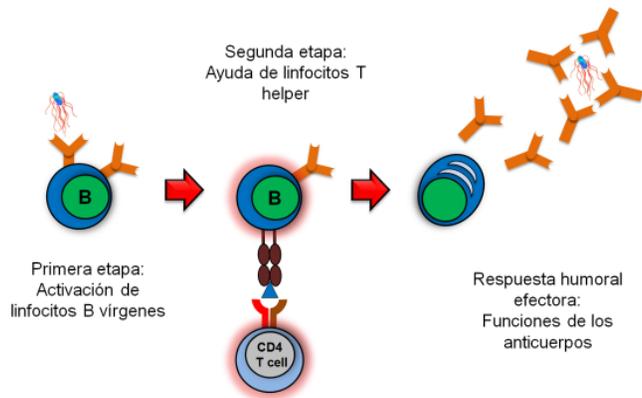
# Hapteno

## Pioneering work of Karl Landsteiner



# Hapteno

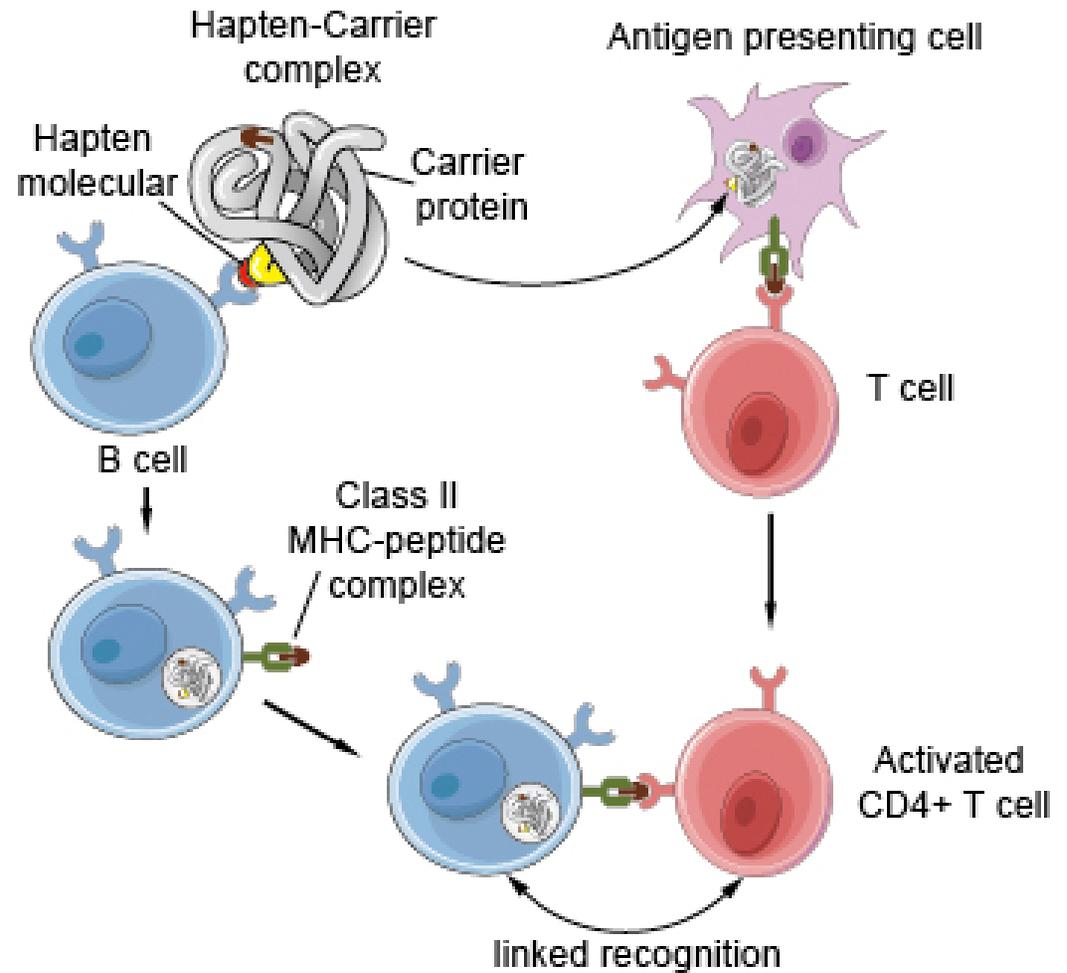
## Etapas de la Inmunidad humoral



Receptor-mediated endocytosis of antigen

Antigen processing and presentation

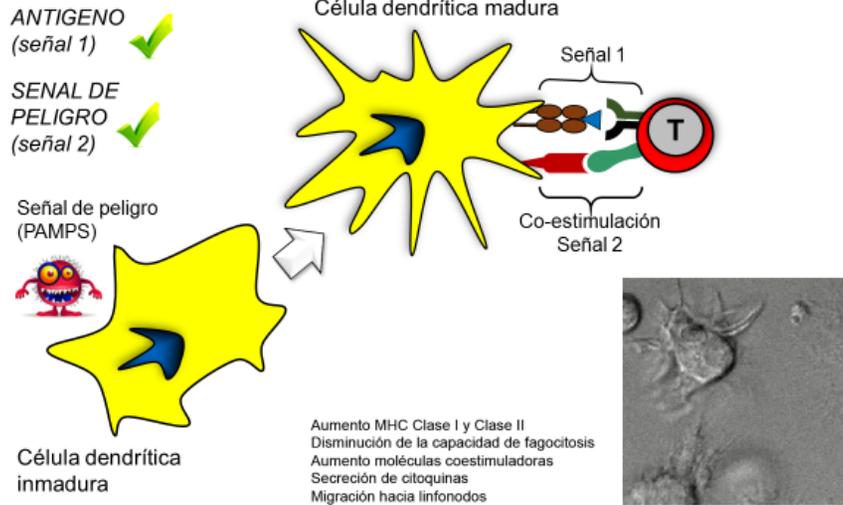
T cell recognition of antigen



# Adjuvantes

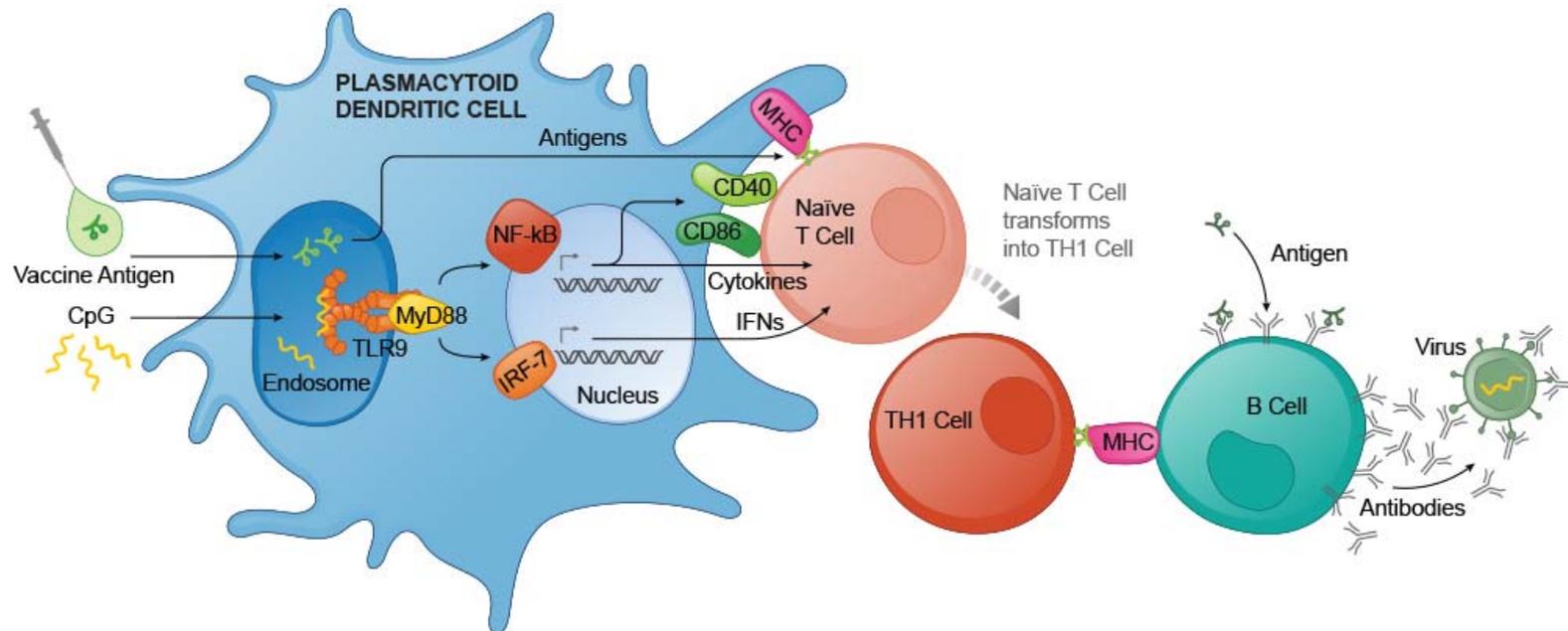
Los linfocitos T requieren de 2 señales para activarse

En presencia de señales de peligro la célula dendrítica activa linfocitos T naive



A substance that non-specifically enhances the immune response to an antigen

- Prolong the presence of the antigen
- Enhance production of co-stimulatory signals
- Non-specifically stimulate lymphocytes



## Discusión con la clase

*Ejemplos de “cosas” muy  
antigénicas pero poco  
inmunogénicas y viceversa?*

# Palabras claves de esta clase

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- ***Criterios para la inmunogenicidad***
  - *Clasificación de antígenos*
  - *Determinante antigénico*
    - *Epitope/o, Paratopo*
    - *Superantígeno*

# Criterios para la inmunogenicidad

1. Foreignness (most essential)
2. Molecular size
3. Chemical composition and heterogeneity
4. Degradability
5. Adequate dose & route
6. Genetic constitution of host

# Criteria for immunogenicity

1. Foreignness (most essential)
2. Molecular size
3. Chemical composition and heterogeneity
4. Degradability
5. Adequate dose & route
6. Genetic constitution of host

Parameter	Increase immunogenicity	Decreased immunogenicity
Size	Large	Small (MW<2500)
Composition	Complex	Simple
Similarity to self protein	Multiple differences	Few differences
Interaction with host MHC	Effective	Ineffective

**Table 1: Intrinsic properties of proteins that affect immunogenicity.**

# Criteria for immunogenicity

1. Foreignness (most essential)
2. Molecular size
3. Chemical composition and heterogeneity
4. Degradability
5. Adequate dose & route
6. Genetic constitution of host

Parameter	Increased immunogenicity	Decreased immunogenicity
Dose	Intermediate	High or low
Route	Subcutaneous > intraperitoneal > intravenous or intragastric	
Form	Particulate	Soluble
	Denatured	Native
Adjuvants	Slow release	Rapid release
	Bacteria	No bacteria

**Table 2: Factors that influence the adapted immune response to an antigen.**

## Discusión con la clase

*Un inmunógeno se comporta como tal en cualquier individuo?*

# Palabras claves de esta clase

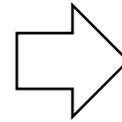
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# Principales clases de antígenos

*El problema:*



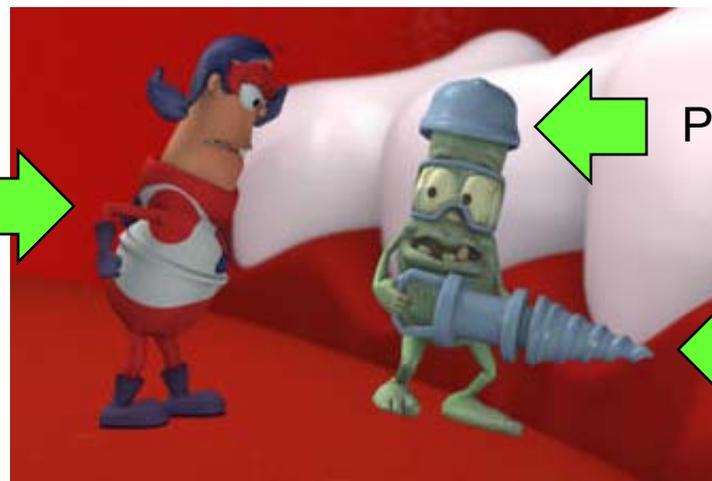
**VS**



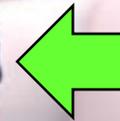
*Nos parecemos mucho!!!  
(molecularmente hablando)*

**Proteínas**  
**Ácidos nucleicos**  
**Lípidos**  
Azúcares

Célula dendrítica



Patógeno



Señal de peligro  
(PAMP)



Principales clases de antígenos  
Inmunogenicidad

# Proteínas

## Azúcares

## Ácidos nucleicos

## Lípidos

# Actúan como antígenos:

## ***Infectious materials***

- microbial structures (cell walls, capsules, flagella, pili, viral capsids, envelope-associated glycoproteins, etc)
- microbial toxins

## ***Noninfectious materials***

- allergens (dust, pollen, hair, foods, dander, bee venom, drugs, and other agents causing allergic reactions)
- foreign tissues and cells (from transplants and transfusions)
- the body's own cells that the body fails to recognize as "normal self" (cancer cells, infected cells, cells involved in autoimmune diseases).

# Clasificación de antígenos

## ***According to chemical nature***

- Proteins- virtually all
- Polysaccharides – potentially but not always
  - Nucleic acids – poor antigens
  - Lipids- may act as haptens

## ***According to mode of action***

- Thymus dependent – Protein antigens
- Thymus independent – Polysaccharides

## ***According to epitope***

- Unideterminant univalent
- Unideterminant multivalent
- Multideterminant multivalent

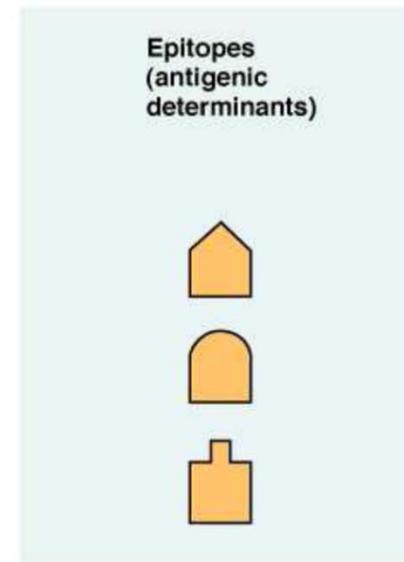
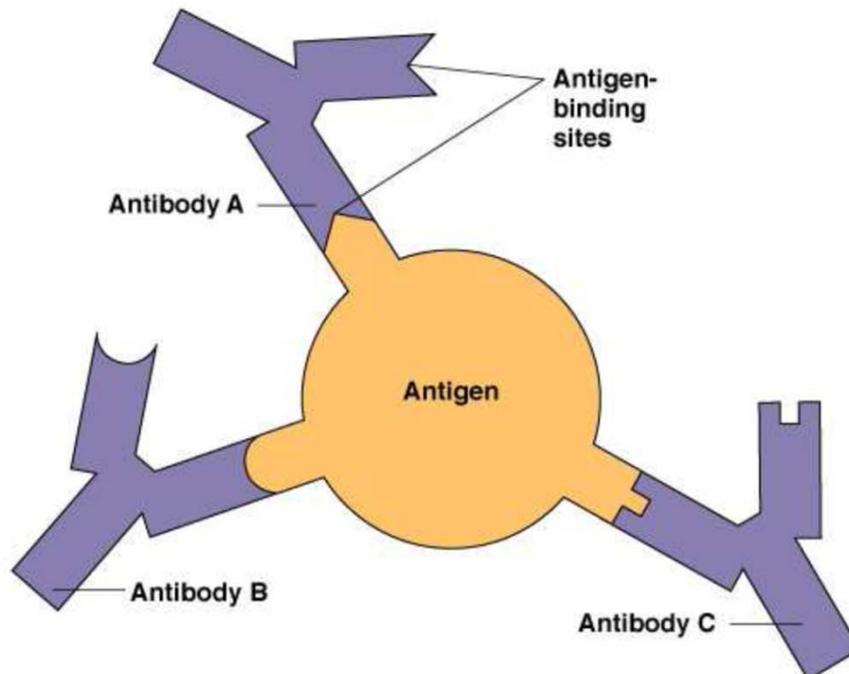
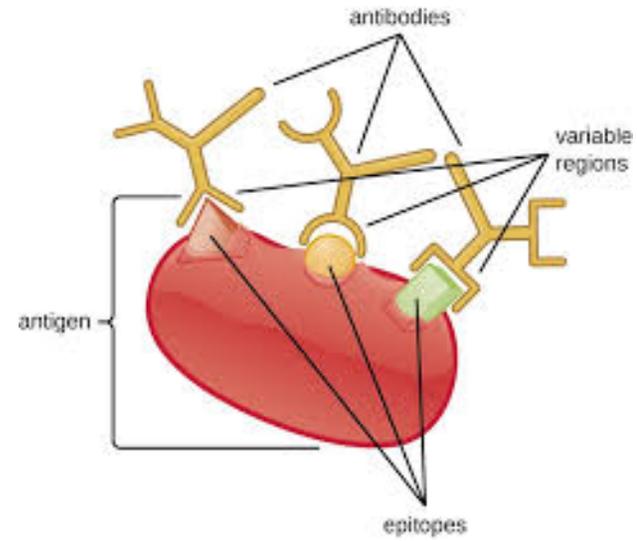
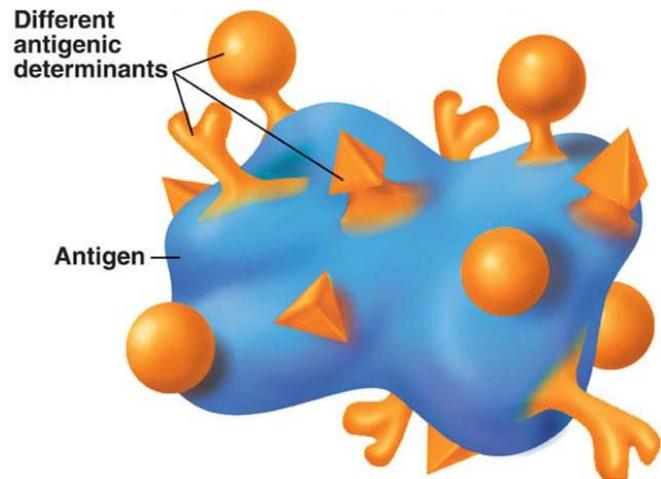
## ***According to Source***

- Exogenous
- Endogenous

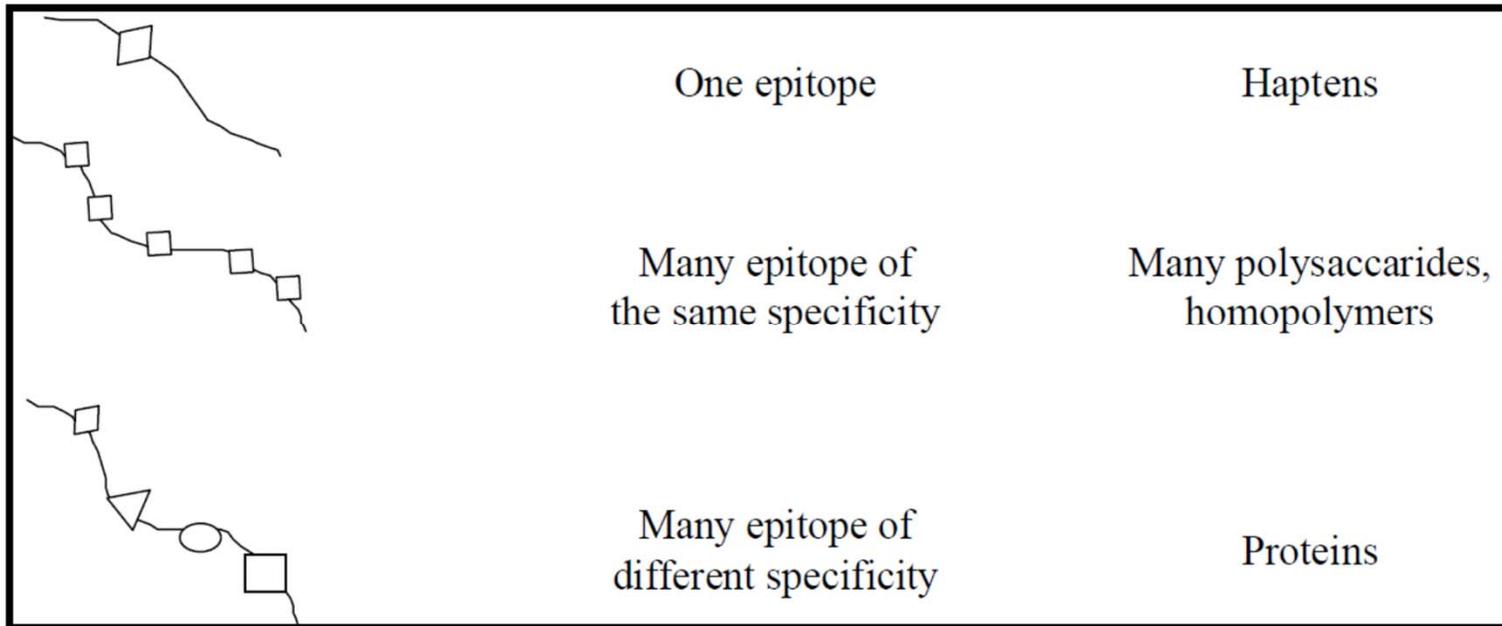
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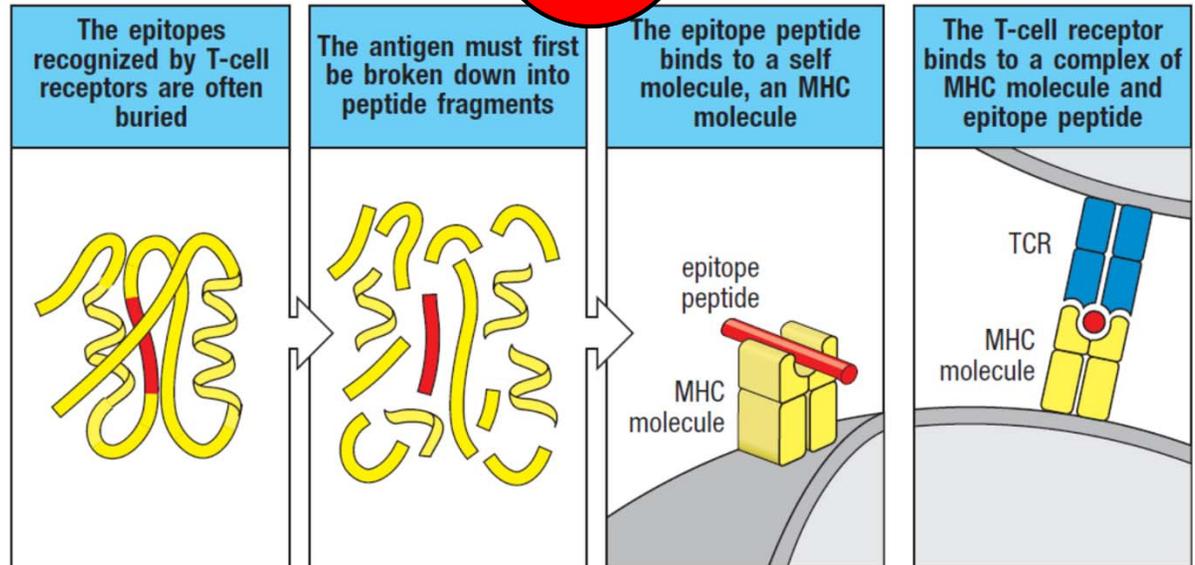
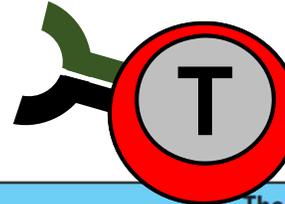
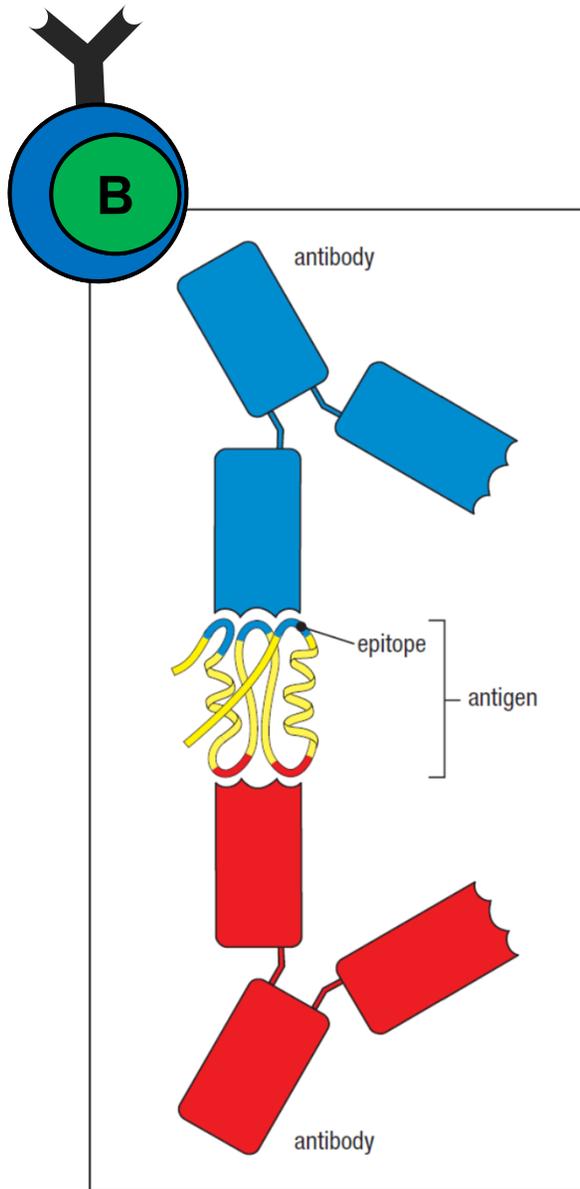
# Determinante antigénico



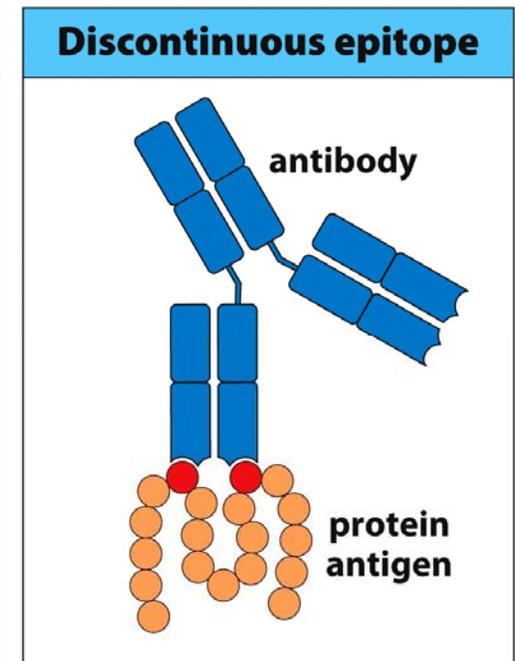
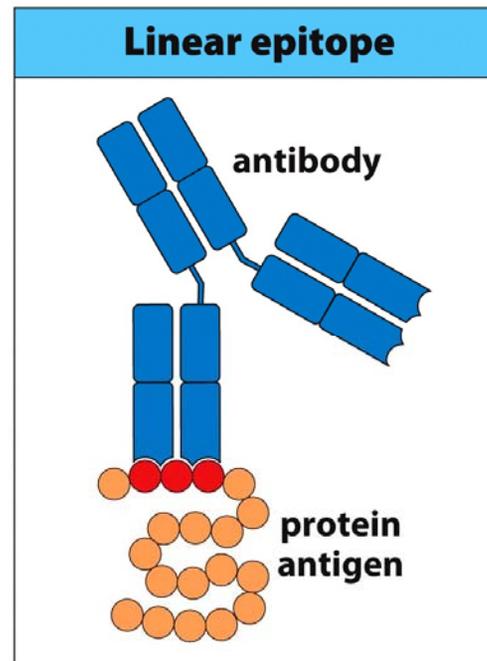
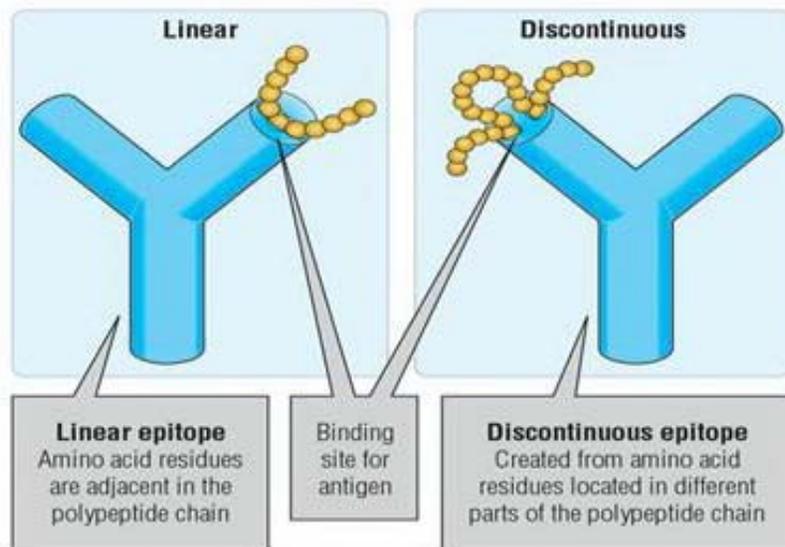
# Determinante antigénico



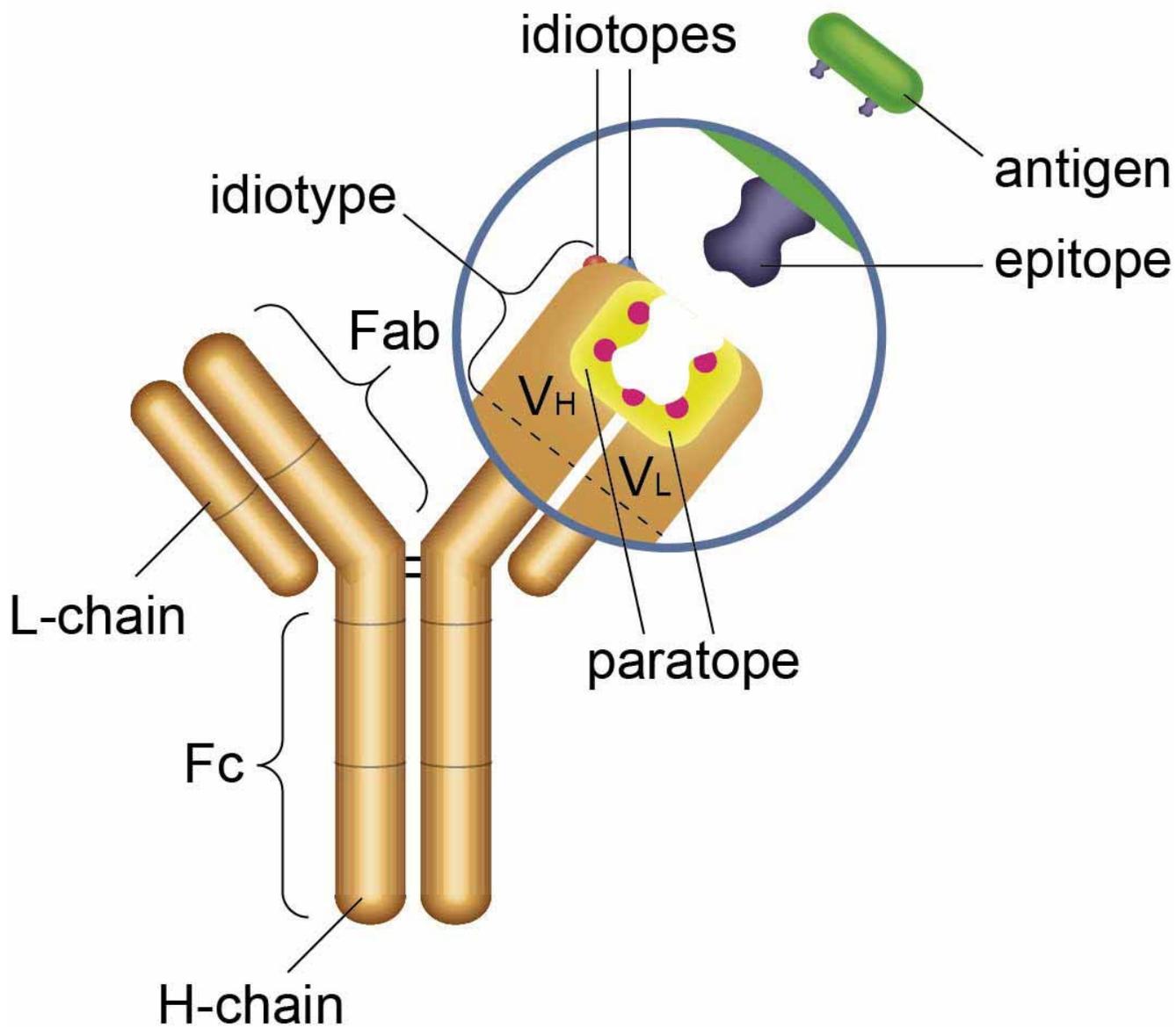
# Epitopes B y T



# Epitopos lineales y conformacionales



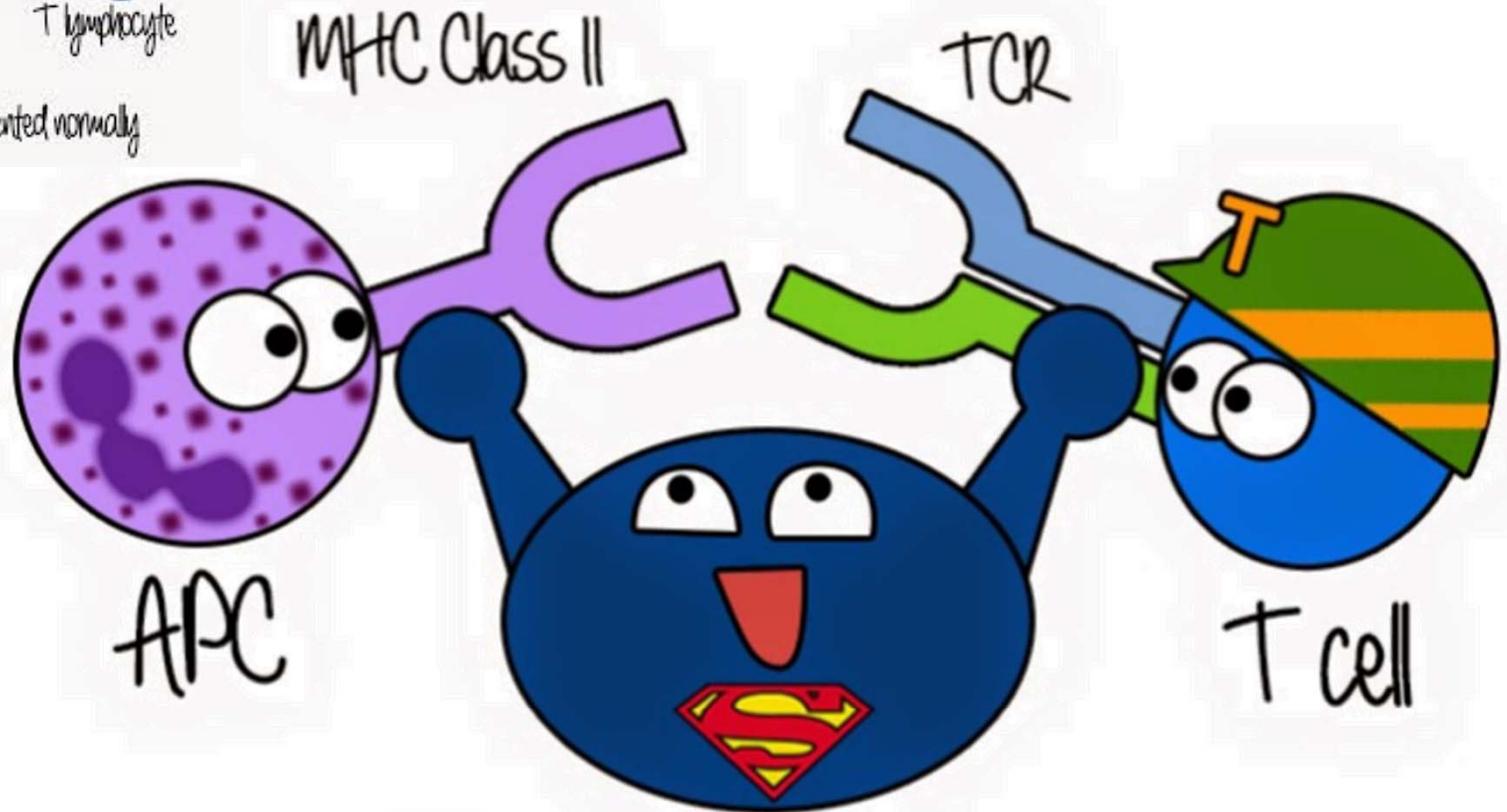
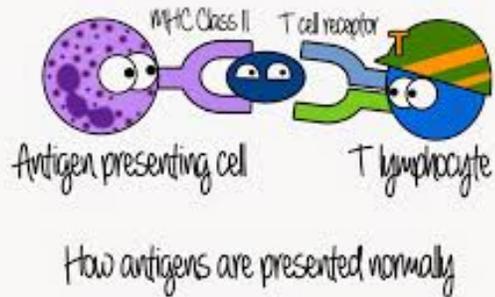
# Idiotipo y paratopo



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  - *Epitope/o, Paratopo*
  - ***Superantígeno***

# Superantigenos

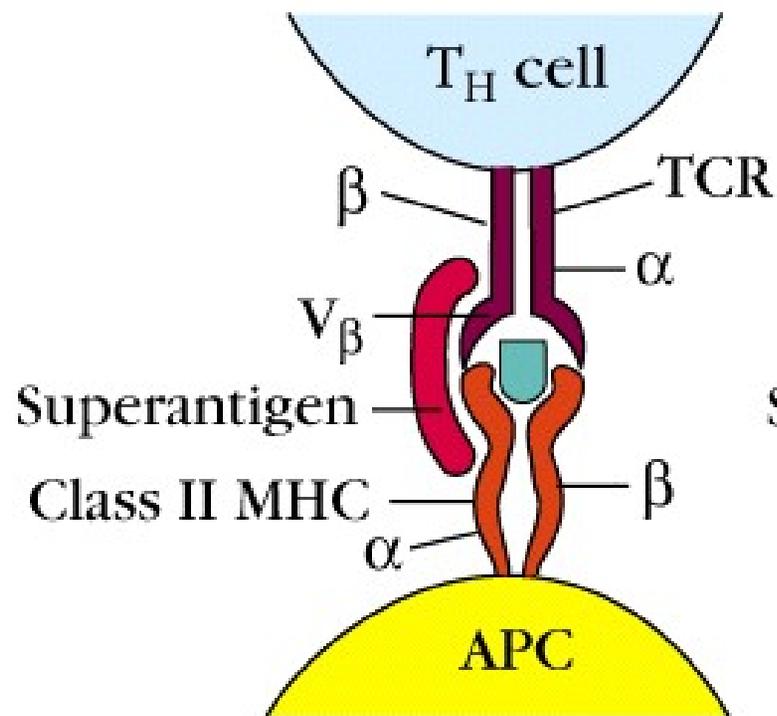


How super antigens work

# Superantigenos

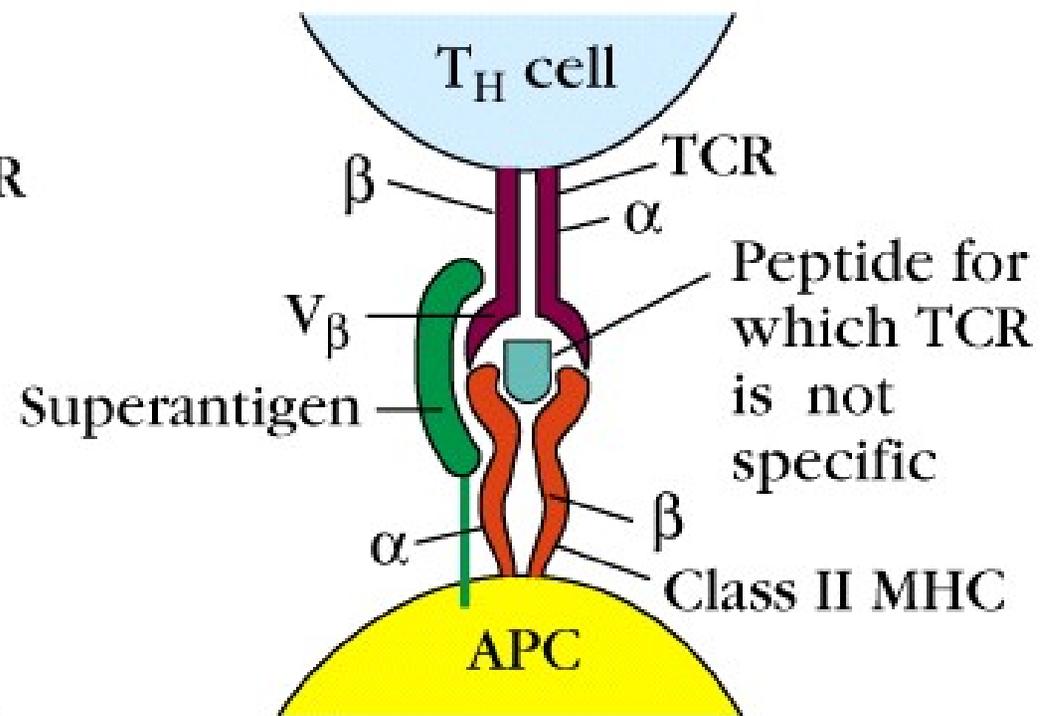
(a)

Exogenous  
superantigen

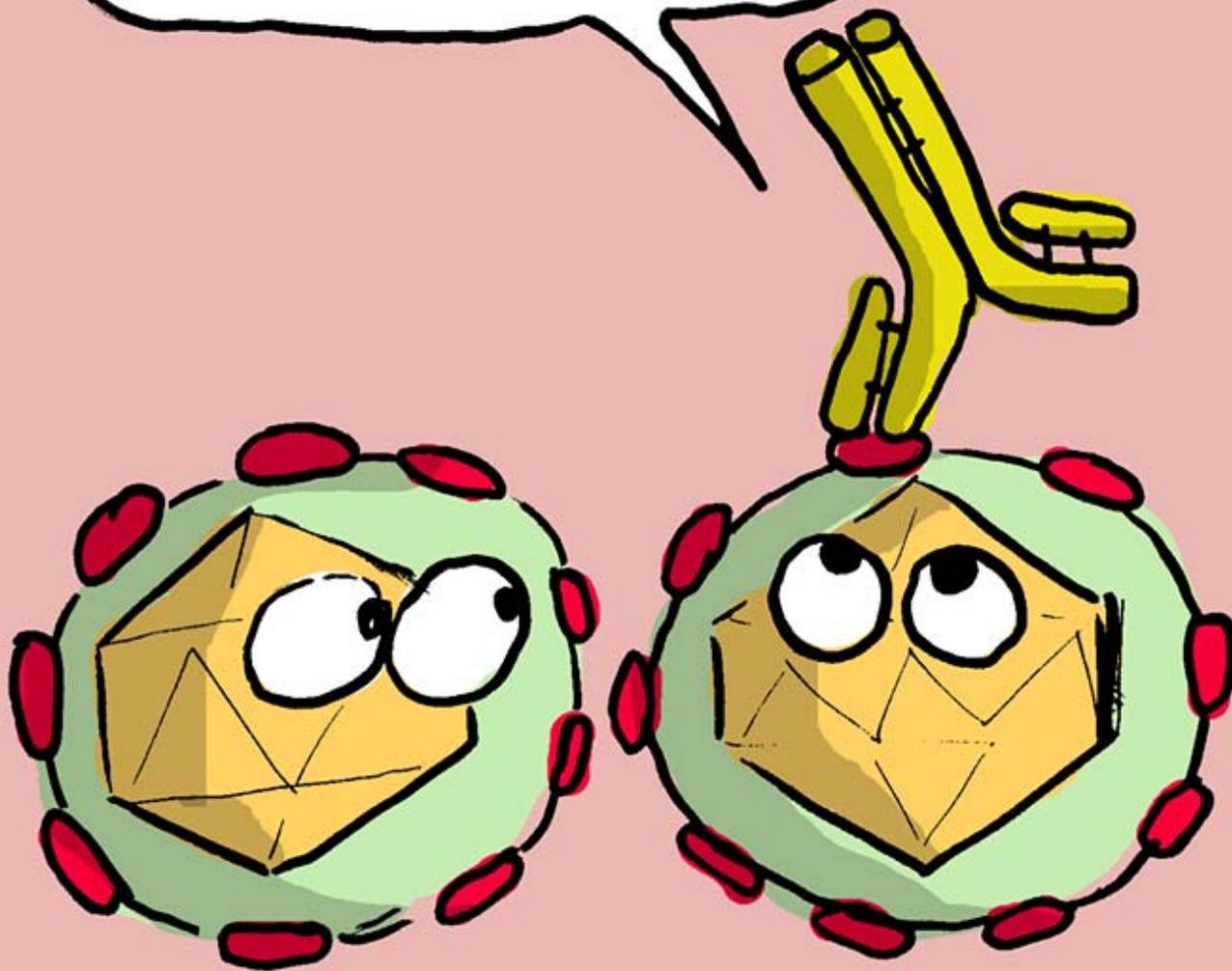


(b)

Endogenous  
superantigen



Dunno... I just  
woke up like this.





# ***“Antígenos e inmunógenos”***

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