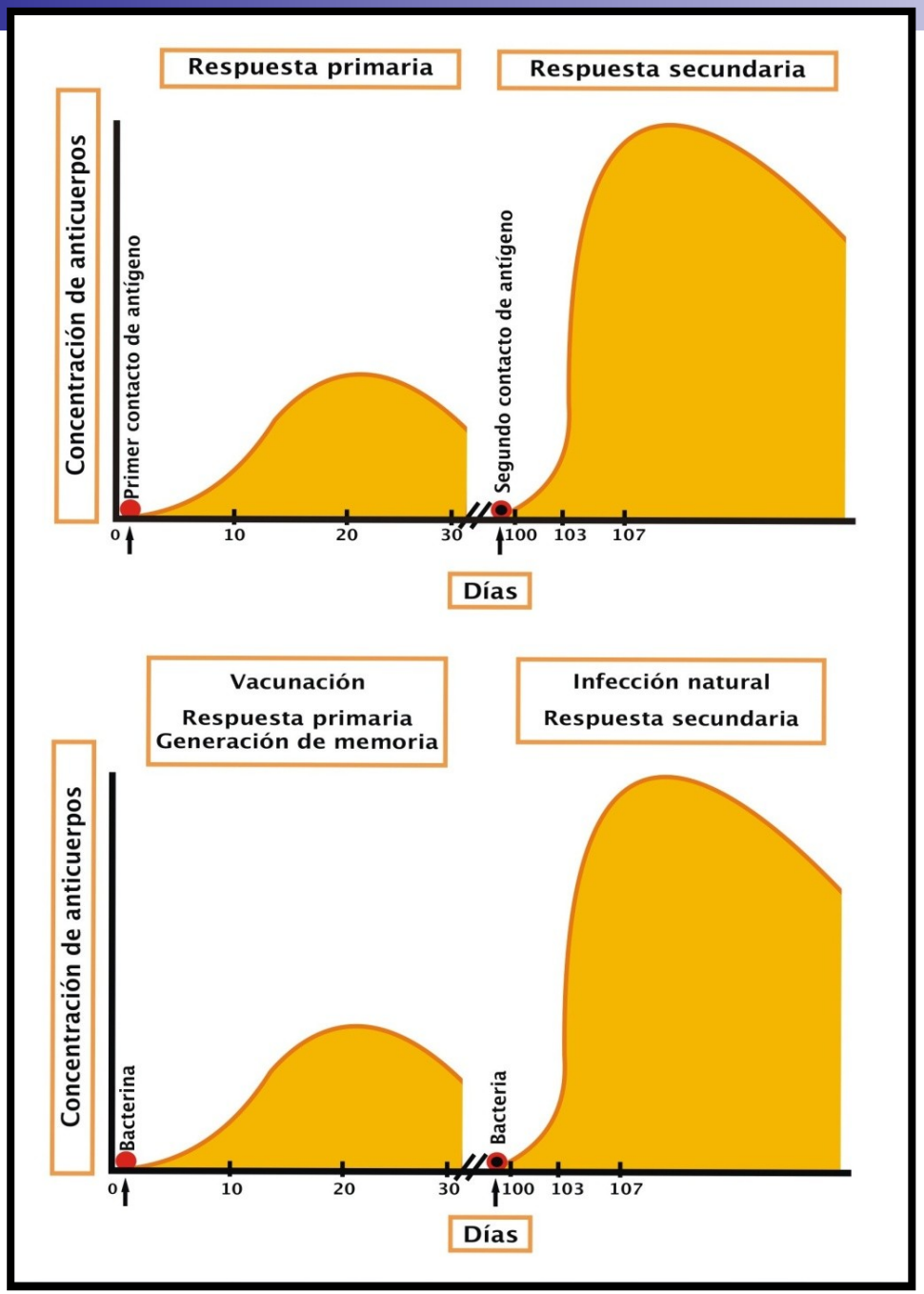
3. Inmunidad Adaptativa (Adquirida): Aspectos Generales

La inmunidad adaptativa es:

1. Inducida
2. Específica
3. Tiene memoria:

a) Respuesta primaria

b) Respuesta secundaria


Respuesta primaria
Respuesta secundaria
Concentración de anticuerpos
Primer contacto de antígeno
Segundo contacto de antígeno
0
10
20
30
100
103
107
Días
Vacunación
Respuesta primaria
Generación de memoria
Infección natural
Respuesta secundaria
Concentración de anticuerpos
Bacterina
Bacteria
0
10
20
30
100
103
107
Días

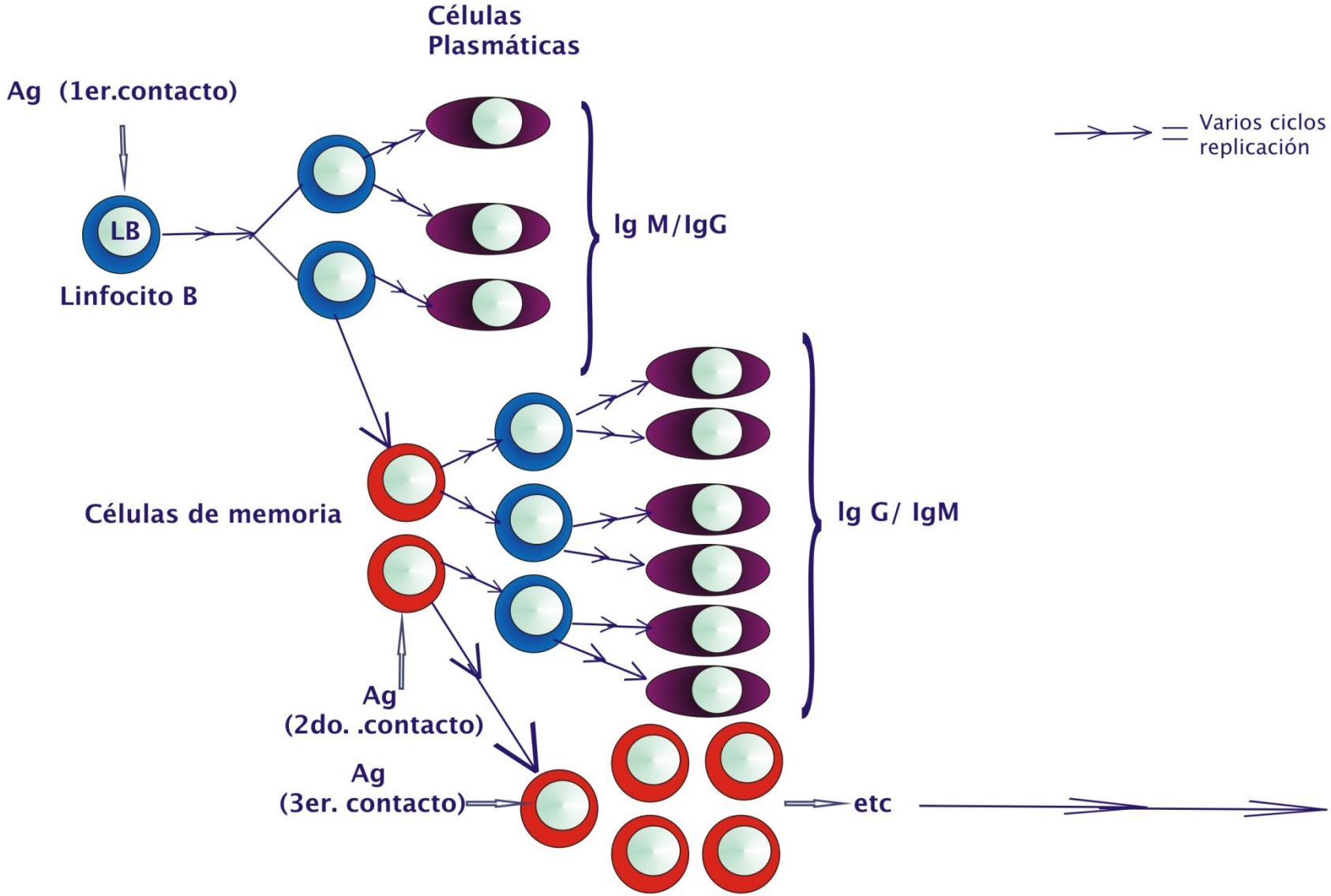


Figura 3.3. Respuesta primaria y secundaria. Desarrollo de memoria inmunológica

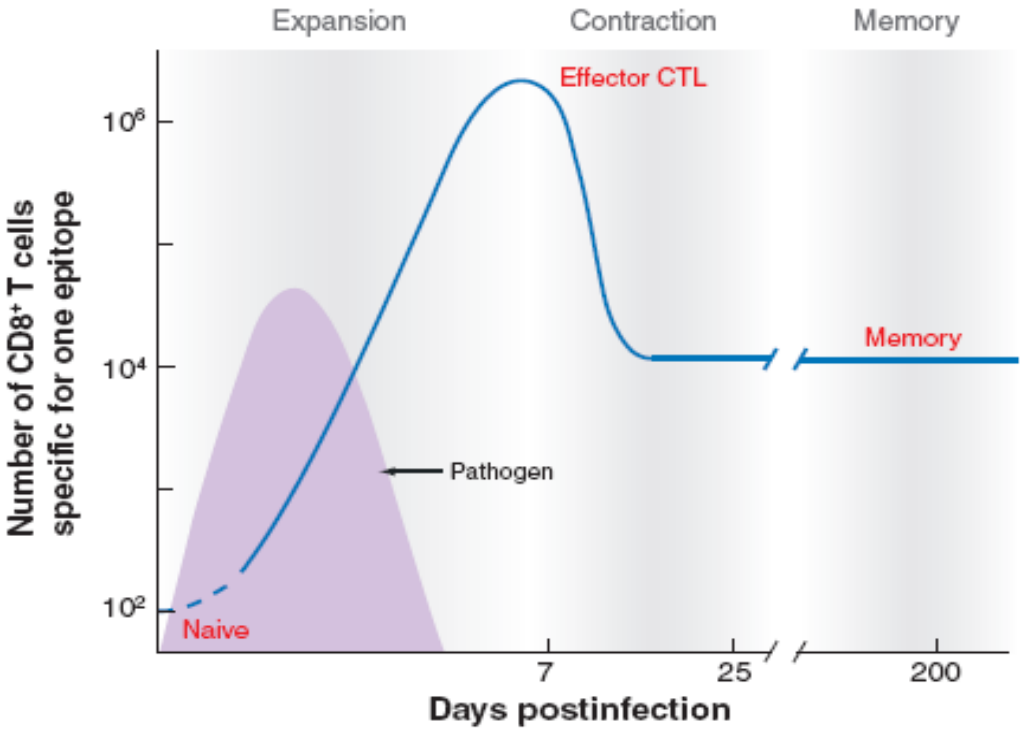


Figure 1

Graphic illustration of the kinetics of the massive proliferative response of naive $CD8^+$ T cells following infection of a mouse with a virulent pathogen such as *Listeria monocytogenes*, lymphocytic choriomeningitis virus, vesicular stomatitis virus, or vaccinia. By some estimates, a mouse contains 50–200 naive $CD8^+$ T cells specific for any one epitope. After a lag of about 24 h, these precursors go through 15–20 cell divisions and generate millions of effector CTL by day 7–8 postinfection. When a pathogen is cleared, the majority of the effectors die, leaving behind a pool of $CD8^+$ memory T cells.

Ann. Rev. Immunol. 25:171, 2007

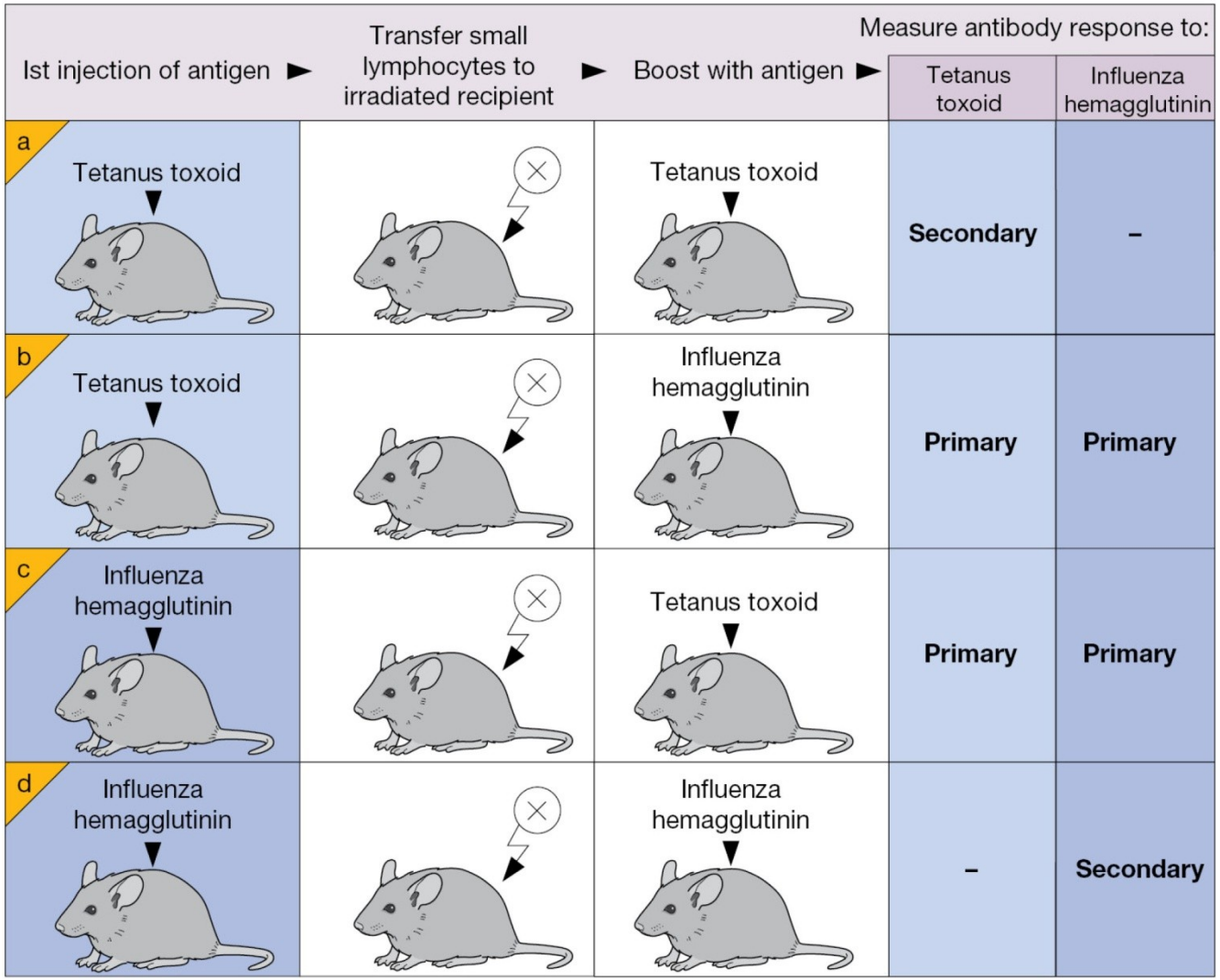


Figure 2.13 Memory for a primary response can be transferred by small lymphocytes. Recipients are treated with a dose of X-rays that directly kill lymphocytes (highly sensitive to radiation) but only affect other body cells when they divide; the recipient thus permits the function of the donor cells to be followed. The reasons for the design of the experiment are given in the text.

Roitt's Essential Immunology, Thirteenth Edition. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, and Ivan M. Roitt.

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Niveles de Ac séricos en el humano

Manz et al Ann. Rev. Immunol. 23:367, 2005

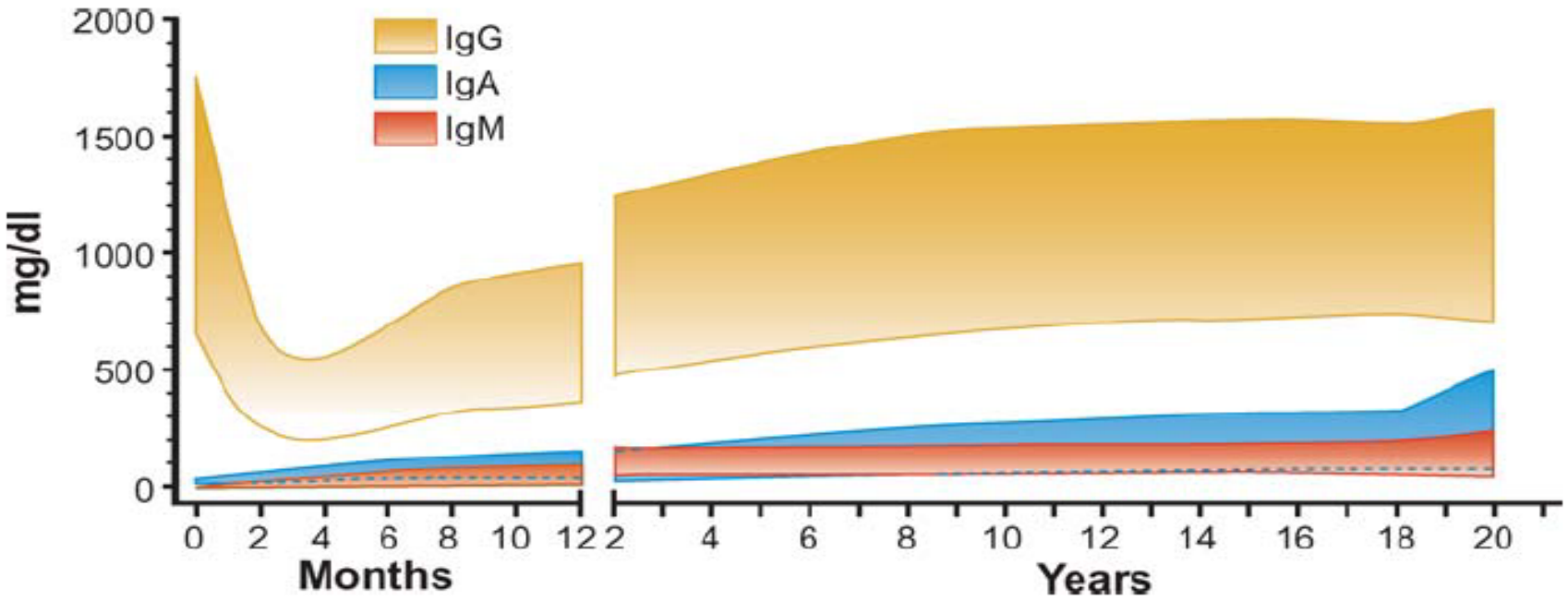


Figure 1 Antibody titers in serum. Levels of IgG, IgA, and IgM increase slowly until adulthood and remain stable thereafter (19).

Altos niveles de Ac de memoria son críticos para la supervivencia de la especie; debido al elevado grado de polimorfismo en el CMH, la transmisión pasiva de LT de memoria puede resultar inútil y peligrosa (GVH)

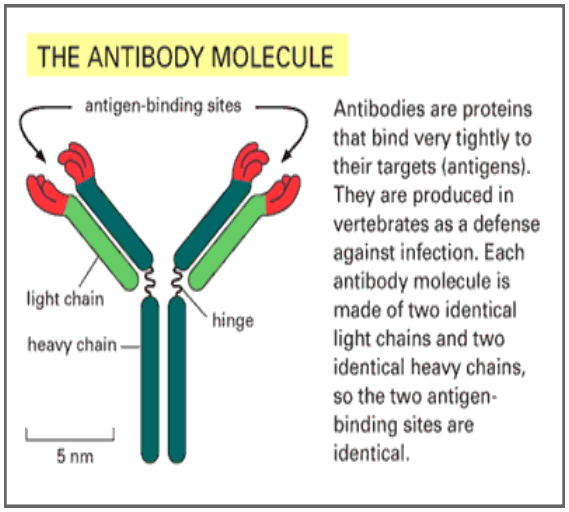
Immunological memory: lessons from the past and look to the future
D. L. Farber et al, Nat Rev Immunol 16:124, 2016

- ¿**Cómo se puede definir la memoria inmunológica**?
- ✓ Las células responsables deben ser de vida larga y mantenerse independientemente de la presencia de Ag; las células implicadas deben haber sido modificadas previamente por el contacto con el Ag, por ejemplo responder más rapidamente.
- ✓ Históricamente el concepto se postulo para explicar la protección clínica a reinfecciones. Los experimentos más recientes muestran que una sola inmunización con un Ag que no persiste por más de 10 días, no mantiene inmunidad protectora.
- ¿**Cuáles se pueden considerar los principales hallazgos en las últimas décadas?**
- ✓ La persistencia de células plasmáticas de larga vida en la medula ósea del ratón y humano.
- ✓ Protección inmune solo se mantiene si hay niveles suficientes de Ac o LT protectores

Inmunidad humoral y celular

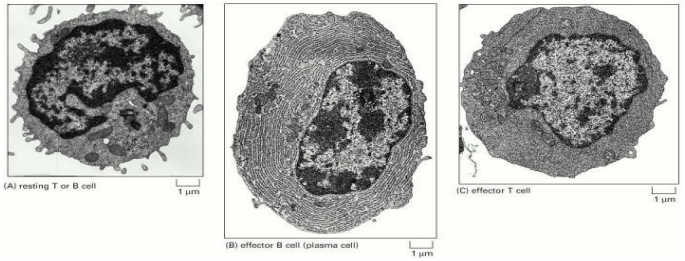
RIH:

- Dependiente de Ac o Igs
- IgG, IgM, IgAS, IgE, IgD
- Eficaz contra patógenos extracelulares



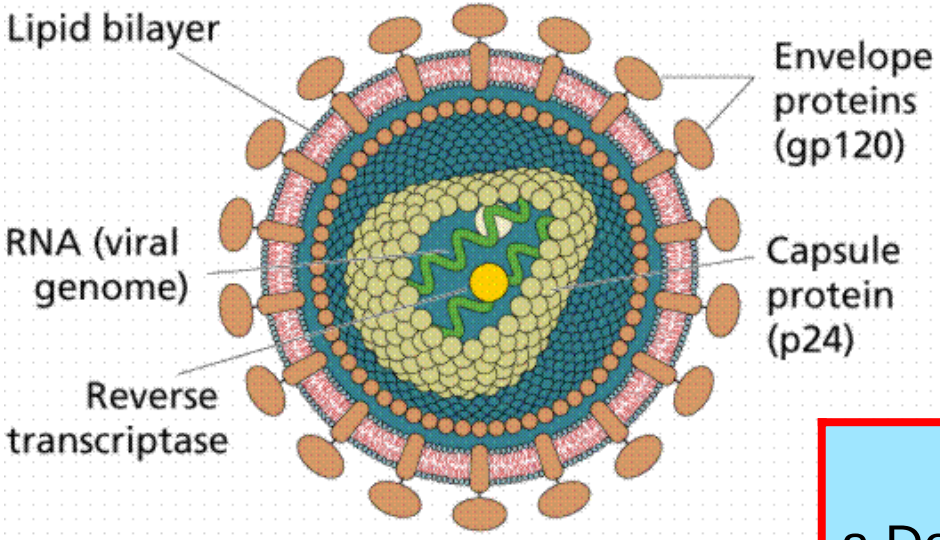
RIC:

- Dependiente de LT
- LTCD4, LTCD8
- Eficaz contra patógenos intracelulares



Antígeno

1. Ajeno al SI
2. Naturaleza química
3. Tamaño molecular



Antigenicidad:

a. Dosis
b. Vía de aplicación
c. Adyuvantes
d. Condiciones inmunosupresoras
e. Factores desnaturalizantes
f. Factores individuales

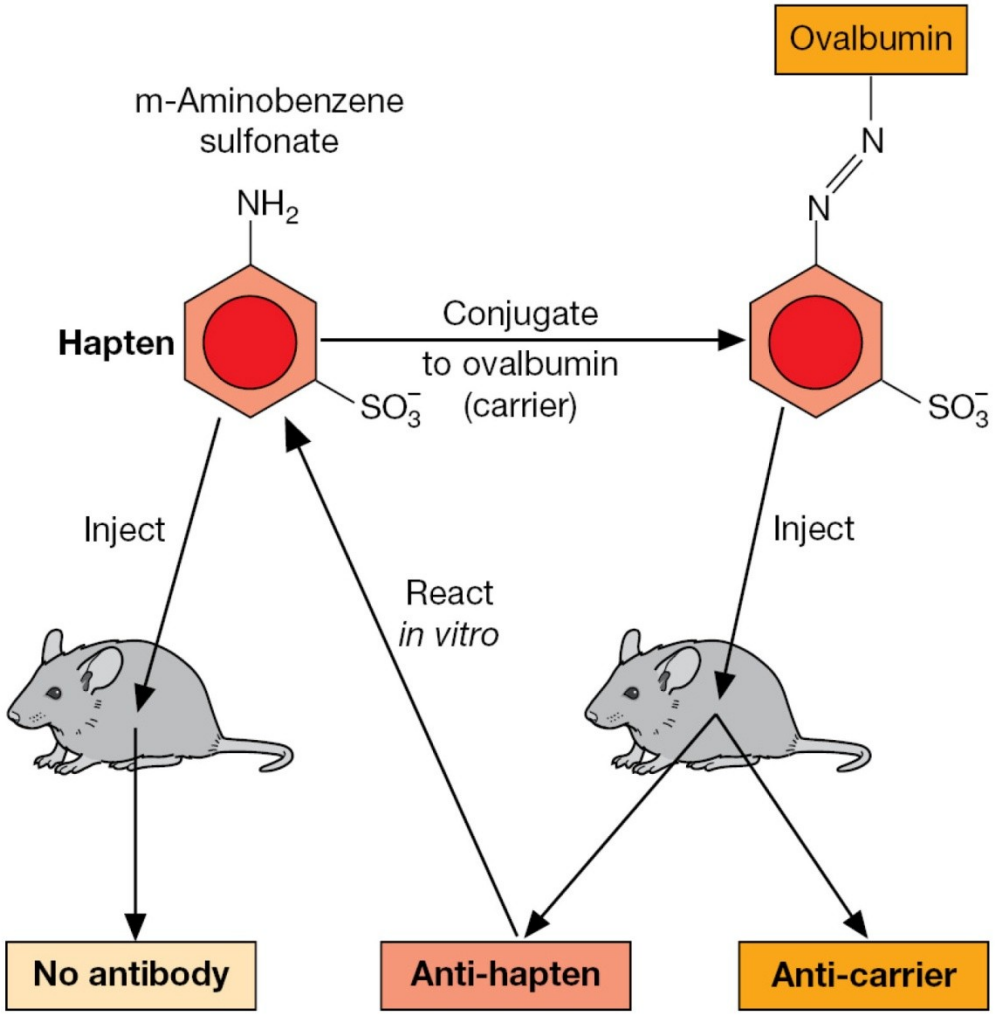


Figure 5.6 Antigenicity and immunogenicity. A free small molecule hapten will not induce antibodies if injected in to an animal. However, high-affinity antibodies specific for the free hapten can be obtained by injecting the hapten conjugated to a protein carrier molecule such as ovalbumin.

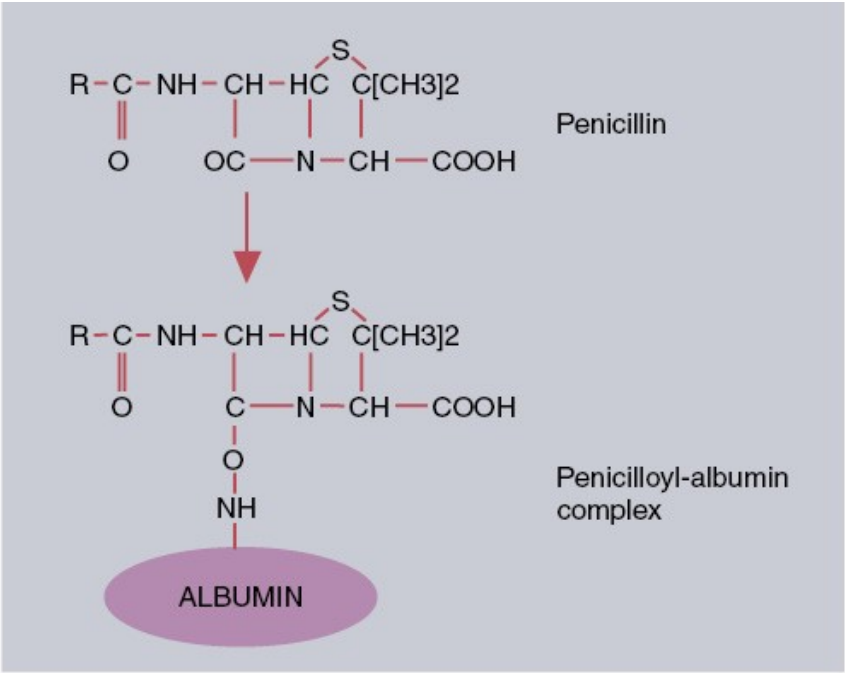


FIGURE 9-7 Penicillin as a hapten. Penicillin can break down in vivo by several different pathways. The most important derivative is a penicillanic acid that combines with amino groups in a protein such as serum albumin to form a penicilloyl-protein complex. This complex may provoke an immune response and result in a penicillin allergy.

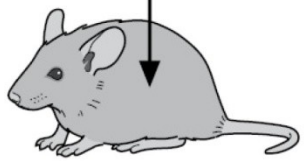
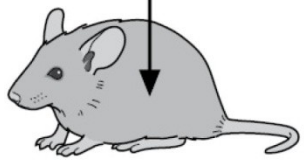
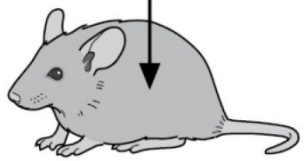
Thymectomy	Ag injected	Antibody response
Sham	Tetanus toxoid or Pneumococcal polysaccharide SIII 	+++
Neonatal	Tetanus toxoid 	–
Neonatal	Pneumococcal polysaccharide 	+++

Figure M7.1.1 The antibody response to some antigens is thymus dependent and, to others, thymus independent. The response to tetanus toxoid in neonatally thymectomized animals could be restored by the injection of thymocytes.

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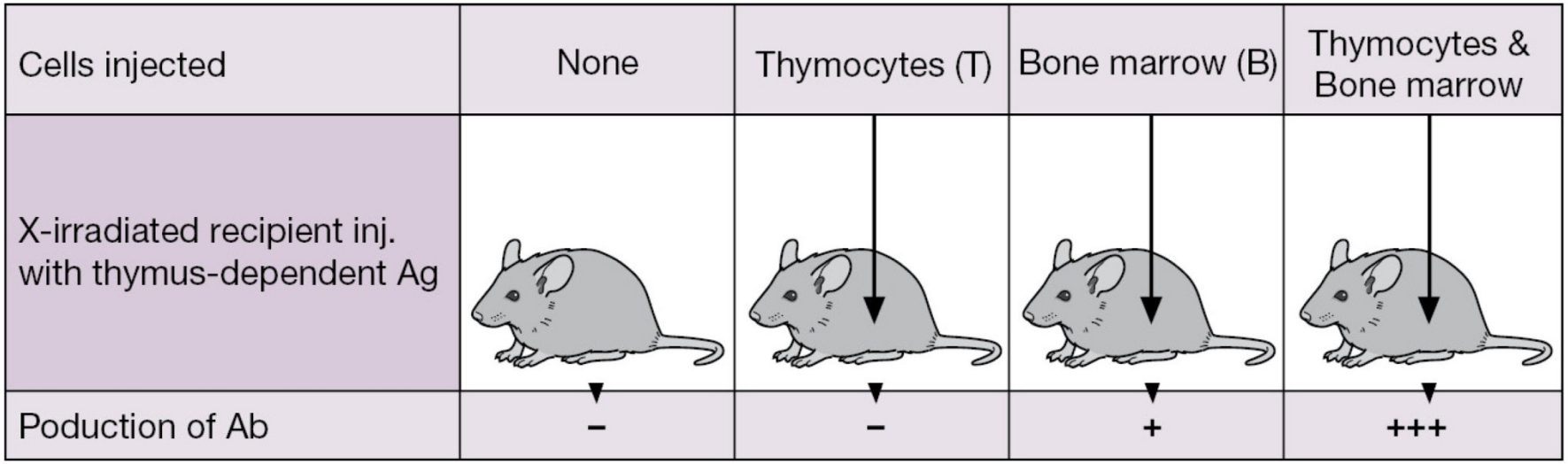

Figure M7.1.2 The antibody response to a thymus-dependent antigen requires two different lymphocyte populations. Different populations of cells from a normal mouse histocompatible with the recipient (i.e., of the same H-2 haplotype) were injected into recipients that had been X-irradiated to destroy their own lymphocyte responses. They were then primed with a thymus-dependent antigen such as sheep red blood cells (i.e., an antigen that fails to give a response in neonatally thymectomized mice; Figure M7.1.1) and examined for the production of antibody after 2 weeks. The small amount of antibody (Ab) synthesized by animals receiving bone marrow alone is due to the presence of thymocyte precursors in the cell inoculum that differentiate in the intact thymus gland of the recipient.

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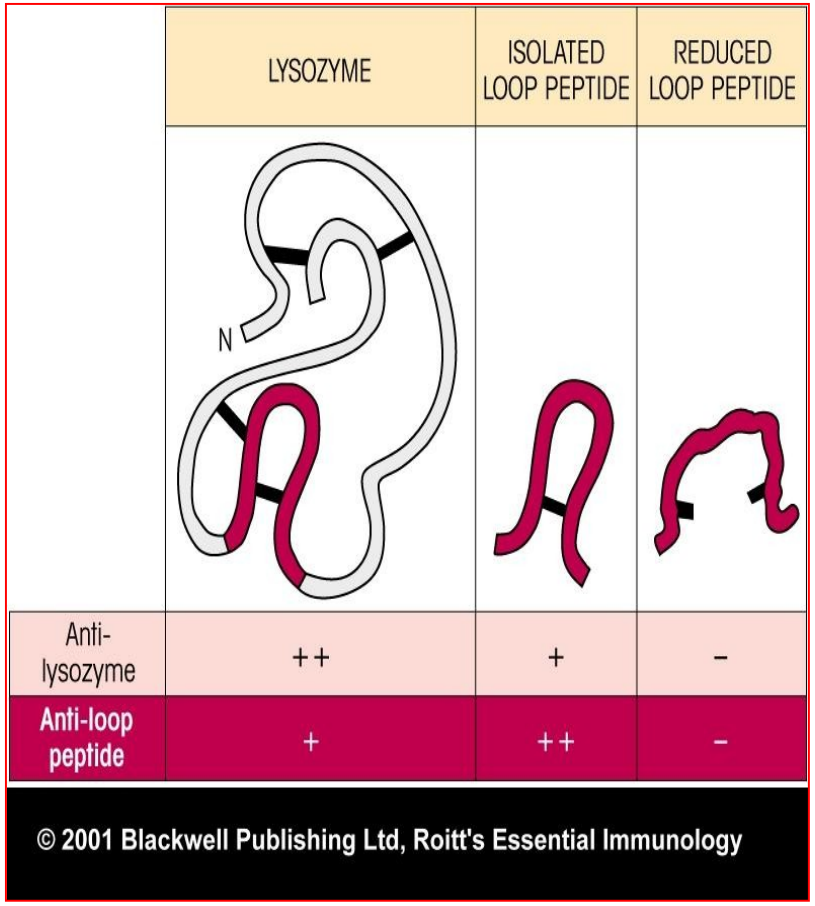
Determinantes antigénicos



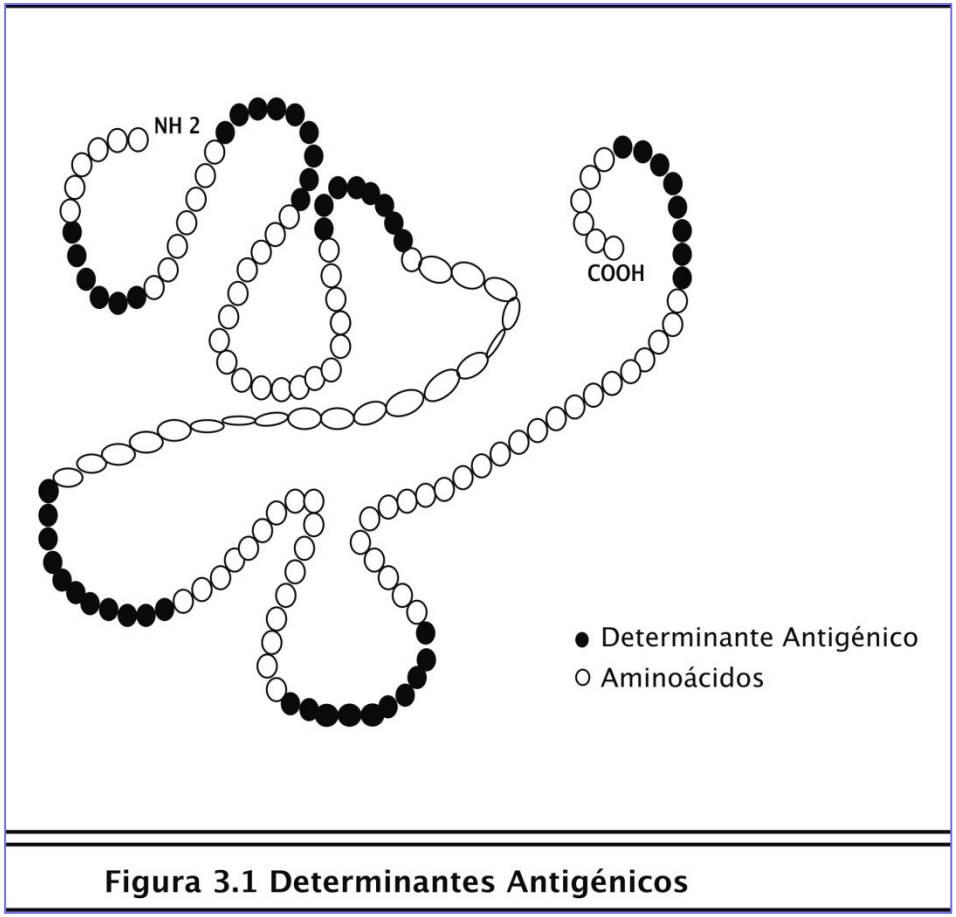


Figura 3.1 Determinantes Antigénicos

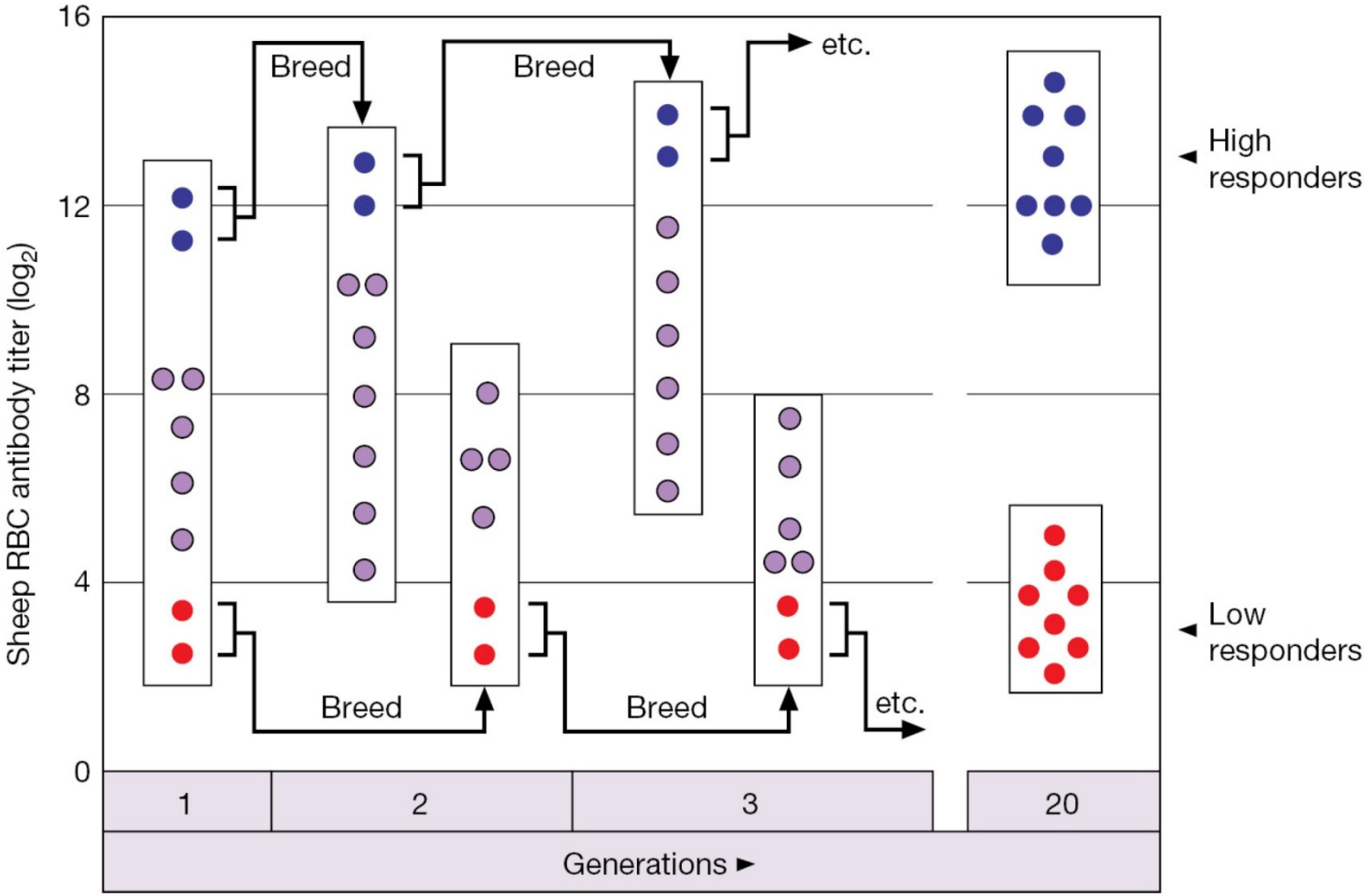


Figure 9.2 Selective breeding of high and low antibody responders. A foundation population of wild mice (with diverse genetic makeup and great variability in antibody response) is immunized with sheep red blood cells (RBC), a multideterminant antigen. The antibody titer of each individual mouse is shown by a circle. The male and female giving the highest titer antibodies (blue dots) were bred and their litter challenged with antigen. Again, the best responders were bred together and so on for 20 generations when all mice were high responders to sheep RBC and a variety of other antigens. The same was done for the poorest responders (red dots), yielding a strain of low responder animals.

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Inmunidad activa y pasiva

- Inmunidad activa natural: Infecciones y enfermedad.
- Inmunidad activa artificial: Vacunación.

- Inmunidad pasiva natural: Calostro y saco vitelino

- Inmunidad pasiva artificial: Sueros hiperinmunes.

Vacunas tradicionales

- **Vacunas:**

1) Virus vivos atenuados o muertos.
2) Bacterias vivas, atenuadas o esporas.
3) Fases parasitarias vivas

- **Bacterinas:**
- Bacterias muertas.
- **Toxoides:**

Toxinas inactivadas.

❖

En términos generales:

Las vacunas que contienen microorganismos vivos o atenuados inducen RIH y RIC.

Las vacunas que contienen microorganismos muertos y/o toxinas inducen RIH.

Las vacunas de nueva generación

- Subcelulares (RIH)

  (ej. Colibacilosis K88, K99;
  Pleuroneumonia ApxI, ApxII, ApxIII)
- Recombinantes (RIH y RIC)

  (ej. Rabia silvestre)
- De ADN (RIH y RIC)

  (ej. Virus del Este del Nilo-EUA)

Conceptos para recordar

- Antígeno
- Antígenos ocultos
- Hapteno
- Determinante antigénico
- Respuesta primaria y secundaria
- Linfocito virgen y linfocito de memoria
- Inmunidad humoral e inmunidad celular
- Inmunglobulina
- Inmunida activa y pasiva
- Inmunidad natural y artificial