IMMUNE RESPONSE TO VACCINES (contd)

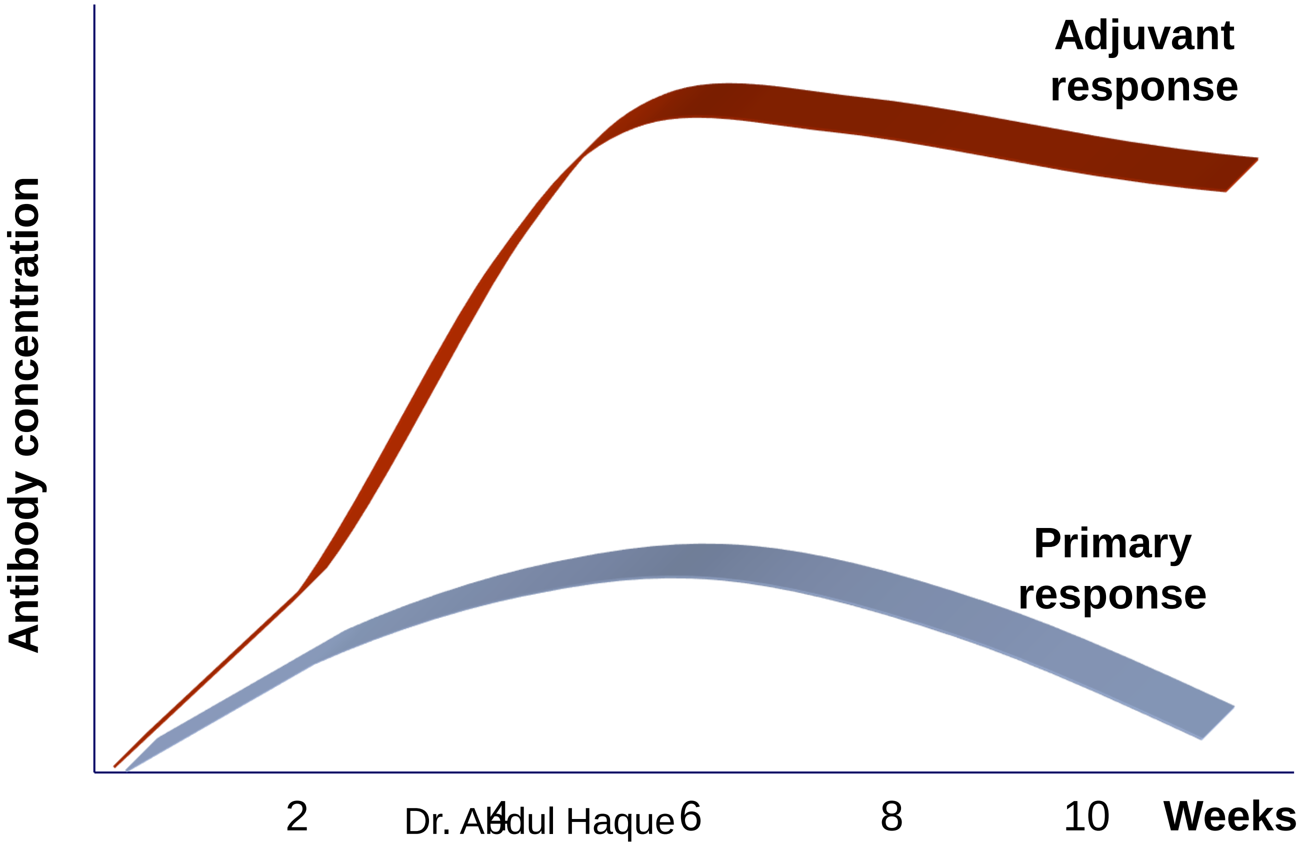
ADJUVANTS

- An adjuvant is an agent that **stimulates the immune system** and **increase the response to a vaccine**, *without having any specific antigenic effect in itself*.

- An adjuvant **augments** the activities of **dendritic cells, lymphocytes** and **macrophages**.

- Additionally, it helps the antigen to be **slowly released** for a sustained immune response.

Adjuvants



Tang H, GSK, 2006

Types of adjuvants

Inorganic adjuvants

Aluminium phosphate and **aluminium hydroxide** have been the most common adjuvants in human vaccines.

Aluminum salts are rarely used now, since they develop their effect by inducing **local inflammation**.

Organic adjuvants

Used in some **veterinary vaccines.** Example **peanut oil.**

Mineral Oil-based adjuvants

The most commonly used are **Freund's** complete and incomplete adjuvants.

These are mainly used in animals.

Freunds incomplete adjuvant:

Mineral oil (usually paraffin oil or pristane) + water

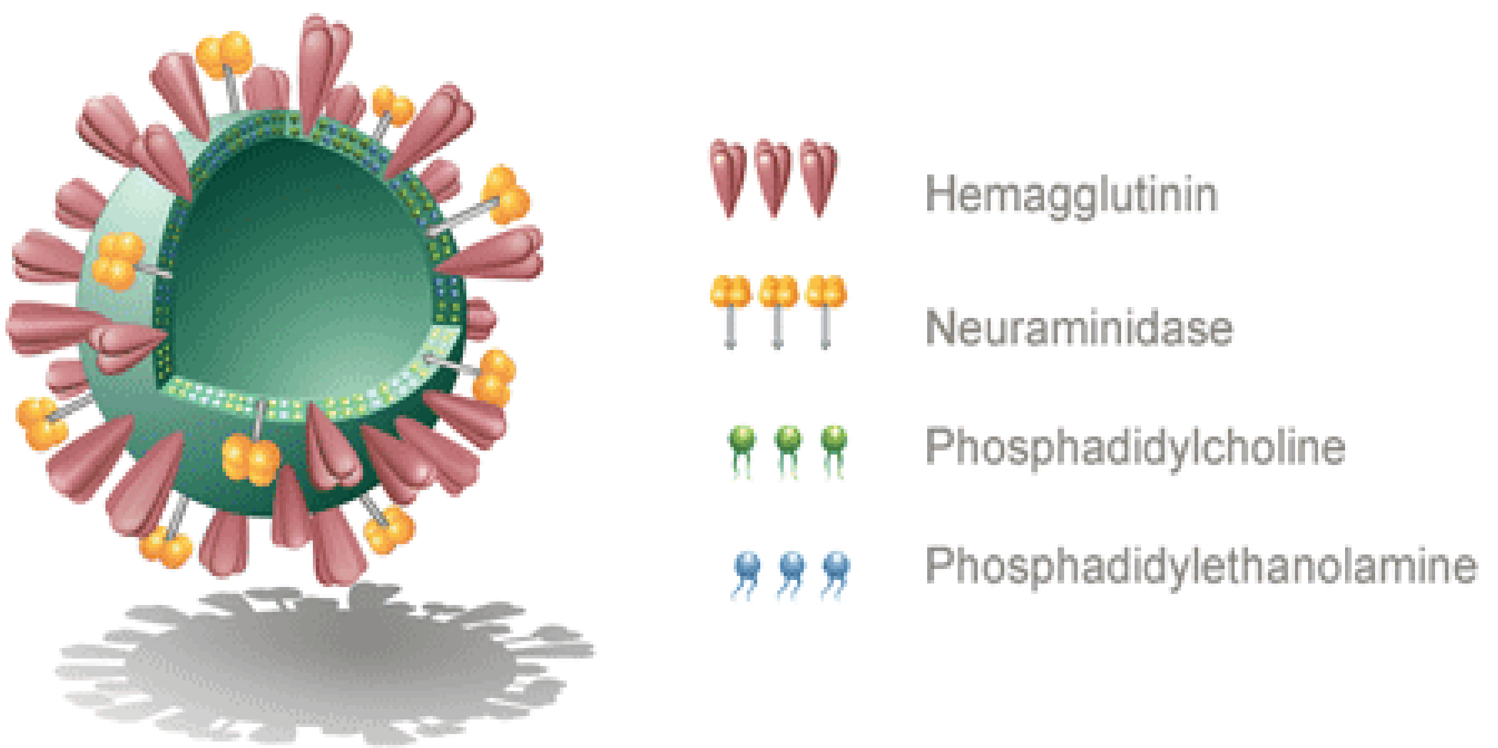
Freunds complete adjuvant:

Mineral oil + water + inactivated *Myco. tuberculosis*

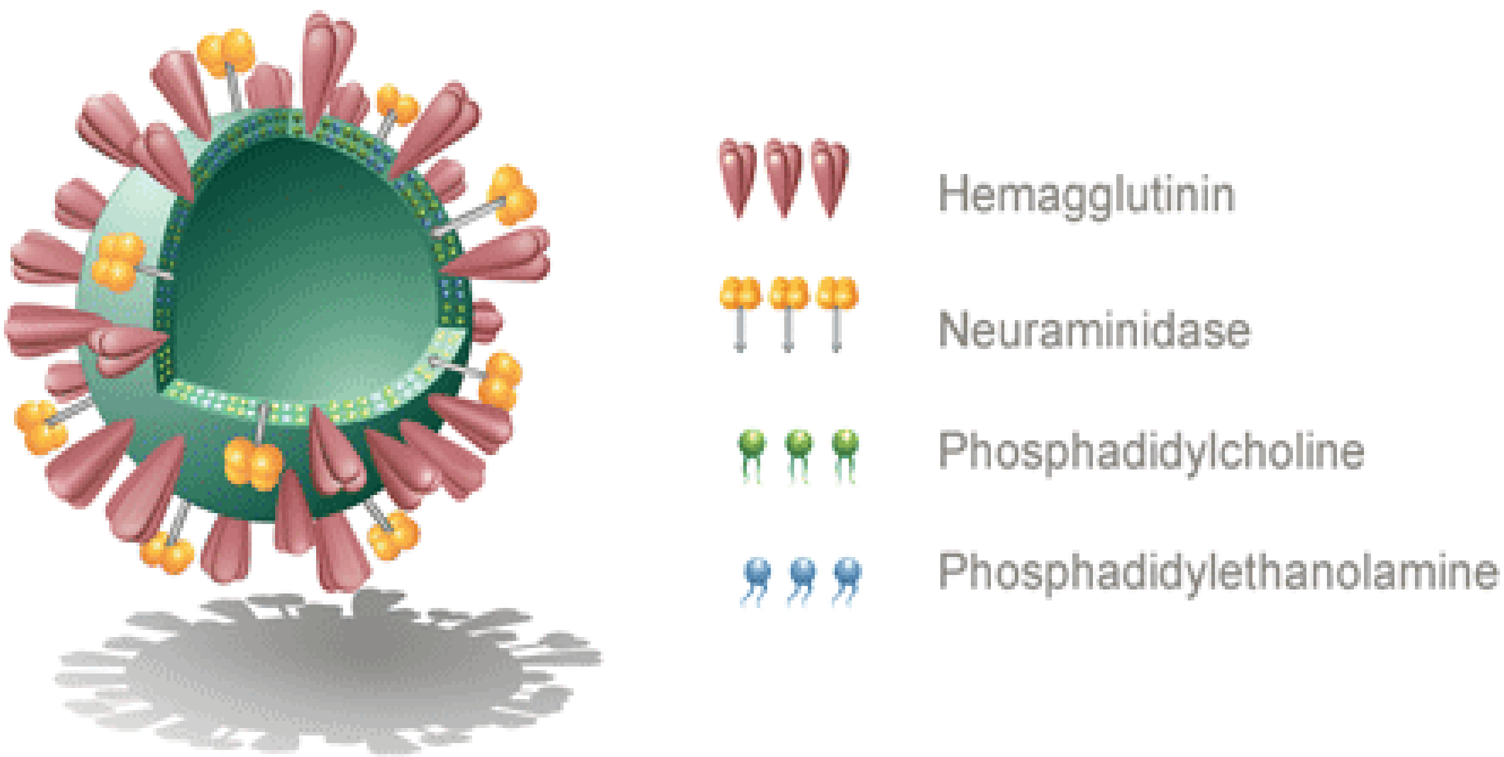
Virosomes

- **Virosomes** are **artificial** viruses
- They **do not cause** any inflammatory reaction.
- They facilitate the **uptake** of antigen **into antigen presenting cells (APC)** and induce a **natural antigen-processing pathway.**
- Structurally, a virosome is a **unilamellar phospholipid bilayer vesicle** with a mean diameter of **150 nm**.

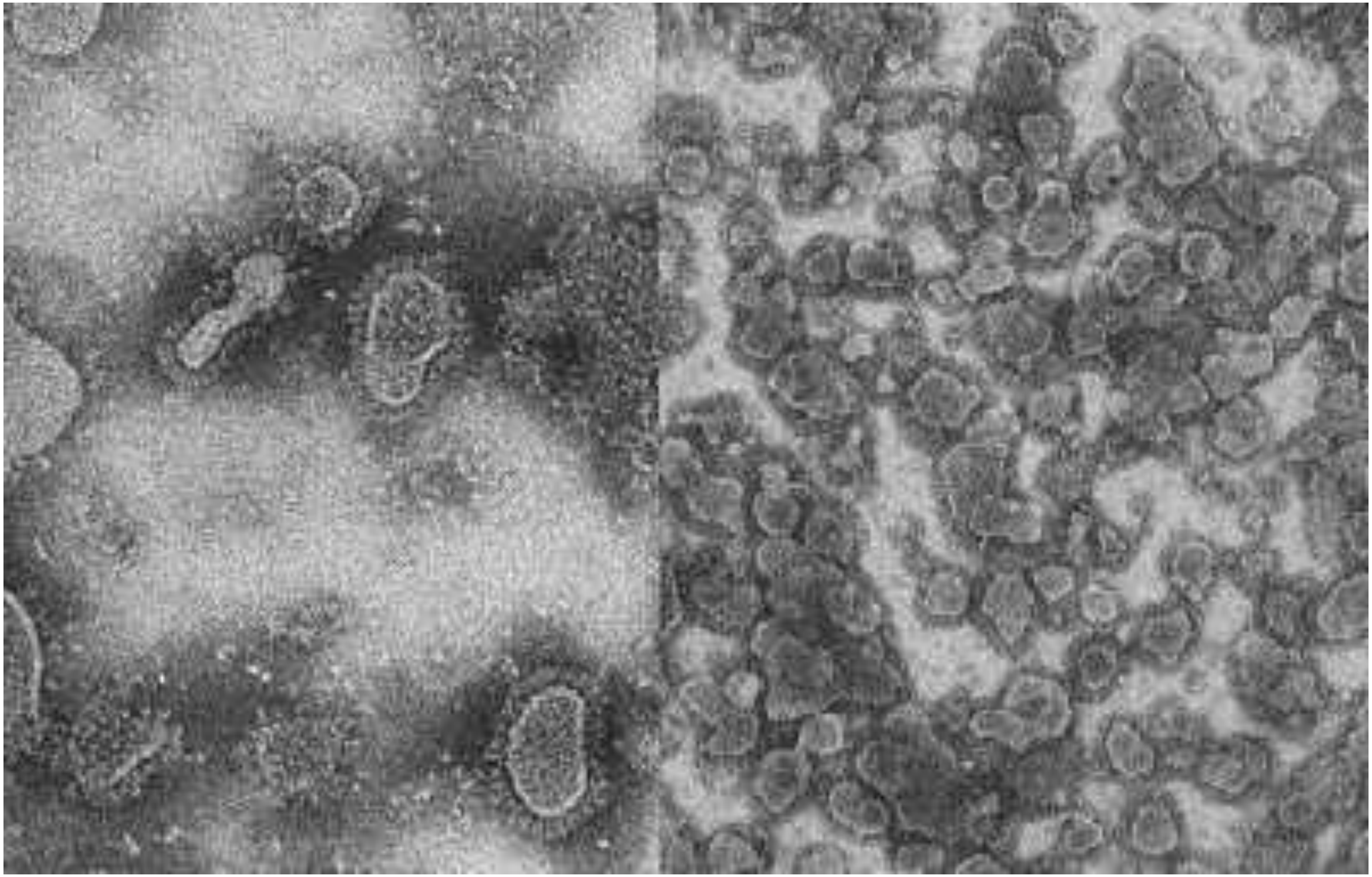
- Virosomes represent **reconstituted empty influenza virus envelopes**, devoid of the nucleocapsid including the genetic material of the source virus.



- However, virosomes **contain functional viral envelope glycoproteins**: influenza virus hemagglutinin (HA) and neuraminidase (NA) intercalated in the phospholipid bilayer membrane.



Virosomes



Institute of Pathology, University of Bern

Immuno-stimulating Complexes (ISCOMs)

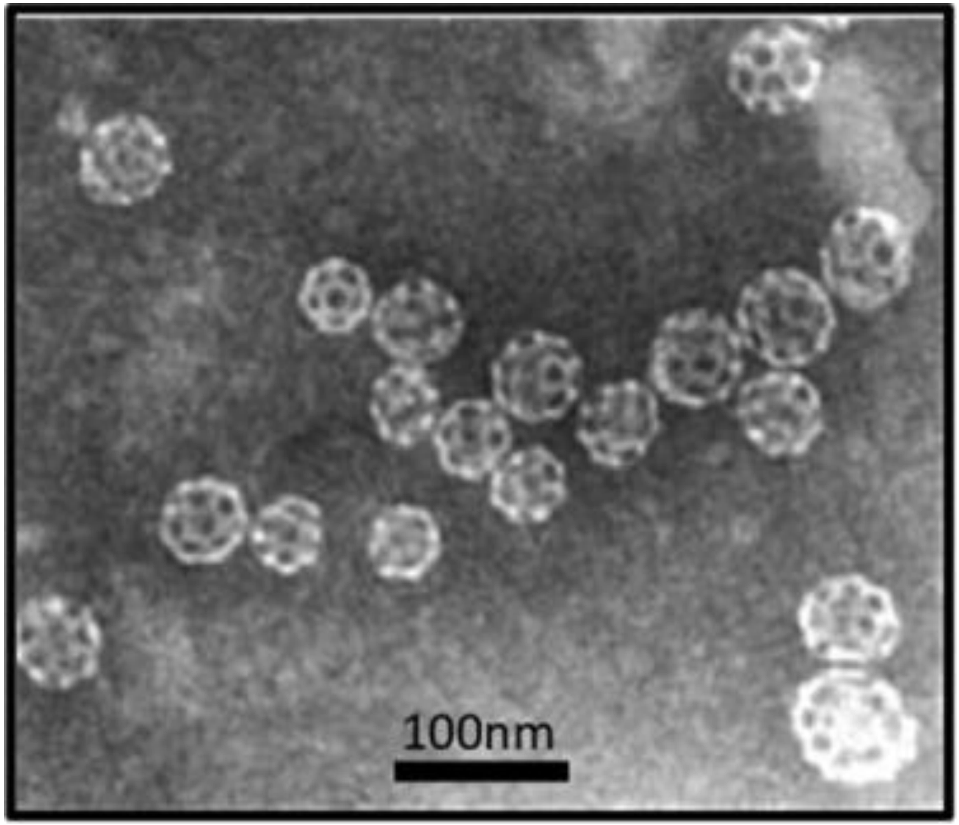
- **ISCOMs** are **artificial** adjuvants with **multiple** properties.

- The antigen is presented in an **accessible, multimeric, physically well defined complex.**

- They are built up by cholesterol, other lipids, immunogen, and saponins (e.g., Quil A) **held in a cage like structure.**

- Mean diameter is **35-40 nm**.

- ISCOMs have been demonstrated to promote **antibody responses** and **induce T helper cell** as well as **cytotoxic T lymphocyte** responses.



SELECTIVE INDUCTION OF DIFFERENT IMMUNE RESPONSES

- Two cytokines in particular, **IL-4** and **IL-12**, have been shown to **dominate the overall immune response.**

- **IL-4** induces a **type 2 T-cell response** characterized by **strong Ig responses**.

- In contrast **IL-12** favors a **type 1 T-cell response**.

BOOSTER DOSES

- Boosting a vaccine involves **revaccination** by the **same** or some **other** vaccine.

- Booster doses help in raising **sufficiently large immune response** to be effective in protecting against disease.

- Boosting helps to **replenish** the immune response after a **long period** (e.g., 10 years as is the case for tetanus vaccine).

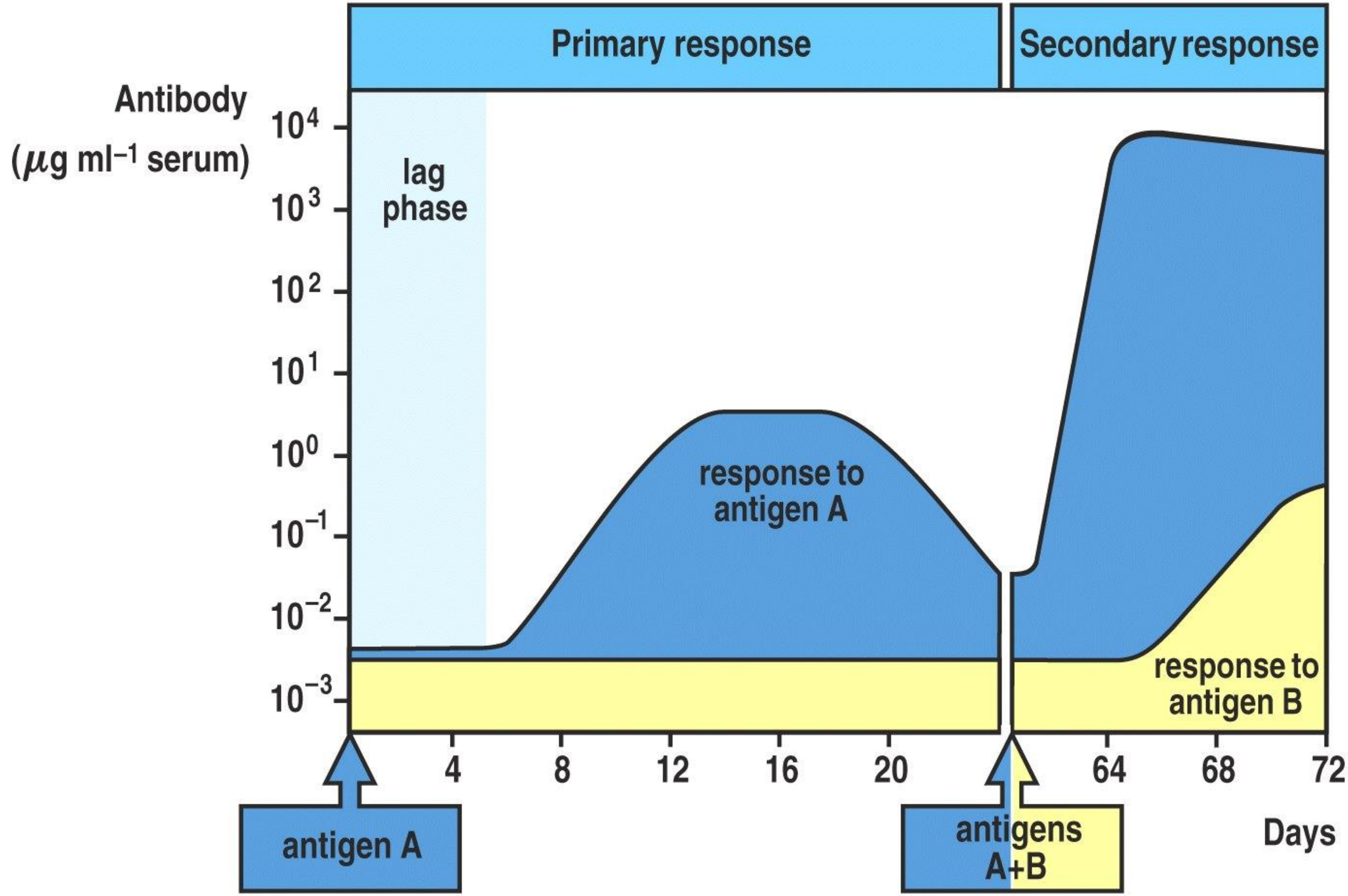


Figure 1-20 Immunobiology, 6/e. (© Garland Science 2005)

REQUIREMENTS FOR SUCCESSFUL VACCINATION

The requirements for **successful** vaccination are:

- **Activation of APCs**, involving the processing of antigens.
- The **expression** of **co-stimulatory factors** and **chemokine receptors** at the cell surface.
- Secretion of certain **cytokines**.

- The **activation, replication,** and **differentiation** of **T and B lymphocytes** leading to the generation of large pools of **memory cells** of both types.

- The incorporation of **sufficient B cell epitopes** in the vaccine to generate strong **neutralizing antibody responses.**

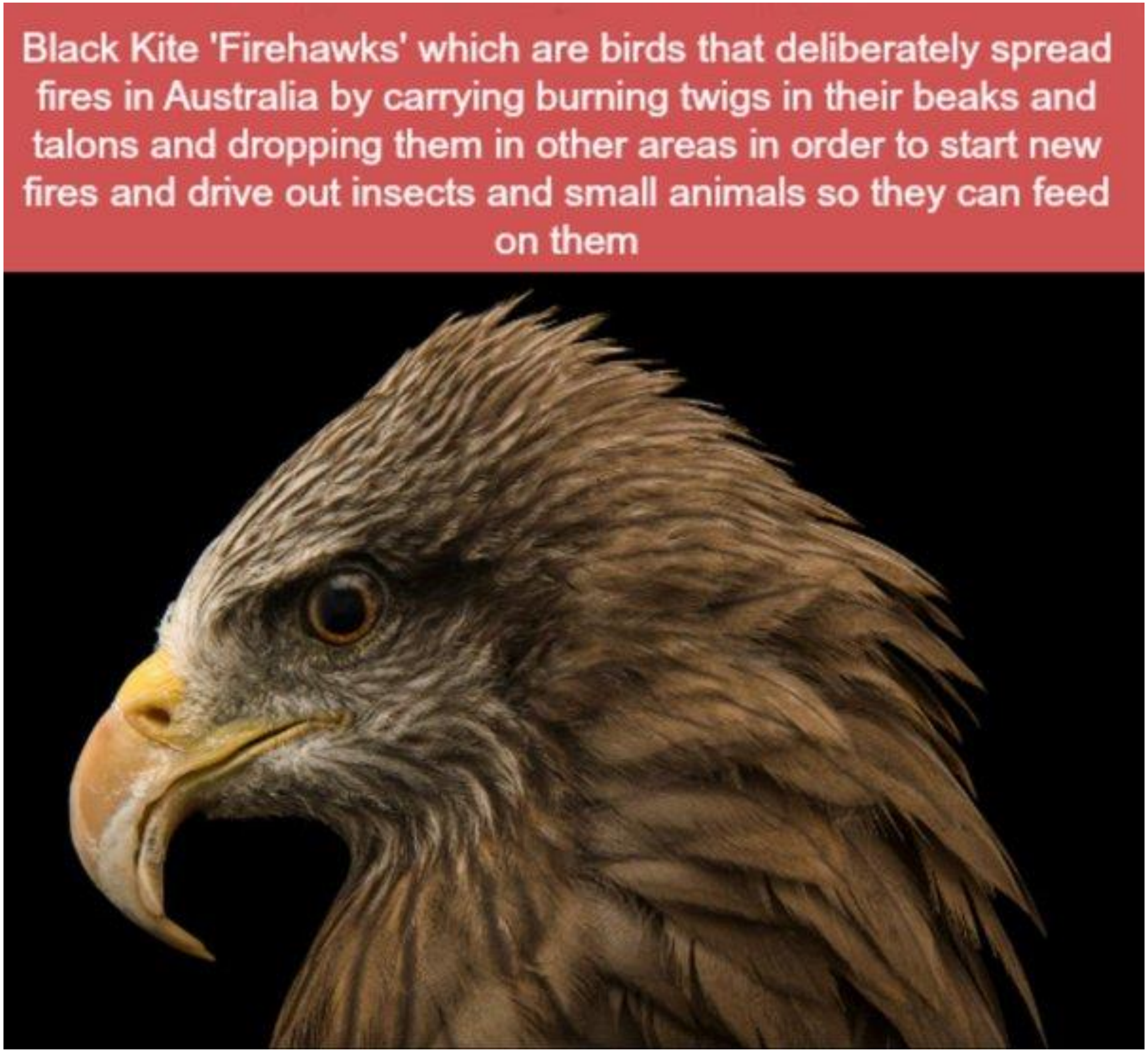
- The incorporation of **T-cell determinants** that bind with **high affinity** to **MHC** molecules so that the complex is recognized by the **T-cell receptor**.

-- The **long-term persistence** of **conformationally intact antigen**, preferably as aggregates complexed with antibody and held at the **surface of FDCs** in lymphoid tissues.

This allows the **continuing** production of cells that secrete **antibody of increasingly high affinity**, and of **memory B cells.**


”انکل ہم لوگ جدید ٹیکنالوجی کیوں یُوز نہیں کرتے؟“
”اسلئے کہ ہم نے جھوٹ بولنا ہوتا ہے اور ٹیکنالوجی جھوٹ نہیں بولتی“


BRIAN LARA


Black Kite 'Firehawks' which are birds that deliberately spread fires in Australia by carrying burning twigs in their beaks and talons and dropping them in other areas in order to start new fires and drive out insects and small animals so they can feed on them


Thank You!