A New Approach to Vaccine Development for Porcine Virus Infections

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An immune response is a bad thing

Inflammation: flu like symptoms (cytokine storm), toxic shock syndrome (cytokine storm that kills), allergies, tissue destruction, etc.

Autoimmune disease; arthritis, diabetes, multiple sclerosis, lupus, etc.

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Not making an immune response

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Inflammation: flu like symptoms (cytokine storm), toxic shock syndrome (cytokine storm that kills), allergies, tissue destruction, etc.

Autoimmune disease; arthritis, diabetes, multiple sclerosis, lupus, etc.

Not making an immune response is worse

Vaccination is the act of purposefully inoculating an individual to induce an immune response to protect against exposure to the pathogen. Other than live attenuated vaccines,

Vaccination is an artificial induction of the immune response.

To understand how vaccines work, you must understand the immune response

Why not live, attenuated vaccines

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In 1956, Dr. Walter Plowright (1923-2010) was assigned to the Muguga Laboratory of the East African Veterinary Research Organization

He developed a method to grow rinderpest virus in vitro and passaged the virus extensively, resulting in a rinderpest vaccine strain that was highly attenuated. The vaccine stimulates both humoral and cellular immune responses for comprehensive protection

The ability to lyophilize (freeze dry) the virus and eliminating the need for a cold chain was critical for eradication of the disease.

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This process took decades to isolate a safe, vaccine strain of the virus and testing was vaccinate/challenge and screen for disease.

In the face of the spread of African swine fever virus,

porcine reproduction and respiratory syndrome virus,

swine influenza virus, porcine epidemic diarrhoea virus,

we DO NOT have decades to develop new,

efficacious vaccines.

And this will make it worse!

FarmJournal's PORK

Jennifer Shike

November 12, 2019

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Underground ASF Vaccines in China: What's the Risk?

Simple and quick

New PEDV vaccine
was developed within a year of the first outbreak.

Composed of killed virus and adjuvant,

Simple and quick

New PEDV vaccine
was developed within a year of the first outbreak.

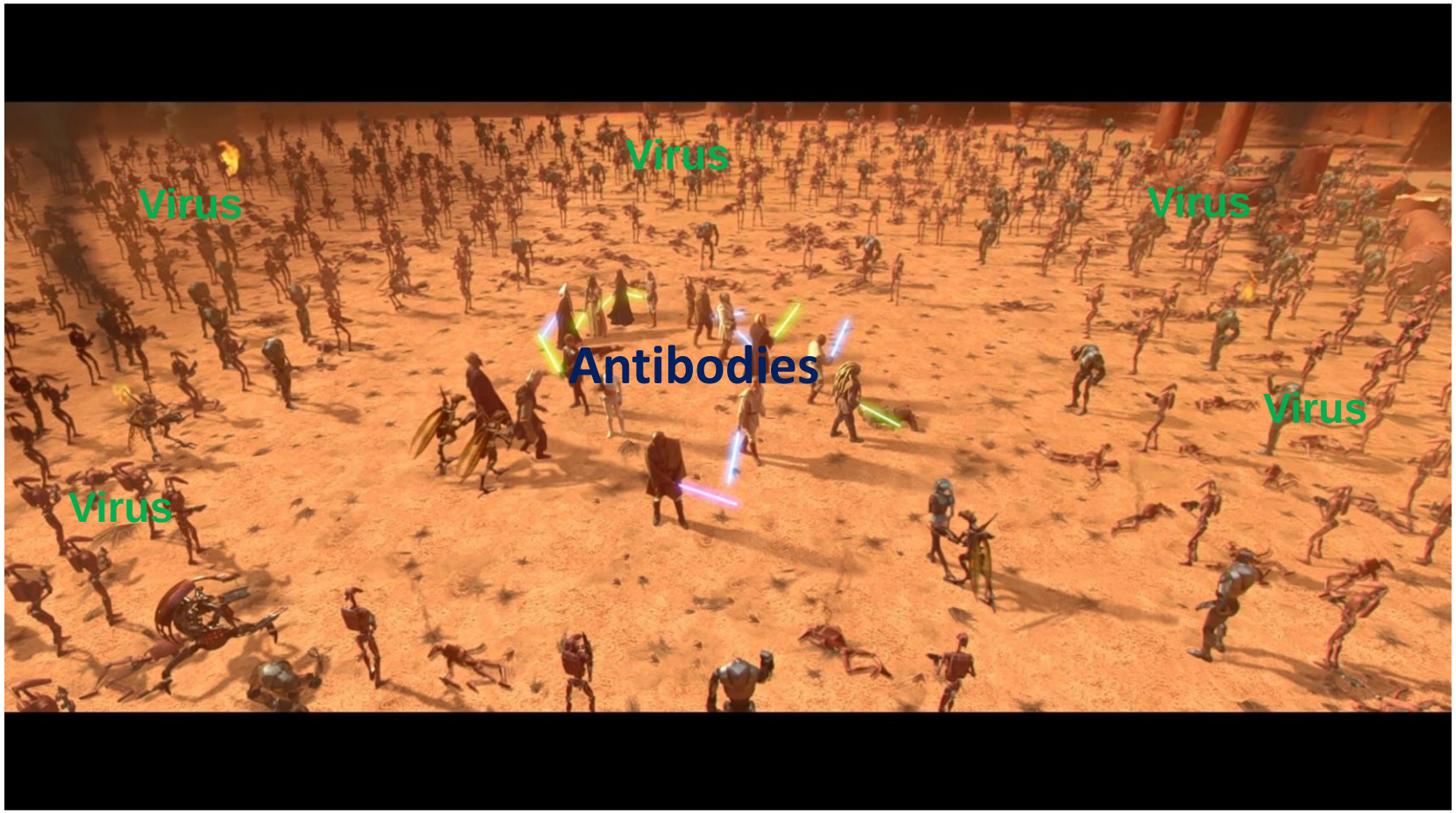
Composed of killed virus and adjuvant,
the vaccine does not alter virus spread in the herd.

(J Swine Health Prod. 2019;27(5):256-264.)

Good antibody response, no effect on shedding!

Star Wars: Attack of the Clones

Killed Vaccines: Control of the Virus

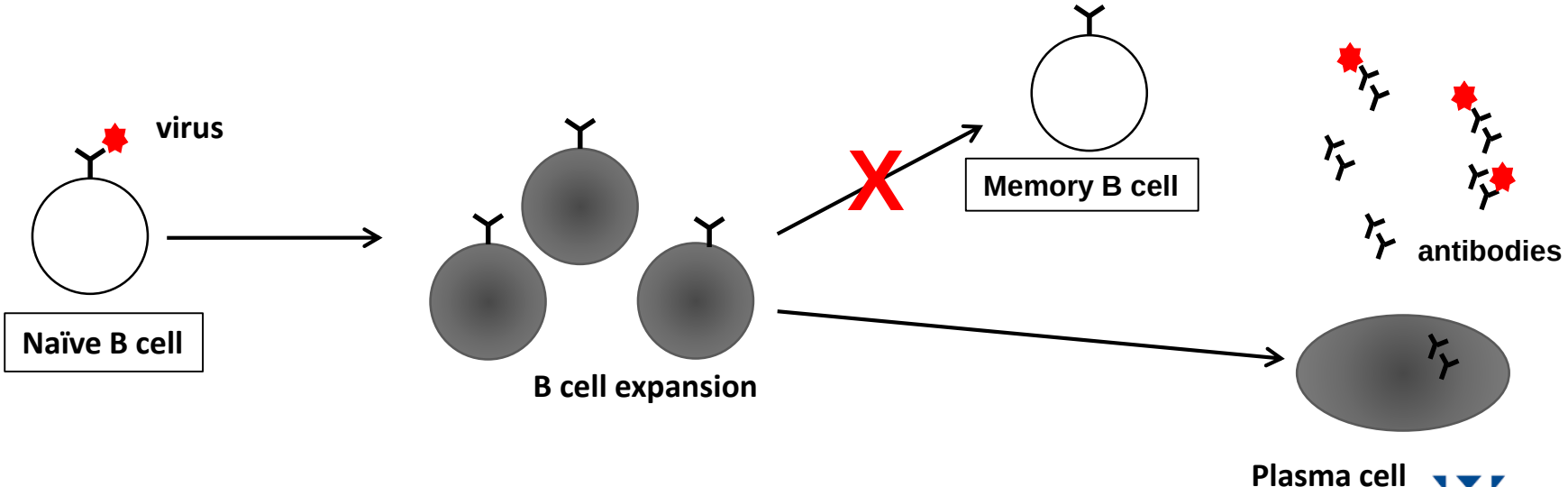


Problem:

Antibodies are outnumbered following vaccination with protein

(recombinant/killed pathogen/vectored, empty capsid/VLP)

provides limited antigen exposure and a finite amount of anti-virus antibody producing cells are induced AND they are short lived



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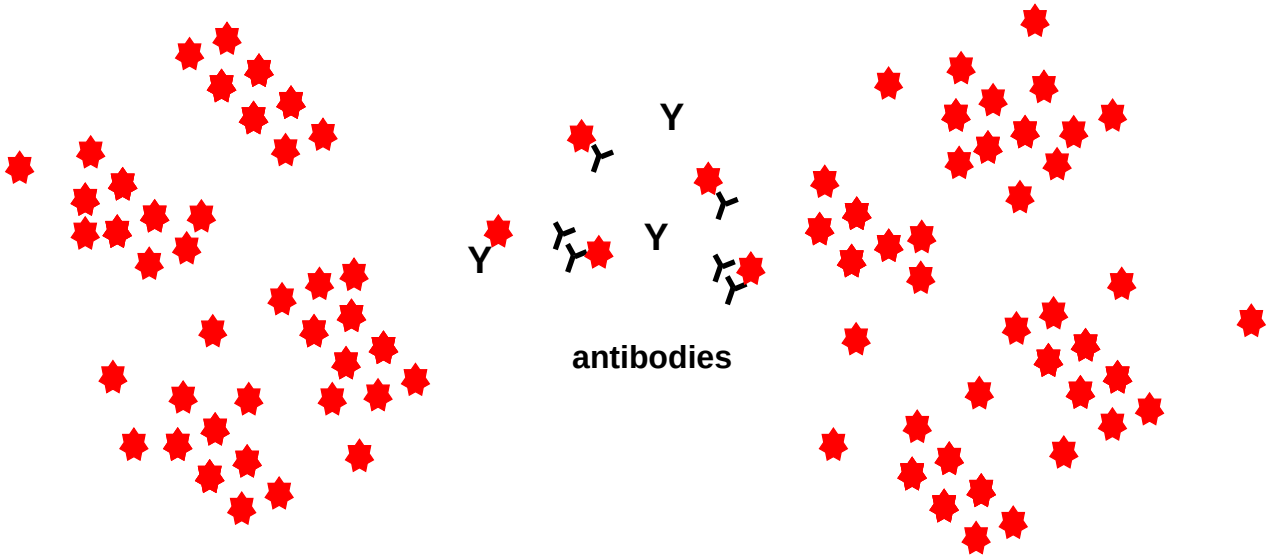

In the face of large amounts of virus

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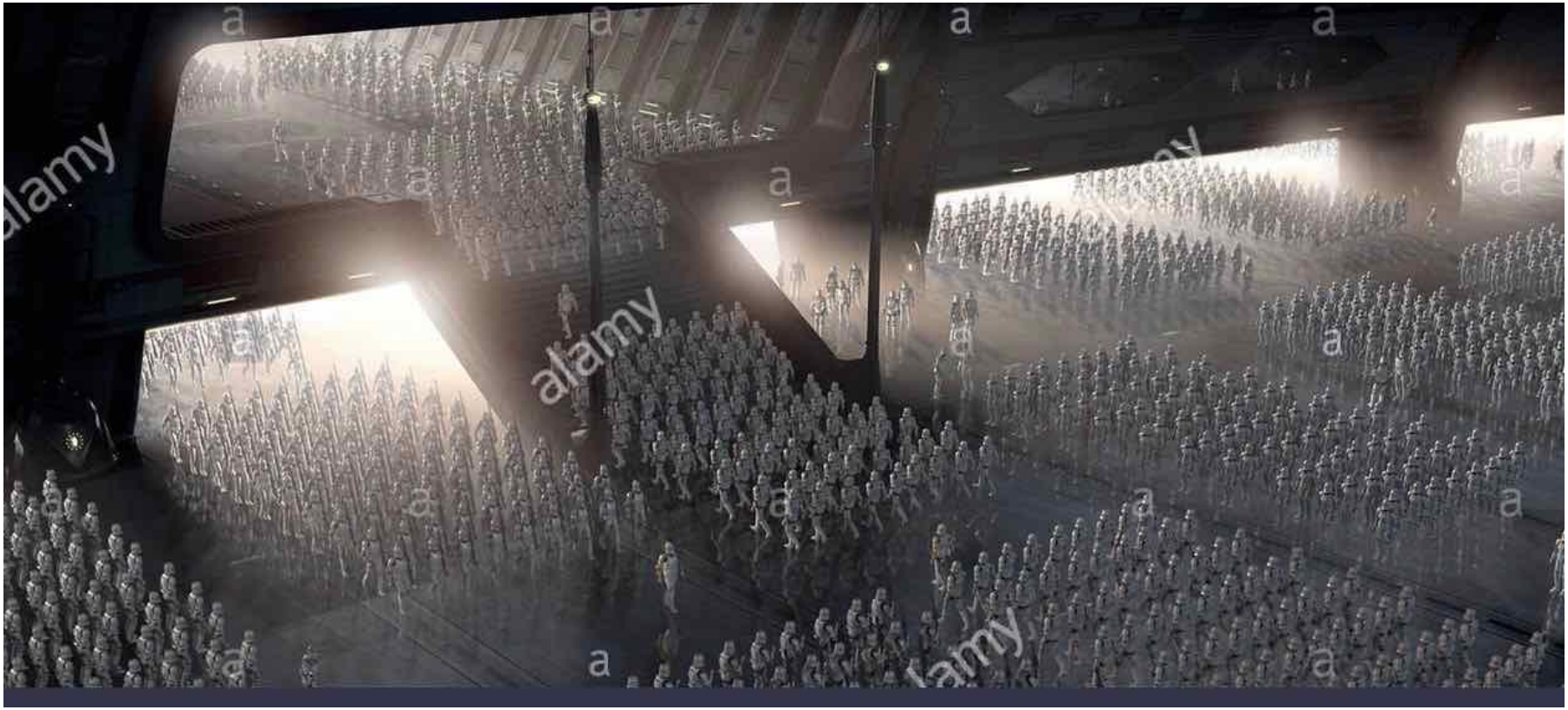
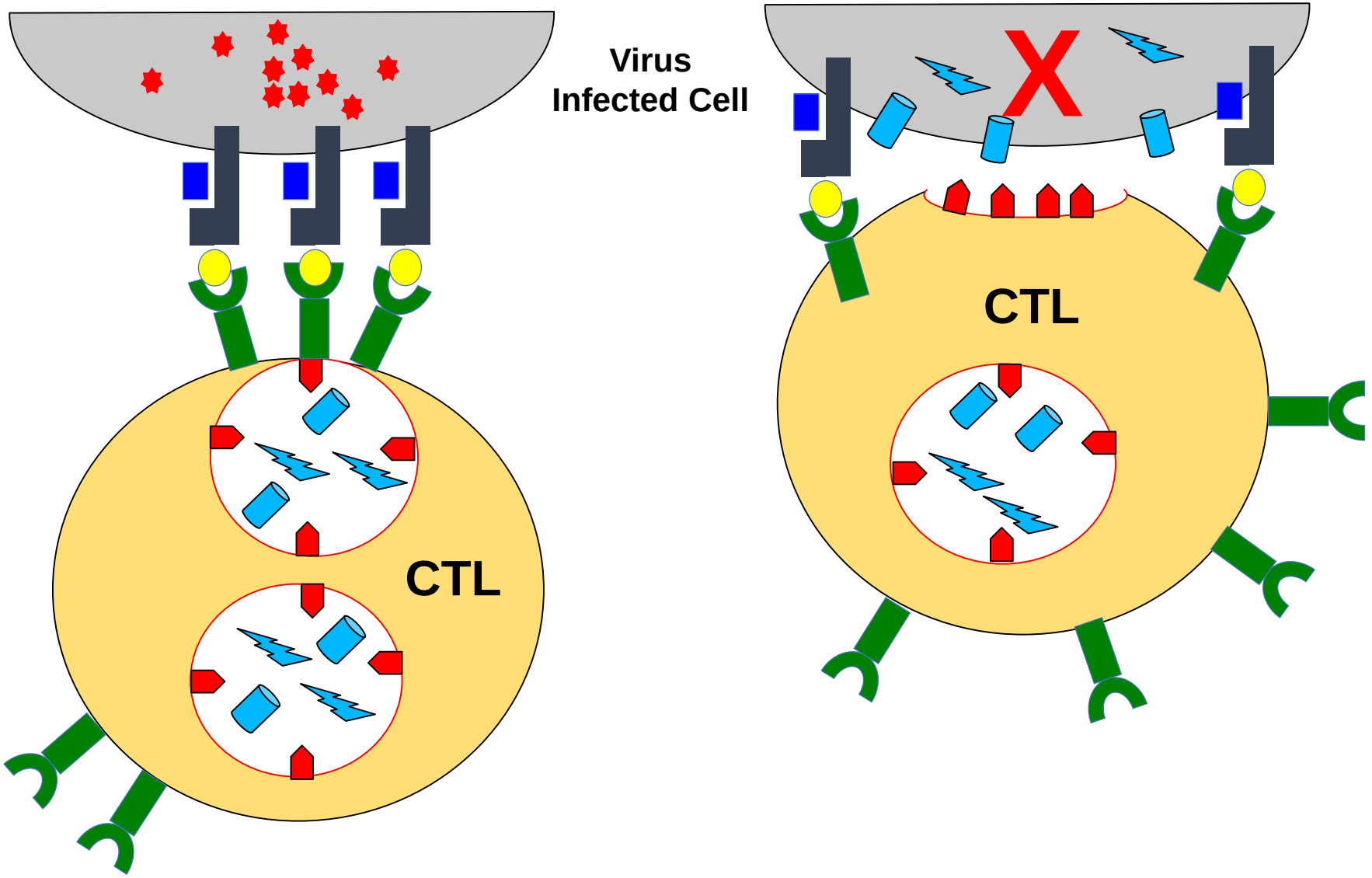
How do you win the war with the clones (viruses)?



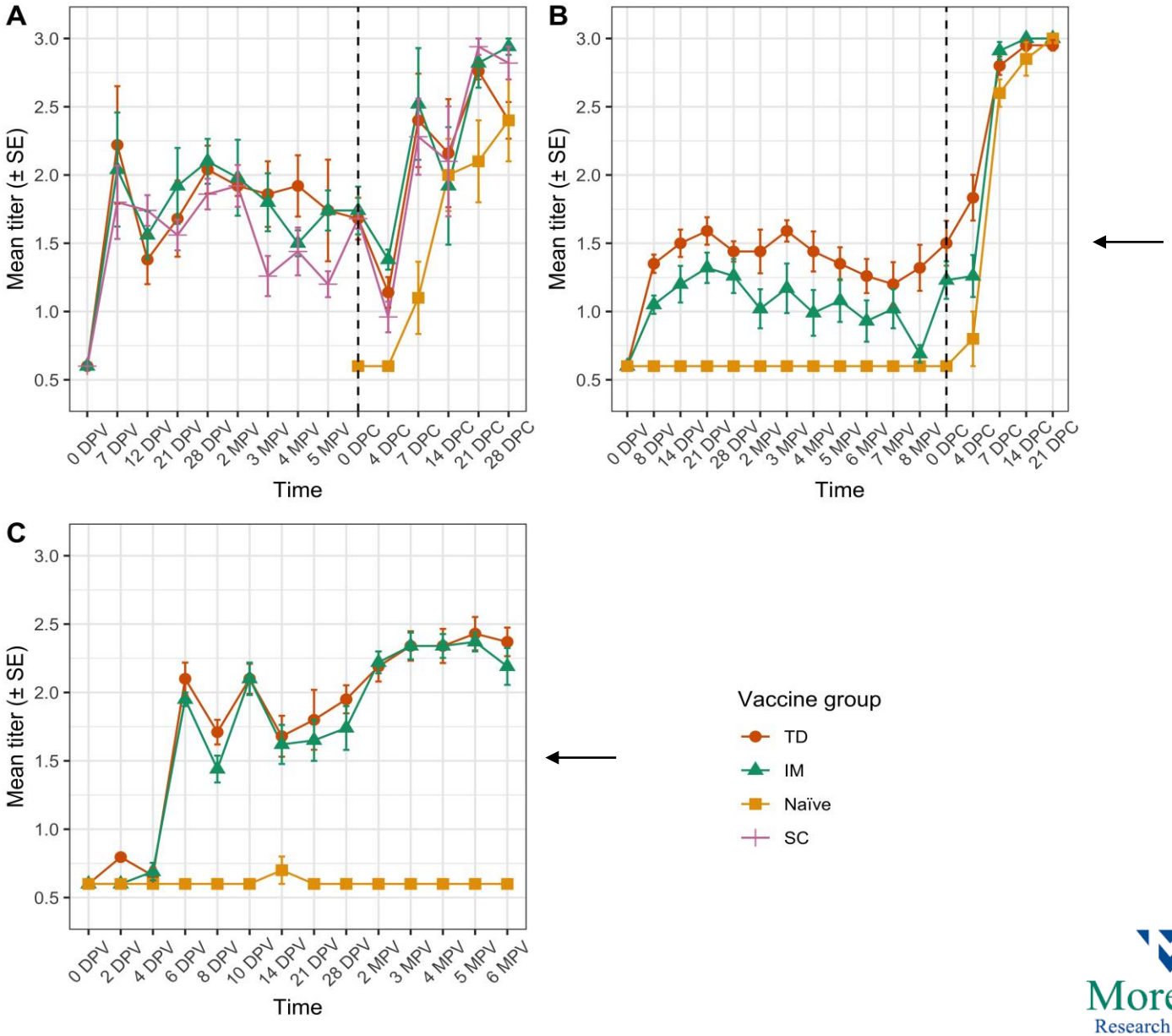
Destroy the Factory (virus infected cell)



Cytotoxic T Lymphocytes (CTL) kill virus infected cells

Lessons from Studies of Foot-and-Mouth Disease Virus

Virus Neutralising Titres (VNTs) to FMDV following vaccination



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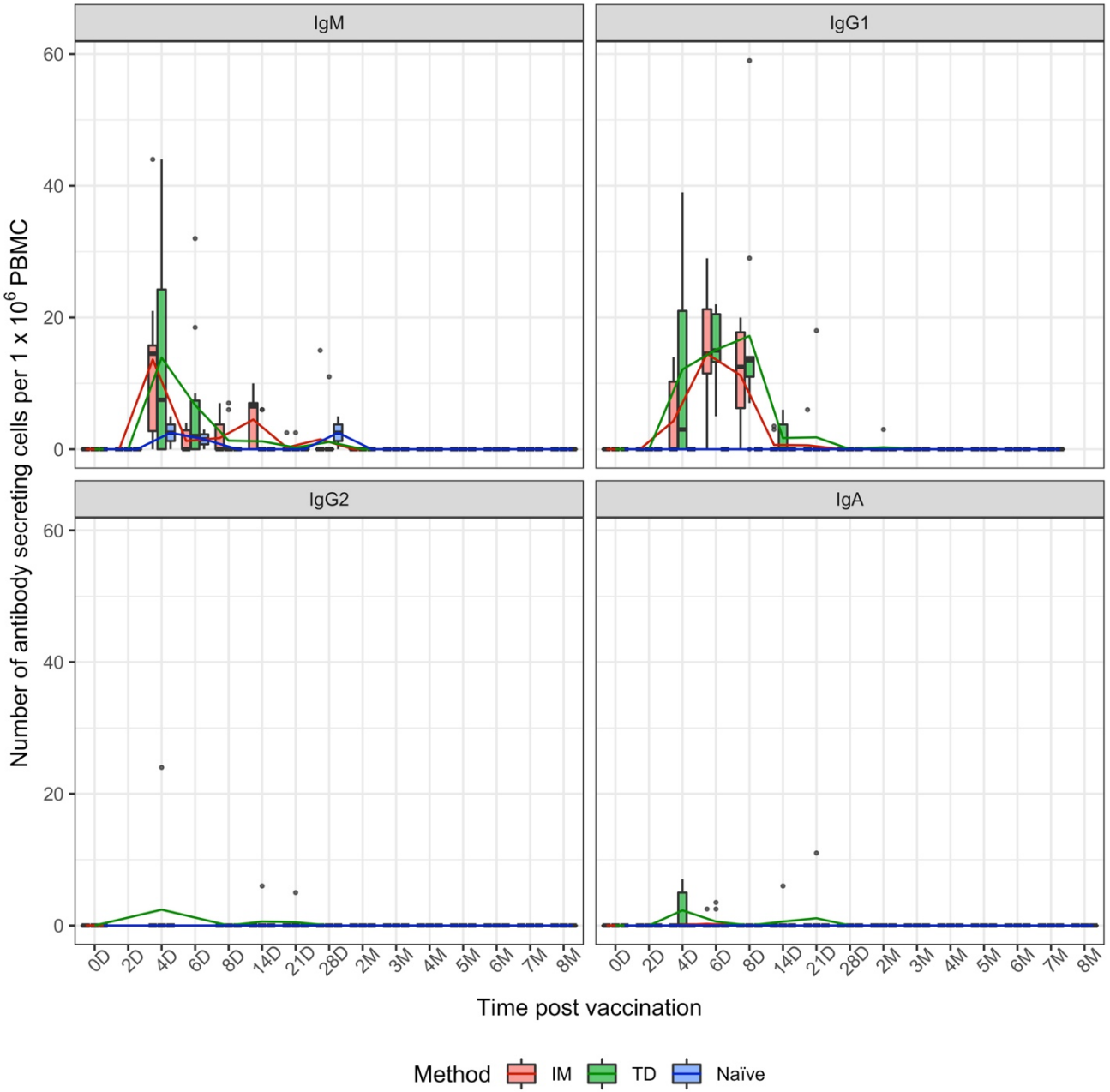
Measuring Antibody Secreting Cells



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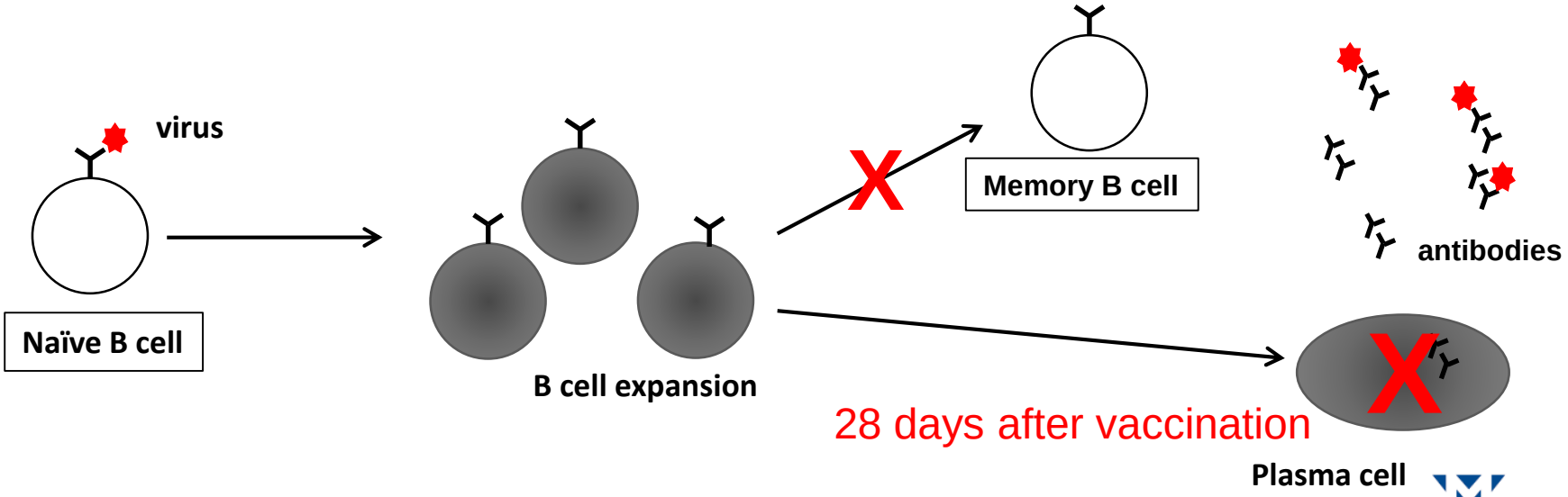

What about
Cytotoxic T Lymphocytes (CTL) killing virus infected cells

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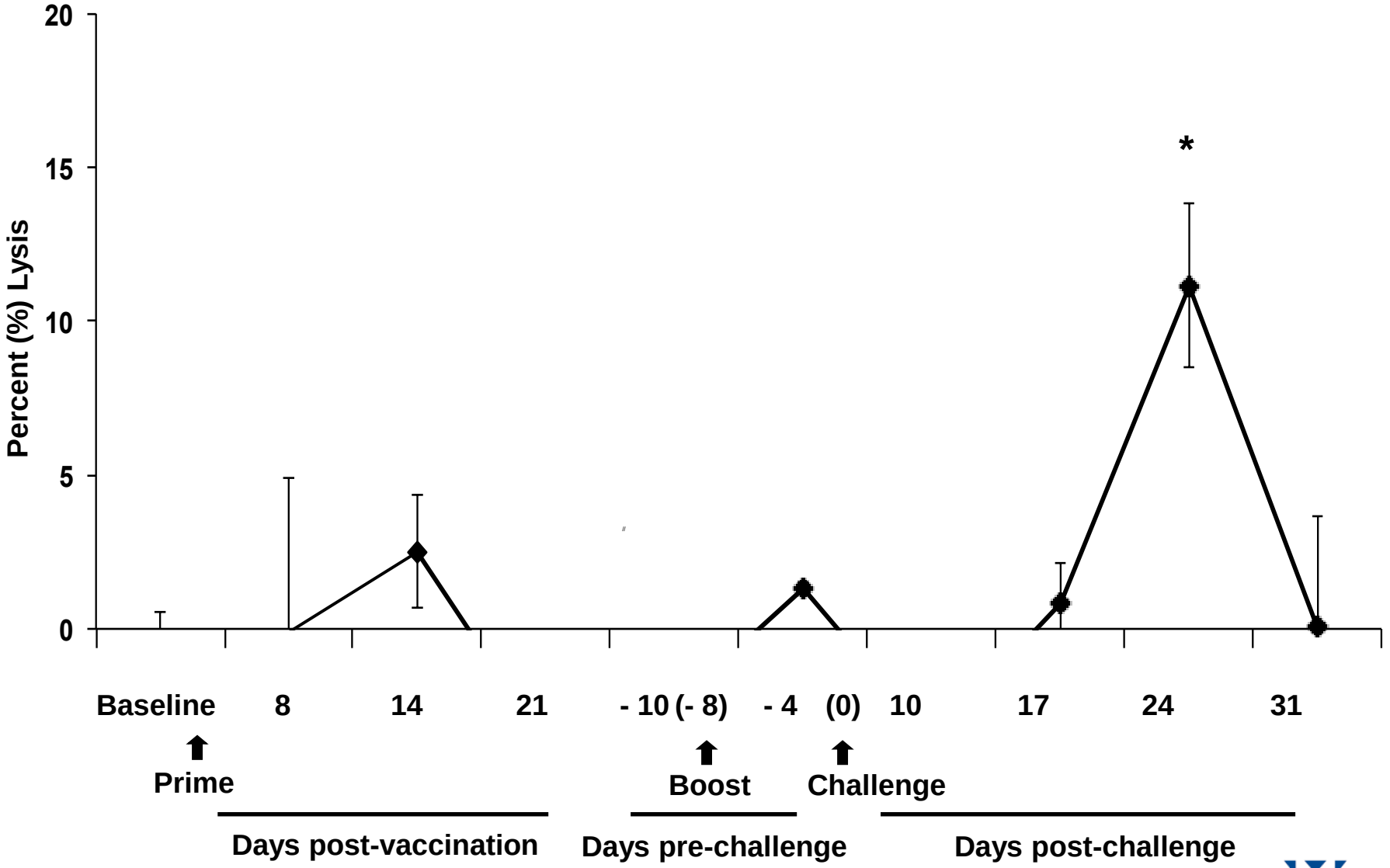

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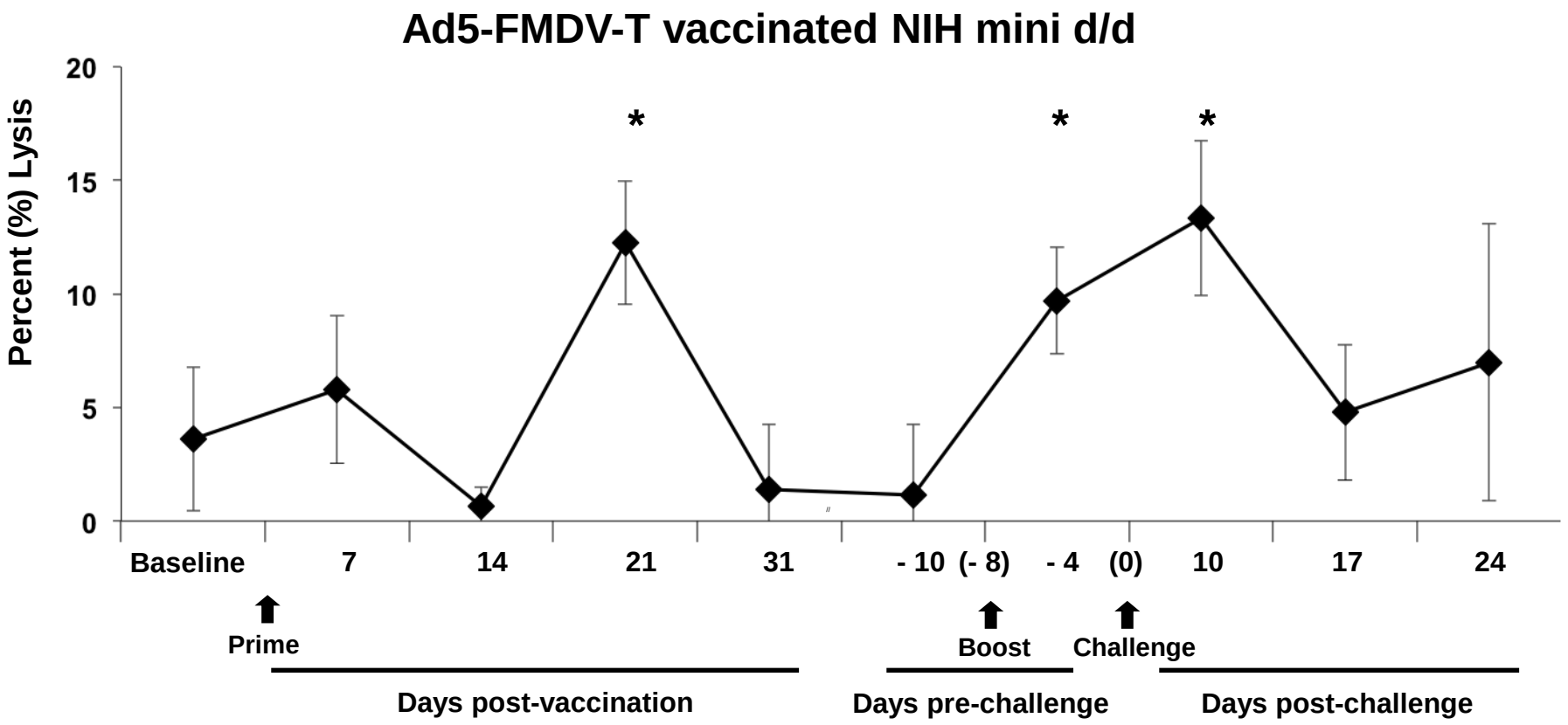
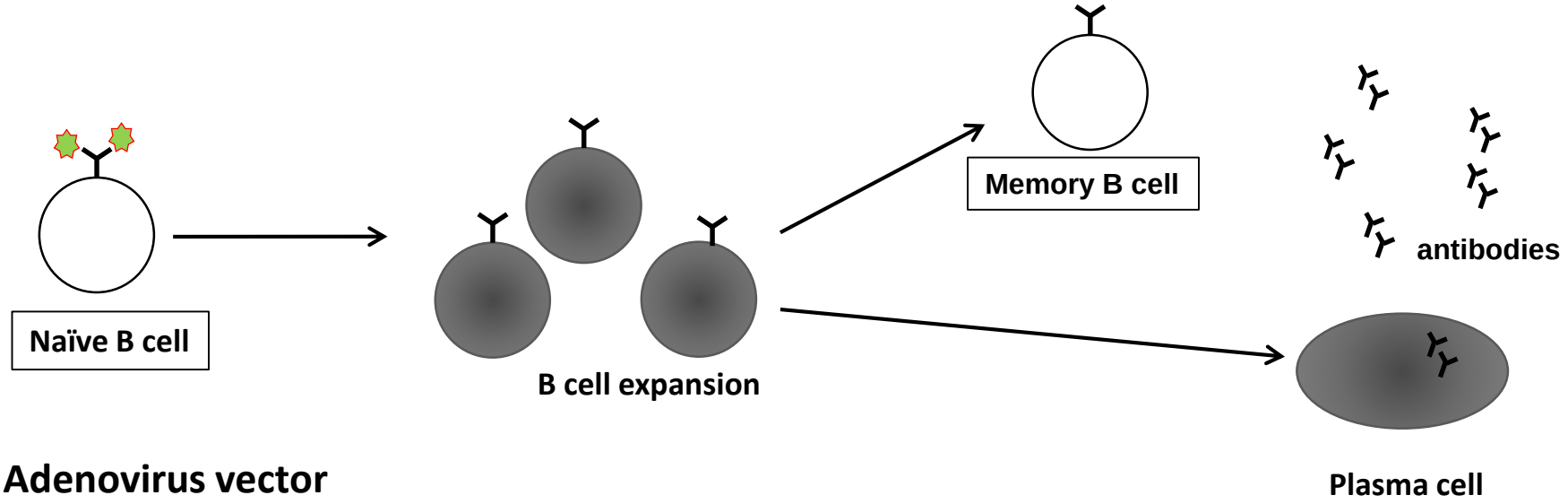
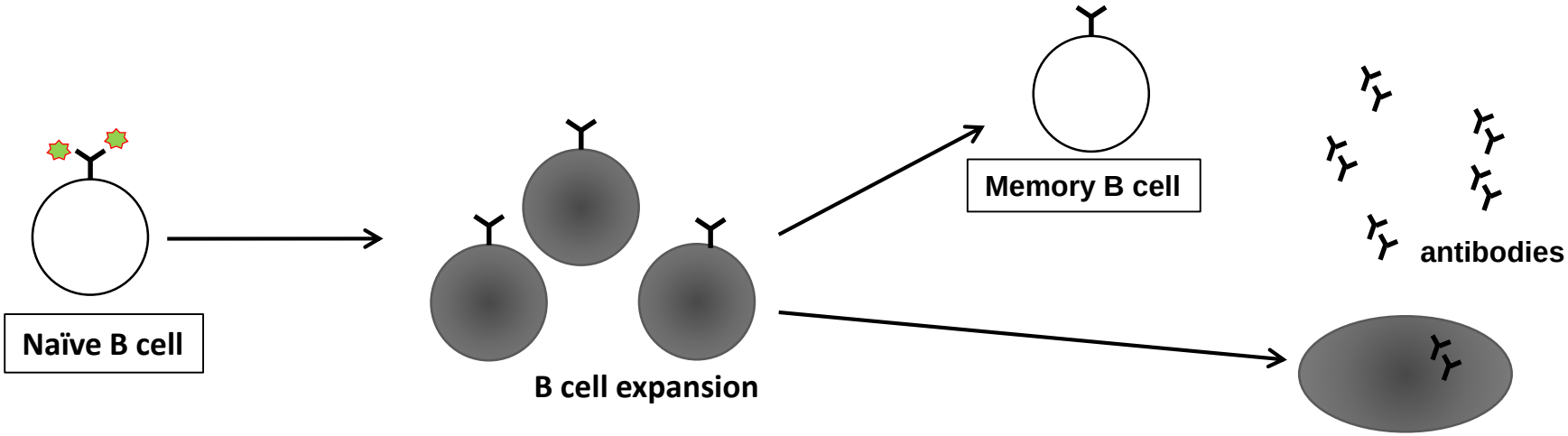




Adenovirus vector delivering empty capsid



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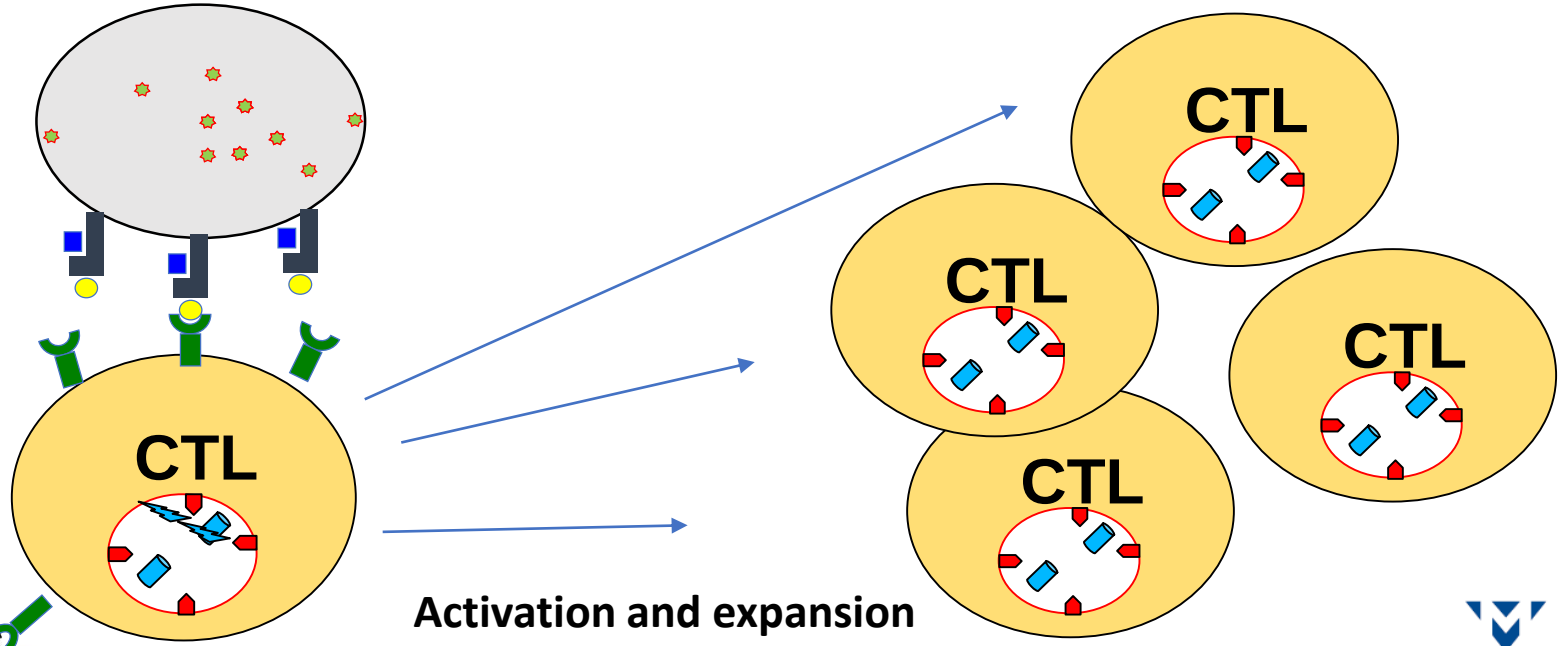

Activation and expansion of virus specific T cells

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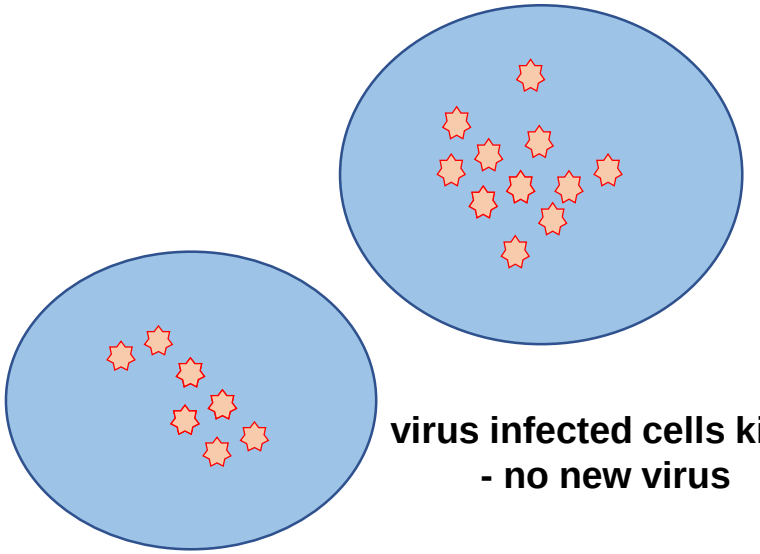
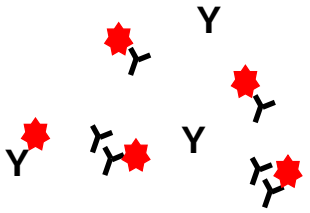
Solution:

Like live, attenuated vaccines, redesigned vectored vaccines show induction of both antibody responses and cellular immunity



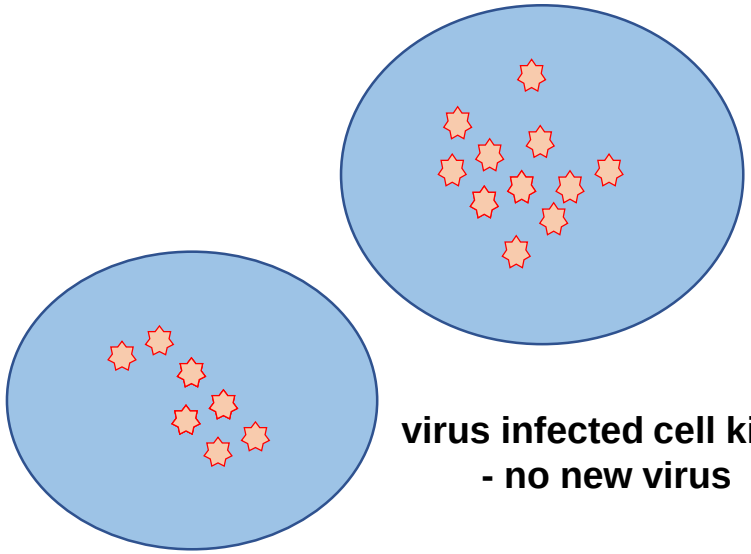
virus infected cells killed - no new virus



antibodies neutralize virus

Solution:

Destroy the factory and send the antibodies to clean up



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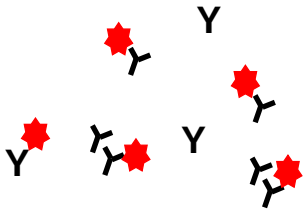

antibodies
neutralize virus

Destroyed the factory

now antibodies can handle the residual virus

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Thank you

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