7 THINGS ALL PARENTS SHOULD KNOW ABOUT VACCINES

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Disclosures

- No financial relationship with pharmaceutical companies
- But I do have a pro-immunization bias….

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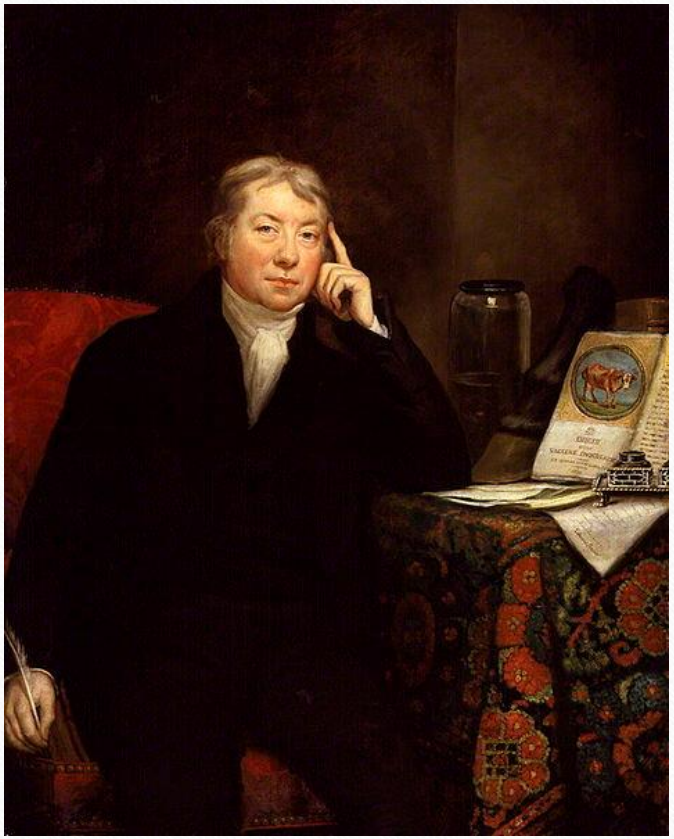
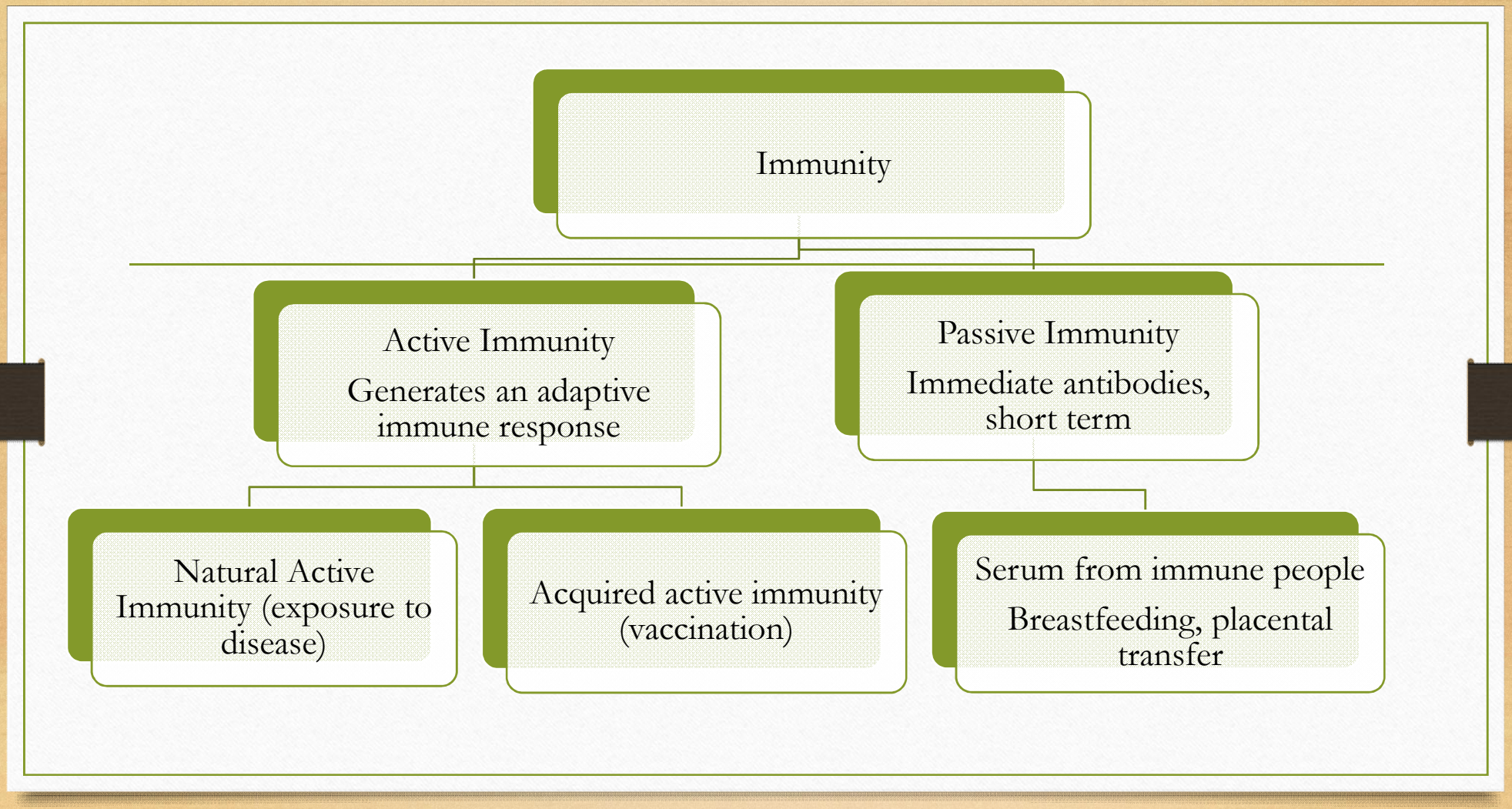
Vaccines Are Trainers for the Immune System

fortmillpersonaltraining.com/personal-training

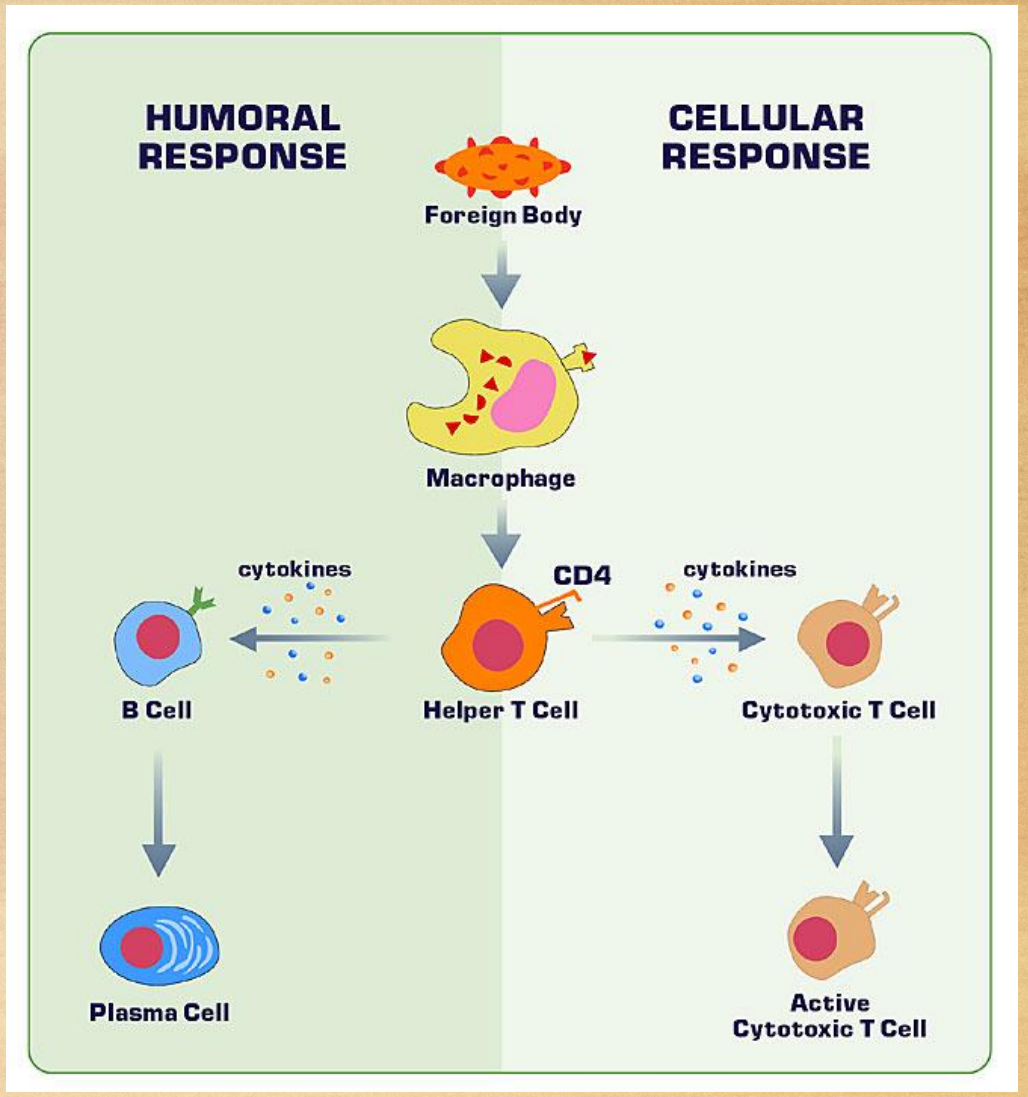
What is a Vaccine?

- A vaccine is a preparation containing agents that resemble a micro-organism that stimulates the body's immune system to mount an immune response to that organism
- In 1786 Edward Jenner used the cowpox virus to confer protection to smallpox



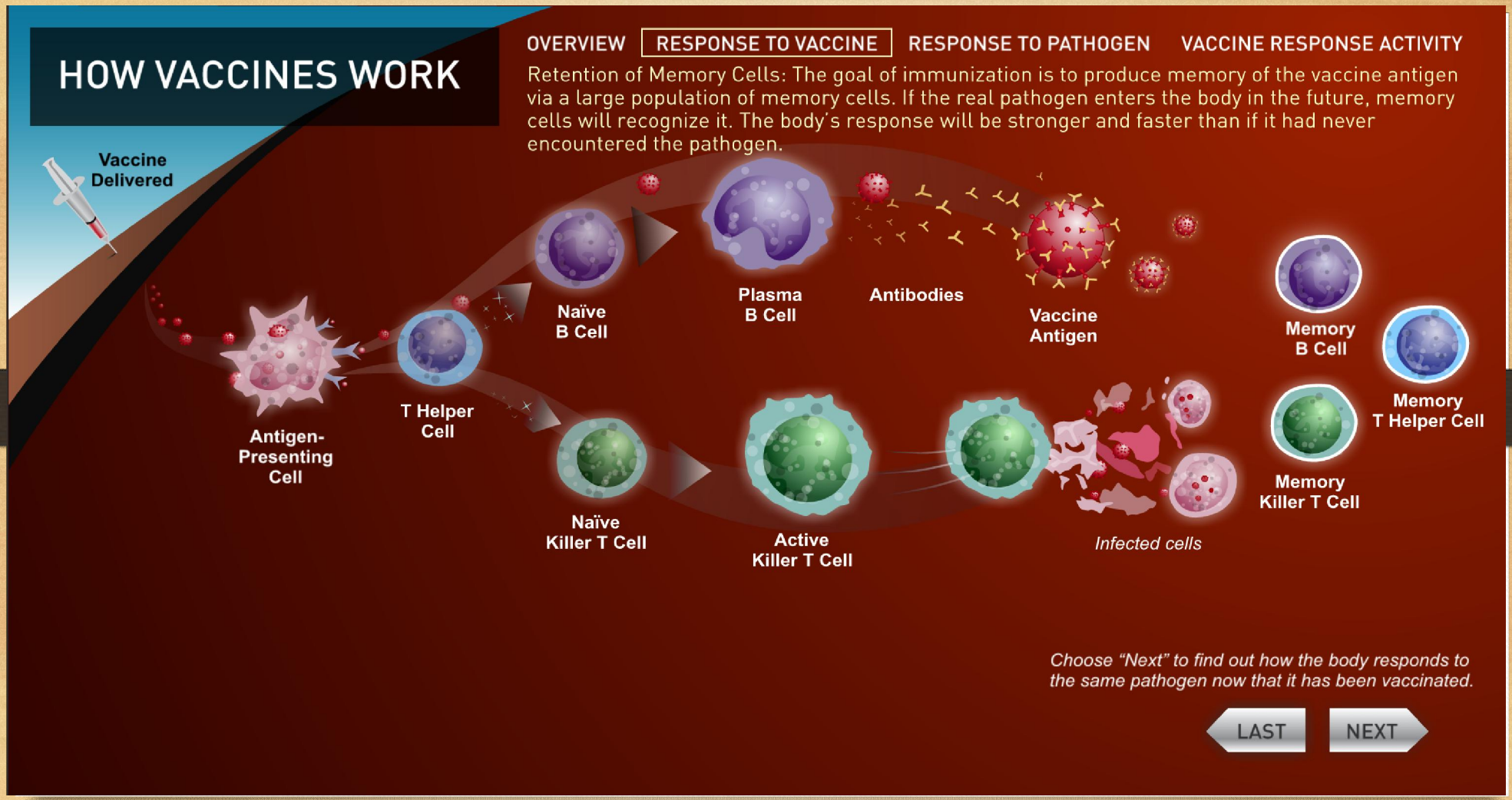

Immunity
Active Immunity
Generates an adaptive immune response
Passive Immunity
Immediate antibodies, short term
Natural Active Immunity (exposure to disease)
Acquired active immunity (vaccination)
Serum from immune people
Breastfeeding, placental transfer

Immune System
Adaptive Immunity

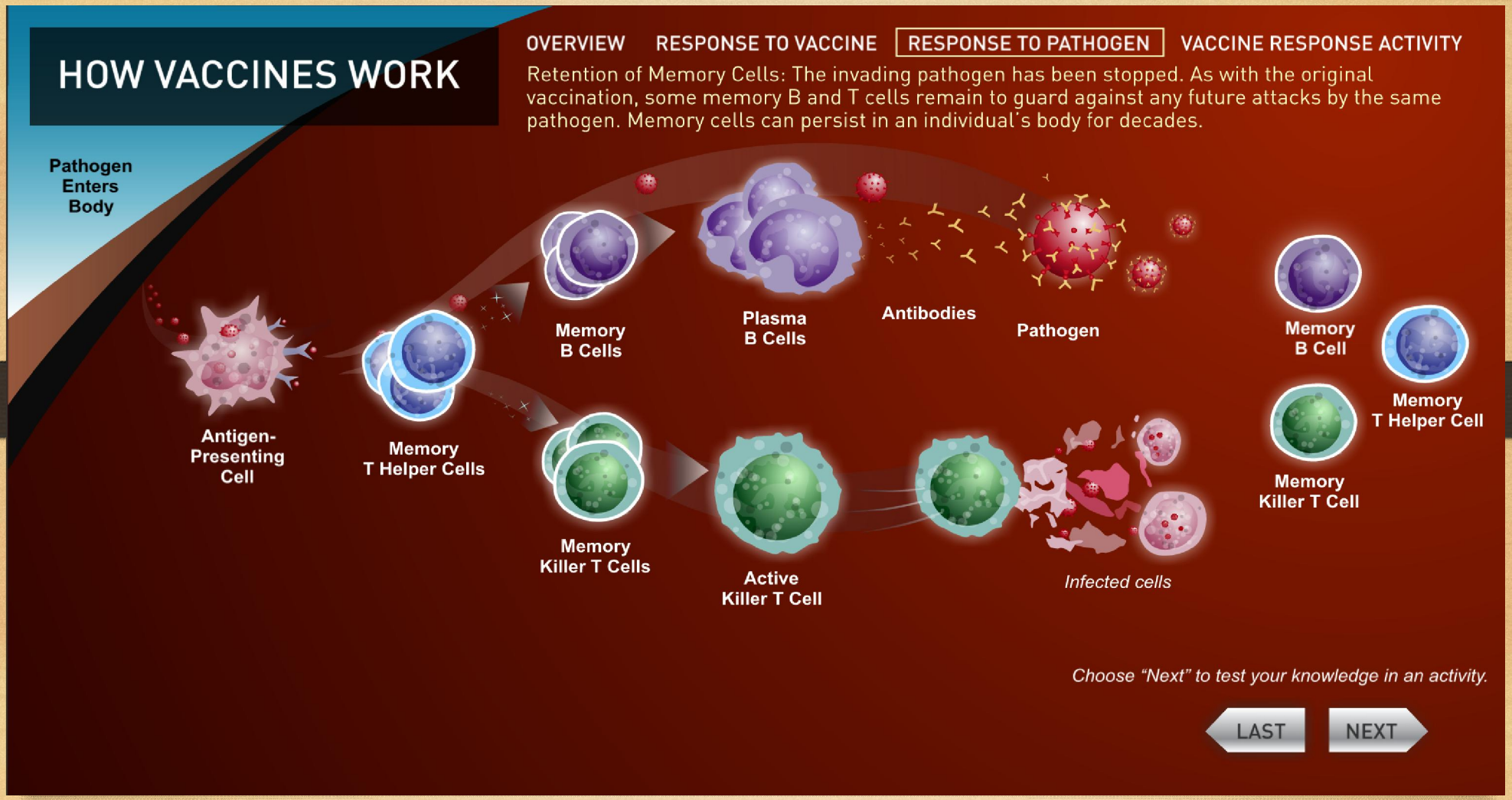


Antigens, Immune Response and Vaccines

- Antigens: molecules on a microbe that identify it as foreign and stimulate the immune system to attack it
  - Every microbe carries its own unique set of antigens
- Immune cells (macrophages) digest most parts of the microbes but save the antigens and carry them back to the lymph nodes, bean-sized organs scattered throughout your body where immune system cells congregate.



http://www.historyofvaccines.org/content/how-vaccines-work



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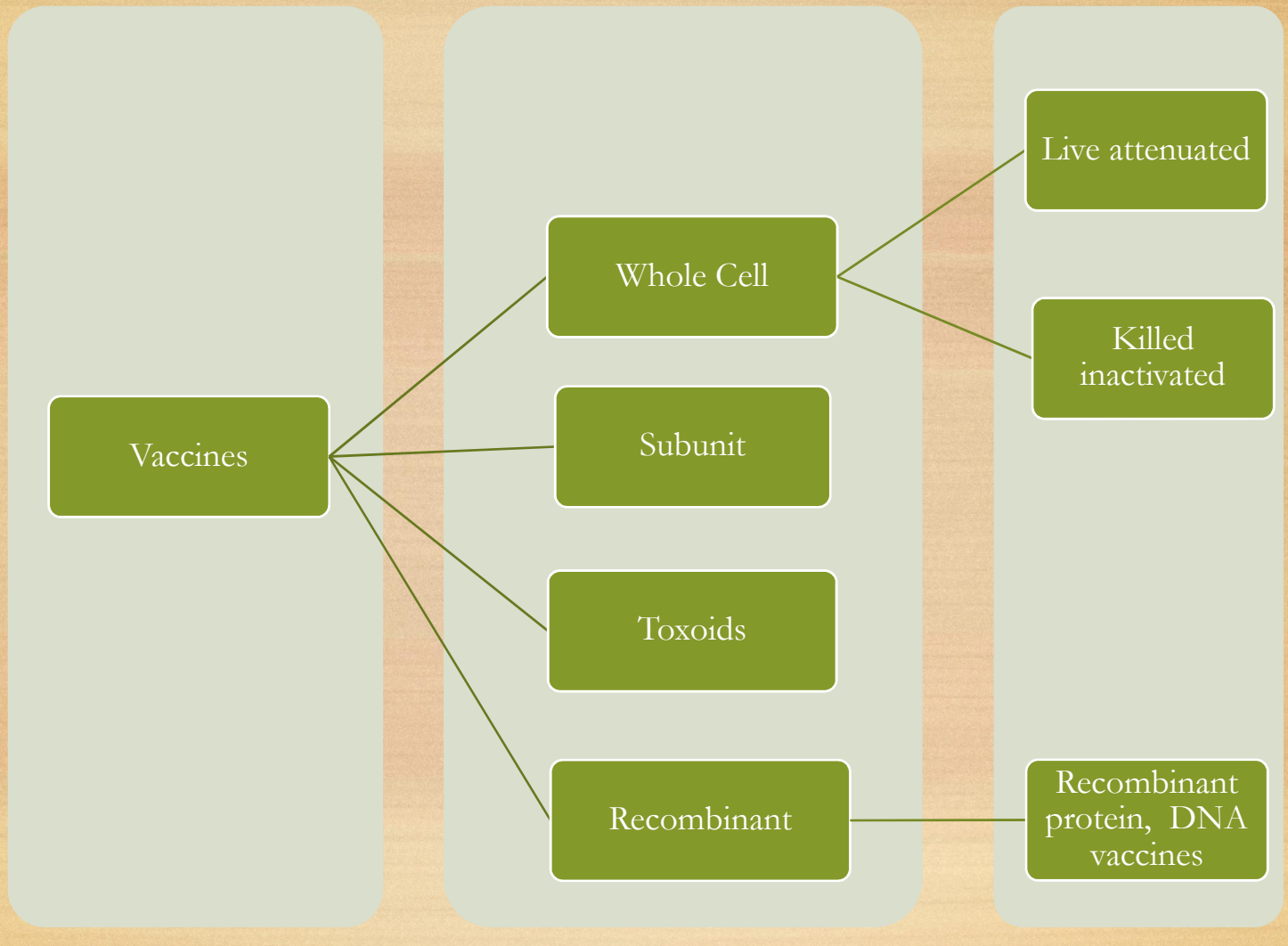
Vaccines
Whole Cell
Subunit
Toxoids
Recombinant
Live attenuated
Killed inactivated
Recombinant protein, DNA vaccines

Vaccines are like personal trainers to the immune system

- Vaccines train the immune system for a specific task
  - To respond to a specific disease: whooping cough, measles, tetanus
- They create long lasting protection by activating the adaptive branch of the active part of the immune system
- They induce a response to a specific antigen
- We have many vaccine but they all use the same basic principle

https://www.pinterest.com/brittanypreston/certified-personal-trainer/

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Timing of Vaccines Matters!

Cartoonstock.com

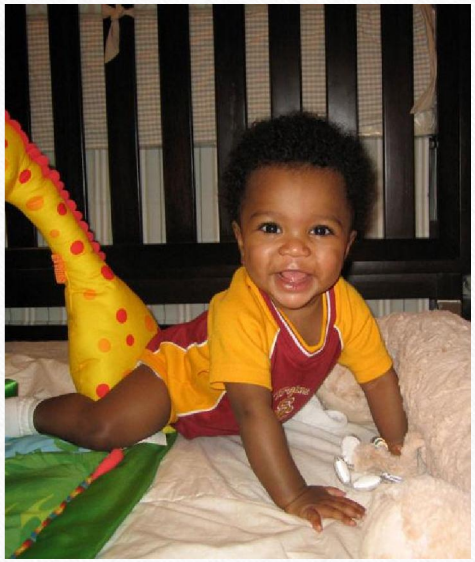
Alberta Immunization Schedule

- We start immunizations at 2 months of age
- However, vaccines can be given earlier as well
  - Hepatitis B vaccine can be given at birth

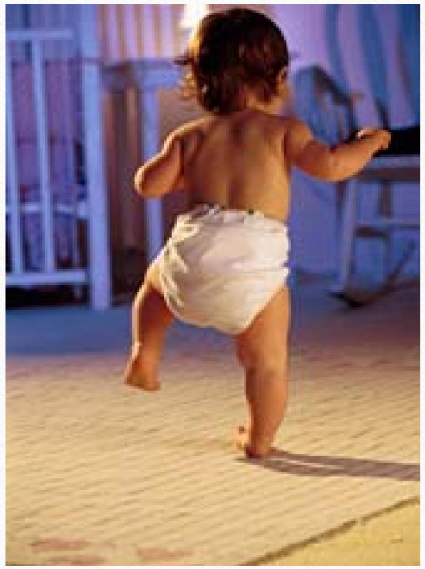
2 months

4 months

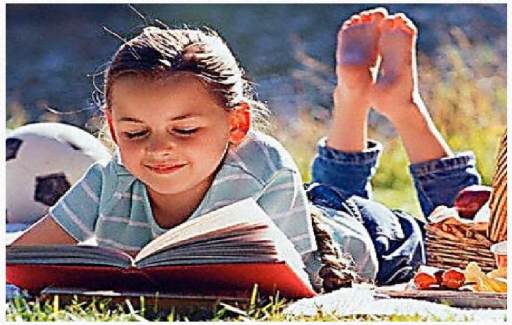
6 months

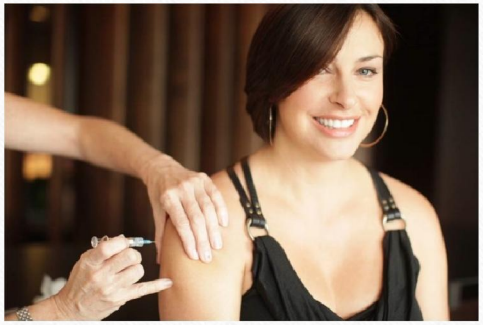


12 months 18 months 4-6 yrs



Grade 5 Grade 9 Adult





Why do we start so early?

- Passive immunity from mom is limited
  - Placental
  - Breastfeeding
  - Only works if mom has immunity herself
  - Lasts for up to 6 months
- In early infancy, children are most vulnerable to certain diseases

Pertussis Alberta 2012

Alberta Health Services

Memorandum
Office of the Medical Officer of Health
South Zone

Date: **16 March 2012**

To: **South Zone Physicians**

From: **Dr. Vivien Suttorp, Lead Medical Officer of Health - South Zone**

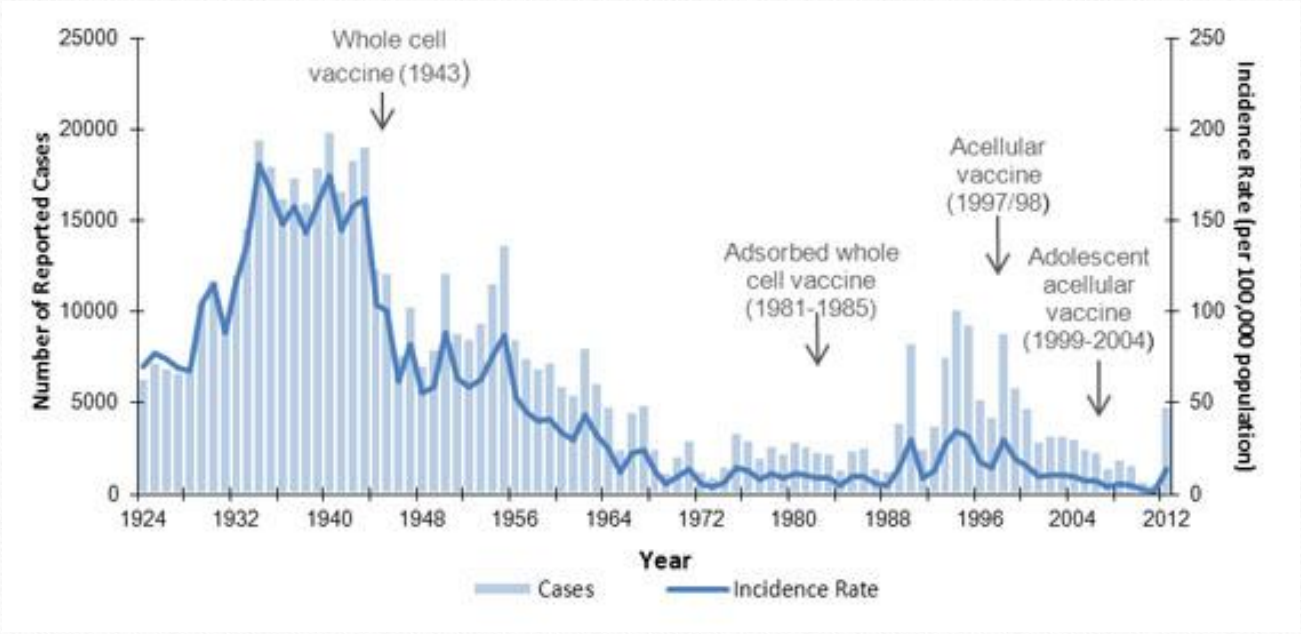
RE: **Pertussis Outbreak – South Zone / EI #174**

A Pertussis outbreak has been declared for South Zone. As of today, we have 5 confirmed cases (one of which is hospitalized) as well as numerous probable cases with epidemiological family links. Cases have been reported in Medicine Hat, Wrenthem, and Raymond (all in non-immunized Low German Mennonite population).

July 19, 2012 **Updated:** July 19, 2012 | 10:29 pm

Alberta baby's whooping cough death renews health calls for vaccinations

Pertussis is a continuous threat



Alberta Health Services

Public Service Announcement

December 4, 2014

Follow AHS_Media on Twitter

Whooping cough outbreak declared in AHS Central Zone

RED DEER – Due to a sustained increase in the number of cases of whooping cough (pertussis) confirmed in the Central Zone of Alberta Health Services (AHS), AHS has declared a pertussis outbreak in Central Zone and is offering additional immunization appointment opportunities for at-risk individuals.

Why do we give so many shots?

- Like any good athlete, it takes practice to get to high performance

Vaccine	Dose 1	Subsequent dose(s)	Booster	Herd Immunity
Measles	85%	99-100%		90-95%
Pertussis	70%	80%	90%	92-94%

Why do we give so many shots?

- Performance can decrease over time and boosters are needed
- Protection against pertussis wanes during the 5 years after the fifth dose of DTaP
- Meningococcus also needs booster shots for waning immunity

N Engl J Med. 2012 Sep 13;367(11):1012-9.

Why is sticking to the schedule important?

- The schedule is designed based on epidemiology
  - Highest burden of disease
    - Meningococcus c is under 1 year of age
    - *Hemophilus influenzae* B is under 3 years of age
  - Highest severity of disease if acquired
    - Pertussis under 6 months of age
  - Accounts for lifestyle and risk factors
    - HPV vaccine most relevant before onset of sexual activity

Timing of vaccine matters summary

- Vaccine schedule is made to optimize protection for infants while accounting for the time it takes for the immune system training
- Multiple shots are needed to mount the appropriate immune response and boosters needed to sustain it

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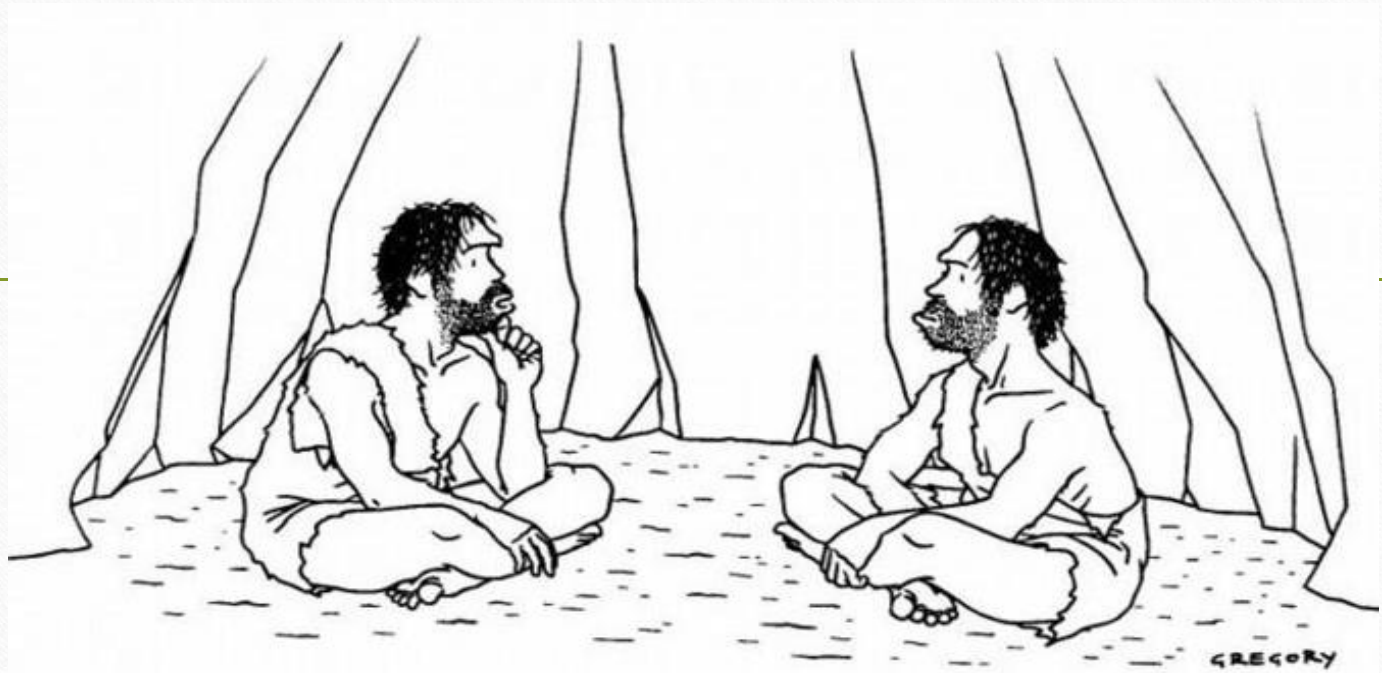
Healthy Living is not a Substitute for Vaccination

Because despite our best efforts kids will still eat dirt…or lick pigs



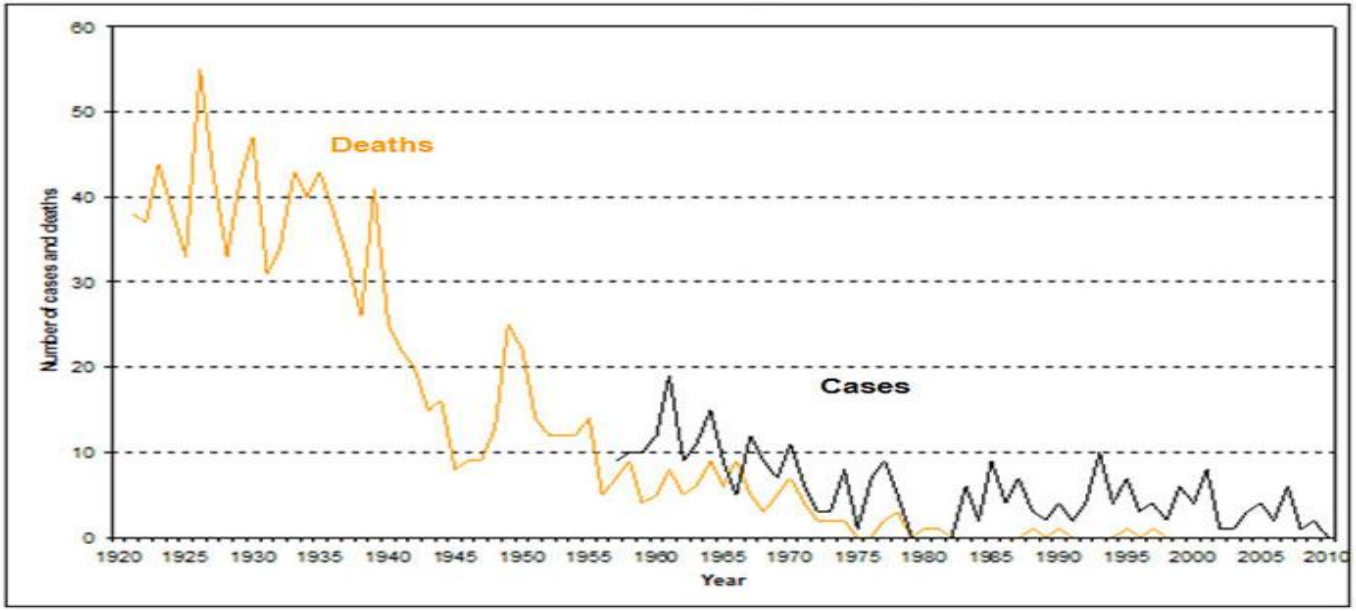
"Something's just not right—our air is clean, our water is pure, we all get plenty of exercise, everything we eat is organic and free-range, and yet nobody lives past thirty."

Healthy Lifestyle and Vaccines

- The immune system is influenced by diet, psyche and physical fitness
- However, vaccines train the immune system for a specific task
- We cannot control everything our children get exposed to

http://www.chatelaine.com/health/fitness/

The Case of Tetanus



Public Health Agency of Canada, Canada Immunization Guide

The case of tetanus

- *C. tetani* spores live in the soil, animal/human feces or dust
- Spores enter the body:
  - Via lacerations (most frequent), injection drug use, and animal bites
  - Cases may occur following small, insignificant wounds, especially when there is dead tissue present.
  - It is often associated with blunt trauma or deep puncture wounds.
- Herd immunity won't work with tetanus

Public Health Agency of Canada, Canada Immunization Guide

The case of tetanus

- Tetanus is characterized by muscle spasms, usually in a descending pattern, beginning in the jaw muscles.
- The case fatality rate in the unvaccinated varies from 10% to over 80%
  - Highest in infants and the elderly.

Public Health Agency of Canada, Canada Immunization Guide

Healthy lifestyles are not substitutes for vaccination summary

- Despite our best efforts to uphold good immune function, our immune system still needs specific training
- Some diseases are acquired from the environment
- To ensure adequate protection for our kids, we need to add vaccination to our healthy lifestyle list

You may own the safest SUV on the market but you still need a carseat

http://dailymomtra.com/2011/03/30/the-picture-guide-to-car-seat-safety/

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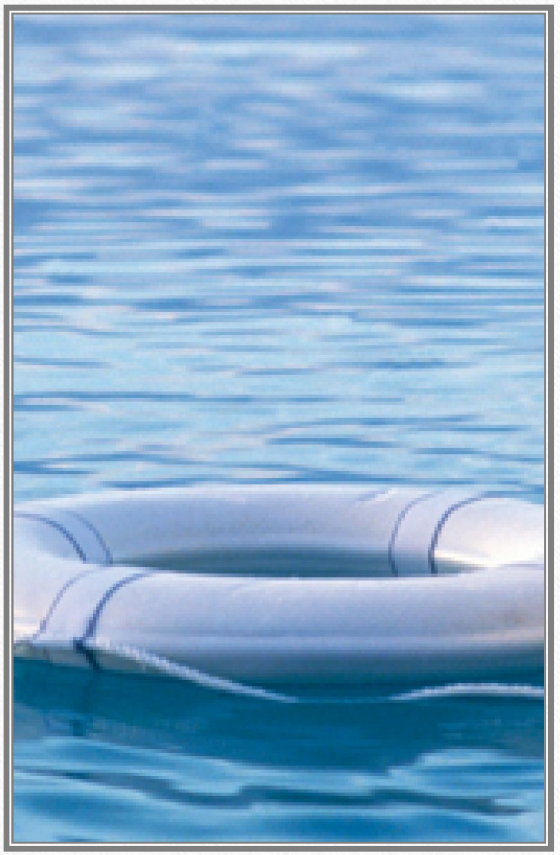
The Alternative is NO Alternative



Natural Immunity

- Immunity gained from surviving a natural infection
- Natural immunity may last longer in some cases than vaccine-induced immunity can, but the risks of natural *infection* outweigh the risks of immunization for every recommended vaccine.

Why natural immunity is not preferable

- Vaccine preventable diseases are very serious:
  - Meningococcus: meningitis, blood infection, death
  - Pneumococcal: meningitis, pneumonia, hearing loss, strokes, death
  - Pertussis: prolonged coughing fits, rib fractures, pneumonia, respiratory failure, death

Natural Immunity vs Vaccine: Sink or Swim

http://communitytable.com/22729/jmarquez/why-every-child-should-learn-to-swim-this-summer/

Why natural immunity is not preferable

Adverse Event	Vaccine	Natural Disease
Encephalitis MMR	1 in 1 Million	1 in 1000
Guillian Barre, Influenza	1 in 1 Million	17 in 1 Million
Anaphylaxis MMR	1.5 per 1 Million doses	1 death in 3000 cases measles

- HiB and tetanus vaccines actually provide more effective immunity than natural infection

Homeopathic Nosodes

- Nosodes are ultra-diluted forms of diseased tissue, pus, blood, or excretions of a sick person or animal
- 82 of these nosodes are used for the prevention of diseases like influenza, pertussis, measles, and polio
- Health Canada: "This product is not intended to be an alternative to vaccination."

Homeopathic Nosodes

- There are no published double-blind, placebo-controlled trials examining the effectiveness for infectious disease prophylaxis of any of the homeopathic nosodes approved by Health Canada.
- Many of the studies were published prior to 1980, with a very heavy reliance on anecdotes

Vaccine Efficacy and Effectiveness

- Vaccine efficacy is best measured by double-blind, randomized, clinical controlled trials
  - Such vaccine efficacy trials represent the " best case scenarios" of vaccine protectiveness under controlled conditions and are commonly required before a new vaccine is licensed
- Vaccine effectiveness is a " real world" view of how a vaccine reduces disease in a population
  - This measure assesses the net balance of benefits and adverse effects of a vaccination program under more natural field conditions, rather than in a controlled clinical trial.

G A. Weinberg and P Szilagyi. Clinical Infectious Diseases 2010

Vaccine Studies

	Phase I →	Phase II →	Phase III
Volunteer group size	20-100	100-300	10 000 or more
Duration	up to 2 yrs	2 or more yrs	up to 4 yrs
Looking for	safety, side effects, optimal dose / schedule	safety, immune response	safety, effectiveness

The research to develop the HPV vaccine spanned 15 years and two continents

Plotkin SL, Plotkin SA. A short history of vaccination. 2008

The Alternative is NOT an Alternative summary

- Natural Immunity is a lot more dangerous than vaccines
  - In some cases it is also not as effective
- Homeopathic nosodes do not have any convincing evidence for efficacy or effectiveness

5

Safety is a Big Deal with Vaccines

How do we know a vaccine is safe?

- Studies and measures before a vaccine is licensed
- Studies and surveillance after a vaccine is licensed

Before vaccines are licensed

- Biologics and Genetic Therapies Directorate of Health Canada
- In-depth reviews of scientific product data on vaccine efficacy, stability, teratogenicity, toxicity and safety are performed
  - Pre-licensing vaccine trials now always involve thousands and even tens of thousands of people
  - Every adverse event noted in the pre-licensing studies is scrutinized carefully and assessed to determine whether the vaccine is the cause
- Each lot of vaccine manufactured is tested by the manufacturer for potency, safety and purity before it can be released (should meet governmental standards)
- Formal independent review separate from the licensing review is done by the National Advisory Committee on Immunization

Post licensure

- Vaccine manufacturers are required to conduct surveillance studies to determine whether there are any exceedingly rare but important serious adverse events
- Population level surveillance

Surveillance in Canada

- Passive surveillance
  - CAEFISS
- Active surveillance
  - IMPACT
    - 12 Canadian centres, which represent about 90% of all tertiary care pediatric beds in Canada.

Table 1: The Canadian Immunization Monitoring Program ACTive (IMPACT) adverse events following immunization surveillance targets and reporting intervals, 2014

Specific targets	IMPACT intervals for reporting
Neurologic Events	
Seizure	0–3 days after inactivated vaccine(s); 0–15 days after live vaccine(s) [1]
Guillain-Barré syndrome (GBS)	0–42 days after inactivated or live vaccine(s)
Other acute flaccid paralysis (AFP)	0–42 days after inactivated or live vaccine(s)
Encephalitis	0–42 days after inactivated or live vaccine(s)
Acute disseminated encephalomyelitis (ADEM)	0–42 days after inactivated or live vaccine(s)
Myelitis	0–42 days after inactivated or live vaccine(s)
Aseptic meningitis	0-42 days after inactivated or live vaccine(s)
Thrombocytopenia (<100 x 109/litre with clinical evidence of bleeding, including Idiopathic Thrombocytopenic Purpura (ITP) [2]	0–42 days after inactivated or live vaccine(s)
Intussusceptionin infants <1 year of age	Within 0–21 days after live attenuated rotavirus vaccine only
Vasculitides (Kawasaki disease, Henoch-Schonlein Purpura (HSP), etc.)	0-42 days after inactivated or live vaccine(s)
Complication of vaccination	
Anaphylactic shock	48 hours after any vaccine
Vaccination site cellulitis or abscess	No specific timeline but needs to be localized to the vaccination site.
Non-vaccination site infectious complication including sepsis or infection of a normally sterile body site	No specific timeline but needs clear evidence linking the infection to a prior vaccination.
Varicella vaccine reactivation illness (Varicelliform rash or	>42 days after varicella vaccination

Autism occurrence by MMR vaccine status among US children with older siblings with and without autism

- 95,727 children received MMR vaccine, 994 diagnosed with Autism, 1929 had an older sibling with autism
- Receipt of the MMR vaccine was not associated with increased risk of ASD, regardless of whether older siblings had ASD
- No harmful association between MMR vaccine receipt and ASD even among children already at higher risk for ASD

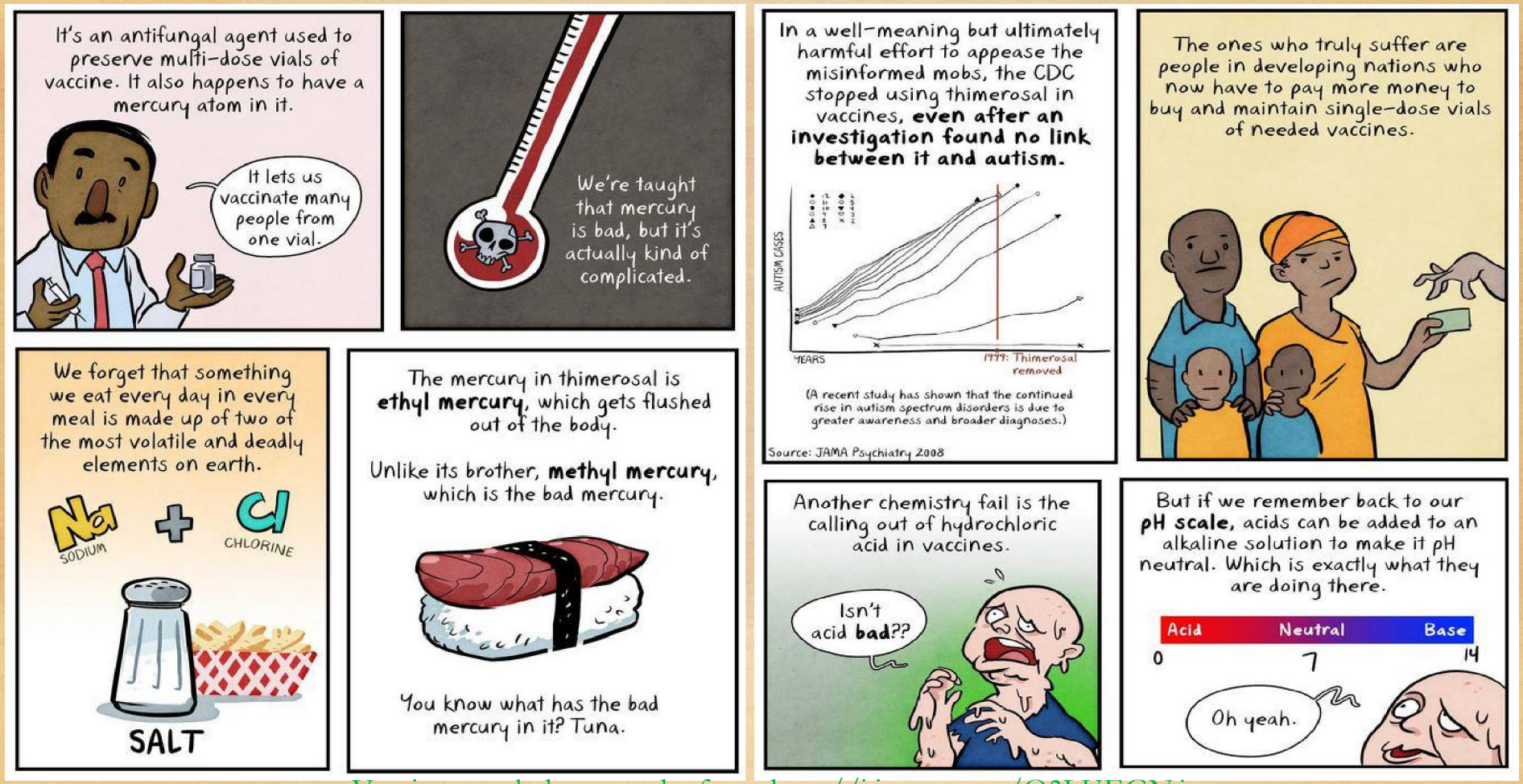
JAMA. 2015 Apr 21;313(15):1534-40.


MikeKeefeINTOON.com 5·18·12
caglecartoons.com
DOMESTIC SPYING
IT FOLLOWED ME HOME... CAN WE KEEP IT?

Other components of vaccines

- Preservatives/stabilizers:
  - Antibiotics, formaldehyde, thimerosal
- Adjuvants: substances that enhance immune response by mimicking molecules common to pathogenic microbes
  - Aluminum salts

Thimerosal



Vaccines work, here are the facts: http://i.imgur.com/O3LUEGN.jpg

Safety is a big deal with vaccines summary

- There are multiple check stops before and after the licensure of vaccines in Canada
- Vaccine studies include thousands to tens of thousands of people
- Other additives in vaccines also shown to be safe