Game plan

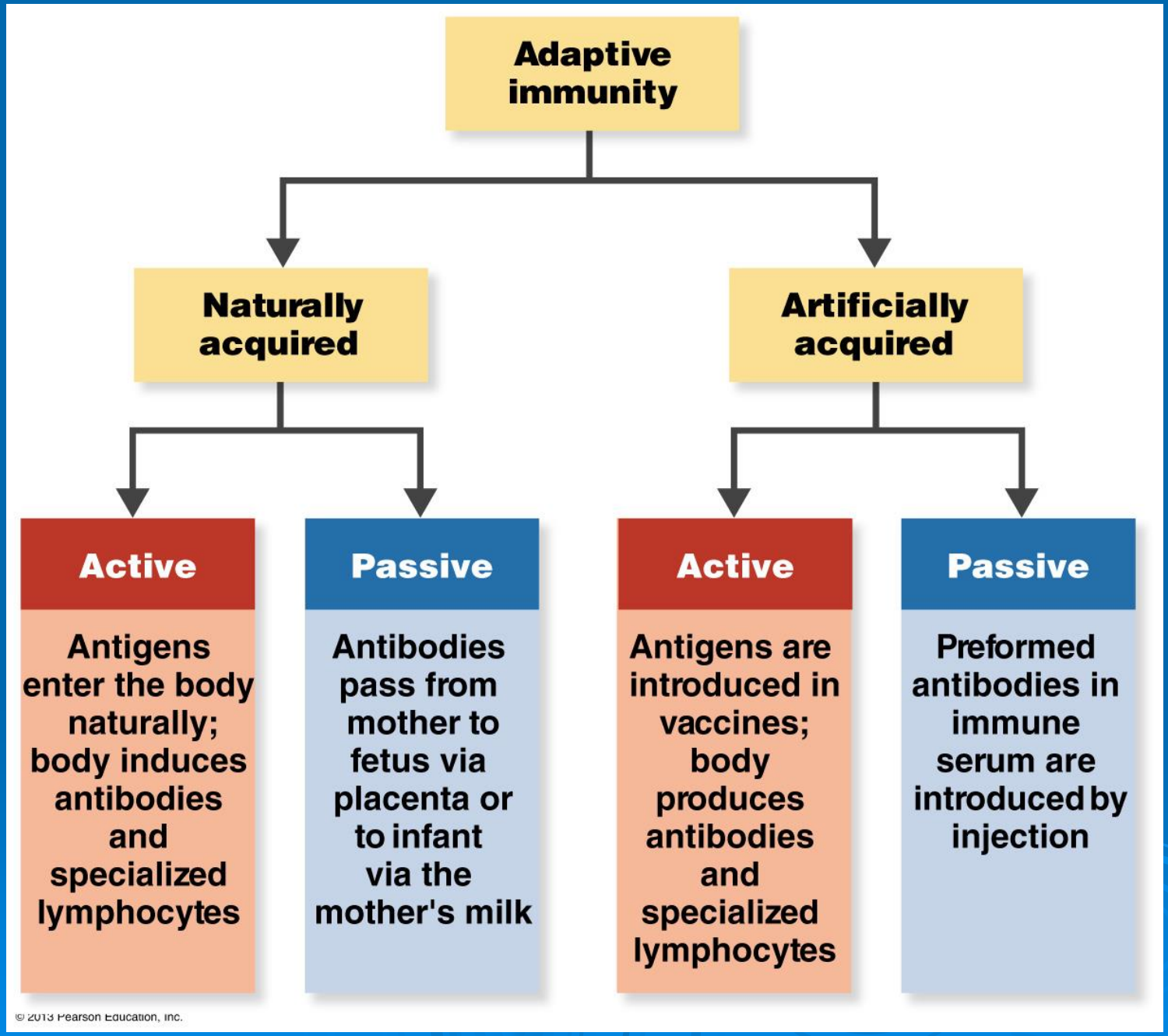
Lecture

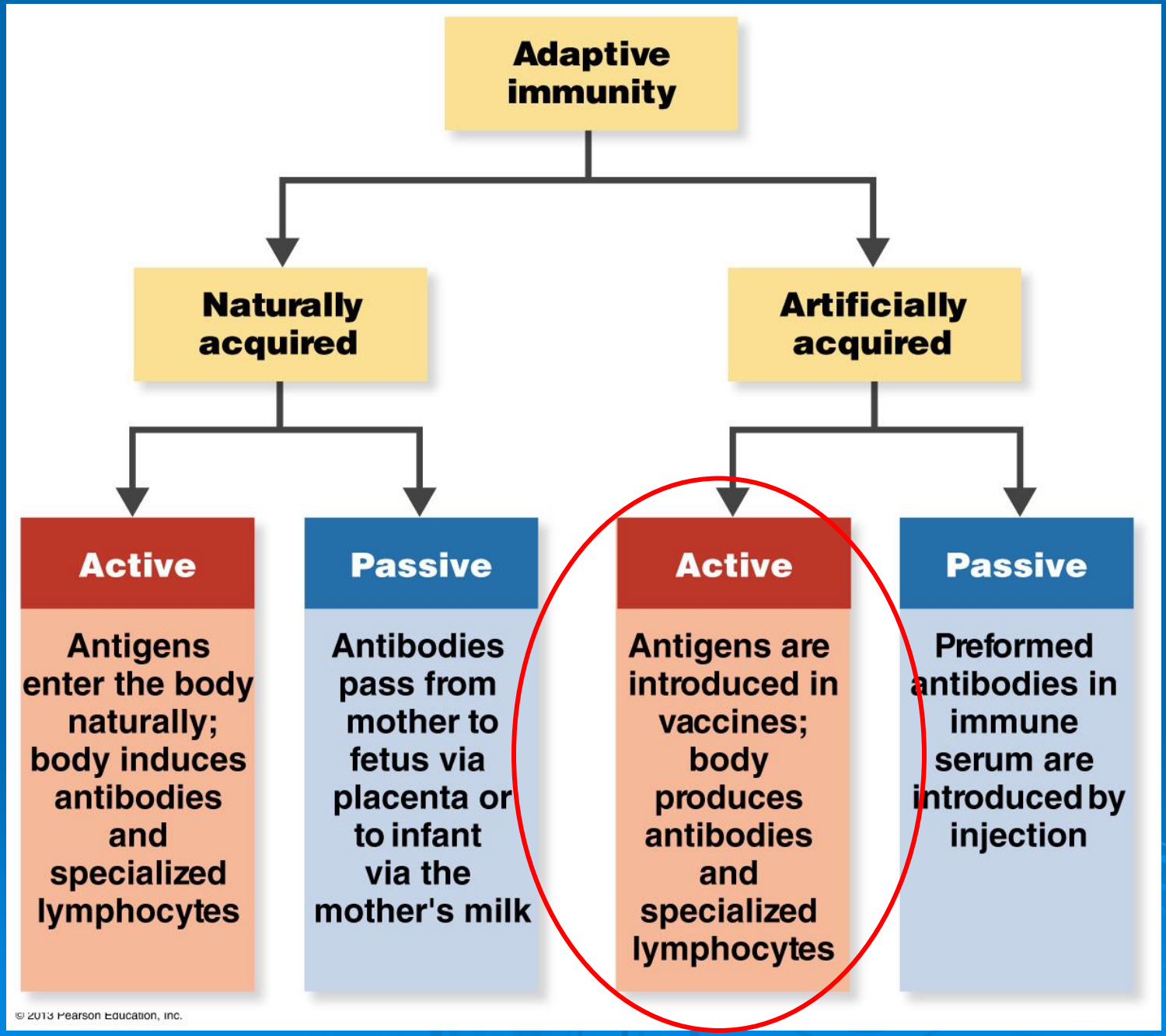
Vaccinations
ELISAs

Lab

Finish SSE

Begin Major Unknown





Immunological applications: vaccines

Attenuated whole-agent vaccines- weakened microbes (measles, mumps, rubella, chickenpox…)

Inactivated (killed) whole-agent vaccines- killed microbes (polio, rabies, pertussis)

Toxoids- inactivated toxins (tetanus, diptheria, pertussis)

Subunit vaccines- partial antigenic fragments of microbes (hepatitis B)

Conjugated vaccines- polysaccharides combined with proteins (*H. influenza* b)

Table 18.3

CDC-recommended vaccines

TABLE 18.1 CDC-Recommended Vaccines to Prevent Bacterial Diseases

Disease(s)	Vaccine	Recommendation	Booster
Haemophilus influenzae type b meningitis	Polysaccharide from *Haemophilus influenzae* type b	Children 2–18 months.	None recommended
Meningococcal meningitis	Purified polysaccharide from *Neisseria meningitidis*	For people with substantial risk of infection; recommended for college freshmen, especially if living in dormitories.	Need not established
Pneumococcal pneumonia	Purified polysaccharide from 13 or 23 strains of *Streptococcus pneumoniae*	PV23 for adults with certain chronic diseases; people over 65; PV13 for children 2–18 months; years 4–6.	None if first dose administered ≥ 24 months
Tetanus, diphtheria, and pertussis	DTaP (children younger than 3), Tdap (older children and adults), Td (booster for tetanus and pertussis)	DTaP (children 2-18 months; 4-6 years); Tdap (similar to Td; single dose for children aged 11–12 years and adults).	Tdap or Td every 10 years

CDC-recommended vaccines

TABLE 18.2 CDC-Recommended Vaccines to Prevent Viral Diseases

Disease	Vaccine	Recommendation	Booster
Chickenpox	Attenuated virus	For infants aged 12 months.	(Duration of immunity not known)
Hepatitis A	Inactivated virus	Children at age 1 year; live in or travel to endemic area; homosexual men; street-drug users; receive blood-clotting factors.	Duration of protection estimated at about 10 years
Hepatitis B	Antigenic fragments of virus	For infants and children; for adults, especially health care workers, homosexual men, injecting street-drug users, heterosexual people with multiple partners, and household contacts of hepatitis B carriers.	Duration of protection at least 7 years; need for boosters uncertain
Herpes zoster	Attenuated virus	Adults over age 60.	None recommended
Human papillomavirus	Antigenic fragments of virus	Boys and girls ages 11–12.	Duration at least 5 years
Influenza	Injected vaccine, inactivated virus (A nasally administered vaccine with attenuated virus is not available for the 2016–2017 flu season.)	Everyone over 6 months of age.	Annual

CDC-recommended vaccines

TABLE 18.2 CDC-Recommended Vaccines to Prevent Viral Diseases

Disease	Vaccine	Recommendation	Booster
Measles	Attenuated virus	For infants aged 15 months.	Adults if exposed during outbreak
Mumps	Attenuated virus	For infants aged 15 months.	Adults if exposed during outbreak
Poliomyelitis	Killed virus	For children; for adults, as risk to exposure warrants.	(Duration of immunity not known)
Rabies	Killed virus	For field biologists in contact with wildlife in endemic areas; for veterinarians; for people exposed to rabies virus by bites.	Every 2 years
Rotavirus	Rota Teq®, modified rotaviruses; Rotarix® vaccine, attenuated strain	Oral, for infants up to 8 months	None recommended
Rubella	Attenuated virus	For infants aged 15 months; for women of childbearing age who are not pregnant.	Adults if exposed during outbreak
Smallpox	Live vaccinia virus	Certain military and health care personnel.	Duration of protection estimated at about 3 to 5 years

Vaccine schedule

TABLE 18.3 Recommended Immunization Schedule for Persons Aged 0–6 Years—United States, 2011 (CDC)

Vaccine ▼ / Age ▶	Birth	1 month	2 months	4 months	6 months	12 months	15 months	18 months	19–23 months	2–3 years	4–6 years
Hepatitis B	HepB	HepB			HepB						
Rotavirus			Rv	Rv	Rv						
Diphtheria, Tetanus, Pertussis			DTaP	DTaP	DTaP		DTaP				DTaP
Haemophilus influenzae type b			Hib	Hib	Hib	Hib					
Pneumococcal*			PCV	PCV	PCV	PCV				PPSV	
Inactivated Poliovirus			IPV	IPV	IPV						IPV
Influenza					Influenza (Yearly)						
Measles, Mumps, Rubella						MMR					MMR
Varicella						Varicella					Varicella
Hepatitis A†						HepA (2 doses)					
Meningococcal‡										MCV	

Note: Vaccines are listed under routinely recommended ageBars indicate range of recommended ages for immunization. For those who fall behind or start late, see the catch-up schedule. Additional information at www.cdc.gov/vaccines/recs/schedules/

* PCV = Pneumococcal conjugate vaccine, PPSV = Pneumococcal polysaccharide vaccine.

† The two doses at least 6 mo. apart.

‡ Meningococcal conjugate vaccine (MCV) for children aged 2–10 years with defective immune systems and certain other high risk situations.

Why not vaccinate?

-Complacency about disease

-Benefits of vaccination not immediately evident
(adverse reactions are immediate)

-Media's biased role

-Need to link tragic events (eg. autism) with cause

-Philosophical beliefs based on above
- -Vaccines don't work.
- -Why vaccinate when the disease is so rare?
- -Vaccines cause secondary disease.

Complacency/ benefits example: smallpox success story

-Caused by variola virus (major and minor)

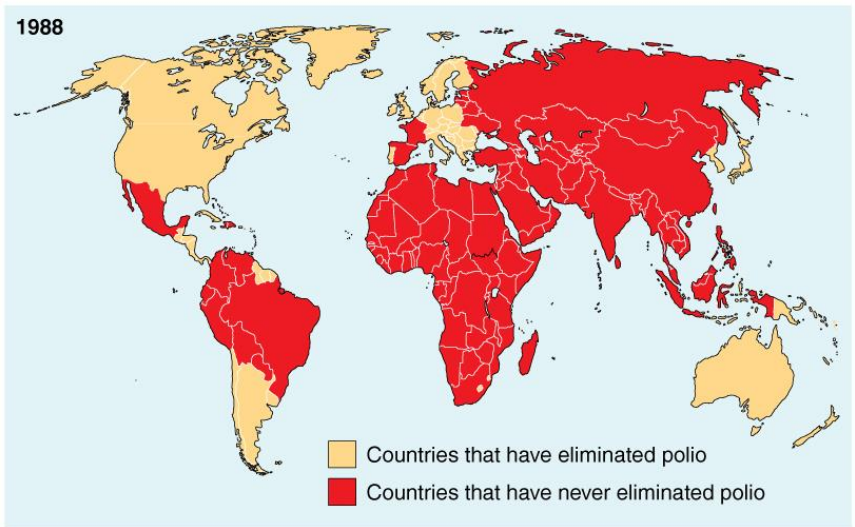
-First disease for which immunity was artificially induced

-Last US case in 1948; last case worldwide in 1977 in Somalia

-Further information:
http://www.bt.cdc.gov/agent/smallpox/overview/disease-facts.asp

Source: Centers for Disease Control and Prevention

Adverse reactions- these can be immediate and obvious



-**1955-** IPV or Salk polio vaccine induced 260 cases polio, resulted in 10 deaths (not fully inactivated). Current Salk vaccine is inactivated.

-Currently polio is endemic to only a small part of the world, due to vaccinations

Media's role: inaccurate reporting

Case study:

1000 students at school
995 received MMR vaccine
all exposed to 1 student with measles

12 cases of measles resulted
5 were not previously immunized
7 were immunized (less severe cases)

MEDIA REPORT: MMR Vaccine Does Not Work!!

Need to link tragedies with cause

MMR vaccine and autism data

(Summary of information found in "Vaccines and Autism" article)

-**1998**: Wakefield et al. suggest MMR vaccine caused autism in 12 children

ISSUES: MMR vaccine/ autism diagnosis occurs at same time

Studies of autism in vaccinated vs. unvaccinated not done

Claim that autism is consequence of gastrointestinal inflammation caused by vaccine, but GI issues occurred before vaccine in 8 cases

RESULT: Paper was retracted by all but one author

Paper was retracted by publishing journal

Need to link tragedies with cause

Studies by multiple independent groups to determine causal relationship between MMR vaccine and autism

(Summary of information found in "Vaccines and Autism" article)

-**1999:** Taylor et al. examines receipt of MMR vaccine and autism (case study of 500 children)

RESULTS:

% vaccinated children with autism same as those without

No difference in age of diagnosis between vaccinated and unvaccinated children

Onset of symptoms did not occur within 6 months of MMR vaccine

Need to link tragedies with cause

Genetic basis of autism and timing of development of disease

-**Genetics:** Look at percentage of autism in twins. If one has it:

<u>Strict definition of autism</u>
60% of monozygotic twin will have it
~0% of dizygotic twin

<u>Broad defintion (autistic spectrum disorder)</u>
92% monozygotic twin will have it
10 % of dizygotic twin will have it

Bailey, A., et al. Autism as a strongly genetic disorder: evidence from a British twin study. Psychol Med 25:63-77, 1995. http://www.ncbi.nlm.nih.gov/entrez/query.fcgi?cmd=Retrieve&db=PubMed&list_uids=7792363&dopt= Abstract

Folstein, S., et al. Infantile autism: a genetic study of 21 twin pairs. J Child Psychol Psychiatry 18:297-321, 1977.

Need to link tragedies with cause

Genetic basis of autism and timing of development of disease

-**Timing:** Autism symptoms present before 1 year of age (studies done in 1991, 1992, 1993, 1994, 1998)

Autism symptoms present before 4 months (studies done in 1998)

Adrien, J., et al. Blind ratings of early symptoms of autism based upon family home movies. J Am Acad Child Adolesc Psychiatry

Adrien, J., et al. Early symptoms in autism from family home movies: evaluation and comparison between 1st and 2nd year of life using I.B.S.E. scale. Acta Paedopsychiatrica 55:71-75,

Adrien, J., et al. Autism and family home movies: preliminary findings. J Autism Devel Disorders 21:43-49,1991.

Osterling, J., et al. Early recognition of children with autism: a study of first birthday home videotapes.J Autism Devel Disorders 24:247-257, 1994.

Mars, A.E., et al. Symptoms of pervasive developmental disorders as observed in prediagnostic home videos of infants and toddlers. J Pediatr 132:500-504, 1998.

Teitelbaum, P., et al. Movement analysis in infancy may be useful for the early diagnosis of autism. Proc Natl Acad Sci USA 95:13982-13987, 1998.

Stromland, K., et al. Autism in thalidomide embropathy: a population study. In Devel Med Child Neurol 36:351-356, 1994.

Rodier P., et al. Embryological origin for autism: developmental anomalies of the cranial nerve motor nuclei. J Comp Neurol 370:247-261, 1996.

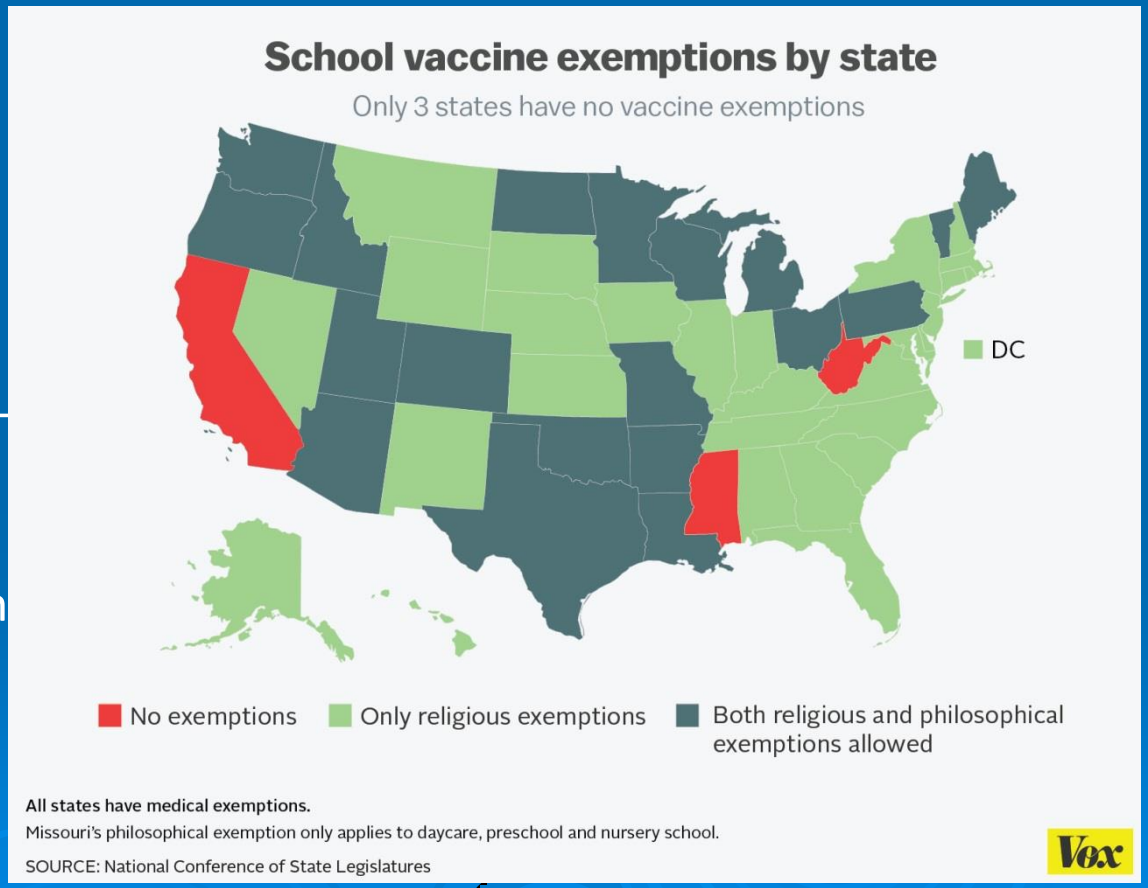
Need to link tragedies with cause
WHAT NOW?

-Years of research to refute hypothesis and calm fears

Link to CDC thimerosal research page

-Exemptions allowed in 19 states- places community at risk

-Exemptions no longer allowed in California, except for medical exemptions.



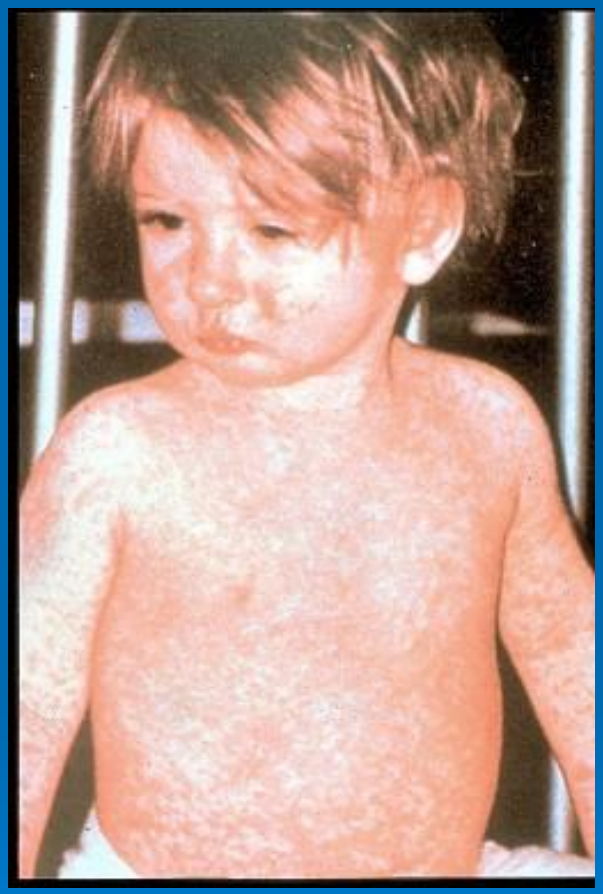
Need to link tragedies with cause
WHAT NOW?

-.

- Increase in measles in population due to exemptions for MMR vaccine
  - Was declared eliminated from US in 2000
  - Pockets of unvaccinated communities in New York, New Jersey, Texas, Utah, Michigan, Washington and Oregon
  - 465 cases this year so far

- Los Angeles (April 2016)

Refusing vaccinations- who suffers?



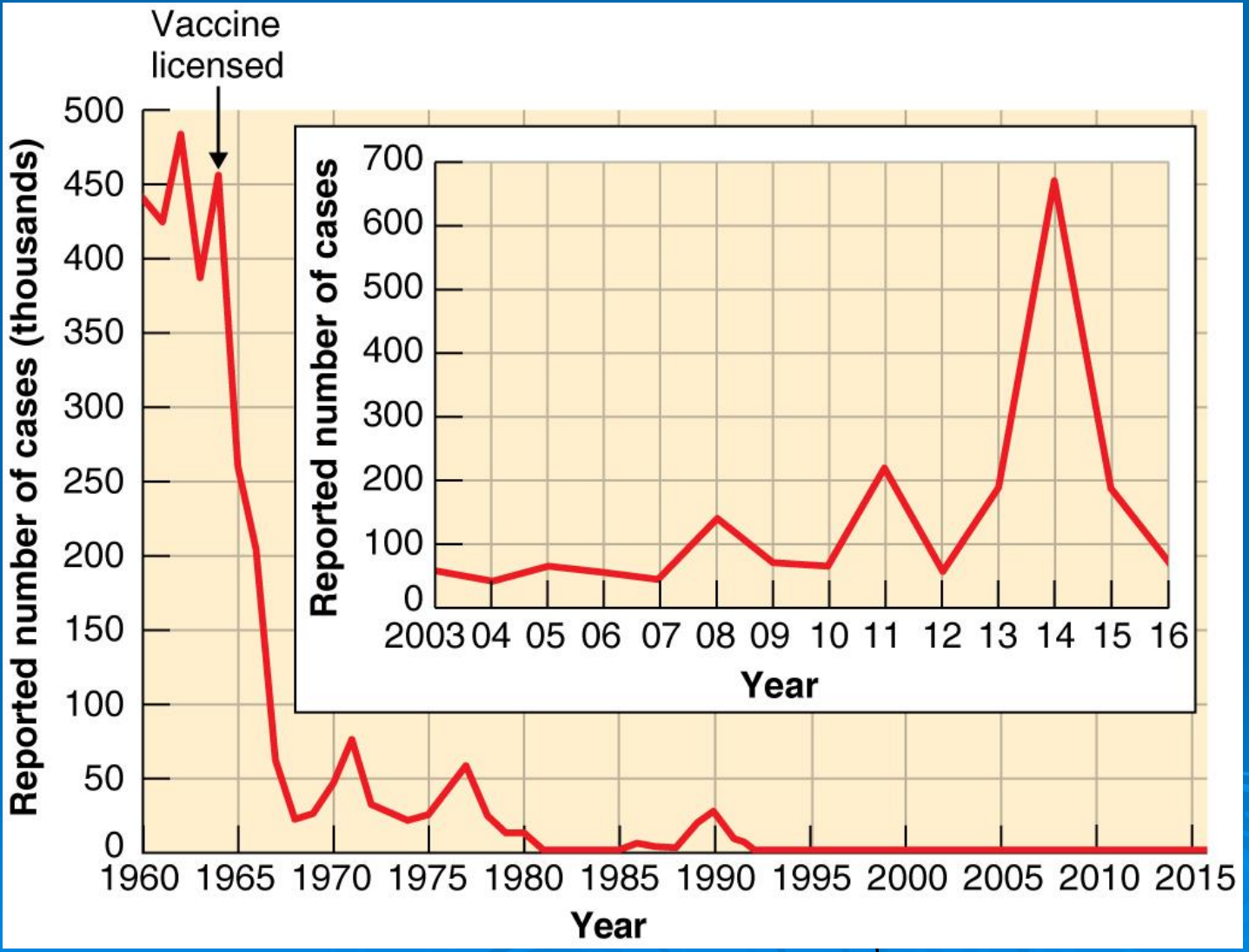
-**Measles** caused by Rubeola virus

-**Symptoms:** fever, rash, conjunctivitis, pneumonia, blindness, deafness, encephalitis (permanent damage), and/or death

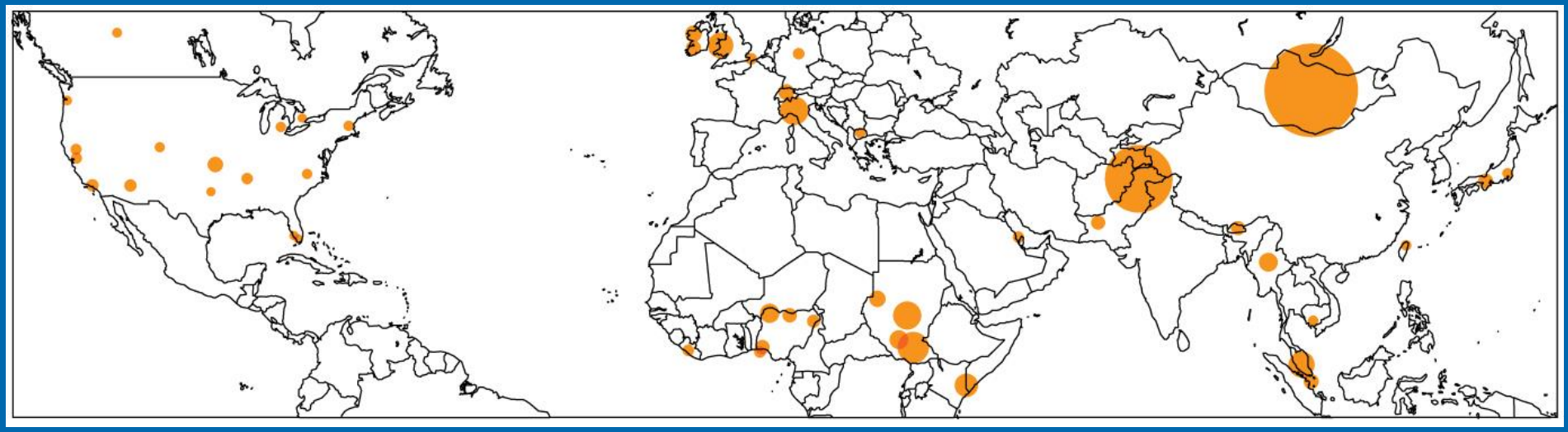
-**Pre-vaccine:** 2.6 million deaths each year!

-**Highly contagious:** requires > 90% vaccination coverage in population; but 2 doses of vaccine are over 97% effective.

Measles requires high vaccination coverage



Measles worldwide



Currently leading cause of death from a vaccine-preventable disease

- 2017- 110,000 deaths globally (mostly children under 5)
- Measles and Rubella Initiative to eliminate disease in 5 WHO regions by 2020. http://www.who.int/mediacentre/factsheets/fs286/en/

Vaccines- the bottom line

-Vaccines work!

A total 98.8% reduction in vaccine preventable diseases in the US since vaccination schedule was implemented.

-Exemptors of vaccines break down herd immunity and increase risk of disease on a population level

-Vaccines will never be 100% effective or 100% safe

Primary goal of current vaccine research is based on safety and EIDs

-It is a personal choice, but be aware that one's choice affects the rest of the community

-Personal vigilence is required to be informed and prevent complacency in public, health organizations, and research/ drug development

Diagnostic applications: Enzyme-Linked Immunosorbent Assay

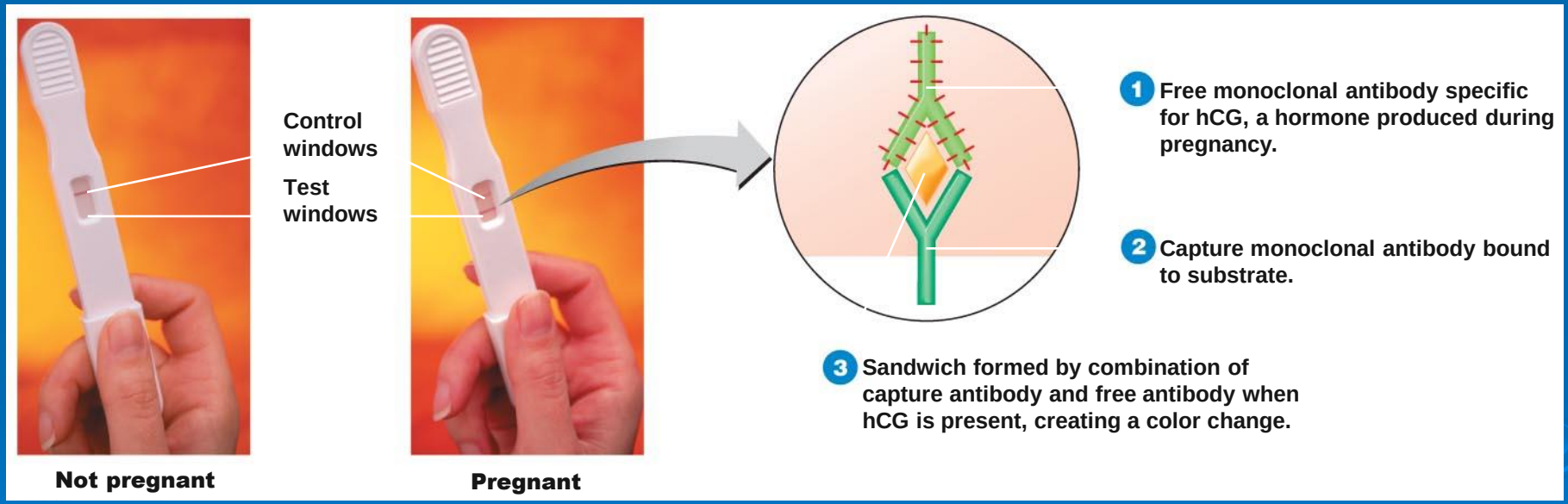


Figure 18.13

Enzyme-Linked Immunosorbent Assay (Direct vs Indirect ELISA)

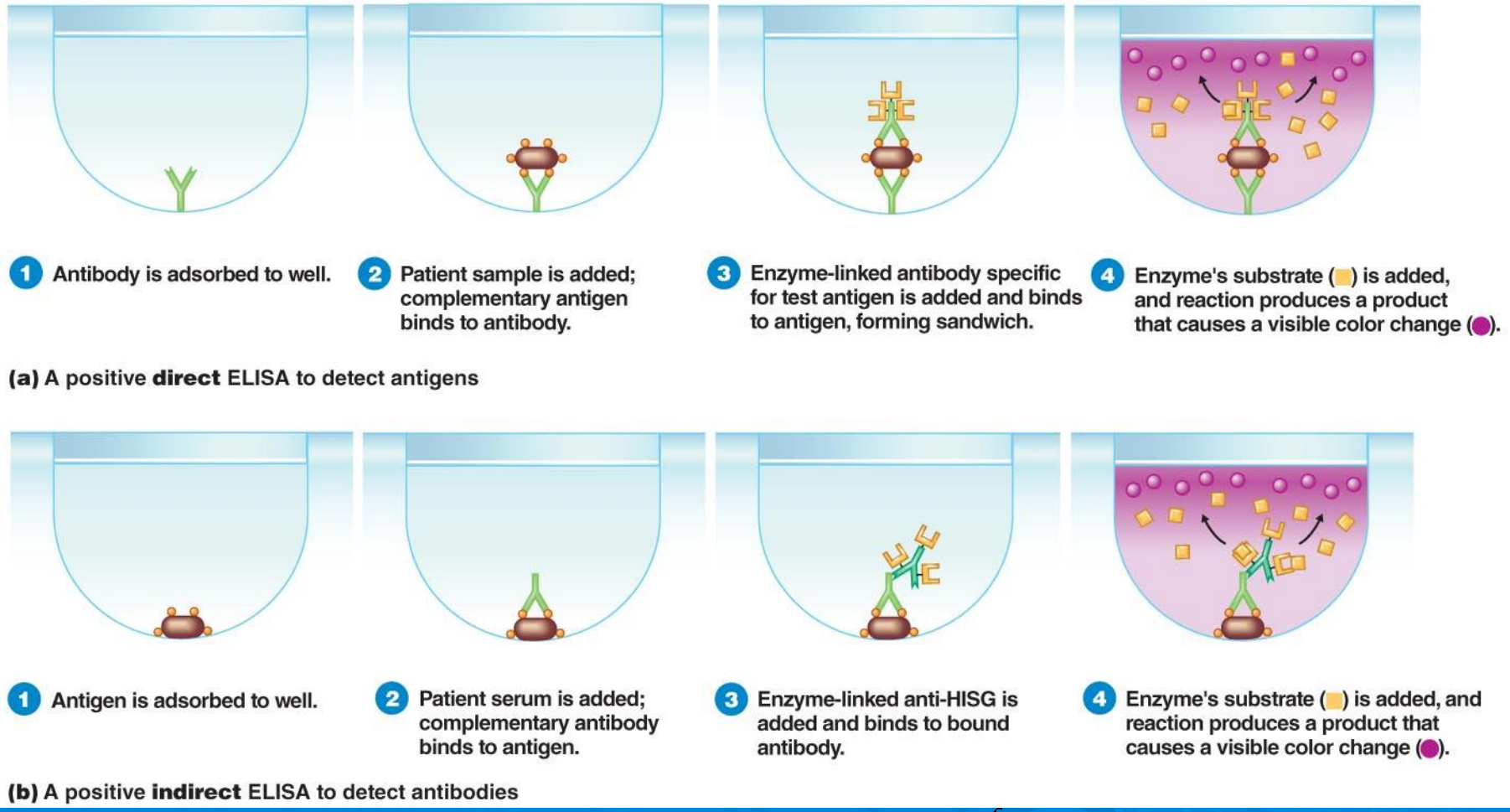
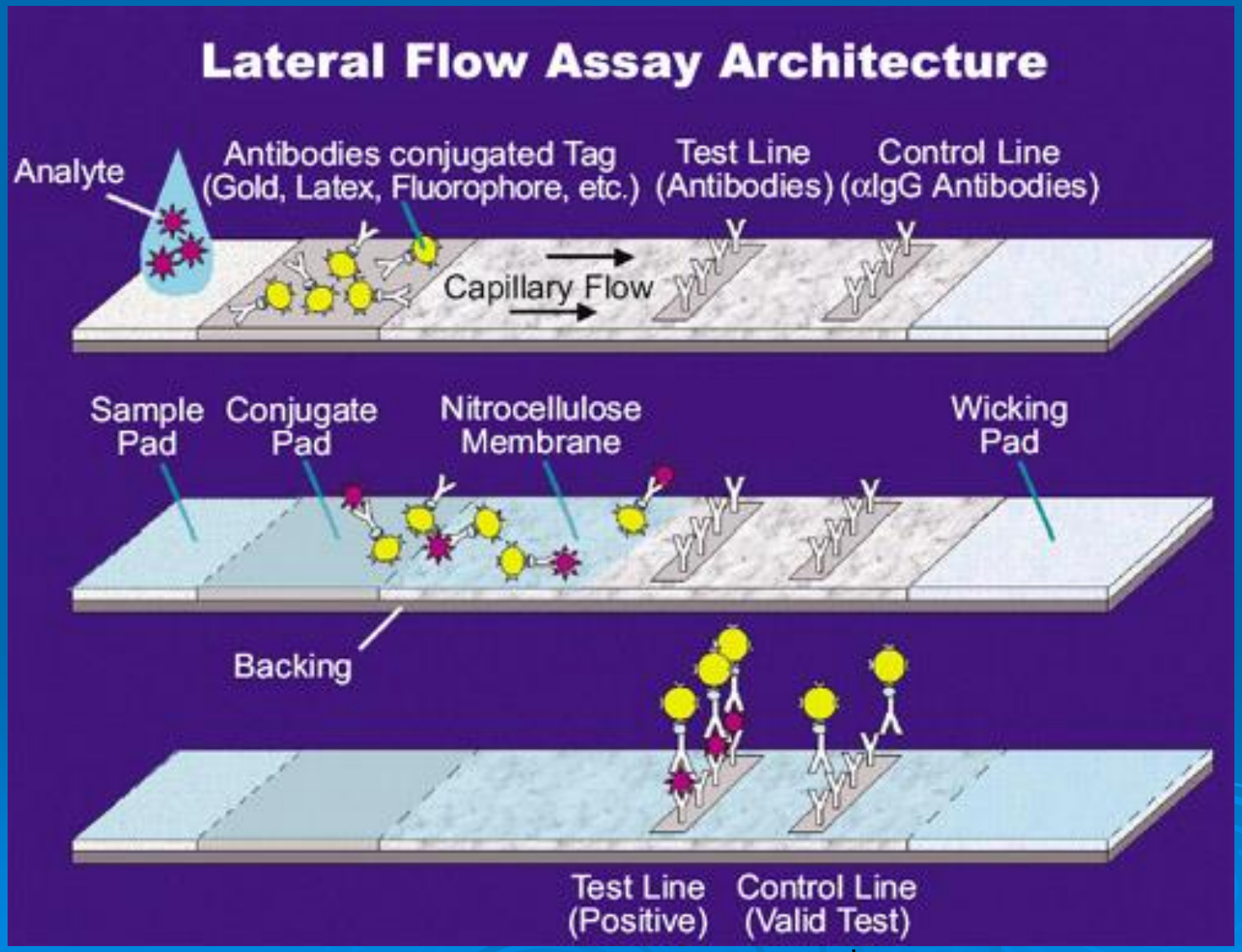


Figure 18.14 - Overview

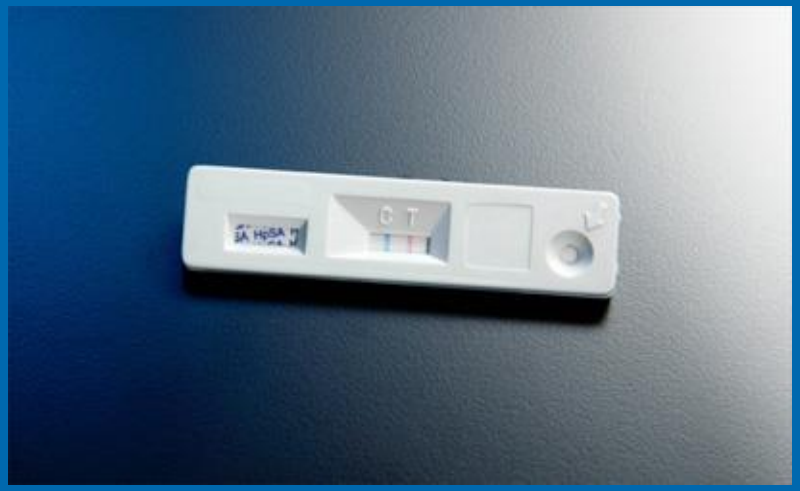
Lateral Flow Technology



U.S. National Aeronautics and Space Administration
http://exploration.nasa.gov/articles/images/homeplanet_3.jpg

New lateral flow (ELISA) technology

Immunocard:
Detects *C. difficile* toxins
A and B



Immunocard: STAT!
Detects *H. pylori* in stool

New lateral flow (ELISA) technology

Binax NOW Malaria:
Differentiates between
P. falciparum and others

NOW Flu:
Detects influenza A and B

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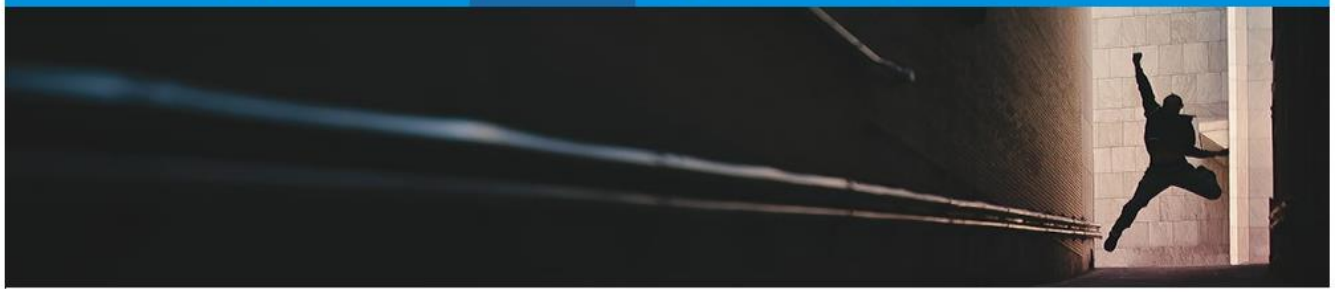

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Lateral Flow Test Kits

Lateral flow assays, also known as lateral flow immunoassays, lateral flow tests, immunochromatographic assays, or rapid strip tests, are a form of rapid and portable immunoassay in which the test sample flows along a solid substrate by capillary action. After the sample is applied to the test, it encounters a colored reagent which mixes with the sample, encountering lines or zones which have been pretreated with an antibody or antigen. It can detect a wide variety of pathogens, drugs, hormones, metabolites, and other molecules from biological and chemical samples.

>> Online inquiry

Application Type

› Autoimmune Disease Tests	› Fertility Tests	› Plant Pathogen Tests
› Animal Diseases Tests	› Allergy Tests	› Tumor/Cancer Markers Tests
› Cardiac Markers Tests	› Diabetes	› Urinary Reagent Tests
› Drugs of Abuse Tests	› Food Safety Tests	› Infectious Disease Tests
› Antibody Isotyping Kits		

https://www.cd-diatest.com/lateral-flow-test-kits_c27