What the Heck is in Vaccines?

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Disclosures

- No disclosures.
- I receive no support from pharmaceutical companies either directly or indirectly.
- No photograph is of a patient.
- Use of a trade name of a vaccine does not imply endorsement of that vaccine.

Poison or Harmless?

- Plutonium
- Lead
- Vitamin A
- Water


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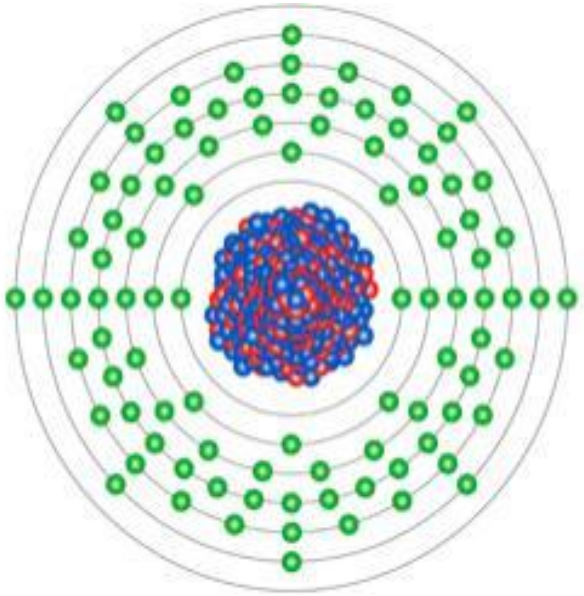
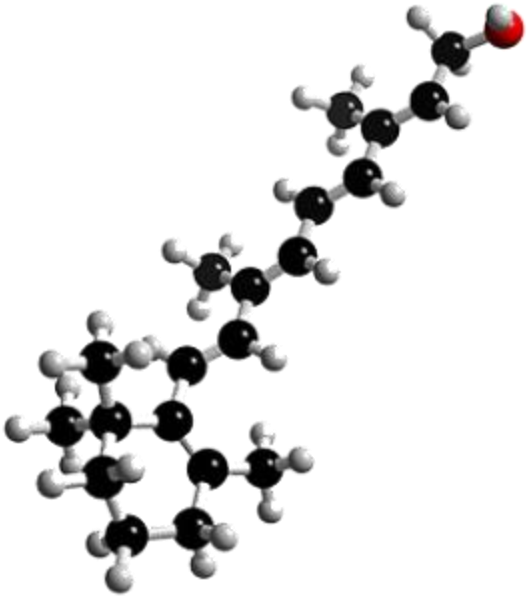
Paracelsus

- Born in Switzerland in 1493
- Alchemist, botanist, chemist, doctor, astrologer
- Full correct name was Theophrastus Phillippus Aureolus Bombastus von Hohenheim
- „Dose makes the poison“.
  - All substances have the potential to be both innocuous and poisonous





Vaccines

- Like all other chemicals, the contents of vaccines could be both poisonous or harmless.
- In the amounts in vaccines doses, vaccines are safe.
- Vaccines prompt the immune system to undergo the same biological reactions caused by a disease without inducing illness.

So What is in Vaccines?

- Antigens
- Preservatives, antibiotics
- Buffers, stabilizers, solubilizer
- Adjuvants
- Residuals

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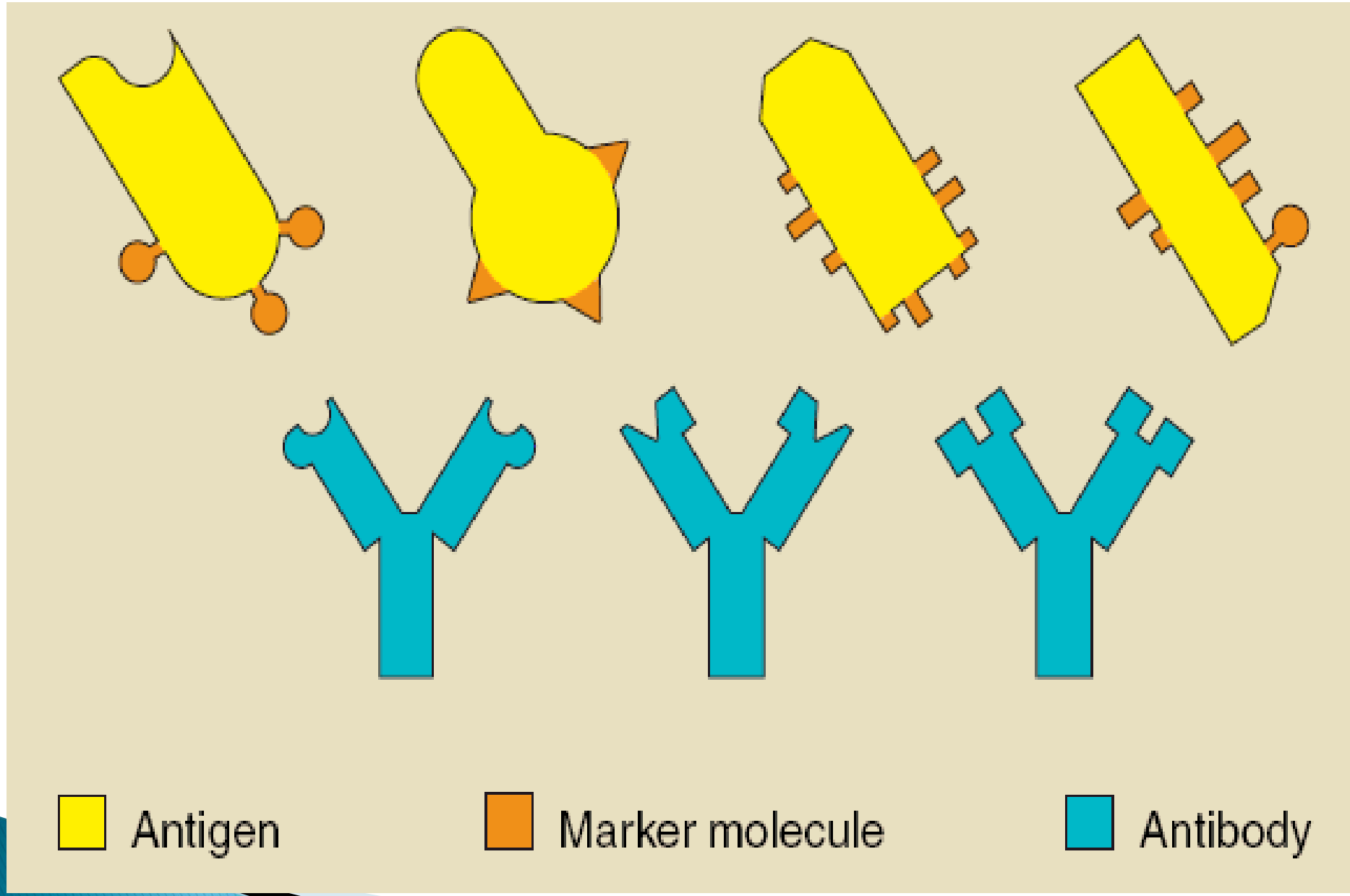
Antigen
Marker molecule
Antibody

Antigens

Toxoids – diphtheria, tetanus,
Inactivated (killed) virus – polio, Hep A
Recombinant viral surface protein – Hep B
Purified, subunit viral proteins – inact. influenza
Live, attenuated viruses – M,M,R,V, rotavirus
Live, cold adapted, temp sens – LAIV
Bacterial
  proteins – pertussis
  conjugated polysaccharides – Hib, PCV13, meningococcus

How Vaccines Work

- 1:45 video describing how vaccine antigens induce antibody formation
  - http://www.immunizeforgood.com/vaccines/how-vaccines-work

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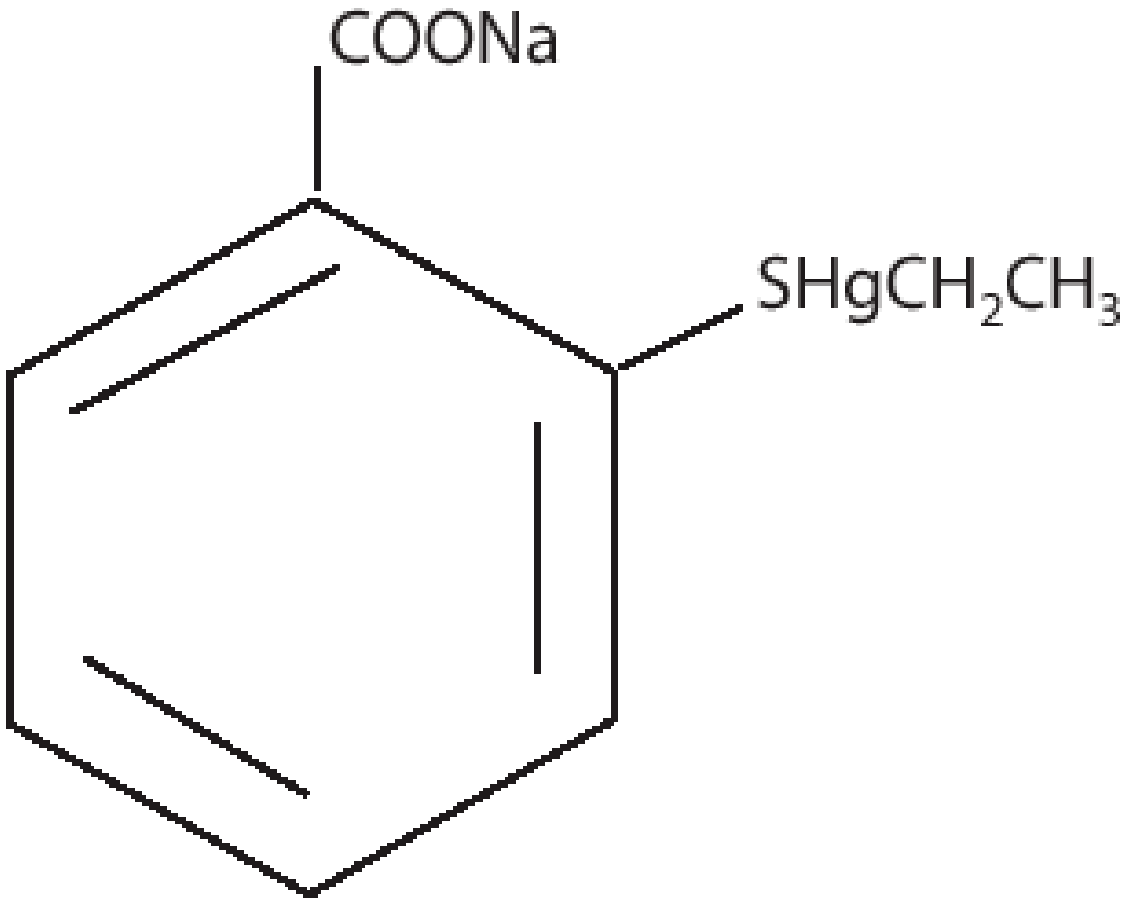
Preservatives

- Prevent the growth of bacteria, fungi
- Required to be in multi-dose vaccine vials in the US
- Definition is functional
  - A vaccine preservative must reduce the number of test dose bacteria and prevent the growth of yeast (In: Vaccines additives and manufacturing residuals in U.S.-licensed vaccines, pg 74.)
  - Challenged with *Candida albicans, Aspergillus niger, E.coli, Staph aureus, Pseudomonas aeruginosa*

Thimerosal



Thimerosal

- Added to multi-dose vaccines in the 1930s.
  - Without a preservative, vaccines drawn from multi-dose vials could cause abscesses, septicemia
- 1990s number of vaccines had increased.
- Thimerosal had never been proven to harm, it was removed from all vaccines except multi-dose influenza vaccine
- Mercury is a naturally occurring element
- A breast fed infant receives 15X amount of mercury than in an influenza vaccine

Preservatives, antibiotics

- Cannot decrease potency of the product
- Preservatives used
  - phenol (Pneumovax 23)
  - 2-phenoxyethanol (Daptacel, Pentacel, Adacel, IPV)
  - Thimerosal (multidose influenza). Trace amounts in several vaccines.
- Antibiotics
  - Residual from cell culture
  - Streptomycin B, gentamicin, neomycin, polymyxin B

Prion diseases

- Derived from “protein” and “infection”
- Non-nucleic acid based, ? Life
- Prions are theorized to be mis-folded proteins that can induce folding of proteins from the usual, functional shape to their own mis-folded shape
- Bovine products rarely can transmit prion disease
- Cattle – “mad cow disease” “Jakob-Creutzfeld disease” “bovine spongiform encephalopthy” (BSE)
  - Bovine products sourced from non BSE-countries

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Buffers, solubilizers

- Hydrochloric acid
  - Adjusts pH to be more acidic in DTaP
- Emulsifier, solubilizer: Polysorbate 80
  - Made from glucose and oleic acid
  - Rarely allergenic

Stabilizers

- "Stabilizers" have several purposes
  - Prevention of adherence to vial wall
  - Stability in freeze-drying
    - Removes water, prolongs storage
    - Sugars (sucrose, sorbitol), amino acids, proteins
    - Albumin (bovine), gelatin (porcine)

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Adjuvants

- Adjuvant is a substance to improve the immune response
- Aluminum-based compounds most common
- During the first 6 months of life, children could receive 4 mg of aluminum
  - During the same interval
    - 10 mg in breast milk
    - 40 mg in cow-milk formula
    - 120 mg in soy-based formula

Adjuvants

- Aluminum compounds
  - Crystalline Al oxyhydroxide, high surface area
  - Adsorb antigens well
  - Solubilized by citric, oxalic and malic acids
  - Immunopotentiator, property discovered in 1926
    - Mechanism uncertain
      - Depot
      - Inflammation
      - Adsorption
  - Al has been associated by one French physician with macrophagic myofascitis but controversial

Adjuvants

- Monophosphoryl lipid A
  - Bacterial lipid toxoid
  - Used in HPV2

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Residuals

- Formaldehyde, formalin (water solubilized), glutaraldehyde (many non-live vaccines)
  - Function is to inactivate the toxin activity while preserving antigenicity

Residuals

- Protein:
  - E.g. yeast, egg
- Cell walls
  - E.g. Vero cells, monkey kidney cells
- DNA
  - E.g. Vero cells, fetal cell lines,

What Vaccines Do NOT Contain Antifreeze

- Historic type of antifreeze is
- ethylene glycol
- Vaccines contain propylene glycol
  - Component of oils that are used in many foods
  - Can be used to reduce freezing temperature

Vaccines Do NOT Contain Fetal Tissue

- Aborted fetal tissue are used to grow:
  - Varicella, shingles, hepatitis A, rubella, rabies
- Two cell lines that were derived from cells from legal abortions, 1960s
  - 2005 Vatican Pontifical Academy for Life statement
    - Usage was acceptable because vaccines save lives.
    - Parents who chose not to give vaccines derived from these cells would be in more proximate cooperation with evil than those parents who give their children the vaccines in question

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Vaccine constituents

- Non-human products can induce anaphylaxis
  - 5 cases in 7,644,000 doses
  - Epinephrine, diphenhydramine should be quickly available
  - Advise a mock reaction to practice response
- Most important anaphylactic constituents:
  - Gelatin, calf serum
  - Egg protein (influenza)
  - Antibiotic residuals
  - Yeast proteins
  - Latex packaging

List of vaccine excipients

- CDC Pinkbook, appendix
  - internet
- Package inserts of individual vaccines


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