Addressing Vaccine Concerns

Paul J Carson, MD, FACP

Overview - Goals

- Review the main concerns for vaccine hesitancy and their historical origins
- Review the processes and evidence that assure vaccine safety and necessity
- Discuss what providers can do in the medical encounter to improve vaccine acceptance
Ten Greatest Public Health Achievements in the U.S: 1900–1999*

- Vaccination
- Motor-vehicle safety
- Safer workplaces
- Control of infectious diseases
- Decline in deaths from coronary heart disease and stroke
- Safer and healthier foods
- Healthier mothers and babies
- Family planning
- Fluoridation of drinking water
- Recognition of tobacco use as a health hazard


The Tremendous Impact of Immunization on Our Health

<table>
<thead>
<tr>
<th>Disease</th>
<th>20th Century Annual Morbidity</th>
<th>2011 Reported Cases</th>
<th>Percent Decrease</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smallpox</td>
<td>29,005</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Diphtheria</td>
<td>21,053</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Measles</td>
<td>530,217</td>
<td>212</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Mumps</td>
<td>162,344</td>
<td>370</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Pertussis</td>
<td>200,752</td>
<td>15,216</td>
<td>92%</td>
</tr>
<tr>
<td>Polio (paralytic)</td>
<td>16,316</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Rubella</td>
<td>47,745</td>
<td>4</td>
<td>&gt; 99%</td>
</tr>
<tr>
<td>Congenital Rubella Syndrome</td>
<td>152</td>
<td>0</td>
<td>100%</td>
</tr>
<tr>
<td>Tetanus</td>
<td>580</td>
<td>9</td>
<td>98%</td>
</tr>
<tr>
<td><em>Haemophilus influenzae</em></td>
<td>20,000</td>
<td>8*</td>
<td>&gt; 99%</td>
</tr>
</tbody>
</table>

*Source: JAMA. 2007;298(18):2155-2163
* Haemophilus influenzae type b (Hib) < 5 years of age. An additional 14 cases of Hib are estimated to have occurred among the 237 reports of Hi (< 5 years of age) with unknown serotype.
Vaccines have become victims of their own success

Increasingly, parents are skeptical of the safety and necessity of vaccines and are opting out of immunizing their children
History of the Anti-Vaccine Movement

What are the Main Concerns?

Birth of the Modern Anti-Vaccine Movement

Lea Thompson

Barbara Loe Fisher

April 19, 1982

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A Shot in the Dark

- 1985 book claims that DTP vaccine causes neurological damage, including autism
- Book details 100+ cases of DTP vaccine-induced brain inflammation and immune system dysfunction
  - Including children who developed regressive autism after brain inflammation and encephalopathy following DPT vaccination
- New DTaP vaccine created

Effects of Vaccine Roulette and Shot in the Dark

- Media coverage claiming whole-cell pertussis vaccine caused brain damage
- Flood of lawsuits successfully claiming pertussis vaccine caused SIDS, Reye’s Syndrome, coma, mental retardation, epilepsy, and transverse myelitis
- Price of DTP vaccine rose from $0.19 in 1980 to $12.00 in 1986
- Number of OPV vaccine makers declined from 3 to 1, measles vaccine makers from 6 to 1, and pertussis vaccine from 8 to 1
- At President’s request, congress stepped in and passed the National Childhood Vaccine Injury Act in 1986
Modern Anti-Vaccine Origins

- British physician and researcher gastroenterologist
- Study published in Lancet 1998
- Study of 12 children with a history of autism or developmental disorder “referred” to gastroenterology clinic.

Findings:
- Onset of behavioral symptoms, per parents, started after MMR immunization in 8 of the children
- Bowel abnormalities in all of the children on endoscopy

Conclusions: speculated a connection between bowel pathology after MMR immunization that allowed “toxins” to circulate to brain causing brain damage and autism
# Americans Beliefs About Autism and Vaccines

- Online Harris poll of 1756 adults for the National Consumer League in 2013

- Only 39% of parents described themselves as being extremely or very knowledgeable about how vaccines work….. Yet…….

- 33% of parents of children under 18, and 29% of adults agree with the statement, “vaccinations can cause autism”.

## What Do Vaccine-Hesitant Parents Think?

- More likely to believe they can control child’s susceptibility to disease

- Doubt the reliability of vaccine information

- Prefer negative outcomes due to inaction (not vaccinating) versus action (vaccinating)

- More willing to rely on herd immunity to protect their child

- Are frequently unsophisticated at risk-perception (e.g. smallpox vs influenza)

- More likely to believe the diseases are not harmful
What Do Parents Think?
Summary of U.S. Parent/Guardian Survey - 2009

N = 1,278
- Vaccinators with no concerns
- Significant refusers
- Minor refusers

ASTHO Survey, 2009
Vaccination Rates and Parental Exemption Rates For ND Children Entering Kindergarten or 1st Grade

Herd Protection
Herd Immunity

- https://www.youtube.com/watch?v=UqKP-ETVvrc

- The percent of the population that needs to be immune to confer herd immunity varies depending on how infectious is the pathogen
  - 90-95% for measles
  - 85% for pertussis

- Americans focus on individual, culturally opposed to “public health”

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Measles Immunization and Cases in U.K.

[Graph showing measles immunization rate and cases in the U.K., with a peak around the time of the Wakefield paper publication.]
Vaccine Safety

Why the Provider Can be Very Confident
FDA Process for Vaccine Licensure

- Rigorous process to assure safety and efficacy before vaccine is licensed
- Multiple stages
  - File IND – outlines method of manufacture, quality control tests, animal safety and efficacy data, and proposed human clinical trials
  - Pre-licensure trials
    - **Phase I** – safety and immunogenicity in small number of subjects
    - **Phase II** – dose ranging studies in hundreds of subjects
    - **Phase III** – efficacy and safety data collected on thousands of subjects
- Process can take up to 10 yrs before vaccine is licensed

Additional Measures Beyond Usual FDA Process

- Government passed the **National Childhood Vaccine Injury Act** in 1986
  - Requires health providers to provide a Vaccine Information Statement (VIS)
  - Providers are required to report certain adverse events to the Vaccine Adverse Events Reporting System (VAERS), anyone can report
  - Formed the National Vaccine Injury Compensation Program (NVICP)
    - Tasked the Institute of Medicine to review all science on vaccine safety
- Established the Vaccine Safety Datalink (VSD) collaboration in 1990
- Clinical Immunization Safety Assessment (CISA) Network
Institute of Medicine Reports

- MMR Vaccine and Autism - 2001
- Thimerosal-containing Vaccines and N-D disorders - 2001
- Multiple-immunization and immune dysfunction - 2002
- Hepatitis B Vaccine and demyelinating disorders - 2002
- SV-40 Contamination of Polio Vaccine and Cancer - 2002
- Vaccinations and SIDS - 2003
- Influenza vaccine and neurological complications - 2004
- Vaccines and Autism - 2004

No drug, device, process, or procedure in healthcare is as heavily scrutinized and monitored for safety and efficacy as are vaccines!
Specific Parental Concerns

- Risk of autism from the MMR vaccine
- Believe child receives too many shots too soon
- Dangers from the disease are minimal, vaccine not necessary (influenza, chickenpox, neonatal hepatitis B)
- Risks from “toxins” in the vaccines, esp mercury (thimerosal) or aluminum
- Long-term effects of vaccine and possible links to chronic auto-immune disease

Our Brains Are Hardwired to Make Associations

Observation: People who sleep in their shoes frequently wake up with headaches

Conclusion: Going to bed with shoes on causes headaches
Association vs Causality – U.S. Cell Phone Use and Autism

![Graph showing the prevalence of children diagnosed with autism per 1000 and the number of U.S. cell phone subscribers x 100,000 over time.]

Hierarchy of Epidemiologic Study Design

- Case reports
- Case series
- Ecologic studies
- Cross-sectional studies
- Case-control studies
- Cohort studies
- Randomized controlled trials

Generate hypotheses → Establish causality
Evidence based meta-analysis of vaccines and their association with autism

- 2014 review of 10 well designed studies looking for associations between MMR vaccination and/or thimerosol exposure in children, and the development of autism
- 5 case-control studies, 5 cohort studies

Taylor LE. Vaccine 2014.

Case-Control Studies

- Studies done in USA, Poland, UK, and Japan
- 9,920 total children studied
- No evidence of any association between MMR vaccination, Hg, or thimerosol exposure and any form of ASD

Taylor LE. Vaccine 2014.
Cohort Studies Comparing Risk of Autism/ASD with Exposure to MMR, Mercury, or Thimerosal

Total number of children studied in these 5 Cohort Studies

N = 1,256,407

Avg length of follow up – 8.6 yrs

Conclusions – No association

Cochrane Review of Autism/MMR Link

- Respected independent collaboration that undertakes exhaustive reviews of the medical literature
- Feb 2012 released their review of 27 cohort studies, 17 case-control studies, 5 time series trials, 1 case cross-over trial, 2 ecological studies, 6 self-controlled case series
- All told – involved 14,700,000 children assessing safety and efficacy of MMR vaccine
- Conclusions: Vaccine was unlikely to be associated with autism, asthma, leukemia, hay fever, diabetes, gait disturbance, Crohn's disease, or demyelinating disease
Brian Deer: Investigative Reporter

- Never received IRB approval to do his study,
- Study participants were recruited by an anti-vaccine group
- All the children's medical histories were found to be misreported
- 8 mos prior to the paper's publication, Wakefield submitted a patent for a new measles vaccine.
- Wakefield had been paid by a trial lawyer group building a case to sue vaccine makers for making a product that causes autism - almost $675,000
- No conflicts of interest disclosed to the Lancet
- One of his colleagues later confessed that when the lab specimens didn't come out the way Wakefield wanted, he didn't report some of those.
- Five of the patients were later found to have had problems BEFORE ever receiving the vaccine, and 3 never had autism.
- His paper was retracted in 2011, co-authors removed their name from the paper, and an expose' on the fraud appeared the BMJ.
- England's General Medical Council removed his medical license for his "callous disregard" for putting children through clinically unnecessary invasive medical procedures.

Do Too Many Vaccines “Overwhelm” the Immune System?

**1940**
- DTP
- SMALLPOX

**1980**
- DTP (2 months)
- Polio (2 months)
- DTP (4 months)
- Polio (4 months)
- DTP (6 months)
- Polio (6 months)
- MMR (12 months)
- DTP (18 months)
- DTP (5 years old)

**2012**
- Flu+HIB (Pentavall)
- HepA (Bredt)
- Dip (2 months)
- Polio (2 months)
- HB (2 months)
- Prex1 (2 months)
- Rotavirus (2 months)
- HepA (2 months)
- Dip (4 months)
- Polio (4 months)
- HB (4 months)
- Prex1 (4 month)
- Rotavirus (4 months)
- Dip (6 months)
- Polio (6 months)
- HB (6 months)
- Flu+HIB (17 months)
- Flu+HIB (17 months)
- Prex1 (12 months)
- MMR (12 months)
- Varicella (15 months)
- HepA (15 months)
- Dip (18 months)
- Polio (18 Months)
- HB (18 months)
- HepA (18 months)
- Flu+HIB (18 months)
- Flu+HIB (2.5 years)
- Dip (4-6 years)
- Polio (4-6 years)
- MMR (4-6 years)
- Varicella (4-6 years)
- Flu+HIB (4-6 years)

*49 DOSES of 14 vaccines by the age of 6 (in 2012)*

Antigens are what activate the immune system, not numbers of vaccines or shots.

Need to count antigens!
# More Childhood Vaccines - But Fewer Antigens

Thanks to advances in technology, vaccines today contain fewer antigens. Even with more vaccines, the total immunologic load is much less.1,2

<table>
<thead>
<tr>
<th>Year</th>
<th>Vaccine Proteins</th>
<th>Vaccine Proteins</th>
<th>Vaccine Proteins</th>
<th>Vaccine Proteins/Polysaccharides</th>
</tr>
</thead>
<tbody>
<tr>
<td>1900</td>
<td>~200 Smallpox</td>
<td>~200 Tetanus</td>
<td>1 Diphtheria</td>
<td>1</td>
</tr>
<tr>
<td>1960</td>
<td>~200 Diphtheria</td>
<td>~3000 WC pertussis</td>
<td>15 Polio</td>
<td>15</td>
</tr>
<tr>
<td>1980</td>
<td>~200 Tetanus</td>
<td>~3000 Acellular pertussis</td>
<td>10 Measles</td>
<td>10</td>
</tr>
<tr>
<td>2000</td>
<td>~3217 Rubella</td>
<td>9 Mumps</td>
<td>5 Rubella</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>TOTAL ~3217</td>
<td>9 Mumps</td>
<td>5 Rubella</td>
<td>2</td>
</tr>
</tbody>
</table>

WC = Whole-cell.

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# “I Prefer to Spread Out the Vaccines”

- 42 in-depth neuropsychological tests performed on 1047 children age 7-10. Outcomes compared between those fully vaccinated on-time, vs those with delayed vaccination.
- In univariate analysis, timely receipt associated with better NP scores on 12/42 tests.
- In multivariate analysis (adjusting for social and familiar factors), timely receipt remained independently associated with better performance on:
  - Developmental neuropsychological assessment speeded naming test
  - Scored 2.7 points higher on Wechsler IQ tests

Smith MJ. Pediatrics 2010
“I Prefer to Spread Out the Vaccines”

- Multiple neuropsychological tests performed on 1047 children age 7-10. Outcomes compared between those receiving varying amounts of antigens at 7, 12, and 24 mos.
- Increase in the amount of antigens (per 1000) not associated with any NP outcomes
- Antigen counts above the 10th percentile compared to lower counts → no adverse outcomes
- Only association: Children with higher antigen counts at 24 mos performed better on attention and executive function tests (OR 1.96)

When put to the test, the only evidence out there would suggest that vaccines may make your kid smarter!
Who Do Parents Trust?

- 2009 survey of 2521 parents with children under 17. 62% response rate.
- Freed GL. Pediatrics 2011
- Same results in several other studies

| TABLE 2 Parental Report of Levels of Trust of Certain People for Vaccine-Safety Information |
|---------------------------------|-------|-----|------|
|                                 | A Lot | Some, % | Not at All, % |
| My child(ren)'s doctor          | 76    | 22    | 2     |
| Other health care providers      | 26    | 70    | 4     |
| Government vaccine experts/officials | 23    | 61    | 16    |
| Family and friends              | 15    | 67    | 18    |
| Parents who believe their child was harmed by a vaccine | 8 | 65 | 27 |
| Celebrities                      | 2     | 24    | 74    |

What can be done at the medical encounter?
What Not To Do

How Strong Should You Make the Argument?

- Web based survey of a volunteer cohort - fictional disease and preventive vaccine
- Randomized to getting information on vaccine risks, disease risks, and then strong vs weak messages negating the vaccine risks
- Assessed their perceived probability of a VAE and likelihood of vaccinating
- Paradoxical finding that **stronger messages** suggesting “no risk” were more likely to lead to concern about VAEs and **less likely to vaccinate**

Betsch. Health Psychology, 2013
Physician Training Intervention

- Cluster randomized trial of 56 clinics in Washington state
- Physicians received training on “novel communication strategy” of “Ask, Acknowledge, and Advise” based on theory of planned behavior and best practices in physician patient communication literature
- Assessed moms vaccine attitudes at child’s birth, and 6 mos later
- Assessed physician confidence in communicating with parents about vaccination
- Outcome: NO BENEFIT
- Did they get it right?

Henrickson. Pediatrics 2015

Vaccination Today ??

Opel D. Pediatrics 2013
How You Frame the Question Study

- Cross-sectional observational study of pediatrician-parent discussions at well-child visits for children age 1-19 mos around topic of vaccination
- Study described to providers and parents only in general terms re: “communication”
- Parents assessed on prior survey for degree of vaccine hesitancy, over-sampled vaccine-hesitant parents
- Video camera recorded the encounter in the pediatrician’s exam room
- Communications experts assessed the manner in which conversation was initiated

Summary: Framing the Question and Pursuit

<table>
<thead>
<tr>
<th>Presume</th>
<th>Pursue</th>
<th>Pursue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance</td>
<td>74%</td>
<td>12%</td>
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</tbody>
</table>

= 88% accept
5% offer mitigated plan
7% reject immunization

<table>
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<tr>
<th>Participate</th>
<th>Pursue</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance</td>
<td>4%</td>
</tr>
</tbody>
</table>

= 25% accept
42% offer mitigated plan
33% resist immunization

<table>
<thead>
<tr>
<th>Participate</th>
<th>Acquiesce</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceptance</td>
<td>4%</td>
</tr>
</tbody>
</table>

= 4% accept
13% offer mitigated plan
83% resist immunization

Opel D. Pediatrics 2013
Presumption of Vaccination

**YES**
“We have to do some shots today.”
“Suzie will need a few shots today, the nurse will be right in with those.”
“All right….. time for those shots!”

**NO**
“We’d like to do some shots today, do you have any specific questions or concerns?”
“What do you want to do about shots?”
“Are you ok with the (flu, HPV, Varicella…. etc.) shot along with the others?”
“Can we get Suzie her vaccines today?”
Study Design:

- 2 – wave web-based survey experiment on 1759 parents in U.S.
- 1st wave – surveyed re: attitudes towards vaccination
- 2nd wave - randomly assigned to receive 1 of 4 interventions:
  - CDC information explaining lack of evidence that MMR causes autism
  - Textual information about the dangers of diseases prevented by MMR
  - Images of children with the diseases
  - A dramatic narrative about an infant who almost died

Results:

- None of the interventions increased parental intent to vaccinate a future child
- Refuting claims of an MMR/Autism link successfully reduced misperceptions that vaccines cause autism, however, it decreased intent to vaccinate among parents who had least favorable vaccine attitudes at preset
- Paradoxical findings:
  - Images of sick children increased expressed belief in a vaccine/autism link
  - Dramatic narrative about infant in danger fr disease increased self-reported belief in serious vaccine side effects
- Conclusion: talking about dangers (either refuting vaccine dangers or highlighting disease dangers) made parents more wary

Nyhan. Pediatrics 2014
The C-A-S-E Approach: Robert Jacobson MD, Mayo Clinic

“C” – Corroborate the parents concern. Find the area on which you agree. Set tone for respectful, successful dialogue.

“A” – About me: Describe what you have done to build your knowledge base and expertise.

“S” – Science: relate what the science says

“E” – Explain and advise your patient based on the science

Corroborate

- “What is your main concern”
  - Don’t permit a vague refusal
  - Make parent get specific

Then
- “That’s a valid question, I glad you take a proactive approach to your child’s health”
- “When I heard that, I sought out answers myself”
- “We both want your child to be free of illness and injury”
- “We both want to avoid unnecessary medications and their side effects
About Me

- Raise doubts about the source of their information and strengthen their natural inclination to trust you, their child’s provider
  - “The internet has a lot of information out there that can make things very confusing, but we have to be careful to make sure the sources are reliable”
  - “Vaccinations represent a major part of my professional effort as your child's doctor/provider. I consider understanding all the issues around vaccine safety one of the most important aspects of my work.”
  - “I’m committed to your child’s health, and I’ve dedicated my career to that work”
  - “I've been studying medicine and pediatrics now for “x” years”
  - “One of the areas where I read a great deal is about infections, immunity, and vaccination”

About Me – the Paul Offit Approach

- Recommends being passionate in response to vaccine refusal
- “Look, let me love your child. What you’re really asking me to do is to violate a standard of care. Please don’t put me in that position”
- Regarding vaccine refusal, he comments – “[When you dismiss a patient] you’re saying, ‘It's so important to me, and you're making a choice that's substandard care, and I can't participate in that position.”
Science

➢ Try to avoid in-depth discussion of side-effects, perceived harms etc. Emphasize safety record and the processes to assure safety

➢ “Vaccines are better studied than any other medicine I prescribe or test I order”

➢ “Each vaccine is safer than any medicine I prescribe”

➢ “Vaccines are not fool-proof, but they are the most effective means to prevent certain injuries and illnesses”

➢ “The decision what to give when is based on the vaccine’s effectiveness, safety, and specific need for the child at that particular age”

Explain/Advise

➢ “That’s why I am recommending this vaccine”

➢ “If this were my child, I would be vaccinating her today”

➢ “I made sure my children got these vaccines, and I am very confident this is the best way to keep your child safe and healthy”

➢ “I got this vaccine”

➢ “That’s why if I were you, I would be getting these vaccines for your child”
Conclusions of Do’s and Don’t

Do
- Be presumptive.
- Affirm the parent’s desire to do what’s best
- Pursue if meet resistance
- Stick to your guns and strongly advocate
- Highlight your expertise and shared desire to do what’s best for the child
- Refute with science as your last resort

Don’t
- Start the conversation with solicitous language
- Be confrontational, denigrating, or argumentative
- If possible, avoid getting into discussion about dangers (danger priming effect and availability heuristic)
- Fire the patient

Emotion Based Appeals?

- Video images of parents with substantial regrets about choice not to vaccinate
- Nyhan study suggests may not help (but it was pictures or text only)
- Need to validate with further research, but probably worth a try
Kristen, died at age 23 from cervical cancer

Jesse, died at age 9 from chickenpox

Lore, died at age 3 mos from whooping cough

Nick, lost his arms and legs from meningococcal meningitis

Alana, died at age 5 ½ yrs from influenza

Kristen, died at age 23 from cervical cancer

Amanda, died at age 4 ½ yrs from influenza

Barry, a veteran fire-fighter, died at age 44 from influenza

http://shotbyshot.org/story-gallery/
Resources

➢ AAP -  http://www2.aap.org/immunization/families/safety.html
➢ Shot of Prevention -  http://shotofprevention.com/
➢ Voices for Vaccines -  http://www.voicesforvaccines.org/
➢ Children’s Hospital of Philadelphia Vaccine Education Center –  
  http://vec.chop.edu/service/vaccine-education-center/home.html
➢ Pertussis videos:  http://www.youtube.com/watch?v=Rmio2tsr0gs, 
  https://www.youtube.com/watch?v=53cZ9KGqMMw

“Toxins” in Vaccines

Warning:
Flu shot ingredients include—
• Mercury
• Antifreeze
• Phenol
• Animal Blood
• Animal Viruses
• And Formaldehyde
This is just a partial list...
**Common Flaws in Anti-Vaccine Literature**

- Incorrect compound cited for “toxic” effects and limit
- Inaccurate level of exposure reported
- Inaccurate claims of “toxin” presence in all vaccines
- Failure to report “toxin” purpose
- Failure to differentiate acute vs. chronic exposure
- Inaccurate mode of entry referenced
- No understanding of general chemistry and overall fear of “unnatural chemicals”

**Dangerous Chemicals?**

- 3-methyl-butyraldehyde
- Ethyl ethanoate
- Tocopherol
- Alpha-terpanine
- Terpinyl-acetate
- Proline
- Octene
- Hexanal
- Benzaldehyde
## Components of Vaccines

<table>
<thead>
<tr>
<th>Type of Ingredient</th>
<th>Purpose</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adjuvants</td>
<td>Improve the body’s immune response to antigens</td>
<td>Aluminum salts</td>
</tr>
<tr>
<td>Preservatives</td>
<td>Prevent contamination</td>
<td>Thimerosal</td>
</tr>
<tr>
<td>Stabilizers</td>
<td>Maintain vaccine potency during transportation and storage</td>
<td>Sorbitol, gelatin</td>
</tr>
<tr>
<td>Residual antibiotics</td>
<td>Prevent contamination by bacteria during manufacturing process</td>
<td>Neomycin</td>
</tr>
<tr>
<td>Residual inactivating ingredients</td>
<td>Kill virus or inactivate toxins during the manufacturing process</td>
<td>Formaldehyde</td>
</tr>
<tr>
<td>Residual cell material</td>
<td>To grow enough of the virus or bacteria to make the vaccine</td>
<td>Egg protein</td>
</tr>
</tbody>
</table>

*Source: Centers for Disease Control and Prevention*

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### Paracelsus, “Father of Toxicology” 1493-1541

*“Alle Dinge sind Gift und nichts ist ohne Gift, allein die Dosis macht es, dass ein Ding kein Gift ist.”*

*“The dose makes the poison!”*
Thimerosal in Vaccines

- Ethyl Mercury: half-life of 7 days
- Methyl Mercury: half-life of 50 days

- Very effective preservative that prevents bacterial and fungal contamination of vaccines
- Multiple studies have shown it to be safe with no long-term effects
- Removed from all childhood vaccines in 2001. MMR, varicella, and IPV never contained thimerosal
- Still present in multi-dose vials of influenza vaccine (not in individual dose vaccine)

Ethyl Mercury:
half-life of 7 days

1 vaccine dose ~ 50 mcg ethyl-mercury

Methyl Mercury:
half-life of 50 days

1 can tuna ~ 85 mcg methyl-mercury

“Aluminum is Toxic to All Forms of Life!”

Dr. Suzanne Humphries – anti-vaccine advocate

Aluminum Exposure (mcg)

At Birth
2 Months
4 Months
6 Months
12 Months
15 Months
18 Months

Hep B
PCV
DTaP
Hib

...250mcg
...1,225mcg
...975mcg
...1,000mcg
...600mcg
...625mcg
...250mcg

4,925mcg

Aluminium in NZ Vaccines 1980 vs 2013

1980
2013
Formaldehyde in Vaccines

- Used to kill the viruses that are used in producing inactivated viral virus vaccines
- Naturally occurs in many foods and is made by the human body
- Can be toxic when inhaled in large quantities over prolonged periods of time
- The EPA oral reference dose considered safe for long-term exposure is ingesting less than 200 mcg / kg body-weight per day (70 kg man could ingest **14,000 mcg daily** for prolonged periods)
Formaldehyde in Vaccines

Concerned about formaldehyde in vaccines? Consider the pear...

A pear contains ~60,000 μg of formaldehyde, naturally.

Vaccines contain ~100 μg or 0.16% of the formaldehyde in a typical pear.

The amount of formaldehyde in a vaccine is so tiny that it doesn’t even affect the naturally occurring levels of formaldehyde in a child’s blood.

Circulating normally in The bloodstream:

1100 mcg/mL