Vaccine Ingredients: Frequently Asked Questions

By: Megan Donahue, MD, FAAP & Victoria McPherson, DO

As a parent, you may wonder what goes into childhood vaccines—and that's a good thing. Asking questions means you're being thoughtful (https://www.youtube.com/watch?v=rpsxyzJRXUc) about your child's health. Let's take a look at the facts.

What ingredients are in vaccines?

Antigens

All vaccines contain antigens. Antigens make vaccines work. They prompt the body to create the immune response needed to protect against infection. Antigens come in several forms. The form used in a vaccine is chosen because studies show it is the best way to protect against a particular infection. Antigen forms include:

- **Inactivated (or killed) viruses.** These viruses cannot cause even mild illness. However, the body still recognizes the virus and creates an immune response to protect itself. The polio (/English/health-issues/vaccine-preventable-diseases/Pages/Polio.aspx), hepatitis A (/English/health-issues/conditions/abdominal/Pages/Hepatitis.aspx) and some influenza vaccines contain inactivated viruses.
- **Weakened live viruses.** These are too weak to cause disease but can still prompt an immune response. Live vaccines tend to cue a stronger immune response. Measles (/English/health-issues/vaccine-preventable-diseases/Pages/Measles.aspx), mumps and rubella (MMR), rotavirus (/English/safety-prevention/immunizations/Pages/Rotavirus-Vaccine-What-You-Need-to-Know.aspx), chickenpox (/English/health-issues/vaccine-preventable-diseases/Pages/Varicella-ChickenPox.aspx) (varicella) and one type of influenza (/English/health-issues/conditions/flu/Pages/which-flu-vaccine-should-my-child-get-this-year.aspx) (flu) vaccine contain weakened live viruses.
- **Virus subunit.** These are made up of a fragment or portion of the dead virus. This will prompt the body's protective immune response. Some vaccines made this way include the hepatitis B (/English/safety-prevention/immunizations/Pages/hepatitis-b-vaccine-what-you-need-to-know.aspx) and human papillomavirus (HPV (/English/safety-prevention/immunizations/Pages/are-your-kids-protected-from-cancer-caused-by-hpv.aspx)) vaccine.
- **Partial bacteria.** Vaccines that contain partial bacteria have a fragment or portion of the dead bacteria to prompt a protective immune response. Some vaccines made with partial bacteria including the Haemophilus influenzae type b (Hib (/English/safety-prevention/immunizations/Pages/Haemophilus-Influenzae-TypeB-Hib-Vaccine-What-You-Need-to-Know.aspx)), pneumococcal (/English/safety-prevention/immunizations/Pages/Pneumococcal-Conjugate-Vaccine-What-You-Need-to-Know.aspx), meningococcal (/English/safety-prevention/immunizations/pages/Meningococcal-Vaccines-What-You-Need-to-Know.aspx) and DTaP (diphtheria, tetanus and pertussis (/English/health-issues/conditions/chest-lungs/Pages/Whooping-Cough.aspx)) vaccines.

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Other common vaccine ingredients include:

- **Preservatives** keep the vials from becoming contaminated with germs.
- **Adjuvants** help the body create a better immune response. The most common adjuvants are aluminum salts.
- **Additives** help the vaccine stay effective while it is being stored. Additives include gelatin, albumin, sucrose, lactose, monosodium glutamate (MSG) and glycine.
- **Residuals of the vaccine production process.** Some ingredients are needed to make the vaccine. Although these ingredients are removed, residual (tiny) amounts remain in the final product. Depending on how the vaccine is made, it may include tiny amounts of antibiotics (neomycin), formaldehyde, egg protein or yeast protein.

Are these other ingredients in vaccines safe?

Yes. They have been studied and are safe in the amount used in vaccines. This amount is much less than children encounter in their environment, food and water.

Why are these other ingredients in vaccines?

Each of these other ingredients has a specific function, making the vaccine more effective.

- **Formaldehyde** is used to detoxify diphtheria and tetanus toxins, or to inactivate a virus. The tiny amount which may be left in these vaccines is safe. Vaccines have a tiny amount of formaldehyde—way less than what your body naturally makes or what you get from everyday foods like apples and pears. In fact, we are exposed to over 100 times more formaldehyde from food and our own bodies than from any vaccine.
- **Antibiotics,** such as neomycin, polymyxin B, and streptomycin, are used in some vaccines to prevent bacterial contamination when the vaccine is made. These antibiotics are then reduced to very small or undetectable amounts during processing of vaccines. Trace amounts of antibiotics in vaccines rarely, if ever, cause allergic reactions.
- **Egg protein.** Influenza and yellow fever vaccines are produced in eggs. So, trace amounts of egg protein are in the final product. However, we now know that anyone age 6 months of older can get the flu vaccine every year without any side effects, even if they are severely allergic to eggs.

  Measles and mumps vaccines are made in chick embryo cells in culture, not in eggs. The even smaller amount of remaining egg proteins found in the MMR (measles, mumps, rubella) vaccine does not usually cause a reaction egg allergic children. Yellow fever (https://www.cdc.gov/yellow-fever/vaccine/index.html) is the only vaccine ontraindicated to be used in egg-allergic children.

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- **Gelatin.** Some vaccines contain gelatin to protect them against freeze-drying or heat. People with severe allergies to gelatin should avoid getting gelatin-containing vaccines (https://www.chop.edu/vaccine-education-center/vaccine-safety/vaccine-ingredients/gelatin).

- **Aluminum.** Small amounts of aluminum salts (https://www.aap.org/en/news-room/fact-checked/fact-checked-aluminum-in-vaccines-strengthen-immune-responses-do-not-cause-autism-serious-health-issues/?srsltid=AfmBOoqmql2BO0bKw91fMncyXHiwBKElPYnajePR0OXJUMaFp4iZ10ZD) are used in some vaccines to increase immune response to a vaccine. These includes the DTaP, pneumococcal, HPV, hepatitis B, hepatitis A, Hib and meningococcal vaccines.

  Aluminum salts are found naturally in soil, water and foods such as soy. Decades of research involving millions of children show that the tiny amounts of aluminum salts in vaccines are safe. (You can read the full toxicology profile of aluminum from the U.S. Department of Health and Human Services here (https://www.atsdr.cdc.gov/toxprofiles/tp22-c1.pdf).) .) No credible evidence supports claims that aluminum salts in vaccines may cause food allergies (/English/healthy-living/nutrition/Pages/Food-Allergies-in-Children.aspx), including peanut allergies, or neurodevelopmental disorders such as autism (/English/health-issues/conditions/Autism/Pages/Autism-Spectrum-Disorder.aspx).

Hear more about aluminum salts in vaccines from Dr. Ari Brown:

Fact Checked: Aluminum Salts, Safety & Shots | AAP

Do vaccines contain antifreeze?

No. Antifreeze is typically made of ethylene glycol, which is toxic. Polyethylene glycol (PEG) and ethylene glycol sound similar, but they are not the same. PEG is made from ethylene glycol but is a very different substance—it is non-toxic and used in medications, cosmetics, and foods. It is used to inactivate the influenza virus in some influenza vaccines. It is also used to purify other vaccines.

Do vaccines contain thimerosal or mercury?

Mercury is an element naturally found in the air, soil and water. There are two types of mercury—and they are very different. One type, methylmercury, can be toxic and can get into food (such as some types of fish (/English/safety-prevention/all-around/Pages/Protecting-Your-Children-From-Contaminated-Fish.aspx)). It has never been a vaccine ingredient.

The other type is ethylmercury. It is used in a vaccine preservative called thimerosal (https://www.aap.org/en/news-room/fact-checked/fact-checked-extensive-research-shows-thimerosal-is-safe/), and it is not toxic. Ethylmercury was ed from routine childhood vaccinations in the United States more than 20 years ago. It is only used in one of the ations of the flu (/English/health-issues/conditions/flu/Pages/default.aspx) vaccine.

Several valid scientific studies have proved there is no link between ethylmercury and autism. The American Academy of Pediatrics (AAP), the American Medical Association and the Institute of Medicine (IOM) agree that science does not support a link between thimerosal in vaccines and autism. Read the IOM report here (https://www.ncbi.nlm.nih.gov/books/NBK223724/#ddd00052).

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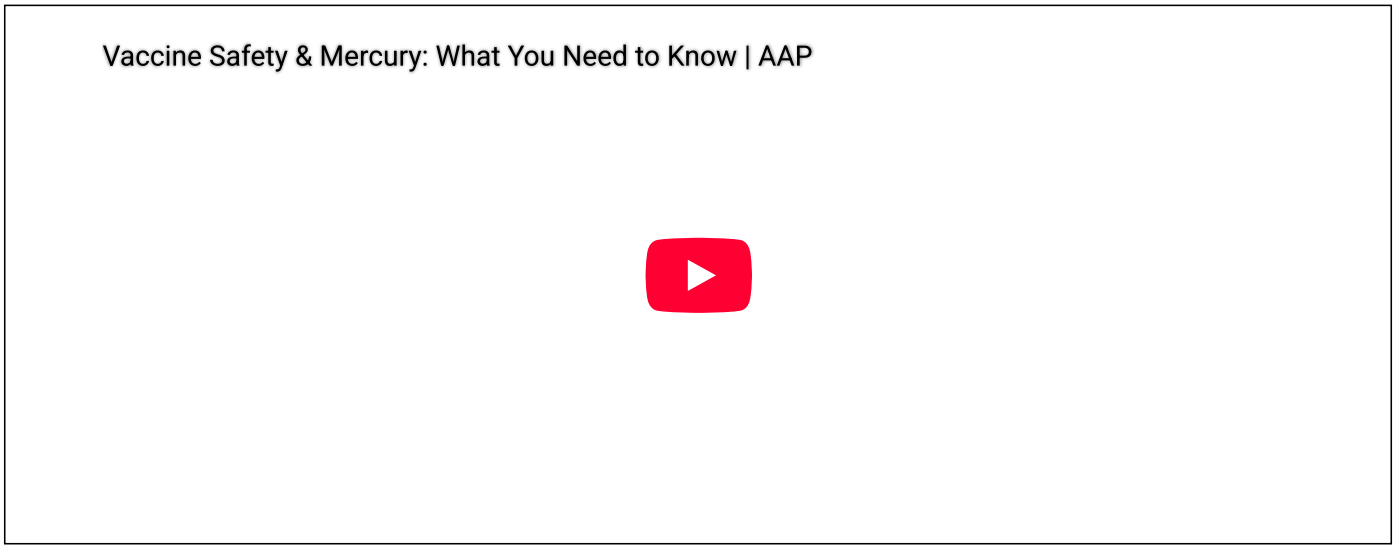
There is no link between mercury in vaccines and autism. Pediatrician Joanna Parga-Belinkie explains in this video.



Do vaccines contain fetal cells?

No. A few vaccines involve growing the viruses in human cell culture. Two cell lines provide the cultures needed for producing vaccines. These lines were developed from two fetuses in the 1960s. The fetuses were aborted for medical reasons, not for the purpose of producing vaccines. These cell lines have an indefinite life span, meaning that no new aborted fetuses are ever used. Purification processes during vaccine production result in no fetal tissue included in the final version of vaccines. So, children are not injected with any part of an aborted fetus.

Should vaccines contain fewer ingredients?

The amount of each additive used in vaccines is very small. In fact, we are exposed to much higher levels of these chemicals in our everyday lives. In vaccines, these ingredients are used to make the vaccine more effective. Each vaccine is tested many times (/English/safety-prevention/immunizations/Pages/vaccine-studies-examine-the-evidence.aspx) to make sure it is safe and works. Taking ingredients out might affect the ability of the vaccine to protect a child. Research is always being done to make sure that ingredients in vaccines continue to be the safest and best available for children.

Remember

Don't hesitate to talk with your child's pediatrician if you have questions about your child's health.

More information

- Vaccine Safety: Get the Facts (/English/safety-prevention/immunizations/Pages/Vaccine-Safety-The-Facts.aspx)
- How Vaccines Are Developed, Safety Tested & Approved (/English/safety-prevention/immunizations/Pages/how-vaccines-are-developed-tested-for-safety-and-approved-step-by-step.aspx)

`ıct Checked: Vaccines Do Not Contain Fetal Cells, Thimerosal (https://www.aap.org/en/news-room/fact-ıecked/fact-checked-vaccines-do-not-contain-fetal-cells-thimerosal/?_gl=1%2akzkkoj%2a_ga%2aMjA5MTMyOTk0NC4xNzM2OTcwMTg5%2a_ga_FD9D3XZVQQ%2aczE3NTI1ODgxNDI

kbzM1NyRnMSR0MTc1MjU5MTQ5MyRqMzEkbDAkaDA.) (AAP.org)

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- Fact Checked: Aluminum in Vaccines Strengthen Immune Responses, Do Not Cause Autism, Serious Health Issues (https://www.aap.org/en/news-room/fact-checked/fact-checked-aluminum-in-vaccines-strengthen-immune-responses-do-not-cause-autism-serious-health-issues/) (AAP.org)
- What's in a Vaccine? (https://www.who.int/news-room/feature-stories/detail/how-are-vaccines-developed) (World Health Organization)

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