The Measles, Mumps, and Rubella (MMR) Vaccine

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In 1971 Maurice Hilleman at the Merck Institute of Therapeutic Research, a pharmaceutical company in West Point, Pennsylvania, created the measles, mumps, and rubella (MMR) vaccine. The vaccine combined three separate vaccines for measles, mumps, and rubella, common and sometimes fatal diseases. Measles causes a red skin rash and severe fevers that can be fatal. Mumps causes fever and swelling of the salivary glands in the mouth and jaw, while rubella causes milder fevers and skin rashes. Pregnant women that contract rubella sometimes pass the virus to their fetuses, causing congenital rubella syndrome, which results in malformations of the eyes, ears, heart, and brain in the fetuses. The MMR vaccine has protected millions of people from contracting the potentially deadly diseases of measles, mumps, and rubella, as well as prevented the development congenital rubella syndrome in the fetuses.

Hilleman developed the MMR vaccine while working in the vaccine research laboratories at Merck. There, Hilleman created forty different vaccines over his career. During his time at Merck, Hilleman created the vaccines for both measles and mumps, which he later incorporated into the MMR vaccine. He developed his first measles vaccine in 1963 and a subsequent improved version of that vaccine in 1968. In 1967, Hilleman developed his mumps vaccine using samples of mumps virus which he isolated from his five-year-old daughter, Jeryl Lynn Hilleman, who had contracted the mumps. Though Hilleman created a rubella vaccine himself in 1969, he used the rubella vaccine developed that year by Stanley Plotkin at the Wistar Institute, in the MMR vaccine instead.

Plotkin used human fetal cells to develop his rubella vaccine, whereas Hilleman had used animal cells in his rubella vaccine. Using human cells rather than animal cells enabled Plotkin to develop a rubella vaccine that was better adapted to protect against the disease in humans and produced fewer negative side effects after vaccination.

When a virus infects an individual, that individual’s immune system begins to make antibodies specific to that virus to combat the infection. Antibodies are proteins that recognize and bind to the specific chemical signatures of the virus, marking the virus as a target for removal by the other parts of the immune system. Even after the immune system eliminates the infection, the antibodies remain to protect against future similar infections. The immune system continues to produces those antibodies, providing immunity from, or protection against, future infections from the same type of virus.

The MMR vaccine contains within it small amounts of attenuated (weakened) or inactive viruses, which are not infectious. Even if the virus is inactive or attenuated, the immune system still responds as if the virus were active. Because the virus is inactive or attenuated, the virus does not cause a full-strength infection with accompanying symptoms. However, the immune system still produces the same antibodies that it would if it were a full-strength infection. When an individual vaccinated with the MMR vaccine encounters the full-strength version of the virus, the antibodies specific to measles, mumps, and rubella provide immunity against those viruses, meaning they prevent infection. By exposing individuals to a mild version of viral infections, the MMR vaccine gives the immune system an opportunity to build defenses against weaker measles, mumps, and rubella infections before it encounters the full-strength viruses.

When the MMR vaccine was developed in 1971, it did not protect against measles, mumps, and rubella in a new way. Instead, it was a combination vaccine, a vaccine that contained the ingredients of multiple other vaccines, specifically vaccines against measles, mumps, and rubella. With combination vaccines, physicians could immunize against multiple diseases with a single injection rather than multiple vaccinations over time. Combination vaccines enabled quicker and more thorough vaccination coverage in the public. As a combination vaccine, the MMR vaccine contains attenuated viral material from measles, mumps, and rubella viruses. Each dose of the MMR vaccine became typically administered via injection, often in the upper part of recipient’s arm, resulting in few, if any, side effects from the MMR vaccine. The most common side effects are minor and include mild fevers or rashes. In rarer cases, about one in every 3,000 people receiving the vaccine, the MMR vaccine could cause temporary joint pain or stiffness in teens or adults, as well as high fevers that may lead to seizures.

Though a single dose of the MMR vaccine protects against contracting measles, mumps, and rubella, it is most effective after two doses of the vaccine spread out over time. The second dose of the MMR vaccine is more than a booster to immunity gained from the first dose. Instead, the second dose helps to produce immunity in individuals that did not receive it from the first dose. A single dose of the MMR vaccine imparts immunity against measles in about 93 percent of recipients, mumps in about 78 percent of recipients, and rubella in about 90 percent to 95 percent of recipients. The second dose increases immunity against measles to
Sources


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