The “MOO”-ving History of Vaccines

In order to effectively understand the history of vaccines, we must first familiarize ourselves with smallpox. You may just shrug it off, because smallpox has been completely eradicated (ahem, thanks to vaccines), and smallpox has in no way affected your life or your loved ones. However, smallpox was at one point a very devastating, and potentially fatal disease.

A virus known as Variola causes smallpox, which is a Latin term for “spotted” or “pimple.” Variola is the same family as chickenpox or cowpox.

Symptoms of smallpox include fever, muscle aches, headaches, nausea, vomiting and backache. However, the most telltale signs of smallpox were the rashes it produced on the skin. The rash would first start off as small red spots on the mouth and tongue, which would eventually break open, depositing the virus into the mouth and throat. It was at that point in the virus life cycle that its infected host was most contagious. As the mouth sores would start to break down, other rashes would appear on the face, then quickly spreading to the arms, legs and then hands and feet. With the appearance of this rash, an infected person would usually begin to feel better, but the rash would then turn into raised bumps. Within 24 hours, the bumps filled with a thick, opaque fluid and often had a depression in the center that looks like a bellybutton. Fever often will rise again at this time and remain high until scabs form over the bumps. The scabs would become pustules—meaning bumps that were filled with pus. It is important to note that pus is a dead type of white blood cell known as neutrophils. The pustules would scab over once again, and the person remained contagious until the scabs fell off.

Smallpox is believed to have appeared around 10,000 BC, at the time of the first agricultural settlements in northeastern Africa. From there, it may have spread from to India by ancient Egyptian merchants. The earliest evidence of skin lesions resembling those of smallpox is found on faces of mummies from the 18th and 20th Egyptian Dynasties (1570–1085 BC). At the same time, smallpox has been reported in ancient Asian cultures: smallpox was described as early as 1122 BC in China and is mentioned in ancient Sanskrit texts of India.

It was common knowledge that survivors of smallpox became immune to the disease; meaning, they could not contract the disease again. As early as 430 BC, survivors of smallpox were called upon to nurse the afflicted. Man had long been trying to find a cure for the smallpox disease.

However, the most successful way of combating smallpox before the discovery of vaccination was inoculation. The word is derived from the Latin inoculare, meaning, “to graft.” Inoculation
referred to the subcutaneous (meaning under the skin) introduction of the smallpox virus into individuals who have not yet had the virus. The inoculator usually used a sharp lancet dipped in pus taken from a ripe pustule of some person who suffered from smallpox. The person was then pricked with the lancet on arms or legs.

1. What causes smallpox? ____________________________________________________________

2. When is smallpox believed to have appeared? When is the earliest known recording of smallpox? ____________________________________________________________

3. During which symptom is the virus the most contagious? ________________________________

4. What is a pustule? __________________________________________________________________

5. What is inoculation? What is its purpose? _____________________________________________

Inoculation was likely practiced in Africa, India, and China long before the 18th century, which was when it was introduced to Europe. In 1670, Circassian traders introduced inoculation “Ottoman” Empire in Turkey. Circassian women, who were in great demand in the Turkish sultan's harem in Istanbul because of their legendary beauty, were inoculated as children in parts of their bodies where scars would not be seen. These women must also have brought the practice of inoculation to the government of the Sublime Porte in Instanbul.

Inoculation came to Europe at the beginning of the 18th century with the arrival of travelers from Istanbul; however, they did not change the ways of the conservative English physicians, who believed that Eastern medicine was inferior and thought inoculation would go the way of bloodletting.

It was the continued advocacy of the English aristocrat Lady Mary Wortley Montague that was responsible for the introduction of inoculation in England. In 1715, Lady Montague suffered from an episode of smallpox, which severely disfigured her beautiful face. Her 20-year-old brother died of the illness 18 months later. In 1717, Lady Montague's husband, Edward Wortley Montague, was appointed ambassador to the Sublime Porte. A few weeks after their arrival in Istanbul, Lady Montague wrote to her friend about the method of inoculation. Lady Montague was so determined to prevent smallpox that she ordered the embassy surgeon to inoculate her 5-year-old son.
Upon their return to London in April 1721, Lady Montague had the family physician, Charles Maitland, inoculate her 4-year-old daughter in the presence of physicians of the royal court.

Given the success of Lady Montague’s children, Charles Maitland was granted a royal license to perform a trial of inoculation on six prisoners in 1721. Several court physicians, members of the Royal Society, and members of the College of Physicians observed the trial. All prisoners survived the experiment, and those exposed to smallpox later proved to be immune. In the months following this very first trial, Maitland repeated the experiment on orphaned children, again with success. Finally, on April 17, 1722, Maitland successfully treated the two daughters of the Princess of Wales.

Not long after Lady Montague presented inoculation, physicians performed inoculation on a massive scale. Although 2% to 3% of inoculated persons died from disease, inoculation rapidly gained popularity among both aristocratic and common people in Europe. The case-fatality rate associated with inoculation was 10 times lower than that associated with naturally occurring smallpox. In the 1750s more European princes died of smallpox, giving further motivation for inoculation. Many well-known royal families were inoculated. In fact, inoculation was becoming widespread throughout the world. That is, until a discovery made by a man named Edward Jenner.

6. During the 18th century, what was England’s view on inoculations?

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7. Who is Lady Montague and why is she a historic figure in inoculations?

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8. When and how did inoculation finally become acceptable in England?

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9. The fatality risk of inoculation was ______ times lower than the fatality risk of naturally occurring smallpox.

Edward Jenner was born on May 17, 1749, in Berkeley, Gloucestershire. During his early school years, Edward developed a strong interest in science and nature that continued throughout his life. At age 13 he was apprenticed to a country surgeon named George Harwicke, where Jenner heard a dairymaid say, “I shall never have smallpox for I have had cowpox. I shall never have an ugly pockmarked face.” In fact, it was a
common belief that dairymaids were in some way protected from smallpox.

While Jenner's interest in the protective effects of cowpox began during his apprenticeship with George Harwicke, it was not until 1796 before he made the first step in eradicating smallpox. For many years, Jenner had heard the tales that dairymaids were protected from smallpox naturally after having suffered from cowpox.

Cowpox is similar to smallpox, but it is a much more mild disease. Pondering this, Jenner concluded that cowpox not only protected against smallpox but also could be transmitted from one person to another as a deliberate mechanism of protection. In May 1796, Edward Jenner found a young dairymaid, Sarah Nelms, who had fresh cowpox lesions on her hands and arms. On May 14, 1796, using fluid from Nelms' lesions, he inoculated an 8-year-old boy, James Phipps. Subsequently, the boy developed mild fever and discomfort. Nine days after the procedure he felt cold and had lost his appetite, but the next day he was much better. In July 1796, Jenner inoculated the boy again, this time with fluid from a fresh smallpox lesion. No disease developed, and Jenner concluded that protection was complete.

In 1797, Jenner sent a short communication to the Royal Society describing his experiment and observations. However, the paper was rejected. Then in 1798, having added a few more cases to his initial experiment, Jenner privately published a small booklet entitled *An Inquiry into the Causes and Effects of the Variolae Vaccinae, a disease discovered in some of the western counties of England, particularly Gloucestershire and Known by the Name of Cow Pox*. The Latin word for cow is *vacca*, and cowpox is *vaccinia*; Jenner decided to call this new procedure *vaccination*.

Eventually, vaccination became popular through the activities of others, particularly the surgeon Henry Cline, to whom Jenner had given some of the inoculant. Later in 1799, other respectable doctors began to support vaccination among their patients. Jenner conducted a nationwide survey in search of proof of resistance to smallpox or to inoculation among persons who had cowpox. The results of this survey confirmed his theory. Despite errors, many controversies, and chicanery, the use of vaccination spread rapidly in England, and by the year 1800, it had also reached most European countries.

In 1800, a professor by the name of Benjamin Waterhouse, a professor of physics at Harvard University, was given some of Jenner’s smallpox “vaccine”. Waterhouse introduced vaccination in New England, and then persuaded Thomas Jefferson to try it in Virginia. Waterhouse received great support from Jefferson, who appointed him to the National Vaccine Institute, an organization set up to implement a national vaccination program in the United States.
Although he received worldwide recognition and many honors, Jenner made no attempt to enrich himself through his discovery. However, he not only received honors but also found himself subjected to attacks and ridicule. Despite all this, he continued his activities on behalf of the vaccination program. Gradually, vaccination replaced inoculation, which became prohibited in England in 1840.

10. How did vaccinations get their name? ________________________________________________

11. What was the procedure during the first successful vaccination? ____________________________

12. Why was Jenner’s vaccination a more ideal way to prevent smallpox than traditional inoculation? ________________________________________________________________

13. Hypothesize a reason as to why vaccinations were successful in immunizing an individual for the smallpox virus. ________________________________________________________________

14. Name two interesting facts that you learned during this article: ____________________________

15. How has the term “vaccination” changed over time? Thanks to Edward Jenner, what other diseases can be prevented with vaccines? ________________________________________________________________