Center for Science and Democracy at the Union of Concerned Scientists

FACT SHEET

CASE STUDIES IN SCIENCE AND DEMOCRACY

Life, Liberty, and the Pursuit of Immunity

How the Founding Fathers' Support for Science Helped Eradicate Smallpox

HIGHLIGHT

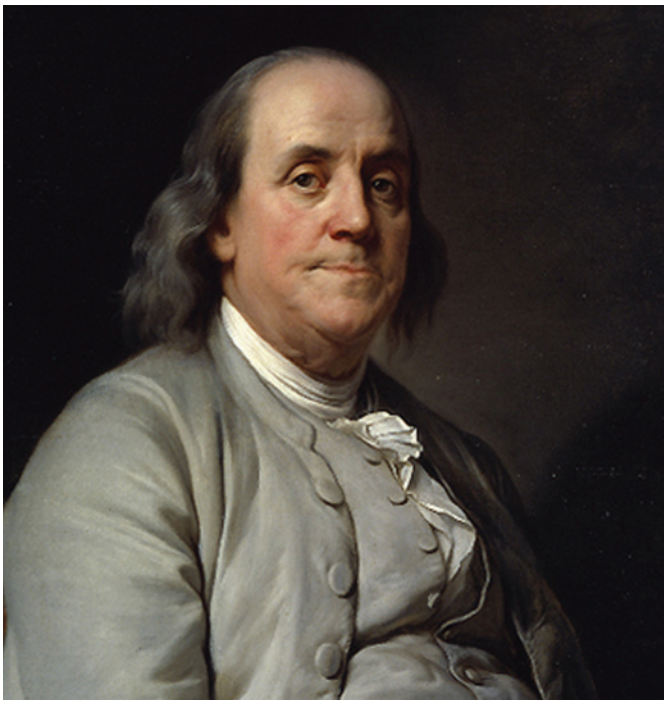
Benjamin Franklin, George Washington, John Adams, Thomas Jefferson, and James Madison all understood the scientific evidence supporting inoculation and, later, vaccination. Yet Franklin chose to ignore the evidence when it came to his own son—a decision that holds a lesson for us today.

As Franklin wrote, "I long regretted, and still regret, that I had not given [smallpox] to him by inoculation. This I admit for the sake of parents who omit that operation, under the supposition that they should never forgive themselves if a child died under it; my example showing that the regret may be the same either way, and that, therefore, the safer should be chosen."

In 1736, Benjamin Franklin's four-year-old son Francis ("Franky") contracted smallpox. Having observed the first uses of inoculation—the precursor to vaccination—during smallpox outbreaks in Boston in 1721 and 1730, Franklin was an enthusiastic proponent of the practice. But because Franky also suffered from gastrointestinal problems of an unknown cause, Franklin feared how even a controlled exposure to smallpox—necessary for inoculation—would affect the boy's fragile health.

Weighing many variables and driven by uncertainty, Franklin gave in to caution and chose to postpone inoculating Franky—a decision not dissimilar to those made by some vaccine-hesitant parents today, which may seem rational and in the best interest of the child at the time but go against the scientific evidence. Franklin's decision proved fatal.

Much as the disease left permanent pockmarks on victims lucky enough to survive, Franklin carried the scar of his decision not to inoculate Franky for the rest of his life. Writing in his autobiography years later, Franklin counseled other parents on the basis of his tragic experience: "I long regretted, and still regret, that I had not given [smallpox] to him by inoculation. This I admit for the sake of parents who omit that operation, under the supposition that they should never forgive themselves if a child died under it; my example showing that the regret may be the same either way, and that, therefore, the safer should be chosen."



Benjamin Franklin deeply regretted his decision not to inoculate his son Franky against smallpox—even though he had seen the practice work in other patients.

The history of smallpox in America illustrates not only the value of the scientific method in fighting disease, but also the importance of recognizing the established scientific evidence when making decisions that affect both our personal and public health. As Americans debate what role government should play in the use of vaccines, we should consider how inoculation and vaccination immeasurably improved the human condition when they became widely practiced, and how ignoring this scientific fact can put everyone's health at risk.

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Smallpox ravaged humanity throughout much of our history. No discussion of vaccines is complete without acknowledging the essential role they played in ending this horrific scourge (which was eradicated globally by 1980).

Protecting Public Health in Early America

Smallpox was eradicated in the United States in 1949 (globally in 1980), but throughout most of history, this highly contagious disease ravaged humanity. It afflicted people across continents, cultures, and social classes—from kings to commoners with no regard for race or creed—and typically killed between 15 and 30 percent of its victims. Its first signs were fever, headache, and fatigue, but after a few days small red spots would appear all over the body. The spots would swell and become raw, oozing, smelly, blister-like pustules that eventually—over the course of several weeks—scabbed over, peeled off, and left survivors with deep, pitted, permanent scars. Smallpox could also cause blindness when the area around the eyes was affected. Hemorrhagic smallpox, an atypical but even more dangerous form of the disease, caused severe internal bleeding and bleeding under the skin; it was fatal in almost all cases.

At the time Benjamin Franklin's son died from smallpox, the method of vaccination discovered by the English doctor Edward Jenner that eventually led to the disease's eradication—and paved the way for the modern-day vaccine revolution—was still decades away. Inoculation (also called "variolation" after the variola virus that caused smallpox) involved collecting pus from an infected person's sores and inserting it under the skin of a healthy person. Vaccination, by contrast, relied on exposure to the mild, nonlethal cowpox virus instead of the deadly smallpox virus. Jenner's groundbreaking discovery was that inoculating people with cowpox induced immunity to both diseases.

Inoculation was performed by passing a thread through a pustule on a recovering smallpox patient. The thread was allowed to dry for at least 24 hours (though it could be preserved for months), and then a half-inch piece was cut and placed into a shallow, half-inch incision—just barely allowing blood to come to the surface—in the arm or leg of the person being inoculated. The small wound containing the inoculating thread was covered with plaster for a day and then the thread was removed. When all went well, inoculation produced a minor smallpox infection and conferred lifetime immunity. However, a small percentage of those who received inoculation came down with a serious or even fatal case of the disease. Recipients of inoculation also remained contagious

until they recovered from their symptoms. Typically, they were kept quarantined and cared for by those with immunity, but if protocol was not followed, it was possible to spread the disease to others.

The Evidence for Inoculation

Although inoculation had been performed in China for centuries and had made its way to parts of Africa and the Ottoman Empire, it had never been carried out systematically nor its results quantified. During the colonial era, inoculation was still very new to much of Europe and the New World.

One source for early information about inoculation in Britain and colonial America was a British aristocrat named Lady Mary Wortley Montagu who had survived smallpox in her twenties and had been left permanently disfigured by it. Not long after she recovered, while traveling in Turkey in 1717 with her husband (the British ambassador at Istanbul), she observed Turkish children being inoculated. Convinced of the safety and effectiveness of the procedure, she had her own two children inoculated and wrote of the experience to the Royal Society of London. Her ongoing efforts helped spread the practice in Britain.

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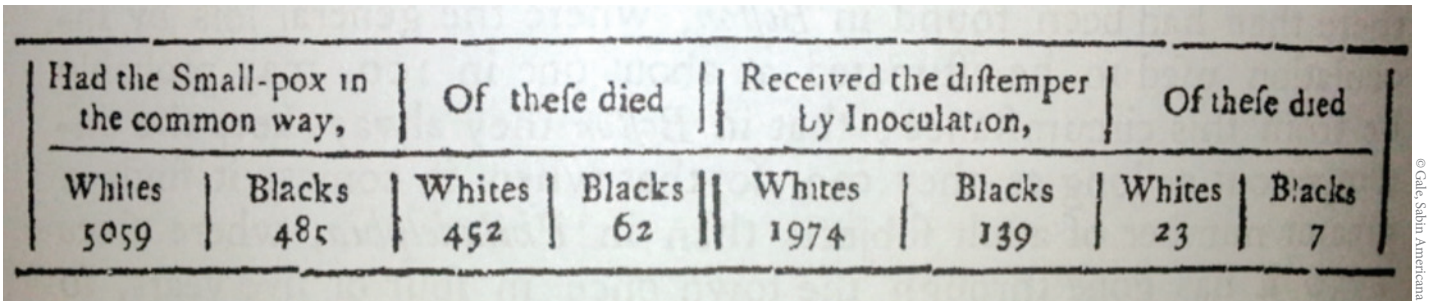
Around the same time as Montagu's experience, the influential New England minister Cotton Mather learned about inoculation for the first time from a slave in his household. Onesimus, as Mather called him, had undergone inoculation while still in Africa, and Mather shared what Onesimus told him with the medical establishments in both London and Boston. In a 1716 letter to the Royal Society of London, written before Montagu's report, Mather stated that Onesimus had described "an Operation, which had given him

Lady Mary Wortley Montagu with her son, Edward Wortley Montagu, and attendants, painted by Jean Baptiste Vanmour. Having observed Turkish children being inoculated against smallpox, Montagu was so convinced of the safety and efficacy that she had her own two children inoculated, and promoted the practice throughout the rest of her life.



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Benjamin Franklin's pamphlet on inoculation, which was widely distributed for free in the American colonies, shows the effectiveness of the practice during a 1753–1754 outbreak of smallpox in Boston.

something of ye Small-Pox, and would forever preserve him from it, adding, That it was often used among [Africans] and whoever had ye Courage to use it, was forever free from ye Fear of the Contagion. He described ye Operation to me, and showed me in his Arm ye Scar."

Science-based Action Pays Off

Little is known about what happened to Onesimus after he purchased his freedom from Mather, but the cross-cultural sharing of information between the two men—and between Mather and the broader scientific community—saved lives.

In 1721, little more than a decade before Franklin's son contracted the disease, a smallpox outbreak devastated Boston. Colonists reacted to the concept of inoculation with skepticism both because of its very real—albeit small—risks and because of racial and cultural prejudices. The practice came from non-Western, non-Christian countries, and some colonists also distrusted doctors, who they believed were promoting inoculation for their own financial gain. Against this opposition, which threatened his very life (a crudely constructed bomb thrown through a window of his house failed to explode), Cotton Mather pushed for the first widespread inoculation effort in the American colonies, urging doctors all over Boston to implement the procedure Onesimus had described.

Zabdiel Boylston was the only doctor who answered Mather's call, and through the joint efforts of the two men to gather data during and after the outbreak, persuasive scientific evidence emerged supporting inoculation. When the 1721 outbreak ended, almost 900 people had died, but the difference in death rates between those who contracted the disease via inoculation and all other victims was striking. Respectively, only six out of 244 people (2.5 percent) who contracted smallpox via inoculation died, while the disease claimed 14.1 percent of all other victims (844 out of 5,980). On the basis of this evidence, and additional evidence gathered from subsequent outbreaks, inoculation became an increasingly common practice in the American colonies and the early nation.

> ***The influential New England minister Cotton Mather pushed for the first widespread inoculation effort in the American colonies.***

Making Better Health Available to All

Motivated by the consequences of his decision not to act on the evidence supporting inoculation, Franklin took several steps over the course of his lifetime that helped spread the science of inoculation throughout early America. During the 1750s, he collaborated with the physician William Heberden to collect more quantitative data and in 1759 published a pamphlet called "Some Account of the Success of Inoculation for the Small-Pox in England and America: Together with Plain Instructions By which any Person may be enabled to perform the Operation and conduct the Patient through the Distemper."

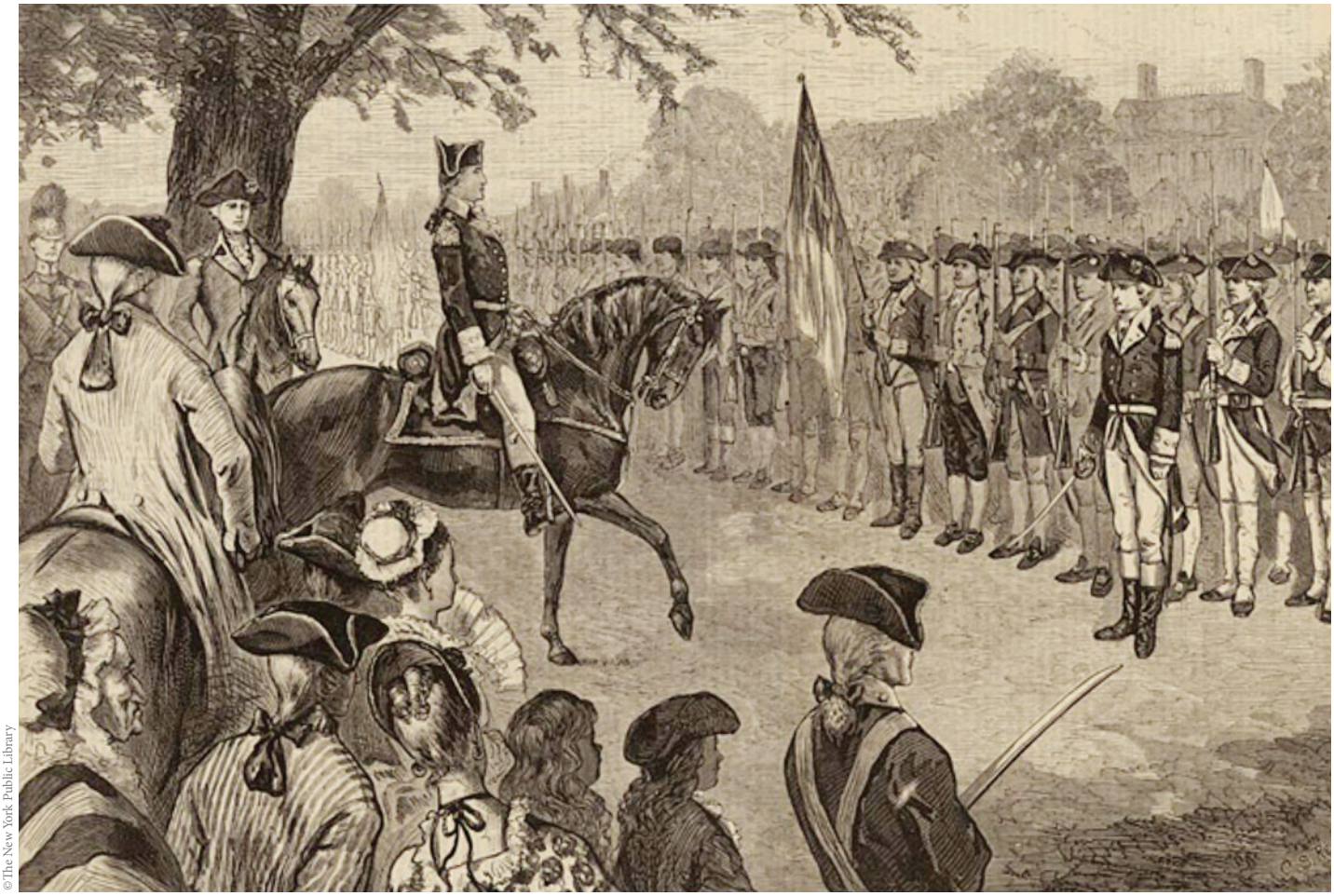
Franklin provided detailed information in the pamphlet on the importance and effectiveness of inoculation, and—given his concern that many people would not be able to afford doctors' fees—included clear and meticulous directions on how to perform it safely without a doctor. Some 1,500 copies were distributed to the public free of charge, and in 1774, Franklin also launched the Society for Inoculating the Poor Gratis, which offered free, doctor-administered inoculation.

Science Aids in the Fight for Freedom

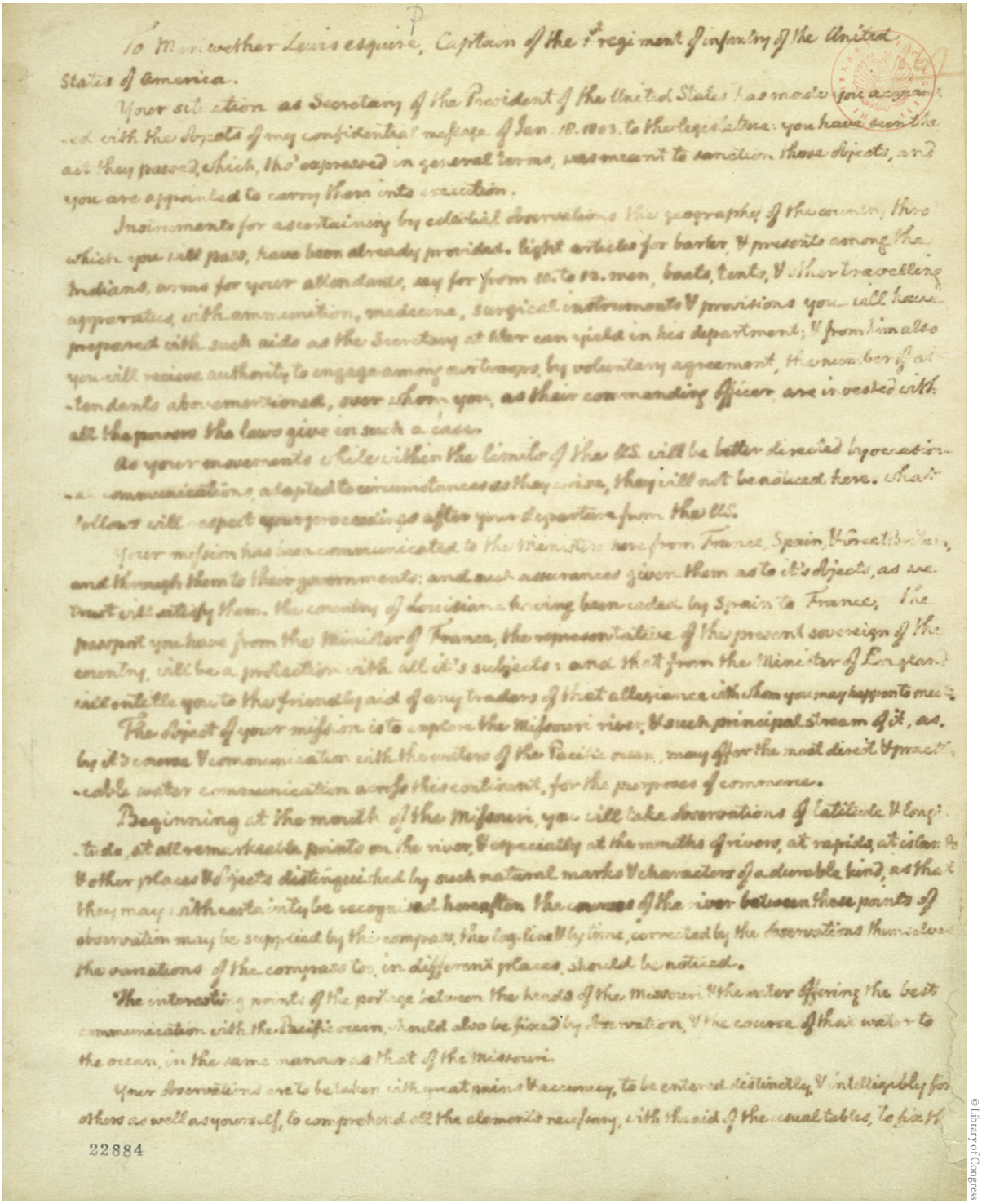
Franklin was not unique among the founding fathers in embracing the scientific evidence supporting inoculation. The actions he and others took not only protected the public but also primed the nation for Jenner's 1796 discovery of the much safer method of vaccination, which induced immunity without the risk of getting or spreading smallpox.

For example, George Washington (who was not inoculated but survived smallpox as a teenager) made inoculation mandatory for the entire Continental Army. During the siege of Boston (1775–1776), the British took advantage of a smallpox outbreak in the city by ordering some infected individuals to leave—not to protect other residents but to spread the disease. Washington refused to allow anyone exiting Boston to come into contact with the American troops camped just outside. Even after the British evacuated Boston, rumors circulated that they were continuing to use smallpox as a form of biological warfare. So in 1777, more than 50 years after the 1721 Boston outbreak that provided the first quantitative data on the effectiveness of inoculation, Washington decided to inoculate the army despite persistent public skepticism about the practice. He even resorted to inoculating some troops secretly, to avoid arousing opposition and fear in nearby towns. Historians view this science-based decision as an important military strategy that contributed to America's victory over the British in the Revolutionary War.

John Adams and Thomas Jefferson had themselves inoculated well before the United States declared independence. Later, after Jenner's discovery of the first vaccine, President Jefferson provided Meriwether Lewis and William Clark with quantities of the vaccine to distribute to Native Americans they encountered during their famous expedition. In letters written at the time, Jefferson said, "Every friend of humanity must look with pleasure on this discovery, by which one evil more is withdrawn from the condition of man. . . . I know of no one discovery in medicine equally valuable."



During the Revolutionary War, suspicions that the British were using smallpox as a form of biological warfare led General George Washington to order that all his troops be inoculated.



To Meriwether Lewis esquire, Captain of the 1st regiment of infantry of the United States of America.

Your situation as Secretary of the President of the United States has made you acquainted with the objects of my confidential message of Jan. 18. 1803. to the legislature: you have seen the act they passed, which, tho' expressed in general terms, was meant to sanction those objects, and you are appointed to carry them into execution.

Instruments for ascertaining by celestial observations the geography of the country thro' which you will pass, have been already provided. light articles for barter & presents among the Indians, arms for your attendants, say for from 10. to 12. men, boats, tents, & other travelling apparatus, with ammunition, medicine, surgical instruments & provisions you will have prepared with such aids as the Secretary at War can yield in his department; & from him also you will receive authority to engage among our troops, by voluntary agreement, the number of attendants above mentioned, over whom you, as their commanding officer are invested with all the powers the laws give in such a case.

As your movements while within the limits of the U.S. will be better directed by occasional communications adapted to circumstances as they arise, they will not be noticed here. what follows will respect your proceedings after your departure from the U.S.

Your mission has been communicated to the Ministers here from France, Spain & Great Britain, and through them to their governments: and such assurances given them as to it's objects, as we trust will satisfy them. the country of Louisiana having been ceded by Spain to France, the passport you have from the Minister of France, the representative of the present sovereign of the country, will be a protection with all it's subjects: and that from the Minister of England will entitle you to the friendly aid of any traders of that allegiance with whom you may happen to meet.

The object of your mission is to explore the Missouri river, & such principal stream of it, as, by it's course & communication with the waters of the Pacific ocean, may offer the most direct & practicable water communication across this continent, for the purposes of commerce.

Beginning at the mouth of the Missouri, you will take observations of latitude & longitude, at all remarkable points on the river, & especially at the mouths of rivers, at rapids, at islands & other places & objects distinguished by such natural marks & characters of a durable kind, as that they may with certainty be recognised hereafter. the courses of the river between these points of observation may be supplied by the compass, the log-line & by time, corrected by the observations themselves. the variations of the compass too, in different places, should be noticed.

The interesting points of the portage between the heads of the Missouri & the water offering the best communication with the Pacific ocean, should also be fixed by observation, & the course of that water to the ocean, in the same manner as that of the Missouri.

Your observations are to be taken with great pains & accuracy, to be entered distinctly, & intelligibly for others as well as yourself, to comprehend all the elements necessary, with the aid of the usual tables, to fix the

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The first page of a letter dated June 2, 1803, in which Thomas Jefferson gives instructions to Meriwether Lewis and William Clark in preparation for their scientific expedition across America. On a subsequent page he made provision for sharing vaccines with Native Americans: "Carry with you some matter of the kine-pox; inform those of them with whom you may be of its efficacy as a preservative from the smallpox and encourage them in the use of it."

Science and Democracy Must Work Together

In 1813, almost a century after Cotton Mather's information-driven efforts to end the smallpox outbreak in Boston, President James Madison signed into law the first major vaccine policy in the United States. Entitled An Act to Encourage Vaccination, it created a National Vaccine Agency and made the shipping of vaccine materials through the U.S. postal service free, so all Americans could benefit no matter where they lived or what their circumstances.

For nearly another century, smallpox remained the only disease for which a vaccine existed. As scientists researched vaccines for other diseases, they came to understand "community immunity" (also called "herd immunity")—the effect that immunizing many members of a community has in protecting others who lack immunity. Citizens and policy makers, meanwhile, wrangled over science-informed initiatives in order to strike an acceptable balance between improvement in public health and protection of individual civil liberties. In 1855, for example, vigorous debate attended Boston's passage of the first law in the United States requiring children to be vaccinated before they could attend public school.

Today, vaccines are available to protect the public from more diseases than ever before. Although our scientific knowledge about vaccines has increased vastly since the nation's earliest days, some Americans now question the science supporting the safety and effectiveness of vaccines—which is ironic given the fact that vaccines have eliminated or nearly eliminated some of the most serious diseases our ancestors suffered. Some also question whether government-mandated vaccines serve the interests of both public health and personal freedom. For these reasons, current U.S. vaccine policies should be understood and discussed within the proper historical context. If we choose to ignore or reject the centuries of scientific evidence and science-based policies supporting vaccination, we risk reversing many of the hard-won gains we have made over disease in the past.

> ***"Every friend of humanity must look with pleasure on this discovery, by which one evil more is withdrawn from the condition of man. . . . I know of no one discovery in medicine equally valuable."***
>
> —THOMAS JEFFERSON

To combat smallpox, President James Madison signed the first major piece of vaccine legislation, entitled An Act to Encourage Vaccination.

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