

## Chapter 1 : The Journey of Vaccination | GLOBALVAX

*The global spread of smallpox can be traced to the growth and spread of civilizations, exploration, and expanding trade routes over the centuries. Smallpox was a devastating disease. On average, 3 out of every 10 people who got it died. Those who survived were usually left with scars, which were.*

Backache A rash with flat red sores There is no treatment. Fluids and medicines for pain or fever can help control symptoms. Most people with smallpox recovered, but about 3 out of every 10 people with smallpox died. Many smallpox survivors have permanent scars over large areas of their body, especially their faces. Some are left blind. Military and other high-risk groups continue to get the vaccine. The vaccine makes some people sick, so doctors save it for those at highest risk of disease. Smallpox virus Figure 2. Smallpox rash Smallpox history The origin of smallpox is unknown. Smallpox is thought to date back to the Egyptian Empire around the 3rd century BC, based on a smallpox-like rash found on three mummies. The earliest written description of a disease that clearly resembles smallpox appeared in China in the 4th century AD. Early written descriptions also appeared in India in the 7th century and in Asia Minor in the 10th century. Spread of Smallpox The global spread of smallpox can be traced to the growth and spread of civilizations, exploration, and expanding trade routes over the centuries. Early Control Efforts Smallpox was a devastating disease. On average, 3 out of every 10 people who got it died. Those who survived were usually left with scars, which were sometimes severe. One of the first methods for controlling the spread of smallpox was the use of variolation. Named after the virus that causes smallpox variola virus, variolation is the process by which material from smallpox sores pustules was given to people who had never had smallpox. This was done either by scratching the material into the arm or inhaling it through the nose. With both types of variolation, people usually went on to develop the symptoms associated with smallpox, such as fever and a rash. However, fewer people died from variolation than if they had acquired smallpox naturally. The basis for vaccination began in when an English doctor named Edward Jenner observed that milkmaids who had gotten cowpox did not show any symptoms of smallpox after variolation. Months later, Jenner exposed Phipps a number of times to variola virus, but Phipps never developed smallpox. At some point in the s the precise time remains unclear, the virus used to make the smallpox vaccine changed from cowpox to vaccinia virus. Unfortunately, this global eradication campaign suffered from lack of funds, personnel, and commitment from countries, as well as a shortage of vaccine donations. Despite their best efforts, smallpox was still widespread in, causing regular outbreaks in multiple countries across South America, Africa, and Asia. The Intensified Eradication Program began in with a promise of renewed efforts. This time, laboratories in many countries where smallpox occurred regularly endemic countries were able to produce more, higher quality freeze-dried vaccine. A number of other factors also played an important role in the success of the intensified efforts, including the development of the bifurcated needle, establishment of a surveillance system to detect and investigate cases, and mass vaccination campaigns, to name a few. By the time the Intensified Eradication Program began in, smallpox had already been eliminated in North America and Europe, leaving South America, Asia, and Africa smallpox was never widespread in Australia. The Program made steady progress toward ridding the world of this disease, and by smallpox was eradicated from South America, followed by Asia, and finally Africa World Free of Smallpox Almost two centuries after Jenner published his hope that vaccination could annihilate smallpox, on May 8, 1980, the 33rd World Health Assembly officially declared the world free of this disease. Eradication of smallpox is considered the biggest achievement in international public health. Smallpox vs chickenpox Chickenpox is caused by the varicella zoster virus. It can be spread either through close person-to-person contact, or through sneezing and coughing just like a cold or flu. Later in the illness, the virus is spread by direct contact with the fluid in the blisters. Chickenpox infection triggers an immune response and people rarely get chickenpox twice. It takes 1 to 3 weeks from the time you were exposed to chickenpox for the spots to start appearing. Chickenpox is usually a mild and common childhood illness that can also occur at any stage of life. The illness can be associated with severe complications and even death so must be treated seriously in all cases. Immunisation can help prevent the spread of chickenpox. Chickenpox

causes a rash of red, itchy spots that turn into fluid-filled blisters. They then crust over to form scabs, which eventually drop off. Your child is likely to have a fever at least for the first few days of the illness and the spots can be incredibly itchy, so expect them to feel pretty miserable and irritable while they have chickenpox. Some children have only a few spots, but in others they can cover the entire body. The spots are most likely to appear on the face, ears and scalp, under the arms, on the chest and belly and on the arms and legs. The incubation period for chickenpox is between one and three weeks. The most infectious time is between one and two days before the rash appears, but it continues to be infectious until all the blisters have crusted over. Chickenpox can be severe at any age and have serious complications. Pregnant women should be especially careful to avoid chickenpox as it can affect the unborn baby by causing foetal malformations, skin scarring and other serious problems congenital varicella syndrome. There is no specific treatment for chickenpox, but there are medicines and pharmacy products which can help alleviate symptoms, such as: In most children, the blisters crust up and fall off naturally within one to two weeks. Adults who have had chickenpox as a child may also get shingles later in life, as they are both caused by the virus varicella zoster. What causes smallpox Smallpox is caused by infection with the variola virus. Variola virus is a member of the orthopoxvirus genus, which also includes viruses that cause cowpox, monkeypox, orf, and molluscum contagiosum. Poxviruses are the largest animal viruses, visible with a light microscope. They are larger than some bacteria and contain double-stranded DNA. The variola virus is the only known cause of smallpox. The disease affects only humans. No animal reservoirs or insect vectors insects that spread a disease exist, and no carrier state period when the virus is in the body, but the person is not actively sick occurs. Before smallpox was wiped out, the disease survived through continual person-to-person transmission. Pregnant women and children had a heightened risk for the illness. Smallpox also affected them more severely than normal. The virus is only transmitted from human to human; there are no known animal infections. The virus is acquired from inhalation breathing into the lungs. Virus particles can remain on such items as clothing, bedding, and surfaces for up to one week. The virus starts in the lungs. From there, the virus invades the bloodstream and spreads to the skin, intestines, lungs, kidneys, and brain. The virus activity in the skin cells creates a rash that starts as macules flat, red lesions. After this, vesicles raised blisters form. Then, pustules pus-filled pimples appear about days after a person becomes infected. Survivors of smallpox often have severely deformed skin from the pustules. Four types of variola exist: Classic smallpox is believed to be the most communicable disease; about a third of unvaccinated people who come in contact with it become infected. The hemorrhagic variety of variola has a much higher death rate than classic smallpox and leads to death more quickly. Infected people often die before the pustules form. This variety is recognizable by certain types of bleeding sores in mucous tissues. Pregnant women are more likely to contract this version. Lesions were flat, often described as feeling velvety. The modified variety of smallpox essentially affects people who have been vaccinated and still have some immune response to the vaccine. The virus can be transmitted: Directly from person to person. Smallpox is highly contagious and mainly spreads from person to person by inhalation. Direct transmission of the virus requires fairly prolonged face-to-face contact. The virus can be transmitted through the air by droplets that escape when an infected person coughs, sneezes or talks. However, infectious smallpox virus particles can remain viable on surfaces, clothing, and bedding for up to one week. Indirectly from an infected person. In rare instances, airborne virus can spread farther, possibly through the ventilation system in a building, infecting people in other rooms or on other floors. Smallpox can also spread through contact with contaminated clothing and bedding, although the risk of infection from these sources is less common. As a terrorist weapon, potentially. A deliberate release of smallpox is a remote threat. However, because any release of the virus could spread the disease quickly, government officials have taken numerous precautions to protect against this possibility, such as stockpiling smallpox vaccine. Before smallpox was eradicated, it was mainly spread by direct and fairly prolonged face-to-face contact between people. Smallpox patients became contagious once the first sores appeared in their mouth and throat early rash stage. They spread the virus when they coughed or sneezed and droplets from their nose or mouth spread to other people. They remained contagious until their last smallpox scab fell off. The virus can spread through these materials or through the objects contaminated by them, such as bedding or clothing. People who cared for smallpox patients and

washed their bedding or clothing had to wear gloves and take care to not get infected. Rarely, smallpox has spread through the air in enclosed settings, such as a building airborne route.

**Chapter 2 : Edward Jenner Biography | Biography Online**

*Smallpox made one last attempt to stage a comeback. In September Janet Parker, a medical photographer at the University of Birmingham, was accidentally infected with smallpox and later died.*

Y-DNA haplogroups in indigenous peoples of the Americas Genetic diversity and population structure in the American land mass using DNA micro-satellite markers genotype sampled from North, Central, and South America have been analyzed against similar data available from other indigenous populations worldwide. According to Noble David Cook, a community of scholars have recently, albeit slowly, "been quietly accumulating piece by piece data on early epidemics in the Americas and their relation to subjugation of native peoples. This was applied through the *encomienda*, which was a system ostensibly set up to protect people from warring tribes as well as to teach them the Spanish language and the Catholic religion, but in practice was tantamount to serfdom and slavery. Many Native Americans viewed their troubles in terms of religious or supernatural causes within their own belief systems. One reason this death toll was overlooked is that once introduced, the diseases raced ahead of European immigration in many areas. Disease killed a sizable portion of the populations before European written records were made. After the epidemics had already killed massive numbers of natives, many newer European immigrants assumed that there had always been relatively few indigenous peoples. One of the most devastating diseases was smallpox, but other deadly diseases included typhus, measles, influenza, bubonic plague, cholera, malaria, tuberculosis, mumps, yellow fever and pertussis, which were chronic in Eurasia. The epidemics had very different effects in different regions of the Americas. The most vulnerable groups were those with a relatively small population and few built-up immunities. Many island-based groups were annihilated. While disease raged swiftly through the densely populated empires of Mesoamerica, the more scattered populations of North America saw a slower spread. A more resilient disease would establish an equilibrium; if its victims lived beyond infection, the disease would spread further. The evolutionary process selects against quick lethality, with the most immediately fatal diseases being the most short-lived. For example, in the first fifty years of the sixteenth century, an unusually strong strain [clarification needed] of syphilis killed a high proportion of infected Europeans within a few months; over time, however, the disease has become much less virulent. These people die at a much higher rate, resulting in what is known as a "virgin soil" epidemic. Before the European arrival, the Americas had been isolated from the Eurasian-African landmass. The peoples of the Old World had had thousands of years for their populations to accommodate to their common diseases. The fact that all members of an immunologically naive population are exposed to a new disease simultaneously increases the fatalities. Because they were resistant to reinfection, they are able to care for individuals who caught the disease for the first time, including the next generation of children. With proper care, many of these "childhood diseases" are often survivable. In a naive population, all age groups are affected at once, leaving few or no healthy caregivers to nurse the sick. With no resistant individuals healthy enough to tend to the ill, a disease may have higher fatalities. The natives of the Americas were faced with several new diseases at once creating a situation where some who successfully resisted one disease might die from another. Multiple simultaneous infections e. In this scenario, death rates can also be elevated by combinations of new and familiar diseases: Native American medical treatments such as sweat baths and cold water immersion practiced in some areas weakened some patients and probably increased mortality rates. Domestication usually means close and frequent contact between animals and people, which allows diseases of domestic animals to migrate into the human population when the necessary mutations occur. Climate zones also extend for thousands of miles, which facilitated the spread of agriculture, domestication of animals, and the diseases associated with domestication. The Americas extend mainly north and south, which, according to the environmental determinist theory popularized by Jared Diamond in *Guns, Germs, and Steel*, meant that it was much harder for cultivated plant species, domesticated animals, and diseases to migrate. Biological warfare [edit] When Old World diseases were first carried to the Americas at the end of the fifteenth century, they spread throughout the southern and northern hemispheres, leaving the indigenous populations in near ruins. In response, the Franciscans and Dominicans created public

fountains and aqueducts to guarantee access to drinking water. Well-documented accounts of incidents involving both threats and acts of deliberate infection are very rare, but may have occurred more frequently than scholars have previously acknowledged. They well understood the concept of quarantine, and that contact with the sick could infect the healthy with smallpox, and those who survived the illness would not be infected again. Whether the threats were carried out, or how effective individual attempts were, is uncertain. I am the smallpox chief. In this bottle I have it confined. All I have to do is to pull the cork, send it forth among you, and you are dead men. But this is for my enemies and not my friends. We must on this occasion use every stratagem in our power to reduce them. Peter "was guilty of contributing to the deaths of thousands of innocent people. The law calls his offense criminal negligence. Yet in light of all the deaths, the almost complete annihilation of the Mandans, and the terrible suffering the region endured, the label criminal negligence is benign, hardly befitting an action that had such horrendous consequences. Ramenofsky writing, "Variola Major can be transmitted through contaminated articles such as clothing or blankets. In the nineteenth century, the U. Army sent contaminated blankets to Native Americans, especially Plains groups, to control the Indian problem. Many colonists and natives were vaccinated, although, in some cases, officials tried to vaccinate natives only to discover that the disease was too widespread to stop. At other times, trade demands led to broken quarantines. In other cases, natives refused vaccination because of suspicion of whites. The first international healthcare expedition in history was the Balmis expedition which had the aim of vaccinating indigenous peoples against smallpox all along the Spanish Empire in In , government officials vaccinated the Yankton Sioux at Sioux Agency. The Santee Sioux refused vaccination and many died. Spanish colonization of the Americas , American Indian Wars , Arauco War , Chichimeca War , and Conquest of the Desert Storming of the Teocalli by Cortez and His Troops by Emanuel Leutze While epidemic disease was a leading factor of the population decline of the American indigenous peoples after , there were other contributing factors, all of them related to European contact and colonization. One of these factors was warfare. According to demographer Russell Thornton, although many lives were lost in wars over the centuries, and war sometimes contributed to the near extinction of certain tribes, warfare and death by other violent means was a comparatively minor cause of overall native population decline. Bureau of the Census in They have cost the lives of about 19, white men, women and children, including those killed in individual combats, and the lives of about 30, Indians. The actual number of killed and wounded Indians must be very much higher than the given Fifty percent additional would be a safe estimate The South or Central American infrastructure allowed for thousands of European conquistadors and tens of thousands of their Indian auxiliaries to attack the dominant indigenous civilization. Empires such as the Incas depended on a highly centralized administration for the distribution of resources. Disruption caused by the war and the colonization hampered the traditional economy, and possibly led to shortages of food and materials. Due to many revolts and military encounters, Emperor Charles V helped relieve the strain on both the Indian laborers and the Spanish vanguards probing the Caribana for military and diplomatic purposes. The Spanish also employed the pre-Columbian draft system called the mita , [56] and treated their subjects as something between slaves and serfs. Serfs stayed to work the land; slaves were exported to the mines, where large numbers of them died. In other areas the Spaniards replaced the ruling Aztecs and Incas and divided the conquered lands among themselves ruling as the new feudal lords with often, but unsuccessful lobbying to the viceroys of the Spanish crown to pay Tlaxcalan war demnities. Serfdom existed as such in parts of Latin America well into the 19th century, past independence. Please improve this by adding secondary or tertiary sources.

## Chapter 3 : Smallpox - Symptoms, Vaccine, Diagnosis, Treatment

*Smallpox (pox= Latin word for "spotted"), was once one of the world's most dreaded diseases. Caused by the variola virus, it is a contagious and fatal infectious disease with a death rate as high as 30%.*

Smallpox The threat of terrorism has raised the spectre of the use of biological agents as weapons. One of the possible agents is the variola virus, the cause of smallpox. Within a few weeks he was fully recovered. Since that time, not a case of smallpox except as a result of one laboratory accident has been discovered anywhere in the world. By May of 1980, the World Health Organization WHO felt that it could confidently announce that smallpox had been completely eradicated. The WHO also asked that all countries with any stocks of variola virus in their laboratories either destroy them or transfer them to one of two secure laboratories at the Centers for Disease Control and Prevention CDC in Atlanta, Georgia or a state lab in Koltsovo in Russia. Although 74 countries did so, the fear remains that some countries may have retained stocks of the virus. Even before the complete eradication of smallpox, routine vaccination against the disease was halted in most Western countries. So today anyone under 30 years of age is fully susceptible and even those older may have lost protection against the disease. Smallpox certainly qualified as one of the greatest scourges of humanity. Introduced into Europe around the sixth century A. Introduced into the New World in the sixteenth century, smallpox devastated the native populations and played a far greater role than weaponry in the Spanish Conquest. How was such a pestilence eradicated? Four factors were decisive. The variola virus, which causes the disease, attacks only humans; no animal reservoirs have been found as they have for the yellow fever virus, the rabies virus, and the plague bacillus. If the victim recovers, the virus is completely eliminated from the body. There are no smallpox "carriers" as there are for such diseases as typhoid fever and malaria. An effective vaccine was available. The vaccine could quickly establish a strong and reasonably long-lasting immunity. Thus the chain of contagion could be quickly broken by vaccinating all possible contacts associated with a new case. The WHO and the countries involved provided personnel, money, and the determination to do the job. An effective vaccine had, as we shall see, been available since 1789 and had already rendered many parts of the world free of the disease during the first half of the 20th century. But still the disease smoldered in Asia, Indonesia, Brazil, and Africa. Only a heroic public health effort—a campaign that began in 1967—finally eliminated it worldwide. Variolation The first effective attempts to cope with smallpox were made in some of the same regions—Asia, India, Africa—that were the last to be freed of the disease. The technique was deliberately to inoculate susceptible individuals. This practice, called variolation, induced an active case in the recipient, but usually the case was less severe than if the disease had been contracted in the normal way by inhalation as it turned out. Variolation was introduced into England and the American colonies early in the 18th century. The practice was often accompanied by violent controversy. It was not entirely safe. The variolated person often became quite ill and the mortality rate, although only a fraction of that for people who contracted the disease in the normal way, was nonetheless appreciable. But far more significant in terms of public acceptance was the fact that variolated people were fully contagious to others during the period of their brief, hopefully mild, illness. Thus a family electing variolation could start a fresh smallpox epidemic. Nonetheless, the practice gradually gained favor until it was replaced by vaccination. This table from J. Blake, *Public Health in the Town of Boston*, Harvard University Press, shows the effect of variolation on the death rate from smallpox during three epidemics in Boston.

**Chapter 4 : History of Smallpox | Smallpox | CDC**

*By smallpox had become the first-ever disease to be eradicated. Yet, today, its possible use in biological warfare presents a major threat. This is an accessible account of the history, and possible future, of a terrifying disease.*

Mark Miller, Scott Barrett, and D. We cannot refrain altogether from examining the roots of this controversy if only because the extreme views for and against eradication have exerted and are still exerting a. Yekutieli, Eradication of Infectious Diseases: A Critical Study Eradication of an infectious disease is an extraordinary goal. Its possibility became apparent as soon as Edward Jenner demonstrated an ability to provide immunity to smallpox. Writing in , Jenner observed that, through broad application of vaccination, "it now becomes too manifest to admit of controversy that the annihilation of the Small Pox, the most dreadful scourge of the human species, must be the result of this practice" Jenner Louis Pasteur claimed that it was "within the power of man to eradicate infection from the earth" Dubos and Dubos And yet, by and large, public health has proceeded with more modest goals of local and regional disease control. Notable successes have occurred. Indeed, some diseases now thought of as "tropical" were previously endemic in temperate climates. Systematic application of hygiene, sanitation, environmental modification, vector control, and vaccines have led, in many countries, to the interruption of transmission of microbes causing such diseases as cholera, malaria, and yellow fever. Intensive efforts to eliminate breeding sites of the yellow fever mosquito vector, *Aedes aegypti*, interrupted transmission of this disease in Havana in and throughout Cuba soon thereafter. Subsequently, yellow fever and malaria were able to be controlled in Panama, thus permitting construction of the Panama Canal. In , the Rockefeller Foundation launched an effort to eradicate the disease worldwide. Transmission appeared to have ceased in the Americas by , but then cases reappeared, and by , it became clear that a nonhuman endemic focus was serving to reinfect areas otherwise free of yellow fever. In the s, F. Soper set out to eradicate the *Aedes aegypti* vector from the Americas. By , Soper reported that he had largely succeeded except for the United States, where the program received little support. By the s, *Aedes aegypti* had become reestablished in Central and South America. In , Brock Chisholm, the first director-general of the World Health Organization WHO , tried to persuade the World Health Assembly WHA to undertake smallpox eradication, but a number of countries objected on the grounds that eradication was not technically feasible. Instead, in , under the leadership of his successor, Marcolino Candau, WHO began a global effort to eradicate malaria primarily by means of household spraying of DDT. The relatively sophisticated science of malaria control was abandoned in favor of this simplistic technology Jeffrey Even while the malaria eradication effort was under way, the Soviet Union, in , proposed to the WHA that smallpox be eradicated. A resolution to this effect was offered in and passed unanimously. However, the resolution provided little international funding or support. Over the next seven years, disease transmission was interrupted in some 30 countries in Africa, Asia, and South America, but endemic smallpox persisted in the Indian subcontinent, Indonesia, most of Sub-Saharan Africa, and Brazil. WHO launched an intensified effort in to eradicate the disease within a decade. The resolution passed by the narrowest of margins, but a reinvigorated effort was soon under way and paved the way for a historic public health achievement Henderson Following an extraordinary worldwide effort, the last case of smallpox was isolated in October , and the disease was certified as being eradicated in , years after Edward Jenner first dreamed of that possibility. Understanding how and why smallpox eradication succeeded is essential to the study of control and eradication. At a meeting convened by the Fogarty International Center of the National Institutes of Health in , scientists, public health officials, and policy makers discussed the merits of eradicating other diseases, with schistosomiasis, dracunculiasis, poliomyelitis, and measles identified as possible candidates a Henderson a. However, no consensus was reached at that time on moving forward with any of those diseases. Poliomyelitis became the next principal target when mass vaccination campaigns, proposed by Albert Sabin , proved remarkably successfully in Cuba and Brazil. In , an American Health Organization coordinated campaign was launched to interrupt poliovirus transmission in the Americas by , and this effort succeeded. Some believed that global eradication might be possible, although others were concerned that the far less developed infrastructure of health, transportation, and communications

services in many parts of Asia and Africa would make it an unachievable task. In 1988, the WHA adopted a resolution to eradicate polio, but at that time, a longer-term strategy for ending polio vaccination was neither formulated nor agreed on by the public health and scientific community. The WHA has adopted only one other resolution to eradicate a disease—the guinea worm, or dracunculiasis. The eradication of this disease can be achieved by applying simple technologies for providing water that is free of the vector copepod and parasite and for treatment of patients with the disease. This eradication program has made steady progress but has been hampered in part by civil and political unrest and lack of program priority because of low mortality and low incidence in some remaining endemic areas. However, given the environmental restriction of the parasite to rural tropical areas and its relatively low transmissibility, eventual global eradication seems within reach. One other case—that of measles—is worth noting. A number of public health authorities have raised the possibility of eradicating that disease. In the Americas, spurred on by the success of regional cessation of transmission of wild poliovirus, eventual consensus was reached to intensify measles control efforts, primarily through surveillance and periodic pulse application of measles vaccine in national campaigns. As a consequence, transmission of measles virus was temporarily interrupted in the Americas on several occasions but reestablished again by importations CDC a. Centers for Disease Control and Prevention CDC and WHO have advocated extending measles "elimination" through vaccination campaigns and second-dose opportunities to other regions Biellik and others ; CDC a ; b , a , b , d , b , d , f , the intensive control efforts required to break transmission of this highly infectious agent make global eradication unlikely at this time. A conference devoted to eradication held in Dahlem, Germany, in Dowdle and Hopkins set out to provide precise definitions for control, elimination, eradication, and extinction in a biological, economic, and political context Dowdle , ; Ottesen and others ; however, a number of eminent public health officials Cochi and others ; de Quadros ; Goodman and others b ; Henderson b ; Salisbury challenged these definitions at two subsequent meetings at the CDC Goodman and others a , b and the U. Institute of Medicine Knobler, Lederberg, and Pray Unfortunately, broadly accepted, standard definitions for key concepts pertaining to disease control and eradication do not exist in the literature. Making matters more confusing, certain of the concepts have been given names that are part of our everyday language and so are easily misinterpreted by nonspecialists as meaning something different from the meanings understood by those who are preoccupied with eradication programs. Most unfortunate is the all too casual use of the words elimination and eradication to promote programs that cannot reasonably be expected to achieve the promise implicit in these words. Moreover, the two words themselves are commonly used interchangeably. Control Two concepts are central to this chapter: By control, we mean a public policy intervention that restricts the circulation of an infectious agent beyond the level that would result from spontaneous, individual behaviors to protect against infection Barrett Although control is a range rather than a level, a particular level of control may be an aim of policy. Because every choice entails consequences, choice of the "optimal" level of control requires economic analysis. Optimal here is defined in relation to the model that gives rise to the result. Control is local and so needs to be looked at from the local perspective. The level of control that is optimal for one country region may not be optimal from the perspective of the world as a whole. Thus, a need exists to distinguish between, say, a locally optimal level of control and one that is globally optimal. Finally, control requires ongoing intervention. Sustaining a given level of control requires an annual expenditure. Eradication Eradication differs from control in that it is global. The term denotes the certified total absence of human cases, the absence of a reservoir for the organism in nature, and absolute containment of any infectious source. Eradication permits control interventions to stop or at least to be curtailed significantly. Finally, eradication is binary. Control levels can vary, but a disease is either certified as eradicated or not. Every disease can be controlled, even if only by using simple measures, such as quarantine. The ultimate achievement of control is eradication. But not every disease that can be controlled can be eradicated. Very few diseases, in fact, are potential candidates for eradication. The criteria for the feasibility for eradication as a preference over control are discussed in the section titled "Economic Considerations. The first is elimination. Some who are concerned with eradication programs have explicitly defined this term to denote the cessation of transmission of an organism throughout a country or region. In contrast, eradication is defined as a global achievement. Like control, elimination is location-specific and

would require ongoing interventions to be sustained in order to prevent reemergence of the disease from microbe importations. Two problems exist with the term elimination. First, it has been used to describe different phenomena, not just that described in the definition given above. For example, some public health officials have promoted programs aimed at "eliminating a disease as a public health threat," which is interpreted to mean reducing incidence to an "acceptable" level but not necessarily to zero. This usage is very different from the one outlined above and is almost certain to be misunderstood. Second, the definition of the word elimination in common use, as applied to disease control, is indistinguishable from eradication. The edition of the New Shorter Oxford English Dictionary, for example, defines eliminate as to "remove, get rid of, do away with, cause to exist no longer. For purposes of clarity, we seldom use the term elimination in this chapter and then only to signify control measures sufficient to interrupt microbe transmission in a specified area. Extinction Finally, the literature sometimes refers to extinction as a possible policy goal. In the context of infectious disease control, the concept is problematic for two reasons. First, proving that an organism has become extinct is impossible. To do so would require demonstrating not only that the organism no longer exists in nature but also that it no longer exists in any controlled environment—a practical impossibility. Second, de novo synthesis of viral agents from published genomes Cello, Paul, and Wimmer now put the concept in peril, although much research remains to be done in this area. Extinction, in the context of infectious diseases, may no longer be irreversible. Clearly, policy making will be improved by stating the goal of any particular intervention in precise language. Frameworks for Eradication Numerous issues need to be considered in planning expanded control measures that lead, possibly, to regional cessation of transmission or global eradication of disease. These complex issues will be further examined in the chapter. Scientific Considerations Scientific considerations include the nature of potential reservoirs for disease-causing microbes or their vectors, technologies available for interrupting disease transmission, changes in host capabilities to deter infections and disease, and satisfactory containment of organisms in laboratories. Geographic and Environmental Controls The limit of endemicity for microbes and their associated diseases is determined in part by their ability to exist in nature outside the human host. Both geographic and temporal variations determine the ecological niche of microbes, resulting in variable annual incidence rates throughout the world. This niche limitation is further extended to intermediary vectors and hosts in complex biological systems. Natural environmental barriers also may isolate the habitats of helminths. Infectious agents that are not limited to an environmentally restricted intermediary host or those that have longer latent periods, thereby allowing translocation, may have a global pattern of distribution. Examples include the highly transmissible viral agents such as measles, rubella, influenza, and varicella. Although these agents are not geographically constrained, their transmission patterns are directly and indirectly influenced by seasonal environmental factors and population-based immunity.

**Chapter 5 : The world defeated smallpox. Why does polio still exist? - The Boston Globe**

*What is smallpox. Smallpox is a disease caused by the variola major virus (smallpox virus). Some experts say that over the centuries smallpox has killed more people than all other infectious diseases combined.*

You can see that in a photograph taken in 1976, when he was just 11 years old. The image centers on a scattering of blemishes running up his right arm and across his chest. A health care worker responding to an outbreak of infectious disease in southern Somalia, Maalin had driven two sick children to an isolation camp in a nearby town. The three were together in the car for perhaps 15 minutes — long enough, it turned out, for the infection to pass from passengers to driver. Advertisement Maalin was lucky: The virus that entered his body that day was a relatively mild version of a usually much deadlier pathogen, and he recovered swiftly. No new outbreaks followed though two more cases were to come in as a result of a laboratory error. Months went by, and then a year, and another. Finally, the conclusion was clear. On May 8, 1980, the World Health Organization announced that, for the first time, a human infectious disease had been completely eradicated. So far, smallpox remains the only human pathogen to be eliminated from nature. But now, we may be on the verge of the second such eradication. In living memory and on every continent, the poliomyelitis virus ravaged lives. Polio was and remains, terrifying — causing lasting weakness, paralysis, and death. As recently as the 1950s, an estimated 10,000 countries people came down with polio each year. Like smallpox, however, it is a vaccine preventable disease. The the new vaccines showed their power immediately. US polio infections peaked at over 50,000 in 1955, then dropped to just 61 in 1961, and to zero in 1979. That regional triumph, and other such polio success stories led the WHO to announce in 1988 that it would target the disease for global eradication by 2000. The WHO missed that deadline as it has each subsequent one. There have been advances, extraordinary ones. Two of the three wild forms of the disease are completely gone from the world. Polio today remains endemic in just three countries: Pakistan, Afghanistan and Nigeria — and there were no new infections in Nigeria last year. There have been tragic setbacks. Because the oral vaccine uses a weakened version of live polio virus, it can, on occasion, mutate into full blown infectious disease. In Syria, where the ruination of the civil war creates the perfect conditions for the spread of infectious disease — wrecked water systems and interrupted vaccination campaigns — vaccine-derived polio has recurred repeatedly, most recently last summer, in a five-month outbreak that left at least 17 children paralyzed. That episode is a brutal reminder: Until a disease is wholly gone, it remains a threat. If polio were to break out of its last reservoirs, then, according to one official estimate, there could be as many as 200,000 new cases per year as soon as 2010. Advertisement In all, the effort to eliminate polio has now taken 30 years and counting — almost two decades more than originally planned, and three times as long as it took to get rid of smallpox. Every disease is different and presents distinct biological challenges, of course. But the different courses of the smallpox and polio campaigns point to another harsh truth: Public health is as much a political challenge as it is a medical one. In 1774, an English country doctor named Edward Jenner used material from a related illness, cowpox, to inoculate James Phipps, the 9-year-old son of his gardener. He then exposed the boy to smallpox, several times. Phipps never became ill, and after several more trials, Jenner published his results, then dared to dream. To do so, the still-young WHO had to learn a hard lesson. As the agency began to consider eradication, the most common tactic for such public health campaigns was mass vaccination. But even before global eradication became the target, it was known that mass vaccine campaigns were inefficient, costly in both money and, sometimes, human suffering. He felt fine when he boarded the bus, but began to feel just a little sick that evening — a headache, and some neck pain. On arrival, he checked into a hotel, went sightseeing, browsed through a big department store. About a week after he set out on his journey, Le Bar entered the hospital, with his smallpox infection still undiagnosed, and five days later he was dead. Le Bar was patient zero for an outbreak — but the entire chain of infection only reached 11 more people, one of whom died. But by 1968, many New Yorkers lacked immunity to the disease, as smallpox had not been a local threat for decades. The return of a legendary killer sparked a mass vaccination campaign. Over 6 million people were dosed. Six of them died. At the same time, wholesale vaccination campaigns were proving less effective than needed. Epidemiologists found that as long as enough of a population evaded the vaccinators, a

reservoir of the disease would remain. Any previously safe region would be vulnerable, as New York was in 1947. Thus, in 1967, when the WHO launched its full, world-wide assault on smallpox, the move came with a shift in strategy. Instead of trying to vaccinate every person in a country or a region, public health officials began to concentrate only on places where smallpox actually appeared. This watch-and-react approach, combining disease surveillance with a localized push to vaccinate any unprotected person nearby whenever a smallpox case appeared, applied with increasing precision once the global effort started in earnest. The WHO officially committed itself to the elimination of smallpox only when the Soviet Union rejoined the agency in 1975. The Soviet delegation proposed a five-year plan to eliminate smallpox at the next plenary meeting, offering 25 million doses of the vaccine to get things started. There were certainly pragmatic reasons behind the Soviet offer: Smallpox had been eliminated within the country in the 1930s, but had re-emerged repeatedly as travelers brought contagion with them. But the move was also a Cold War exercise of soft power. The United States countered in the next decade. Even though the WHO had officially launched the eradication campaign in the late 1960s, there was almost no money directed to that commitment. Little happened until 1975, when President Johnson announced a hugely ambitious plan to take the Great Society global. During this era any public display of good intentions by the United States or Soviet Union always carried an obvious subtext. But the work made possible by such cut-and-parry was real and vital. Once Washington announced its full support for smallpox eradication “with cash attached to the commitment” the WHO managed, within a little more than a decade, to end smallpox. In some sense, this first eradication of human pathogen was the happy result of the Cold War. In a bipolar world, ideological competition and the muscle of the two superpowers were crucial in getting good works done. Yet the smallpox campaign revealed another reality of the post-war era: International institutions could be agents of valuable change across borders. Throughout the effort, Americans working on smallpox eradication under the umbrella of the WHO were able to work effectively in countries aligned with their Soviet rivals. The faith that the cause transcended politics could be both sincere and persuasive. But by the time smallpox was finally declared gone, in 1980, the circumstances boosting the work of eradication had already begun to shift. What this meant has become evident in how the next great eradication campaign has played out. Sign Up Thank you for signing up! Sign up for more newsletters here The declared, international war against polio has taken 30 years old and counting, three times as long as it took to rid the world of smallpox. There is no single, reductionist explanation for the extraordinary difficulty in getting to zero. But the way the world has changed between the two efforts is at least part of the story The ideological competition that helped spur the superpowers to fund international efforts ended with the Cold War “and a shortage of cash contributed to the drop in polio vaccination in India in the early years of the new century. Local and regional conflict, often fueled by cross-cutting international interference, offered opportunities for the disease as well. In other words in a war-zone. In the Syrian outbreak, 74 people were infected, more than triple the number of wild polio cases. In the last years of the smallpox campaign, public health workers had to navigate the local conflicts of the Horn of Africa. Syria is our latest reminder that infection loves war. Rumors that the polio vaccine might cause women to lose the ability to bear children shut down vaccination campaigns in parts of Nigeria and elsewhere and led to the murders of some vaccinators. Pakistani suspicion of vaccinators deepened when, as US intelligence services hunted for Osama bin Laden in 2011, a possibly unwitting Pakistani physician, Dr. Afridi was enlisted into a campaign against hepatitis B and was tasked to visit the house in which it was suspected bin Laden might be hiding, vaccinating, then hanging on to the used needles to supply DNA for the CIA to test. Nine vaccinators were killed shortly after the bin Laden news broke, and as recently as mid-January of this year, a mother-daughter team in Quetta, Pakistan, were gunned down while they were giving oral polio doses to local children. There were just 22 wild-polio infections worldwide last year, all in Pakistan and Afghanistan. So far in 2014, there have been only two new cases, both in Afghanistan. If and when that occurs, it will be a monument to the power of public health work. But the question will remain: Why was the end of polio so long in coming? Rather, it was because such achievements exist within history, the way human beings construct our world at any given time. The history still being made of polio eradication reveals the costs that follow when the ability to pursue common goals degrades within and between nations. Infectious disease, pollution, and conflict itself do not respect borders, not even those of countries that build

big, beautiful walls. There is one last story, a small, sad one, that captures the reality of interconnection, of the need to rebuild the ability to think and work globally. When the polio eradication campaign began in Somalia in , he signed up again. In he became an official vaccinator, and with his colleagues, was able to celebrate the elimination of the disease from his country in March of Then, after six polio-free years, it returned. An outbreak flared in the spring of

### Chapter 6 : Population history of indigenous peoples of the Americas - Wikipedia

*There, he expressed his wishes to develop "the annihilation of the smallpox," and that "the most dreadful scourge of the human species, must be the final result of this practice." From there, the next step was organized efforts to eradicate the disease entirely from the face of the earth.*

About Edward Jenner Biography Edward Jenner 17 May – 26 January was an English doctor who helped create and popularise a vaccination for smallpox. The son of a local vicar, he was interested in natural history and medicine from an early age. Aged 14, he began his training to be a doctor in Chipping Sodbury, Gloucestershire before completing his training in London. In his spare time, he pursued his study of native wildlife and also followed any new developments in medical science. Jenner and the Vaccine for Small Pox During the late eighteenth-century, one of the most feared diseases was smallpox. At the time, there was little-known treatments or vaccinations that could prevent it. Jenner was interested in the observation that milkmaids who were in close contact with cows, very rarely contacted the disease. With this revelation, Jenner was interested in testing a theory that inoculating humans with a strain of the cowpox virus could protect them from smallpox – through the immunity gained from the similar, but much less dangerous, cowpox strain. This practice of using a cowpox virus had been tried on the odd occasions before, for example, farmers such as Benjamin Jesty had deliberately arranged a cowpox infection for their family. However, these unofficial tests had not proved anything to a sceptical medical, scientific community. In , Jenner tested his theory by inoculating James Phipps, a young boy of eight with cowpox blisters from the hand of a milkmaid who had caught cowpox. He wrote in Thus, Jenner had provided a relatively safe way to immunise people from the deadly smallpox virus. After some delay, his research was published by the Royal Society to a mixture of scepticism and interest. After this, Jenner gave up his medical practice and devoted himself full time to immunisation work. He was given a grant from Parliament to support him in his work. This involved setting up the Jennerian Institution – a society concerned with promoting vaccination to eradicate smallpox. His reputation led to his appointment as a physician extraordinary to King George IV and was made a Justice of the Peace. He died on 25 January , after a stroke from which he never recovered. It is said, through his work on vaccinations, Jenner saved the lives of more people than anyone else. Updated 3 February Jenner was keen on fossil collecting and horticulture. His favourite saying was.

**Chapter 7 : BBC - History - British History in depth: Smallpox: Eradicating the Scourge**

*Smallpox is caused by a virus that may be airborne or spread by direct contact. After an incubation period of about two weeks, fever, aching, and prostration occur, lasting two or three days. An eruption then appears and spreads over the entire body the lesions become blisterlike and pustular within a week.*

Written by Behrouz Zand, M. Elliott Smith, an anatomist and Egyptologist, was investigating the process of mummification at the Cairo Museum of Antiquities when he came upon an odd looking vesicular lesion all over the body of one of the mummies. A young boy with a severe hemorrhagic form of smallpox. Smallpox has been one of the deadliest diseases of civilization, and historians believe humanity had been suffering from this virus since 10, BC from ancient writings describing a disease resembling it. When infected, smallpox killed three out every ten people often in a gruesome death. Mostly by sending the body into shock with multi-organ failure or by a coagulopathy causing bleeding from the nose, mouth, and eyes. No other virus has tallied up this striking of a body count quite like smallpox. In the 20th century, an estimated million people died as a result of smallpox. Some of those who survived are left with terrible disfiguring scars for the remainder of their lives. His experimentation of cowpox inoculation on smallpox immunity became the basis for vaccinations. But then in the late 18th century, like many other breakthroughs in scientific discovery, serendipity happened. Edward Jenner, an English physician, noticed that milkmaids who contracted cowpox were not affected by smallpox outbreaks. Cowpox is a closely related virus to smallpox but not nearly as contagious and typically results in a milder non-deadly rash. Exposure after exposure to smallpox, Pipp never contracted this disease. He was so hopeful that his vaccination technique would eradicate smallpox that in his manuscript he said: At first, Jenner had many critics and opposition to his vaccination idea. However, as his vaccination technique became more broadly used, his critics became silenced as the apparent advantage of vaccination helped many survive smallpox outbreaks So how exactly did the cowpox inoculation work? When exposed to the cowpox antigen, our immune system generates antibodies to neutralize the virus. These antibodies are still present if the patient is later exposed to smallpox. They bind to the smallpox antigen, tagging it so other parts of the immune system can destroy the virus. Also, the cowpox virus was replaced with the much less harmful vaccinia virus. Unfortunately, this global eradication campaign suffered many setbacks. But then in , another turning point occurred in Nigeria. William Foege, a year-old physician towering at 6 foot 7 inches, came to Africa from the state of Washington as a medical missionary to help stop the suffering of Smallpox. One day, getting word that several villages in Nigeria were reported to have people infected with smallpox, he and his team found themselves in a dire situation with only a limited supply of vaccines. Their next shipment of vaccines would not arrive in a few months. Foege came up with a plan: This meant finding their family members and other close contacts. The contacts would be easy to find because transmission of smallpox usually required prolonged face-to-face contact. They also made sure to isolate all infected individuals to contain the spread. CDC Anxiously awaiting to see if their strategy worked, the secondary location of infections started occurring, but many of the people in those locations were protected from the vaccine and did not become infected. By four weeks, using their minimal supply, all the smallpox infections in the villages had been eradicated. This made their approach much more efficient requiring less need of vaccine resources and costs. Although at first, there was concerning skepticism, low and behold it worked. And it worked again and again. Foege would go on to become director of CDC from After leaving the CDC, he became the founder of The Task Force for Global Health, a nonprofit organization that works to improve the health of people in need, primarily in developing countries. Today, the eradication of smallpox by vaccination is one of the greatest achievements in medicine and global health.

*"the annihilation of smallpox must be the final result of this practice". In , his prediction seemed to have been fulfilled. Today we are not so confident.*

History[ edit ] Though the exact origins of smallpox are unknown, variola major likely jumped species from cows or other domesticated animals at least years ago. Pharaoh Ramses V who died in BC is believed to have died from smallpox. Inoculation and vaccination[ edit ] Connecting the survival of smallpox infection and immunity, the practice of inoculation began to be exercised during the 18th century, although the practice can be found dating back to AD in India, Western Asia, and China. Because of the low dose of infectious material, this would cause a mild case of the disease, but render the individual generally immune to future cases of smallpox. However, if done improperly, inoculation would result in extreme infection. In , observing that individuals who contract cowpox become immune from smallpox, Edward Jenner, a British physician, inoculated a young boy with cowpox and then challenged his immune system with smallpox. Although a challenge trial with a potentially fatal disease would be considered unethical by modern standards, Jenner was correct in his observation and accomplished the first vaccination of smallpox. Vaccine[ edit ] The smallpox vaccine is manufactured from the vaccinia cowpox virus, and is the best available protection against smallpox infection, although there have recently been attempts to develop anti-viral medications. Smallpox vaccine aka cowpox infection is not without its issues. Because it is a live-virus vaccine, it cannot be administered to individuals who are immune-compromised, or women that are pregnant or breastfeeding. The vaccine also causes severe reactions in people who have ever had any type of skin condition, particularly eczema. In all, the vaccine has a severe complication rate of 1 in , with side effects ranging up to death in approximately 1 case per million. Eradication[ edit ] "The annihilation of smallpoxâ€”the dreadful scourge of the human raceâ€”will be the final result of vaccination. Although many western nations had achieved mandatory vaccination programs, other countries could not afford the expense. As early as , the Soviet Union called for the eradication of smallpox by a volunteer effort. Beginning in , the World Health Organization began a world wide vaccination campaign with the purpose of eradicating smallpox. The last natural case of variola major occurred in , and the last natural case of variola minor in . The Post-Smallpox Era[ edit ] Following the eradication of smallpox, an accident occurred in resulting in the death of a British journalist. Based on this accident, all samples outside the control of the CDC, and the Soviet Ministry of Health were ordered destroyed. Despite subsequent calls for the destruction of the US and Russian stocks, they are still kept as the last remaining official stocks of smallpox.

**Chapter 9 : Genocide and American Indian History - Oxford Research Encyclopedia of American History**

*Smallpox, also known as variola, is an infectious disease caused by the variola virus, a member of the Poxviridae family, and characterized by high fever and aches with subsequent widespread eruption of pimples that blister, pustulate, scab over, and leave scar tissue behind.*

**ShareCompartir Origin of Smallpox** The origin of smallpox is unknown. Smallpox is thought to date back to the Egyptian Empire around the 3rd century BCE Before Common Era , based on a smallpox-like rash found on three mummies. The earliest written description of a disease that clearly resembles smallpox appeared in China in the 4th century CE Common Era. Early written descriptions also appeared in India in the 7th century and in Asia Minor in the 10th century. **Spread of Smallpox** The global spread of smallpox can be traced to the growth and spread of civilizations, exploration, and expanding trade routes over the centuries. **Early Control Efforts** Smallpox was a devastating disease. On average, 3 out of every 10 people who got it died. Those who survived were usually left with scars, which were sometimes severe. One of the first methods for controlling the spread of smallpox was the use of variolation. Named after the virus that causes smallpox variola virus , variolation is the process by which material from smallpox sores pustules was given to people who had never had smallpox. This was done either by scratching the material into the arm or inhaling it through the nose. With both types of variolation, people usually went on to develop the symptoms associated with smallpox, such as fever and a rash. However, fewer people died from variolation than if they had acquired smallpox naturally. The basis for vaccination began in when an English doctor named Edward Jenner observed that milkmaids who had gotten cowpox did not show any symptoms of smallpox after variolation. Months later, Jenner exposed Phipps a number of times to variola virus, but Phipps never developed smallpox. At some point in the s the precise time remains unclear , the virus used to make the smallpox vaccine changed from cowpox to vaccinia virus. Traces of smallpox pustules found on the head of a year-old mummy of the Pharaoh Ramses V. Photo courtesy of the National Library of Medicine. Unfortunately, this global eradication campaign suffered from lack of funds, personnel, and commitment from countries, as well as a shortage of vaccine donations. Despite their best efforts, smallpox was still widespread in , causing regular outbreaks in multiple countries across South America, Africa, and Asia. The Intensified Eradication Program began in with a promise of renewed efforts. This time, laboratories in many countries where smallpox occurred regularly endemic countries were able to produce more, higher quality freeze-dried vaccine. A number of other factors also played an important role in the success of the intensified efforts, including the development of the bifurcated needle, establishment of a surveillance system to detect and investigate cases, and mass vaccination campaigns, to name a few. By the time the Intensified Eradication Program began in , smallpox had already been eliminated in North America and Europe , leaving South America, Asia, and Africa smallpox was never widespread in Australia. The Program made steady progress toward ridding the world of this disease, and by smallpox was eradicated from South America, followed by Asia , and finally Africa She was isolated at home with house guards posted 24 hours a day until she was no longer infectious. A house-to-house vaccination campaign within a 1. A reward was also offered to anyone for reporting a smallpox case. Ali Maow Maalin was the last person to have naturally acquired smallpox caused by variola minor. Maalin was a hospital cook in Merca, Somalia. On October 12, , he accompanied two smallpox patients in a vehicle from the hospital to the local smallpox office. On October 22, he developed a fever. At first he was diagnosed with malaria, and then chickenpox. He was correctly diagnosed with smallpox by the smallpox eradication staff on October Maalin was isolated and made a full recovery. Maalin died of malaria on July 22, while working in the polio eradication campaign. Janet Parker was the last person to die of smallpox. It was , and Parker was a medical photographer at the Birmingham University Medical School in England and worked one floor above the Medical Microbiology Department where smallpox research was being conducted. She became ill on August 11 and developed a rash on August 15 but was not diagnosed with smallpox until 9 days later. She died on September 11, Her mother, who was providing care for her, developed smallpox on September 7, despite having been vaccinated on August Eradication of smallpox is considered the biggest achievement in

international public health. They agreed to reduce the number of laboratories holding stocks of variola virus to only four locations. In 1976, the four countries that either served as a WHO collaborating center or were actively working with variola virus were the United States, England, Russia, and South Africa. By 1978, England and South Africa had either destroyed their stocks or transferred them to other approved labs. There are now only two locations where variola virus is officially stored and handled under WHO supervision: Three-year-old Rahima Banu, who is the last known person to have had naturally acquired smallpox, or variola major, in the world, with her mother in Bangladesh. Her case was reported to the local Smallpox Eradication Program team by an 8-year-old girl named Bilkisunnessa, who was paid Taka reward for her diligence. WHO poster commemorating the eradication of smallpox in October 1979, which was later officially endorsed by the 33rd World Health Assembly on May 8,