

Vaccine Voyage

■ On November 30, 1803, the Spanish sloop *María Pita* sailed out of La Coruña harbor into the Atlantic, carrying five physicians, two surgeons, three male nurses and a shipload of small boys on the most remarkable and least known adventure in the annals of medicine. Armed with royal authority, don Francisco Xavier de Balmis wrote, says Dr. Félix Martí-Ibáñez, "a glorious page in the history of medicine" when he "vaccinated hundreds of thousands of people around the globe, thus making the first tour around the world accomplished by a physician on a heroic errand of mercy."

THE SCOURGE. Smallpox came to the New World with its discoverers and spread throughout the hemisphere with the European conquerors and their African slaves. In 1515 an epidemic took 200,000 lives on Santo Domingo, moved on to kill two-thirds of the Indians in Puerto Rico, was carried by a slave to Mexico to rage there with equal ferocity. It arrived in Colombia in 1566 and in two epidemics within 20 years it caused a 90 percent mortality among the Indians, then moved on to Ecuador to take 30,000 more lives. In 1603 a fleet of slave ships brought it to Buenos Aires and it reached epidemic levels in Río de la Plata colonies in 1620; in 1718 it caused more than 17,000 deaths in the Argentine province of Córdoba alone.

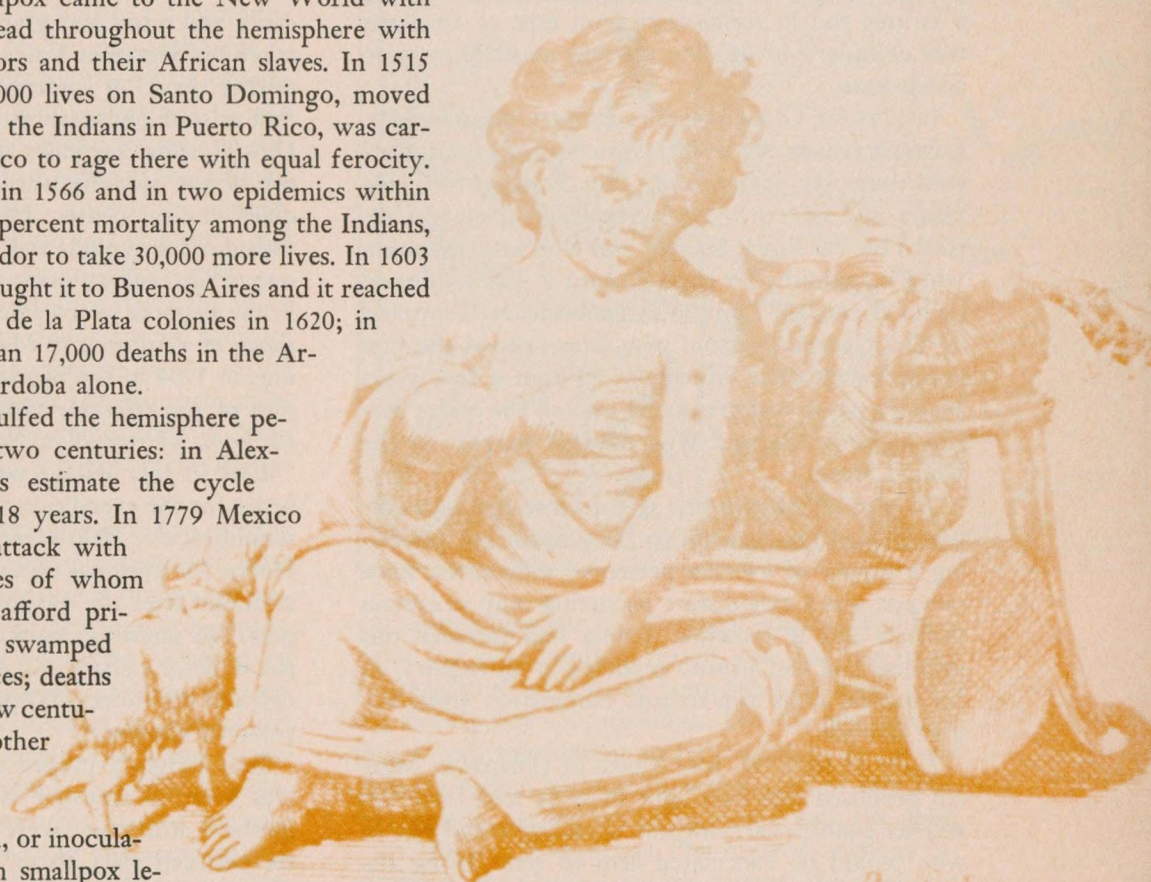
Epidemic waves engulfed the hemisphere periodically throughout two centuries: in Alexander von Humboldt's estimate the cycle recurred every 17 or 18 years. In 1779 Mexico City suffered a mass attack with more than 44,000 cases of whom only a fraction could afford private care while the rest swamped the hospitals and hospices; deaths numbered 8820. The new century opened with still another hemispheric onslaught.

The ancient Asian technique of variolation, or inoculation with the pus from smallpox lesions, had been known in the west since the early 18th century. Lady Mary Wortley Montagu had her young son inoculated in Constantinople when her husband was ambassador there. She wrote home enthusiastically of the method and returned to England to urge it successfully on the prince and princess of Wales for their children.

The Greek physician Dr. Emanuel Timoni and the Venetian Dr. James Pylarini earlier brought the method to the attention of the Royal Society in London, and Sir Hans Sloane wrote a report for the society's *Philosophical Transactions* in 1716. Although it was demonstrably successful

MD

ADVENTURE



falsa vaccina

Frontispiece engraving shows a vaccinated boy on Balmis' expedition and development of the evidential pustules. Map shows the routes of the expedition through Mexico.



in conferring immunity, the danger of contracting a serious and in some cases fatal case of smallpox was considerable and the method never won wide acceptance.

In 1798 the Gloucestershire country physician Dr. Edward Jenner reported his successful experiments with cowpox vaccination. His *Inquiry into the causes and effects of the variolae vaccinae* was rejected by the Royal Society and won little attention when he published it himself, until it was confirmed by his friend, the London surgeon Henry Cline, and by Dr. George Pearson, who later opened the first public vaccination dispensary. Within a few years Jenner's paper was translated into all the major European languages and won medical support in the United States.

Tidings of the new and safe defense against smallpox crossed the Atlantic to New Spain but providing a supply of vaccine presented difficulties, since cowpox was a rare disease occurring only in certain districts and at intervals. Jenner had foreseen this problem and had already reported in his *Inquiry* on his success with arm-to-arm vaccination from human donors.

Early in 1803 Dr. José Flores of Chiapas in Mexico proposed that two light ships be sent from the mother country carrying inoculated cows and youths who would be vaccinated arm to arm during the voyage, to bring fresh vaccine to Spain's colonies. The suggestion was supported by Charles IV's minister Manuel de Godoy.

THE LEADER. The choice of a leader for the expedition lay between its originator Dr. Flores, and Dr. Francisco Xavier de Balmis, who also had served in New Spain. Balmis was already known in Madrid as an advocate of vaccination and translator of the French physician Moreau de la Sarthe's *Historical and Practical Treatise on Vaccination*.

In 1803 Balmis was 50 years old, a native of Alicante and a son and grandson of surgeons. He had taken his degree at Valencia University in 1772 and during the 1779 epidemic he was in Mexico City, first as staff physician at the 300-year-old Amor de Dios Hospital for yaws and syphilis and then director of the syphilis ward at San Andrés, Mexico's chief clinical center. He tried out various native remedies for syphilis and believed that he had found one in the century plant (*Amaryllis americana*) and in the begonia later named for him, *Begonia balmisiana*; on returning to Madrid he published his findings in 1794 in the handsomely printed *Demonstration of the effective virtues recently discovered in the roots of two New Spain plants*.

Late in July Balmis was appointed and the royal order for the expedition was issued on August 4: he would receive 2000 silver pesos a year and 200 doubloons for personal expenses, with half his salary to continue after the mission until he found a suitable post. His physician assistants were awarded one-half the director's salary and expense grant, the surgeons 600 and the nurses 500 pesos, and 50 doubloons for personal expenses.

Balmis rightly judged that his weightiest problem was how to transmit the vaccine. Two favorite methods at the time were to seal active cowpox matter between glass plates, or to impregnate cloth or silk threads with it and allow it to dry: neither method assured a reliable vaccine. The most dependable procedure, also the most costly and difficult, was that of human transport, and this was the method Balmis adopted. The royal decree empowered him to carry "a sufficient number of children, not having had smallpox, for successive inoculation during the voyage, to enable the first arm-to-arm operation on their arrival in the Indies." It placed at his disposal children from the foundling home with per-

mission of their parents where these were known; in recompense the government would pay for the children's education.

Balmis took five foundlings from Madrid, to be vaccinated in turn on the trip to La Coruña, where their part of the mission was taken over by 20 boys between eight and ten years old from the Coruña foundling home. The children were to travel under the care of the home's directress, doña Isabel de Cendala y Gómez, who brought her own small son along. The five little Madrileños were sent home and at the end of November the expedition was ready to sail.

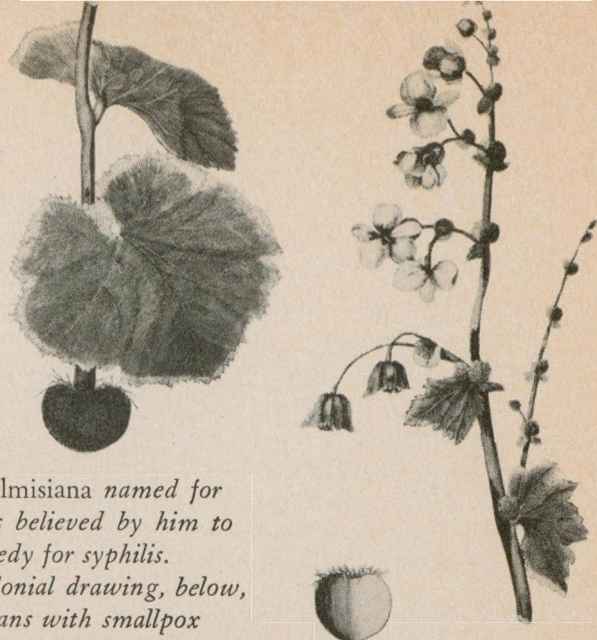
Balmis also carried several thousand samples of vaccine sealed between glass slides. He took barometers and thermometers for meteorologic observations en route, and 500 copies of his Moreau translation to distribute in the colonial capitals, partly as adjunct to his royal mandate to teach practitioners the operation, probably also to bolster his authority as a qualified disseminator of the new technique.

On his importance as head of the royal expedition he showed himself frequently too quick to take offense, but his ability as an organizer and his decisiveness in leadership proved equal to the difficult mission. His medical assistants, chosen by himself, bore out his judgment as brave and able men, and one sacrificed his life in accomplishing his task.

The route was planned in advance: from the West Indies the expedition was to divide forces, some to carry the vaccine and instructions in its use to the South American provinces while Balmis led the main party to Mexico City and the viceroyalty of New Spain. From there he would proceed to the Philippines.

For the children he insisted on good food, proper clothing, and a separate sleeping cubicle for each boy, as a general health precaution but more specifically to prevent accidental vaccination by body contact. His foresight was rewarded: despite the malnourished state of some of the children of poor Indian or *criollo* families entrusted to him in the colonies, on a journey that circled the world by sea and covered thousands of miles of jungle and mountain wilderness on two continents, except for seasickness the children suffered not one accident and only one case of illness. Doña Isabel became so devoted to her task that when given a choice of returning home from Mexico or continuing across the Pacific she chose to continue.

A permanent public health measure which Balmis considered most important was to set up local boards for the propagation of the vaccine and its dissemination through the provinces, and public centers for vaccination, clean, comfortable rooms well marked by a large outdoor sign. He gave various reasons for



Begonia balmisiana named for Balmis was believed by him to hold a remedy for syphilis. Spanish colonial drawing, below, shows Indians with smallpox during a 1520 epidemic in Mexico.



not entrusting these tasks to local hospitals and hospices, but his unspoken reason was that like many Europeans of his time he considered colonials lacking intelligence and reliability. For the propagation boards and vaccinating centers he drew up precise rules for record keeping, re-examination of vaccinated children, dealing with infants and with the poor.

LANDFALL. The *María Pita* arrived without incident at the Canary Islands, where the governor greeted Balmis with a public demonstration and he performed the expedition's first vaccinations. After a fair voyage of about five weeks the mission landed at Puerto Rico, to find generous provisions for the travelers' housing and comfort.

But no courtesies outweighed the news that the vaccine had already arrived, procured by the governor from the Danes on St. Thomas where it had been sent from England. It came in glass containers

and in the arm of a two-year-old slave girl, and vaccinations had already been performed by the surgeons Francisco Oller and Tomás Prieto. In his vexation Balmis declared the vaccinations defective and Oller himself maladroit. The surgeon brought his own son, whom he had vaccinated, to be revaccinated by Balmis, and the bishop also volunteered for a second vaccination, but when both of these failed to develop the evidential pustule Balmis declined to continue.

Governor Castro reported to Madrid that he was deeply offended and he and the municipality were shocked by the director's ill-tempered return for all the assistance given to him, and this contretemps delayed the establishment of a vaccine board in Puerto Rico for 14 years. After a month of contention the *María Pita* left with the director still angry and only four boys to transmit the vaccine.

The next port of call was La Guaira, the harbor town for Caracas, but the vessel was blown off course. After four days at sea the new children were too seasick to be vaccinated and Balmis, faced with the imminent failure of his entire mission, determined to land at the first available port. On March 20, with his last boy's vaccination ripe for use the same day, the sloop dropped anchor at Puerto Cabello, many miles west of La Guaira on the Venezuelan coast.

The mayor rallied the townsfolk to the aid of the unexpected arrivals, the leading families brought their children to be vaccinated and Balmis at once applied his needle to the arms of 28 boys. With new heart, an ample supply of vaccine and a train of pack mules and horses provided by their hosts, the party set off overland for Caracas. An escort of Indian soldiers met them outside the capital with a luxurious carriage for Balmis and the day's vaccine-bearing boy, and in the city the captain-general awaited them with bands, fireworks, a committee of high officials and a cheering populace.

Again the leading families brought their children: the first of 64 vaccinated on the first day was two-year-old Luis Blanco who grew up to become a distinguished judge. Andrés Bello, then 23, who later won fame as Venezuela's outstanding poet, critic, grammarian and lawmaker, celebrated the event with an ode "To Vaccination" extolling the king, the expedition and its director, "A tutelary spirit of health / Spreading with thy every step / A seed of life."

Balmis and his aides vaccinated 2064 persons in Caracas and established a vaccine board which spread the technique throughout the eastern province, vaccinating 20,000 Indians within the following year. Balmis himself impressed the captain-general, who wrote home to the king about the director's "high-

(Continued on page 207)

216.
Com fecha de 29 del mes próximo pasado me dice el Señor Don Joseph Antonio Caballero lo siguiente:

„Excelentísimo Señor=Deseando el Rey ocurrir á los estragos que causan en sus dominios de Indias las epidemias frecuentes de viruelas, y proporcionar á aquellos sus amados vasallos los auxilios que dictan la humanidad y el bien del Estado; se ha servido resolver que se propague á ambas Américas, y si posible fuere á Filipinas, á costa del Real Erario, el precioso descubrimiento de la vacuna, acreditado en España y casi en toda Europa como un preservativo de las viruelas naturales.

Á este fin ha nombrado S. M. para Director de la expedición marítima, que quanto antes debe salir de la Coruña para la Havana, con escala precisa en las Islas de Tenerife y Puerto-Rico, á su Médico de Cámara honorario Don Francisco Xavier de Balmis, asignándole dos mil pesos fuertes de sueldo, que deberá gozar anualmente desde que salga de Madrid hasta su regreso de la comision: despues la mitad interin se coloca en destino correspondiente al zelo y desempeño que acreditare; y doscientos doblones por una vez para su habilitacion.

Para Ayudantes suyos, en consideracion á los diferentes rumbos en que deberá dividirse la expedicion á su arribo á Indias, ha nombrado S. M. á los Facultativos Don Joseph Salvani, Don Ramon Fernandez Ochoa, Don Manuel Julian Grajales y Don Antonino Gutierrez y Robredo, con el sueldo de mil pesos fuertes anuales á cada uno, la mitad á su regreso, ó finalizado el encargo en los términos referidos, y cien doblones á cada uno para habilitacion.

Para Practicantes á los Cirujanos Don Francisco Pastor y Balmis y Don Rafael Lozano Perez, con seiscientos pesos á cada uno; y para Enfermeros

Extract from the royal order commissioning Balmis' expedition and, below, the title page of Balmis' Demonstration of the effective virtues recently discovered in the roots of two New Spain plants.

DEMOSTRACION
DE LAS EFICACES VIRTUDES
NUEVAMENTE DESCUBIERTAS
EN LAS RAICES DE DOS PLANTAS
DE NUEVA-ESPAÑA,
ESPECIES DE ÁGAVE Y DE BEGÓNIA,
PARA LA CURACION
DEL VICIO VENÉREO Y ESCROFULOSO,
Y de otras graves enfermedades que resisten
al uso del Mercurio, y demas remedios
conocidos.

POR EL LICENCIADO
DON FRANCISCO XAVIER BÁLMI
Cirujano Consultor de los Reales Exércitos, y Socio
de la Real Academia Médica-Matritense, Comisionado por S. M. para la comprobacion que se ha
hecho en Madrid y Sitios Reales, de la eficacia
de ambas raices.



MADRID MDCCXCIV.
EN LA IMPRENTA DE LA VIUDA DE D. JOAQUIN IBARRA.
CON SUPERIOR PERMISO.

est efficiency, of which he has given me many proofs, not allowing fatigue or anything else to prevent or delay his coming with the vaccine from Puerto Cabello."

ACROSS THE ANDES. According to plan, Balmis divided his staff at Caracas, sending his assistant director José Salvani, the physician aide Manuel Grajales and the male nurse Basilio Bolaños to carry the vaccine to the far-flung South American provinces. Cartagena was to be their first stop on a journey across the Andes.

The mission nearly ended before it began when their vessel was shipwrecked near Barranquilla at the mouth of the Magdalena River. All aboard came safely to shore, and Salvani at once set up operations in a native hut and began vaccinating. Late in May he led his band into Cartagena, where he set up a vaccine board* and performed more than 2000 vaccinations; he also inoculated a number of cows for a further supply of vaccine.

He sent a group of boys under a friar's care to Portobello and Panama with instructions in vaccinating them successively en route; at the governor's urging he also sent vaccine in flasks with instructions to the governor of Río de la Plata. He then set off up the Magdalena River with ten boys provided by the governor, vaccinating at settlements along the way, sending Grajales part of the way by another route to perform the same task. The party was reunited in December in the viceregal capital of Santa Fe de Bogotá, and by that February they had performed 5000 vaccinations in Colombia.

In Bogotá Salvani fell gravely ill with a "fluxion" and suffered loss of vision in an eye. In March he

* District commissioners were required to bring in a boy every nine days to maintain the vaccine chain.

pushed on, taking the surgeon Rafael Lozano Pérez with him via Cartago, Llano and Chocó while Grajales went to Neiva and La Plata. At Popayán, despite a renewed hemorrhage, Salvani organized a vaccine board, but he sent Grajales ahead to Quito where a smallpox epidemic had meanwhile broken out: officials from the beleaguered city met the party and gathered the little vaccine bearers in their arms.

Reuniting his party in Quito, Salvani left in September and arrived after a month's travel in Cuenca. When he heard that smallpox was raging in Peru he set out in haste across the Andes. The route, difficult at best, was beset by hostile tribes and the bearers deserted, leaving the travelers to subsist for three days on handfuls of roasted corn. At the end of May the exhausted Salvani led his party into Lima to find poor and unsanitary quarters awaiting them, and after more than a year of struggle against hardship and illness since he had left Balmis on the coast, Salvani succumbed. Dr. Gregorio Marañón wrote of this heroic physician: "Racked with fever, an emaciated specter spitting blood at every change of altitude, Salvani led his band of children on, never ceasing his vaccinations until the needle dropped from his lifeless hand."

NEW SPAIN. Balmis meanwhile took the main party from Cartagena on a stormy crossing to Cuba, where, as in Puerto Rico, the vaccine had preceded him, but he pronounced himself content with what had been done and bought four slaves to extend his vaccine-carrying group for the trip to Yucatán. Here again vaccine had already arrived, a vaccinating expedition having gone out from Veracruz, and Balmis' mission was once more endangered by a shortage of vaccine carriers, until the local officials

Royal authority for Balmis' heroic expedition was granted by Charles IV, left, and his minister Manuel de Godoy. Original suggestion for a vaccination expedition was offered by Dr. José Flores of Chiapas, Mexico.



gathered ten unvaccinated volunteers. Fearful of the endemic diseases, mainly yellow fever, and now suffering a fever and dysentery himself, Balmis asked for seven coaches at Veracruz and hurried on.

In Mexico City, metropolis of the vast viceroyalty of New Spain,* vaccination had been practiced for some time under the archbishop's auspices and the expedition created little stir. Few people came to Balmis' vaccination center: the mayor sent 20 Indian mothers who reluctantly submitted their children for the procedure and took them at once to an apothecary for an antidote; in all he was able to perform only 479 vaccinations in the capital.

But his journey north to Santa Fe (New Mexico) became a triumphal progress: he was greeted with balls, banquets, illuminations, gifts for the children, feed for the pack animals, the services of coachmen, servants, cooks. He vaccinated, set up boards, gathered children collected by priests who had been forewarned by the archbishop. He worked joyfully, vaccinating 1076 children in nine hours in the town of Zacatecas alone.

Assistant physician Antonino Gutiérrez y Robledo made side trips to Valladolid, Celaya, Guadalajara and San Luis Potosí. The surgeon Francisco Pastor, whom Balmis had left in the south, carried the vaccine by ship, dugout and canoe into Tabasco and Guatemala. A local physician, Alejandro García Arbolea, at the viceroy's orders and with Balmis' instructions, took vaccine-carrying boys to Tehuacán, Teotitlán and Oaxaca. Other independent expeditions inspired by Balmis carried the work up the Pacific coast to Baja California, San Diego, Santa Cruz and San Francisco.

ACROSS THE PACIFIC. On January 14, 1805, with Gutiérrez and Pastor reunited with the party and 26 boys gathered from all over Mexico, Balmis set sail from Acapulco in the *San Francisco de Magallanes*. He had seen to the care of his Spanish children, had returned the Mexican children to their homes, had provided the children who were to carry the vaccine to the Philippines with clothing for their journey (their parents were compensated in cash) and had specified the food and accommodations for the voyage, to which the ship's captain agreed. Instead he provided bad food and no cubicles for the children, who huddled together miserably on a rat-infested lower deck. Seven spontaneous vaccinations occurred, reviving the specter of a loss of vaccine, but despite a painful 67-day voyage the party arrived in good order in mid April; Balmis alone was in poor health with a persistent dysentery.

In Manila he found the governor indifferent but the dean of the cathedral and other officials came to

his aid and in little time 9000 people had been vaccinated in the city. Pastor and a male nurse journeyed through the archipelago and raised the total to 20,000, scoring a triumph for medicine in the Visaya islands where hostile tribes on the point of insurrection were pacified by the offer of protection against a dread disease. His royal mission completed, Balmis sent the children back to Mexico in Gutiérrez' charge while he continued with Pastor and three boys to Macao, arriving safely through a storm that took the lives of 20 of the crew.

The Portuguese colony received him as a distinguished visitor. Vaccine had come from Manila but without a system for perpetuating the supply, and Balmis demonstrated the arm-to-arm method. The interest shown by the Chinese in Macao encouraged him to go on to Canton and introduce the new smallpox prevention to the ancient empire that had practiced its own inoculation method for many centuries, administering powdered dried exudate by inhalation.

The British in Canton placed a house at his disposal, but few people came to be vaccinated until the news of an epidemic brought the Chinese in numbers. During his stay Balmis made a collection of Chinese therapeutic plants, and after his return home he presented an album describing the most important species to the Madrid museum of natural history.

During his voyage home Balmis stopped at St. Helena and won the British governor's support for his vaccination crusade. On September 7, 1806, the king received him with a royal welcome at Court, the *Gazeta* of Madrid published a glowing account of the successful mission and the poet laureate José Quintana composed an ode in Balmis' honor.

EPILOGUE. In 1810, feeling his work still incomplete, Balmis again took ship for New Spain to note the progress of his vaccination program. He remained for three years and located an indigenous form of cowpox as a reliable source of vaccine.

Disaster awaited him on his return in 1813: during Napoleon's brief conquest of Spain Balmis' house was sacked, his fortune ruined, his royal connections swept away and all hope of further professional achievement was destroyed. He died in 1820, obscure and in poverty, and remained forgotten by the world until Spanish, Latin-American and North American medical historians more than a century later brought to light his heroic adventure in the cause of medicine and humanity.

SUMMING UP. By Dr. Félix Martí-Ibáñez: "The Balmis vaccine expedition is a perfect example of what medicine, allied with the impulse for adventure, has done for humanity in the course of history."



* It reached from Yucatán and Guatemala theoretically to Russian Alaska and British Canada, from the California coast to Louisiana.