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fluenced the outcome of the Revolution and considers the disease in its 1970 perspective. Zinsser assigned military and political immortality to lice and typhus but ignored their American heritage.

How lice and rickettsiae reached the Colonies is unclear. James Lind, a remarkable eighteenth century physician, noted in 1740 that scurvy was the chief disorder among men returning to England from long foreign voyages. Yet, when those ships were refitted in the Thames for sailing, even in times of peace "jail distemper" was often transmitted from London. Pressed seamen and other passengers of such ships wore filthy rags. There was a great mortality among them of "ship fever" as typhus was called, especially on vessels carrying felons to America. Lind was convinced that the infection was carried on the bodies of men, upon clothes and other kinds of materials, such as wool, cotton, linen and might cling to wooden beams, chairs and bedsteads.

Recall that Charles Nicolle did not incriminate lice as vectors of typhus until 1909 when, with Ricketts, he identified the causative agent in louse feces. Only recently have we appreciated that rickettsial-laden louse and flea feces may remain viable for five or more years.

Yet Lind appreciated this, without scientific proof, and advocated fumigation through cleansing and scouring, removal of bedding and clothing to the decks of ships for sunlight and recommended that physicians and nurses change their clothing when leaving the hospital. Lind even appreciated that the distemper extended only short distances from its source and that it might vanish spontaneously in a convalescent population. He understood active or convalescent immunity.

A striking epidemic of typhus fever in the New World wiped out a whole Indian nation in Nova Scotia in 1746. A French squadron under the Duc d'Anville suffered from an infectious fever at Chubucto, near Halifax, during the summer. (Note summer.) Blankets and old clothes used in the tents and hospitals were left behind when the squadrons returned to Europe. Minnack Indians used these discarded French garments for clothing and distributed them throughout the tribe. Lacking any natural herd immunity, the whole nation of Indians was virtually wiped out by French blankets. Either infected lice surviving in the blankets or dried rickettsial-laden feces could have initiated the epidemic.

Trotter, an Englishman, cited the perils that British sailors faced when exposed to seamen from other countries, particularly French. Crews of French ships were often ill and from "being dirty to an extreme degree a contagious fever carried off many." English ships taking captives on board became infected with typhus.

Ship fever was undoubtedly imported to the United States early in the

PRESIDENT'S ADDRESS
TYPHUS VERDICT IN AMERICAN HISTORY

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BALTIMORE

INTRODUCTION

My two distinguished predecessors to the Chair of Medicine at the University of Maryland devoted their Presidential Addresses to the Climatological Association to problems of medical education. Of academic unrest, Dr. Gordon Wilson scored "the failure to realize that the laboratory sciences are confirmatory rather than diagnostic." This is true today. Dr. Maurice Phicores stressed the need for generalists and called upon faculties of medical schools to accept and act upon the principle that the objective of post-graduate training in their hospitals and clinics is not solely to reproduce their likes but also to train men for the specific demands of general practice.

For several months after you honored me with this memorable privilege, it was my intention to follow a similar theme and discuss the ethics of our clinical investigation. After re-reading each scientific paper presented to the Association during the past two decades of unprecedented medical progress it was obvious to me that the studies were well-conceived, justified, informative and conducted according to the highest medical and ethical standards. The subject was ultimately abandoned since, last year, Josh Billings so effectively reminded us of our moral conscience. My message is an historical vignette entitled "Typhus Verdict in American History."

TYPHUS VERDICT IN AMERICAN HISTORY

Throughout history certain female non-conformists have adapted themselves to filth, human misery and civil disorganization. Actually they have enjoyed eminent success in fostering mass unrest and panic when given the proper environmental setting. Personal association with these little insurrectionists and their consorts for part of my medical life prompted me to account for you how they might have adversely influenced American history particularly in the colonial era.

The females were *Pediculus humanus corporis* (body lice) and their passengers *Rickettsia prowazekii* which cause typhus fever. This is a short, previously unexpressed interpretation of how typhus fever may have in-

army as ever marched into Canada has this year been entirely ruined by the smallpox." Conceivably, this defeat by a virus explains why Eastern Canada does not now belong to the United States!

Smallpox and scurvy made Boston thoroughly unpleasant for the British and when General William Howe evacuated the city on March 17, 1776, he said, "I embarked with about 6000 rank and file fit for duty, and about 900 sick." His destination was New York where the action moved against the middle colonies.

There were dreary days ahead for the rebels and only partially because of His Majesty's forces. New York was a very unhealthy place. In late summer of 1776, an epidemic of contagious fever struck the New York army with about one-third of the muster on sick report.

In this setting there was a specific individual whose illness may have prolonged the war. Major General Nathanael Greene, Commander-in-Chief of Washington's Ground Forces, was assigned to meet and repel General Howe and his brother, Admiral Richard Howe, on Long Island.

The Rebel Forces were unseasoned and undisciplined, yet they responded to the leadership and command of Greene. He inspired confidence, was regarded as a brilliant strategist and had the full respect of General Washington. During the early summer of 1776, Greene pressed military training, discipline and the building of fortifications. Fate kept him from participating in the critical Battle of Long Island which, militarily speaking, was an example of mismanagement. General George Washington and Generals Sullivan and Putnam, Greene's replacements, reacted like amateurs. The rebel left flank was over-run with the entire force put in flight. Some heroic Marylanders and Delaware Continentals on the right flank, as well as a fortuitous fog and a change of wind allowed a retreat to Manhattan for better manœuvring and prevented a complete annihilation.

The available information suggests that General Greene was incapacitated because of louse-borne typhus fever. Whether he could have turned the tide to a victory and a defeat of the Howe brothers is conjecture.

Nathanael Greene, of Rhode Island, had always been healthy without disabling illness. In August, 1776, he was promoted to the rank of Major General and designated Commander-in-Chief of Ground Forces for New York at the age of 34. He was taken ill on August 14, 1776, and attended his most pressing duties until August 16, when he went to bed with a raging fever. His Aide reported to Washington that he had a very bad night and was critically ill. He was moved to New York where his brother, Christopher, gradually nursed him back to health.

Correspondence confirms that he suffered headaches and violent fever for one week; during the second week he was delirious. Recovery was

eighteenth century since it remained limited to eastern cities such as Philadelphia, Boston, Baltimore and New York. Pressed seamen were often stripped, washed and provided fresh clothes. Hair was cut before they mingled with the ship's company. Doubtless this guarded against further introduction of typhus, relapsing fever and verminous disease in general. These measures were employed at Portsmouth with results that fulfilled expectations.

Lice are not exclusively American. In medieval times, they were important politically. In Hurdemberg, Sweden, all of the eligible bearded males sat around a round table, leaned forward and placed their beards toward the center. The mayor for the next year was that man whose beard was chosen by a louse placed in the center of the table.

George Washington, to whom we will later refer, wrote in his fourteenth year on "Rules of Civility." "Kill no vermin as fleas, lice, ticks, in the site of others, if you see any filth or thick spittle, put your foot dexteriously upon it, if it is upon the clothes of your companions, put it off privately, and if it is upon your own clothes return thanks to him who puts it off."

A short digression to Central America is warranted. Lice probably existed in America before the invasion by white men. A few scalps and hair samples of prehistoric American Indian mummies in the Museum of American History show nits and lice in all stages of development. Historical evidence suggests that typhus fever existed among South American natives in pre-Columbian days and recognizable epidemics occurred in Mexico before the arrival of Cortez at Vera Cruz in 1519. The Spanish may have transported infected rats and infected fleas could have transmitted the disease to a louse infected population which started an epidemic.

Without doubt, Europe periodically bestowed the gift of typhus fever upon the Western Hemisphere and there were separate packages for the colonies in the East and Mexico and Latin America in the West. There appear to be no inter-epidemic relationships between the two foci.

Epidemics of infectious diseases clearly influenced American history. Smallpox helped defeat the specially picked Expeditionary Army which invaded Canada; 2000 men under Montgomery and 1100 commandoes led by Arnold. They attacked Quebec New Year's Eve, 1775, and were repulsed with the added price of Montgomery's death and Arnold's serious injury. The newly appointed Commanding General, John Thomas, himself a physician, either had no time to inoculate his troops or did not believe in the practice of variolation. The American camp before Quebec became a shambles, Thomas died of smallpox, and a broken army staggered back to Crown Point on Lake Champlain. According to General Gates "as fine an

rapid, almost by crisis. Two weeks later, when his defeated troops arrived in New York, he had no appetite and could scarcely sit up for an hour. During the first week of September Greene's strength returned rapidly. On the fifth, he resumed his command and two days later he attended a war council which was directed by General Washington.

In August and September of 1776, 8528 soldiers of the New York Army, one-third of the muster, were on sick report. The epidemic was probably typhus. Greene's violent but short illness of two weeks with rapid return to full command favors typhus rather than typhoid.

It is typical of typhus patients to develop acute and devastating illness and to recover rapidly. By contrast, typhoid fever is typified by protracted illness, weakness, mental fatigue and often relapse.

Available records of the New York Historical Society, gleaned from newspapers, indicate that 1776 was a cooler summer than normal. Lice favor cooler weather because more clothing is worn and people avoid bathing.

Greene wrote to Washington, "I have not the vanity to think the event would have been otherwise had I been there, yet I think I could have given the Commanding General a good deal of necessary information. Great events, sometimes depend upon very little causes." Henry Knox and John Adams believed Greene too modest. Had he been there, Knox wrote, "matters would have worn a very different appearance at present."

It is suggested as an hypothesis that were it not for lice and typhus His Majesty's forces might have experienced another Breed's Hill sufficiently disastrous to have prompted the Howe brothers to return to England and call the whole thing off.

Were it not for a vagrant rickettsial-laden louse, the war might have ended two years earlier, Valley Forge might now be a remote hamlet, Cornwallis would not have contracted malaria along with about 2000 of his troops in the swampy area of tidewater Yorktown where he gained immortality, a Rhode Island Quaker rather than a Virginia aristocrat might have been the Father of the New Republic with the capital well north of the Mason-Dixon Line, the Blue and Gray, Bull Run, Gettysburg and Abraham Lincoln might not have been necessary, and there would be no cherry trees bordering the Potomac.

The next events in the typhus biography are factual and not interpretative. For the first time, in 1836, William Gerhard of Philadelphia clearly distinguished between typhus and typhoid fevers. During this summer, which was unseasonably cool, he observed the clinical manifestations of an epidemic which occurred from March until August involving inhabitants of the congested courts and alleys of Slippin, Small, St. Marys, Lombard, Fifth and Eighth Streets. The patients were usually young who

had resided in Philadelphia for a short time and who were often taken ill on shipboard. His postmortem findings of six patients revealed the remarkable absence of ulceration of Peyer's patches. He wrote with remarkable confidence, "the anatomical characters of these varieties of fevers are peculiar to themselves, and it is as impossible to substitute the lesion of the follicles of the small intestine observed in the typhoid fever for the pathological phenomena of typhus, as it is by treatment or other means to transform the eruption of measles into the pustules of smallpox."

The disease remained limited to the larger eastern cities. Small outbreaks during winter months with sporadic cases during the summer undoubtedly kept the fires kindled as did importation of new cases and infected lice to Philadelphia, New York, Boston and Baltimore. An itinerant louse struck President Zachary Taylor in Washington, D. C., and killed him with typhus on July 9, 1850, after sixteen months in office and an illness of about five days. One wonders if this was not a tick and Rocky Mountain spotted fever. The last sizable outbreak of epidemic typhus on the Atlantic seaboard was in New York City in 1892-1893, when some 484 cases were removed to the reception hospital from poorer tenements and lodging houses.

From 1896 to 1910 Nathan Brill, of New York, studied 221 febrile patients whose illness reminded him of typhus rather than typhoid fever in spite of protestations of his colleagues. Negative blood cultures and Widal reactions led him to call it an illness of unknown cause which we now correctly refer to as Brill-Zinsser disease or recrudescent typhus fever. Throughout the late nineteenth and early twentieth centuries, clinicians recognized sporadic cases of typhus fever, often called endemic typhus in the southeastern states and in large harbor cities. Occasionally, the illness was erroneously referred to as Brill's disease.

The rickettsial story requires an additional acknowledgment to Howard Taylor Ricketts, who, from 1906 to 1909, isolated the causative organism from patients with RMSF, showed the animal transmissibility of the agent and identified the small microorganism in ticks. These were the fundamental etiologic observations upon which our knowledge of these serious illnesses is based. Ricketts died of louse-borne typhus fever in Mexico in 1910. His son, Henry Ricketts, is a member of the Climatological and his daughter, Mrs. Walter Palmer, graces our meetings.

In 1926, Kenneth Maxey, a wise epidemiologist and clinician, studied Virginia with endemic typhus in Alabama, Georgia, North Carolina and Rickettsia from the blood and noted their antigenic similarity and differences to *R. prowazeki* (epidemic typhus) and *R. rickettsii* (Rocky Moun-

Zinsser said so aptly, "Typhus is not dead. It will live on for centuries, and it will continue to break into the open whenever human stupidity and brutality give it a chance, as most likely they occasionally will. But its freedom of action is being restricted, and more and more it will be confined, like other savage creatures, in the zoological gardens of controlled diseases."

Let us hope that it remains there.

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tain spotted fever). Based on his observations, Maxey stated so clearly and concisely:

It is suggested as an hypothesis which seems to afford a more probable explanation of the mode of transmission that a reservoir exists other than in man, and that this reservoir is in rodents, probably rats or mice, from which the disease is occasionally transmitted to man.

The epidemiological characteristics afford no evidence suggesting louse transmission and are interpreted as being at variance with man to man transfer by lice. The parasitic intermediaries which are first suspected are fleas, mites or possibly ticks.

In 1930, this prophecy was confirmed in Baltimore. Dr. Joseph Lipsky, a physician-pharmacist, became ill with fever, headache and rash and was hospitalized on the fourth febrile day at The Mercy Hospital in September, 1930. Dr. Louis Krause was his physician and Doctor Pineoffs examined him in consultation. Their initial diagnosis was typhoid fever. Blood cultures and the Widal reaction were negative while the Proteus OX19 reaction reached a titer of 1:320. Endemic typhus fever was the discharge diagnosis. On the day of discharge, Doctor Lipsky's female clerk was hospitalized in the same room with the same disease, as was the male clerk three weeks later.

This constellation of typhus patients led to the trapping of rats in the basement of Doctor Lipsky's drug store at Pennsylvania Avenue and Laurens Street across from the Lafayette Market. Dyer and his associates showed the murine reservoir of rickettsia and incriminated the flea as a vector. Maxey's prophecy was richly fulfilled.

Just recently, I found Doctor Lipsky who was busily practicing medicine in Odenton, Maryland, near Fort Meade. He is 78 and plays tennis daily whenever possible. He recalled the large number of rats in his basement and attributed them to the foodstuffs stored there by an Italian merchant who operated a stall in the market across the street. Doctor Lipsky remarked that fleas literally swarmed through cracks in the floor. Forty years after his illness, Doctor Lipsky's serum shows complement fixing antibodies for murine typhus. He is the index case which led to identification of the rodent reservoir. Doctor Dyer confirmed for me recently that the traps were set in the basement of this pharmacy. Doctor Lipsky allowed me to give him a 1.0 cc. injection of purified epidemic rickettsial vaccine. His lymphocytes and plasma cells demonstrated a phenomenal 40 year memory because in three days he showed very high titers of complement fixing antibodies of the 7S type. This is the typical antibody globulin pattern of recall. Recently, we have found about 10 per cent typhus infestation in rats taken in the locale of markets and grain depots in Baltimore.